Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)

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Doctor of Philosophy in Food Science and Nutrition

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Certificate

This is to certify that the thesis titled **"Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)"** submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, in partial fulfilment of the requirements for the award of the Degree of **Doctor of Philosophy in Food Science and Nutrition,** is a record of original research work done by **Suba, G** during the period of her study in the Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, under my supervision and guidance and the dissertation has not formed the basis for the award of any Degree/ Diploma/ Assoicateship/ Fellowship or similar title to any candidate of any other University and it represents an entirely independent work on the part of the candidate.

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Signature of the Supervisor

Signature of the Dean

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I hereby declare that the thesis entitled **"Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)"** submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, in partial fulfillment of the requirements for the award of the Degree of **Doctor of Philosophy in Food Science and Nutrition** is a record of original research work done by me under the supervision and guidance of **Dr. A. Thirumani Devi**, Professor, Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and that it has not formed the basis for the award of any Degree/ Diploma/ Associateship/ Fellowship or similar title to any candidate of any other University.

22/12/17

Signature of the Supervisor

Signature of the Candidate

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1

INTRODUCTION

"Body growth, strength and healthy constitution are the products of correct nutrition. So let your food be your medicine and let your medicine be your food"

-Hippocrates,the Father of Modern Medicine

Food is an integral part of the rituals and is a part of a discipline in daily living of the Indian way of life. But within the last few decades, the relationship between "food and culture" has been shifted to food and lifestyle pattern. Now the concept is highlighted to "food and health". Health consciousness is gaining momentum and becoming a widely acknowledged fact among the public, in general. Nutrition is an integral component of health and well being of all individuals. Good nutrition enables one to lead a physically, mentally, socially and economically active life and it improves the quality of life as evidenced through the enhanced nutritional status of the population groups, better work efficiency rate, reduced mortality and morbidity rate by raising the standard of living. Thereby, nutrition plays a vital role in positive health, functional efficiency and productivity in later stages of life.

"The life of all living things is based on food and the whole world seeks proper growth, happiness, satisfaction and intelligence which are established in foods" speaks the Vedas that are believed to be as old as 5000 to 8000 years. The Thirukkural and the Holy Quran also speak of medicinal value of foods and the relationship with health status of an individual. Precise nutritional research investigations today, endorse the above statements of Vedas and Quran in their expression of "You are what you eat".

During each and every stage of life span nutrition is of paramount importance because it is a foundation for life time health, strength and intellectual vitality. Adulthood is the stage of life where physical growth and maturation is completed. A well balanced, nutritious diet is needed at this stage of life for the maintenance of physical, mental and social well being. Adequate nutrition and sufficient physical activity during adulthood will not only ensure health but also prevent chronic degenerative diseases including reproductive diseases or disorders and disabilities in the years ahead (WHO, 2010I).

The process of physical maturation usually entails attaining one's full height, which gets completed by the end of adolescence. The cell growth and division necessary for the proper functioning of body organs continues during adulthood. Physical abilities like bone mass, muscle strength and reproductive functional efficiency peak during 18-35 years of age. Thereafter, a decline in various physiological functions is noted which is termed a ageing. A well balanced diet, moderate physical activities and emotional stability can reduce biological age and slow down the process of ageing and other health problems.

Cognitive development is completed by the end of adolescence and as teenagers enter the early years of adulthood, they gain a sense of responsibility and move into adult roles. The increased ability in decision-making and independent functioning helps them to identify their career goals. They also have increased emotional stability. They tend to form new relationships with their parents and gradually prepare themselves for marriage and family life and their reproductive health addresses reproductive process, function and systems at all stages of life especially adulthood. Hormones are key factors to reproduce health in all aspects of a woman's sexual life. They regulate fertility, menopause and sex desire (libido). These hormones are responsible for inviting many health problems including reproductive health problems when they are not in a balance. Good nutrition plays a fundamental role in preserving overall wellness (including reproductive health), maintaining a healthy weight and preventing diseases associated with ageing. The focus of nutrition has now shifted to maintain a healthy and active lifestyle during adulthood, so as to prevent life style related disorders and also reproductive health problems like Premenstrual Syndrome.

The term premenstrual syndrome refers to a cluster of mood, physical and cognitive symptoms that occur during the luteal phase of menstrual cycle and subside with the onset of menstruation. PMS is a group of physiological and somatic symptoms related to menstrual cycle (Indusekhar, et al, 2007). As many as 80 per cent of the women of reproductive age experience premenstrual emotional and physical changes (ACOG, 2000)and associated with substantial impairment in life activities (Chocano-Bedoya*et al*., 2011).

According to Singh, *e.al*, (2015) premenstrual symptoms is the second most (60.5 percent) prevalent disorder among adolescent girls and young adult women.

Premenstrual syndrome is a constellation of physical, emotional and behavioural symptoms that occur during the week before and during the first few days of menstruation (Brown *etal*., 2011). Ninety percent of women in their reproductive age group experience PMS symptomseven though mild to moderate in intensity might adversely affect and influence daily activity and work productivity (Freeman, 2003). Between 10 and 40 per cent of thewomen population will experience severe symptoms to the extent that they are considered a 'syndrome'. PMS affects all race and cultural groups who may have a different set of criteria for characterizing symptoms and coping with any symptoms. Premenstrual Dysphoric Disorder is an acute type of PMS, affecting up to eight per cent of women who suffer from PMS (Backstrom and Andrean, 2013).

PMS isolates women from social, cultural, and envIronmental context of their lives by defining their experience as a medical problem. The cultural belief that premenstrual women are erratic and even dangerous that legitimates the restriction of women's opportunities in the society. PMS is also the collection of emotional symptoms with or without physical symptoms, related to a woman's menstruation cycle (Perz and Ussher, 2013). PMS in its severe condition affects the regular economic and social activities of a woman. Based on meta-analysis study done on epidemiology of PMS by Direkvand–Maghadam, et al, (2014), prevalence of PMS was highest in Iran 98 per cent and lowest in France 12 per cent. Classic symptoms of premenstrual syndrome often include tension, irritability, anger, depression, lack of self-control, food craving, breast swelling and pain, and headache (Salamat *etal*., 2012).

According to Gopalan (2013), several strategies have been worked out and implemented to promote health status and to prevent disease conditions. The key strategies are dietary diversification, supplementation, food fortification, genetic modification, promotion of community and home gardens and nutrition education. However, the sustainable solution to reduce the incidence lies in the discovery and the implementation of innovative and affordable ways to improve people's diet. The most important step is ensuring regular and adequate consumption of micro nutrient rich foods in their daily diet, together with an appropriate intake of protein and energy. The food based approach is more durable and sustainable than a "drug based" one and should look into our farms and not our pharmacies to solve health problems.

Two key reasons of interest in nutrition and health issues among young adult population are large population size and changing lifestyle. In many developing countries, their demographic slice is much larger. This large number makes them an important group as the future economic prospects of country will also depend on the health and educational status of young adults today. Secondly, young adults provide an opportunity to nurture the life style habits necessary for a healthy productive life, which avoids or reverses the current trend towards degenerative and metabolic diseases and disorders including reproductive health problems(Gopalan, 2013). Adolescence and young adulthood is also popularly known as the age and stage for fertility, which is the natural human capability of producing off-springs. A woman's fertility peaked in the middle twenties to early thirties after which it starts declining being accelerated decline after the age of 35 years with advanced maternal age causing an increased risk of female infertility. This is popularly referred as a "woman's biological clock" basically based on their health status (Ramachandran, 2017).

During adulthood, energy needs vary widely depending on their BMR and physical activities, to lead an active healthy life. Energy intake helps in maintaining body weight, temperature and metabolic activity. Energy can neither be created nor be destroyed; it can only be transformed from one form to another. Body weight is stable when the energy consumed through food is equal to the energy expanded in various activities. When the energy balance is maintained over a prolonged period, an individual is considered as being in a steady state. This can include short periods of day to day imbalance between intake and expenditure. The energy is reserved in the body in the form of fat, which can take care of any imbalances between energy intake and expenditure. The energy is reserved in the body in the form of fat and obesity occurs and invites other health problems (WHO, 2012).

Mahan and Stumps (2014) opine that Calcium and phosphorus are required for bone development and also involved to alleviate the premenstrual problems especially luteal phase symptoms effectively. Derman*et al*., (2014) pointed out that the subjects consumed more Calcium rich foods like milk (200-500 ml), yoghurt (300 ml), cheese (50 g) daily reduced the premenstrual syndrome more effectively and frequency of occurrence of PMS was also reduced.

Yehuda and Mostofsky (2010) summarize that Iron remains a nutrient of special concern. Iron needs increase in girls as they start to mature. Any substantial reduction in Iron content, RBC and haemoglobin, reduces the capacity of oxygen transport to tissues and it can be regarded as an adverse health outcome. Thus, Iron deficiency has a definite effect on health especially reproductive health status. Ironalso plays an important role in the formation of melatonin in the body. Melatonin is an important component fighting against depression during reproductive health problems like Premenstrual Syndrome (PMS).Iron is a co-factor for the enzyme tryptophan hydroxylase, which catalyse the conversion of tryptophan into 5-hydroxy tryptophan, a precursor of serotonin.

Study by Chocano-Bedoya*et al*., (2011) revealed that there was an inverse association between total intake of Iron and reproductive health problems like Premenstrual Syndrome (PMS). But when multivariable adjustment was made, it was noted that the participants with higher non heme Iron intake had 31 per cent lower risk of PMS than those with lower Iron intake. It was exclusively from non-heme Iron only. Heme Iron intake by a group does not relate to the risk of PMS. Intake of other minerals like Magnesium and zinc are the minerals of great importance in the treatment of PMS. Vitamins like Vitamin A, E, B_6 and B_{12} are also involved in reproductive activities-especially hormonal secretions which are essential to promote the fertility and reduce the symptoms and consequences of reproductive problems like premenstrual syndrome. Adequate intake of Vitamin B_6 reduces the symptoms of tiredness, depression, nervous irritability and exhaustion which are related to reproductive health problems of PMS. Long standing irregular veginal bleeding in young women and girls were successfully treated with Vitamin B_6. It controls bleeding by inhibiting the activity of oestrogen and ripening of follicles to impact ovarian dysfunction. Hence Vitamin B_6 is found to have a sedative effecton CNS. Mental irritability, feeling of run down condition, sleeplessness and mental stress were relieved by supplementation of Vitamin B_6 (Panda, 2012).

A double blinded study done by Hardy (2010) indicated that supplementation with 400 IU of Vitamin-E per day can further help to reduce many PMS symptoms and its consequences. Vitamin-E, Vitamin-B_6 and Magnesium are all known to affect prostaglandins which are involved with making of prostaglandins with many symptoms of PMS. These nutrients help the body to make prostaglandin hormone that reduces PMS symptoms in general.

Addressing reproductive health needs many means of interventions to reduce unwanted fertility as well as the burden of reproductive mortality and morbidity. Researches in India show that poor women carry a heavy burden of reproductive morbidity, a significant component of such morbidity is unrelated to pregnancy and is due to reproductive tract infections, many of which are sexually transmitted, these reproductive illness among women are invisible because of the "culture of silence", that surrounds them and women do not have access to health care for these illness and many intervention studies recognised women only as mother, many women were not served and many reproductive health problems were not addressed (Tarafeder,*et al*., 2012).

Women's health in India has assumed importance only of late, particularly after the International Conference on Population and Development held at Cairo, Egypt in 1994 and the Fourth World Conference on Women, held in Beijing in 1995. Both these conferences placed immense importance on women's health, empowerment and reproductive rights. Not discounting the importance of health needs and health status of men, the fact remains that over a lifetime the health of women is usually worse than that of men. Moreover, certain health problems are more prevalent among women than among men and certain health problems are unique to women and affect women differently than men. Furthermore, some envIronmental problems have a disproportionate impact on women compared to their male counterparts (Tamang*et al*., 2014). Women with PMS carry over their suffering throughout their life time. Common painful sufferings include painful menstrual days and PMS. Most of the women not even express their painful periods to their family members or friends. Only when the problem become intolerable to an extent it affects their regular activities, they seek medical care and support or sometimes it might be self medication.

All these factors together are involved in the severity of PMS. PMS affects approximately one-third of all premenopausal women. One of the main underlying causes of PMS has been shown to be a high oestrogen to progesterone ratio (Meschino, 2015). Hormones are key to reproduce health in all aspects of a woman's sexual life. They regulate menstruation, fertility, menopause, and sex drive (libido). The main hormones affecting the menstrual cycle and fertility are produced by glands in the brain and by ovaries (US National Women's Health Information Centre, 2008). Under unfavourable situations, hormones are the main causes for many menstrual disorders, which are very

common among teen agers and young adult women. These disorders are often considered as the source of physical and psychological problems for the women and their families (Naeimi, 2015).

According to Nutrition Foundation of India, the average age of menarche is 13.4 years, yet 50 percent of girls aged 12-15 do not know about menstruation. This is true for rural as well as urban poor. The lack of information can be attributed to a veil of secrecy that surrounds menarche (US National Women's Health Information Centre, 2008).Menstruation is a landmark in every woman's life and is a major physical event that transmits the female from girlhood to womanhood. Its onset may occur as early as nine years or as late as 17 years, but age 12 is the average.Menstruation is there by considered as a recurrent process that most women experience during their lifetime, a common expected part of life of a woman. It occurs on an average every 28 days beginning in childhood and ceasing anywhere from late 30 to 50s. It is a normal process (Lee*et al*., 2011).

Menstrual cycles are not always regular or stable; they may be disturbed by many disorders which commonly occur at the extremes of reproductive age. The causes of menstrual disorders can be triggered by a number of different factors, such as hormone imbalance, genetic factors, blood clotting disorders and pelvic diseases.Menstruation in girls and women is accompanied by some symptoms and problems that are multidimensional and has diverse effect on physiological and psychological system (Halbreich, 2013).

Nutrition and health education is another aspect that bridges the gap between health information and health practices and considered as a key activity in many health promotion activities in many health promotion programmes. Nutrition and health education aims to give people, the means to adopt a healthy lifestyle including dietary pattern by transmitting knowledge, social skills and so on and thus is found in the point of acquiring individual attitude and capacities. It also aims to make the community to take responsibility for prevention of health problems and encourage community participation which stems from the point 'reinforcing community action' and community participation is the key factor in creating long lasting health promotion activities (Ather, 2014).

According to Meschino (2015), scientific evidenceconfirmed that appropriate attention given to nutrition and the daily use of specific dietary supplements helped to support women's hormonal balance and improve the management of menopause symptoms, PMS, fibrocystic breast disease, osteoporosis, uterine fibroids, endometriosis and so on with an appropriate dietary pattern is necessary for a healthy life style that could have the effects on much aspect of life such as menstrual cycles in women.

All women, regardless of race, age, or socioeconomic status, have experienced discomfort during their menstrual periods. To our knowledge, when female workers have PMS, health care personnel in the workplace usually provide heat packs or suggest bed rest at a health centre or may provide painkillers. These methods, which merely alleviate female workers' pain at the time the menstrual cramps occur, are not preventive methods. Hence, more and more workplaces and employers are attempting to determine preventive methods that can ameliorate PMS in female workers during their menstrual periods, and further investigate the correlation between yoga exercise intervention classes especially in the workplace and index of menstrual pain, discomfort during menstrual periods, overall wellbeing, and quality of life (Tsai, 2016).

Premenstrual symptoms even though mild to moderate in intensity might adversely affect and influence daily activity and work productivity (Freeman, 2003). PMS Symptoms are often under diagnosed as they are usually not reported by the patient correctly or a clinician often finds it difficult to ask the questions and it has difficulty in diagnosis.

Most of the adolescent girls have premenstrual symptoms and they don't know how to overcome the problems (Fallah *et al,* 2013). PMS is considered as a disease and attention is paid only in recent days. When this is the global scenario in India, the problem of PMS was considered as an issue that may even interfere with the daily activities. Even then women folk are not coming forward to express their suffering and to get a permanent solution to overcome these problems. This is because the women folk of India feel that the pain is a part of their daily life and they have to tolerate it as a natural phenomenon like their mothers and grandmothers. Talking about PMS even among their peer group was not encouraged. Only very recently women came forward to talk freely on

their menstrual and premenstrual problems. So studies related to menstrual problems are progressively increasing. Even then most of the studies were carried out among urban target group of medical and health science students having adequate knowledge on PMS and not among women in other fields. Data on the lay population on PMS is very limited. The knowledge on PMS and coping mechanisms were not discussed openly even by mothers to child. The knowledge is poor or sometimes misleading to create further complications and problems among them, and also considered as the factor for having ill health among the young women.

Premenstrual symptoms may affect not only the individual, but also her family and the community. Many studies in different countries indicated that premenstrual symptoms were more common among adolescent girls and need to have effective follow-up of non-pharmacological interventions to reduce the symptoms and to improve the quality of life.

Medical and nutritional education, supportive counseling and general self-care measures can improve the mild symptoms.For moderate symptoms, life style modification including exercise and adoption of a healthy diet are sufficient whereas severe symptoms need a variety of medications using drugs and it will be more helpful to solve the problems of PMS. For many women however, neither the lifestyle changes nor the use of drugs is an entirely satisfactory approach to PMS. Some women with moderate symptoms find lifestyle modifications which are not sufficient to control their symptoms and also they are reluctant to consider the long-term use of prescriptions all of which have significant side effects.

Bhatia and Bhatia (2002) concluded that non-pharmacological intervention could be beneficial for the individuals with mild to moderate symptoms such as dietary modification, lifestyle changes and supportive treatment.The desire for safe and effective non-drug alternative has prompted and many women to consider the use of dietary supplement for PMS.

Due to the delicate approach and need for adequate knowledge, PMS studies have been carried out to considerable extentonly in thehealth sectors. Some more studies were also done among medical or health science professionals or students, and very limited studies were available on PMS among general female population.

Dietary supplement is an attractive and least expensive strategy to reach the quality and quantity food for vulnerable group of population. This dietary strategy is hopefully expected to enhance nutritional and health status and to eliminate the complications and consequences of health problems like reproductive health problems among young women. Food supplement in the form of nutrient dense health mix helps to contribute macro and micro nutrients to bridge the gap of a vulnerable group of population for optimum health and their well being.

Local resources and technology seem to be the most relevant solution to the health problems like PMS. Cereals especially millets with combination of plant protein rich foods and oil seeds are often referred as a boon to solve many health problems. This type of food supplements is attractive, sustainable, least expensive and affordable strategy to reach the quality and quantity of nutrition needed to enhance their health status and prevent their health problems. Thereby next generation will lead a healthy and happy life.

With these backdrops, the present study has been undertaken by the investigator with the specific objectives

- Find out the prevalence of PMS (PMS) among the women of reproductive age (20-45 years).
- Study the influence of demographic, dietary, menstrual, nutritional and psychological variables on PMS
- Formulation and evaluation of health mix rich in micro nutrients for dietary intervention
- Development and evaluation of educational modules for nutrition education and
- Evaluate the effect of nutrition intervention strategies on symptoms PMS

"Young women" are the human resource and assets of a country. A nation's health is gauged through the health status of its women. It is therefore essential that women are allowed to live in an envIronment where their nutritional, social, emotional, educational and psychological needs are fulfilled and their health care is also considered as the priority items in the country's developmental agenda.

2

REVIEW OF LITERATURE

The literature pertaining to the present study **"Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)"** is reviewed under the following headings:

A. Women and menstrual cycle- A point of great concern

a. Meaning and process of menstrual cycle
b. Hormones involved in female reproductive health
c. Terminologies used in female reproductive health problems and disorders

B. Premenstrual Syndrome – The symptoms of painful menstruation

a. Meaning and definition
b. Prevalence
c. Classification
d. Causes
e. Signs and symptoms
f. Complications
g. Diagnostic methods
h. Medical care

C. Healthy solutions for prevention of PMS – The need of an hour

a. Healthy dietary pattern
b. Physical activity and exercise
c. Stress management
d. Yoga and meditation

D. Nutritional intervention to tackle PMS

a. Dietary intervention
b. Nutrition education and counselling
c. Life style modification

A. Women and menstrual cycle – A point of great concern

a. Meaning and process of menstrual cycle

Menstruationis a natural process similar to any other cyclic process happening in the maternal body at the reproductive age. Towards the end of puberty, girls begin to release eggs as part of a monthly period, called the female reproductive cycle, or menstrual cycle (menstrual referring to "monthly"). Approximately every 28 days, during ovulation, an ovary sends a tiny egg into one of the fallopian tubes. Unless the egg is fertilized by a sperm, while in the fallopian tube in the two to three days following ovulation, the egg dries up and leaves the body about two weeks later, through the vagina. This process is called menstruation. Blood and tissues from the inner lining of the uterus (the endometrium) combine to form the menstrual flow, while generally lasts from four to seven days. The first period is called menarche. During menstruation, arteries that supply the lining of the uterus contract and capillaries weaken; blood spilling from the damaged vessels detaches layers of the lining, not all at once, but in random patches. Endometrial mucus and blood descending from the uterus, through the liquid creates the menstrual flow (Mustaniemi *et al*., 2011).

i. The reproductive cycle – It can be divided into ovarian cycle and a uterine cycle (Comparison of ovarian histology and uterine histology is given in the Figure-1)

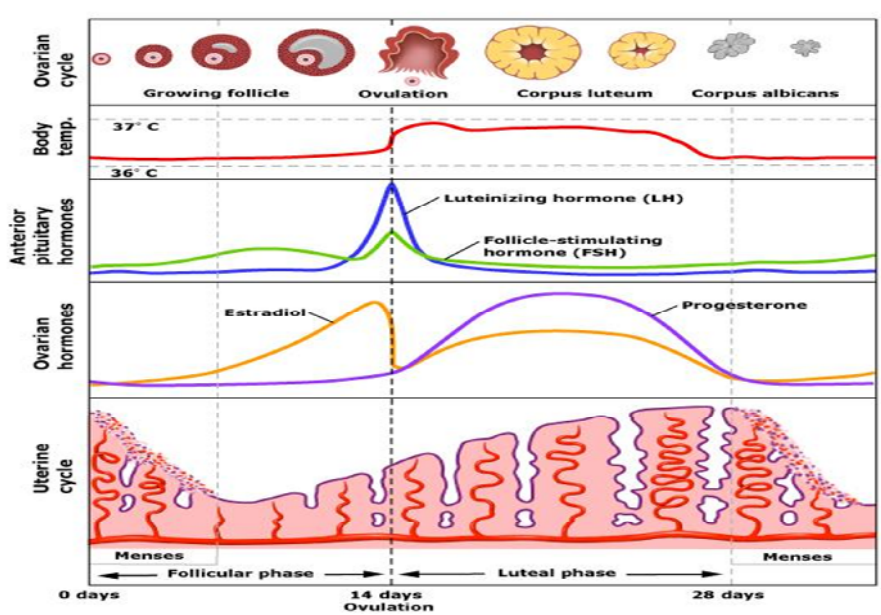


Figure – 1. Histology of Menstrual cycle

During the uterine cycle, the endometrial lining of the uterus builds up under the influence of increasing levels of oestrogen. Follicles develop and within a few days one matures into an ovum or egg. The ovary then releases this egg, at the time of ovulation. After ovulation, the uterine lining enters a secretary phase, or the ovarian cycle, in preparation for implantation of the embryo under the influence of progesterone. Progesterone is produced by the corpus luteum (the follicle after ovulation) and enriches the uterus with a thick lining of blood vessel and capillaries, so that it can sustain the growing foetus. If fertilization and implantation occur, the embryo produces Human Chorionic Gonadotropin (HCG), which maintains the corpus luteum and causes it to continue the production of progesterone until the placenta can take over production of progesterone. So progesterone is 'progestational' and maintains the uterine lining during all of pregnancy. If fertilization and implantation do not occur, the corpus luteum degenerates into a corpus albicans and progesterone level fall. This fall in progesterone level causes the endometrial lining to break down and slip off through the vagina. This is called menstruation, which marks the low point for oestrogen activity and is the starting point of a new cycle. Menstruation forms a normal part of a natural cyclic process occurring in healthy women between puberty and the end of the reproductive years. The onset of menstruation, known as menarche, occurs at an average age of 12, but is normal anywhere between 8 and 16. Factors such as heredity, diet, overall health status and life style pattern accelerate or delay the onset of menarche. PMS changes may initiate from 2-6 days prior to the menstruation and lasted for 2 days (upto 4 days) after the onset of menstruation (Mustaniemi *et al*., 2011).

Menstrual cycle is the term given to the periodic discharge of blood, tissue fluid and mucus from the reproductive organs of sexually mature females. The flow usually lasts from 3-6 days each month and is caused by a sudden decrease in the hormones oestrogen and progesterone. It is a hormone grooven process and balance and interplay between these hormones that regulate the specific events that makeup the menstrual cycle there by menstruation is a normal physiological impact in each girl's life. And thus is a monthly uterine bleeding lasts for 3-5 days every 28 days from puberty till menopause (Dickerson *et al*., 2013). According to Harlow and Campbell, (2004) the length and regularity of menstrual cycles reflect changes in ovarian steroid production. Hormones of reproductive cycle involved at the onset of puberty are progesterone, oestrogen, LH and

FSH. Each hormone has a function to do in the menstrual process. The two major hormones involved in menstruation oestrogen and progesterone.

Normal menstrual cycle is 28 days although normal cycle varies between 22-36 days. Menstrual cycle consists of follicular and luteal phase. Follicular phase begins on first day of menstruation and ends with ovulation. The luteal phase begins with ovulation and ends with menstruation. The luteal phase lasts 10-16 days. The luteal phase is very consistent but follicular phase is much more variable (Casper, 2016). Women who experience some discomfort in the days leading up to their periods are termed as premenstrual syndrome (PMS). PMS usually is at its worst the seven days before a period starts and can continue through the end of the period. PMS usually includes both physical and emotional symptoms: acne, bloating, and headache, constipation, diarrhoea, food craving, depression, and irritability, difficulty in concentration or handling stress (Dickerson *et al*., 2003).

Tolossa and Bakele (2014) reported that the participants whose average length of one cycle of menstruation is 1-3 days were 5 times more likely to develop PMS than participants with average length of menses is 6-8 days as noted by binary logistic regression analysis. This could be explained by light and short duration of menses associated with fluctuation of oestrogen and progesterone which develops in the luteal phase.

b. Hormones involved in female reproductive health

Comasco and Sundstrom, (2015) pointed out the various hormones are involved in maintaining female reproductive health and are discussed in the following pages

i.Oestrogen

- Promotes the development and maintenance of female reproductive structures (especially in the endometrial lining of the uterus), assists in the control of fluid retention and electrolyte balance in the body.
- Prepares the follicle for the release of an egg and thus the female hormone starts rising soon after menstruation and peak around mid-ovulation period, about a fortnight ahead of the next menstrual cycle. It falls sharply after that, then rises again slowly, and falls just before the start of next menstruation.

ii. Progesterone

- Secretes at the time of ovulation
- Helps to prepare endometrium (womb lining) for the implantation of egg
- Prepares mammary glands for milk production
- Primarily concerned with the procreation and survival of the foetus.

iii.Follicle Stimulating Hormone

- Stimulates the follicles to ripen several eggs, at the same time the ovaries release oestrogen for the process of reproduction.

iv Luteinising Hormone

- Develops the follicles, triggers ovulation and stimulates production of other hormones necessary for the post ovulatory stage of menstrual cycle.

These hormones are usually present in small amounts and the relationship between the levels of hormones is critical. Premenstrual steroid hormone levels have an important influence on subsequent development of chronic diseases in women. Brain releases special chemicals in the form of Endomorphins and serotonin. Endomorphins are natural pain killers while serotonin provides a feeling of happiness. Varying levels of these important chemicals make to feel immense pain or feel low and out of spirits. These are common PMS symptoms. Different aetiologies like hormonal imbalance, nutritional defects and envIronmental factors are associated with PMS. Women with and without PMS do not differ with aspect the production of gonadal steroids indicating that PMS might be associated with enhanced responsiveness to normal, fluctuating concentration of hormones (Marjoribanks *et al*., 2013).

c. Terminologies used in female reproductive health problems and disorders

Women are commonly dealing with many different diseases and disorders that pertain to the reproductive system. Some of the most common reproductive problems are discussed below.

- Vulvovaginitis is an inflammation of the vulva and vagina. It may be caused by irritating substances such as laundry soap, bubble baths or poor hygiene such as wiping from back to front. Symptoms include redness and itching in these areas and

sometimes vaginal discharge. It can also be caused by an overgrowth of Candida, a fungus, normally present in the vagina.

- Non menstrual vaginal bleeding is most commonly due to the presence of a foreign body in the vagina. It may also due to urethral prolapsed, a condition in which the mucus membranes of the urethra protrude into the vagina and forms a tiny, doughnut shaped mass of tissue that bleeds easily. It can also be due to a straddle injury vaginal trauma from sexual abuse.
- Ovarian tumours, although rare, can occur. Women with ovarian tumour may have abdominal pain and masses that can be felt in the abdomen. Surgery may be needed to remove the tumour.
- Ovarian cysts are non cancerous sacs filled with fluid or semi solid materials. Although they are common and generally harmless, they can become a problem if they grow very large. Large cysts may push on surrounding organs, causing abdominal pain. In most cases, cysts will pass or disappear on their own and treatment is not necessary. If the cysts are painful and occur frequently medical care is prescribed to alter their growth and occurrence. Surgery is also an option if they need to be removed.
- Polycystic ovary syndrome is a hormone disorder in which too many hormones are produced by the ovaries. This condition causes the ovaries to become enlarged and develop many fluid filled sacs or cysts. It often first appears during the teen years. Depending up on the type and severity of the conditions, treatment is given for regulating hormone balance and menstruation.
- Dysmenorrhoea is a painful menstrual periods.
- Oligomenorrhoea is when a woman misses or has infrequent periods, eventhough she has been menstruating for a while and is not pregnant.
- Menorrhogea is when a woman has very heavy periods with excess bleeding.
- Amenorrhoea is when a girl has not started her period by the time she is 16 years old or three years after puberty has started, has not developed signs of puberty by 14, or has had normal periods but has stopped menstruating for some reasons other than pregnancy.
- Candidasissymptoms of yeast infection include itching, burning and discharge. Yeast organism are always present in all people but are usually prevented from

"overgrowth" (uncontrolled multiplication resulting in symptoms) by naturally occurring micro organisms. At least three quarters of all women will experience candidasis at some point in their lives. The candida albicans organism is found in the vaginas of almost all women and normally causes no problems. However, when it gets out of balance with the other "normal flora" such as lactobacilli, an overgrowth of yeast can result in noticeable symptoms.

- There are also cancers of the female reproductive symptoms such as cervical, ovarian, uterine and breast cancer.
- Endometriosis is the most common gynaecological diseases, affecting more than 55 million in North America. The two most common symptoms are pain and infertility. In this disease, a specialised type of tissue that normally lines the inside of the uterus (the endometrium), becomes implanted outside the uterus, most commonly on the fallopian tubes, ovaries or the tissue lining the pelvis. During the menstrual cycle, hormones signal the lining of the uterus is thicken to prepare for possible pregnancy. If pregnancy does not occur, the hormone levels decrease, causing the thickened lining to shed (Comasco and Sundstrom, 2015).

When endometrial tissues are located in other parts, it continues to act in its normal way. It thickens, break down and bleed each month as the hormone levels rise and fall. However because there nowhere for the blood from this dislocated tissue body, become trapped and surrounding tissue becomes irritated and trapped blood may lead to growth of cysts. Cysts in turn may form scar tissue and adhesions. This causes pain in the area of the misplaced tissue, usually the pelvis. Endometriosis can cause fertility problems. In fact, scars and adhesions on the ovaries or fallopian tubes can prevent pregnancy. Endometriosis can be mild, moderate or severe and tends to get worse over time without treatment(Kato*et al*., 2013).

B. Premenstrual Syndrome - The symptoms of painful menstruation

In general population, mild premenstrual mood symptoms occur in upto 80 per cent of women. Serious case of PMS impairs daily activities, in social, family and work functioning (Kato *et al*., 2013). Up to 85 per cent of menstruating women reported to have one or more premenstrual symptoms and two to 10 per cent reported the disturbing symptoms severe enough to warrant treatment (Lee *et al*., 2011). PMS is a multi

symptomatic disorder characterised by the cyclic recurrence of symptoms during the luteal phase of menstrual cycle (Lolas-Talhami *et al*., 2015).

Menstrual cycle disorders are highly prevalent among women due to oligomenorrhoea, transient amenorrhoea, polymenorrhoea and menorrhagia. Premenstrual Syndrome/ Premenstrual Dysphoric Disorder (PMS / PMDD) are severely disabling disorders which lead to time off work, social isolation and even suicide in extreme cases (Heinmen*et al*., 2010). Some studies confirmed the clinical association of mood changes with dysmenorrhoea (Miller*et al*., 2008). There is an association between infection and behavioural abnormalities in women with PMS (Simanek *et al*., 2014).

According to Lolas-Talhami *et al*., (2015) the aetiology of PMS is infectious-inflammatory-immune paradigm rather than hormonal or psychosomatic disorder. Twenty percent of women have frequently experienced behavioural, emotional or physical symptoms of PMS in their child bearing age (Nisar *et al*., 2008). In a study conducted in Nigeria, students in Calabar University, it was noted that the most common symptoms were muscle pain, acne, chest pain, puffy face, depression and distress. PMS is a multi symptomatic disorder characterised by cyclic recurrence of symptoms during the luteral phase of the menstrual cycle. More than 200 behavioural, psychological and physical symptoms have been associated with PMS. Irritability, pelvic pain, migraine, breast tenderness, swelling and bloating are the ones most frequently observed. Mild PMS is common by affecting 75 per cent of women with regular menstrual cycles; PMDD affects only 3-5 per cent of women. This condition affects women of any socioeconomic, cultural and ethicnic background (Casper, 2016).

Up to 85 per cent of menstruating women reported for having one or more premenstrual symptoms and 2-10 percent reported that the disabling symptoms were severe enough to warrant treatment usually consisting of ovulation suppression, pain killers, anti-inflammatory drugs, psychoactive drugs and several other symptomatic medications (Lee *et al*., 2011).

Several patterns of true or apparent commorbidity can occur in women with premenstrual symptoms. First pattern might have experienced a psychiatric disorder at another point in her life. Second pattern might have an ongoing psychiatric or general medical condition and concurrent premenstrual symptoms that are not part of theco-

occurring disorder (concurrent commorbidity). Third pattern might have an ongoing psychiatric or general medical condition that becomes worse premenstrual – usually defined as premenstrual exacerbation (Steiner, 2010). PMS and PMDD are severely disabling disorders, which lead patients to time off work, social isolation and even suicide in extreme cases (Heinemann *et al*., 2010). According to epidemiological studies (Adam and Sattar, 2014), PMS prevalence rate is higher in Asia, low in Europe and France has the lowest PMS prevalence rate.

In olden days repeated pregnancies, lactation or malnourishment lead to extended periods of amenorrhoea, a situation that has changed by advances in nutrition with our capacity to control reproduction. The result is that women today have much longer periods of cyclic fluctuation of oestrogen and progesterone with associated PMS (Mac Donald *et al*., 2011).

a. Meaning and Definition

The physical or psychological symptoms attributed to the premenstrual phase of the menstrual cycle are called premenstrual syndrome (Yonkers*et al*., 2008). According to PMS is defined as the recurrent mood and a physical symptom which is usually in the luteal phase and it remits in the follicular phase of the menstrual cycle (Bakr and Ez-Elarab, 2010).

Shifts of the hormone oestrogen and progesterone that trigger the female reproductive cycle affect the health of women. Associated with menses is a complex set of physical and psychological symptoms known as PMS (Mahan and Stumps 2014). Premenstrual symptom refers to a combination of symptoms that appear during the week before menstruation and resolve within a week of onset of menses. Constellation of psychological and physical symptoms that occur regularly in the luteal phase of the menstrual cycle, remit for at least one week in the follicular phase and cause distress and functional impairment is called PMS (Christler and Caplan, 2012). PMS refers to a group of expectable physical, cognitive, affective and behavioural symptoms that are observed cyclically during the luteal phase of the menstrual cycle and resolves immediately in a few days at the beginning of menstruation (Halbreich, 2004). PMS is a pathological and somatic symptom related to the menstrual cycle. These symptoms occur during the luteal phase of the menstrual cycle when the plasma progesterone concentration is high and

resolved at the end of menstruation. Helibreich (2004) also pointed out that PMS is a disorder characterised by physical and emotional symptom restricted to luteal phase of menstrual cycle that substantially impair life activities and social relationships.

PMS is used to describe physical, cognitive, affective and behavioural symptoms that occur clinically during the luteal phase of menstrual cycle and resolve quickly at or within few days (7-14 days) of menstrual cycle (Nulufer *et al*., 2010 and Kathleen *et al*., 2010).

Moore (2007) viewed PMS as a common disorder among women of reproductive age, characterised by cyclic recurrence of physical, mental and cognitive symptoms in the luteal phase of the menstrual cycle. PMS is only a physiological condition rather than a pathological state that occur due to the imbalance in the oestrogen level in the luteal phase of menstrual cycle. According to Windmair *et al*., (2011), PMS is the transient physical and emotional symptoms that appear in many women prior to the onset of menstrual flow and disappear within a few days after the start of menstruation. Hippocrates in 1800's itself described PMS as premenstrual mood changes. PMS is not the underlying pathology that causes distress, but is the distress itself (Kathleen *et al*., 2010)

PMS has been conceptualized as a static pathological entity caused by biomedical or psychological factors. But recently it has been recognised that many women experience PMS changes in emotion, behaviour or embodiment and do not inevitably position these changes as PMS and do not inevitably experience distress (Cosgrove and Riddle, 2013 and Ussher and Perz, 2016).

PMS is a cyclic reoccurrence of distressing somatic and affective symptoms in the luteal phase of menstrual cycle in the few days (1-3 days) of next follicular phase (Ziba *et al*., 2008). In the Britannica online encyclopaedia (2008), it was quoted that a change in mood behaviour, appearance of some abnormal vague symptoms is often noticed in second half of the cycle. But if the symptoms are severe enough to disturb life cycle of a women or require medical attention called Premenstrual Syndrome.

Thys-Jacobs*et al*., (2005) in their study recorded that PMS is only a physiological condition rather than a pathological state that occurs due to the imbalance in the oestrogen level in the luteal phase of menstrual cycle. Hence, it reoccurs every month 7-10 days

before the menstrual discharge. It disappears at the onset of menses. The nature and severity vary from individual to individual due to various factors including nutritional, lifestyle pattern and stress and strain of the person.

b. Prevalence

Whelan, et al., (1994) has documented that women are affected by PMS irrespective of socio-economic status, race or cultural back ground and family clusters. According to ACOG (2010), PMS is experienced by 90 per cent of women of child bearing age. A smaller subset meet criteria of PMS and less than 10 per cent are diagnosed as having premenstrual dysphoric disorder (PMDD). Higher prevalence of PMS about 80 per cent of mild symptom, 20-50 per cent of moderate and only five per cent of PMS severity is noted in the study done by Bakr and Ez-Elarab, (2010). The study done by Kaur and Thakur (2009) reported that 85 per cent of menstruating women aged between 25 and 35 years had one or more symptoms of PMS.

Halberich (2004) mentioned that approximately eight per cent to 15 per cent of reproductive age group women suffered from PMS. Potter*et al*., (2009) and Wittchen*et al*., (2010) reported that more than 20 per cent of menstruating women experienced PMS to a degree that warrants clinical treatment.

According to recent epidemiological investigations using current diagnostic criteria for PMS published by the ACOG, the prevalence of PMS among women in US ranged from 19 -90 per cent (Strine*et al*., 2003) and up to 30 per cent with women in the late twenties and early thirties most likely to seek health care for their symptoms (Dell*et al*., 2008).Thys-Jacobs (2000) stated that the PMS afflicts millions of premenopausal women described as one of the most common disorders in women.

Samia *et al*., (2005) and Nour*et al*., (2009) opined from retrospective community surveys that nearly 90 per cent of women have experienced at least one PMS. Epidemiological surveys have estimated that as many as 75 per cent of reproductive age women experienced some symptoms attributed to the premenstrual phase of menstrual cycle. Studies of Pearlstein and Steiner (2008) and Joshi*et al*., (2010) show that about 80 per cent of women reported mild symptoms, and about five per cent report severe symptoms for several days with impairment of functioning capacity of the organs.

Although severities of symptoms are prone to suffer with premenstrual dysphonic disorder (PMDD), in such patients, the symptoms are severe that interferes with daily life, causing disability whichis life threatening at times.

According to Angst *et al.,* (2011) the prevalence of PMS among reproductive age women of Iran was 85 per cent. Study done by Razaee, *etal.,* (2017) among women of Isfhan city in Iran was noted that the prevalence of PMS based on ACOG scoring pattern was 79.5 per cent.Based on ACOG diagnostic criteria, Hasan Zadeh and collegues recorded a prevalence of PMS in teen agers as 83.1 per cent.According to Freemen (2003) the prevalence of PMS was about 90 per cent with approximately 20 per cent of women have frequently experienced behavioural, emotional or physical symptoms of PMS in their child bearing age.

Up to 70-90 per cent of reproductive age women have one or more signs of physical discomfort of emotional symptom in the menstrual phase i.e. the luteal phase of menstrual cycle. About 20-40 per cent of the menstruating women have PMS that are bothersome. A small number up to 8 per cent experience more severe symptom which lead to substantial distress or functional impairment and are referred to as PMDD (Halbreich *et al*.,2013). Prevalence of PMS among University students at Jundishapur, Ahwaz in a study done by Darabi*et al*., (2014) was 65 per cent.

In an Iranian study Derman*et al*., (2014) reported that incidence of PMS ranged from 19-90 per cent. In an American study, Mishell (2005) pointed out those 43-55 million women experienced uncomfortable symptoms premenstrually.Lifetime prevalence of PMS was estimated to be approximately 13-18 percent among women of reproductive age.According to Ussher and Perz (2013) PMS affects women in their late 20s-30s. It also affects adolescents (Rapkin*et al*., 2006). Average onset of PMS is 26 years in the study done by Steiner (2010).Based on the study done by Tolossa and Bakele (2014), the prevalence of PMS among 18-25 year girls was 37 per cent. Ozturk*et al*., (2011) pointed out that the prevalence of PMS from various studies ranged between five and seventy-six per cent.

In general population mild PMS mood symptoms occur in up to 80 per cent of women but serious cases can impair daily activities in social, family and work functioning

and cases featuring PMDD range between 2-8 per cent (Dean*et al*., 2006 and Yonkers *et al*., 2013).

A cross sectional study done by Tolossa and Bakele (2014) among health science students reported that 83.2 per cent of the participants had PMS symptoms. In a community study performed in Iraq, the prevalence of PMS was fund to be between 90 per cent in women between 15-14 years (Treloar *et al*., 2002). In the cross sectional study, the prevalence of PMS among female health science students in North Ethiopia was 83.2 per cent and also reported that there is a higher prevalence of PMS about 80 per cent of women had mild PMS, 20-50 per cent moderate and 5 per cent reported severe PMS symptom (Pearlstein and Steiner, 2008).

According to epidemiological studies, the prevalence rate of PMS in high in Asia and low in Europe. Among Asian countries lowest prevalence was reported in China France has the lowest prevalence of PMS among European countries and Iran has highest prevalence among Asian countries(Adam and Sattar, 2014).In Egypt, the prevalence of PMS was reported as 89.6 per cent whereas in Japan, the prevalence of PMS among high school students of Japan was recorded as 64.6 per cent(Bakr and Ez- Elarah, 2010).

Based on the prospective survey on PMS among medical and nursing students, teaching and non-teaching staff of Vadodara, Gujarat, it was found that PMS was common in women during reproductive agethe prevalence of PMS was 100 per cent. All the participants suffered from PMS among them 42 per cent were found to be suffering regularly and 58 per cent occasionally (Brahmbhatt*et al*., 2013). As per previous studies in India, PMS is 20 per cent of which 8 per cent suffer with severe symptoms (Pearlstein and Steiner, 2008, Joshi*et al*., 2010).Naeimi (2015) recorded that the prevalence of PMS in the age group of 18-24 years was 85.6 per cent based on ACOG (2000) criteria and its severity was 42.8 per cent (mild), 35.8 per cent (moderate) and seven per cent (severe) among women of 18-24 years. In India, majority of menstruating women experienced some form of PMS. The study done by Tamilselvi (2012) showed that the prevalence of PMS among adolescent girls was 55 per cent among adolescent girls in Tamil nadu.

A study done by Anand (2011) among female medical students of SRM University, Tamilnadu, showed up to 40 per cent prevalence of PMS that affected their ability to perform work. Pain was often disregarded by women who considered pain to be

a normal part of menstrual cycle.Six out of ten women in suffer from PMS which as in India the rate of PMS is at higher level, 159760591 against 106507607 population which is a nine out of ten (Indian express, 2011). Based on the study on PMS among reproductive age women done by Malhotra (2012), PMS may affect 30-40 per cent of female population and has been implicated in work absenteeism, criminal behaviours, marital discode and billions of dollars worth loss of business.

c. Classification

i. Type-A

It is due to high oestrogen and low progesterone level. The main symptoms include nervous tension, weepiness, anxiety, mood swings and irritability. Menstrual bleeding is also suddenly started and are heavy with clots.

ii.Type-B

Stress is a prime factor in this type of PMS. The mood changes and irritability lean more towards aggression than depression. Aggression or depression is just energy (labelled as negative) which is either directed outwards- aggression, or directed inwards-depression. The main symptoms are related to bloating with weight gain, swelling of hands and feet and breast tenderness. The nutrients needed to overcome the problems are Vitamin C with bioflavonoid. The important food to be avoided is salt since it is the main cause of oedema. Diuretic foods like celery or juniper help in reducing oedema. Increased intake of water removes toxins from the system. High fluid intake is helpful for the effective functioning of kidneys.

iii.Type-C

Fluctuations in blood sugar level are often associated and included headache and fatigue, moodiness and with irritability due to drop in blood sugar level. The element, Magnesium is very important to aid insulin metabolism. Small frequent meals with starchy and complex carbohydrate foods like pasta, potatoes, vegetables and quality proteins like lean meat and fish help in reducing the problem of blood sugar level. Refined foods and sugar aggravate the symptoms of having hyperglycaemia.

iv. Type-D

Type D is due to low oestrogen and high progesterone ratio. Emotional changes like depression, forgetfulness, insomnia, confusion and tiredness are commonly noticed.

v. Type-H

Water imbalance symptoms include fluid retention, bloating, breast tenderness, swollen hands and feet related to high Sodium and alcohol intake (MacLeord, 2016). The details related to the different types of PMS are presented inTable-1.

Table-I

Types of PMS

Types	Causes	Symptoms
Type-A (Anxiety)	High Oestrogen/ Low Progesterone.	Nervous tension, weepiness, anxiety, mood swing, irritability.
Type-B (Bloating)	Increases fluid retention due to elevated progesterone level.	Stress is the major factor in this type and the mood changes and irritability will lean more towards aggression than depression.
Type-C (Craving)	Correlation between imbalanced blood sugar level and symptoms.	Increased appetite, craving for sweets, head ache, fatigue, fainting spells and heart palpitations.
Type-D (Depression)	`Low oestrogen and High Progesterone ratio.	Emotional change like depression, forgetfulness, insomnia, confusion and weepiness.
Type-H (Hyerhydration)	Excess Aldosterone resulting in fluid retention	Weight gain (greater than the normal weight), abdominal bloating and discomfort, breast tenderness and the occasional swelling of the face, hands and ankles

Source:MacLeord, 2016

d. Causes

The causes of PMS have not been clearly elucidated (Smith*et al*., 2005) but have been attributed to hormonal change, neurotransmitters, prostaglandins, diet, drugs and lifestyle pattern. Hence the casual treatment is difficult to manage or support the condition of PMS (Kupper and Loch, 2016).

Gillan (2007) opined that one of the main underlying causes of PMS has been shown to be high oestrogen to progesterone ratio (too much oestrogen to too little

progesterone). Parker (2007) pointed out that the varying level of oestrogen lead to fluid retention which may cause weight gain and neurological effect causing increased brain activity, believed to sometimes lead to seizures and a drop in the blood sugar level and post-pregnancy. PMS causes severe depression among the subjects having the problem of PMS.

Meschino (2015) viewed that one of the most underlying causes of PMS was high oestrogen to progesterone ratio. Non-ovulatory cycles, abolished ovariectomy or treatment with ovaluation inhibitors and reinstated by administration of exogenous hormone are also considered as the causative factors for the occurrence of PMS. The patho-physiology of PMS may include an interaction of ovarian hormones with brain neurotransmitters, such as serotonin and γ-amino butyric acid (GABA) (Backstrom *et al*., 2015)

Different aetiological factors like hormonal imbalance, nutritional defects and envIronmental factors are associated with PMS (Martinez *et al*., 2015). PMS affects quality of life, economic status and social performance (Marjoribanks *et al*., 2013).

The leading etiologic theory is that premenstrual symptoms occur due to a differential sensitivity to mood perturbing effects of gonadalsteroid fluctuations in vulnerable women (Yonkers *et al.,*2008). Gonadal steroid fluctuations may modulate serotonergic transmission, and many studies have identified dysregulation of the serotonin system in women with PMDD and PMS. Steroid fluctuations also modulate Calcium, circadian rhythms, brain-derived neurotrophic factor (BDNF), the hypothalamic–pituitary axis, and immune function (Henshaw and Pearson (2015). The differential sensitivity to fluctuations of gonadal steroids may also involve changes in llopregnanolone (ALLO) levels. ALLO is a metabolite of progesterone that acts as a positive allosteric modulator of the GABA receptor leading to anxiolytic actions. Several studies have suggested that women with PMDD have decreased luteal phase sensitivity of the GABA receptor as well as altered ALLO biosynthesis (Henshaw and Pearson, 2015). It has also been postulated that women with PMDD have a paradoxical irritability and anxiety response to GABA receptor modulators (Bäckström *et al*., 2015). The rapid efficacy of selective serotonin reuptake inhibitors (SSRIs) in PMDD may be due in part to their ability to increase ALLO levels in the brain and enhance GABA receptor function with a resulting decrease in

anxiety. A recent study with a 5α-reductase inhibitor dutasteride, that blocks the conversion of progesterone to ALLO, reported that dutasteride 2.5 mg daily decreased several premenstrual symptoms (Martinez *et al*.,2015).

Angst*et al*., (2011) opined that psychological factors of PMS include stressful life events, personality dimensions and psychiatric co morbidity. A higher psychiatric co morbidity was observed among women with PMS and PMDD. Studies done by Cohen*et al*., (2002), Critchlow *et al*., (2001) and Soares *et al*., (2011) pointed out that lifetime prevalence of major depression has been found to be 53-58 per cent in women with prospectively confirmed PMDD.

Apreliminary unpublished study reported a decrease in premenstrual symptoms with isoallopregnanolone, an ALLO antagonist (Bäckström *et al*., 2015). The menstrual cycle fluctuations in gonadal steroids also lead to modulation of cognitive and emotional circumstances. The possible risk factors reported by Parker (2010) are

i. Stress: Women leading stressful lives, either in their professional or personal sphere, are more prone to PMS symptoms. Menstrual stress cause more problems than physical stress.
ii. Heredity: PMS symptoms often travel from mothers to daughters, although intensity and the mix of symptoms differ. Some studies suggested that women whose mothers reported PMS are more likely to develop PMS (70 per cent versus 37 per cent of daughters of unaffected mother) and concordance rates for PMS are significantly higher for monozygotic twins (93 per cent) compared to dizygotic twins (44per cent) (Pauala and Braveman, 2007).
iii. Age: PMS symptoms are more pronounced and occur with greater frequency in women between the ages of 20 and 40. According to Paualaand Braveman (2007), risk factors for PMS included the advancing age (beyond 30 years) and genetic factors.
iv. Depression and Psychological Disorders**:** Women suffering from depression, anxiety or other psychological disorders are more vulnerable to PMS symptoms.
v. Dietary factors: PMS symptoms are more evident in women that have food rich in salt and sugar. Salty foods drain away body water levels while sugar foods are throughout by some to be responsible for severe mood changes and overall fatigue.

Low micro nutrient level in the body, especially Manganese, Magnesium and Vitamin-E, increase therisk of developing PMS symptoms. Excessive caffeine and alcohol intake is equally harmful and invites the problems of PMS.

vi. Sedentary lifestyle: Lack of regular exercise is believed to be another important risk factor for PMS. In Asian population BMI values alone cannot make a sensible measurement of health and well being. This is very clear by noting Indians with BMI values under normal range but still with obesity and risk of other degenerative diseases. Researches over the last several years have shown that Indian bodies and genetics are different from their western counterparts as Indians suffer from abdominal obesity compared to people in the West whose bodies are uniformly obese. This body composition puts Indian in the high risk zone for diabetes and hypertension (WHO, 2013). The waist hip ratio is a better indicator along with the BMI value to decide upon the nutritional status of Indians (WHO, 2014). Regular, asymptomatic menstruation is usually considered as a measure of general good health in females after a regular rhythm has been established causes. It seems that lifestyle, physical activity and dietary pattern affect PMS. Body mass index (BMI) (as an index of indicating body Composition) is also a factor that is probably related to PMS. It has been demonstrated that women who are suffering from PMS have higher BMI value (Rosenfield *et al*., 2008). According to Hoghighi *et al*., (2015), plasma levels of sex hormones are impaired in women who have PMS symptoms.and was noted that adipose tissue and steroid hormones have a direct relationship and sex steroid hormones are involved in metabolism, storage and distribution of fat tissues direct effects of sex steroid hormones on adipose tissue and obesity.

Furjiwara and Nakata (2013) viewed that wide spread consumption of fatty food, skipping of food intake and shift from local food to western food items are increasing among the young women. So it is important to evaluate the present situation of eating habit in young women and estimate the impact on menstrual cycle and concluded that women who skipped breakfast had a significantly higher degree of dysmenorrhoeal symptoms than young women who eat breakfast, suggesting a positive correlation between skipping breakfast and menstrual disorders.

vii. Hormone: Martin *et al*., (2006) has observed that PMS were more severe when patient were experiencing migraine. The association between these pain symptoms and PMS is consistent with the hypothesis that the symptom may be linked to fluctuations in the level of oestrogen and progesterone. High aldosterone level was also considered as a contributor of PMS symptoms (Farage *et al.,* 2008).

e. Signs and Symptoms

Symptoms of PMS are categorised into three major heads- physical, emotional and behavioural symptoms. The core symptoms identified are anxiety, tension, mood swings, aches, appetite, food cravings, cramps and decreased interest in activities (Delara *et al*., 2012 and Myint *et al*., 2006)

Eissa (2013) opined that the most of the symptoms are mild and manageable among women having PMS. However three to eight of women reported that premenstrual irritability, tension, dysphonia and mood liability seriously interfered with daily living and relationships.The changes in hormonal balance leads to a series of symptoms including depression, emotional fluctuations, irritation, anxiety, sleep disorders, increase in appetite, sensitivity and pain in breasts, bloating, weight gain, stomach ache, headache and fatigue (Dickerson *et al*., 2013, Indusekhar *et al*., 2007and Steiner and Peer, 2011).

The most frequently experienced psychological and behavioural symptoms of premenstrual symptoms as reported by Braverman (2007) and Indusekhar *et al*., (2007) are irritability, anxiety, tension easily crying, mood changes, hypersomnia-insomnia and social isolation. The most commonly experienced physical symptoms of PMS are tiredness, abdominal pain, fullness of breasts, headache, oedema in limbs, joint and muscle pain, acne, increase in the appetite thereby increase in food intake.Windmair *et al*., (2011) viewed that the symptoms of PMS include painful swollen breasts, headache, backache, depression, irritability and other attributed to excessive level of oestrogen or progesterone excess. In order of increasing severity of symptoms the overall problem is categorised as PMS or PMDD. Various studies conducted by Rapkin and Mikacieh (2013); Steiner and Peer, (2011) and Freeman (2003), reported that the main symptoms of PMS are headache, nausea, and weight gain, tenderness of breast, swollen abdomen, food cravings and fatigue.

Steiner *et al*., (2003) in their study reported that the nervousness, irritability, emotional instability, anxiety, depression, oedema and nausea usually disappearing in a few hours after onset of menses as symptoms of PMS. Women with clinically significant premenstrual symptoms tend to have a specific symptom profile that recurs in each cycle but may vary in severity in response to envIronmental stressors or other health problems (Connolly, 2011). Mahan and Stump (2014) mentioned that the symptoms of PMS are general discomfort, anxiety, fatigue, breast pain and cramping. Such symptoms are repeated to occur approximately a week to 10 days before the onset of menses and increase in severity into menses.Because symptoms are varied and are restricted to the luteal phase, the patho- physiology of PMS likely involves multiple symptoms affected by hormonal cyclicity (Halbreich, 2013).The symptoms of PMS vary from woman to woman and from cycle to cycle. In many, symptoms are significant but brief and not disabling; in others, normal functioning is disturbed. Symptoms last a few hours to few days, usually disappearing when menstruation begins. In some, they may persist through and after menstruation and tends to diminish with age (Wong and Koo, 2010).

The physical and emotional changes experienced may be more or less intense with each menstrual cycle. The main symptoms are headache, nausea, weight gain, breast tenderness, swollen abdomen, food carving (Steiner and Peer, 2011). Dietary intakes of certain micronutrients, including Calcium, Vitamin-D, thiamine and riboflavin are associated with PMS, but the role of minerals has not been explored. Iron, Magnesium, zinc, copper, manganese, potassium and sodium are involved in the patho- physiology of PMS through a variety of mechanism. Blood levels of potassium, Magnesium and zinc fluctuate across the menstrual cycle (Chocano-Bedoya *et al.*, 2013)

Based on the study done by Nierenberg (2013), the classic signs of PMS included the bloating, irritability or depression and also stated that PMS affects from 8-15 per cent of women during their child bearing years and is characterized by physical and emotional symptoms are ranging from breast tenderness and food cravings to fatigue and moodiness.

Women with PMS symptoms that are both psychological, such as irritability and physical, such as head ache and back pain (Direkvand-Moghadam *et al*., 2014). Takeda *et al*., (2006) opines that PMS may result in a depressed mood and greater psychiatric comorbdity.

Direkvand-Moghadam *et al*., (2014) noted that there was a higher prevalence of physical premenstrual symptoms (abdominal swelling, fatigue, back ache and abdominal cramps) in female employees deeply negative affects their health related quality of life and decreased occupational productivity. Some women, experienced moderate or severe symptoms were emotionally disabling, particularly in the area of personal relationship and social activity.

PMS is one of the factors that make women more susceptible than men to depression, particularly during periods of rapid fluctuation of gonadal hormones, such as PMS, post partum and climacteric. Studies from different countries indicated that PMS are more common and more severe among high-level educated women than non-educated women with a possible association of stress with PMS (Kathleen *et al*., 2010).A study done by Andrea and Sharon, (2008) on PMS and quality of life reported that the PMS symptoms reappeared monthly and last for an average of six days per month especially during their reproductive ages. It has been calculated that affected women experience almost 3000 days of severe symptoms during reproductive years.

The most important somatic symptoms are feeling overwhelmed, food craving, insomnia or hypersomnia, headache pelvic pain, discomfort, breast tenderness, joint pain and bloating. The most common distressing effective symptoms are irritability, anxiety, depression, mood swing, hostility, poor concentration, confusion, social withdrawal and interpersonal conflicts. The significant appearance of these symptoms starts from the teen years and worsen through the process of ageing. During the child bearing age, up to 40 per cent of women have some form of PMS but only three to eight per cent have severe psychological manifestations of PMS. Symptoms of PMS are emotional, psychological, physical, and behavioural and it varies in intensity, PMDD is severe form of PMS. In PMDD various symptoms interfere with normal activities of a woman including social, occupational, interpersonal and even the sexual functioning and are not related to any organic and functional disease (Asha *et al*., 2010).

Balaha *et al*., (2010) declared that the most frequent symptoms in mild and moderate cases of PMS were somatic (abdominal bloating, breast tenderness and headache), whereas the most frequent symptoms in severe cases included both somatic

(abdominal bloating and breast tenderness) and psychological symptoms (confusion, irritability, angry out bursts, social withdrawal and depression).

Symptoms of both PMS and PMDD occur during the luteal phase of the menstrual cycle (days 14–28 in a 28-day cycle) and notably subside within 2–3 days after menses begins. Some women experience positive symptoms, such as a sense of well-being, in theluteal phase of their cycles. More often, negative symptoms undermine a woman's ability to function across multiple settings including work, school, and home (Masho *et al*., 2005).

Although more than 200 symptoms have been associated withPMS, most common symptoms are listed in the following Table II(Dickerson *et al*.,2003).

Table-II

Symptoms of PMS

Physiological symptoms	Behavioural symptoms	Psychological symptoms
➢ Abdominal bloating ➢ Back pain ➢ Breast pain, tenderness, and/or swelling ➢ Headache ➢ Muscle aches ➢ Weight gain	➢ Aggression ➢ Changes in sexual interest ➢ Dizziness ➢ Fatigue ➢ Food cravings or Over eating ➢ Insomnia	➢ Anger ➢ Anxiety ➢ Confusion ➢ Crying and tearfulness ➢ Decreased self-esteem ➢ Depressed mood ➢ Difficulty in concentration ➢ Forgetfulness ➢ Irritability ➢ Loneliness ➢ Mood swings ➢ Restlessness ➢ Tension

Dickerson *et al*., 2003

Length of symptoms expression varies between days and two weeks. Symptom often worsen substantially six days before, and peak at about two days before, menses start (Pearlstein *et al*., 2005). Anger and irritability are the severe complaints and started slightly earlier than other symptoms (Meaden*et al*., 2005). Acne and genital purists are

common manifestations during the luteal phase in PMS patients. Luteal phase progesterone inhibits type 1 helper T cells by stimulating secretion of IL-4 and IL-10 from type 2 helper cells. That leads to less effective control of fungi, virus and intracellular bacteria (Doyle *et al*., 2007).

According to Myint *et al*., (2006) the most common emotional and mood related symptom of PMS among University students in Thailand included depression, irritability, tension, cry, over sensitivity and mood swing with altering sadness and anger. Physical discomfort includes abdominal cramps, fatigue, bloating, breast tenderness (mastalgia) acne and weight gain. Behavioural symptoms include food cravings, forgetfulness decreased motivation. Based on the study done by Brahmbhatt *et al*., (2013), the most common symptoms were back ache, leg cramps, fatigue, breast tenderness, anger, anxiety and generalized body ache.

MacDonald *et al*., (2011) in their study pointed out that in olden days, repeated pregnancies, prolonged lactation periods, malnourishments lead to extended periods of amenorrhoea. So the problem of PMS in a women's life reduced substantially. But with advances in education, nutrition and birth control methods, women of today have longer periods of cyclic fluctuations of oestrogen and progesterone with associated PMS.

f. Complications

Though the term PMS and PMDD were known for years, only in recent days the importance of the symptoms in affecting the functions has been systematically examined. Women with PMDD reported that they had impaired adjustment and reduced quality of life which is at their worst during luteal phase. They also differ from women without PMDD during the asymptomatic follicular phase, although for most factors these differences do not cause impairment. According to Deuster *et al*., (1999) PMS is associated with reduction in health related quality of life and work productivity.

Borenstein*et al*., (2007) pointed out that the impact of PMS included direct and indirect economic consequences because of significant reduction in the productivity at work and increased health care costs. Similar statement was given by Nour*et al*., (2009) in his research that PMS is associated with reduction in health related quality of life and women with PMS have greater work productivity impairment than women without PMS.

Yan*et al*., (2011) also reported that PMS is a common encountered complaint among women and affect women's quality of life and reduce their occupational productivity. PMS negatively affects the quality of life of millions of women (Barnard *et al*., 2003). PMS symptoms severity may disrupt interpersonal relations, social activities, work performance or quality of life (Temple, 2011).

Parker (2007) stated that the symptoms of PMS are culmination of psychological, physical and emotional disturbances. The hormonal changes affect a woman's emotional setup extensively and a very common outcome is irritability. Since the PMS symptoms are due to hormonal changes, apart from luteal phase, the PMS symptoms commonly appear at the state of puberty, when first taking birth control pill, after pregnancy, at the onset of menopause or during hormone surgery (such as tubal ligation or hysterectomy). Female employees with PMS have decreased job career satisfaction levels and well-being; have more issues balancing family work commitments and more stress at work; are less involved in decisions that affect themselves at work, and are less happy about their working conditions. Kahyaoglu and Mestogullari (2016) and Cheng *et al*., (2013) reported that PMS is linked to depression and is associated with both direct and indirect causes of absenteeism and low productivity in work place. Pinar *et al*., (2011) declared that child disturbance and family violence in families of patients with PMS were reported and therefore PMS affects not only the individual but also however family and the community.

g. Diagnostic methods:

The American College of Obstetrics and Gynecology (ACOG, 2011) published the diagnostic criteria for PMS. It was considered that if at least one of the six affective and one of the four somatic symptoms was reported five days prior to the onset of menses in the three prior menstrual cycles and ceased within four days of onset of menses it is PMS. Originally entitled as "late luteal phase dysphoric disorder" was later renamed as "Premenstrual Dysphonic Disorder". The diagnosis of PMDD stipulates the presence of at least five luteal phase symptoms (panel), tension, affect liability or persistent anger or irritability, two cycles of daily changes to confirm symptoms and evidence of functional impairment. It has been noted that women have the same set of symptoms from one cycle to the next (Bloch *et al*., 1997).

ACOG (2014) suggested that PMS exists only when the symptom must be persistent in the five days before periods for at least three menstrual cycles in a row, end with four days after period starts, interfere with some of the normal activities. According to Joshi *et al*., (2010) due to variations in the universally accepted diagnosis criteria and different in the interpretation of premenstrual symptoms, there is difficulty in estimating the prevalence of PMS (symptoms there in difficulty in estimating the prevalence of PMS) symptoms. PMS symptoms are often under diagnosed as they are usually not reported by the patient or a clinician often has difficulty in diagnosis (Futterman and Rapkin, 2006).

According to ACOG (2010), a diagnosis of PMS may be given if subjective patients' reports gathered prospectively from five days before menses include at least one affective and somatic symptom from the list given below

- Affective symptoms
    - Anger
    - Anxiety
    - Avolition or social withdrawal
    - Confusion
    - Depression
    - Irritability
- Somatic symptoms
    - Headache
    - Tender or swollen or painful breasts
    - Water retention or swelling of extremities
    - Water retention or bloating of abdomen

PMS complications are elucidated by the drop in progesterone concentration in the late luteal phase, and linked to changes in central nervous system neurotransmitters such as gama amino butyric acid (GABA), mood changes reported by post menopausal women taking sequential hormone replacement therapy suggests that progesterone, rather than oestrogen is responsible for including dysphoria. Luteal administration of oestrogen has been reported to aggravate PMS and luteal administration of an oestrogen antagonist reduces premenstrual nostalgia (Oksa *et al*., 2009).

The most important characteristic feature of PMS is the relation between symptom appearance and menstrual cyclicity, researchers have long suggested that gonadal steroids are involved in the patho-physiology. Symptoms are absent during non-ovulatory cycles abolished by ovariectomy or treatment with ovulation inhibitors and reinstated by administration of exogenous hormones (Smith *et al*., 2005). Possible risk factors for PMS are high Body Mass Index, stress and traumatic events (Perkonigg*et al*., 2014).

h. Medical care

More than 80 different therapies have been suggested for the treatment of PMS and PMDD resulting in much conflicting information and many unwarranted claims of effectiveness. No single intervention is effective for women, and there is a substantial palcebo response with many therapies (Dimmock *et al*., 2000). The use of oral contraceptives reduces dysmenorrhoea intensity and duration of menstrual flow. Because PMS symptoms occur exclusively in ovarian cycle, inhibiting ovulation could be expected to reduce or eliminate these symptoms (Johnson, 2004). Oral contraceptives containing ethinyl estradiol 20 μg and drospirenone (3 mg) administered as 24 days of active pills followed by a four-day hormone-free interval, are another first-line treatment option for the emotional and physical symptoms of PMDD. Common side effects included nausea, inter-menstrual bleeding, and breast pain (Lopez *et al*., 2012).

In 2016, this medication received FDA approval for the treatment of PMDD in women desiring oral contraception. The efficacy of this particular oral contraceptives for reducing premenstrual symptoms may be due to its administration in a 24/4 regimen which provides more stable hormone levels or to the unique anti-mineralo corticoid and anti-androgenic properties of drospirenone. In 2012, the FDA added a warning that drosperinone-containing oral contraceptives may be associated with higher risks of venous thromboembolism than oral contraceptives containing other progestins. Studies of oral contraceptives with other progestins or continuous oral contraceptives administration for PMDD have demonstrated mixed results (Reid, 2012). Danazol, a synthetic steroid, alleviates premenstrual symptoms when administered at doses that induce anovulation, but adverse effects limit its widespread use. Most studies of progesterone have involved luteal phase progesterone administration, and the literature is mixed. Hysterectomy with ovophorectomy should be considered a last-resort treatment option for women with severe

PMDD who have not responded to or cannot tolerate standard treatments. Preliminary confirmation of alleviation of PMDD with suppression of ovulation with a GnRH agonist should be obtained prior to hysterectomy (Nevatte *et al*., 2013).

Sodium restriction was also recommended to reduce abdominal bloating, fluid retention, irritability and insomnia. Coffee intake was restricted as it was associated with PMS irritability and insomnia (Lori *et al*., 2003). Calcium, VitaminB_6 and Vitamin E also have positive effect by controlling PMS symptoms (Lakshmi, 2015).

The PMS treatments are divided into herbal, psychotropic, hormonal and surgical methods. Women who mostly suffer from severe PMS need psychotropic or hormonal treatment to control the symptoms (Hamid *et al*., 2012).An appropriate dietary pattern is necessary for a healthy style that could positive effect on many aspects of life such as menstrual cycles in women (Sayegh *et al*., 2005). PMS implies the quality of life and social lurching, the presence of only PMS is mostly not perceived as either distressing or debilitating hence presence of PMS symptoms is different from categorical symptoms. A study conducted by Bakhshani *et al*., (2012) revealed that the adolescent girls who suffered from PMS had low intake of dairy products fruits and vegetables when compared to healthy girls.

Use of progesterone in luteal phase has been one of the strategic measures to treat PMS which holds good even today (Wyatt *et al.,* 2001). Recently selective serotogenic uptake inhibitors (SSRI) have gained importance in management of PMS. Other medications include anxiolytics like Aloprazolam and Bromocriptine for decreasing breast tenderness (Pearlstein and Steiner, 2008).

C. Healthy solutions for prevention of PMS – The need of an hour

More than 80 different therapies have been suggested for the treatment of menstrual problems like PMS/PMDD, resulting in much conflicting information and many unwarranted claims of effectiveness. No single intervention is effective for all women and there is a substantial palcebo response with many therapies. It may take time and several attempts determine the safest and most effective treatment for an individual. Treatment of PMS/PMDD is the best approached in step-wise fashion, beginning with life style modification and progressing to nutritional supplementation, non-pharmacological therapy

and non prescribed and prescribed medications. Conservative treatments have proved beneficial in many women and should be considered first line therapy in women with mild symptoms and adjunctive therapy in all other conditions (Sayegh *et al*., 2005).

a. Healthy dietary pattern

i. Diet:

High protein and moderate carbohydrate approach in the PMS diet is in line with the new Dietary Reference Intakes (DRI) released in 2005 by the National Academy of Sciences Institute of Medicine. To meet a person's energy and nutritional needs, the DRI report recommends a range of 45-65 percent of calories from carbohydrates, 10-35 per cent of calories form protein and 20-35 percent calories from fat. These ranges allow flexibility in planning a healthy PMS diet.Basically PMS diet is not specifically designed for weight loss, although weight loss will be one of its primary benefits. It is designed to make the person healthier and reduce PMS symptoms (Lori *et al*., 2003).

Dietary modification helped the PMS women either to gain or loose weight. This is borne out by a study at the Universityof Pittsburgh, where the diet of PMS women was compared with non PMS women. The study found that although PMS women tend to be more over weight, there was virtually no difference in their diet. However when lean PMS women were compared to lean normal women, the investigators found that the lean PMS women consumed fewer calories than the lean non PMS women. In other words, the lean PMS women eat fewer calories to maintain their weight compared to normal lean women. This study also suggested that PMS women tend to gain more weight with the same amount of calories when compared to non PMS women (Hardey, 2010).

Insulin resistance due to huge fluctuations in calorie ingestion especially carbohydrate is related to the development of menstrual irregularities including PMS and PCOS. There is some evidence that calorie fluctuation slightly help to reduce PMS, PCOS and infertility(Pitman, 2016).

A very interesting study conducted at the University of Adelaide (Australia) with 28 mildly overweight women with PMS. Half the women were put on a high protein diet for twelve weeks. The other half was put on a high carbohydrate diet. On either diet they were restricted to 1433 calories a day. After the 12 weeks, they were put on a four week "maintenance diet" that allowed to eat more calories from their diet. At the end of the trial,

the high protein group had lost 18.7 pounds, while the high carbohydrate group had lost 15.2 pounds –not a significant difference between the two groups. However, even this minor loss of weight resulted in significant reproductive, endocrine and metabolic improvement in both groups of women and had an improvement in menstrual cycling and minimizing the severity of the symptoms of PMS (Hardy, 2010).

ii. Food items related to PMS

Vegetables such as peas and spinach contain non heme Iron. A diet rich in the minerals help to protect against PMS. Ironis related to PMS because it is involved in producing serotonin, a neuro transmitter that helps in regulating mood (Bertone*et al.,* 2009). According to Hardy (2010), eating less animal fat and consuming more dietary fibre has also been shown to help lower excessive oestrogen levels and assist in the management of PMS. Aerobic exercise is associated with a lower incidence of PMS and has neen shown to be an important adjuvant to the management of this condition.

The use of soy isoflavone and Black cohosh extract supplementation has yielded very favourable results. These ingredients have the effect of body's oestrogen receptors on various tissues, blocking their over stimulation by the body's more powerful oestrogens. Additionally, the triterpene compounds provide the building block from which the body can synthesis progesterone to help balance the oestrogen progesterone ratio. Other nutritional factors that have been to reduce the symptoms of PMS include Vitamin B_6 supplementation (50-100 mg per day) and Magnesium supplementation (up to 400mg per day). It is best to take a complete B complex Vitamins as opposed to take Vitamin B_6 alone (Hardy, 2010).

Women were recommended to eliminate the intake of caffeine, sugar, alcohol particularly in luteal phase, all were associated with increase in stress hormone cortisol and reduced serotonin. Caffine restriction was recommended primarily due to its association with an increase in irritability, anxiety, insomnia. Alcohol can exacerbate PMS symptom and also deplete body B Vitamin stores (Pitman, 2016).

In the diet, fibre and oestrogen have some impact on normal fertility. A precise balance between oestrogen and progesterone is essential for normal fertility while normal oestrogen levels are usually increased during the first half of the cycle a failure to ovulate stops progesterone from reaching normal levels during the second half of the cycle, which

is required for the proper balance between oestrogen and progesterone. If oestrogen levels continue cycle after cycle to be unopposed by progesterone, "oestrogen dominance" can be the result. Results from various studies indicate that a generous intake of dietary fibre helps to reduce excessive levels of oestrogen, thus helping to bring the body into better hormonal balance (Pitman, 2016).

Apart from providing energy and other nutrients, plant foods contain a wide array of signaling substances that influence the cell performance. This fact is especially important for women with PMS. In menstrual irregularity like PMS and PCOS, normal and other cell signalling systems are not working optimally. Eating fresh, whole plant foods improve the ability of the body to function perfectly and prevent many health problems including reproductive diseases and disorders (Tsai, 2016).

In a study at Harvard University, researchers sought to determine where there was a link between infertility and milk consumption by analysis milk consumption in different countries. They found that women who drank more quantity of milk were the most infertile. When milk (lactose) is digested, it is broken down into glucose and galactose. Women who are able to digest milk sugar and who drink lots of milk thus have a greater exposure to galactose. There is some clinical and experimental evidence to suggest that galactose is toxic to ovarian egg cells and leads to premature ovarian failure. Women who were lactose intolerance or who drank less milk had less exposure to galactose and have fewer fertility problems. Another factor is that some women who have impaired liver function or have a deficiency of the enzyme required to metabolize galactose, which could lead to higher than normal galactose levels (Ussher and Perz, 2016).

A healthy liver is also essential to recover the hormone balance, maintaining blood sugar control, improving fertility and performing other work that will keep menstrual problems and symptoms under control. PMS is characterised by an excess or a deficiency in one or more of these hormones like insulin, testosterone, cortisone, oestrogen, progesterone, prolactin, follicle stimulating hormone, lutenizing hormone, and thyroid hormone. In a serious case of PMS, many of these hormones are in balance. Essential fatty acids help to perform efficiently to minimise the consequences of PMS (Fommei *et al*., 2009).

iii. Nutrients related to PMS

PMS is probably multi-factorial and it is probably way more complicated than one or two supplements or mineral deficiencies might cause. Dietary intakes of certain micronutrients including Calcium, VitaminD, Thiamine and riboflavin have been associated with the development of PMS (Bertone-Johnson *et al*., 2005 and Chocono-Bedoya, 2011). Iron, Magnesium, Copper, Manganese, Potassium, Zinc and Sodium are involved in the patho-physiology of PMS through a variety of mechanism.. Blood level of Potassium, Magnesiumand Zinc fluctuate across the menstrual cycle (Das and Chowdhury, 1997) in a cross sectional study done among 1057 women, total intake of non-heme Iron, Magnesium, Manganese, Potassium, Zinc and Copper were modestly highly correlated with the severity of PMS.

Calcium

Study done by Sutariya *et al*., (2011) in their intervention study of supplementation of Calcium among women with PMS found that a Calcium supplement effectively alleviates the luteal phase symptoms.Two welldefined rigorous trials assessed the efficacy of Calcium supplementation for PMS. It was reported from the study that Calcium supplementation for at least three cycles may be of benefit to women suffering from PMS. (Thys-Jacobs *et al*., 1995).Calcium assists with treating bloating and abdominal cramps and Magnesium helps the body absorb the Calcium (Chocono-Bedoya, 2011). Derman *et al*., (2014), noted that the patients consumed more than 200 ml. of milk, 300 ml of yogurt and more than 50 g of cheese per day reduces the frequency of occurrence of PMS.

Iron

In a research done by Nierenberg (2013) among reproductive age women at University of Massachusetts at Amberst found that women with an Iron intake more than 20 mg a day has about 35 percent lower risk for being diagnosed with PMS than women who had the lowest Iron intake about 10 mg a day. To get higher amounts of Iron, a woman would only have to eat one cup of Iron fortified cereal which typically contains 24 mg of Iron.

In a longitudinal study done by Nierenberg (2013) among 1970 reproductive age women on mineral intake, 1060 women had been diagnosed with PMS. Bertone*et al.,*

(2009) found that Iron levels were associated with PMS. But it was only the non-heme Iron that showed the beneficial effect on reduction of PMS. Heme Iron from animal sources such as red meat and poultry have the same effect.

It is demonstrated that Iron deficiency anaemia cause excessive menstrual flow. Apart from the Iron deficiency in such cases, t here are certain other factors that after the enzyme of buccal epithelium of humans. These enzymes play an important role in the function of muscle and this fact lends considerable weight to the theory that menorrhagia may be acaused by the weakness of muscular elements in the uterus due to tissue Iron deficiency. This weakness particularly affects the spiral arterioles and often occurs without significant anaemia. Thus Iron deficiency from whatever cause may lead to menorrhagia in turn produces a more severe Iron deficiency. In such conditions, judicious use of oral or parenteral use of Iron not only cures anaemia but also breaks vivacious. It is noticed that such cases who fail to respond to other hormonal treatment got cured by simple Iron therapy (Panda, 2012).

Iron deficiency makes a woman anaemic and red blood cells did not grow and function correctly. This usually results in extreme fatigue. Iron plays a role in the formation of melatonin in the body. Melatonin is an important component fighting against depression during PMS. Based on the study done by Bertone *et al*., (2009) revealed that the intake of Iron just above the recommended daily allowance showed significant benefit.

It has been found that Iron supplements and Iron from green leafy vegetables and plants known as non-heme Iron is the best for treating the Iron deficiency causing the symptoms of PMS. But at the same time, heme Iron from higher intake of red meat is not effective and may sometime aggravate the condition. Study done by Chocano-Bedoya *et al*., (2013) it was noted that there was an inverse association between total intake of Iron and PMS development. But when multivariable adjustment was made, it was noted that the participants with higher non heme Iron intake had 31 per cent lower risk of PMS than those with lower Iron intake. It was exclusively from non-heme Iron only. Heme Iron intake by a group does not relate to risk of PMS. The study also concluded that levels of intake above which the association was observed was more than 20 mg per day which was higher than recommendation for 20-40 years which was 18 mg per day. Iron is a co factor

for the enzyme tryptophan hydroxylase, which catalyse the conversion of tryptophan into 5-hydroxy tryptophan, a precursor of serotonin (Yehuda and Mostofsky, 2010).

Potassium

Intake of potassium was positively associated with abdominal bloating and swelling of extremities, depression and irritability (Chochno-Bedoya *et al*., 2013). Bertone (2009) in their longitudinal study found out that high potassium intake may be associated with high risk of PMS. Chocano-Bedoya *et al*., (2013) in their study confirmed that higher intake (>3,317 mg/ day) was positively associated with PMS and had a relative risk of PMS compared to women who took lower levels of potassium (< 2,319 mg/day) and the potassium was positively associated with PMS risk at levels below current adequate intake of 4700 mg per day.Women with higher zn/cu ratio had lower risk of development PMS (risk=0.069, 95per cent) compared to women with lowest ratio.

Magnesium

In a pilot study on efficacy of and safety of modified release Magnesium for treatment of PMS reported that lower blood levels of zinc and Magnesium have been observed in women with PMS compared to controls (Quarants *et al*., 2007). In a Magnesium intervention study done by Walker*et al*., (2013), Magnesium and potassium have been studied as treatment for PMS.Zinc showed an inverse relationship with PMS risk (median 25 mg / day from supplements).

Vitamin B_6

Pyridoxine ($C_2H_{12}O_8N$) IS abundantly present in vegetarian and non- vegetarian foods like Bengal gram and soyabean etc. The common symptoms caused are tiredness, depression, nervous irritability and exhaustion. Long standing irregular veginal bleeding in young girls is successfully treated with Vitamin B_6. It controls bleeding by inhibiting the activity of oestrogen and ripening of follicles to impact ovarian dysfunction. Hence Vitamin B_6 is found to have a sedative effect on CNS. Mental irritability, feeling of rundown condition, sleeplessness, mental stress were releaved by B_6 supplementation (Bertone-Johnson, 2009) 1 tablet 3 times a day. The patients found remarkable change in their distress (Panda, 2012).

b. Physical activity and exercise

It was reported through some recent studies that there is an association between exercise and PMS and indicated a regular exercise habit decrease some physical and psychologic premenstrual symptoms (Samadi *et al*., 2013).

Borenstein *et al*., (2007), stated that the aetiology of PMS is uncertain. A wide range of different treatment regimens, including lifestyle changes, complementary and alternative medicine and drug therapies are promoted for PMS and PMDD. Based on their study Farrokh *et al*., (2015) concluded that exercise is commonly listed as remedy for PMS. Intervention studies demonstrate that aerobic exercises increase haemoglobin, haematocrit, red cell count, platelet count and decrease the levels of prolactin, esterdiol, progesterone resulting in improvement of fatigue, impaired concentration, confusion and most other symptoms. Findings by Farrokh *et al*., (2015) and Cheng *et al.,* (2013) revealed that exercise effectively reduces the symptoms of PMS and can be used as treatment. Exercise is considered a complementary alternative medicine therapy for improving and maintaining physical and emotional health. A study by Samadi *et al*., (2013), demonstrated the mean score of PMS and symptoms decline after eight weeks of aerobic exercise training in the experimental group and suggested that eight weeks of aerobic exercise effectively reduces the symptoms of PMS and can be used as a treatment.

c. Stress management

Managing stress is a crucial component of the plan to control PMS and also improve the fertility. Stress is any stimulation to the body that challenges its sense of balance and triggers a significant set of biological response; these responses include a release of stress hormones, an increase in blood sugar, tightening of muscles, shallowness of breath, rising blood pressure and rapid heart rate (Pitman, 2016).

Premenstrual syndrome and polycystic ovarian syndrome are major stressors. Most women have some version of 'female perfection' that influences their self perceptions. Most of the healthy women feel that they are healthy, attractive and fertile. But women with PMS feel abnormal, even freakish. Excess hair growth on face, lower and upper chin, over wieghr, acne, absence of the periods and infertility diminish the self esteem and are stressed or tensed and appropriate stress management helps to prevent stressful situation and promote their self esteem relieved from the stressful situation.Control of stress is a

lifelong process that contributes to better health and a greater ability to succeed with the own agenda. Professional help for stress revealed that some stress symptoms such as tension, headache are mild and can be managed by rest, herbal supplements or over the counter dedications (Cheng *et al*., 2013).

Any menstrual problem like PMS/PCODS can be emotional drain, wearing away at the self confidence and body image. Women reported the feelings of unworthy, unwomanly inferior, defective, depressed, scared, confused and embarrassed. Judgement and the attitude towards the women with menstrual problems for their infertility are additional problems. It is also heart breaking to note that others having babies, these emotional factors disturb and effect their personal and social life (Pitman, 2016).

The first step towards dealing with menstrual problems like PMS and PCOS is to unconditionally accept as the women having menstrual problems are rights and the problems are the foundation for constructing a new perspective on her life and tackling action to gain a measure of control over problems. When she is unable to confirm to the pressure of others' expectations, fear of rejections, failure or abandonment can creep in under these circumferences, self confidence diminishes, self confidence is tied to success and may be feeling quite unsuccessful (Ussher and Perz, 2013).

Ussher and Perz (2016) suggested some of the ways to improve self esteem and self confidence during PMS. They arebyimproving the knowledge towards reproductive health and menstrual problems upgrading negative belief to positive belief, replacing failure oriented behaviours with success oriented behaviour iv. Release perfectionism and accept 'what is' and practicing forgiveness of self and others.

d. Yoga and meditation

Yoga is a mind and body practice with historical origins in ancient Indian philosophy. (Sakuma *et al.,*2012). Exercise is commonly listed as a remedy for PMS. Intervention studies demonstrate that aerobic exercise which increases hemoglobin, hematocrit, red cell count, and platelet count, and decreases the levels of prolactin, estradiol, and progesterone; resulting in improvement of fatigue, impaired concentration, confusion, and most other premenstrual symptoms (Borenstein*et al*., 2007 and Farrokh *et al*., 2015). The findings reveal that exercise effectively reduces the symptoms of PMS

and can be used as a treatment. Exercise is considered a Complimentary Alternative Medical (CAM) therapy for improving and maintaining physical and emotional health. A growing body of evidence indicates that yoga benefits physical and mental health by downregulating the hypothalamicpituitaryadrenal axis and the sympathetic nervous system (Bertone *et al*., 2009). A randomized controlled trial in India demonstrated that Yoga Nidra practice was helpful in patients with hormone imbalances (Rani *et al*.,2013). One study reported that three yoga poses (specifically the cobra, cat, and fish poses) reduced the severity and duration of primary dysmenorrhoea (Razaee *et al.,* 2015). Another study reported that a yoga intervention was associated with a reduction in the severity of dysmenorrhoea Chien *et al*., (2012). Even a simple home based yoga program available on a DVD was shown to reduce menstrual pain and improve overall health status (Sakuma *et al*., 2012).

Yoga is a mind and body practice with historical origins in ancient Indian philosophy. Many clinicians treating persistent pain hear about the benefits of yoga from patients who frequently go to yoga centres. Yoga classes specifically designed for women with PMS have increased; however, few intervention based studies have focused on this issue among female workers. Empirical research on the alleviation of menstrual discomfort through yoga cantered health promotion activities remains insufficient, and no research in Taiwan has addressed improvement or changes in female workers' menstrual discomfort through interventional psychologic and physical yoga activities in the workplace. It was postulated that female workers participating in a regular yoga exercise program would have fewer premenstrual symptoms. The results will contribute to our understanding of the current status of a menstrual health friendly workplace. Environment for female employees and can be used to establish a model for a healthy lifestyle (Wren *et al*., 2011).

The patients with mild to moderate anxiety and depressive symptoms improve significantly with 'Yoga Nidra' intervention. There is no improvement in the patients with severe anxietyand depressive symptoms. However, small sample size and selection of subjects from hospital outpatient clinic are the limitations of this study. Yoga Nidra is an effective tool for reduction of psychological problems emerged out of long standing

menstrual problems. Yoga is an ancient discipline designed to bring balance and health to physical, mental, emotional and spiritual dimensions of an individual (Rani *et al*., 2012).

According to Anand (2011), yoga together with relaxation, bio feedback, transcendental meditation and psycho therapy, has been found to have a convincing anti hypertensive effect and also found out that there is a reduction in urinary excretion of adrenaline, nor adrenaline, dopamine and aldosterone and a reduction in the serum testosterone and Luteinizing hormone levels and an increase in cortisol excretion, indicating optimal changes in hormone. Narendran *et al*., (2005), in their study found that yoga practices including physical postures, breathing and meditation practiced by pregnant women one hour per day resulted in increase in birth weight, reduction in preterm labour, reduction in IUGR. The study underscores the value of techniques, such as yoga and therefore pain responses (Smith*et al*., 2005).

Bertone-Johnson*et al*., (2008) in their study declares that yoga benefits physical and mental health of an individual by down regulating the hypothalamic nervous system. Potter*et al*., (2009), stated that yoga has become an increasingly popular complimentary alternative medicine among people with pain. According to Rani *et al*., (2013), a randomized control trial in India demonstrated that yoga Nidra practice was helpful for patients with hormonal imbalances. Study done by Rakhshee (2011), among women with primary dysmenorrhoea, three yoga poses (specifically the cobra, cat and fish) reduced the severity and duration of dysmenorrhoea. Sakuma *et al*., (2012), in their study on simple yoga technique through DVD for child care workers was shown to reduce menstrual pain and improved overall health status and also reported that yogic practice (Yoga Nidra) is a successful therapy for both recent and long standing psychological disturbances of all types especially high anxiety levels.

Chien *et al*., (2012), in their study proved that a yoga intervention reduces the severity of menstrual problems like PMS, PCOS and dysmenorrhoea and is effective for lowering serum homocysteine levels after intervention period of eight weeks. One of the studies done by Wren *et al*., (2011), explored the effect of yoga on persistent pain indicated that yoga could produce psychological changes, such as increased awareness of mental and physical states which may help patients to understand their painbetter. Therefore yoga practices might lead to increase pain acceptance, the willingness to

experience pain and acknowledge negative thoughts and emotions. It is also possible that yoga improves self-efficacy for pain control.

D. Nutritional intervention to tackle PMS

a. Dietary intervention

Nirenberg (2013) opines that diet affects the development of PMS or may ease the severity of its symptoms. For example, diets high in Calcium rich foods have been shown to lower the risk of PMS but little was known about the role it plays and role of other minerals play in prevention of the symptoms. A diet rich in the minerals help to protect against PMS.Chocano-Bedoya *et al*., (2013) pointed out that dietary intake of micronutrients including Calcium, Vitamin D, Thiamine and Riboflavin have been associated with the development of PMS but the role of minerals has not been thoroughly explored. According to Das and Chowdury (1997), Iron, Magnesium, Zinc, Copper, Manganese, Potassium and Sodium are involved in the pathophysiology of PMS through a variety of mechanisms. Blood levels of Potassium, Magnesium, and Zinc fluctuate across the menstrual cycle. Mahan and Stumps (2014) opines that no one consistent imbalance or deficiency has been identified to explain the aetiology of PMS although there are some promising theories related to hormone imbalance (Oestrogen and Progesterone), neurotransmitter synthesis effect, disorders of essential fatty acids metabolism and nutritional deficiencies. A healthy diet that includes fruits and vegetables, whole grains, legumes, quality fats and proteins, when combined with regular exercise and stress reduction or relaxation techniques help the women to cope with PMS and its symptoms.

Treatment of PMS/PMDD is best approached in a stepwise fashion, beginning with lifestyle modifications and progressing to nutritional supplementation, non-pharmacologic therapy, and non-prescription and prescription medications. Conservative treatment has proved beneficial in many women and should be considered as first line therapy in women with mild symptoms and adjunctive therapy in all others. Higher dietary intake of both Calcium and Vitamin D through foods and supplements has been associated with reduced risk of PMS. These two nutrients may influence its development through their relationship to estrogen (Pitman, 2016). Calcium had good quality evidence to support its use in prevention of PMS (Whelan *et al*., 2009).

B Vitamins likeThiamine, Niacin, Riboflavin, Vitamin B_6, Folate and Vitamin B_{12} are involved in the metabolism of neurotransmitters through different mechanisms. Riboflavin is needed to activate Vitamin B_6, which is a cofactor in the generation of serotonin from the amino acid Tryptophan. Niacin deficiency lead to depletion of tryptophan, thereby reducing its availability to form serotonin (Stipanuk 2006). Thiamine is required for the metabolism of glucose and precursors of GABA. Vitamin B12, Vitamin B6, and folate are associated with the formation of Sadenosyl methionine and tetrahydrobiopterin, both of which are required for the metabolism of serotonin and dopamine (Frankenburg, 2007).

Since the most characteristic feature of PMS is related to the onset of the symptoms and menstrual cycle,researchers suggested that gonadalsteroids are involved in the pathophysiology (Frank, 1931). This is supported by studies that symptoms are absent during non-ovulatory cycles, abolished vasectomy or treatment with ovulation inhibitors and reinstated by administration of oestrogenous hormones (Yonkers *et al*., 2003).

A double blinded study done by Hardy (2010) indicated that supplementation with 400 IU of Vitamin-E per day can further help to reduce many PMS symptoms. Vitamin-E, Vitamin-B_6 and Magnesium are all known to affect prostaglandins which are involved with make prostaglandins with many symptoms of PMS. These nutrients help the body make prostaglandin hormone that reduces PMS symptoms in general

Sodium restriction was recommended to reduce abdominal bloating, fluid retention, irritability and insomnia. Coffee intake was restricted as it was associated with PMS irritability and insomnia (Lori *et al*., 2003).

Calcium, VitaminB_6 and Vitamin E also showed positive effect by controlling PMS symptoms (Van-Die *et al*., 2013). The PMS treatments are divided into herbal psychotropic, hormonal and surgical methods. Most women who suffer from sever PMS need psychotropic or hormonal treatment to control the symptoms (Hamid *et al*., 2012).

An appropriate dietary pattern is necessary for a healthy life style that could have positive effect on many aspects of life such as menstrual cycles in women (Sayegh *et al*., 2005)

PMS implies the quality of life and social lurching, the presence of only PMS is mostly not perceived as either distressing or debilitating hence presence of PMS symptoms is different from categorical symptoms.A study on adolescent girls showed that adolescent girls who suffer from PMS had low intake of dairy products fruits and vegetable when compared to healthygirls (Bakhshani *et al*., 2012).

New developments are taking place, given the benefits of new knowledge in nutrition science, new process technologies and the modern consumers demand for foods with multiple health benefits. Also, the focus is on disease prevention and optimizing health by the using the of functional foods ingredients. Functional foods have been defined as foods and food components that provide a health benefit beyond basic nutrition for example conventional foods; fortified, enriched or enhanced foods; and dietary supplements (Handa *et al*., 2012). According to (Fortmann *et al*., 2013) a dietary supplement is intended to provide nutrients that may otherwise not be consumed in sufficient quantities. Supplement is important for the treatment of certain health problems but there is little evidence of benefit when used by those who are otherwise healthy.

b. Nutrition education and counselling

According to the Keely *et al*., (2011), there are significant correlations among education, cognitive variables and behaviours including attitudes and intended choices that can be related to physical activity as well as intake of healthy diet leading to improving general health in women. Nutrition education is widely used for a range of population group as a medium to deliver healthy diets and nutrition information. However, among all methods of intervention, nutrition education was a rarely implemented one. A Korean study by Youand Chang (2009) concluded that the combination of nutrition education and supplementation provision was significantly beneficial in improving body composition, dietary habits, enhancing daily nutrient intake and quality of life. Ha and Canie-Bish (2009) successfully showed an increase in the consumption of fruits and vegetables after nutrition intervention by the experimental group.PMS was poorly understood and in many cases inadequately managed. The unknown aetiology of PMS has lead to many treatments begin suggested as possible therapies (Pitman, 2016). Lua and Elena (2012) in their meta analysis review states that health education though a widely used module for a range of

population groups, it is still rarely implemented in students for effective improvement in eating habits. According to Chou and Chang (1999) in their study among Hong Kong students pointed out that generally the students lacked basic knowledge on PMS and the educational programme has been of value in helping them to obtain a better understanding of health –related issues and PMS self care measures. Health education is also necessary to develop a positive self-concept and positive attitude towards menstruation related symptoms.

c. Life style modification

One of the effective wide ranges of treatment option is life style modification (Indusekhar *et al.,* 2007). Hashemi *et al*., (2016) in their study among college working women on web based lifestyle education confirmed that severity of PMS in the experimental group was significantly reduced compared to control group.

Schulman (2010) declare that life style treatments, including adequate rest, physical activity and exercise, regular hot baths, nutritional strategies (reduced intake of caffeine as well as sugar, reduced salt intake, avoidance of alcohol) plus intake of healthy diet with increased Calcium, Magnesiumrich foods and reduction in factors causing excessive stress are recommended for women with PMS. Kashanian *et al.,* (2007) concluded that Lifestyle modification in the form of yoga, meditation and exercise are also helpful in the management of mild symptoms along with dietary supplements in the form of Calcium, Vitamin B_6 and soy isoflavons. Counselling the victims and relatives is more essential so that sufferers gain more attention and care which helps them to overcome the painful suffering.

According to Brahmbhatt *et al*., (2013), PMS symptoms are managed if diagnosed in right time with suitable pharmacological and non-pharmacological aids. Therefore it is suggested that life style modification and counselling are essential. If neglected, may even be life threatening in patients with severe symptoms. Irrespective of age, literacy and socio-economic status, most of the women tend to suffer with PMS which may be understood by them or they may be ignorant of it.

Exercise has been shown to increase Endomorphins, improving mood and decreasing feelings of lethargy and emotional symptoms and has been shown to increase

serotonin levels and mood balance and also minimizing the severity of PMS (Johnson, 2004 and Pearlstein, 2012).

Communities and countries and ultimately the world are only as strong as the health of their women.

- Michelle Obama

3

METHODOLOGY

The research methodology pertaining to the study on "**Effect of Nutrition Intervention on Symptoms of PMS (PMS) among Women of Reproductive Age (20-45 Years)"** is presented under the following phases.

PHASE-I: Identification of participants for intervention studies

A. Selection of area
B. Selection and screening of participants having PMS
C. Formulation oftools to conduct the study

PHASE -II:Mapping of participants for nutrition intervention

A. Conduct of the survey
B. Assessment of the nutritional status of the selected participants
C. Assessment of the psychological profile of the selected participants
D. Recording the symptoms of PMS using Premenstrual Daily Symptom Diary and
E. Assessment of knowledge related to PMS

PHASE - III: Formulation, sensory evaluation and nutritional analysis of health mix cookies for dietary intervention

A. Selection of ingredients and formulation of health mix
B. Sensory and nutritional evaluation of health mix
C. Preparation of cookies with the best scored health mix
D. Analysis of the physical qualities, nutrient content, microbial count and cost effectiveness of the health mix cookies

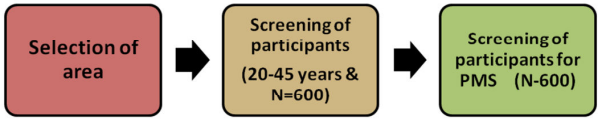
PHASE -IV: Impact of nutrition intervention on the symptoms of PMS

A. Impact of dietary intervention on the nutritional status and symptoms of PMS among the selected participants
B. Impact of nutrition and health education on the knowledge of PMS among the selected participants

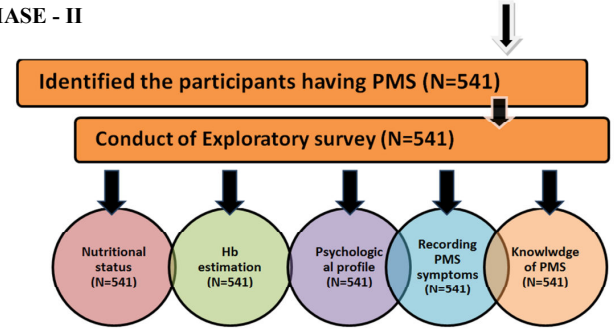
PHASE - V: Data Analysis and Interpretation

RESEARCH DESIGN

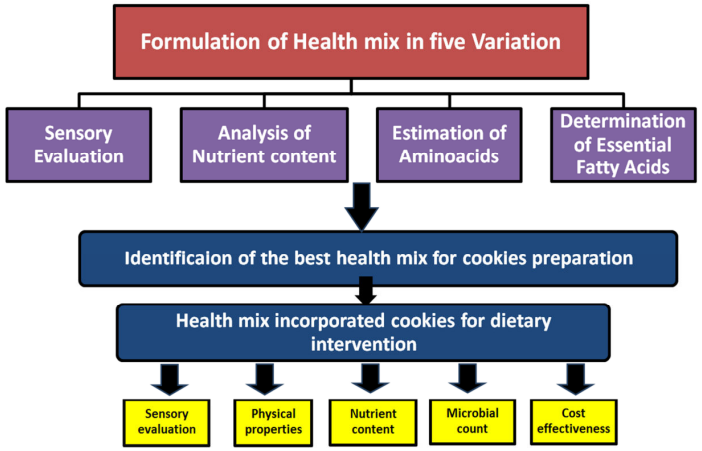
PHASE - I



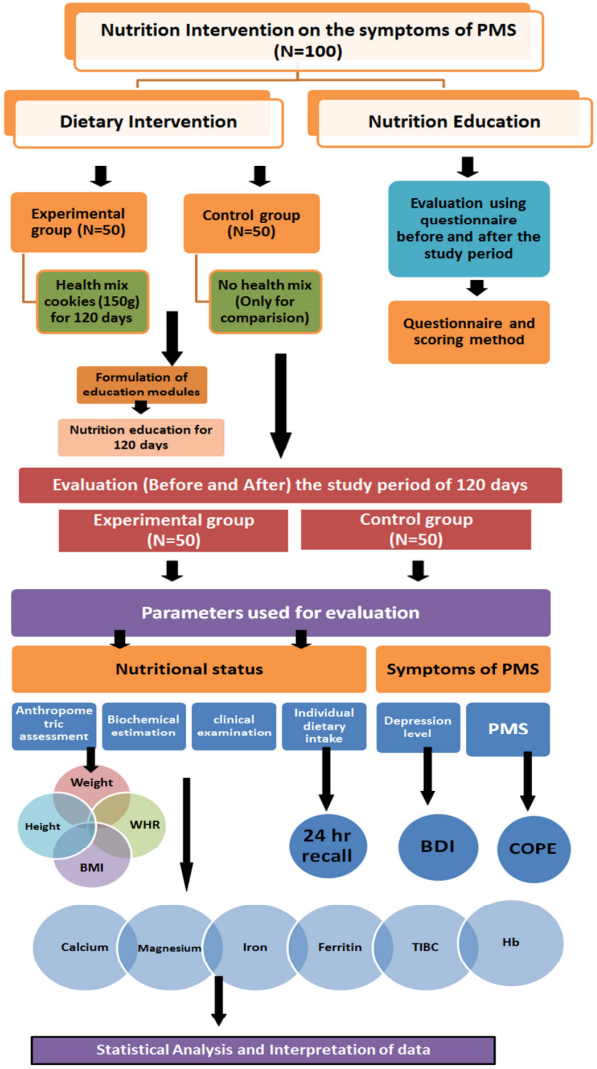
PHASE - II



PHASE - III



PHASE - IV



PHASE – I

Identification of participants for intervention studies

A. Selection of area

The target group of reproductive age women (20-45 Years) was selected from the prominent residential areas of Sulur, Coimbatore District. Coimbatore is an expanding city with a total population of 34, 58,045 and a female population of 17, 28,748 with a female sex ratio of 964 (Census of India, 2011). Sulur is a taluk area located at 11^0 2' 0" North, 77^0 8' 0" East in Coimbatore Urban District of Tamil Nadu (Figure-2). This area was selected on the basis of easy accessibility, availability of adequate number of participants and the cooperation rendered towards the study by the participants, since the assessment of PMS was recorded for two to three months. Sulur has a total female population of 1, 21,157 (Census of India, 2011). Total female population (15-49 years) in Sulur town was 6061.



Figure-2 Suleur area map

B. Selection and screening of participants having PMS

Premenstrual Syndrome (PMS) refers to a cluster of physical, mood and cognitive symptoms that occur during the luteal phase (from 14 to 28 days of menstrual cycle) of menstrual cycle and subsides with the onset of menstruation. Nearly 80 per cent of the women of reproductive age, suffer from premenstrual physical and emotional change that occurs between ovulation and first day of menstrual bleeding, stop after bleeding and are not present for at least seven days after the menstrual period (ACOG, 2014).Up to 70-90 per cent of reproductive age women have one or more signs of physical discomfort or emotional symptoms in the menstrual phase i.e. the luteal phase of menstrual cycle. About 20-40 per cent of the menstruating women have PMS that are bothersome. A small

number up to eight per cent experienced more severe symptoms which lead to substantial distress or functional impairment and are referred to as PMDD (Halbreich *et al.,* 2013). According to Ussher and Perz (2013) PMS affects women in their age of 20s-30s. Hence, the investigator selected adult women of reproductive age group (20-45 years) as participants for the present study. Table-III highlights the Criteria for selection of participants for Phase-I

Table-III

Criteria for selection of participants

Inclusion criteria	Exclusion criteria
• Adult women of reproductive age (20-45 years) • Willing to participate and extend their co-operation for the study • Who are literates • Ready to give written consent for the intervention	• Adult women above the age of 45 years and less than 20 years • Pregnant and lactating mothers • Who have undergone hysterectomy • Who are illiterates • Who have not given the written consent • Who are severely anaemic

On the basis of the inclusion criteria, a quick screening of PMS was carried out among a representative sample of 600 reproductive age women using American College of Obsteristics and Gynaecology (ACOG) diagnostic criteria (2000). Based on the ACOG Diagnostic Criteria (Appendix-I), those who have PMSwere selected for the study. Convenience sampling refers to the fraction of population being investigated which is selected neither by probability nor by judgement but byconvenience (Gupta, 2016).Based on the formula given below, the sample size was calculated and it was 595.

$$N = \frac{Z^2 P (1-P)}{(d)^2}$$

where N= sample size; P= expected prevalence or proportion; d =precision

Hence the number of participants selected for the study was 600 and ACOG diagnostic criteria for PMS was used to find out the prevalence ofPMS. A total of 541 adult women of reproductive age group (20-45 years) had PMS. The selected participants were given orientation regarding the protocol of the study and also explained modalities

and purpose of the study. They were also informed about the dietary intervention and nutrition education and the follow-up to be carried out for four months for the assessment of nutritional and health status.Prior to the actual conduct of the study, a good rapport was established among the selected participants and their family members through proper counselling. The purpose and procedure involved in the study were clearly explained to the selected participants and their family members were also effectively motivated through an interactive session by the investigator to extend their full co-operation for successful conduct of the study.

C. **Formulation of tools to conduct the study**

A Questionnaire schedule was prepared to collect demographic profile related to family background, age, educational, occupational, economic and marital status, dietary pattern, medical history mainly related to the reproductive health and knowledge on the causes, prevalence, symptoms, problems and treatment of PMS and anxiety level of the participants (Appendix-II).

The specially designed questionnaire was validated by medical and nutrition experts for its contents and the necessary changes were carried out on the basis of the suggestions given by the experts. Tamil and English version of the questionnaires were tested by parallel form questionnaire method among ten participants for the reliability of the questionnaire and the Tamil version was similar to English questionnaire with a score of r=0.926.

All the selected participants were clearly instructed to record the daily symptoms, at the same time itself in the form given to them. This was supervised by the investigator regularly by checking the entries made by the selected participants in the Premenstrual daily symptom diary (PMDD) through periodical visits and this was systematically followed through two menstrual cycles (three months) in order to obtain accurate and reliable data related to PMS.

The study design was registered in the Clinical Trial Registry of India (CTRI), ICMR. CTRI registration number is **REF/2013/005727.** To conduct nutrition intervention, the methodology of the present study was presented beforethe Institutional Human Ethical

Committee (IHEC) of Avinashilingam University and the approval number **AUW/IHEC-13-14/FHP-01** was obtained**.**

PHASE – II

Mapping of participantsfor nutrition intervention

A. Conduct of the survey

Demographic profile, dietary pattern, the personal and family medical history were collected from the selected participants (N=541) using the specially designed questionnaire (Appendix-II). Background information such as age, sex, type and number of members in the family, educational qualification, marital status, occupation and income level were collected.

Dietary pattern such as type of food items, inclusion of foods, consumption of coffee, tea, health drinks and other beverages were collected. The details of family medical history, frequency of health problems including reproductive health problems and the complications were gathered and recorded carefully.

B. Assessment ofnutritional status of the selected participants

Assessment of nutritional status of the selected participants included medical, social and dietary history, anthropometric data, biochemical data, clinical evaluation and review of drugs used (Weigley *et al,* 2014). In the present study, nutritional status of the selected participants was assessed through anthropometric measurements, clinical examination, biochemical estimation and dietary intake.

a. Anthropometric measurements

Anthropometry is the universally acceptable, inexpensive and non-invasive procedure. It is the measurement of the body's physical dimensions. The physical dimensions are used to develop an understanding of individual's nutritional status. The anthropometric data including height, weight, BMI and waist/ hip ratio of the selected participants (N=541) were recorded carefully to obtain reliable data.







Plate - 1 Recording anthropometric measurements

i. **Height:** Height is a stable measurement of growth as opposed by body weight. Weight reflects only the present health status of an individual whereas, height indicates the events in the past also (Park, 2017). For recording height of the selected participants, non-stretchable measuring tape was fixed to the wall and the participants were asked to stand erectly on the flat floor with feet parallel and with heels, buttocks, shoulders and back of the head touching the wall. The head was held comfortably erect and arms hanging at the sides in a natural manner. A head piece (scale) was lowered, crushing the hair and making contact with the top of the head and height was recorded to the nearest 0.5 cm. This process was repeated thrice and the consistent reading was obtained (Plate-1). Height of the selected participants was recorded in centimetre to the nearest millimetre (ICMR, 2015).

ii. **Weight**: Weight is the most widely used simplest reproducible anthropometric measurement for the evaluation of nutritional status of the population. It is a measure of total mass and hence, it is sensitive to the changes in body fluids, fats, muscle mass, skeleton and other organs (Gopalan and Chatterjee, 2010). Weight gives the present nutritional status of an individual. Weight was recorded in the morning after evacuation of bladder with minimum clothing, while standing in upright position (Rey *et al*, 2008).

The investigator used a sturdy portable digital weighing balance to record the weight of participants. Weight was recorded accurately to the nearest 0.1 kg. and precautions suggested were followed while taking the weights. The electronic digital weighing machine was checked periodically using standard weights while recording the weight of the selected participants.

iii. **Body Mass Index:** Several indices and ratios were derived from anthropometric measurements. The most commonly used, well known indicator of body fatness is the Body Mass Index. According to WHO, Body Mass Index (BMI) is a simple index of height and weight that is commonly used to classify the different grades of malnutrition. BMI is calculated using the formula

$$BMI = \frac{Weight(kg)}{Height(m^2)}$$

After the computation of BMI, selected participants were classified according to the norms given by ICMR (2011), as mentioned in the Table-IV**.**

Table- IV

Grades of Malnutrition

BMI classification	Grade of malnutrition
Underweight	<18.50
Severe thinness	<16.00
Moderate thinness	16.00 - 16.99
Mild thinness	17.00 - 18.49
Normal range	18.50 - 24.99
Overweight	≥25.00
Pre-obese	25.00 - 29.99
Obese	≥30.00
Mild Obese class I	30.00 - 32.49
Moderate Obese Class I	32.50 - 34.99
Mild Obese class II	35.00 - 37.49
Moderate Obese Class I	37.50 - 39.99
Obese class III	>40

(Source: NIN Methodologies for fitness assessment, ICMR, 2011)

BMI is a measure of the body weight relative to height that is associated with body fat and health risk. As a measure of relative weight, BMI is easy to obtain. It is an acceptable proxy for thinness and fatness, and has been directly related to health risks and death rates in many populations (Nishida *et al.,* 2004). BMI was computed carefully for the participants.

iv. Waist/Hip Ratio

Waist-Hip Ratio (WHR) is used as the best indicator along with the BMI values to measure the health status of an individual and also measure the risk of health problems.Scientific data of the research revealed that people with ‘apple shaped’ bodies face more health risks than those who are with ‘pear shaped’ bodies. WHR used as a measurement of obesity, is a possible indicator of other serious health conditions in recent

past, with the increasing incidence of obesity, considering the incidence of abdominal adiposity in diet related chronic diseases, waist-hip circumferences were used to assess the abdominal adiposity in selected participants (WHO, 2008).

The Waist-Hip ratio (WHR) is the ratio of the circumference of waist to that of hip. The waist circumference should be measured at the midpoint between the lower margin of the last palatable rib and the top of the iliac crest, using a stretch-resistant measuring tape. Hip circumference should be measured around the widest portion of the buttocks, with the tape parallel to the floor. For both measurements, the selected participants were asked to stand with feet close together, arms at the side and body weight evenly distributed and with little clothing. The selected participants were made to relax, and the measurements were taken at the end of a normal expiration. Each measurement was repeated thrice. Measurements were within one cm of accuracy, the average was calculated and if the difference between the two measurements exceeded one cm, the two measurements were repeated.

Waist Hip Ratio (WHR) was calculated using the formula

$$WHR = \frac{\text{Waist circumference(cm)}}{\text{Hip circumference(cm)}}$$

According to the guidelines (ICMR, 2011), the cut-offs for WHR is 0.90 for Indian man and 0.80 for Indian woman.

b. Biochemical estimation

Biochemical estimation is the most sensitive indicator of the health status of an individual. Compared to other methods, biochemical estimation provides the most objective and quantitative data on nutritional status. The usefulness of biochemical tests is to provide indications of nutrient long before clinical manifestations and signs appear (FSAU, 2004).

Haemoglobin estimation was carried out by cyanomethaemoglobin method for all the participants (N= 541). Twenty micro litres of finger prick blood samples by skin puncture technique using sterile lancet needles were collected into standard micropipettes (Plate-3) and transferred to Whatman No.1 Filter Paper, having identification particulars of blood sample and spread over an area of 1-1.5 cm. diameter. Papers were dried in shade

and placed in a cover. Each twentieth sample was collected in duplicate to check variation. The collected samples were used for haemoglobin estimation.

C. Assessment of the psychological profile of the selected participants

Health is defined as the condition of complete physical, mental and social well-being and not merely free from illness or infirmity (WHO, 2010). Based on the references, the present study indicates that the presence of anxiety, low self esteem or depression has a great impact on PMS symptoms. Psychological status of the selected participants was evaluated using the anxiety level, self esteem and depression levels.

a. Assessment of anxiety level –It is measured using State Trait Inventory and state trait inventory-I, STI and STI-I form (Spielberger and Sydeman, 1994), which differentiates between temporary or emotional state anxiety versus long standing personality trait anxiety in adults. The State-Trait Anxiety Inventory (STI) is a psychological inventory based on a 4-point Likert scale and consists of 40 questions on a self-report basis. The STI-I measures two types of anxiety - state anxiety or anxiety about an event, and trait anxiety or anxiety level as a personal characteristic. Higher scores were positively correlated with higher level of anxiety. The average maximum score was 4. UsingState anxiety (S-anxiety) and Trait anxiety (T-anxiety) the anxiety level of the selected participants of 541 was carefully recorded and assessed.

b. **Assessment of self-esteem** – Self-esteem was done based on Rosenberger'sInventory for self-esteem. It contains four point Likert scale with positive and negative statements. A 10-item scale that measures global self-worth by measuring both positive and negative feelings about the self. The scale is believed to be uni-dimensional. All items were answered using a 4-point Likert scale format ranging from strongly agree to strongly disagree (Rosenberg, 1965). The scale was administered to the selected participants (N=541) and the relevant data was collected.

D. Recording the symptoms of PMS

Premenstrual Daily Symptom Diary was used to find out the symptoms of PMS. It is a table with list of 21 common symptoms of PMS and graduated with 30 columns for

entry of symptom presence as numbers (1- no symptom, 2-mild symptom, 3-moderate symptom, 4 –severe symptom). The selected participants (N=541) were instructed to make an entry at the end of each day to note the different types of symptoms. Average score of all symptoms marked only in the luteal phase of the menstrual cycle for three consecutive monthswere considered as symptoms of PMS.

E. Assessment of knowledge related to PMS

The questionnaire consists of 10 questions of multiple choice type with one correct answer, carries one mark for each question and are related to meaning, causes, prevalence, age group affected, complications and treatment.

Grading the marks was done based on the formula

Good < average score + sigma

Average = (average score - sigma) - (average score + sigma)

Poor > average score – sigma (Bhatacharya , 2006)

The average score was arrived and from that the marks, good and poor werefixed.

PHASE - III

Formulation, sensory evaluation and nutritional analysis of health mix cookies for dietary intervention

Food supplementation is one of the most effective methods of promoting health and preventing or combating health problems, to reach some or all population.Supplementary foods were formulated on the basis of low cost, locally available foods, familiar to home maker and easy for preparation. These aspects helped to develop a suitable health mix to meet the nutritional support for the prevention of the signs and symptoms of PMS. Keeping all the points in mind, the investigator formulated macro and micro nutrient rich health mix for dietary intervention.The formulated health mix was valuable for its Calcium and Magnesium content apart from the macronutrients contribution.

A. Selection of the ingredients and formulation ofthe health mix

List of Calciumand Magnesiumrich food items were selected to formulate the health mix for dietary intervention. Table-IIIand Figure-3 depicts the food items used in the formulation of health mix.

Table- V

Food items used in the formulation of health mix

Ingredients	Botanical Name	Active Constituents	Action	Responses
Sprouted ragi	*Eleusine coracana*	Iron and Calcium	Improving blood Iron and Calcium level	Reduces the symptoms of PMS like cramps, fatigue
Rice flake	*Orysa sativa*	Iron	Readily absorbed when taken with Vitamin C	Reduces fatigue
Sprouted horse gram	*Macrotylom auniflorum*	Rich in Iron, Calcium Molybdenum, Polyphenols	High antioxidant property, rich in EFA and EAA	Polyphenols help to reduce weight gain, fatigue, cramps
Roasted Bengal gram	*Cicer ariertinum*	Rich in Protein and Iron	Readily digested and enhances Iron absorption	Reduces the symptoms of PMS
Soya bean	*Glycine max*	Rich EFA, EAAs, Poly phenols, Protein	Maintains adequate protein levels	Reduces overall symptoms of PMS
Gingelly seed	*Seasmum indicum*	Rich in EFA , Iron and Calcium	Improving blood Iron and Calcium levels	Reduces symptoms of PMS like cramps and fatigue
Jaggery	*Caryota urens*	Iron	Improving blood Iron and Calcium Level	Reduces symptoms of PMS like cramps and fatigue



Figure – 3.Ingredients used in the formulation of health mix

i. Pre-treatment of the ingredients

Ragi and horse gram were germinated to enhance the nutrient content. Then it was sun dried and roasted. The other ingredients were slightly roasted. The quantity of ragi was gradually increased from 20 to 60 grams to increase Calcium content of the health mix and proportionately the quantity of rice flake content was reduced from 40 to10 grams. All the other ingredients were kept constant except jaggery and gingelly seed which were slightly altered. Horse gram, roasted Bengal gram dhal and soya were kept in constant quantity to avoid digestive problems due to regular consumption of health mix in the form of cookies during dietary intervention. The ingredients were mixed in various combinations and ground into fine flour for the preparation of health mix. Quantity of ingredients used in each of the variations is given in Table –VI.

Table-VI

Ingredients used in the formulation of health mix

Ingredients	Variations (g)				
	I	II	III	IV	V
Sprouted ragi	20	30	40	50	55
Rice flake	40	30	20	10	15
Jaggery	20	10	20	20	10
Gingelly seed	5	15	5	5	5
Sprouted horse gram	5	5	5	5	5
Roasted Bengal gram	5	5	5	5	5
Soya	5	5	5	5	5
Total	100	100	100	100	100

The steps involved in the formulation of the health mix and cookies are given in Figure -4.

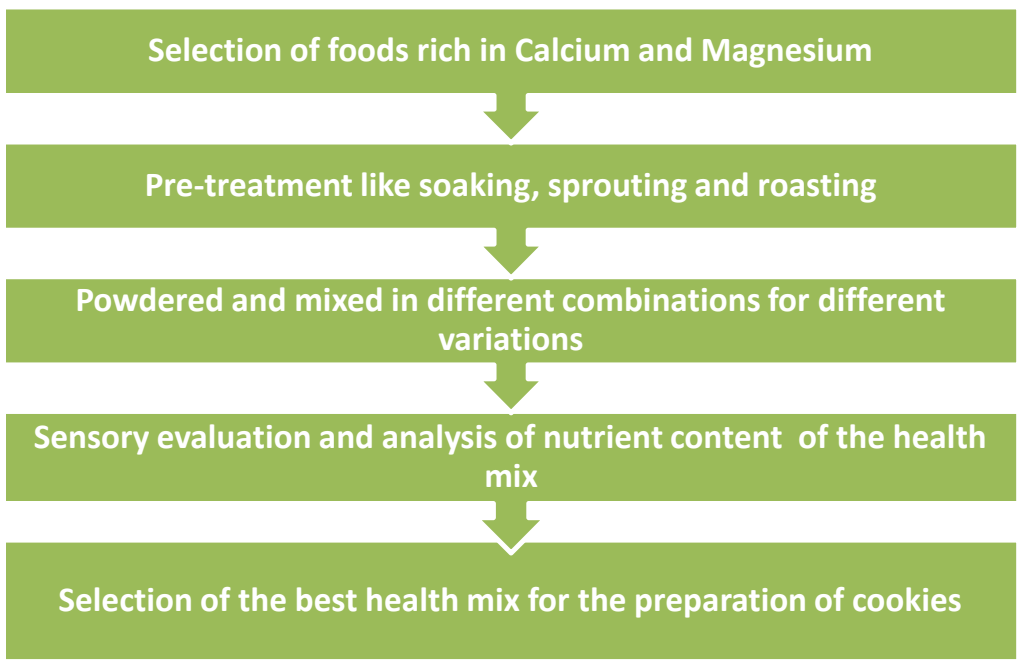


Figure- 4 Steps involved in the formulation of health mix

B. Sensory and nutritional evaluation of the health mix

Sensory evaluation is a multi disciplinary science that uses human panellist's senses of sight, smell, taste, touch and hearing to measure the sensory characteristics and acceptability of the products. Thus, quality of food is judged in terms of appearance, colour, taste, texture and doneness which are considered as key factors in successful product development (Chandrasekar, 2002). Steps involved in the sensory evaluation of the health mix were discussed in the following paras.

i. Selection of taste panel members

A taste panel is a group of assessors chosen to participate in a sensory test. To avoid errors due to physical, psychological, envIronmental and individual characteristics, a panel of assessors is used rather than a single assessor. Twenty semi skilled personnel were selected on the basis of their health, co-operation, willingness and knowledge of sensory analysis and also the ability to discriminate the various criteria for sensory evaluation.

ii. Formulation of the score card

Scoring is a form of rating of the prepared food using a numerical scale where the numbers form an interval or ratio scale was demonstrated mathematical relationship to each other (Piggot, 1988). A seven point hedonic scale was formulated for the acceptance of appearance, colour, taste, flavours and texture and grades were given according to the degree of acceptance by the selected taste panel members (Appendix-IV).

iii. Formulation and evaluation of health mix

Fifteen variations selected for acceptability trial were prepared at different point of time and presented to the panel members for sensory evaluation. Five variations which obtained high acceptability scores were chosen for the nutrient analysis. The five variations were once again given to the panel members; invite all the panel members at a time to score for the organoleptic qualities of the five variations. So as to prevent a biased result the remarks were recorded. Acceptability trials were carried (for the five variations) thrice to obtain more

reliable results and were considered for further standardization of recipes to prepare cookies. The health mix was prepared using nutrient rich ingredients and their nutritive value, sensory attributes, amino acid profile and essential fatty acid profile were analysed.

iv. Sensory evaluation

Sensory evaluation was carried out using 7 Point Hedonic Scale and presented in Table-VII.

Table-VII

Sensory evaluation scores of the health mixes

Sensory attributes	Mean scores of different Variations				
	I	II	III	IV	V
Appearance	5.46	6.80	5.78	6.66	4.71
Colour	6.0	6.0	5.84	5.75	4.84
Flavor	5.16	6.16	5.16	5.9	4.15
Taste	6.0	5.98	5.96	3.83	4.93
Texture	6.2	6.6	6.0	3.95	4.95
Overall acceptability	**28.62**	**32.58**	**28.64**	**26.09**	**23.58**

Sensory evaluation of the health mix cookies is presented in Table-V. Among the various variety of health mixes, Variation II secured the highest score for all sensory attributes except for taste which was secured second.

v. Analysis of nutrient content, amino acids and essential fatty acids profile

Five variations of health mixes were considered for the nutrient analysis, using Standard methods (NIN, 2011). Table-VIII presents the nutritive value of the health mix.

Table-VIII

Nutritive value of formulated health mix***

Nutrient	Variations(100g)				
	I	II	III	IV	V
Energy (Kcal)	271.5	296.5	282.6	261.4	286.2
Protein (g)	27.82	33.04	20.05	26.10	18.25
Fat (g)	5.087	4.223	3.986	4.361	3.989
Calcium (mg)	613.3	707.2	360.5	703.8	702.3
Magnesium (mg)	673.3	881.3	630.2	666.8	792
Iron (mg)	9.0	7.18	6.01	6.1	9.01
Vitamin –A (µg)	667	337	602	804.5	905
Thiamine (mg)	0.575	0.756	0.854	0.934	1.02
Riboflavin (mg)	1.255	0.845	0.599	2.464	1.02
Niacin (mg)	4.49	3.801	2.733	3.026	5.251
Vitamin-C (mg)	13.07	10.77	17.877	10.25	10.927

***Procedure given in Appendix

The analysed nutrient content of the formulated health mixes in five variations is presented in Table- VIII. It was noted that Variation –II had the highest levels of Calcium, Magnesium and protein content and considered for the preparation of cookies.

vi. Estimation of Amino acid and Essential Fatty acid

Essential amino acids play a major role in maintaining health status. They are involved in the synthesis of serotonin that helps in reducing emotional problems in the luteal phase. The amino acids and essential fatty acids profile of the five variations is presented in Table-IX. Amino acid profile of the five variations of the health mixes shows that the Variation II had highest score for alanine, isoleucine, phenyl alanine, histidine, leucine, threonine, tryptophan and valine. Methionine was scored third in Variation-II. From the literature study, it is also evident to note that the essential fatty acids like linoleic acid and gamma linoleic acid are helpful in reducing the PMS symptoms. These amino acids are highest in Variation II. Hence the amino acid profile of the Variation II was suitable for the preparation of cookies used in the intervention study.

Table-IX

Amino acidsand essential fatty acids profile of the formulated health mixes***

AA/EFA	Variations(100g)				
	I	II	III	IV	V
Amino acids (g/100 g)					
Alanine	1.223	1.787	0.9034	8.754	1.04
Isoleucine	0.784	1.02	0.6762	0.7343	0.992
Phenyl alanine	0.345	0.763	0.313	0.5453	0.445
Histidine	0.196	0.234	0.184	0.1676	0.229
Leucine	0.113	0.193	0.201	0.2034	0.203
Methionine	0.443	0.374	0.313	0.1893	0.543
Threonine	0.194	0.378	0.154	0.1435	0.215
Tryptophan	0.201	0.354	0.173	0.1734	0.235
Valine	0.198	0.304	0.191	0.408	0.304
Essential fatty acids					
Alpha linoleic acid (**g/100g**)	0.7834	0.9453	0.7724	0.8734	0.7743
Morotic acid(g/100g)	0.7434	0.8945	0.6734	0.5045	0.7394
Ecosa pentanoic acid (mg/100g)	145.7	156.0	141.2	152.5	98.4
Decosa hexanoic acid (mg/100g)	72.5	78.5	68.2	74.5	60.5

***Procedure given in Appendix

Based on the nutrient content, aminoacids and essential fatty acids profile, Variation-II was selected for the preparation of cookies which was used for dietary intervention.

C. Preparation of cookies with the best scored health mix

Cookies were prepared using the health mix (Variation-II)and other ingredients used in cookies preparation and are tabulated in Table-X.

Table- X

Ingredients used for the preparation of cookies

Ingredients	Quantity (g)
Health mix	90
Jaggery	5
Groundnut oil+ coconut oil	2.5+2.5
Total	100

In the standard cookies, the basic ingredients were wheat flour 50g, sugar 25g, fat 25g, egg 10g and baking powder 1g and prepared using the standard procedure (Mc Watters et. al. 2003). Whereas in the health mix cookies, wheat flour was replaced by the formulated health mix (90 g), jaggery (5 g) and a mixture of coconut oil and groundnut oil (2.5+2.5 g).

Each cookie weighed 18.62 grams and eight cookies were given to each participant (150 g) to meet the micronutrient requirement of the selected participants. Four cookies were given at mid morning and four at mid afternoon daily. Distribution schedule was planned and implemented effectively by the investigator.

D. Analysis of physical qualities, nutrient content, microbial count and cost effectiveness of the healthmix cookies

a. Physical evaluation

The physical characteristics like weight, width, diameter, thickness and spread factor were determined. The physical characteristics were measured according to the methods described by Mc Watters *etal.,* (2003). The physical measurements were recorded for the standard and formulated health mix cookies (Plate-2).

i. Weight (W): Weight was determined using electronic weighing balance.

ii. Diameter (D): Diameter of cookies was measured by placing six cookies horizontally edge to edge and rotated at 90 degree angle for duplicated reading.

iii. Thickness (T): The thickness of cookies was measured by placing six cookies one on the top of other and the duplicate reading was recorded.

iv. Spread ‘ratio (SR): The spread ratio is defined as a ratio of diameter and thickness was calculated according to the formula SR= (Diameter/Thickness x CF) x 10



Plate-2Physical measurements of the cookies

b. Nutrient content

Variation II of health mix was used for the preparation of cookies and analysis of the nutrient content. Standard cookies were also prepared and considered for comparison and analysis of the nutrient content. Analysis of different nutrients in cookies was carried out using the standard methods suggested by ICMR-NIN (2015)

c. Microbial count

Microbial count of the health mix cookies was done in the microbiology lab. The result of the score was tabulated. The microbial count gave valuable information on the keeping quality of the cookies, which were prepared without using preservatives.

d. Cost effectiveness

The ingredients used in the health mix cookies were seasonal, locally available and low cost items. Hence the cost of the cookies was comparatively lower than the standard cookies.

PHASE – IV

Impact of nutrition interventionon the symptoms of PMS

A number of 100 participants consisting of experimental group (N= 50) and the control group (N= 50) having moderate level of PMS, were selected for the study by purposive sampling method. The written consent was collected from the selected participants of experimental (N=50) and control group (N=50). The impact of nutrition intervention (dietary intervention and nutrition and health education) on the nutritional status and the symptoms of PMS and on knowledge of the selected participants is presented under the following headings.

A. Impact of dietary intervention on nutritional status and symptoms of PMS among the selected participants

Health mix in the form of cookies (150g consists of eight pieces) was distributed in airtight containers once in a week who were gathered periodically in the same place for a period of 120 days. The cookies were given to each participantin the experimental group (N=50) and instructed to consume four cookies in the mid morning and four in the mid afternoon regularly and were also instructed not to take coffee or tea or carbonated beverages before and after the intake of the health mix cookies. The study participants were encouraged to drink fresh fruit juices or fruits rich in Vitamin C. Dietary intervention were carried out for a period of 120 days.

Impact of dietary intervention on nutritional status and symptoms of PMS was evaluated. For the present study, nutritional anthropometry, biochemical estimation, clinical examination and individual dietary intake by 24 hour recall method and were used to assess the nutritional status of the selected participants. Impact of dietary intervention on the symptoms of PMS was also assessed by standard tool of calendar of premenstrual event (COPE) and depression level by Beck depression index (BDI).

a. **Impact of dietary intervention on nutritional status of the selected Participants**

i. Anthropometric measurements

Anthropometric measurements like height, weight, BMI, and WHR were carried out for the selected participants (N=100) before and after the intervention study.

ii. Biochemical estimation:

Biochemical parameters like blood haemoglobin level, serum Calcium, Magnesium, Iron, ferritin and Total Iron binding capacity (TIBC) were conducted. Two ml of the blood sample was collected from 100 selected participants who were involved in the dietary intervention and nutrition education (Plate-3).

- **Blood haemoglobin**

  Blood haemoglobin level was estimated by cyanomethaemoglobin method.

- **Serum Calcium**

  Calcium supplementation reported that 48 per cent of selected participants receiving 1000 mg of Calcium showed that there was a reduction in the severity of symptoms of PMS compared to placebo (Johnson, 2004). A reduction in

Calciumlevel causes disturbances like muscular cramps and prevented by suitable Calcium supplements (Parker, 2007). With this View Serum Calcium level was assessed using colometric method.

- **Serum Magnesium**

  Serum Magnesium concentration has been shown to vary cyclically in women of reproductive age group. The level of Magnesium in erythrocytes and leukocytes of women with PMS were found to be lower than those women without PMS, whereas in plasma Magnesium level, this trend was not noticed (Muneyyirci-Delale, *et al.,* 2001).Magnesium is also involved in the activity of serotonin and other neurotransmitters, as well as in vascular contraction, neuromuscular function and cell membrane stability. These might be possible pathways by which it influences PMS (Tonick and Muneyyirci-Delale, 2016). Serum Magnesium level was assessed gravimetrically.



Plate – 3 Collection of blood for intervention study

- **Serum Iron**

  According to Bertone (2008) limited studies were done on the relationship of Iron with PMS symptoms. But it was noted that the intake of non-heme Iron reduced the PMS risk whereas heme Iron from animal sources did not have the same effect of reducing the risk of PMS symptoms. For its health benefit, serum Iron content was analyzed by Wong's method.

- **Serum ferritinand Total Iron binding capacity (TIBC)** was estimated to know the serum Iron profile of the selected participants using colorimetric method.

  Blood parameters (serum Calcium, Magnesium, Iron, TIBC, serim ferritin) were analyzed using standard procedures mentioned in NIN Laboratory Manual (2011).

iii. Clinical examination

Clinical examination relies on the examination of physical signs of the body that are symptomatic of nutritional disorders (Jelliffe and Jelliffe, 1991). The objective of clinical examination is to assess the levels of health of individuals or of groups in relation to the food consumption pattern. It is the simplest and the most practical method of ascertaining the nutritional status of an individual (Park, 2017). Clinical sign is the assessment of nutritional status that results from lack of both nutritional and non-nutritional factors. Signs and symptoms should be investigated and combined with anthropometrical, dietary evaluation and biochemical estimation for accurate analysis and interpretation of the data (FSAU, 2004). Clinical examination was carried out using Clinical assessment schedule of Jelliffe and Jelliffe (1991) to all the selected participants with the help of general physician (Appendix-II).

iv. Individual dietary intake

Twenty four hour dietary recall method was used to gather information on their food intake. In this method, the selected participants were asked to recollect the quality and quantity of foods consumed and was expressed in terms of grams during the last 24 hours. The amounts of various nutrients were calculated using Food composition tables. This was done for the 100 selected participants in experimental and control groups.



Plate – 4.Distribution of the formulated health mix cookies to the selected participants

b. Impact of dietary intervention on symptoms of PMS of the selected participants

The impact of dietary intervention on the symptoms of PMS was determined by using the depression level and PMS symptoms expression.

i. Assessment of depression level

It was done using Beck Depression Index (BDI). The Beck Depression Scale consists of 21 items to assess the intensity of depression in clinical and normal patients. Each item is a list of four statements arranged in increasing severity about a particular symptom of depression. The BDI was administered to find out the depression level of the selected participantsin the experimental and control groups, befor and after the study period of 120 days.

ii. Assessment of PMS symptoms

Calendar of Premenstrual Events (COPE) was used to gather accurate details on the PMS symptoms. It is a self assessment standard tool used for assessment of PMS in many studies. This also rated symptoms from 1-4 (0- No symptom, 1-mild symptom, 2-moderate symptom, 3-severe symptom). The COPE is a reliable instrument for identifying fluctuations in behavioural and physical symptoms during the luteal phase of menstrual cycle and PMS symptoms can be reliably conceptualized within four factors. Symptom expression may increase in response to daily self-monitoring.It is made up of a calendar of 32 days with column of 23 symptoms (physical, social and

emotional) and rows with provision for entry of date, weight and bleeding days. There are provisions for entry of any other symptoms not in the list to be entered by the selected participants and also use of medication. (Appendix- III). The selected participants were clearly explained about the filling of COPE tool and their doubts were clarified. The entries made by the participants in the study groups were also noted regularly. Regular visits of the investigator helped to confirm the recording of the symptoms experienced byselected participants and to indentify the premenstrual changes in participants. The recording of COPE was carried out for two successive menstrual cycles so as to confirm the premenstrual changes missed in one period may be entered in the next cycle before the dietary intervention.

During the dietary intervention period, COPE was not administered to find out the symptoms of PMS among the participants in the study groups. After the study period of four months, the same tool was implemented to assess the PMS symptoms among the participants in the study groups.

B. Impact of nutrition education on the knowledge of PMS among the selected participants

Nutrition education and diet counselling was given to 100 selected participants inthe study group of experimental and control group.

a. Imparting nutrition and health education to the participants

Nutrition and health education is defined as "a process that informs, motivates and helps people to adopt and maintain healthy practices and life style, advocate envIronmental changes as needed to facilitate this goal and conducts professional training and research. Nutrition education is a major intervention for the prevention of malnutrition, promotion of health and improving quality of life (Park, 2017). According to Evans (2006) social marketing and education are the vital strategies to bring about changes in feeding behaviour of the population and enhance their quality of life. With this back drop nutrition education was given to the selected participants adopting the following steps. Nutrition and health education for the 100 selected participants was given periodically for 120 days.



Plate – 5. Nutrition and health education on PMS

b. Preparation of the nutrition and health education module

The investigator prepared an educational module covering all the aspects of PMS (Appendix-V). Modules for nutrition and health education were developed using relevant scientific literature with suitable pictures related to PMS. The developed modules consisted of brief introduction and meaning of PMS, prevalence, causes, signs symptoms, complications, prognosis and diagnosis, modes of treatment, role of nutrients on PMS symptoms, dietary and other non-pharmacological approaches to minimise the PMS symptoms and the role of adequate exercise and lifestyle on prevention of PMS symptoms. Hand book in English and Tamil (Appendix-VIa, VIb),power point presentation and nutrition educationposter (Appendix-VIIa, VII b), and and handouts (Appendix-VIII) were prepared covering all the above mentioned aspects. The time allotment for each topic was planned systematically and evaluated carefully.

c. Conduct of Nutrition and Health Education

Nutrition and health education was given to the selected participants in experimental and control groups for 120 days. Totally ten topics were framed for nutrition and health education. Each topic consisted of 15 minutes lecture on the topic followed by group discussion along with Power point presentation and exhibition (Plate-4). Posters were used as supportive aids as the common mode of education to the participants. The investigator gave lecture with power point presentation once in a week for each topic and covered all aspects within the study period.

i. Topics for Nutrition and Health Education

The topics covered for education followed by discussion were introduction and meaning of PMS, prevalence, causes, signs symptoms, complications, prognosis and diagnosis, modes of treatment, role of nutrients on symptoms ofPMS, dietary and other non-pharmacological approaches to minimise the symptoms of PMS and the role of adequate exercise and lifestyle on prevention of PMS symptoms. In group discussion, the quarries of selected participants were clearly clarified. The developed educational modules were distributed to the selected participants during the study period.

ii. Formulation of the questionnaire

A specially designed short structured questionnaire was developed and pre-tested to collect information on knowledge about PMS among the participants. All the

questions were multiple-choice types with only one correct answer. Totally twenty questions were given related to the ten aspects of educational modules. All the questions had equal weightage of scores. Each correct answer was given one mark. Total scoring for the questionnaire was twenty.

iii. Administration of PMS knowledge questionnaire

As the first step in nutrition and health education, a specially framed questionnaire with 20 questions on various aspects of PMS was administered to the selected participants (N=100) in the experimental as well as control group (Plate-II). Then at the end of the study period, the same questionnaire was administered to evaluate the effect of nutrition and health education on the prevention or minimizing the signs and symptoms and the consequences of PMS among the selected participants in the experimental and control groups. Application of statistical analysis revealed the impact of nutrition education on the knowledge of the selected participants in the study groups.

PHASE – V

Analysis and interpretation of the data

After the data collection, it is essential to organize the discrete data in a systematic manner to obtain the desired results and interpretation scientifically. The collected data was systematically consolidated and statistically analysed for arriving at the result of the effect of different intervention on reducing the severity of the symptoms of PMS. Statistical methods play a major role in transforming a data into information. Statistical data, once collected, must be arranged purposively, in order to bring out the important points clearly. Therefore the manner in which statistical data is presented is the most important aspect for the effective documentation and recommendation (Park, 2017). Descriptive statistics like range, percentage and mean were used for exploring the demographic characteristics, BMI levels, prevalence of PMS and anaemia, knowledge levels of the study groups. Inferential statistics like correlation and chi-square were applied to find the association and differences between the variables, effect of dietary intervention and nutrition and health education on the symptoms of PMS. The detailed discussions are presented in chapter IV – Results and Discussion.

4

RESULTS AND DISCUSSION

The results of the study on **"Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)"** are presented and discussed under the following headings.

PHASE - I : Prevalence of Premenstrual Syndrome

A. Demographic profile of the selected participants
B. Dietary pattern of the selected participants
C. Menarche and menstrual cycle details of the selected participants
D. Nutritional status of the selected participants
E. Prevalence of premenstrual syndrome among the selected participants
F. Anxiety level of the selected participants
G. Knowledge on premenstrual syndrome and
H. Influence of the demographic, dietary, menstrual and nutritional variables on premenstrual symptom score

PHASE – II: Evaluation of health mix cookies

A. Sensory evaluation
B. Physical properties
C. Analysis of nutrient content
D. Estimation of microbial count and
E. Calculation of cost effectiveness

PHASE – III: Impact of dietary intervention on nutritional status and the symptoms of PMS among the selected participants

A. Impact of dietary intervention on nutritional status of the selected participants

a. Anthropometric measurements
b. Biochemical estimation
c. Clinical examination
d. Individual dietary intake

B. Impact of dietary intervention on the symptoms of PMS among the selected participants

a. Depression level

b. Premenstrual Symptom assessment using COPE

c. Relationship between biochemical parameters and individual PMS symptoms

PHASE - IV: Impact of nutrition education on the knowledge and symptoms of Premenstrual Syndrome of the selected participants

A. Assessment of knowledge on PMS

B. Impact of nutrition education on the knowledge and symptoms of PMS

PHASEI

Prevalence of premenstrual syndrome

A. Demographic profile of the selected participants

The nutritional status and health condition of an individual is influenced by the socio-economic status of the family. Health and nutritional status of an individual is affected by unfavourable socio-economic status of the family like poverty, illiteracy, physical activities and ineffective health care services. These social, educational and economic factors are strongly inter related and influence the nutritional habits, physical activities, health behaviours and also the clusters of metabolic disorders or any other health problems. Hence, it is important to include the socio-economic status of the families of selected participants in the present study. The data gathered through household surveys are presented in the following pages. Table-XI highlights the demographic profile of families of the selected participants.

In the present study, the data gathered from 541 selected participants revealed that majority of the selected participants (42 per cent) were selected from rural areas and rest of them were selected from semi-urban (29 per cent) and urban (29 per cent) areas. Among the selected participants from different locations, majority of them stayed in their own house (62 per cent) and only 38 per cent were staying in the rented house. Among the selected participants, 65 per cent were from nuclear family system and 33 per cent of them

were being in traditional joint family system. Meagre per cent (two per cent) of the selected participants were from extended families. The present study is on par with the study conducted by the Life Insurance Corporation of India Census (India Year Book, 2014) in which it was pointed out that as low as 10-15 per cent of the total Indian population live in the age old joint family system and others stick on the nuclear family system.

Table - XI

Demographic profile of families of the selected participants

Demographic details		Frequency (N=541)	Per cent
Location	Rural	230	42
	Urban	154	29
	Semi urban	157	29
	Total	541	100
Type of house	Own house	335	62
	Rented house	206	38
	Total	541	100
Type of family	Joint	179	33
	Nuclear	354	65
	Extended	8	2
	Total	541	100.0
Family size	1-4 members	106	20
	5-6 members	320	59
	> 6 members	115	21
	Total	541	100
Family income*	Rs. 2500-4500	268	50
	Rs. 4501-7500	195	36
	Rs. 7501 and above	78	14
	Total	541	100

*Source-HUDCO Income Classification (2012)

This might be due to the technological growth in terms of urbanisation and industrialization that leads to the disruption of joint family systems in India. In search of better employment opportunities, people tend to break away from the traditional joint family and move towards cities and towns. This observation is in line with the report published in the India Year Book (2014) which revealed that more than 80 per cent of families are nuclear family type in this modern era. Similar pattern was noted in Kumar (2014) where 73.3 per cent of the participants were in nuclear families and 26.7 per cent were in joint families. Family size is one of the factors, which affects the nutritional status of an individual, thereby the entire family and the society. The categories are based on the ideal family size of four. Twenty per cent of the selected families had one to four members and belonged to be in a small family. Fifty nine per cent of the families were composed of 5 to 6 members and twenty one per cent of the families had more than six members. According to India Year Book (2014), the average family size of the urban and rural areas in Tamil Nadu is 4.9. The findings of the present study were in tune with the above statement.

a. Educational and occupational status of parents of the selected participants

The educational and occupational status of the parents of the selected participants were recorded and depicted in the following paragraphs.

i. Educational status of the families of the selected participants

With regard to the educational background of the mothers of the selected participants, majority (83 per cent) of the selected participant's mothers had middle school education, followed by high school level education (11 per cent) two percent of the mothers were graduates having either under graduation or post graduation and only two of the mothers were illiterates. The same trend was also noticed in the educational status of the fathers of the selected participants. WHO (2013) reported that the level of education appears to be inversely associated with the health problems of the families.

i. Occupational status of the families of the selected participants

The data revealed that thirty four per cent of the mothers of the selected participants were full time home makers. Seventeen per cent were government employees, 39 per cent were employed in various private sectors and 10 per cent were self employed and earned money to run their families. In case of their father's occupational status, 34 per

cent and 44 per cent were employed in Governmental and Non Governmental concerns respectively. Only 19 per cent were engaged in their own business. Employed adults spend nine quarters of their lives at work and the pressure and demands of work may affect their eating habits and activity patterns, which in turn lead to have one or other problems.

b. Background information of the selected families

The background information such as age, marital status, educational qualification and occupational status of the selected participants (N=541) were categorized and tabulated in Table-XII.

From the Table XII, it was noted that among the 541 selected participants surveyed, majority (55 per cent) of the selected participants were in the age group of 20-30 years, 24 per cent of the selected participants were in the age group of 31-40 years and 21 per cent were in the age group of 41-45years.

Table-XII

Background information of the selected participants

Background information		Frequency (N=541)	Per cent
Age range (years)	20-30	297	55
	31-40	127	24
	41-45	117	21
	Total	541	100.0
Marital status	Married	231	43
	Unmarried	297	55
	Widow	1	0.2
	Separated	12	2.2
	Total	541	100
Educational status	middle school	128	23
	Secondary school	76	14
	Higher secondary	112	20
	UG courses	205	37
	PG courses	20	3
	Total	**541**	**100**
Occupational status	Government employee	109	20
	Business	110	20
	Students	243	45
	Seeking job	79	15
	Total	**541**	**100**

The mean age of the selected participants was 30.04±4.06. Razaee *et al.,* (2015) in their study reported that 52 per cent of the selected participants were in the age group of 26-35 years, 33.3 per cent were between 36 and 45 years and only 14.7 per cent were in 14-25 years of age. But the mean age of the selected participants in their study was 29.92+5.52 which was comparable with the present study.

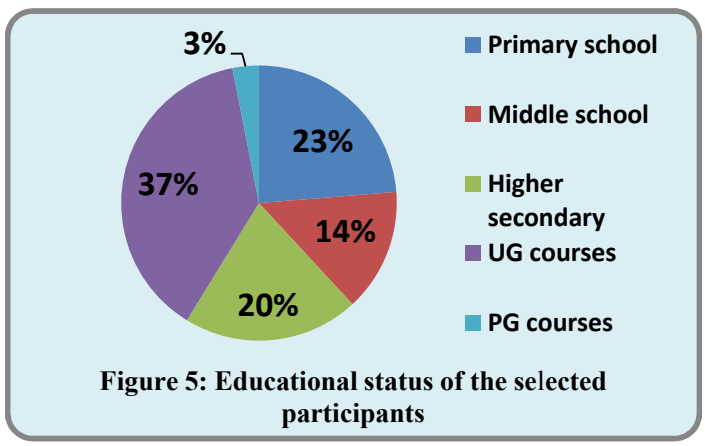


Figure 5: Educational status of the selected participants

With regard to the marital status, nearly 43 per cent of the selected participants were married. Fifty five per cent of the selected participants were unmarried and only meagre per cent (less than one per cent) of the selected participants were widow and two per cent of selected participants were separated from their in laws family and living with their parents. The present study was contradictory to the study done by Kumari and Sachdeva (2016), as seventy per cent of selected participants were unmarried and thirty per cent of the selected participants were married.Educational status of the population is the powerful determinant of nutritional status, as it creates the awareness on the importance of good nutrition and balanceddiet for optimum growth and development.

Among the selected participants, 23 per cent had education up to middle school level and 14 per cent and 20 per cent had secondary school education and upto higher secondary school level respectively and 37 per cent had under graduation and six per cent had post graduation. None of the selected participants were illiterates. It was higher than in the study done by Razaee *et*

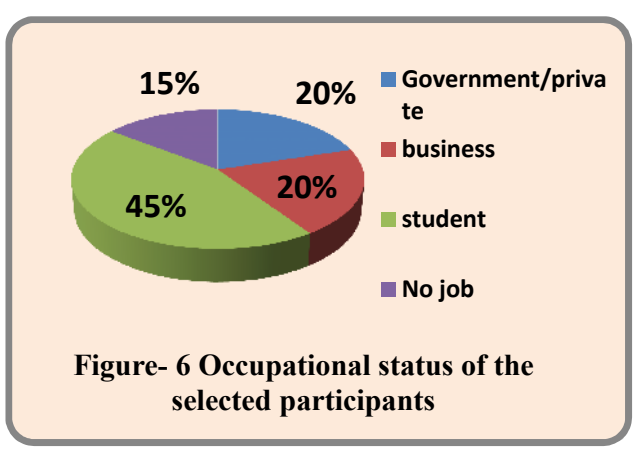


Figure- 6 Occupational status of the selected participants

al.,(2015) in which 1.6 per cent of the participants were illiterates and also stated that family history of disease and low educational levels are related to the occurrence of disease conditions. According to Indian Literacy (2009), by empowering every individual with functional literacy and an understanding of their basic rights and responsibilities, 100 per cent literacy can be reached. India is achievable (www.ilphyd.com) and has made progress in terms of increasing primary education attendance rate and expanding literacy to approximately three fourth of the population. India's improved education system is often cited as one of the main contributors to the economic rise of India (Raman, 2008).

As far as the occupational status is considered, 45 per cent of the selected participants were students having different levels of school and college education and 20 per cent were government employees or self employed business women. Only 15 per cent of selected participants were seeking jobs to strengthen their standard of living. This was in contrast to the study done by Razaee *et al,* (2017) in which 84 per cent of the selected participants were home makers involved in their household activities.

B. Dietary pattern of the selected participants

Good health is a pre requisite of human productivity. Good food habits are essential aspects to achieve the maximum genetic potential. Women's health should encompass all aspects of women's lives including reproductive function, biological reality and the social context in which women live, work and age as mentioned by Anju (2000) and Kumar (2014).

a. Food expenditure pattern

Table- XIII shows the food expenditure pattern of the selected families.

Table - XIII

Food expenditure pattern

Income spent on food (Rs)	Frequency	Per cent
1000-2000	200	37
2001-3000	168	31
3001-4000	97	18
More than 4000	76	14
Total	**541**	**100**

The data related to food expenditure pattern of the families of the selected participants were gathered through household survey. Out of 541 families, 37 per cent of the families spent Rs.1000-2000, 31 per cent spent Rs.2001-3000, and 18 per cent spent Rs.3001-4000 and rest of the 14 per cent spent more than Rs.4000 for purchasing various types of food items to meet their nutritional requirements and to maintain their health status. Brahman (2008) opined that optimum health and nutritional status plays an important role in the developmental progress of an individual and the family.

b. Dietary habits

Dietary habits are corner stone that promote the health status of an individual. It paves the way to grow, develop, work, play, resist infection and aspire to realise the health potential of an individual and society. Among 541 selected participants surveyed, 64 per cent were non-vegetarians, 18 per cent were vegetarians, 15 per cent were ovo-vegetarians and three per cent were lacto-vegetarians.

c. Meal planning

Regarding planning the meal, 62 per cent of the selected families particularly homemakers planned their meal previously and rest of them took decision on the spot. Forty eight per cent planned their meals based on the likes and dislikes of the members of their families whereas rest of them planned their meal depending on the availability of food items in their houses. From the household survey, it was vivid that all the selected home makers prepared breakfast, lunch, tea and dinner regularly and they felt that cooking is one of the important aspects of their household activities to fulfil the needs of their family members.

d. Meal pattern

Sixty four per cent of the selected participants had the habit of having three meals a day, consisting of breakfast, lunch and dinner. Nineteen per cent of the selected participants consumed two meals a day and 17 per cent consumed four meals a day including tea with their major three meals.

e. Skipping of meals

Out of 541 selected participants, majority (61 per cent) of them skipped meal occasionally, 14 per cent skipped meal weekly once and 11 skipped meal daily. Only 14

per cent of the selected participants had regularity in taking meal without skipping. Among those who skipped meals, 36 per cent of the selected participants skipped their breakfast, 18 per cent of the selected participants skipped their lunch and 26 per cent of the selected participants skipped dinner. The reason expressed by the selected participants for skipping meal were lack of time (21 per cent), fasting (eight per cent) and sixteen per cent of the selected participants skipped meal to maintain their body weight and conscious towards their health and beauty.

f. Consumption pattern of water and beverages among the selected participants

Table-XIV presents the detail of the consumption of water and other beverages of the selected participants. Water is a vital salient nutrient needed for the growth and health of an organism. When there is a disturbance in water intake, it may affect several functions in the body. Various studies have reported that intake of water has an impact on the prevalence and intensity of Premenstrual symptoms.

Table-XIV

Consumption of water and beverages

Items	Quantity/ frequency of intake	Number	Per cent
Intake of water	1 litre	95	18
	1-1.5 litres	286	53
	1.5-2 litres	122	22
	>2 litres	38	7
	Total	541	100
Intake of milk and milk products	>350 ml	189	35
	250-350 ml	107	20
	100-200 ml	135	25
	<100 ml	110	20
	Total	541	100
Intake of coffee/ Tea	>5 times	92	17
	5 times	115	22
	3-4 times	261	48
	1-2 times	72	13
	No coffee	1	.2
	Total	541	100
Carbonated beverages and soft drinks	Daily	13	2
	Occasionally	420	78
	Rarely	108	20
	Total	541	100

An increase in water intake aids in the reduction of PMS symptoms among the reproductive age women. Fifty three per cent of the selected participants took 1-1.5 litres of water per day. Eighteen per cent of the selected participants took less than one litre of water per day. Twenty two per cent took 1.5-2 litres of water. Only seven per cent of the selected participants took more than two litres of water daily.

It was satisfactory to note that majority (35 per cent) of the selected participants took more than 350 ml of milk; 20 per cent of the selected participants took 250-350 ml of milk which could be fulfilling their Calcium needs. Twenty five per cent of the selected participants took only less than 100 ml of milk. This is of concern as milk is an excellent source of Calcium and other Vitamins for majority of Indian population. Among the selected participants, 49 per cent of them preferred to have low fat content milk (less than four per cent), 31 per cent of the selected participants preferred to have medium fat content in different quantities. Like that, 20 per cent of the selected participants had curd using low fat milk and 10 per cent had curd of medium fat milk. Majority (61 per cent) of the selected participants had buttermilk in different quantities ranged from 100-400 ml. Nearly 37 per cent of the selected participants used paneer and cheese in their food preparation in weekly once dietaries.

Coffee and tea were widely consumed by 91 per cent with their meals or directly after their breakfast or in evening, while nine per cent preferred to consume these beverages in between their meal time. However both beverages have a high content of phenolic compounds which strongly inhibit the absorption of non heme Iron. A cup of tea with a meal reduces Iron absorption by about 75 per cent depending on the amount of phenolic compounds per cup. The amount of phenolic compounds depends on difference in the amount brand and steeping time used to prepare the tea. A cup of coffee with a meal has been shown to reduce Iron absorption by about 60 per cent Iron- absorption and considered as the factor for the occurrence of anaemia (www. fand sc.che.umn.edu/pf/out reach/ faculty - outreach/ nutrinet/). Majority (48 per cent) of the selected participants took coffee or tea 3-5 times a day. Twenty two per cent and 17 per cent of the selected participants took coffee or tea 4-5 times and more than five times respectively. Thirteen teen per cent of the selected participants took coffee only in between 1-2 times. Less than one per cent did not have the habit of taking coffee or tea. Majority of

the selected participants had carbonated beverages and soft drinks daily to refresh themselves.

g. Consumption pattern of junk and fast foods

Consumption of junk and fast food items was not very common among the selected participants. Yet the frequency of intake of fast foods, junk foods and bakery items showed a pattern that even the middle aged women now enter into the fast food culture with the intake of all items similar to teen agers. This might be the distressing fact as the junk foods might not fulfill the nutrient needs of reproductive age women and lead to deficiency diseases and pave way to chronic diseases. Table XV highlights the consumption pattern of junk and fast foods.

Table - XV

Consumption pattern of junk or fast foods

Junk/fast foods*	Age in years	Frequency of consumption					
		Weekly		Fortnightly		Monthly	
		(N=541)	(%)	N=541	(%)	N=541	(%)
Bakery items	20-30	249	46	140	26	249	20
	31-40	157	29	140	26	227	42
	41-45	60	11	113	21	195	36
Hot and spicy chat items	20-30	157	29	227	42	87	16
	31-40	103	19	173	32	76	14
	41-45	113	21	86	16	168	31
Fried items	20-30	87	16	76	14	124	23
	31-40	157	29	179	33	130	24
	41-45	227	42	103	19	86	16

*Multiple responses

Junk and fast food consumption pattern of the selected participants revealed that they consumed more amounts of carbonated beverages, bakery items, fast foods and less performance towards consumption of millets based preparations, irrespective of the socio economic conditions. However, consumption of vegetables, green leafy vegetables and fruits was moderate and inadequate to promote their optimum health status, (www.ncbi.nlm.nih.gov/pulmed/17299495). From the survey, it was noticed that 46 per

cent of the selected participants in the age group of 20-30 years consumed bakery items weekly once, 26 per cent consumed fortnightly and 20 per cent consumed monthly once whereas among 31-40 years, 29 per cent, 26 per cent and 42 per cent consumed bakery items weekly once, fortnightly and monthly once respectively. Eleven per cent, 21 per cent and 36 per cent of the selected participants in the age group of 41-45 years consumed bakery items weekly once, fortnightly and monthly once respectively.

Twenty nine per cent of the selected participants in the age group of 20-30 years preferred to have more hot spicy and chaat items weekly once, 42 per cent had fortnightly and 16 per cent had monthly once whereas selected participants in the age group of 41-45 years preferred to have fried items like vadai, bonda, bajji etc. and 42 per cent consumed fried items weekly once, 19 per cent had fortnightly and 16 per cent monthly once, in their routine dietary pattern. The frequency of intake of bakery items was higher among 20-30 years (46 per cent), hot spicy and chatt items was taken in higher frequency (29 per cent) by 20-30 years and intake of fried items was in higher frequency among 41-45 years (42 per cent) on a daily basis.

h. Consumption of Iron rich foods

Iron is the basic element needed for the growth of the tissues and maintenance of health and prevents the consequences of anaemia. Regular intake of foods rich in Iron is important to prevent anaemia. Low level of Iron is also a determinant in the prevalence of PMS symptoms. The frequency of intake of Iron rich foods consumed by the selected participants is presented in Table-XVI.

From the Table XVI, it was evident to note that 12 per cent, 21 per cent, six per cent and eight per cent of the selected participants preferred to have Iron rich whole cereals for their food preparation, once in a day, weekly, fortnightly and occasionally respectively. In case of pulses, roasted Bengal gram was used daily in their chutney (side dish of breakfast and dinner item) preparations. It is interesting to note that 28 per cent of the selected participants consumed green leafy vegetables in their daily dietary pattern. Eleven present and nine per cent consumed egg (yolk), lean and red meat and liver respectively.

Table-XVI

Consumption of Iron rich foods

Iron rich foods*	Frequency of consumption pattern							
	Daily		Weekly		Fortnightly		Monthly	
	N=541	per cent	N=541	per cent	N=541	per cent	N=541	per cent
Whole cereals	65	12	114	21	33	6	43	8
Pulses(Roasted Bengal gram)	20	37	87	16	130	24	90	18
Green leafy vegetables	151	28	87	16	100	19	130	24
Egg	60	11	87	16	97	18	120	23
Lean / red meat and liver	49	9	17	32	220	41	76	14
Brown sugar & jaggery	70	13	100	19	210	39	227	42
Dried fruits	102	19	130	24	180	33	157	29

*Multiple responses

Nineteen per cent, 24 per cent, 33 per cent and 29 percent of the selected participants included dried fruits like dates and raisins in their dietaries daily, weekly, fortnightly and monthly once respectively. Brown sugar and jaggery were included by 13 per cent, 19 per cent, 39 and 42 per cent of the participants daily, weekly, fortnightly and monthly respectively in their diet. It is also interesting to note that ten per cent of the selected participants consumed Iron rich foods in different point of time but not at regular manner. But none of them were aware of lotus stem as excellent source Iron content. Table-XVI explains clearly that the daily intake of Iron rich food items like whole cereals, whole pulses, green leaves, egg yolk, lean meat, jaggery and dry fruits were taken only by less per cent (9-37 per cent) of the selected participants on a daily basis. Also it was noted that the quantity of intake of the Iron rich food items was very less.

i. Consumption of Vitamin C rich foods

Vitamin C with a meal containing Iron rich foods makes the diet of high bioavailability because this can triple the amount of absorption of Iron than Iron rich foods

by itself (Suba, 2008). The list of Vitamin C rich foods consumed by the selected participants is listed in Table- XVII.

Table -XVII

Consumption of Vitamin C rich foods

Foods rich in Vitamin C	Daily		Weekly		Fort nightly		Occasionally	
	N=541	Per cent	N=541	Per cent	N=541	Per cent	N=541	Per cent
Sprouted grains (cereals & pulses)	43	8	65	12	49	9	103	19
Amla / guava	22	4	16	3	43	8	60	11
Citrus fruits	38	7	65	12	76	14	81	15
Raw fresh vegetables, GLVs & Fruits	43	8	103	19	76	14	54	10

*Multiple responses

Out of 541 participants selected for the study, it was interesting to note that eight per cent of the selected participants consumed germinated grains of cereals and pulses for their salad preparations daily since they were particular to have raw vegetables and fruits salad with this germinated grain and 12 per cent, nine per cent and 19 per cent consumed germinated grains weekly once, fortnightly and occasionally respectively. The same trend was noted in the consumption pattern of the selected participants.

j. Consumption of Calcium rich foods

Calcium is an important mineral needed for bone strength. It also aids in reducing the symptoms of PMS. Many studies have shown a positive impact of Calcium supplementation on symptoms of PMS. Diets high in Calcium rich foods have been shown to lower the risk of PMS but little was known about the role it plays and other minerals' role in preventing the symptoms of PMS (Nierenberg, 2013).Types of foods rich in Calcium and frequency of consumption is given in Table-XVIII.

Table -XVIII

Frequency of Calcium rich foods consumption

Foods rich in Calcium*	Daily N=541		Weekly N=541		Fort nightly N=541		Occasionally N=541	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Ragi / millets	97	18	105	19	215	42	114	21
Milk and milk products	357	66	70	13	60	11	54	10
Green leafy vegetables	87	16	221	41	103	19	135	25
Gingelly seeds	49	9	130	24	130	24	135	25
Meat	49	9	173	32	222	41	97	18
Tender bones	54	10	157	29	195	36	135	25

*Multiple responses

Calcium is the mineral, essential for orthogenesis. Ragi is a rich source of Calcium but, intake of ragi was very less. Only 18 per cent of the selected participants took ragi in their daily diet on a regular basis. It is interesting to note that 66 per cent of the selected participants consumed milk daily in their routine dietary pattern. Sixteen per cent of them used green leafy vegetables daily in their dietary pattern. Other Calcium rich foods like nuts and oil seeds especially, gingelly seeds, meat and tender bones were included in the diet. But the quantity of intake was not sufficient to meet the ICMR (2012) suggested RDA for Calcium. Though 66 percent of the subjects said that they included milk in their daily diet, it was only up to 200-300 ml for the whole family which was far below the desirable intake.

k. Consumption of fats and oils

Cooking oil and fats are essential commodities which are used for various cooking purposes and constituting 15-20 per cent of the consumer's family budget. The edible oils

and fats used for cooking purposes are different from one area to another; the choice of fat depends on the availability and traditional habits, geographic location, economy, nature of oil and beneficial effect (Rao*et al.,* 2015). Vegetable oil is an important source of essential fatty acids. Studies have pointed out that the essential fatty acid intake reduces the PMS symptoms. Essential fatty acids like omega 3 fatty acid and gamma linoleic acid reduced the PMS symptoms. Figure-7 shows the per capita oil consumption per day.

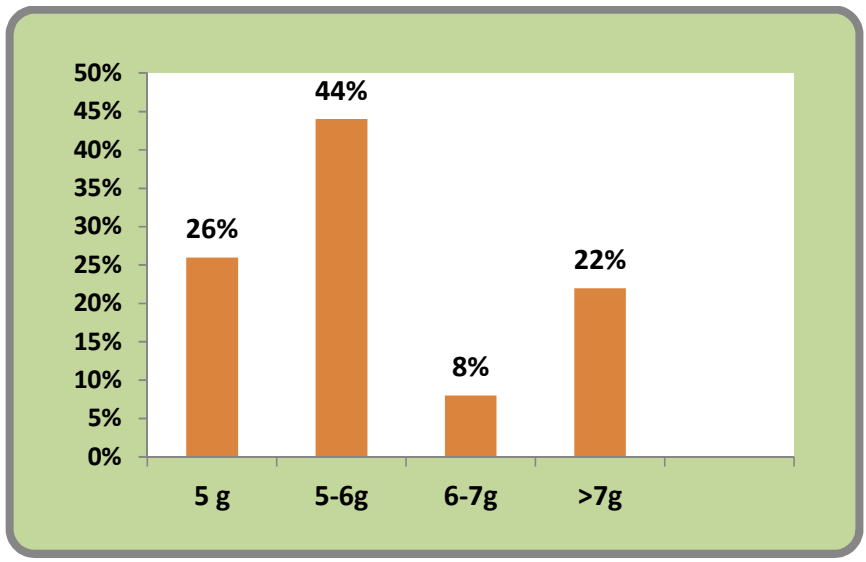


Figure-7 Per capita oil consumption/ day

It was noted that majority (44 per cent) of the selected participants took 5-6grams of oil per day. Twenty six per cent of the selected participants took less than 5 grams of oil eight per cent of the selected participants took 6-7 grams and 22 per cent consumed more than 7grams of oil per day. It was noted that 70 per cent of the selected participants took oil much less than the RDA of 35 grams recommended by ICMR (2012). At the same time, cooking oils, an integral part of every ones daily diet is becoming higher and higher cost-wise.

Table –XIX provides a glimpse of the different types and frequency of cooking oils used in various food preparations of the selected families.

Table –XIX

Types and frequency of fats and oils consumption

Types of fat & oils*	Frequency of usage of fats and oil							
	Daily	Per cent	Weekly once/twice	Per cent	Fort nightly	Per cent	Occasionally	Per cent
Butter	65	12	200	37	76	14	200	37
Ghee	81	15	157	29	146	27	151	28
Vanaspathy	54	10	108	20	97	18	281	52
Groundnut oil	444	82	38	7	27	5	32	6
Gingelly oil	368	68	65	12	70	13	1	7
Coconut oil	476	58	141	26	65	12	1	4
Palm oil	279	34	76	14	151	28	4	24
Sunflower oil	314	58	65	12	32	6	1	4

*Multiple responses

Among the selected families, it is happy to note that only 12 per cent of families used butter and 15 per cent took ghee daily. Vanaspathy was used by 10 per cent of the families daily in their food preparations to enhance taste, texture, flavour and calorie content. Majority of the families (34-82 per cent) used plant origin vegetable oils like groundnut oil, gingelly oil, coconut oil and so on daily for various food preparations to enhance the taste, texture, flavour, and caloric content.

l. Consumption of dietary fibre

From the data gathered, it was observed that 67 per cent of the selected participants were aware of the nutritional importance and health benefit of dietary fibre. Twenty eight per cent of the selected participants consumed whole grains, other vegetables and green leafy vegetables daily in their dietaries. Thirty eight per cent included green leafy vegetables and other vegetables, weekly twice in their dietaries. Twenty five per cent used fibre rich vegetables and fruits once in fortnight and rest of them occasionally used fibre rich foods like whole cereals, pulses, and legumes, vegetables like GLV, other vegetables, fruits etc in their dietaries. Intake of dietary fibre

and whole grain is inversely related to obesity, Type 2 diabetes, cancer, CVD and so on. Increased dietary fibre intake like consumption of fruits and vegetables has been recommended as a part of an overall healthy diet and as an agent in the treatment of elevated serum cholesterol profile (James *et al*., 2010).

C. Menarche and menstrual cycle details of the selected participants

The health status of the selected participants revealed that there is a decline in the age of initiation of the growth spurt. Menarche is the major milestone or the starting point in the reproductive health of a woman. Hence the age at menarche and foods taken in menarche interferes indirectly with the reproductive health of an individual. Girls who attained menarche in their younger ages were facing many reproductive health problems like PMS, PCOD. The trend seems to have stopped with the age of menarche levelling off at 12.6 years. Research shows that menarche has dropped from 14-15 years to 12-13 years (www.mum.org/menarche.htm).

a.Age at the onset of menarche

Information on the age at the onset of menarche was collected and depicted in the Table XX.

Table-XX

Age at the onset of menarche

Age at menarche (years)	Frequency	Per cent	Mean ±SD
<12	35	7.0	13.04 ±1.285
12	169	31.0	
13	157	29.0	
14	115	21.0	
15	49	9.1	
>15	16	3.0	
Total	541	100.0	

Among the selected participants (N=541), nearly seven per cent attained puberty before the age of 12 years, 31 per cent, 29 per cent and 21 per cent attained their puberty at the age of 12 years, 13 years and 14 years respectively. Only nine per cent and three per cent attained their menarche at the age of 15 years and after the age of 15 years

respectively. Indian Human Development Survey report presented by Pathak *et al.,* (2014) intimated that the mean age at menarche in Indian population was 13.76 years and is declining at a rate of three months per decade. This coincided with the present study. The mean age at menarche in the present study was 13.04±1.285. A study conducted by Darabi *et al.,* (2014) among the University students reported that the mean age at menarche was 13.3 ±1.3 years. Similar data was noted by the study conducted by Kumari*et al., (*2015). In a cross sectional study done by Tolossa and Bakele (2014), it was noted that the mean age at menarche was found to be 13.92±0.46 and 64 per cent of the selected participants had the age at menarche ranged between 13-15 years, followed by 22.5 per cent before the age of 13 years which was similar to the present study in which 60 per cent of the selected participants had mean age at menarche between 13-15 years and 37 per cent had menarche before the age of 13 years.

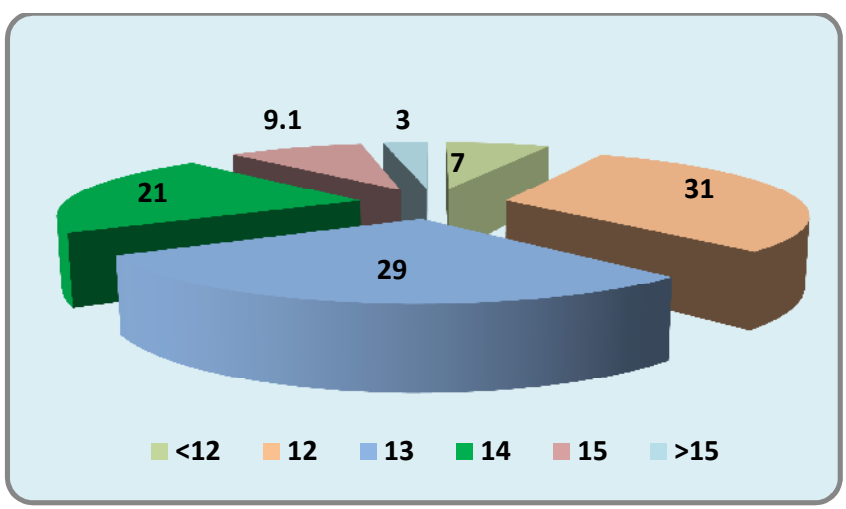


Figure – 8 Age at menarche

b. Information related to menstrual flow

A female's first menstrual cycle usually is reported to be of medium flow and the need for menstrual hygiene is not typically excessive. Although experts reported that the blood flow per menstrual cycle is 30 ml per cycle and chronic loss of more than 80ml. This is associated with anaemia. This has limited clinical utility because most of the females are unable to measure their blood loss (Warner, 2010). Table-XXI represents the information related to menstrual flow of the selected participants.

Table - XXI

Information related to menstrual cycle

Menstrual cycle details	Details	Frequency (N=541)	Per cent	Mean ± SD
Menstrual regularity	Regular	468	87	-
	Irregular	73	13	
	Total	541	100	
Duration of menstrual cycle	Irregular	73	13	28.45±3.34
	25 days	63	12	
	28 days	189	35	
	30 days and above	216	40	
	Total	541	100	
Days of menstruation	4 days	249	46	4.21±1.41
	5-6 days	246	45	
	7 days and more	46	9	
	Total	541	100	
Menstrual flow	Mild	112	21	-
	Moderate	262	48	
	Severe & excess	167	31	
	Total	541	100	

Among the selected participants, it was heart-warming to note that 87 per cent had regular menstrual cycle onset and 13 per cent had irregular menstrual cycle. Nearly 80 per cent of the selected participants had severe pain before the onset of menstrual cycle. It was noted from the gathered data that 45 per cent of the selected participants had 5-6 days of menstruation and other 46 per cent had less than four days of menstruation. This was slightly less than the study done by Tolossa and Bakele (2014). Forty eight per cent of the selected participants had moderate menstrual flow accompanied by pain. This was higher than the level reported by Tolossa and Bakele (2014) in which 63 per cent had mild flow in their menstrual cycle. In India, urbanisation and modernization have been associated with obesity.

The average menstrual cycle of 28 days with one ovulation when eggs are released, but anywhere between 21 and 35 days is considered as normal and an irregular menstrual cycle is having either eight or less menstrual cycles per year and menstrual cycle longer than 35 days. Some women with menstrual problems like PMS, PCOS ect. also experience heavier or lighter bleeding during their menstrual cycle (http://jeanharler.org.arr.com). The gathered data revealed that 35 per cent of the selected participants had menstrual cycle of 28 days. Twelve per cent had 25 days of menstrual cycle. Forty per cent of the selected participants had their menstrual cycle at or more than 30 days whereas 13 per cent of them had menstrual cycle irregularly. Tolossa and Bakele (2014) stated that 58 per cent of the selected participants had 28 days of menstrual cycle compared to the present study in which 35 per cent of the selected participants had 28 days of menstrual cycle.

Menstrual bleeding was categorised into mild, moderate and severe. In case of mild flow, very scanty flow of menstrual bleeding, it was categorised as mild, a moderate blood flow with discomfort was marked as moderate and a heavy bleeding with severe pain was categorised as severe menstrual flow. The data regarding the tolerance of menstrual flow revealed that 21 per cent of the selected participants suffered from excessive menstrual pain with severe flow, before the onset of menstrual cycle. It was observed that 48 per cent of the selected participants had moderate flow of bleeding, in terms of tolerance and adjustable condition whereas in 31 per cent of the selected participants in severe condition, bleeding was heavy and not able to tolerate or control the flow of bleeding.

c. Foods included at the time of menarche or puberty

Food plays a vital role in every milestone of life. Special nutritional care was given traditionally to girls when they attained menarche to strengthen their reproductive organs and pelvic bone. The quality and quantity of nutrients in the diet appeared to be an important consideration. In developing countries like India, various nutritional problems affect the life of population especially young girls and women of reproductive age. Improvement in supply and consumption of macro and micro nutrient rich foods are important strategies to improve the nutritional status and to prevent the disease conditions. Foods included specially during menarche are presented in Table-XXII.

Table - XXII

Foods included in menarche

Foods included*	Number (N=541)	Per cent
Gingelly oil with raw egg	243	45
Black gram dhal with jiggery	287	53
Rice flakes with jiggery	103	19
Fenugreek seeds incorporated food preparations	124	23
Fruit juices and milk	97	18

*Multiple responses

Among the selected participants, 45 per cent had gingelly oil with raw egg at the time of puberty. Fifty three per cent had black gram dhal and jaggery based sweet laddu and/ or in the form of porridge. Nineteen, 23 and 18 per cent had rice flakes with jaggery, fenugreek seed incorporated food preparations and fruit juices and milk respectively to strengthen pelvic bones and uterus and also helped to have relief from stomach and back pain with proper clearance of unwanted waste blood. It is important to note that the food items included during menarche were rich in Iron, Calcium, protein and essential amino acids and essential fatty acids, which are essential for the strengthening of bones and reproductive organs.

d. Foods avoided at the time of menarche

It was found that 59 per cent of the selected participants avoided certain type of foods that are considered as the hot foods and are mango, jack fruit, papaya and pine apple and the family members of the selected participants expressed that these food items were hot and disturbed the pathological and functional capacity of the reproductive organs and initiated to have excessive bleeding during menstrual cycle. Forty two per cent avoided sweets and oily or fried food items mostly due to the feeling that these food items leads to have more pimples in their face. Certain vegetables like brinjal, raw banana and certain roots and tubers were also avoided and expressed that these vegetables created off odour and also disturbed the normal menstrual flow.

D. Nutritional status of the selected participants

Assessment of nutritional status of the selected 541 participants by anthropometric measurements and biochemical estimation were also considered for identifying the participants to involve in nutrition intervention. The data related to the nutritional status of the selected 541 participants are discussed in the following pages.

a. **Anthropometric measurements**

An anthropometric measurement is not only an outcome of food intake but also a determinant of health status. The anthropometric measurements like height, weight, waist and hip circumference were recorded and Body Mass Index (BMI) and Waist /Hip Ratio (WHR) were calculated for all the selected participants (N=541) and used for assessing the health status of the selected participants.

i. Height

Height of an individual along with weight plays a major role in identifying malnutrition. Mean height of the selected participants is presented in Table-XXIII and Figure - 9.

Table - XXIII

Height of the selected participants

Range of Height (cm)	Frequency (N=541)	Per cent	Mean ± SD
120-140.0	134	25	152.32±8.
140.1-150.0	326	60	
150.1-160.0	71	13	
160.1-170.0	10	2	
Total	541	100	

*ICMR 2012

The height of the selectedparticipants revealed that 25 per cent had their height ranged between 120 –139.9cm, 60 per cent had their height ranged from 140.1 – 150.0 cm. Thirteen per cent had

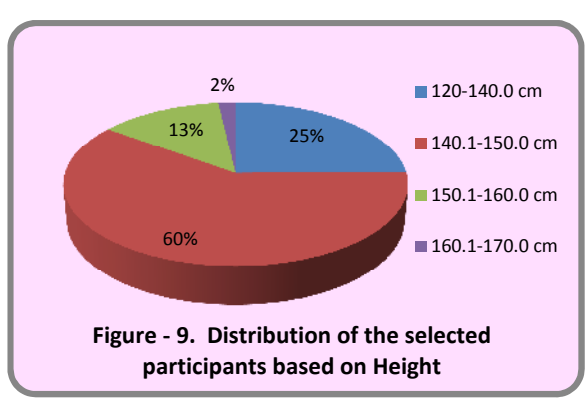


Figure - 9. Distribution of the selected participants based on Height

the height range of 150.1 – 160.0cm and only two per cent had their height in the range of160.1-170.0cm (Figure-9). The mean height of the selected participants was found to be 152.32 ± 8.3 and was lower than the value of standard height of 175 cm suggested by ICMR (2012).

ii. Weight

Table- XXIV highlights the weight of the selected participants of 541.

With regard to the weight of the selected participants, 34 per cent had their body weight in the range of 40.1-50 kg, the body weight in the range of 50.1-60 and 60.1-70 was noted among 33 per cent and 21 per cent of the selected participants respectively.

Table-XXIV

Weight of the selected participants

Range of weight *(Kg)	Frequency (N=541)	Per cent	Mean & SD
30.1-40	33	6	59.59± 10.366
40.1-50	185	34	
50.1-60	183	33	
60.1-70	108	21	
70.1-80	24	4	
80.1-90	8	2	
Total	541	100	

*ICMR 2012

Meagre per cent of the selected participants were in underweight range of 30.1-40 kg and four per cent and two per cent were in the weight range of 70.1-80 kg and 80-90 kg respectively. The mean weight of the selected participants was 59.59±10.366, which was above the standard weight of 55 Kg suggested by ICMR (2012).

iii. Computation of Body Mass Index

Body Mass Index is used to assess nutritional status of the selected group of population. It indicates the individual body weight departs from what is normal or

desirable for a person of his or her height. WHO (2013) revealed that BMI of less than 18.5 is considered as an underweight and indicates the poor nutritional status and occurrence of many deficiency diseases and health problems, whereas BMI of more than 25 is considered as an overweight and more than 30 is noted as obesity. The BMI range of the selected participants is presented Table – XXV andFigure-10.

Table-XXV

Body Mass Index

Range of BMI	Grades of Malnutrition	Frequency	Per cent	Mean ± SD
16.00 - 16.99	Moderate malnutrition	72	13	23.65 ± 4.8
17.00 - 18.49	mild malnutrition	203	38	
18.50 - 24.99	Normal	96	18	
25.00-29.9	Overweight	110	20	
>30.00	Obesity	60	11	
Total		541	100	

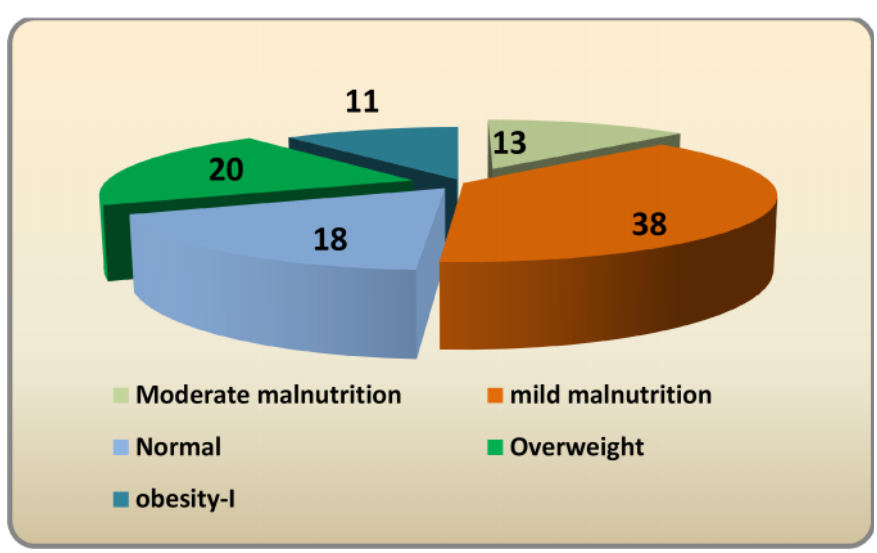


Figure-10 Distribution of selected participants based on their BMI values

Based on this BMI values, the grade of malnutrition was categorized from under nutrition to over nutrition in term of overweight and obesity. Table XXV revealed that 13

per cent of the selected participants were in the category of moderate malnutrition and followed by 38 per cent had mild malnutrition. It was shocked to note that only 18 per cent of the selected participants had normal BMI of 18.5-24.99. Twenty per cent and 11 per cent were in the category of overweight and obesity respectively. It was heart warming to note that none of the selected participants were severely malnourished. The mean BMI of the selected participants was found to be 23.6523±4.8.This was considered to be in the normal category as per BMI standard values.

iv. Waist/Hip ratio

Table-XXVI highlights the waist/hip ratio of the selected participants.

Table-XXVI

Waist/Hip ratio

Parameters	Grades of Malnutrition	Frequency	Per cent	Mean ±SD
Waist/Hip ratio*	Normal	41	8	0.8442± 0.098
	Mild obesity	315	58	
	Moderate obesity	185	34	
	Total	541	100.0	

*Normal 0.85 for women

According to Gopalan (1998) and WHO (2000), the waist hip ratio (WHR) has been accepted as a claimed method for identifying obesity in patients with abdominal fat accumulation. WHR greater than 1.0 in men and greater than 0.85 in women is considered as on obesity. Based on the WHR calculation about 8 per cent of the selected participants had normal WHR. Fifty eight per cent had mild obesity and 34 per cent had moderate obesity. The mean WHR of the selected participants was found to be 0.8442 ± 0.098 which was very much nearer to the WHR of 0.85.

Gopalan (1998) reported that the selected participants of middle class families with abdominal adiposity (WHR >1.0 in males and >0.85 in female), was found to be 34.9 per cent in males and 49.7 per cent in females compared to the figure for general overweight (BMI > 25) where 19.6 per cent in males and44.5 per cent in females. Studies by Gouda

and Prusty (2014) have shown that Asian Indian have i)average BMI , ii) average waist and hip circumference iii) less muscle mass and on the other hand have iv) higher WHR v) trunk abdominal fat – both subcutaneous and intra abdominal. Hence, BMI above does not accurately predict over weight in Asian Indian. Hence for obesity, BMI as well as abdominal obesity (WHR) have to be taken into consideration.

b. Biochemical Estimation

Haemoglobin level

Haemoglobin level was estimated by cyanomethaeamoglobin method suggested by Varley (2011) and considered for screening the prevalence of anaemia among the selected participants. Table-XXVIII and Figure-11 gives the percentage prevalence of anaemia among the selected participants

Table-XXVII

Blood Haemoglobin profile

Grade of anaemia	Haemoglobin levels (g/dl)	Frequency	Per cent	Mean ± SD
Severe	<8	50	9.0	10.5215 ±2.24
Moderate	8.1-10.9	201	37.0	
Mild	11.0-11.9	119	22.0	
Normal & non-anaemic	12 and above	171	32.0	
Total		541	100.0	

It is interesting to note that 32 per cent of the selected participants were healthy and non anaemic. However 22 and 37 per cent had mild and moderateanaemia respectively. It was heart-warming to note that only nine per cent of the selected participants were in

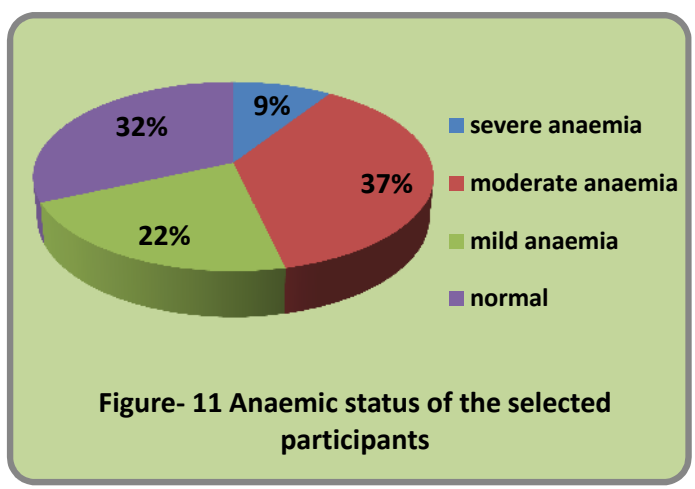


Figure- 11 Anaemic status of the selected participants

severely anaemic condition and had less than eight gram of haemoglobin per 100 g of blood.

E. Prevalence of premenstrual syndrome among the selected participants

PMS symptoms are cluster of physical, social and emotional symptoms occurring in the luteal phase of the menstrual cycle. The screening of PMS was done with standard tool -Premenstrual Daily Symptom Diary (Appendix-II). The prevalence of PMS among the selected participants is presented in Table-XXVIII and Figure-12.

Table-XXVIII

Prevalence of Premenstrual Syndrome

PMS symptom level	Symptom grade	Frequency	Per cent
No symptom	1	0	0
Mild symptoms	2	259	48
Moderate symptoms	3	242	45
Severe symptoms	4	40	7
Total	-	541	100

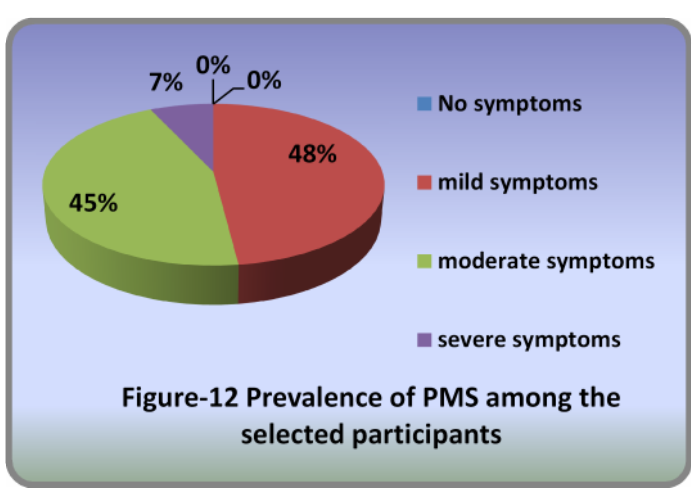


Figure-12 Prevalence of PMS among the selected participants

Based on the premenstrual daily symptom diary, the prevalence of symptomsof PMS among the selected participants were graded and scored on basis of no symptoms, mild symptoms,moderate symptoms and severe symptoms.

The prevalence of PMS among the selected participants was noted as 90 per cent from Phase I. The severity of PMS was noted and 48 per cent had mild symptoms of PMS. Forty five per cent of the selected participants had moderate symptoms, only seven percent of the participants had severe PMS symptoms. Similar prevalence was noted in the study of Tolossa and Bakele (2014) in which 83.2 per cent of the selected participants had PMS symptoms and noted in the study conducted by Naeimi (2015) among reproductive

age women, it was noted that 14.4 per cent did not have PMS symptoms and 85.6 per cent had PMS symptoms.

Similar pattern was observed in the study done by Tolossa and Bakele (2016) a European study pointed out that 89 per cent of individuals experienced various degrees of PMS. In the same manner Balaha et al., (2010) reported that mild symptom was noted among 45 per cent, moderate symptom as noted among 32.6 per cent and severe symptom was noted among 22.6 per cent of the selected participants. PMS was noted among 61.5 per cent of the rural school students of West Bengal, in the study done by Sarkar, et al., (2015).whereas in the present study the prevalence of PMS was high. Basically PMS is a group of physical, emotional and behavioural symptoms, noted in leutal phase of menstrual cycle. The prevalence of PMS for behavioural, emotional and physical symptoms were graded and presented in Table-XXIX and Figure-13.

Table-XXIX

Prevalence of emotional, behavioural and physical PMS symptoms among the selected participants

Type of PMS Problems	Symptoms of PMS	Frequency (N=541)	Per cent
Emotional	Irritability	387	72
	Anxiety	207	38
	Anger	280	52
	Depression	215	40
	Crying	165	30
	Insomenia	190	35
	Changes in sex desire	26	5
Behavioural	Food craving	385	71
	Tiredness	270	50
	Feeling over whelmed	222	41
	Difficulty in concentration	220	40
Physical	Head ache	62	11
	Breast swelling/pain	436	81
	Back pain	382	71
	Muscular pain	272	50
	Weight gain	382	71
	Nausea	168	31
	Abdominal pain	446	82

*Multiple responses

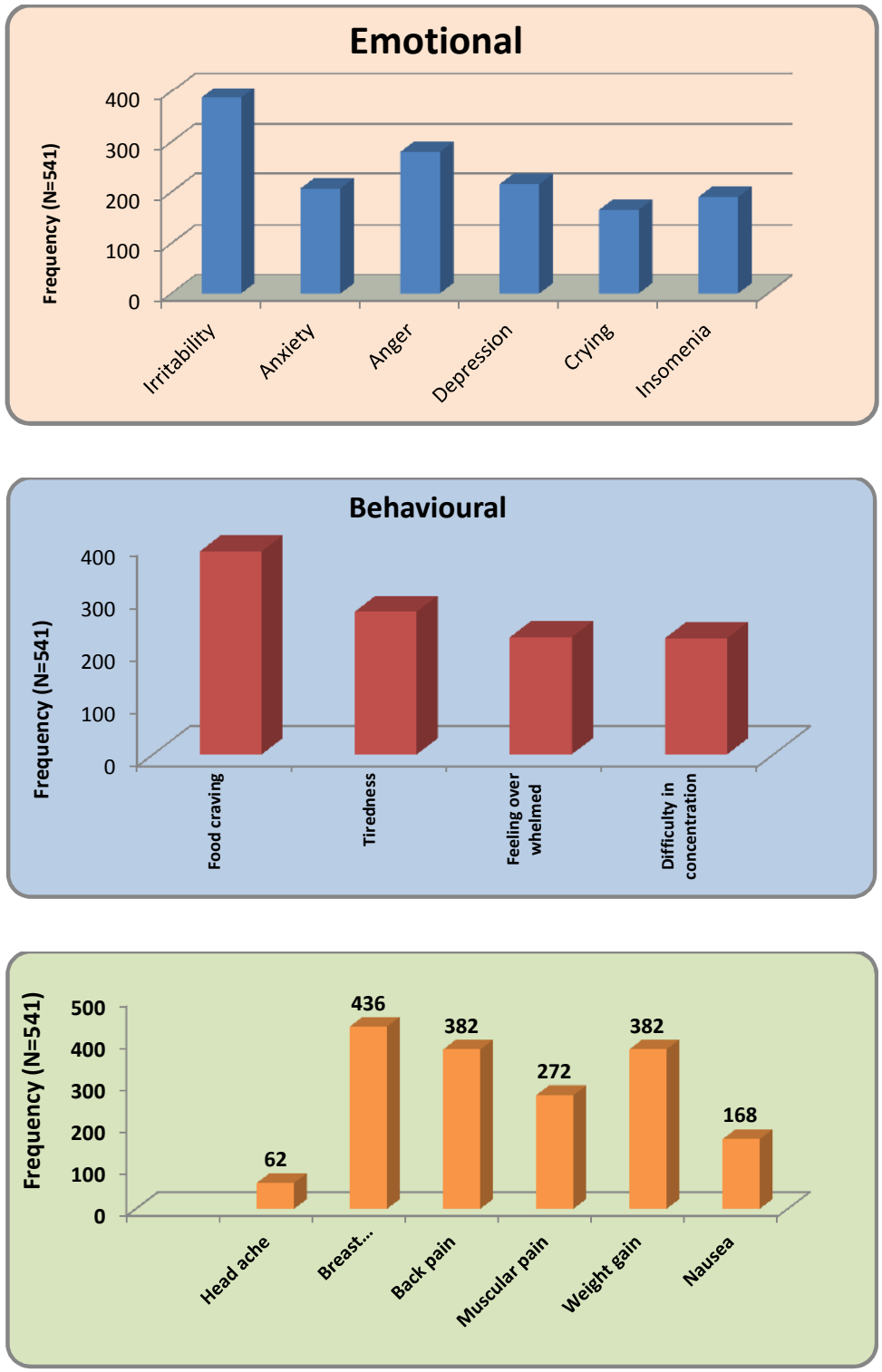


Figure 13 Prevalence of physical, behavioural and emotional symptoms of PMS among the selected participants

Table-XXIX highlights the physical, behavioural and emotional symptoms of PMS among the selected participants. Somatic symptoms like abdominal pain (82 per cent) and breast swelling (81per cent) were higher in prevalence. Least mentioned symptom was changes in sex desire (5 per cent). Abdominal pain was higher in prevalence in the present study (82 per cent) than in the participants participated in the study conducted by Rezaee*et al*., (2017), in which the prevalence of abdominal pain was 57 per cent and head ache was 92 per cent where as in the present study, it was 11 per cent.Among the social symptoms, the prevalence of irritability was 72 per cent was higher followed by anger (52per cent), depression (40per cent), anxiety (38per cent), insomenia (35 per cent) and crying (30 per cent) and the least reported social symptom was change in sex desire(5 per cent).

The major behavioural symptom noted was food craving (71 per cent) followed by tiredness (50 per cent), feeling over whelmed (41per cent) and difficulty in concentration (40per cent). All the selected participants had different levels (mild, moderate and severe) of each of the PMS symptom.

a. **Physical symptoms**

The levels of the physical symptoms in different grades are presented in Table-XXX.

Table - XXX

Level of physical symptoms of PMS

Symptom	Level of PMS symptoms	Frequency (N=541)	Per cent
Head ache	Mild symptom	50	81
	Moderate symptom	9	14
	Severe symptom	3	5
	Total	62	100
Breast swelling	Mild symptom	341	78
	Moderate symptom	76	17
	Severe symptom	19	5
	Total	436	100
Back pain	Mild symptom	296	78
	Moderate symptom	73	19
	Severe symptom	13	3
	Total	382	100
Muscle pain	Mild symptom	205	75
	Moderate symptom	50	19
	Severe symptom	17	6
	Total	272	100
Weight gain	Mild symptom	210	55
	Moderate symptom	62	16
	Severe symptom	110	29
	Total	382	100
Nausea	Mild symptom	132	79
	Moderate symptom	29	17
	Severe symptom	7	4
	Total	168	100
Abdominal pain	Mild symptom	332	75
	Moderate symptom	107	23
	Severe symptom	7	2
	Total	446	100

The Table presents the details on the physical or somatic symptoms at different levels. The trend showed that majority (73-81 per cent) of the selected participant's experienced mild symptoms only. It was noted that 14-23 per cent of the selected

participants experienced moderate symptoms and only 2-4 per cent of the selected participants had severe PMS symptoms.

b. Behavioural symptoms

Table XXXI presents the details of different level of the behavioural symptoms of the selected participants.

Table-XXXI

Level of behavioural symptoms of PMS

Symptom	Level of symptoms	Frequency (N=541)	Per cent
Tiredness	Mild symptom	200	74
	Moderate symptom	58	22
	Severe symptom	12	4
	Total	270	100
Insomenia	Mild symptom	150	79
	Moderate symptom	36	19
	Severe symptom	4	2
	Total	190	100
Changes in sex desire	Mild symptom	24	92
	Moderate symptom	2	8
	Total	26	100
Food cravings	Mild symptom	222	83
	Moderate symptom	49	13
	Severe symptom	14	4
	Total	385	100
Difficulty in concentrating	Mild symptom	174	79
	Moderate symptom	33	15
	Severe symptom	13	6
	Total	220	10
Feeling over whelmed	Mild symptom	175	79
	Moderate symptom	34	15
	Severe symptom	13	6
	Total	222	100

From the data related to the behavioural symptoms of PMS among the selected participants, it was observed that majority (74-92 per cent) of the selected participants had only mild behavioural symptoms. The various behavioural symptoms like tiredness(22 per

cent), insomenia (19per cent), changes in sex desire (8 per cent), and feeling overwhelmed (15per cent) were moderate in nature. Severe symptoms for all the behaviours were between two and eight per cent only indicating that the selected participants were rarely suffering from severe PMS symptoms.

c. Emotional symptoms

Table - XXXII presents the details on the prevalence of different grades of emotional symptoms of PMS.

Table-XXXII

Level of emotional symptoms of PMS

Symptom	Level of symptoms	Frequency (N=541)	Per cent
Irritability	Mild symptom	301	78
	Moderate symptom	69	18
	Severe symptom	17	4
	Total	387	100
Anxiety	Mild symptom	148	72
	Moderate symptom	47	23
	Severe symptom	12	5
	Total	207	100
Anger	Mild symptom	195	72
	Moderate symptom	67	23
	Severe symptom	18	5
	Total	207	100
Depression	Mild symptom	39	18
	Moderate symptom	125	58
	Severe symptom	51	24
		215	100
Feel like Cry	Mild symptom	105	64
	Moderate symptom	50	30
	Severe symptom	10	6
		165	100
Relationship problem	Mild symptom	211	74
	Moderate symptom	62	22
	Severe symptom	14	4
	Total	287	100

Among the emotional symptoms, majority of the selected participants had mild symptoms of Irritability (78per cent), anxiety (72per cent), anger (72per cent), feel like cry (64per cent) and relationship problem (74per cent).Hence they were unable to manage the emotional symptoms. Depression showed a moderate level of the symptoms (58per cent) and others with moderate level of symptoms were irritability, anxiety, anger feel like cry, relationship problem were noted among 18-30 per cent of the selected participants.

F. Anxiety level of the selected participants

Anxiety level of a person indicates many aspects of the health condition of an individual. Various studies indicated that increased stress or anxiety level increase the severity of the symptoms of PMS. Anxiety level and self-esteem level of the selected participants is presented in Table-XXXIII.

Table-XXXIII

Anxiety and Self Esteem level of the selected participants

Anxiety/self esteem	Level	Frequency (N=541)	Per cent	Mean ±SD
State anxiety*	No anxiety	13	2.0	2.8817 ±0.64468
	Mild	109	20.0	
	Moderate	348	65.0	
	Severe	71	13.0	
	Total	541	100.0	
Trait anxiety**	No anxiety	8	2.0	2.8355 ± 0.55837
	Mild	112	21.0	
	Moderate	382	71.0	
	Severe	39	7.0	
	Total	541	100.0	
Self esteem***	No self esteem	10	2.0	3.0998 ± 0.64206
	Less self esteem	57	11.0	
	Moderate self esteem	343	63.0	
	High self esteem	131	24.0	
	Total	541	100.0	

*State Trait Inventory **State Trait Anxiety Inventory ***Rosenberg's Inventory

Table-XXXIII presents the existence of state (present condition) and Trait (personality) anxiety among the selected participants. It was noted that 98 per cent of the selected participants had State Anxiety and Trait Anxiety. Majority (65per cent and 71per cent) of the selected participants had moderate anxiety with respect to state anxiety and personality trait anxiety. Twenty per cent of the selected participants had mild state anxiety and twenty one per cent had mild trait anxiety. Thirteen and seven per cent of the selected participants had severe state and trait anxiety respectively. Only two per cent of the selected participants had no anxiety. Self Esteem was also noted among 24 per cent of the selected participants. Sixty three per cent of the selected participants had moderate Self Esteem and 11 per cent had low Self Esteem.

G. Knowledge on PMS

In the initial stage of the study, knowledge on PMS was assessed on the basis of the specially structured questionnaire. The knowledge score of the selected participants was presented in Table-XXXIV.

Table-XXXIV

Level of knowledge on PMS

Level of knowledge (in score)	Frequency (N=541)	Per cent	Mean ± SD
Poor (0-3)	422	78.0	2.7084 ±1.48229
Average (4-7)	107	20.0	
Good (8-10)	12	2.0	
Total	541	100.0	

It was noted from the above table that majority (78 per cent) of the selected participants had poor knowledge on PMS, 20 per cent had average and only two per cent of the participants had good knowledge on PMS.

Table XXXV presents distribution of selected participants based on the correct knowledge scores the level of knowledge of the selected participants on PMS.

Table-XXXV

Distribution of the correct knowledge scores

Details of PMS*	Frequency	Per cent
Meaning of PMS	480	89
Causes of PMS	504	93
Occurrence of PMS	42	8
Age of high prevalence of PMS	32	6
Symptoms of PMS	157	29
Time of disappearance of PMS symptoms	289	53
Sever complications of PMS	19	4
Influencing factors of PMS	309	57
Food craving during PMS	89	16
Management of PMS	65	12

*Multiple responses

Table-XXXV presents the details of the correct answers obtained for each question in the knowledge on PMS questionnaire. From the data it was noted that majority of the selected participants (89 per cent) were aware of the meaning of PMS. Ninety three per cent of the selected participants mentioned the causes of PMS. Fifty seven and 53 per cent of the selected participants gave correct answer for the factors which influence PMS and disappearance of PMS symptoms respectively. The symptoms of PMS were answered correctly by 29 per cent of the selected participants. The aspect on food craving during PMS was answered correctly by 16 per cent of the selected participants and only 12 per cent gave correct answer for management of PMS. But it was discouraging to note that time of occurrence of PMS, age of high prevalence of PMS and complications of PMS were answered by meagre per cent of the selected participants (4-8 per cent) only. Based on the research reports, health education regarding various aspects of PMS guide the selected participants in management of PMS in a wise manner and minimise the consequence of PMS.

H. Influence of the demographic, dietary, menstrual and nutritional variables on Premenstrual symptom score

The PMS is influenced by various factors like demographic characteristics, dietary habits, health or nutritional status and emotional variables and has some impact on the premenstrual symptoms.

a. Relationship between PMS and demographic characteristics

Table - XXXVI presents the relationship between premenstrual symptoms and demographic characteristics.

Table-XXXVI

Relationship between demographic characteristicsand PMS

Demographic details		Frequency	Per cent	Mean PMS score± SD	Correlation/ Chi square Value df significance
Location	Rural	230	42	1.44±0.49	18.436[b] 8 0.018*
	Urban	154	29	1.61±0.49	
	Semi urban	157	29	1.62±0.49	
	Total	541	100		
House	Own house	335	62	1.40±0.5	2.011[b] 3 0.570[NS]
	Rented house	206	38	1.46±0.5	
	Total	541	100		
Family type	Joint/ extended	187	35	1.62±0.49	7.596[b] 3 0.055[NS]
	Nuclear	354	65	1.63±0.48	
	Total	541	100		
Family size	2-3 members	106	20	1.37±1.15	9.638[a] 8 0.291[NS]
	4-5 members	320	59	1.24±1.07	
	> 5 members	115	21	1.50±1.14	
	Total	541	100		
Father's education	Illiterate	6	1	1.33±0.66	5.524[b] 9 0.786[NS]
	Primary School	393	73	1.29±0.64	
	Secondary School	104	20	1.33±0.66	
	Higher secondary	11	2	1.33±0.66	
	Under Graduation	14	2	1.25±0.24	
	Post Graduation	13	2	1.23±0.48	
	Total	541	100		
Mother's education	Middle school	454	83	1.24±0.58	3.524[b] 9 0.786[NS]
	High school	58	11	1.22±0.56	
	Higher secondary	15	3	1.21±0.59	
	College	14	3	1.3±0.34	

Demographic details		Frequency	Per cent	Mean PMS score± SD	Correlation/ Chi square Value df significance
	Total	541	100		
Father's occupation	Govt employee	183	34	1.78±0.67	65.062[b] 12 0.00**
	NGO Employee	240	44	1.81±0.64	
	Business	103	19	1.47±0.64	
	Unemployed	15	2	1.65±0.74	
	Total	541	100		
Mother's occupation	Govt employee	91	17	1.88±0.76	44.721[b] 12 00**
	NGO Employee	211	39	1.72±0.88	
	Business	55	10	1.73±0.83	
	Unemployed	184	34	1.63±0.7	
	Total	541	100		
Family income * (Rs)	2500-4500	268	50	1.53±0.5	3.439[a] 3 0.329[NS]
	4501-7500	195	36	1.53±0.5	
	7501 and above	78	14	1.49±0.5	
Family type	Joint/ extended	187	35	1.62±0.49	7.596[b] 3 0.055[NS]
	Nuclear	354	65	1.63±0.48	
	Total	541	100		
Family size	2-3 members	106	20	1.37±1.15	9.638[a] 8 0.291[NS]
	4-5 members	320	59	1.24±1.07	
	> 5 members	115	21	1.50±1.14	
	Total	541	100		
Age (years)	20-30	297	55	1.45±0.5	4.316[b] 3 0.229[NS]
	31-40	127	24	1.40±0.5	
	41-45	117	21	1.60±0.5	
	Total	541	100.0		
Marital status	Married	231	43	1.60±0.49	36.186[b] 4 0.001*
	Unmarried /Widow/Separated	310	57	1.67±0.47	
	Total	541	100.0		
Education of participant	School level	316	23	1.57±0.5	10.979[b] 4 0.027*
	College level	225	37	1.49±0.5	
	Total	541	100		

a-correlation; b-chi square *Significant at 5% level ** Significant at 1% level

Table-XXXVI presents the demographic variables like marital status, occupation of the subjects, educational status of the subject, location of house and their association with the PMS score. These data were subjected to 'chi square' test. From the statistical inferences, it was noted that the demographic variables like marital, occupational and

educational status of the selected participants, location of house and parents' occupation showed significant association with PMS scores at ($p<0.05$) level. Age and other demographic characteristics like family size and type of family did not have any statistical significance with PMS symptom score. This was similar to the study by Brahmbhattet al.,(2013) in which age and other demographic variables were not identified as the influencing factors for PMS. Rezaee, *et al.,* (2017) in their study found that age of women had a significant relationship with PMS symptom score. Kumari and Sachdeva (2016) found that PMS were more common in women with higher education than primary education and also reported that occupation of the selected participants showed higher statistical significance with PMS symptom score ($p< 0.01$). Occupation of females was an important predicator of PMS symptom Based on a study among reproductive age women, Tehrani (2012) reported that level of higher education is accompanied with the prevalence of PMS. This provided supportive evidence that education is a factor affecting PMS. According to Sarkar *et al.,* (2015) PMS was significantly associated with homemakers. There existed an association between the location of selected participants and PMS symptom score with higher statistical significance ($p<0.05$). This might be due to the fact that the selected participants residing in rural areas have less interaction and less knowledge on PMS than in urban areas. Rented house did not show any statistical significance with PMS symptom score.

The mean score of age indicates that the PMS is high among the 41-45 group compared to other groups. Though there was no significant difference in the PMS scores among the type of families. The mean PMS score was higher among the nuclear families compared to joint/extended families. The PMS score was highest among the selected participants whose mothers had college education than lower educational levels. Table- XXXVI shows that there was no significant difference in PMS symptom score among the selected participants with respect to family size. But the mean score value indicated that the mean PMS score was higher in the families which had more than five members in their family.

b. Impact of dietary habits on the premenstrual symptom score

Diet plays a vital role in health status of an individual. Decreased intake of micronutrients like Iron, Calcium, Magnesium, Vitamin B_6, Zinc and inadequate fluids

lead to expression of various Physical, Social and Emotional symptoms. Hence it was pointed in the present study that there is a relationship between type of health defect or illness and dietary intake of an individual. Table–XXXVII presents the relationship between the dietary habits and PMS symptom score.

Table- XXXVII

Relationship between dietary habits and premenstrual symptom score

Daily dietary intake	Quantity/ frequency of intake	Frequency	Per cent	Mean PMS score ±SD	Correlation/chi square value df significance
Intake of Water	1 litre	95	18	2.36±0.96	17.867[b] 9 0.037*
	1-1.5 litres	286	53	2.25±0.92	
	1.5-2 litres	122	22	2.24±0.95	
	>2 litres	38	7	2.18±0.94	
	Total	541	100		
Intake of Milk	>350ml	189	35	2.29±0.92	-0.063[a] 0.189 541
	250-350ml	107	20	2.33±0.98	
	100-200ml	135	25	2.27±0.87	
	<100ml	110	20	2.10±0.92	
	Total	541	100		
Intake of coffee	>5times	92	17	2.36±0.98	+0.422[a] .000** 541
	5times	115	22	2.28±0.83	
	3-4times	261	48	2.22±0.92	
	<2times	73	13	2.20±0.11	
	Total	541	100		
Skipping of meals	Daily	63	11	2.34±0.87	6.991[b] 9 0.638[NS]
	Weekly	75	14	2.18±0.98	
	Occasionally	329	61	2.25±0.94	
	Not at all	74	14	2.29±0.94	
	Total	541	100		
Intake of vegetables	<100g	145	26	2.28±0.96	-.003[a] .939[NS] 541
	100-200g	257	48	2.28±0.94	
	>200g	101	19	2.22±0.79	
	Nil	38	7	2.05±0.97	
	Total	541	100		
Intake of green leafy vegetables	<100g	150	28	2.29±0.92	-0.059[a] 0.170
	100-200g	208	38	2.35±0.91	

Daily dietary intake	Quantity/ frequency of intake	Frequency	Per cent	Mean PMS score ±SD	Correlation/chi square value df significance
	>200g	134	25	2.14±0.16	541
	Nil	49	9	2.21±0.96	
	Total	541	100		
Intake of fruits	<25grams	132	24.4	2.25±0.92	-0.038[a] .378[NS] 541
	25-50grams	202	37.3	2.25±0.97	
	50-75grams	134	24.8	2.23±0.95	
	75-100 gram	72	13.3	2.25±0.83	
	Total	541	100		
Fats and oils	0-10 ml	102	18.9	2.23±0.78	+ 0.050[a] 0.244[NS] 541
	10.1-20 ml	38	7.0	2.47±0.28	
	20.1-30 ml	228	42.1	2.27±0.48	
	30.1-40 ml	2	.4	2.26±0.78	
	40 ml & above	171	32	2.24±0.85	
	Total	541	100.0		
Carbonated beverages	Daily	13	2	2.41±0.86	11.198[b] 6 0.082[NS]
	Occasionally	420	78	2.28±0.86	
	Rarely	108	20	2.24±0.94	
	Total	541	100		

a-correlation, b-chi square *Significant at 5% level **Significant at 1% level

The present study also revealed that there was an association between the intake of water and PMS symptom score and it was statistically significant at ($p<0.05$) level. There was a mild degree of positive correlation between the frequency of intake of coffee and PMS symptom score and it was statistically significant at ($p=000$).

A mild degree of negative correlation existed between the intake of milk, vegetables, and green leafy vegetables and fruits and PMS symptom score though it is not statistically significant. Similar results were obtained in the study on PMS and dietary pattern conducted by Darabi, *et al*., (2014) in which intake of milk gave a negative correlation with PMS symptom score ($p<0.05$) and frequency of intake of coffee had shown a positive correlation with PMS symptom score which is highly significant ($p<0.00$).

Intake of vegetables and green leafy vegetables showed a mild degree of negative correlation with PMS symptom score and were not statistically significant. Intake of fruits

also showed a mild degree of negative correlation with PMS symptom score which was not statistically significant. Similar trend was noted in the study done by Darabi, et al.,(2014). Oil consumption and intake of carbonated beverages had a mild degree of positive correlation with PMS symptom score that was not statistically significant.

c. Impact of menarche and menstrual cycle on the PMS symptoms score

The gynaecological aspects like age at menarche, duration of menstrual cycle and days of menses have some impact on the PMS symptom scores like prevalence and intensity. Table-XXXVIII presents the relationship between the menarche and menstrual cycle and PMS symptom score.

Table - XXXVIII

Relationship between the menarche and menstrual cycle and PMS symptom score

Menarche/ Menstruation	Detail	Frequency	Per cent	Mean PMS score and SD	chi square df significance
Age at menarche (years)	<12	35	6.5	2.31±0.82	36.256 24 0.05*
	12	169	31.2	2.26±0.9	
	13	157	29.0	2.30±0.88	
	14	115	21.3	2.27±0.86	
	15	49	9.1	2.21±1.09	
	>15	16	3.0	2.05±0.96	
	Total	541	100.0		
Days of menstruation	Irregular	13	2.4	2.19±0.36	23.099 9 0.048*
	3 days	218	40.3	2.27±0.3	
	5 days	267	49.4	2.28±0.86	
	>7 days	43	7.9	2.42±0.92	
	Total	541	100.0		
Duration of menstrual cycle	Irregular	13	2	2.05±0.89	30.709 15 0.010**
	25 days	63	12	2.23±0.91	
	28 days	189	35	2.33±0.96	
	30 days and above	276	51	2.38±0.95	
	Total	541	100		
Menstrual flow	Mild	112	20.7	1.46±0.14	1.540 6 0.957NS
	Moderate	312	57.7	1.36±1.12	
	Heavy	117	21.6	1.37±1.12	
	Total	541	100.0		

*Significant at 5% level **Significant at 1% level

Table- XXXVIII shows that there was significant relationship between the menstrual cycle duration, days of menstrual cycle, menstrual flow and age at menarche with that of premenstrual symptom score. In the present study, it was noted that there was significant relationship between menstrual cycle days and PMS symptom score ($p<0.01$). The mean score of PMS was gradually decreased from less than 12 years to more than 15 years. This indicates that with increase in age at menarche, the mean PMS symptoms scores reduced. Sarkar *et al*., (2016) highlighted that the age at menarche showed negative correlation with PMS emotional symptoms ($p=0.034$, $r=0.229$). Darabi *et al.,* (2014) has reported that there was a significant negative relationship between menarche age and pain ($p=0.006$, $r=0.229$). According to Tehrani, et al., (2012) there was no significant relationship among the PMS symptom score and menstrual cycle days. The present study was in accordance to the study of Kiyani et. al. (2009) and suggested that those who have menstruation bleeding more than eight days and longer cycle experienced more number of PMS symptoms.

d. Relationship between anthropometric measurements and PMS symptom score

Anthropometric measurement is the direct measures that reflects the nutritional status and play a role in the prevalence and severity of PMS symptom score. The correlation between the anthropometric measurements and PMS symptom score is presented in Table -XXXIX

Table-XXXIX

Anthropometric measurement and its association with premenstrual symptom score

Anthropometric measurements	Range	Frequency	Per cent	Mean PMS score ± SD	Chi square df significance
Weight (Kg)	30-40	33	6	1.09±1.04	42.014 15 0.00**
	40.1-50	185	34	1.14±0.84	
	50.1-60	183	33	1.35±1.2	
	60.1-70	108	21	1.39±1.2	
	70.1-80	24	4	2.09±1.2	
	80.1-90	8	2	2.3±1.6	
		Total	541	100	
Height (cm)	120-139.9	134	25	1.25±1.18	19.588 9 0.021*
	140-149.9	326	60	1.04±0.95	
	150-159.9	71	13	1.55±1.16	
	160-169.9	10	2	1.62±1.17	
	Total	541	100		
Body Mass Index	Mild malnutrition	203	38	1.37±1.06	10.571 12 0.566^{NS}
	Moderate malnutrition	72	13	1.15±0.67	
	Normal	96	18	1.20±0.92	
	Overweight	110	20	1.03±0.68	
	Obesity	60	11	1.3±0.68	
	Total	541	100		
Waist/Hip Ratio	Normal	41	8	1.36±1.13	4.720 3 0.193^{NS}
	Mild obesity	315	58	1.57±1.3	
	Moderate obesity	185	34	1.37±1.13	
	Total	541	100.0		

*Significant at 5% level **Significant at 1% level NS- Not Significant

It was noted that weight of the selected participants had highly significant association with the PMS symptom score (p=0.00). The mean PMS score for overweight (>70 kg) was higher than for normal and lower weight group. The mean PMS symptom score for height was also higher in the tall selected participants (>160 cm) than normal and short selected participants. Height also had significant association with PMS symptom score (p<0.05), whereas BMI and WHR did not have any association with PMS symptom score.

e. Correlation between haemoglobin level and PMS symptom score

Anaemic condition of the selected participants had a significant impact on the symptoms of PMS. Reduced Iron levels affect the reproductive health of an individual. Table-XL presents the correlation between the haemoglobin levels and PMS symptom score.

Table-XL

Correlation between Haemoglobin level and PMS symptom score

Biochemical parameter	Grades of anaemia	Frequency	Per cent	Mean PMS score ±SD	Correlation df significance
Haemoglobin (g/dl)	Severe (<8g/dl)	50	9.2	2.12±1.04	-0.007 0.873^{NS} 541
	Moderate (10.9-8g/dl)	201	37.2	2.21±0.83	
	Mild (11-11.9 g/dl)	119	22.0	2.13±0.10	
	Normal (12-14 g/dl)	171	31.6	2.01±1.2	
	Total	541	100.0		

NS- Not Significant

The correlation between the haemoglobin level and premenstrual symptom score showed that there was no relationship with PMS symptom score.

f. Association between the anxiety and self esteem levels with PMS symptom score

Anxiety, stress and self pity are the psychological factors associated with PMS. Studies done among college students have shown that stress levels correlated well with PMS symptom scores. Table XLI presents the association between anxiety levels and self esteem with PMS symptom score.

Table-XLI

Correlation between the psychological factors and PMS symptom score

Anxiety/self esteem	Range	Frequency	Per cent	Mean PMS score ± SD	Chi square df Significance
State anxiety	No anxiety	13	2.4	1.20±2.3	45.925 9 0.00**
	Mild	109	20.1	1.69± 1.3	
	Moderate	348	64.3	1.72± 2.0	
	Severe	71	13.1	1.97±1.01	
	Total	541	100.0		
Trait anxiety	No anxiety	8	1.5	1.39±1.3	45.818 9 0.00**
	Mild	112	20.7	1.42±2.0	
	Moderate	382	70.6	1.56±1.9	
	Severe	39	7.2	1.67±3.1	
	Total	541	100.0		
Self esteem	No self esteem	10	1.8	1.96±1.03	64.803 9 0.00**
	Less self esteem	57	10.5	1.83±2.02	
	Moderate self esteem	343	63.4	1.42±2.3	
	High self esteem	131	24.2	1.03±1.92	
	Total	541	100.0		

*Significant at 5% level **Significant at 1% level NS- Not Significant

State Anxiety (measured by State Trait Inventory) and Trait Anxiety (measured by State Trait Inventory-I) had association with PMS symptom (p=0.00) which was highly significant. Similarly Self Esteem also had a higher level of association with PMS symptom score. Self Esteem showed that there was a mild negative correlation with PMS symptom which was statistically significant.

g. Level of knowledge of PMS and its association with PMS symptom score

Like educational level, knowledge on various aspects of PMS makes a person to be aware of the consequences of PMS and its preventive strategies. Table-XLII expresses the association between the level of knowledge on PMS and PMS symptom score.

Table-XLII

Relationship between PMS knowledge score and PMS symptom score

Level of knowledge	Frequency	Per cent	Mean PMS score	Chi square df=6 significance
Poor (0-3)	422	78.0	2.36±1.04	16.436 6 0.018*
Average (4-7)	107	20.0	2.12± 1.03	
Good (8-10)	12	2.0	2.01± 2.02	
Total	541	100.0		

*Significant at 5% level **Significant at 1% level NS- Not Significant

Table XLII shows the level of PMS knowledge and PMS symptom score. Analysed data highlighted that there was an association between level of knowledge of PMS and PMS symptom score $p<0.05$). The mean PMS symptom score was highest for poor knowledge (2.36±1.04) followed by average knowledge (2.12± 1.03) and lowest among good knowledge (2.01± 2.02).

h. Correlation of dietary indices with individual Premenstrual symptoms

Table- XLIII shows the correlation of the dietary pattern of the selected participants and individual PMS symptom score. It was noted that intake of water was negatively correlated with irritability ($p<0.01$), head ache ($p<0.01$), abdominal pain ($p=0.00$), food craving ($p=0.05$) and weight gain (0.01). With excess intake of water, the PMS symptoms were noticeably reduced. Water intake had a positive correlation with Muscular pain ($p=0.00$).The intake of fruits had a negative correlation with PMS symptom score. Intake of fruits was negatively correlated with the individual symptoms like anxiety ($p<0.05$), tiredness ($p<0.05$), changes in sex desire ($p=0.00$) and difficulty in concentration ($p=0.01$).

Table-XLIII

Relationship between of dietary indices with individual PMS symptoms

Food item	Signs and Symptoms of PMS	Correlation (r value)	Significance
Intake of water	Irritability	-0.119	0.009**
	Head ache	-0.137	0.003**
	Abdominal pain	- 0.331	0.00**
	Muscle pain	0.178	0.00**
	Food craving	-0.089	0.050*
	Weight gain	-0.117	0.010**
Intake of fruits	Anxiety	-0.101	0.027*
	Tiredness	-0.109	0.016*
	Changes in sex desire	-0.168	0.00**
	Difficulty in concentrating	-0.120	0.008**
Intake of vegetables	Cry	-0.089	0.050*
	Relationship problem	-0.142	0.002*
	Food craving	-0.093	0.042*
	Back pain	0.141	0.002**
	Muscle pain	-0.115	0.011*
	Weight gain	-0.115	0.011*
green leafy vegetables	Tiredness	0.135	0.003**
	Back pain	0.119	0.009**
	Difficulty in concentration	-0.113	0.013*
	Muscle pain	-0.119	0.009**
Intake of coffee intake	Irritability	0.258	0.00**
	Anger	0.175	0.00**
	Anxiety	0.096	0.035*
	Depression	0.127	0.005**
	Food craving	0.185	0.005**
	Difficulty in concentration	0.130	0.004**
	Abdominal pain	0.152	0.001**
	Nausea	0.165	0.00**
	Irritability	-0.217	0.00**
	Tiredness	0.174	0.00**
	Breast tenderness	-0.125	0.00**

Food item	Signs and Symptoms of PMS	Correlation (r value)	Significance
Oil consumption	Muscle pain	-0.216	0.00**
	Weight gain	0.306	0.00**
	Over whelming	-0.259	0.00**
	Nausea	0.121	0.008**
Skipping of meals	Irritability	-0.116	0.011*
	Breast tenderness	-0.214	0.00**
	Back pain	0.210	0.00**
	Muscle pain	0.212	0.00**
	Weight gain	-0.182	0.00**
Intake of milk	Cry	-0.188	0.00**
	Tiredness	-0.180	0.00**
	Food craving	-0.187	0.00**
	Insomnia	-0.264	0.00**
	Head ache	0.137	0.003**
	Difficulty in concentration	-0.107	0.019*
	Abdominal pain	-0.331	0.00**
	Muscle pain	-0.178	0.00**
	Weight gain	-0.117	0.010**

*Significant at 5% level **Significant at 1% level NS- Not Significant

Intake of vegetables also showed a negative correlation with the individual PMS symptom scores like cry ($p=0.05$), relationship problem ($p<0.01$), food craving ($p<0.05$), back pain ($p<0.005$), muscle pain ($p<0.05$) and weight gain ($p<0.05$).

Oil consumption showed positive correlation with tiredness ($p=0.00$), weight gain ($p=0.00$) and nausea ($p<0.01$). Oil consumption was negatively correlated with the symptoms like irritability, breast tenderness, muscle pain and over whelming ($p< 0.00$). Similar pattern was reported by Darabi et al., (2014) in which it was noted that there was a negative relationship between milk servings and pain ($p=0.038$; $r=0.224$).

Intake of coffee was positively correlated with irritability and anger ($p=0.00$), anxiety, depression, difficulty in concentration, abdominal pain ($p<0.01$). Hence, it was noted that excessive intake of coffee was an important determining factor for the emotional symptoms.

Skipping of meal showed a mild degree of negative correlation with irritability ($p<0.05$) and breast tenderness and weight gain ($p=0.00$). Skipping of meal showed the positive correlation with back pain and muscle pain with a significance of ($p=0.00$).

Intake of milk was negatively correlated with the individual PMS symptom score like cry, tiredness, food craving, insomenia with ($p=0.00$), head ache ($p<0.005$), difficulty in concentrating ($p<0.05$), abdominal and muscular pain ($p=0.00$) and weight gain ($p=0.01$).

i. Correlation of obstetric and gynaecological indices with individual PMS symptoms

The PMS symptoms have a strong relationship with the menstrual cycle characteristics like days of menstruation, menstrual flow, duration of menstruation and menstrual irregularity. Table XLIV presents the details of the correlation with menarche and PMS symptoms.

Table-XLIV

Correlation of obstetric and gynaecological indices with individual PMS symptoms

Details of Menarche/ menstrual cycle	Symptoms	Correlation (r value)	Significance
Age at menarche	Anger	+0.093	0.042*
Days of menses	Irritability	-0.258	0.00**
	Depression	-0.108	0.018*

*Significance at 5% level ** Significance at 1% level

Table -XLIV pasteurises the correlation of age at menarche and days of menstrual cycle with PMS symptom score. It was clear that there is a mild degree of positive correlation of age at menarche with the symptom of anxiety ($p<0.01$). Though many of physical, behavioural and emotional symptoms had mild degree of correlation with the PMS symptom score and were not statistically significant. Age at menarche showed a positive correlation with emotional symptoms such as irritability, anger, anxiety,

depression, cry and relationship problem. Anger was statistically significant ($p<0.005$). Age at menarche showed positive correlation with behavioural symptoms like tiredness, changes in sex desire, food craving, difficulty in concentration and feeling over whelmed.

Days of menstrual cycle indicates that there was a mild degree of negative correlation ($p<0.00$) with PMS symptom score –irritability ($p=0.00$), and a mild degree of negative correlation with depression ($p<0.05$). Most of other symptoms also had a mild degree of correlation which was not statistically significant. The correlation of duration of menstrual cycle had mild degree of correlation with PMS symptom score. But that was not statistically significant.

j. Correlation of the Waist-Hip Ratiowith individual PMS symptom scores

Anthropometric measurements are the important indices of nutritional status of an individual and influence PMS symptoms. Table –XLV explains the correlation between the Waist-Hip Ratio and individual PMS symptom score.

Table-XLV

Correlation of Waist-Hip Ratiowith individual PMS symptom scores

Details	Problems	Correlation (r value)	Significance
Waist/Hip Ratio	Changes in sex desire	0.322	0.00**
	Food craving	0.101	0.027*
	Abdominal pain	0.109	0.016*

*Significance at 5% level ** Significance at 1% level

Table-XLV presents the details of Waist-Hip Ratio and individual PMS symptom score. Though most of the symptoms had mild degree of positive correlation with Waist-Hip Ratio and other anthropometric parameters like BMI values, height and weight and were not statistically significant. The Waist-Hip Ratio showed a positive correlation with the change in sex desire ($p=0.00$), food cravings ($p< 0.05$) and abdominal pain ($p<0.05$).

k. Correlation of the anxiety levelswith individual PMS symptom scores

The stress and self esteem and the knowledge on PMS will have an impact on the PMS symptom score. Table- XLVI depicts the impact of stress on PMS symptom score.

Table-XLVI

Correlation of anxiety level, self esteem level and PMS knowledge scores on individual symptoms of PMS

Details	Symptoms of PMS	Correlation (r value)	Significance
State anxiety	Breast tenderness	0.134	0.003**
Trait anxiety	Back pain	0.091	0.045*
Self esteem	Anger	-0.094	0.034*
PMS Knowledge score	Head ache	-0.091	0.045*
	Back pain	-0.095	0.038*
	Muscle pain	-0.101	0.026*
	Changes in sex desire	-0.129	0.004**
	Irritability	-0.096	0.034*
	Anger	-0.094	0.034*

*Significance at 5% level ** Significance at 1% level

Table-XLVI presents the details of the anxiety level, self esteem and knowledge on PMS with individual PMS symptoms. State anxiety showed positive correlation with breast tenderness that was statistically significant ($p<0.005$). The trait anxiety showed a positive correlation with back pain ($p<0.05$). Self esteem was negatively correlated with anger ($p<0.05$). Knowledge on PMS showed a negative correlation with head ache, back pain, muscle pain, irritability and anger at a level of ($p<0.05$) and changes in sex desire at a level of ($p<0.005$).

PHASE-II

EVALUATION OF HEALTH MIX COOKIES

Health mix was prepared using Calcium and Magnesium rich ingredients and their nutritive value, sensory attributes, amono acids profile, essential fatty acids profile were analysed and the best scored health mix was used for the preparation of cookies. The nutritive value, sensory attributes and microbial count and cost effectiveness were carried out and were presented in the following pages.

Ingredients used in the health mix were valuable for the calorie, protein, minerals like (Iron, Calcium and Magnesium) and B complex Vitamins content are easily prepared by all income groups. A total of fifteen variations were prepared and used for sensory evaluation to select the best five health mix for dietary intervention. Sensory evaluation, nutrients content, microbial count and calculation of cost effectiveness were done for the health mix cookies.

A. Sensory evaluation

Sensory evaluation is an important criterion as it decides the acceptability of the food by the selected participants in the nutrition intervention study. Health mix cookies were used for dietary intervention study and were carefully evaluated and presented in the following pages. Sensory evaluation was carried out for the standard and health mix cookies and the comparison between the secured scores of the standard and formulated health mix cookies was presented in Table - XLVII.

Table - XLVII

Comparison between the scores of standard and formulated cookies

Sensory attributes	Standard Cookies	Formulated Cookies
Appearance	7	6.8
Colour	7	6.0
Texture	6	5.16
Flavour	5.9	4.98
Taste	6.5	6.6
Overall acceptability	6.9	6.36

The sensory evaluation of formulated cookies revealed that the scores secured were slightly lower than the standard cookies. Sensory evaluation of cookies emphasised that scores of colour was lower than standard cookies. It might be due to incorporation of ragi, horse gram and jaggery in the formulated cookies. The texture showed difference in the mean scores of the standard and formulated cookies. The mean score for taste did not show significant difference between the standard and formulated health mix cookies. The highest score for overall acceptability of formulated cookies was lower than the standard

cookies. This was over looked when the nutritional significance of the formulated cookies was considered for maintenance of the health status. Similar result was obtained in the study by Younas *et al*., (2011) on Effect of rice bran on cooking qualities of cookies in which sensory evaluation emphasized that scores for colour lowered due to addition of rice bran.

B. Physical properties

Table - XLVIIIhighlights the physical properties of the standard and formulated cookies. The physical properties of the formulated cookies were compared with standard cookies. The physical properties like weight, diameter, width, thickness and spread factor were measured or calculated on the basis of method mentioned by Mc Watters *et al.,* (2003). The physical properties like weight, thickness and spread factor all were influenced by the ingredients. More fibre content in the ingredient has increased the weight, thickness and spread factor of the cookies as reported in studies by Sharif et al., (2009) in preparation of fibre and mineral rich defatted rice bran cookies. The same trend was noticed in another study done by Younas, et al., (2011) on 'Effect of rice bran supplementation on cookie baking quality'. The evaluation of physical properties such as thickness, diameter, weight, width, spread factor were presented in Table- XLVIII.

Table-XLVIII

Physical properties of standard and formulated cookies

Physical qualities	Standard cookies	Formulated cookies
Weight (g)	18.62	18.93
Width (cm)	5.22	5.6
Diameter (cm)	5.49	5.65
Thickness (cm)	1.79	2.3
Spread ratio	52	45.9

The average weight of the formulated cookies (18. 93 g) was more than the standard cookies (18. 62 g). The average width of the formulated cookies (5.6 cm) was higher than the standard cookies (5.22 cm). The average diameter of the formulated cookies was 5.65 cm which was higher than the standard cookies (5.49 cm). The average

thickness of the formulated cookies (2.3 cm) was higher compared to the standard cookies (1.79 cm). The spread factor was calculated using the thickness and diameter of the cookies. The formulated cookies had a spread ratio of 45.9 cm which was less than the spread ratio of standard cookies (52 cm). The increased thickness, width and spread ratio of the formulated cookies was due to its fibre content. Similar results were obtained in studies done by Younas *et al*., (2011) on rice bran supplementation in which the weight, width, diameter and thickness of the cookies increased with increase in the incorporation of rice bran but the Spread ratio reduced with increase in the fibre content compared to the standard wheat cookies. These physical properties confirmed the amount of dietary fibre in the formulated cookies.

C. Nutrient content

Nutrient contentof the standard and formulated cookies were analysed and the details are presented in Table- IL.

Table-IL

Nutrient content of standard and formulated cookies (100 g)

Nutrients	Standard cookies	Formulated cookies
Moisture(%)	7.725	2.084
Protein (g)	15.3	19.05
Fat (g)	52.5	14.9
Calorie (kcal)	567	365
Fibre (g)	1.6	2.44
Calcium (mg)	18	507
Magnesium (mg)	10.5	604
Iron (mg)	2.1	18.9
Beta carotene (µg)	1.50	233
Thiamine (mg)	0.3	1.93
Riboflavin (mg)	0.1	1.21
Vit-B6 (mg)	0.0	2.44

Table-IL highlights the nutrient content of standard and formulated health mix cookies**.** Macro nutrient content of standard cookie was higher than the formulated health mix cookies except for protein. The formulated health mix cookies contributed more micro nutrients especially, minerals (Calcium, Magnesium and Iron) and Vitamins (thiamine, riboflavin, beta carotene and Vitamin-C) and also higher content of fibre.

The physical properties like weight, thickness and spread factor were influenced by the ingredients used in the preparation. More fibre content of the ingredient increased the weight, thickness and spread factor of the cookies as reported in studies done by Sharif et al., (2009) in preparation of fibre and mineral rich defatted rice bran cookies. The same trend was noticed by another study done by Younas, *et al*.(2011) on the effect of rice bran supplementation on cookie baking quality of the cookies.

D. Estimation of microbial count

Table-L gives the microbial count of the formulated health mix cookies.

Table-L

Microbial count of the formulated health mix cookies

Microbial count	No. of CFU's / ml		
	10^{th} day	20^{th} day	30^{th} day
TBC - Total Bacterial Count	-	-	1.9×10^5
TFC - Total Fungal Count	-	-	4×10^4

Table-L shows the details of the microbial count of the cookies on first, tenth, twentieth and thirtieth days. Total microbial count (bacteria and fungus) was analysed and it was noted that the product was safe and free from total bacterial and fungal count on the tenth and twentieth day. On the thirtieth day only the bacterial and fungal culture were noted at a level of 1.9×10^5 and 4×10^4 respectively.Hence the problem of microbial contamination was eliminated as the cookies was prepared without addition of preservatives once in every 15 days and supplied to the selected participants for dietary intervention.

E. Calculation of cost effectiveness

Ingredients used in the health mix cookies were locally available and low cost. In cost calculation, the cost of the ingredients used and baking charges were considered and given in Table LI

Table - LI

Cost effectiveness of the Health mix cookies

Ingredients/ others	Quantity (g)	Cost (Rs. P)
Ragi	30	1.40
Rice flake	30	0.90
Horse gram	5	0.40
Roasted Bengal gram	5	0.40
Soya flour	5	1.20
Gingelly seed	15	1.50
Jaggery	10	0.60
Baking charges	-	0.75
Total	100	7.15

Table-LI shows the cost of the cookies 100 g including baking charge for cookies. To meet the nutrient requirements of the selected participants in the dietary intervention, eight cookies (150 g) were suggested, the cost was to Rs. 10.73/ day. This was very cheap and sustainable to meet the nutritional requirements of the selected participants.

PHASE-III

IMPACT OF NUTRITION INTERVENTION ON NUTRITIONAL STATUS AND THE SYMPTOMS OF PMS AMONG THE SELECTED PARTICIPANTS

A. Impact of dietary intervention on the nutritional status of the selected participants

a. Anthropometric measurements

According to WHO (2010), young adulthood, is a period in which an individual undergoes major physical, psychological and sexual changes. It presents a window of opportunity to set the stage for healthy and protective including reproductive adulthood and to reduce the likelihood of problems in the years that lie ahead, at the same time; they are sustainable to have many health problems including reproductive disorders or diseases.

Food based approach with sustainable nutrient dense health mix formulae are very effective to promote health status and prevent health problems of the target group of population.

To assess the impact of dietary intervention on the nutritional status of the selected participants, nutritional anthropometric measurements, clinical examination, biochemical estimation and individual dietary intake were used and data collected are given in the following pages. The anthropometric measurements of the selected participants in the study groups before and after dietary intervention in terms of supplementation are presented in Table-LII.

Table - LII

Mean anthropometric measurements

Anthropometric measurements	Study groups	Mean ± SD		Mean difference	Between groups	t value
		Initial	Final			
Weight (kg)	Experimental (N=50)	53.22±1.32	52.02±4.86	-1.2	I VF	0.162^{NS}
	Control (N=50)	49.7±11.9	50.78±9.58	+1.08	IVF EVC (F)	0.216^{NS} 1.26^{NS}
BMI (kg/m^2)	Experimental (N=50)	22.03±2.98	19.81±1.65	-2.22	I VF	4.21**
	Control (N=50)	18.22±22	17.66±3.42	+0.56	IVF EVC (F)	1.132^{NS} 4.352**
Waist/Hip Ratio (WHR)	Experimental (N=50)	0.86±0.46	0.83±0.46	-0.03	I VF	2.418**
	Control (N=50)	0.81±0.78	0.83±0.79	+0.02	IVF EVC(F)	2.571* 3.249**

*Significant at 5% level **significant at 1% level NS- not significant

IVF- Initial vs Final EVC(F)-Experimental vs Control (Final values)

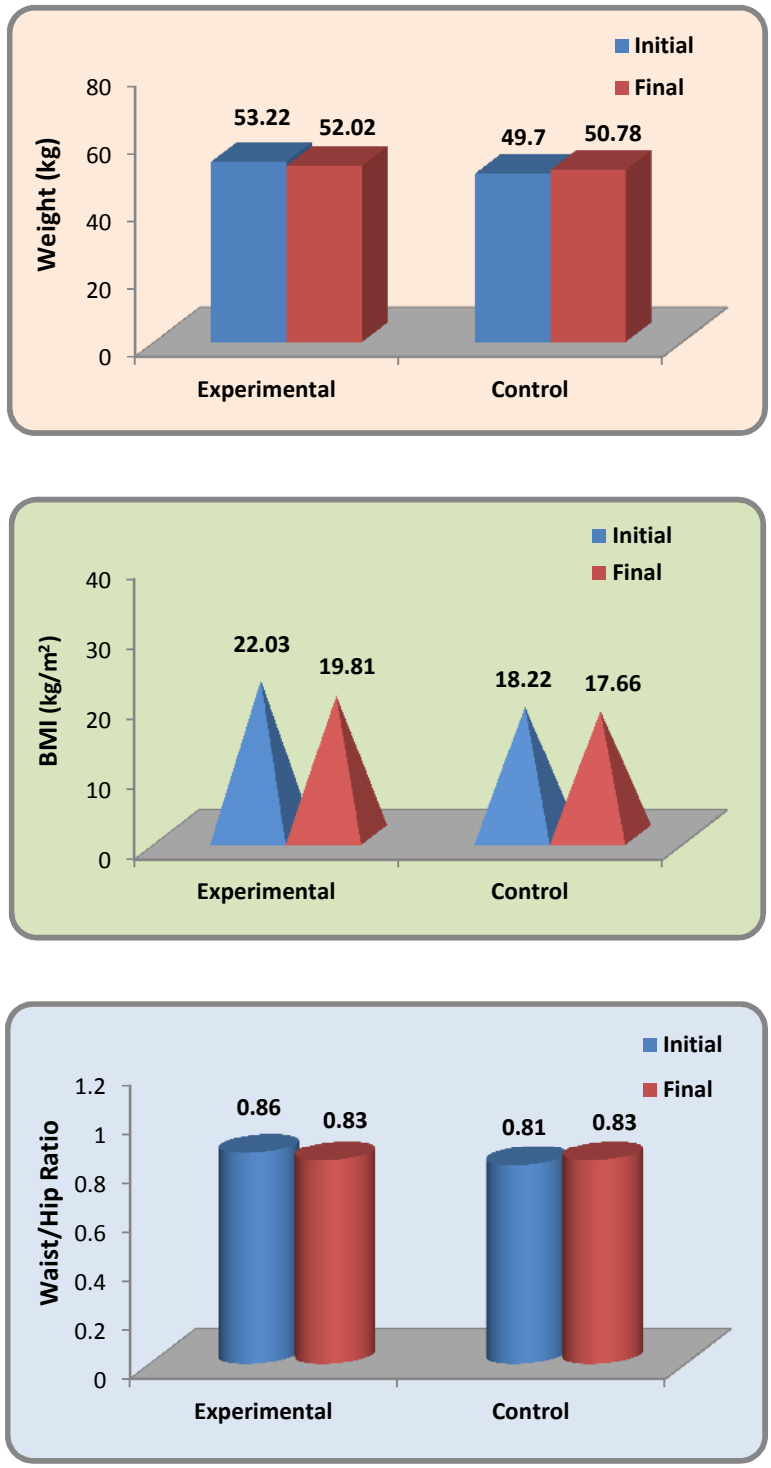


Figure- 14 Mean anthropometric measurements of the selected participants

It is obvious from Table-LII that in both the experimental and control groups, weight did not show any statistical significance within the experimental group as well as the control group and also between experimental and control groups. The mean weight of the selected participants in experimental and control groups before dietary intervention was 53.22 kg and 49.7 kg respectively. From the final observation, it was noted that the body weight was reduced in the experimental group to 52.02 kg whereas in control group there was an improvement to 50.78 kg. The mean difference in weight in experimental and control groups before and after intervention were not statistically significant.Mean difference in the BMI values in the experimental group was -2.22 whereas in the control group it was +0.56. BMI value showed statistical significance in the experimental group before and after intervention at $p<0.05$. It was also noted that the BMI values between the experimental and control group showed statistical significance ($p<0.01$).

In the present study, it was found that there was a statistically significant difference within the experimental and control groups ($p<0.01$) and also between the experimental and control groups. It was noted that though weight did not show significant change, the statistical comparison of BMI and WHR within experimental group and experimental group vs control group were highly significant at $p<0.05$ level. At the same time, the waist hip ratio showed significant difference in the control group ($p<0.01$) also. From the table it may be concluded that the BMI and WHR showed significant difference in the experimental group. Successful weight loss was associated with improvement in the health conditions and individual self image and probably reduced to long term health care costs.

b. Biochemical estimation

Table- LIII highlight the mean haemoglobin, serum Calcium, Magnesium, Iron, ferritin and total Iron binding capacity of the selected participants in the experimental and in the control groups, before and after intervention period of 120 days.

The below table highlights the mean haemoglobin level of the selected participants in the experimental and control group, before and after the intervention period. Mean serum Calcium level of the selected participants in the experimental group had increased from 8.87 to 10.45 mg/dl whereas in control group, there was a meagre increment and was noted from 8.84 to 8.92 mg/dl. Statistical analysis of serum Calcium for experimental and

control group showed the significant difference in the increment at p<0.01 level whereas in control group, the difference was insignificant.

Table-LIII

Mean biochemical profile

Biochemical parameters	Study groups	Mean ± SD		Mean difference	Between groups	t value
		Initial	Final			
Calcium (mg/dl)	Experimental (N=50)	8.87±0.36	10.45±0.96	1.58	I VF	12.17**
	Control (N=50)	8.84±0.34	8.92±0.44	0.08	IVF EVC(F)	6.879** 1.262 NS
Magnesium (mg/dl)	Experimental (N=50)	1.9±0.13	1.97±0.18	0.07	I VF	2.506*
	Control (N=50)	1. 972±0.13	1.976±0.17	0.004	IVF EVC(F)	0.053 NS 2.46*
Ferritin (mg/dl)	Experimental (N=50)	25.04±15.2	29.70±11.5	4.66	I VF	2.94*
	Control (N=50)	25.74±15.32	27.01±17.46	2.73	IVF EVC(F)	1.14 NS 1.72 NS
Iron (mg /dl)	Experimental (N=50)	72.83±37.12	83.36±38.4	10.53	I VF	6.42**
	Control (N=50)	72.29±35.1	75.27±34.1	2.98	IVF EVC(F)	0.411 NS 2.14*
TIBC (micro gram/dl)	Experimental (N=50)	352±51.20	394±75.01	42	I VF	3.295**
	Control (N=50)	346±86.01	361.83±73.3	15.83	IVF EVC(F)	1.109 NS 2.57*
Haemoglobin (g/dl)	Experimental (N=50)	9.81±11.9	11.53±11.0	1.72	I VF	4.67**
	Control (N=50)	9.85±0.34	9.35±0.48	0.05	IVF EVC(F)	0.868 NS 4.96**

*Significant at 5% level **Significant at 1% level NS- Not Significant

IVF- Initial vs Final EVC(F)-Experimental vs Control (Final values)

Mean Magnesium level of experimental group increased from 1.90 to 1.97 mg/dl and for the control group the meagre improvement was noted from 1.972 to 1.976 mg/dl. Statistical comparison of the initial and final values indicated significant difference at $p<0.01$ level in the experimental group. In the control group, the difference between initial and final serum Magnesium level was insignificant after the study period of 120 days. Statistical analysis of the data revealed that the differences were significant ($p<0.01$) between the experimental and control groups. Increment in serum Magnesium level might be due to nutrient dense health mix supplement, used for dietary intervention.

Table-LV also depicts the initial and final serum ferritin level recorded by the selected participants in the experimental and control groups. The mean difference in the serum ferritin level among the experimental group was 4.66 ($p<0.05$), whereas in control group it was found to be 2.73 mg/dl. Serum ferritin level between the experimental and control groups did not show any significant difference.

Mean difference in serum Iron level among the experimental group was 10.53mg/dl that showed significant difference ($p<0.05$) in serum Iron level before and after intervention. But it did not show statistically significant difference in the mean score among control group and the mean difference was 2.98 mg/dl. Mean difference of the serum total Iron binding capacity among the experimental group was 42 mg/dl which was highly significant ($p<0.01$). There was a significant difference in mean TIBC level of the final values of experimental and control group ($p<0.05$). The mean difference in the haemoglobin level in the experimental group was 1.72 mg/dl ($p<0.05$) whereas for control group it was 0.05 mg/ dl.

There was a significant difference among the final values of experimental and control group ($p<0.05$). From the table, it was concluded that there was significant difference in the initial and final values of Calcium, Magnesium, serum Iron, TIBC, serum ferritin level of the selected participants in the experimental group. The final values among experimental and control group showed statistical significance in serum Calcium, Magnesium, Iron and TIBC levels. The final values of the serum ferritin level did not show any statistical significance even though the mean difference was appreciably high in the experimental group.

Statistical analysis also confirmed that the significant improvement in biochemical profile might be due to the amount of micro nutrients present in supplement used in the dietary intervention.

c. Clinical examination

A study conducted by Salamat *et al*. (2008) revealed that young girls and women suffering from reproductive health problems like PCOS, PMS and so on were significantly controlled by health mix prepared with simple easily digestible, low cost foods rich in protein, Calcium, Iron and Magnesium and also revealed that the target group of selected participants did not have severe reproductive health problems during the study period of 120 days.Table LIV and Figure-16 shows the per cent prevalence of clinical signs and symptoms among the selected participants of the nutritional intervention studies.

In the initial stage of the study, the per cent prevalence of the clinical symptoms noted among the selected participants were general weakness, paleness of eyes, poor concentration, rough dry skin, hair changes, thin or lean stature, angular sotmatitis, swollen, bleeding gums and cheliosis. Initially general weakness was noted among 96 per cent of participants in experimental group and 76 per cent of the participants in control group and it was reduced to 56 per cent and 20 per cent in the experimental and control group respectively.

Initially the presence of paleness of eyes was noted among 22 and 34 per cent of the selected participants in experimental and control groups. Finally it was reduced to 18 and 14 per cent in the experimental and control group respectively. Poor concentration was noted among 74 per cent of experimental and 78 per cent of the control group initially and it was reduced to 66 and 70 per cent among the experimental and control groups respectively after the study period. Hair changes were noted among 48and 52 per cent of the experimental and control group in the initial stage. In the final observation, it was noted that the hair changes was 20 per cent in the experimental and 44 per cent in the control group. Rough dry skin was noted among 52 and 40 per cent of the experimental and control group initially. Final observation pointed out that the prevalence was reduced to four per cent in the experimental and 38 per cent in the control group. Thin or lean body built was noted among 56 per cent of experimental and 38 per cent of control group initially. The final observation noted that the thin body built was noted among 44 and 40

per cent of experimental and control group respectively. The same trend was observed in angular stomatitis and cheliosis.

Table-LIV

Per cent prevalence of clinical signs and symptoms

Clinical symptoms #	Experimental				Control				Between groups	Significance
	Initial		Final		Initial		Final			
	F	%	F	%	F	%	F	%		
General weakness	48	96	28	56	38	76	10	20	I VF(E) IVF(C) EVC (F)	0.002** 1.234^{NS} 0.001**
Paleness of eyes	11	22	9	18	17	34	7	14	I VF(E) IVF(C) EVC (F)	0.427^{NS} 0.411 ^{NS} 0.14^{NS}
Poor concentration	38	74	33	66	39	78	35	70	I VF(E) IVF(C) EVC (F)	0.221^{NS} 0.334^{NS} 0.234^{NS}
Hair changes	24	48	10	20	26	52	22	44	I VF(E) IVF(C) EVC (F)	0.044* 1.234^{NS} 0.001**
Rough dry skin	26	52	2	4	20	40	19	38	I VF(E) IVF(C) EVC (F)	0.009** 0.719 ^{NS} 0.008 **
Thin / lean	28	56	22	44	19	38	20	40	I VF(E) IVF(C) EVC (F)	0.00** 1.216^{NS} 2.124^{NS}
Angular stomatitis	11	22	8	16	14	28	10	20	I VF(E) IVF(C) EVC (F)	0.00** 0.301^{NS} 0.005*
Bleeding and swollen gums	26	52	19	38	24	48	22	44	I VF(E) IVF(C) EVC (F)	0.001** 0.421^{NS} 0.003*
Cheliosis	4	8	2	4	5	10	3	6	I VF(E) IVF(C) EVC (F)	0.049* 0.002** 0.001**

#Multiple response *Significant at 5% level **Significant at 1% level NS- Not Significant IVF (E)- Initial and Final Values of Experimental Group;

IVF(C)- Initial and Final Values of Control Group;

EVC(F)- Final Values of Experimental and Control Group

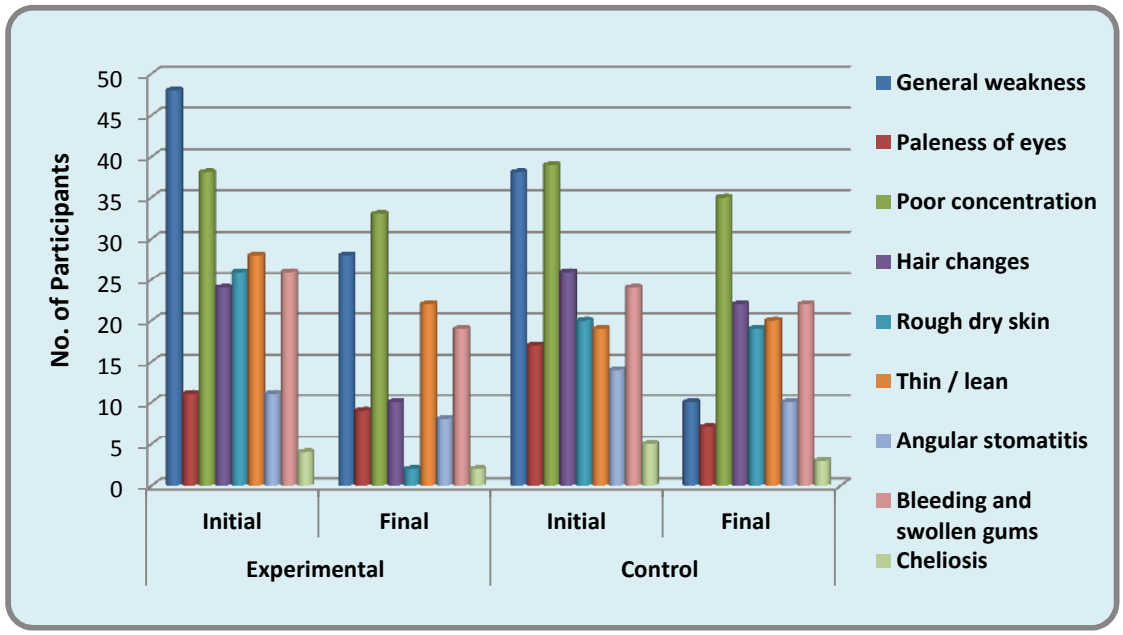


Figure-15 Per cent prevalence of clinical signs and symptoms among the selected participants

Statistical analysis revealed that there is a statistically significant difference noted for the final observation of experimental and control group ($p<0.01$) for the symptoms general weakness, rough dry skin, angular stomatitis, spongy bleeding gums and lean thin body. The significant difference ($p<0.05$) was noted within the experimental and control group in the final observation for symptoms like cheliosis and hair changes. It might be due to the impact of supplementation for the study period of 120 days. No significant difference was noted in experimental and control group in paleness of eye, and poor concentration rough dry skin. From the data, it was concluded that the experimental group showed significant reduction in the per cent prevalence of clinical symptoms in the final observation except for three symptoms paleness of eye, poor concentration and rough dry skin. It might be due to the impact of dietary intervention for the study period of 120 days.

d. Individual dietary intake

Diet is an important component to be considered for maintenance of health and prevention of disease. Various studies reported that PMS is strongly related to the deficiencies of certain nutrients like protein, minerals and Vitamins. Table –LV presents the mean nutritional intake of the study group before and after intervention,

Energy intake of the selected participants in the study group showed that the calorie intake was increased among both the experimental ($p<0.01$) and control group in the final observation. There was significant difference in the final calorie intake among the experimental and control group ($p<0.01$). The mean initial protein intake of the experimental and control group was found to be 44.0 g/day and 45.3 g/day respectively. The final mean protein intake of experimental and control groups were 51.6 and 45.9 g/ day respectively.

Table-LV

Mean nutrient intake

Nutrients	ICMR 2016	Study Groups	Mean ± SD		Mean Difference	Between Groups	t Value
			Initial	Final			
Energy (Kcal)	1900	Experimental (N=50)	1227.7	1474.84	247.14	I VF	3.675**
		Control (N=50)	1291.0	1305.0	314.0	IVF EVC (F)	4.47** 5.056**
Protein (g)	55	Experimental (N=50)	44.0	51.6	7.6	I VF	6.53**
		Control (N=50)	45.3	45.9	0.6	IVF EVC (F)	0.483^{NS} 2.42*
Carbohydrate (g)	-	Experimental (N=50)	246.7	330.0	83.3	I VF	6.67**
		Control (N=50)	283.9	360.0	76.1	I VF EVC (F)	7.34** 5.05**
Fat (g)	20	Experimental (N=50)	21.13	30.4	9.271	I VF	13.24**
		Control (N=50)	25.7	26.05	5.9	I VF EVC (F)	0.83^{NS} 2.714**
Calcium (mg)	600	Experimental (N=50)	496	839.0	310.0	I VF	5.14**
		Control (N=50)	670	720.1	50.0	I VF EVC (F)	0.94^{NS} 22.2**
Magnesium (g)	310	Experimental (N=50)	344.13	985.0	540.87	EVC	21.3**
		Control	367.72	384.72	17.0	I VF	0.615^{NS}

Nutrients	ICMR 2016	Study Groups	Mean ± SD		Mean Difference	Between Groups	t Value
			Initial	Final			
		(N=50)				EVC (F)	2.17*
Iron (mg)	21	Experimental (N=50)	21.18	27.62	6.44	I VF	3.63**
		Control (N=50)	19.7	20.4	0.7	I VF EVC (F)	0.563^{NS} 5.27**
Beta Carotene (µg)	4800	Experimental (N=50)	351.4	1116.18	764.78	I VF	19.4**
		Control (N=50)	320	412	92.0	I VF EVC (F)	0.307^{NS} 22.1**
Thiamine (mg)	1.0	Experimental (N=50)	1.08	1.55	0.47	I VF	6.54**
		Control (N=50)	1.45	0.5	-0. 95	I VF EVC (F)	6.54** 2.05*
Riboflavin (mg)	1.1	Experimental (N=50)	1.03	2.65	1.62	I VF	14.82**
		Control (N=50)	0.90	1.0	0.1	I VF EVC (F)	4.87** 14.8**
Niacin (mg)	12	Experimental (N=50)	11.39	13.52	2.13	I VF	3.176*
		Control (N=50)	10.76	11.34	0.58	IVF EVC (F)	0.63^{NS} 8.47**
Vitamin-C (mg)	40	Experimental (N=50)	20.2	43.13	22.93	I VF	5.05*
		Control (N=50)	16.67	22.25	5.58	IVF EVC (F)	0.143^{NS} 6.47**

*Significant at 5% level**Significant at 1% level NS- Not SignificantIVF (E)- Initial and Final Values Of Experimental Group; IVF(C)- Initial and Final Values of Control Group; EVC(F)- Final Values of Experimental and Control Group

The mean difference in the protein intake was 7.6 and 0.6 g/day in experimental and control group respectively. There was a significant difference in the initial and final protein intake of experimental group ($p<0.01$) and that of final mean protein intake of experimental and control group was statistically significant ($p<0.05$). The difference in the mean protein intake of control group was not statistically significant. The mean initial carbohydrate intake of the experimental and control groups was 246.7 g and 283.9 g

respectively. The mean final carbohydrate intake of experimental and control group was 330 g and 360 g respectively. There was a significant difference in the initial and final mean intake of carbohydrate among the control group and experimental group and also between the experimental and control groups ($p<0.01$).

The mean difference in the Calcium intake of experimental group was 310.0 mg whereas in control group it was 50.0 mg. There was significant difference in the Calcium intake within the experimental group ($p<0.00$), and also between the experimental and control group ($p<0.05$) and there was no significant difference in the initial and final mean intake in the control group. The mean difference in the Magnesium intake of experimental group was 540.87mg and in control group was 17.01 mg. There was significant difference in the Magnesium intake of the experimental and control group after intervention ($p<0.05$), and within the experimental group ($p<0.5$) whereas no significant difference was noted in the control group before and after intervention.

Among the Vitamins, mean difference in the beta carotene levels among the experimental groups 764.78 µg/dl which was statistically significant ($p< 0.05$). But the mean difference in the control group was 92µg/dl. There was significant difference in the experimental group ($p<0.01$), and there was statistically significant difference in the mean intake of beta carotene levels between the experimental and control group also ($p<0.01$). The initial and final intake of thiamine showed statistical significance at $p< 0.01$ in experimental group, between experimental and control group and among the control group. The same trend was noted for Riboflavin and Niacin. The mean difference in the intake of Vitamin C was 22.93 mg and 5.58 mg among the experimental and control group respectively. From the gathered data, it was concluded that there is a significant difference in the initial and final intake of all the nutrients in the experimental group and there was no significant difference in the intake of nutrients of the selected participants in the control group. The significant difference might be due to nutrient dense health mix supplementation. An increase in the intake of nutrients was noted among the control group except for thiamine. This might be due to the impact of nutrition and health education.

B. Impact dietary intervention on the symptoms of PMS

Impact of dietary intervention on the symptoms of PMS was expressed in terms of depression level and PMS assessment using **COPE**

a. Depression Level

Depression was noted as a major reason for premenstrual symptoms. The depression level of the selected participants was identified using a standard tool. The level of depression among the selected participants before and after intervention is presented in Table-LVI

Table-LVI

Depression score

Group	Level of depression	Before		After		Mean depression score (Initial)	Mean depression score (Final)	Category	t-value
		Frequency	Percent	Frequency	Percent				
Experim. group (N=50)	Mild depression(1-21)	17	34	30	60	20.12±8.83	15.3±7.28	IVF	2.17*
	Moderate (22-42)	29	58	15	30				
	Severe (43-63)	1	2	2	4				
	No depression	3	6	3	6				
Control group (N=50)	Mild depression (1-21)	15	30	16	32	20.18±6.03	19.02±6.55	IVF EVC	0.89^{NS} 3.186**
	Moderate (22-42)	32	64	32	64				
	Severe (43-63)	2	4	1	2				
	No depression	1	2	1	2				

*Significant at 5% level **Significant at 1% level NS- Not Significant

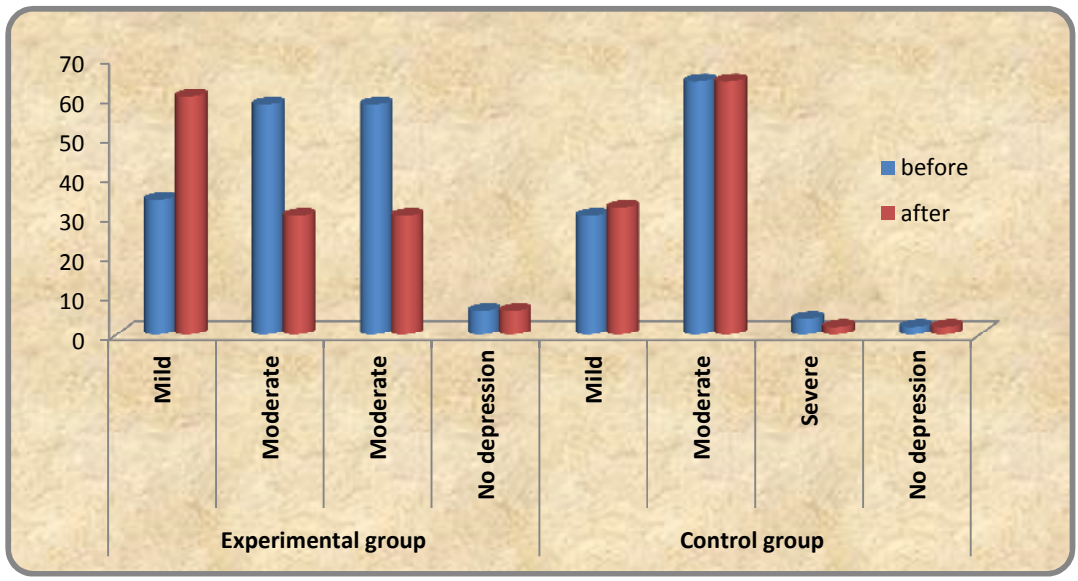


Figure-16 Level of depression scores of the selected participants

From Table-LVI, it was noted that majority of the selected participants in experimental group (58 per cent) and control group (64 percent) had moderate depression both. The mean score of the experimental group before intervention was 20.12±8.83 and after intervention was 15.3±7.28. The initial and final mean score of depression for the control group was 20.18±6.03 and 19.02±6.55 respectively. There was no significant difference in the initial and final mean score of depression among the selected participants in the control group. But there existed statistically significant difference in the initial and final mean score of the experimental ($p<0.05$) as well as the final mean score of experimental and control group ($p<0.01$). From the table it can be concluded that the depression score has reduced significantly in the experimental group due to nutrition intervention. Even in the control group severe symptom was reduced from four per cent to two per cent which might be due to nutritional intervention.

Correlation of mean depression score had a statistically significant negative correlation with serum Calcium ($r=0.214$, $p<0.05$) and serum Magnesium ($r=0.245$, $p<0.05$) levels. Serum ferritin ($r=-0.107$) and serum Iron ($r=0.084$) levels were not statistically significant. Mean depression score also had statistically significant negative correlation with fat intake ($r=-0.260$, $p<0.01$), and Calcium intake ($r=-0.324$, $p=0.01$). Positive correlation existed among mean depression score and calorie ($r=0.238$, $p=0.05$),

protein (r=0.328, p=0.01) and beta carotene (r=0.216, p<0.05) intake. Mean depression score had positive correlation with PMS symptom score (r=0.167) but there was no statistical significance

It was noted that the mean depression score had a mild degree of positive correlation with PMS symptoms like anxiety (r=0.132), back pain (r=0.103), forgetfulness (r=0.164), and negative correlation with loss of appetite (r=-0.164) and sensitivity (r=-0.122) and were not statistically significant.

b. PMS symptoms assessment using COPE

Premenstrual symptoms were assessed using the standard tool (COPE) and PMS scores were obtained. Table-LVII highlights the mean PMS score and number of symptoms of the study groups.

Table - LVII

Mean PMS score and number of PMS symptoms of the study groups

PMS score and symptoms	Study groups	Mean ± SD		Mean difference	Between groups	t value
		Initial	Final			
PMS symptom score	Experimental	2.08±0.53	1.06±0.23	1.02	I VF	12.63**
	Control	2.24±0.59	2.68±1.11	-0.56	IVF EVC	1.750^{NS} 6.71**
Number of PMS symptoms	Experimental	7.54±1.7	3.0±0.71	4.54	I VF	3.79**
	Control	7.68±1.7	7.0±1.8	0.44	IVF EVC	0.593 ^{NS} 8.18**

*Significant at 5% level **Significant at 1% level NS- Not Significant

From the mean PMS symptom score and number of PMS symptoms experienced by the selected participant in the experimental and control groups, it was noted that the overall mean initial PMS symptom score of the experimental and control group was 2.08 and 2.24 respectively. Mean final PMS symptom Score on knowledge related to PMS was 1.06 in experimental and 2.68 in control group respectively. There was a significant difference in the mean PMS score of experimental and control group (p=0.00) and the mean PMS score between experimental and control group (p<0.00). But the mean PMS score was not significant within the control group.

The mean difference in the number of PMS symptoms initially in experimental and control groups was found to be 7.54 and 7.68 respectively whereas the mean difference in the initial number of PMS symptoms of experimental and control groups were 3.0 and 7.0 respectively. There was significant difference in the final observation in the number of symptoms (in mean values) within the experimental group and between the experimental and control group ($p<0.01$). But no statistical significance was noted within the control group before and after nutrition intervention.

c. Relationship between biochemical parameters and individual PMS symptom

Table LIX presents the relationship between the individual scores and blood parameters of the selected participants. There was a negative correlation of the PMS symptoms with haemoglobin alone ($r=-0.276$; $p<0.01$). PMS symptom score had a negative correlation with serum Calcium level ($r=-0.561$; $p=0.00$).

Table-LVIII

Correlation of individual PMS symptom with biochemical parameters

Individual PMS symptoms	Serum Calcium	Individual PMS symptoms	Serum Iron
Head ache	r= -0.238; p<0.05	Palpitation	r= -0.213; p<0.05
Back pain	r= -0.219; p<0.05	Food craving	r= -0.210; p<0.05
Sensitivity	r= -0.266; p<0.01	Mood swing	r=- 0.227; p<0.05
Depression	r= -0.102; p<0.05	**Individual PMS symptoms**	**Magnesium**
Loss of appetite	r= -0.126, p<0.05		
Hot flashes	r= 0.260; p<0.01	Mood swing	r= -0.234; p<0.05
Irritability	r= 0.234; p<0.05	**Individual PMS symptoms**	**Ferritin**
Cry	r= 0.263; p<0.05	Palpitation	r= -0.203; p<0.05

*Significant at 5% level **Significant at 1% level NS- Not Significant

Serum Calcium level had a negative correlation with headache (r=-0.238; p<0.05), back pain (r=-0.219; p<0.05), sensitivity (r=-0.266; p<0.01), depression (r=-0.102, p<0.05) and loss of appetite (r=-0.126, p<0.05). But there was a positive correlation of serum Calcium with hot flashes (r=0.260; p<0.01), irritability (r=0.234; p<0.05) and cry (r=0.263; p<0.05). Serum Magnesium level had negative correlation with mood swing (r=-0.234; p<0.05). Serum ferritin had a negative correlation with palpitation (r=-0.203; p<0.05). Mood swing (r=0.016), irritability (r=0.109) and sensitivity (r=0.143) and were not statistically significant. Serum Iron was negatively correlated with the individual PMS symptoms like palpitation (r=-0.213; p<0.05), food craving (r=-0.210; p<0.05), mood swing (r=0.227; p<0.05). Breast swelling (r=-0.016), loss of appetite (r=-0.109), irritability (r=-0.154) and sensitivity (r=-0.07) also had negative correlation with serum Iron but were not statistically significant.

From the data it was noted that the nutrients like Iron, Calcium and Magnesium had a negative correlation with individual symptoms like head ache, back pain, sensitivity, depression, loss of appetite and positive correlation with hot flashes, irritability and cry, head ache etc. Iron had negative correlation with palpitation, food craving and mood swing. Magnesium had negative correlation with mood swing and ferritin level showed negative correlation with palpitation. It was concluded that PMS symptoms are aggravated by Calcium, Magnesium and Iron deficiencies.

PHASE- IV

IMPACT OF NUTRITION EDUCATION ON THE KNOWLEDGE AND SYMPTOMS OF PMS OF THE SELECTED PARTICIPANTS

The impact of nutrition education on the knowledge and PMS symptoms scores of the selected participants is presented in the following pages.

A. Assessment of knowledge on PMS

Table –LIX and Figure-18 highlight the mean knowledge scores of various or each aspect of PMS among the selected participants before and after the intervention of nutrition education

Table-LIX

Mean PMS knowledge score

Types of questions	Maximum Score	Experimental group (N=50)				Control group N=50)			
		Before		After		Before		After	
		Mean score	Per cent	Mean score	Per cent	Mean score	Per cent	Mean score	Per cent
Meaning	2	0.58	29	1.64	82	0.55	28	0.57	29
Occurrence	2	0.67	34	1.60	80	0.59	30	0.69	35
Physiology	2	0.52	26	1.78	89	0.44	22	0.46	23
Causes	2	0.8	40	1.83	95	0.75	38	0.79	40
Symptoms	2	0.93	47	1.30	65	0.95	48	0.95	48
Risk factors	2	0.7	35	1.50	75	0.7	35	0.79	40
Medical care	2	0.4	20	1.60	80	0.83	42	0.85	43
Complications	2	0.68	34	1.80	90	0.62	31	0.72	36
Diet care	2	0.54	27	1.83	95	0.83	42	0.93	47
Management of PMS	2	1.0	50	2.00	100	1.2	60	1.50	75
Overall score	20	6.82	34	14.88	74	7.56	38	9.97	50

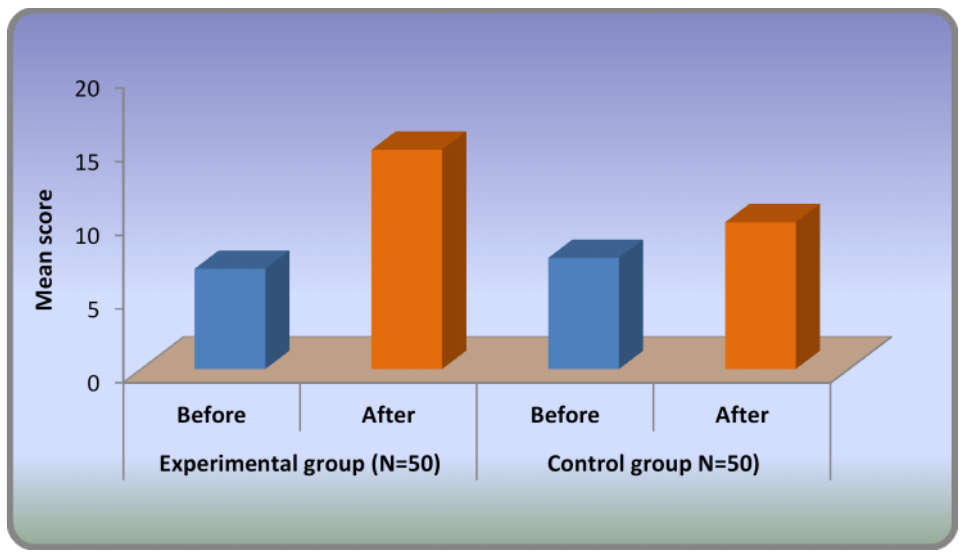


Figure-17 Overall Mean PMS knowledge score among the selected participants

The mean score various aspects of PMS shows that there was appreciable increment in the initial and final score in experimental group compared to the control group. The overall mean knowledge score of PMS was increased from 34 per cent to 74 per cent after intervention and increase in the control group was from 38 per cent to 50 per cent. The knowledge was very high for the management aspect of PMS in both experimental (95 per cent) and control (75 per cent) groups. The mean knowledge score on PMS was least for the aspect of symptoms in the experimental group (65 per cent) and in the aspect of physiology among the control group (23 per cent). The overall per cent score secured by the selected participants in the experimental group was 74 per cent whereas in the control group it was 50 per cent. In this nutrition education intervention, both groups were involved. The improvement in experimental group might be due to nutrition education with the combination of dietary intervention for 120 days.

B. Impact of nutrition education on the knowledge and the symptoms of PMS

Table –LX shows the presence and absence of the symptoms of PMS among the experimental before and after intervention.

Table-LX

Percentage presence of PMS symptoms among the selected participants in the experimental group

PMS Symptoms		Initial (N=50)		Final (N=50)		Mc Nemar significance
		Frequency	Per cent	Frequency	Per cent	
Acne	present	24	48	13	26	0.00**
	absent	26	52	37	74	
Bloating	present	20	40	11	22	0.00**
	absent	30	60	39	78	
Breathlessness	present	44	22	22	44	0.00**
	absent	28	56	30	60	
Dizziness	present	24	48	7	14	0.00**
	absent	26	52	43	86	
Fatigue	present	28	56	15	30	0.016*
	absent	22	44	35	70	
Headache	present	24	48	31	62	0.099^{NS}
	absent	26	52	19	38	

PMS Symptoms		Initial (N=50)		Final (N=50)		Mc Nemar significance
		Frequency	Per cent	Frequency	Per cent	
Hot flashes	present	14	28	11	22	0.00**
	absent	36	72	39	78	
Nausea	present	30	60	18	36	0.86^{NS}
	absent	20	40	32	64	
Palpitation	present	26	52	13	26	0.041*
	absent	24	48	37	74	
Breast Swelling	present	22	44	17	34	0.043*
	absent	28	56	33	66	
Angry	present	24	48	17	34	0.09^{NS}
	absent	26	52	33	66	
Anxiety	present	22	44	15	30	0.042*
	absent	28	56	35	70	
Confusion	present	22	44	23	46	0.46^{NS}
	absent	28	56	27	54	
Cry	present	12	24	18	36	0.00**
	absent	38	76	32	64	
Depression	present	26	52	17	34	0.25^{NS}
	absent	24	48	33	66	
Food craving	present	24	48	22	44	0.53^{NS}
	absent	26	52	28	56	
Forgetfulness	present	20	40	24	48	0.37^{NS}
	absent	30	60	26	52	
Irritability	present	16	32	22	44	0.00**
	absent	34	68	28	56	
Loss of appetite	present	16	32	12	24	0.00**
	absent	34	68	38	76	
Mood swing	present	16	32	12	24	0.04*
	absent	34	68	38	76	
Sensitivity	present	16	32	17	34	0.05*
	absent	34	68	33	66	
Wish to be alone	present	22	44	17	34	0.001**
	absent	28	56	33	66	

*Significant at 5% level **Significant at 1% level NS- Not Significant

Table-LX presents the presence of PMS symptoms in the experimental group. It was clear from the data that the per cent presence of PMS symptoms in the final observation was

reduced from the initial observation. The difference in the frequency of individual PMS symptoms in initial and final observations was statistically significant (p=0.00) for acne, bloating, breathlessness, dizziness, hot flashes, cry, irritability and loss of appetite. It was significant at the level of p<0.05 for the following symptoms like fatigue, palpitation, breast swelling, mood swings and sensitivity (p<0.05). Headache, nausea, anger, anxiety, confusion, depression, forgetfulness and food craving did not show any statistically significant difference. This might be due to the fact that the emotional symptoms may take more time to subside. But majority of the somatic and behavioural symptoms showed greater response to these intervention. Table LXI depicts the per cent presence of symptoms of PMS s among the selected participants in control group.

Table-LXI

Percentage presence of PMS symptoms among the selected participants in the control group

PMS Symptoms		Initial (N=50)		Final (N=50)		McNemar significance
		Frequency	Per cent	Frequency	Per cent	
Acne	present	28	56	29	58	1.00^{NS}
	absent	22	44	21	42	
Abdominal Bloating	present	28	56	26	52	0.832^{NS}
	absent	22	44	24	48	
Breathlessness	present	28	56	28	56	1.00^{NS}
	absent	22	44	22	44	
Dizziness	present	28	56	28	56	1.00^{NS}
	absent	22	44	22	44	
Fatigue	present	28	56	27	54	0.996^{NS}
	absent	22	44	23	46	
Headache	present	32	64	27	54	0.383^{NS}
	absent	18	36	23	46	
Hot flashes	present	16	32	27	54	0.003**
	absent	34	68	23	46	
Nausea	present	28	56	28	56	0.307^{NS}
	absent	22	44	22	44	
Palpitation	present	18	36	16	32	0.851^{NS}
	absent	32	64	34	68	

PMS Symptoms		Initial (N=50)		Final (N=50)		McNemar significance
		Frequency	Per cent	Frequency	Per cent	
Breast tenderness and Swelling	present	20	40	18	36	0.791^{NS}
	Absent	30	60	32	64	
Angry	Present	26	52	17	34	0.188^{NS}
	Absent	24	48	33	66	
Anxiety	Present	28	56	29	58	0.327^{NS}
	Absent	22	44	21	42	
Confusion	Present	26	52	26	52	0.046*
	Absent	24	48	24	48	
Cry	Present	28	56	36	72	0.503^{NS}
	Absent	22	44	18	36	
Depression	Present	24	48	28	56	0.541^{NS}
	Absent	26	52	22	44	
Food craving	Present	24	48	26	52	1.00^{NS}
	Absent	26	52	24	48	
Forgetfulness	Present	26	52	24	48	1.00^{NS}
	Absent	24	48	26	52	
Irritability	Present	26	52	19	38	0.296^{NS}
	Absent	24	48	31	62	
Appetite	Present	22	44	21	42	1.00^{NS}
	Absent	28	56	29	58	
Mood swing	Present	18	36	29	58	0.043*
	Absent	32	64	21	42	
Sensitivity	Present	26	52	29	58	0.69^{NS}
	Absent	24	48	21	42	
Wish to be alone	Present	24	48	18	36	0.031*
	Absent	26	52	32	64	

*Significant at 5% level **Significant at 1% level NS- Not Significant

Table-LXI highlights the statistical analysis of the symptoms noticed among the selected participants in control group. Initially presence of symptoms in the selected participants of control group ranged from 36 to 64 per cent and finally it was between 28 and 56 per cent. In this group there was no statistically significant difference noted in the control group for all the PMS symptoms except hot flashes, confusion, mood swing and wish to be alone.

Table-LXII highlights the statistical analysis of the symptoms noticed among the selected participants in the experimental and control groups.

Table-LXII

PMS symptoms noticed among experimental and control group after intervention

PMS Symptoms		Experimental		Control		Significance #
		Frequency	Per cent	Frequency	Per cent	
Acne	Present	29	58	13	26	0.009**
	Absent	37	74	21	42	
Abdominal bloating	Present	11	22	26	52	0.007*
	Absent	39	78	24	48	
Breathlessness	Present	22	44	28	56	0.001**
	Absent	30	60	22	44	
Dizziness	Present	7	14	28	56	0.001**
	Absent	43	86	22	44	
Fatigue	Present	15	30	27	54	0.00**
	Absent	35	70	23	46	
Headache	Present	31	62	27	54	0.093NS
	Absent	19	38	23	46	
Hot flashes	Present	11	22	27	54	0.012*
	Absent	39	78	23	46	
Nausea	Present	18	36	28	56	0.046*
	Absent	32	64	22	44	
Palpitation	Present	13	26	16	32	0.00**
	Absent	37	74	34	68	
Breast tenderness and Swelling	Present	17	34	18	34	0.241NS
	Absent	33	66	32	64	
Angry	Present	17	34	17	34	0.149NS
	Absent	33	66	33	66	
Anxiety	Present	15	30	29	58	0.001**
	Absent	35	70	21	42	
Confusion	Present	23	46	35	70	0.016*

PMS Symptoms		Experimental		Control		Significance #
		Frequency	Per cent	Frequency	Per cent	
	Absent	27	54	15	30	
Cry	Present	18	36	32	64	0.001**
	Absent	32	64	18	36	
Depression	Present	17	34	28	56	0.041*
	Absent	33	66	22	44	
Food craving	Present	22	44	26	52	0.690NS
	Absent	28	56	24	48	
Forgetfulness	Present	24	48	24	48	0.691NS
	Absent	26	52	26	52	
Irritability	Present	22	44	19	38	0.110NS
	Absent	28	56	31	62	
Appetite	Present	12	24	21	42	0.024**
	Absent	38	76	29	58	
Mood swing	Present	12	24	29	58	0.050*
	Absent	38	76	21	42	
Sensitivity	Present	17	34	29	58	0.003**
	Absent	33	66	21	42	
Wish to be alone	Present	17	34	18	36	0.421NS
	Absent	33	66	32	64	

#Independent samples Mann-Whitney U test

*Significant at 5% level **Significant at 1% level NS- Not Significant

Table-LXII highlights the frequency and per cent of the PMS symptoms in the experimental and control group. The independent sample Mann-Whitney U test showed that there was significant difference between the final observations of experimental and control group for abdominal bloating ($p<0.05$), breathlessness ($p=0.001$), dizziness ($p=0.001$), fatigue ($p<0.00$), head ache ($p<0.01$), hot flashes ($p<0.05$), nausea ($p<0.05$), palpitation ($p=0.00$), breast swelling and tenderness ($p=0.00$), anger ($p=0.00$) confusion($p<0.05$), mood swing ($p=0.05$), depression ($p<0.05$), acne ($p<0.01$) and anxiety (($p<0.01$). But the symptoms like breast tenderness, anger, food craving, forgetfulness, irritability, loss of appetite and sensitivity did not show any significant difference in the

final observation noted among the experimental and control group. Similar trend was noted in the prospective, randomized, controlled interventional study with supplementation of Calcium done by Sutariya et.al., (2011), among the female selected participants between 15 to 45 years of age. It was observed the supplementation of micronutrients like Magnesium, Calcium etc. was able to reduce the symptoms except insomnia and fatigue in the experimental group compared to the control group.

Tables LX - LXII highlighted that there was significant reduction in the presence of PMS symptoms experienced by the participants in the experimental group except for nausea, anxiety, anger, confusion, depression forgetfulness and food craving. This reduction might be due to the nutrient dense health mix cookies. Same dietary supplement may be continued for a long period helps to prevent the complications and consequence of the PMS and to lead a healthy and happy life.

By conclusion, the nutrition intervention played a major role in significantly reduceing the frequency and severity of PMS symptoms among the selected participants in the experimental group. There was a negative correlation among the nutrients like Calcium, and Magnesium with PMS symptoms like back pain and mood swing. Effective nutrition and health education along with proper dietary intervention of value added products rich in micronutrients like Calcium, Iron and Magnesium can reduce the severity of PMS symptoms when consumed regularly in their daily dietaries.

5

SUMMARY AND CONCLUSION

Fertility is the natural human capability of producing offspring. A woman's fertility peaks in the early and mid twenties, after which it starts to decline, being accelerated after the age of 35 years with advanced maternal age causing an increased risk of female infertility. This popularity refers to as a woman's biological clock. According to WHO (2013), the reproductive age generally ranges from 15-45 years. This period is also popularly known as the age and stage of fertility problems like PMS (Kumari, et al., 2015).

Premenstrual Syndrome (PMS) refers to a group of menstrually related disorders, characterised by physical and mental symptoms that occur in the luteal phase of menstrual cycle. These symptoms result in the deterioration of interpersonal relationships, personal health and functional efficacy of the body. Symptoms start shortly after ovulation with increased in severity and reach a maximum during the last five premenstrual days. After the onset of menstrual bleeding, the symptoms rapidly disappear and are usually gone within three to four days. PMS is related to ovulatory cycles and resolves at menopause. PMS have an onset at any time during the reproductive years and once symptoms are established and tend to remain fairly constant until menopause. These symptoms are known to have a great impact on daily life activities and social functions and result in significantlyreduced Quality of Life (QOL). Women with PMS had a worst QOL due to physical pain, vitality, limitations in daily activities, perception and changes in overall health status.

With these backdrops, it is customary to know the prevalence of PMS and assess the nutritional and health status of the participants with PMS. The present study entitled "**Effect of Nutrition Intervention on Symptoms of Premenstrual Syndrome (PMS) among Women of Reproductive Age (20-45 Years)"** has been undertaken by the investigator with the following specific objectives:

- Find out the prevalence of PMSamong the women of reproductive age (20-45 years).

- Study the influence of demographic, dietary, menstrual, nutritional and psychological variables on premenstrual symptoms
- Formulation and evaluation of health mix rich in micro nutrients for dietary intervention
- Development and evaluation of educational modules for nutrition education and
- Evaluate the effect of nutritional intervention strategies on symptoms of PMS

The present study consisted of four phases. In the first phase, household survey was conducted to find out the prevalence of PMS among reproductive age women in Sulur area of Coimbatore. Total of 600participants were selected to screen for PMS. From the 600 participants, 541 with PMS symptoms were screened and included for the study. To gather the correct information in an effective manner three subsequent menstrual cycles were carefully monitored and each and every aspect of menstrual cycles recorded. An interview schedule was adopted to collect relevant information regarding demographic status, dietary pattern, nutritional and health status and menstrual cycle. Details related to premenstrual cycle and syndrome were recorded using a standard tool Premenstrual Daily Symptom Diary (PMDD). Level of Anxiety and self esteem was assessed through the State Anxiety Inventory and State Trait Inventory and Rosen Berg's Self Esteem scale. The basic knowledge of the selected participants on PMS was also assessed.

In the second phase, acceptability trials were carried out for the selected five variations of health mix and evaluated for the selection of the best combination for dietary intervention through sensory evaluation.

In the third phase of the study, the sub sample of 100 participants were selected and assigned to experimental (N=50) and control (N=50) groups. All the participants in the experimental group were supplemented with 150 g of health mix in the form of cookies and nutrition education was given to the selected participants in the experimental and control groups during the study period of 120 days.

In the fourth phase, impact of nutrition intervention was assessed through the nutrition and health status, severity of symptoms of PMS and their knowledge on PMS.

Phase: I Prevalence of Symptoms of PMS

In the first step of the research, prevalence of the symptoms of PMS was recorded using a quick screening tool (ACOG Diagnostic criteria, 2000) among 600 reproductive age women in the age group of 20-45 years. Among the selected 600 participants, 59 participants were healthy and free from PMS and rest of them (N=541) had one or other symptoms of PMS.

Salient findings of the research are discussed in the following pages.

I. Demographic characteristics:

- Forty two per cent of the participants were from rural areas and rest of the participants were (29 per cent) from urban and semi urban locality. Sixty five per centbelonged to nuclear families. Majority (59 per cent) of the families of the participants were comprised of 5-6 members and 50 per cent of the participants belonged to low income group with monthly income of Rs. 2500-4500.
- As far as the educational status of the parents was concerned, 83 per cent of father and 73 per cent of mother of the participants had middle school education.
- Fifty five per cent of the participants were in the age group 20-30 years, 24 per cent were between 31 and 40 years and 21 per cent were in the age group of 41-45 years. The mean age of the participants was found to be 30.04±4.06 years.Fifty five per cent of the participants were unmarried, 43 per cent of them were married and only two per cent were separated and meagre per centof theparticipants were widows.
- Thirty seven per cent of the participants had under graduate education and twenty three participants had only middle school education and rest of them had different levels of school or college education. When considering the occupational status of the participants, 45 percent were students followed by 20 per centwere government or non government employees and 15 per cent were at home or seeking jobs to enhance the economic status of the family.

II. Food and dietary pattern

- Among 541 participants, 64 per cent were non vegetarians, 18 per cent were vegetarians and 15 per cent were ovo-vegetarians and three per cent were

vegans.Thirty seven per cent of the families spent between Rs. 1000-2000 towards their food expenses.

- Eighteen per cent of the participants took less than one litre of water, 53 per cent of the participants took 1-1.5 litre of water, 22 per cent took 1.5-2 litre of water and seven per cent of the participants took more than two litres of water daily. Majority (35 per cent) of the participants took 350 ml. of milk each day. Forty eight per cent of the participants took coffee or tea (3-4 times) daily, followed by 22 per cent had coffee/tea more than five times a day. Seventy eight per cent of the participants had carbonated beverages occasionally.
- Consumption of junk foods by the participants included bakery items, hot spicy, chat and fried foods items. It was noted that irrespective of age, majority (16-46 per cent) of the participants preferred junk foods, once or twice in a week.
- Among the dietary intake of Iron rich foods, roasted bengal gram was mostly included by 37 per cent of the participants. Other Iron rich foods included by the participants were whole cereals, green leafy vegetables, lean meat, jaggery and dried fruits (9-37 per cent). Eight to 19 per cent of participants consumed Vitamin –C rich foods like sprouted grains, amla, guava, citrus fruits, fresh raw vegetables and green leafy vegetables daily.
- Eighteen to 66 per cent of the participantsconsumed Calcium rich food items like ragi, milk, milk products, green leafy vegetables, gingelly seeds, meat and tender bones weekly twice or thrice in their daily dietary.
- Percapita oil consumption per day among 44 per cent of the participants was noted to be five grams, less than five grams among 26 per cent of the participants, more than seven gramswas noted among 22 per cent of the participants. It was noted that the participants consumed fats and oils less than the ICMR suggested RDA of 25 grams (ICMR, 2011).
- Majority (82 per cent) of the participants used groundnut oil for their cooking followed by gingelly oil (68 per cent) coconut oil (58 per cent) and sunflower oil by 58 per cent of the participants. Thirty four per cent also used palm oil for their cooking purposes and only 10-15 per cent took butter, ghee or vanspathi for daily preparations.

III. Details related to menarche and menstrual cycle

- Mean age at menarche was 13.04±1.285among the participants. Majority of the participants reported that the age at menarche was found to be 12 years (31 per cent) and 13 years (29 per cent).
- Eighty seven per cent of the participants had regular menstrual cycle whereas 13 per cent had menstrual irregularity.
- Forty per cent of the participants had regular menstrual cycle at 30 days or above and 28 days cycle was reported by 35 per cent of the participants. The mean of regular menstrual cycle was 28.45±3.34 days.
- It was reported that menstrual bleeding days lasted up to four days among 46 per cent of the participants and more than seven days among nine per cent of the participants and rest of them had scanty or excess bleeding for 3-5 days .The mean menstrual bleeding days were 4.21±1.1 days.
- Menstrual flow was moderate among 48 per cent of the participants. Severe flow was noticed among 31 per cent and mild among 21 per cent of the participants.
- Special food items were included to improve their reproductive and health status of the participants and were gingelly oil and raw egg (45 per cent), black gram dhal with jaggery (53 per cent), rice flakes with jaggery (19 per cent), fenugreek preparations (23 per cent) and fruit juice and adequate milk were consumed by only18 per cent of the participants. Some food items like mango, papaya, pineapple and brinjal were considered as hot foods and were avoided during menarche and menstrual cycle by 59 per cent of the participants.

IV. Nutritional status of the participants

- Nutritional status assessment of the selected participants revealed that the mean height was 152.32±8.1 cm (with a range of 120-170 cm). The mean weight of participants ranged between34-86 Kg. with a mean weight of 59.59±10.366 kg.
- Based on the BMI values, the participants were categorised as moderate malnutrition (13 per cent), mild malnutrition (38 per cent) and normal range (18 per cent) only. Twenty per cent were overweight and 11 per cent were in the grade-I obesity. The mean BMI value was 23.65±4.8. Based on waist-hip ratio, only eight

per cent of the participants were normal, 58 per cent were in mild and 34 per cent were in moderate obesity categories with a mean waist-hip ratio of 0.844±0.098.

- Based on the haemoglobin level, participants were graded as normal or non anaemic (32 per cent), mild anaemia (22 per cent), moderate anaemia (37 per cent) and severe anaemia (9 per cent). The mean haemoglobin level was found to be 10.52±2.24.

V. Prevalence of PMS

- Screening of PMS showed that the prevalence of PMS among 600 participants was 90 per cent (N=541) and the research was carried out for the 541 participants.
- From the collected data, it was noted that 48 per cent had mild symptoms, 45 per cent had moderate symptoms and seven per cent of the participants had severe symptoms of PMS.
- The major emotional symptom observed among the selected participants, was irritability (72 per cent), behavioural symptom was food craving (71 per cent) and physical symptom was abdominal pain (82 per cent). Back pain or breast swelling were experienced by 78 per cent of the selected participants.

VI. Anxiety level of the participants

Majority (65 per cent) of the participants had moderate level of state anxiety. The mean score of state anxiety was 2.88±0.64. The trait anxiety was also at moderate level among 71 per cent of the participants with mean 2.84±0.56. Self esteem level was moderate among 63 per cent of the participants with mean score of 3.1±0.64.

VII. Knowledge of the participants on PMS

- The knowledge of the participants on various aspects of PMS was noted to be poor among 78 per cent of the participants, 20 per centparticipants had average scores and only two per cent of participants had good score for their knowledge on PMS and the mean knowledge score was 2.07±1.48.
- Majority of the participants (98 per cent) were aware of the causes of PMS, 89 per centwere known about the meaning of PMS and least score (4 per cent)

was obtained for the question related to severe complications and consequences of PMS.

VIII. Statistical influence of the demographic, dietary, menstrual and nutritional variables on PMS

- Marital status showed significant association with PMS (p=0.001). Occupation of the participants had significant association with PMS (p<0.05), fathers' occupation (p=0.00) and mothers'occupation (p=0.00). Location of house (p<0.05) also showed significant association with PMS symptom score whereas educational level of father and mother, type, size and income of the family did not show any significant association with PMS symptom scores.
- Intake of water was significantly associated with PMS symptom score (p<0.05) milk and milk products showed mild degree of negative correlation (r = -0.063) with PMS symptom score.
- Intake of coffee was positively correlated with (r = +0.422) PMS symptom score (p=0.00), whereas skipping meal, intake of vegetables, green leafy vegetables, fruits, fats and oils and carbonated beverages did not show any statistical significance with PMS symptom score.
- Age at menarche was significantly associated (p=0.05) with PMS symptom score. Duration of menstrual cycle (p<0.01) and days of menstrual cycle (p<0.05) showed significant association with PMS symptom score. Menstrual blood flow does not show any significant association with PMS symptom score.
- Anthropometric measurements showed that PMS symptom score was significantly associated with weight (p=0.00) and height (p<0.05) whereas BMI values and waist hip ration did not show significant association with PMS symptom score.
- Under biochemical parameters, haemoglobin level of the participants was estimated and found that the anaemic status did not show any association with PMS symptom score.
- PMS symptoms score showed statistically significant association with State Anxiety, Trait Anxiety and Self Esteem at (p=0.00) level.
- Knowledge score of the participants was significantly associated (p<0.05) with PMS symptom score.

- Intake of water had negative correlation with irritability (r=-0.119), head ache (r=-0.137), abdominal pain (r=-0.331) at p<0.001 and food craving (r=-0.088) at p<0.05. Water intake was positively correlated with muscle pain (r=0.178; p=0.00).
- Intake of fruits showed negative correlation with anxiety (r=-0.101) and tiredness (r=-0.109) at p<0.01 level, changes in sex desire (r=-0.168; p<0.01) and difficulty in concentration (r=-0.120) at p=0.00 level.
- Intake of vegetables also showed a negative correlation with individual PMS symptoms cry (r=-0.089; p<0.05), relationship problems (r=-0.142; p<0.05), food craving (r=- 0.093; p<0.05), weight gain (r= -0.115; p<0.011) and muscle pain (r= -0.115; p<0.011). Positively correlated with back pain (r=0.141; p<0.05).
- Intake of green leafy vegetables had positive correlation with tiredness (r=0.135; p<0.01) and back pain (r=0.119; p<0.05) and had negative correlation with difficulty in concentration (r=-0.113; p<0.05) and muscle pain (r=-0.119; p<0.01).
- Intake of coffee showed positive correlation with the symptoms of irritability (r=0.258), anger (r=0.175), anxiety (r=0.096), depression (r=0.127), food craving (r=0.185), difficulty in concentration (r=0.130), abdominal pain (r=0.152) and nausea (r=0.165) at p<0.01.
- Oil consumption was noted to have negative correlation with irritability (r=-0.271), breast tenderness (r=-0.125), muscle pain(r=-0.216) and over whelming(r= -0.259) at p<0.01 level and it was positively correlated with tiredness(r=0.174), weight gain (r=0.306) and nausea (r=0.121) at p<0.01.
- Intake of milk was negatively correlated with cry (r=-0.188), tiredness (r=-0.180), food craving (r=-0.187), insomnia(r=-0.264), abdominal pain (r=-0.331), muscle pain(r=-0.178) at weight gain (r=-0.117) a level of p<0.01 and difficulty in concentrating (r=-0.107) at p<0.05) and positively correlated with headache (r=0.137; p<0.01).
- Skipping of meal was negatively correlated with irritability (r=-0.0.116; p<0.05), breast tenderness (r=-0.214; p<0.01), and weight gain (r=-0.182).

Positively correlated with back pain (r=0.210), muscle pain (r=-0.212), at p=0.00 level.

- Age at menarche had positive correlation with the individual PMS symptoms of anger (r=0.093; p<0.05) and days of menstruation showed negative correlation with the individual PMS symptoms, irritability (r=-0.258; p=0.00) and depression (r=-0.018; p<0.05).
- In anthropometric measurements, Waist/Hip ratio alone had positive correlation with PMS symptoms like changes in sex desire (r=0.322; p=0.00); food craving (r=0.101; p<0.05) and abdominal pain (r=0.109; p<0.05). Though most of the symptoms had mild degree of positive correlation with Waist-Hip Ratio and other anthropometric parameters like BMI values, height and weight, and were statistically not significant.
- State anxiety was positively correlated with breast tenderness (r=0.134; p<0.01) and trait anxiety was positively correlated with back pain (r=0.134; p<0.01) and depression with (r=0.108; p<0.05). Self esteem was negatively correlated with anger (r=-0.094; p<0.05).
- Knowledge score on PMS was negatively correlated with head ache (r=-0.091; p< 0.05), back pain (r=- 0.095; p<0.05), muscle pain (r=-0.101; p<0.05), changes in sex desire (r=-0.129; p<0.01), irritability (r=-0.096; p<0.05) and anger (r= -0.094; p<0.034).

Phase-II Acceptability trial of the formulated health mix cookies

- Sensory evaluation showed that the Variation II was highly acceptable with an overall score of 32.58 out of 35.
- Nutritive value of the five variations of health mix were analysed and calculated Variation II with higher level of Calcium rich health mix cookies was used for dietary intervention. Variation II also showed higher amino acid profile and essential fatty acid profile.
- Sensory evaluation of health mix cookies showed that the score of formulated cookies was lesser than the standard cookies. The participants readily accepted the health mix cookies due to its Calcium and other nutrient content and also its health benefits.

- Formulated health mix cookies contributed 19.05 g of protein, 507 mg of Calcium and 604 mg of Magnesium, 18.9 mg of Iron and 233 micro grams of beta carotene per 100 g of the cookies used for dietary intervention for the period of 120 days.
- During the study period, each participant of the study group was supplied with eight health mix cookies. The study participants were instructed not to take coffee or tea or carbonated beverages before and after the intake of the health mix cookies. The study participants were encouraged to drink fresh fruit juices or fruits rich in Vitamin C. The investigator or her representative was directly involved in the distribution of the health mix cookies to all the participants who were gathered in same place each day in mid morning and mid afternoon.

PHASE-III

Impact of dietary intervention onnutritional statusand symptoms of PMS of the selected participants

Anthropometric measurements, showed that there was a significant difference in the experimental group for BMI and waist-hip ratio ($p<0.01$) before and after intervention.

- Biochemical estimations of serum Calcium, and blood haemoglobinshowed the significant difference between the experimental group ($p<0.01$) and serumMagnesium, TIBC and Ironrevealed that there was a significant difference between the experimental and control group after interventions ($p<0.05$) and also within the experimental group ($p<0.01$), before and after the intervention studies.
- Clinical examination showed that there was significant difference within the experimental group before and after intervention for general weakness, thin or lean stature, angular stomatitis, rough dry skin, bleeding and swollen gums, cheliosis ($p<0.01$) and head ache ($p<0.05$).
- Mean nutrient intake of the participants in the experimental and control groups showed that there was a significant difference within the experimental group before and after interventions and within the experimental for energy, protein, carbohydrate, Calcium, Magnesium, Iron, beta carotene, thiamine, riboflavin, niacin ($p<0.01$) and Vitamin-C ($p<0.05$) and between the final observations of experimental and control group after intervention for energy, protein, carbohydrate, fat, Calcium, Magnesium, Iron, beta carotene, thiamine, riboflavin

and niacin and Vitamin-C ($p<0.01$) and for protein, Magnesium and thiamine it was $p<0.05$.

PHASE- IV

IMPACT OF NUTRITION EDUCATION ON THE KNOWLEDGE AND SYMPTOMS OF PREMENSTRUAL SYNDROME OF THE SELECTED PARTICIPANTS

- PMS symptom score and number of PMS symptoms were statistically analysed and found that there was significant difference in the experimental group before and after intervention ($p<0.01$) and between the experimental and control group after intervention ($p<0.01$).
- The mean depression level of the selected participants showed that there was significant difference in the mean scores for depression within the experimental group ($p<0.05$) and between the experimental and control groups ($p<0.01$).
- There was a negative correlation of number of PMS symptoms with haemoglobin levels ($p<0.01$) and PMS symptom score was negatively correlated with serum Calcium levels. ($p=0.00$).
- Individual PMS symptoms like head ache, back pain, sensitivity, depression and loss of appetite were negatively correlated with serum Calcium level. Mood swing was negatively correlated with serum Magnesium level, palpitation was negatively correlated with serum ferritin level and palpitation, food craving and mood swing were negatively correlated with serum Iron. All showed statistical significance of $p<0.05$.
- Overall mean PMS knowledge score among experimental group before intervention was 31 per cent and after intervention it was 74 per cent. In the case of control group before intervention, it was found to be 38 per cent and that after intervention was 50 per cent.
- The frequency of individual symptoms like acne, abdominal bloating, breathlessness, dizziness, hot flashes, irritability, loss of appetite and wish to be alone ($p<0.01$) and fatigue, palpitation, breast swelling and mood swing ($p<0.05$) in the experimental group before and after intervention noted that there was statistical significant difference. There was no significant difference in the frequency of individual symptoms like headache, nausea, angry, anxiety,

confusion, depression, food craving and forgetfulness in the experimental group before and after intervention.

- There was no significant difference in the frequency of individual symptoms in the control group before and after intervention except for the symptoms of hot flashes ($p<0.01$), confusion, mood swing and wish to be alone ($p<0.05$).
- The presence of individual PMS symptoms of final observations showed statistically significant difference between the experimental and control group for breathlessness, dizziness, fatigue, head ache, palpitation, anger, wish to be alone ($P<0.01$) and abdominal bloating, hot flashes, nausea, breast swelling, confusion and mood swing ($p<0.05$). The significance was noted at $p<0.05$ level.
- From the discussions, it was noted that there was significant improvement in mean nutrient intake of Iron, Calcium, carbohydrate, thiamine, riboflavin, niacin, Vitamin-C, serum Calcium, Magnesium and Protein levels, knowledge on various aspects of PMS, reduction in the number of PMS symptoms and PMS symptom scores. The individual PMS symptoms showed statistically significant difference in the experimental group before and after intervention as well as among the experimental and control group before and after intervention. It might be due to the micro nutrients present in the health mix cookies and also due to the impact of nutrition and health education.
- The results of the study concluded that the nutrition intervention (supplementation and nutrition and health education) proved to be effective in improving the health status and reducing the frequency and severity of PMS symptoms of the participants in the experimental group when compared to control group. There was a slight improvement in the blood parameters, nutrient intake, PMS symptoms, clinical symptoms and moderate increase in knowledge scores among the control group. This was attributed to the conduction of nutrition and health education to the control group also.

Thus, from the findings of the study, it is concluded that micro nutrients rich health mix is a welcoming appropriate and feasible attempt in alleviating the symptoms of PMS and in improving health status of the selected population.

Recommendations

The following recommendations are emerged from the present study.

1. More research works are suggested to improve the nutritional and health status of reproductive age women through nutrition education and dietary intervention since they are the pillar of family to support and uplift the overall development of the family.

2. Create awareness on the locally available, seasonal, inexpensive food items rich in protein, Iron, Calcium, Magnesium and Vitamins to optimise the nutrient intake of the women population.

3. Efforts have to be taken to improve the knowledge on various aspects of PMS among younger generation especially starting from school going and adolescent girls.

4. Elaborate studies must be undertaken on the prevalence of PMS in rural areas, different income groups and also girls or women engaged indifferent physical activities.

5. Popularise the non-pharmacological management techniques like dietary pattern, physical activities, regular exercises, yoga and meditation for reducing the severity of PMS.

6. Explore highly concentrated micronutrients like Iron, Calcium and Magnesium rich food items that can be regularly included in the routine daily dietaries to prevent PMS.

7. Simple recipes using locally readily available seasonal, low cost ingredients can be standardised and popularised so that it can be prepared and consumed regularly by the participants at their house hold level.

Nutritional and health well-being can be achieved only through a food based and not drug based approach. Pills and tablets can never be effective substitute for balanced diet. Our attempts must be to achieve appropriate dietary diversification to reduce the

health problems of PMS. A sound and sustained programme of nutrition education may be helpful in modifying the future of young generation.

"Any investment towards improving the health status of the women is the real investment for the health and wealth of the family".

(Rajammal P.Devadas, 1998)

BIBLIOGRAPHY

ACOG (2010) Premenstrual Syndrome *ACOG practice Bulletin No.15,* Washington,D.C, American college of obstructions and Gynaecologists.

ACOG (2000) ACOG Committee on Practice Bulletins –Gynaecology, ACOG Practice Bulletin, Premenstrual Syndrome, *Obstec Gynecol*, 15, 95(4), suppl , 1- 9.

Adam, K.S. and Sattar, K. (2014) Epidemiology of premenstrual syndrome (PMS)-A systematic review and Meter analysis study, *J Clin Diagn Res,*;8(2); 106-9.

Anand, M.P., (2011) Non-pharmacological management of essential hypertension,*J Indian Med Assoc.,* 97:220–5.

Andrea, J. R. and Sharon, A .W. (2008) Premenstrual syndrome and premenstrual dysphoric disorder: quality of life and burden of illness. *Gynaecological endocrinology,* 24 (11):659-62.

Angst, J., Sellaro, R., Merikargas, K.R. and Endicott, J. (2011) The Epidemiology of Premenstrual Psychological Symptoms. *Acta psychiatric Scand,* 104, 110-116.

Anju, B. (2000) Women and Development, Rwast Publication, New Delhi.

Antai, A., Udezi, A., Ekanem, E., Okon, U. and Umoiyoho, A. (2004) Premenstrual Syndrome Prevalence in Students of the University of Calabar, Nigeria. *African Journal of Biomed Res and Biol Psych*, **32**, 1782-1788.

Asha, M., Zubair, A. and Sanwer, A. (2010) Original article, frequency and associated factors of PMS in medical college girls, *Medical Channel*, 17 (1): 34-38.

Association for India's development, (2008) Ragi- A Wonderful grain, Agricultural Reviews Year: 2008, 30 (1): 64-70.

Ather, A. (2014) Effect of health education programme on teenagers with premenstrual syndrome, *EPMA Journal*, 5: A 158.

Bäckström T, Bixo M and Strömberg, J. (2015) GABA receptor modulating steroids in relation to women's behavioural health, *Curr Psychiatry Rep*., 17: 92-93.

Backstrom, T. and Andrean, L. (2013) The role of hormones and hormonal drugs on Premenstrual Syndrome, *CNS Drugs*, 17 (5): 77-83.

Bakhshani, N., Hasanzadeh, Z. and Raghibi, M. (2012) Prevalence of premenstrual symptoms and premenstrual dysphoric disorder among adolescents students of Zahedan, *Zahedan Journal of Research in Medical Sciences*;13(8):29-34.

Bakhshani, N., Mousavi, M.N. and Khodabandeh, G. (2009) Prevalence and Severity of Premenstrual Symptoms among Iranian Female University Students, *Journal of Pakistan Medical Association*, 59: 205-208.

Bakr, I and Ez-Elarah, H.S. (2010) Prevalence of Premenstrual Syndrome and its effect on the security and the quality of life among medical students, *The Egyptian Journal of community medicine,* 28(2):19-30.

Balaha, M.H. Am, M.A.E., Maghannum, M.S.A. and Muchaidab, N.S.A. (2010) The Phenomenology of PMS in Female medical students: a cross sectional study, *Pan African medical Jnl*, 5(4):1-4.

Barnard, K., Frayne, S.M., Skinne, K.M. and Sullivan, L.M. (2003) Health Status among women with Premenstrual Symptoms, *Jnl. of Women's health,* 12(9):911-19.

Bertone, J. (2008) Plasma 25 – hydroxy Vitamin D and rick of premenstrual syndrome in a prospective cohort study*, BMC women's Health*, 14:56.

Bertone-Johnson, E.R., Hankinson S.E. and Bendich, A. (2005) Calcium and Vitamin D intake and risk of incident premenstrual syndrome. *Arch Intern Med,* 165(11): 1246–1252.

Bertone-Johson, E.R., Hanskinson, S.E. Johnson, A.J. and S.R. Manse, J.E. (2009) Timing of alcohol use and the Insistence of Premenstrual Syndrome and Probable Premenstrual disorder, *J. Women's Health* (Larchmt) 18 (12): 1945-53.

Bhatia, S.C. and Bhatia, S.K. (2002) Diagnosis and treatment of premenstrual dysphoric disorder.*Am Fam Physician*, 66(7):1239–48.

Bhatacharya, D.K., (2006), Research Methodology, II Ed., Excel books Pub., New Delhi, Abhisek Publications ,Chandigarh, India, 203.

Bloch. M, Schmidt .P.J. and Rubinow, D.K., (1997) Premenstrual Syndrome: Evidence for symptom stability across cycles, *Am J Psychiatry*, 12(6):229-32.

Borenstein, J., Chiou, C.F., Dean, B., Wong, J. and Wade, S. (2005) Estimating direct and indirect costs of premenstrual syndrome, *J. Occup. EnvIron. Med.*, *47(4):* 26–33.

Borenstein, J.E., Dean, B.B., Leifke, E., Korner, P. and Yonkers, K.A. (2007) Differences in symptom scores and health outcomes in premenstrual syndrome. *J. Women's Health*, 16 (4): 1139–1144.

Brahman, G.N.V. (2008) Fortify foods to beat micronutrient malnutrition, Food and Nutrition world, (sample issue), 320.

Brahmbhatt, S., Sattigeri, B.M., Shah. H., Kumar, A. and Parikh, D.A. (2013) Prospective survey study on premenstrual syndrome in young and middle aged women with an emphasis on its management *Int J Res Med Sci* 13 (1):69-72.

Braveman, P.K. (2007) Premenstrual syndrome and Premenstrual dysphonic disorder, *Jnl of Paed Adol. Gynecol.,* 20(1):3-12.

Brown, R., Brown, A., Beatz, M, Wagner, J. and Pierson, R. (2011) Mood instability in women with premenstrual syndrome, *J Obstet. and gyneacol.Can*,33(9):927-34

Census of India (2011) Census information India., Ministry of Home affairs, education, literature, government of India,

Chandrasekar, U. (2002) Food Science and applications in Indian cookery, printed at Chamom Offset, New Delhi: 72.

Cheng, S.H., Shih, C.C., Yang, Y.K., Chen, K.T., Chang, Y.H. and Yang, Y.C. (2013) Factors associated with premenstrual syndrome—A survey of new female university students. *Kaohsiung J.Med.Sci.*, *29 (2):* 100–105.

Chien, L.W., Chang, H.C. and Liu, C.F. (2012) Effect of yoga on serum homocysteine and nitric oxide levels in adolescent women with and without dysmenorrhea, *J. Altern. Complement. Med.*, *19*, 20–23.

Chocano– Bedoya, .P., Manson, J., Hankinson, S. and Johnson, S.R (2013) Intake of selected minerals and Risk of Premenstrual syndrome, *Am J epidemiology*, 77 (10): 1118-1127.

Chocano- Bedoya, P., Manson, J. and Hankinson, S. (2011) Dietary B Vitamin intake and incidence of premenstrual syndrome, *Am J Clin Nut,* 93(5):1080–1086.

Chou, J,P. and Chang. A.M. (1999) Effects of an educational programme on adolescents with premenstrual syndrome, *Health Educ Res* 14 (6): 817-830.

Chrisler, J.C. and Caplan, P. (2012) The strange case of Dr. Jekyll and Ms. Hydie: How PMS become a natural phenomenon and a psychiatric disorder, *Annual Review of sex research,* 13:274-306.

Cohen,L.S., Soares,C.N., Otto,M.W., Sweeney,B.H., Liberman,R.F. and Harlow, B.L. (2002) Prevalence and predicators of premenstrual dysphoric disorder (pmdd) in older premenopausal women, the Harvard study of mood and cycles, *Journal of Affect Disorders*, 70: 125-132.

Comasco, E. and Sundström, P. (2015) Neuroimaging the menstrual cycle and premenstrual dysphoric disorder, *Curr Psychiatry Rep,* 17 (1):77-78.

Connolly, M. (2011) Premenstrual syndrome: an update on definitions, diagnosis and management, *Advances in Psychiatric Treatment,* 7: 469–477.

Cosgrove, L. and Riddle, B. (2013) Constructions of femininity and experiences of menstrual distress, *Women and Health*, 38: 37–58.

Critchlow, D.G., Bond, A.J. and Wingrove, J. (2001) Mood disorder history and personality assessment in premenstrual dysphoricc disorder, *Jnl of Clinic Psychy*, 62: 688-693.

Darabi, F., Rasaie, N. and Jafarirad ,S. (2014) The Relationship between premenstrual syndrome and food patterns in university student girls*, Jentashapir Health Res,* 5(6): 26656 .

Das, K. and Chowdhury, A.R. (1997) Metallic Iron concentration during menstrual cycle in normally menstruating women, *Ind J Med Sci*, 51(2):52–54.

Dean, B.B., Borenstein .J.E., Knight, K. and Yonkers, K. (2006) Premenstrual syndrome and Premenstrual Dysphoric Disorder, *J Women's health*,15: 546-55.

Delara,S., Delara. M, Ghofranipour. F, Azadfallah. P, Tavafian. SS, Kazemnejad A. Lori, M.D., Pamela, J.M. and Melissa, H.H. (2012) Premenstrual Syndrome, *Am. Fam. Physician,* 67:1743-52.

Dell, R., Holleran, S. and Ramakrishnan (2008) PMS and depression*, Harv Rev Psychiatry,* 15:146.

Derman, O., Kanbur, N. O., Tokur, T.E. and Kutluk, T. (2014) Premenstrual syndrome and associated symptoms in adolescent girls, *European Jnl of Obst Gyncol and Reprodnve Biology*, 116(2): 201-6.

Desai, A.D. (2010) Effect of supplementation of malted ragi flour on the nutritional and sensorial quality characteristics of cake, *Adv Jnl of Food Science and Technology*, 2(1):67-71.

Deuster, P.A.. Adera, T. and South, P. J. (1999) Biological, social, and behavioural factors associated with premenstrual syndrome, *Arch Fam Med*, 8(2):122-128.

Devadas, R.P. (1998) Update on Nutrition and Health education, Research Highlights, 9(3): 62.

Dickerson, L.M., Maryecol, P.S. and Hunter, M.H. (2013) Premenstrual syndrome, *Amr. Family Physician*, 67(8):1743-52.

Dimmock, P.W., Wyatt, K.M., Jones, D.W and O.Brien, P.S. (2000) Efficacy of selective serotonin- reuptake inhibitors in premenstrual syndrome: *Systemic review Lancet,* 356:1131-6

Direkvand – Moghadam, A., Sayehmiri, K., Delipisheh, A. and Kaikhavandi, S. (2014) Epidemiology of premenstrual syndrome (PMS)-A systemic Review and Meta analysis study, *Journal of clinical Diagnosis Research,* 8(2):106-09.

Doyle, C. Ewald, H.A.S and Ewald, P.W. (2007) PMS; An evolutionary perspective on its causes and treatment, *Perspectives in Biology and Medicine*, 50:181-202.

Eissa, M. (2013) Personality and psychosocial Factors affecting premenstrual Syndrome, *Current Psychiatry*, 17(1): 55-61.

Evans,W..D. (2006) How social marketing works in health care, *BMJ*, 32 (7551) : 1207.

Fallah, Y.L., Azjmi, H. and Sadeghi, T. (2013) The effect of aerobic and walking exercise on physical and psychological symptoms and pain of PMS, *IJN* 25(80):46-55.

Farage, M.A., Osborn, T.W. and MacLean, A.B. (2008) Cognitive, sensory, and emotional changes associated with the menstrual cycle: A review. *Arch Gynecology and Obstetrics*, 27, 299-307.

Farrokh, E. and Slamlou, H., (2015) Premenstrual syndrome and quality of life in Iranian medical students, *Sex. Reprod. Health.*,6, 23–27.

Fommei, E., Ghione, S. and Ripoli, A. (2009) The ovarian cycle, as a factor of variability in the laboratory screening for primary aldosteronism in women, *J Hum Hypertens*, 23(2): 130–135.

Fortmann.S.P, Burda, BU; Serger, C.A, Lin, J.S. and Whitlock. E.P (2013) Vitamin and Mineral Supplements in the Primary Prevention of Cardiovascular Disease and Cancer: An updated *systematic Evidence Review for the US Annals of Internal Medicine*, 159.

Frank .R (1931) The normal causes of Premenstrual Tension, Arc Neural Psychiatry , 26:1053-57.

Frankenburg FR. (2007) The role of one carbon metabolism in schizophrenia and depression. *Harv Rev Psychiatry*, 15:146.

Freeman, E.W. (2003) Premenstrual Syndrome and Premenstrual Dysphoric Disorder: Definitions and Diagnosis. *Psychoneuroendocrinology*, 28: 25-37.

FSAU (2004) Nutrition- A guide to data collection, analysis, interpretation and use, food security Analysis unit for Somalia, FAO.

Furjiwara, T. and Nakata,R. (2013) Current Problems of Food intake in Young women in Japan : Their influence on female reproductive function .*Reprod. med. Biol*, 3:107 - 14.

Futterman, L.A and Rapkin, A.J. (2006) Diagnosis of Premenstrual disorder, *The Jnl. of Repnd. Medicine*, 51 (4) suppl: 349-358.

Gillan, S. (2007) Premenstrual disorder in adolescents female Integrative management, *Reprinted from Australian family physician,* 36(8): 629-30.

Gopalan.C and Chatterjee, A. (2010) Indian evolving food and Nutrition Scenario: An overview, Globalisation and challenges of developing contemporary India, Springer publication, Singapore, 210-12.

Gopalan,C. (2013) The changing Nutrition Scenario, *Indian J Med Res 138*, 392-397.

Gopalan, C., Ramasastri, B.V. and Balasubramanian S.C. (2014) Nutritive value of Indian Foods, (NIN), ICMR, Hyderabad: 59-67.

Gopalan, C. (1998) Women's Nutrition in developing countries, NFI Series 3(82).

Gouda, J. and Prusty, R. (2014) Overweight and Obesity among women by economic stratum in urban India, *Journal of Health, Population and Nutrition*, 32(1):79-88.

Gupta, M.D. (2016) Research Methodology, PHI Publishers, ND, Learning Pvt. Ltd.289-92.

Ha, E.J. and Bish. C.N. (2009) Effect of nutrition intervention using a general nutrition course for promoting fruits and vegetables consumption among college students, *J Nutr Educ Behav*, 41(2):103–109.

Halbreich, U. (2013) The aetiology, biology, and evolving pathology of premenstrual syndromes, *J Psychoneuroendocrinology*, 29(7): 81-84.

Halbreich, U. (2004) The diagnosis of Premenstrual Syndrome and Premenstrual Dysphoric Disorder: clinical procedures and research perspectives. Gynecol Endocrinol, 19(6): 320–334.

Halbreich, U., Borenstein, J., Pearlstein. T. and Kahn, L.S. (2003) The Prevalence, impairment, impact and burden of Premenstrual Dysphoric disorder and Beyond: *Psychoneuroendocrinology*, 28 (3), 23.

Hamid, N., Moghanloo, A. V. and Eidibaygi, M. (2012) Comparison efficacy of three methods of cognitive behaviour therapy, pharmacotherapy and cognitive behaviour therapy with exposure and response prevention in obsessive – compulsive disorder symptoms), *Jentashapir J Health Res,* 5(45):1-12.

Handa, C., Goomer, S. and Siddhu, A. (2012) A physiochemical properties and sensory evaluation of fructo oligosaccharide enriched cookies, *J Food Sci and Tech.,* 49 (2):192-99.

Hardy, M. (2010) Herbs of special interests to women, *J.Am Pharm Assoc*., 40:234-42.

Harlow, S.D. and Campbell, O.M. (2004) Epidemiology of Menstrual disorder in developing countries: A systematic Review, *Br. J Obstet. Gynaecol*., 11(1): 211.

Hashemi, S., Tehrani, F.R., Mohammadi, N., Dovam, M.R., Torkestani, F., Simbar, M and Azizi, F. (2016) Comparison of Metabolic Hormonal profiles of women with and without Premenstrual syndrome: A Community based cross- sectional study, *Int J Endrocrinol metab,* 14(2): 28422.

Heinemann, C. Minh, T and Filonenko, A. (2010) Explorative evaluation of the impact of severe premenstrual disorder on work absenteeism and productivity, Women Health issues, 20(1):201.

Henshaw, C. and Pearson, D. (2015) PMS : Diagnosis, Aetiology, Assessment and Management , Revisiting Premenstrual Syndrome (http://apt.rcpsych.org)

Hoghighi, E.S., Jahromi, M.K. and Daryanoosh, F. (2015) Relationship between Cardio respiratory fitness, habitual physical activity, body mass index and premenstrual symptoms in collegiate students, *J sports med phys fitness*, 55(6): 663-667.

HUDCO (2012) Housing Financial Public division, Patiala House, New Delhi.

ICMR (2015) Nutrient Requirement and Recommendations for Dietary Allowances for Indians, A report of expert group of ICMR, NIN, Hyderabad.

ICMR (2012) Dietary guidelines for Indians- A Manual published by NIN, ICMR, Hyderabad, 5, 11-20.

Indusekhar, R., Usman, S.B. and O'Brien, S. (2007) Psychological aspects of premenstrual syndrome: *Best pract Res Cln obstel Gynaecol.* 21(2):207-20.

Institute of Medicine, (1997) "Dietary Reference Intakes: Calcium, Phosphorus, Magnesium Vit D, and Fluoride," National Academy press, Washington, DC.

Institute of Medicine, (2004) Dietary references, Intake for water, sodium, Calcium, chlorine and sulphur, National Academy Press, Washington DC.

James W, Chen, C. and Inoue S. (2010)Appropriate Asian body mass indices? *Obesity Rev,* 3(4): 139.

Jelliffe, D.B. and Jelliffe, P.E.F. (1991) Community Nutritional Assessment –with special reference to less technically developed countries, Oxford medical publications, 90-93.

Johnson, S.R. (2004) Premenstrual syndrome, premenstrual dysphoric disorder, and beyond: a clinical primer for practitioners. *Obstet Gynecol*.104: 845–859.

Joshi, J.V., Pandey, N, Galvankar, P and Gogate, J.A. (2010) Prevalence of Premenstrual Symptoms: Preliminary analysis and brief review of management strategics, *Journal of med life Health*, 1 (1), 30-34.

Kahyaoglu , H. and Mestogullari, E (2016) Effect of premenstrual syndrome on work related quality of life in Turkish Nurses. *Saf. Health Work ;*7(1),78–82.

Kashanian, M., Mazinani.R.and Jalalmanesh .S. (2007) Pyridoxion (Vitamin B6) therapy for premenstrual syndrome .*Int Jnl of gynaecol obstet*. 96:43-4.

Kathleen, M., Lustyk, B and Gerrish, W.G. (2010) Premenstrual syndrome and Premenstrual dysphoric disorder, Issues of Quality of life, stress and exercise, *Springer Science Business MediaLLc* , (USA):1952-1972.

Kato. J, Toniolo, P. and Konig, K.L., et al. (2013) Epidemiology correlates with menstrual cycle length in middle aged women, *Eur J Epidemic*, 15:809-14.

Kaur, N and Thakur, R.A. (2009) Describe Study to Assess the Premenstrual Syndrome and Coping Behaviour among Nursing Student, *Nursing and midway Research Journal,* 5(1)19-23.

Keely, S.A., Melnyk, B.M., Jacobson, D.L. and Hever, J.A. (2011) Correlates among healthy lifestyle changes, social support and healthy behaviours implication of behavioural changes strategies and future research, *Jnl. of Paediatrics Health care*, 25(4): 216-23.

Kiyani,A., Heidari,M., Tabar, M.S. and Faghihzadesh, S. (2009) Prevalence, signs, symptoms and predisposing factors for PMSin women, *Daneshvar Med. ,* 16(81): 45-54.

Kumar, P. (2014) Rural women Empowerment in India, Asian Journal of multidisciplinary studies, 2(1): 75-79.

Kumari, S. and Sachdeva .A. (2016) Patterns and Predictors of premenstrual symptons among female working in a psychiatry Hospital, Scientifica, Hindawi publishing corporation, ID : 6943852, http//dsc.doi.org.10.1155/2016/6943857.

Kumari, S., Pankaj, S., Sinha, A., Prasad, D. and Kumar, R. (2015) Evaluation of insulin resistance in adolescent girl with menstruation irregularities, *Intr jnl.ofreprod.contracep. obst. and gyneacol.*, 4(6): 1900-1960.

Kupper, C. and Loch, S. (2016) Premenstrual Syndrome, Deutsche Apotheker zeitung. 2(6E) : 3165-3175.

Lakshmi ,A.S. (2015) Impact of life style and dietary habits on menstrual cycle of college students, *International Jnl. of Sci. and Res* 4(4); 2845-2847.

Larmond, E. (1977) Laboratory methods of sensory evaluation of food.Research Branch, Dept. of Food Technology, Canada.

Leather, H.D. and Foster, P. (2012) World food problem, towards understanding and ending under nutrition in developing countries, 5th Edition, Lynne Reienner publications, Boulder, USA.

Lee, J.C., Yu, .K., Yeon, J.H., Lee, K.H., Mini, J.H and Park, S.H (2011) A study on the menstruation of Korean adolescent girls, *Korean Journal of pead*., 54:201-6.

Lolas-Talhami, J., Lafaja-Mazuecos, J. and Ferrandez-Sempere, D. (2015) Is Premenstrual syndrome a Uterine Inflammatory disease? Retrospective evaluation of an aetiologic approach, Open Jnl. of obstet. and gyneacol., 5: 305-12.

Lopez, L.M., Kapten, A.A. and Helmerhorst, F.M. (2012) Strategies for improving contraceptive use: a systematic review, *Contraception,* 79(4):11-7.

Lori ,M.D., Pamela, J.M. and Melissa ,H.H. (2003) Premenstrual Syndrome, *Am Fam Physician*, 67:1743–1752.

Lua.P.L. and Elena.W.D. (2012) The impact of nutrition education interventions on the dietary habits of college students in developed nations: A Brief Review, *The medical Journal of Medical Sciences,* 19(1) : 4-14.

Mac Donald, P.C., Dombroski, R.A. and Cally M.L. (2011) Recurrent secretion of progesterone in large amounts: An endocrine / metabolic disorder unique to young women, *Endocrine review*, 12:372-76.

Mahan .L.K and Stumps .S.E (2014) Kraus' Food and Nutrition Therapy, 12th , Saunder Elsevier, 11830 West line Industrial Drile , Louis Missouri, 146-274.

Malhotra, A. (2012) Fertility and empowerment, work paper series 001-2012-ICRW-FE., International Center for Research on Women; . Remobilizing the Gender and Fertility Connection: the Case for Examining the Impact of Fertility Control and Fertility Declines on Gender Equality: 38.

Marjoribanks, J., Brown ,J., and O'Brien ,P.M. (2015) Selective serotonin reuptake inhibitors for premenstrual syndrome. *Cochrane Database Syst Rev*.,6: D001396.

Martin, V.T., Wernke, S., Mandell, K. and Ramanadan, N., (2006) Symptoms of Premenstrual Syndrome and their association with migraine head ache, *A review arch Gynaecology and Obstetrics,* 27:299-307.

Martinez, P.E., Rubinow, D.R., and Nieman LK (2015) 5α-reductase inhibition prevents the luteal phase increase in plasma allopregnanolone levels and mitigates symptoms in women with premenstrual dysphoric disorder, N*europsychopharmacology*, 2(3):132.

Masho, S.W., Adera, T. and Paul, S.J. (2005) Obesity as a risk factor for Premenstrual Syndrome, J Psychosom.Obstect.Gynaecol., 26 :33-39.

Mc Watters, K.H., Ouedraogo, J.B., Resurrection, AVA., Hung, Y.C. and Philips, C.D. (2003) Physical and sensory characteristics of sugar cookies containing mixtures of wheat flour and cowpea flours, Int. J Food Sci. Tech., 38:403-10.

Meaden, P.M., Hartage .S.A. and Cook, J. (2005) Timing and severity of symptoms associated with menstrual cycle in a community based sample in the mid Western United State, *Psychiatry Res*, 134 : 27-36.

Meschino, J. (2015) Proven supplements for menopause and PMS, A research Review. *Phy. Anthrop.,* 28(3):129-137.

Miller, A.A. (2008) The methylation, neurotransmitter and antioxidant connections between folate and depression, *Altern Med Rev,* 13: 2016.

Mishell, D.R. (2005) Premenstrual disorders: Epidemiology and disease burden. *Am J Manag Care,*11(16 Suppl): 473–479.

Moore, D. (2007) Why don't they demand more? Entitlement and work values of religious and secular women and men in Israel.*Journal of Applied Social Psychology,* 36**,** 1924-1960.

Muneyyirci-Delale, O., Nacharaju, V.L. and Dalloul, M. (2001) Divalent Cations in Women with PCOS: Implications for Cardiovascular Disease. Gynaecological Endocrinology, 15, 198-201.

Mustaniemi, S. and Sipola, K. and Leppänen, M.(2011) Premenstrual symptoms in young adults born preterm at very low birth weight—from the Helsinki study of very low birth weight adults. *BMC Women's Health*, 10, 11-25.

Myint, T.H, Edessa, O.G and Sawhsakapaw, C. (2006) Premenstrual syndrome among female univ .student in Thailand, *AUJT*, 158-62.

Naeimi, N. (2015) The prevalence and symptoms of premenstrual syndrome under examination, *Journal of Bio Science and Medicines*, (3), 1-8.

Narendran, S., Nagarathna, R., Narendran, V., Gunasheela ,S. and Nagendra, H.R. (2005) Efficacy of yoga on pregnancy outcome, *J Altern Complement Med*; 11: 237–44.

Nations challenge to provide nutritional health and education, Indian Express, 2011, New Delhi.

Nevatte, T., O'Brien.P.M. and Backstrom.T.(2013) ISPMD consensus on the management of premenstrual disorders. Arch Women Ment Health, 16:279–291.

Nierenberg (2013) Iron and Zinc may prevent PMS, *My Health News Daily Contributor*:6-7.

NIN (2011) A manual of laboratory techniques, National Institute of Nutrition, ICMR, Hyderabad.

Nisar, N., Zehra, N., Haider, G., Munir, A.A. and Sohoo, N.A. (2008) Frequency, intensity and impact of premenstrual syndrome in medical students.*Journal of College of Physicians and Surgeons Pakistan*, 18, 481-484.

Nishida, C., Barba, C. and Manila, M. (2004) Appropriate Body Mass Index of Asian population and its implications for policy and intervention strategies, *The Lancet,* 363:157-160.

Nour, M.B., Mahnaz, N.M. and Gubahar, K. (2009) Prevalence and severity of premenstrual symptoms among Iranian female university students*, Journal of Pakistan Medical Association,* 51(4) 205-8.

Nulufer, E., Ayşenur, K. and Tulay, K. (2010) Investigation of premenstrual syndrome and contributing factors among university students, *Turk J Med Sci*, 40(4):565–573.

Oksa, S., Lukkaala, T. and Maenpaa, .J. (2009) Toremifene for premenstrual mastalgia: a randomised, placebo-controlled crossover study, *BJOG,* 113:713.

Ozturk, S., Tanriverdi, D. and Eric, B. (2011) Premenstrual syndrome and management behaviours in Turkey*, Australian Jnl. of Advanced Nursing*, 28(3): 54-61.

Panda, H. (2012) Herbal foods and its medicinal values, National Institute of Indus Research - Report, 106-E, Kamala Nagar, Delhi -110 007,181.

Panneerselvam, R. (2014) Determination of sample size, Research Methodology, PHI Learning Private Ltd., II Ed., 219.

Park, K. (2017) Textbook of preventive and social medicine, Banarsidas Bhanot. Product Type, Hardbound. Condition, New Delhi, 408.

Parker, M. A. (2010) The menstrual disorder of teenagers: determining typical menstrual pattern and menstrual disturbance in a large population based study of Australian teenagers, *BJOG*, 117(2):p185-92

Parker, J. (2007) PMS and women's health, A self-health guide to manage and treat premenstrual syndrome, http//www.ebook whole seller.net.

Pathak, P.K., Tripathi, N. and Subramaniam, S.V. (2014) Secular trends in menarcheal age in India- Evidence from the Indian Human Development Survey, *PLoS ONE*, 9(11):e111027.

Pauala, K and Braveman M.D. (2007) Premenstrual syndrome and premenstrual dysphoric disorder, *Journal of Paediatric and Adolescent Gyneacology*, 20:3-12.

Pawar, P. A. and Dhanvijay, V.P. (2007) Weaning foods: An overview. Beverage Food World, 34(11): 27-33.

Pearlstein, T.B., Bachman, G.A, Zacur, H.A. and Yonkers, K.A. (2012) Treatment of Premenstrual dysphonic disorder with a new dnospirenone – containing oral contraceptive formulation, *Contraception,* 72,(41): 4-21.

Pearlstein, T.B. and Steiner. M. (2008) Premenstrual dysphoric disorder; burden of illness and treatment update, J.*Psychiatry neuro sc,* 33:291-301.

Perkonigg, A., Yankers, K., P., Fister, H., Lieb, R. and Wittehen, H.U. (2014) Risk factors for premenstrual dysphoric disorder in a community sample of young women: The role of traumatic events and posttraumatic stress disorder .J. clin psychiatry, 65:1314-22.

Perz, J. and Ussher, J.M. (2013) Women's experience on Premenstrual Syndrome; a case of silencing the self , *J Report and inf psy,* 24(4);289-303.

Piggot, J.R. (1988) Sensory analysis of foods, I Edition, Elsevier Science Publishers Ltd.,152.

Pinar, G., Colak, M. and Oksuz, E. (2011) Premenstrual syndrome in Turukish college students and its effects on life quality, *Sex Reprod Health*, 2:21-27.

Pitman, D. (2016) Nutrition's role in premenstrual syndrome- learn about this disorder and the role of genetics, envIronment and diet may play in its onset, *Today's dietician*, 18(3)50-62.

Potter, J., Bouyer, J., Trussell, J. and Moreau, C. (2009) Premenstrual syndrome prevalence and fluctuation over time: Results from a French population based survey. *J. Womens Health*, *18*, 31–39.

Quaranta ,S., Buscaglia, M.A. and Meroni, M.G. (2007) Pilot study of the efficacy and safety of a modified-release Magnesium (250 mg tablet) (Sincromag) for the treatment of premenstrual syndrome.*Clin Drug Investig*, 27(1):51–58.

Rakhshaee, Z. (2011) Effect of three yoga poses (cobra, cat and fish poses) in women with primary dysmenorrhea: A randomized clinical trial. *J. Pediatr. Adolesc. Gynecol.*, *24*, 192–196.

Ramachandran, P., (2017), Health and nutrition in adolescents and young women: preparing for the next generation, *Indian J Med Res*, 12:129.

Raman, S.A. (2008) Women's education, Encyclopedia of India, 4(9): 235-39.

Rani, K., Tiwari, S.C., Singh .U., Singh, I. and Srivastuva, N. (2012) Yoga Nidra as a complementary treatment of anxiety and depressive symptoms in patients with menstrual disorder, Int .J. of Yoga, 5(1) : 52-56.

Rani, M., Singh, U., Agrawal, G.G., Natu, S.M., Kala, S., Ghildiyal, A. and Srivastava,N. (2013) Impact of Yoga Nidra on menstrual abnormalities in females of reproductive age. *J. Altern. Complement. Med.*, 9, 925–299.

Rao, K.M., Balakrishna, N, Arlappa, A., Laxmiah, A and Brahmam.G.N.V.(2015) Diet and Nutritional status of women in India, *J Hum. Ecol*., 29(3):165-170.

Rao, S.M. and Muralikrishna, G. (2001) Nonstarch polysaccharides and bound phenolic acids from native and malted finger millet (Ragi, *Eleusine coracana*, Indaf-15). Food Chem., 72: 187-192.

Rapkin, A.J. and Mikacieh, J.A. (2013) Premenstrual dysphasic disorder and severe premenstrual syndrome in adolescent, *Predict Drugs*, 15(3):191-202.

Rapkin, A.J., Tsao, J.C.I., Turk, N., Anderson, M. and Zeltzer, L.K. (2006) Relationships among self-rated Tanner staging, hormones, and psychosocial factors in health female adolescents.*J Pediatr Adolesc Gynecol*., 9:181–7.

Razaee, H., Mazaheri1, M.A. and Sadrhashemi1, F. (2017) Premenstrual syndrome and spousal social support among women in isfahan city (Iran), *Global Jnl of Health Sci.,* 9(4): 2017.

Razaee, H., Mahamed, F. and Mazaneri, M.A. (2015) Does spousal support can reduce women's PMS symptom? *Global Jnl. of health Sci.,* 8(5): 19.

Reid RL. (2012) When should surgical treatment be considered for premenstrual of silencing the self, *Jnl. of Reprod. and infant Psychology*, 24(4):289-303.

Rey, E., Garcia-Alonso, M.O., Moreno-Ortega, M., Al-varez-Sanchez, A. and Diaz-Rubio, M. (2008) Determinants of quality of life in irritable bowel syndrome, *Jnl of Clinic Gastroenterology*, 42, 1003-1039.

Rosenberg, M. (1965), Society and the adolescent self- image, Princeton, *N.J*: Princeton university press, London.

Rosenfield, R., Livne, D., Nevo.O., Dayan ,L., Milloul, V. and Lavi, S. (2008) Hormonal and Volume dysregulation in women with premenstrual syndrome, *Jnl. of Hypertension,*51(4):1225-30.

Sakuma, Y., Sasakiotomaru, A., Ishida, S., Kanoya, Y., Arakawa, C., Mochizuki, Y., Seiishi, Y. and Sato, C. (2012) Effect of a home based simple yoga program in childcare workers: A randomized controlled trial. *J. Altern. Complement. Med.*, *18*, 769–776.

Salamat, S., Ismail, K.M. and O' Brien, P.S. (2012) Premenstrual syndrome, *Obstetrics and Gyneacology and reproductive medicine,* 2(2): 29-32.

Samadi, Z., Taghian, F. and Valiani, M. (2013) The effects of eight weeks of regular aerobic exercise on the symptoms of premenstrual syndrome in nonathlete girls. *Iran. J. Nurs. Midwifery Res.*, *18*, 14–19.

Samia, T., Bikis,A., Zahid, A., Wajeena, T. and Rizwana, D. (2005) Premenstrual Symdrome : Frequency and security in Young College girls, *Journal of Pakistan Medical Association*, 5(12):546-49.

Sarkar, A., Mandal, R., and Ghorai, S. (2015) Premenstrual syndrome among adolescent girl students in rural school of West Bengal, India, *Int. Jnl. Med. Sci Public Health*, 1:205-10.

Sayegh, R., Schiff, I., Wurtman, I., Spires, P, M.C., Dermott, J. and Wurtman ,R. (2005) The effect of carbohydrate –rich beverage on mood, appetite and cognitive function in women with premenstrual syndrome , *Obstect and Gynecel ,* 86(4):520-28.

Schulman, L.P. (2010) Gynaecological management of premenstrual symptoms, *Current Pain and Headache Reports*, 14, 367 75.

Sharif, M.K., Butt. M.S., Arjun. F.M. and Nawaz, H. (2009) Preparation of fibre and manual enriched defatted rice bran supplemented cookies, *Pak J.Nutr.,* 8:571-77.

Sharma, P. and Gujral, H.S. (2011) Cookies making behaviour of wheat barley flour blends and effects on antioxidant properties, *Jnl Food Science and technology*, 55 : 301-07.

Simanek, A.M., Cheng, C., Yolken, R, Uddin, M., Galea, S and Aiello, A.E. (2014) herpersviruses, inflammatory markers and incident depression in a longitudinal study of detroit residents, *Psychoneruoendocrinology*, 50:139-48.

Singh, P., Kumari, S, Kaur, H., Swami, M and Soni, A, (2015) Cross sectional identification of PMS and PMDD among college students: A preliminary study, *Indian Journal of Priv Psychiatry,* 9: 21-27.

Smith, S.S., Ruderman, Y., Frey, C., Homanics, G and Yuan, M. (2005) Steroid withdrawal in the mouse results in anxiogenics effects of 3alpha, 5beta-THP: a possible model of premenstrual dysphonic disorder, *Psychopharmacology,* 29:1-11.

Soares, C.N., Cohen, L.S., Otto, M.W. and Harlow, B.L. (2011) Characteristics of women with Premenstrual Dysphonic Disorder (PMDD) who did or did not report history of depression: A preliminary report from the Harward: study of moods and cycles. Journal of women's Health Gender - Based Medicine, 10:873-878. doi:10.1089/152460901 753285778.

Spielberger, C. D. And Sydeman, S.J. (1994) Assessment of emotional states and personality traits: measuring psychological vital.

Steiner, M. and Peer, M. (2011) The Premenstrual symptoms screening tool revised for adolescents (PSST-a): Prevalence of severe PMS and premenstrual dysphoric disorder in adolescents, *Arch Womens Ment Health*,14(1):77–81.

Steiner, M. (2010) Premenstrual syndrome and premenstrual dysphoric disorder: guidelines for management. *J Psychiatry Neurosci*., 25(5):459–68.

Steiner, M, Macdougall, M. and Brown, T. (2003) The Premenstrual symptoms screening tool (PSST) for clinical ' *Archives of women's mental Health,* 6(3),132.

Stipanuk, M.H. (2006) Biochemical, physiological and molecular aspects of humannutrition, 2nd Ed. St Louis, MO: Saunders, Elsevier Inc: 241.

Strine. T.W., Champ. O.P. and Ahluwalia, I.B. (2003) Premenstrual Syndrome, students, Nutr Res Prac., 3(4):309-14.

Suba, G. (2008) Bio availability of Iron a matter of serious concern, *Health Action, 20*(3): 22-23.

Sutariya, S., Talsania, N, Shah,C. and Patel, M.A (2011) An interventional study (Calcium supplementation and health education) on premenstrual syndrome- Effect on premenstrual and menstrual symptoms, *Jnl. of Community Medicine*, 2(1):100-04.

Takeda, T.I., Tasaka, K., Sakata, M. and Murata, Y (2006) Prevalence of Premenstrual Syndrome and Premenstrual Dysphoric Disorder in Japanese women.*Arch. Women's Ment. Health*, *9*, 209–212.

Tamang, L., Black, K., Raynes-Greenow, C. and Mc Geechan, K. (2014) Factors associated with contraception use among young people in the Kathmandu Valley. *Sexual and Reproductive Health Journal,* 3:42-49.

Tamilselvi, K. (2012) Premenstrual Syndrome of adolescent girls in Cuddalore District, Tamilnadu, *Int. Jnl. of Sco. Sci. Tom.*, 1(7): 1-6.

Tarafeder, T., Rashid, T. and Sultan, P. (2012) Reproductive health care services in Bangladesh: A case study of beliefs and attitudes of Indigenous women- Proceedings of the Australia and New Zealand Regional Science Association International (ANZRSAI) Conference, University of Wollongong, pp. 283-295.

Tehrani, F.R., Simbar, M., Tohidi, M., Hasseinpanah, F and Azizi,F. (2012) Prevalence of Polycystic ovary Syndrome in a community sample in Iranian Population: Iranian PCOS prevalence study, *Reprod. Biol. Endocrinol*., 9:39.

Temple, S. (2011) Premenstrual Syndrome in work place, an Occupational health Nurse's guide to premenstruan syndrome, *AAOHNJ,* 49(2):72-73.

Thys-Jacobs, Starkey, P., Bernstein, D. and Tian, J. (2005) The premenstrual syndrome study group: Calcium Carbonate and the premenstrual syndrome: Effects on premenstrual and menstrual symptoms. *Am J obstet Gynecol*, 179:444-452

Thys-Jacobs, S. (2000) Micronutrients in the premenstrual syndrome the case for Calcium, *J Am Coll Nutr*,19(2).220-7.

Thys-Jacobs, S., Alvir, J.M.J. and Fratarcangelo, P. (1995) Premenstrual syndrome management, *Psychopharmacology,* 31:389-96.

Tolossa, F.W. and Bakele, M.L. (2014) Prevalence, imports and medical managements of premenstrual syndrome among female students: cross-sectional study in college of health sciences, Mekelle University, Mekelle, North Ethiopia , *BMC Women's Health*, 14(52) : 102-18.

Tonick S. and Muneyyirci-Delale, O. (2016) Magnesium in women's health and gynaecology, *Open Jnl. of Obst. And Gynaecol*., 6, 325-33.

Treloar, S.A. A.C. and Martin, M.G. (2002) Health, Genetic and envIronmental influences on premenstrual symptoms in an Australian twin sample. Psychological medicine, 32(1): 25-38.

Tsai, S.Y. (2016) Effect of yoga exercise on premenstrual symptoms among female employees in Taiwan*, Int .J. envIron-Res. Public Health*, 721-32.

Ussher, J.M. and Perz, J. (2016) Managing the monstrous famine: regulating the reproductive body, Social Theory and Health, 2(1): 254-72.

Ussher, J.M. and Perz, J. (2013) PMS as a process of negotiation: Women's experience and management of premenstrual distress. *Psycho health,* 28(8):909-27.

Van- Die, M.D, Burger, H.G., Teede, H.J. and Bone K.M. (2013) Vitexagus castus extracts for female reproductive disorder ; A systemic review of clinical trials, *Plunta Med,*79(7);562-75.

Varley, H. (2005) Practical Clinical Biochemistry, IV Edition, CBS Pub. and Dist. Pvt. Ltd. London.

Vijykumar .M., Chappalwar, D., Bobde, P. H., and. John, S. M. (2013) "Quality characteristics of cookies prepared from oats and finger millet based composite flour", *Inter. Jnl of Engg Sci and Techno*, 3 (4):2250-3498,

Walker A, De Souza MC and Marakis G. (2013) Unexpected benefit of sorbitol placebo in Mg intervention study of premenstrual symptoms: implications for choice of placebo in RCTs. *Med Hypotheses*.: 58(3):213–220.

Warner, S. (2010) Referral for menstrual problems: Cross sectional survey of symptoms, reasons for referral and management, *British Medical Journal,* 32(3):31-34.

Weigley, E.S., Mueller,D.H. and Robinson. C.H. (2014) Basic Nutrition and Diet therapy, VII edition, Pearlson Publishers Ltd. London, 1061.

Whelan, A.M., Jurgens T.M. and Naylor, H. (2009) Herbs, Vitamins and Minerals in the treatment of Premenstrual Syndrome: A Systematic review, *Can J clin pharmacol,* 16 (3), 407- 29.

Whelan, E.A., Sundler, D.R. and Root, J.L. (1994) Menstrual cycle pattern and risk of breast cancer, *Am J Epidermal*, 140(1) : 1081-90.

WHO (2015) State of inequality – Reproductiv,e mental,newborn and child health, WHO Report, Switzerland.

WHO (2012).*Reproductive Health*.WHO Press, Geneva, 2-35.

WHO (2010) Global Recommendations on physical activity for health. WHO Press, Geneva, 1-60.

WHO (2010) Equity, social determinants and public health programmes,WHO press, Geneva: 1-48.

WHO (2008) National level monitoring of the achievement of universal access to reproductive health: conceptual and practical considerations and related indicators report of a WHO/UNFPA Technical Consultation, Geneva.

WHO, (2000) The Asia-Pacific perspective: redefining obesity and its treatment, Health Communications Australia: Melbourne .ISBN 0-9577082-1-1.

Windmair, E.P., Riff, H. and Strang.K.T. (2011) Human Physiology, The mechanism of body function, XII Ed, Mc. Graw-Hill Pub., New yark, 612.

Wittchen, H.U., Becker, E., Lieb, R. and Krause, P. (2010) Prevalence, incidence and stability of premenstrual dysphoric disorder in the community. *Psychological Medicine*, 32, 119-132.

Wong, L.P. and Koo, E.M. (2010) Dysmenorrhoea in a nuetiethinic population of adolescent Asian girls, *Int.I Gynaecol Obstet*, 108(1) : 39-42.

Wren, A.A., Wright, M.A., Carson, J.W. and Keefe, F.J. (2011) Yoga for persistent pain: New findings and directions for an ancient practice. *Pain*, *152*, 477–480.

Wyatt, K., Dimmock, D. and Jones,P. (2001) Efficiency of Progesterone and progesterone in management of premenstrual syndrome ; Systemic review, *BMJ* , 323 :776-80.

Yadav, K. and Krishnan, A. (2008) Changing patterns of diet, physical activity and obesity among urban, rural and slum population in India, Social Welfare, 6(2):36.

Yan H.W, Shou Q. L, Rong C and Walton M. B. (2011) Pattern of moderate-to-severe symptoms of premenstrual syndrome in a selected hospital in China, *The Journal of obstetrics and gynaecology Research*, 8:159.

Yehuda, S. and Mostofsky, D. (2010) Iron Deficiency and Overload: From Basic Biology to Clinical Medicine. II ed, NJ: Humana Press; Totowa, 192-93.

Yonkers, K.A., Pearlstein, T.B. and Gotman,N (2013) A pilot study to compare fluoxeine, Calcium and placebo in the treatment of PMS, *J clin psychopharmacol.,* 33:614-20.

Yonkers, K.A., O'Brien, P.S. and Erikisson, E. (2008) Premenstrual syndrome, *The Lancet*, 37(9619):1200-10.

Yonkers, K.A., Pearlstein, T. and Rosenheck, R.A. (2003) Premenstrual disorders: bridging research and clinical reality.*Arch Womens Ment Health*,6(4):287–92.

You, J.S. and Chang, K. (2009) Evaluation of eight week body weight control programme including sea tangle supplementation in Korean female college students, *Nutr Res Prac.*, 3(4):309-14.

Younas, A., Bhatti, M.S., Ahmed,A. and Randhawa, M.A. (2011) Effect of rice bran supplementation on cookie baking quality, *Pak J AgriSci*,;48(2) 129-134.

Ziba, T. Maryam, S., Mohummad, A. and Abbas, M. (2008) The Effect of Premenstrual syndrome on quality of life in Adolescent Girls, *Iran Journal of Psychiatry*, 3:105-199.

Online references

1. ACOG (2011)Frequently asked questions FAQ 05, Gynaecologic problems and PMS, (htpp//www.acog.org).
2. ACOG (2014) Desktop site FAQ, Gynaecologic problems and PMS, *Practice Bulletin No. 15*, Washington, DC: (htpp//www.acog.org).
3. Britannica online Encyclopedia, Premenstrual Syndrome, EiJe://G:\Premenstraul Syndrome Britannica online Encyclopedia.htm 2008; 1-4.
4. Casper, R.F. (2016) Patient Education: Premenstrual syndrome (PMS) and Premenstrual Dysphonic disorder (PMDD) (beyond the basics). www.update .com.
5. Indian literacy (2009) www.ilphyd.compress trust of India, 2008.
6. India Year Book (2014) Life Insurance Corporation of India, http://www.nasi.org.in
7. Mac Leord N (2016) PMS and PMS types, (http://www.menstruation.com. Acc/ period pages / PMS types).
8. U.S. Department of Health and Human Services, National Women's Health Information Center, (2008) Womenshealth.gov. Premenstrual Syndrome, www.4woman.gov/faq/pms.htm. Accessed April 7,.
9. USDA, NRCS. (2011) The Plants Database (http://plants.usda.gov, 19 April 2011), National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
10. WHO(2013) Growth reference study, (MGRS) www.who.int/growth .ref./mgrs/en.

Web searches:

(www.mum.org/menarche.htm).

http://jeanharler.org.arr.com

http://jeanharler.org.arr.com

(www.f&sc.che.umn.edu/pf/out reach/ faculty - outreach/ nutrinet/)

(www.ilphyd.com)

(www.food sc. Che.Umn. Edu/pf/out- reach/faculty outreach/nutrient)

www.ncib.nlm.nih.gov/pulmed/17299495

www.mum.org/menarche.htm

(htpp://jeanharler.org.ass.com)

APPENDIX - I

ACOG Diagnostic Criteria for PMS

Patient reports at least one of each of the following affective and somatic symptoms during the 5 days before menses.

Symptoms must appear in three consecutive menstrual cycles:

Affective : Depression, angry outbursts, irritability, anxiety, confusion, social withdrawal

Somatic : Breast tenderness, abdominal bloating, headache, swelling of extremities

Symptoms must also meet the following criteria:

- Be relieved within 4 days of the onset of menses, without recurrence until at least cycle day 13
- Be present in the absence of any pharmacologic therapy, hormone ingestion, or drug or alcohol use
- Be causing identifiable dysfunction in social or economic Performance
- Occur reproducibly during two cycles of prospective recording

APPENDIX - II

Questionnaire for the Phase-II

Instruction to the respondent: The questionnaire is constructed to gather the general information on the family, dietary habits, medical history of the respondents related to my study. Kindly fill in the needed details accurately and put a tick in appropriate options.

Request: The investigator is thankful to the respondents for sparing their precious time for filling the questionnaire. Parts I,II,III, IV and V can be handed over immediately and part VI alone may need 2 months to fill. I assure you that the details furnished by you will be kept confidentially.

Part I - Demographic characteristics

1. Name :
2. Age :
3. Sex :
4. Address :
5. Area : rural/ urban/ semi urban / metro
6. Marital status : married/ unmarried / widow / separated
7. Family type : joint / nuclear / extended / broken
8. Family size : 2-3 / 4-5 / > 5 members
9. Education : primary / secondary / higher secondary / UG / PG / others
10. Occupation : government / private / student / business / unemployed
11. Nature of job : coolie / clerical / professional / scholarly / administrative
12. Father's education : primary / secondary / higher secondary / UG / PG / others
13. Mother's education : primary / secondary / higher secondary / UG / PG / others
14. Husband's education : primary / secondary / higher secondary / UG / PG / others
15. Occupation of father : government / private / business / unemployed
16. Occupation of mother : government / private / business / unemployed
17. Occupation of husband : government / private / business / unemployed
18. Total income of the family :
    a. <10000 b.1001 – 20000 c.2001 – 30000 d.> 30000
19. Your income :
20. House : own / rented
21. No. of children : (if applicable) one / two / three / > 3 / none

Part II - Dietary habits

1. Dietary habits : vegan / lactovegetarian/nonvegetarian/ova vegetarian
2. Skipping meals : daily/ frequently / occasionally / not at all
3. Intake of fast food : daily/ frequently / occasionally / not at all
4. Intake of fried foods : daily/ frequently / occasionally / not at all
5. Intake of coffee/ tea : >5 / 5-4 /2-3 / 1-2/ none
6. Intake of milk& its products : 350 ml./ 200-350 ml. / 100-200 ml. / < 100 ml. / no
7. Intake of water / liquid : <1 l/ 1-1.5 l/ 1.5 – 2l / > 2l
8. Intake of fruits : < 100g / 100-200g/ no per day
9. Intake of green leafy vegetables : < 100g / 100-200g/ no per day
10. Intake of other vegetables : < 100g / 100-200g/ no per day
11. Frequency of intake of carbonated beverages: > 3 times a day/ once a day/ occassionally/ rarely
12. Monthly usage of cooking oil for total family : _____liters
13. Type of oil used for cooking (please specify even if it is more than one type:

    _____

14. Do you use saturated fat like dalda, ghee, vanaspathi? Yes/ no. If yes _____liters/ month.

Part –II A

Foods taken in special days

Food item taken	Special days	Reason

Part-II B

Foods taken and avoided during menarche

Food item taken	Reason	Avoided	Reason

Part-II C

Foods taken and avoided during menstrual cycle

Food item taken	Reason	Avoided	Reason

Part III - Medical history

1. Age at menarche:
2. Menstrual cycle : 26 days/ 28 days/ 30 days/ irregular
3. Irregularity in periods: yes / no
4. Duration of periods : 3 /5 /7 / > 7 days
5. Health problems related to related to menstrual cycle (specify):
6. Are you under medication?
7. If yes, how long? Why?
8. Do you know what pre menstrual syndrome is? yes/ no
9. What is the source of your knowledge on PMS?

   a. Family members b. Friends c.Books/ magazine d.Internet

   e.Tv and mass media f.Any others (please specify)

Part IV A - Anthropometric assessment

1. Height
2. Weight
3. Waist hip ratio
4. BMI

Part-IV B- clinical Assessment

HAEMOGLOBIN LEVEL:

PART – V

KNOWLEDGE ON PREMENSTRUAL SYNDROME

Kindly encircle the answer which you feel correct.

1. Premenstrual syndrome is a

a. Disease b. Health problem c. Mental disturbance d. Group of symptoms

2. It is due to

a. Disease b. Change in body temperature c. Hormonal change d. Depression

3. It occurs

a. Before menstruation b. After menstruation

c. During menstruation d. After menopause

4. It Occurs in the age group of

a. 18-25 b. 25-30 c. 35-45 d. Any time in reproductive age

5. Symptoms of PMS include _____ symptoms

a. Physical b. Mental c. Social d. All the above

6. The PMS symptoms disappear by

a. Starting of menstruation b. End of menstruation

c. Middle of menstruation d. do not know

7. In severe condition it may

a. Affect regular activity b. Irritating

c. Not affect activity d. do not know

8. PMS is aggravated by

a. Stress b. Smoking c. Alcohol d. All the above

9. There is a tendency to take more

a. Junk foods b. Milk c. Water d. Fibrous fruits

10. Common measures to overcome PMS

a. Exercise b. Calcium supplement c. Vitamin E d. All

Part-VI

STATE TRAIT INVENTORY-1

Instructions: A number if statements which people have used to describe themselves are given below. Read each statement and then tick the appropriate response to the right statement and then tick to indicate how you feel right now, that is how you feel at the moment. There are no right or or wrong answers. This is just to find out how you feel **at present.**

Sno	Statement	Not at all	Some what	Moderately	Very much
1.	I feel calm				
2.	I feel secure				
3.	I feel tense				
4.	Iam regretful				
5.	I feel ease				
6.	I feel upset				
7.	I am presently worrying over possible misfortunes				
8.	I feel rested				
9.	I feel anxious				
10.	I feel comfortable				
11.	I feel self- confident				
12.	I feel nervous				
13.	I am jittery				
14.	I feel “high-strung”				
15.	I am relaxed				
16.	I feel content				
17.	I am worried				
18.	I feel over excited and rattled				
19.	I feel joyful				
20.	I feel pleasant				

STATE TRAIT INVENTORY-II

INSTRUCTIONS: Instructions: A number if statements which people have used to describe themselves are given below. Read each statement and then tick the appropriate response to the right statement and then tick to indicate how you feel right now, that is how you feel at the moment. There are no right or or wrong answers. This is just to find out how you **feel at generally.**

Sno	Statement	Not at all	Some what	Moder ately	Very much
1.	I feel pleasant				
2.	I tire quickly				
3.	I feel like crying				
4.	I wish I could be as happy as others seem to be				
5.	I am losing out on things because I cannot make-up my mind soon enough				
6.	I feel rested				
7.	I feel calm, cool and collected				
8.	I feel that difficulties are piling up so that I cannot overcome them				
9.	I worry too much over something that really does not matter				
10.	I am happy				
11.	I am inclined to take things hard				
12.	I lack self- confidence				
13.	I feel secure				
14.	I try to avoid facing a crisis or difficulty				
15.	I feel blue				
16.	I am content				
17.	Some unimportant thoughts run through my mind and bothers me				
18.	I take disappointment so keenly that I cannot put them out of my mind				
19.	I am a steady person				
20.	I get into a state of tension or turmoil as I think over my recent concern and interests				

ROGENBERG'S INVENTORY

INSTRUCTIONS: The following statements describe how you feel about yourself. Please record the appropriate answer for each item depending on whether you strongly agree, agree, disagree or strongly disagree with the statements by making a tick mark on the appropriate box.

S.No	Statements	Strongly disagree	Disagree	Agree	Strongly agree
1.	On the whole I am satisfied with myself				
2.	At times I think I am not good at all				
3.	I feel that I have a number of good qualities				
4.	I am able to do things as well as most other people				
5.	I feel I do not have much to be proud of				
6.	I certainly feel useless at times				
7.	I feel that I am a person of worth				
8.	I wish I could have more respect for myself				
9.	All in all, I am inclined to think I am a failure				
10.	I take a positive attitude towards myself				

பாரதியாதிகுரிய அறிவுறுத்தல்:

இவ்வினாவளியினை தங்களைபற்றி பற்றிய விபரம் வினவுபவர்களுக்கு பூர்த்தி செய்வதற்காக வடிவமைக்கப்பட்டுள்ளது. இதில் குடும்ப விபரம்,உறவுமுறை பழக்கம், உடல் நலம், பொருளாதார வசதிகளை உள்ளடக்கம். தயவுசெய்து தெளிவாகவும் விபரமாகவும் அதற்குரிய இடங்களில் நிரப்புமாறு வேண்டிக்கொள்கின்றோம்.

வேண்டுகோள்:தங்களை பற்றிய முழுமை இதழால் பூரித்து விளக்குவதற்கு நன்றாக வினவுவதுகொள்கின்றோம். இதில் 5 பகுதிகள் உள்ளன. முதல் நான்கு பகுதிகளும் இப்பொழுது பூரித்துவிடவும். பகுதி 5 மட்டும் 2 மாதங்களில் அவகாசத்தில் பூரித்துவிடவும்.

குறிப்பு: தங்களுடைய சரியான விபரங்களுடன் இரகசியமாக வைக்கப்படும் என *உறுதியளிக்கின்றோம் .*

பகுதி-I

1. பெயர் :
2. முகவரி :
3. இனம்/பால் : ஆண்/பெண்
4. வயது :
5. இடம் :சைவம்/நைவ/நடுத்தர சைவம்/பெண்ணர் நைவ
6. திருமண நிலை : திருமணமாகஆண்/ஆகாதவர்/விதவை/
பிரிந்து வாழ்பவர்
7. குடும்ப வகை :ஊட்டு/தனி/விரிவுபட்ட/ பிரிந்தகுடும்பம்
8. குடும்ப அளவு : சிறிய/பெரிய/நடுத்தரகுடும்பம்.
9. கல்வித் தகுதி : படிக்காத/உயர்நிலை படிக்காத/கல்லூரி/முதுகலை
பட்டதாரி
10. வேலைவாய்ப்பு தகுதி : அரசு வேலை/தனியார்/வேலைவாய்ப்பில்லை
11. வேலை வகை : ஆசிரியர்/அலுவலர்/தலைமைஆசி/பணியாளர்
12. தொழில்நுட்ப கல்வி தகுதி : படிக்காத/உயர்நிலை படிக்காத/கல்லூரி/

(யாரைவேண்டுமானாலும்) முதன்மையான/அதற்குமேலான

1. தாயின் கல்வித்தகுதி :பள்ளி/கல்லூரி/பள்ளி உயர்நிலை/
முதன்மையான அதற்குமேலான/

2. வேலைவாய்ப்பு கல்வித்தகுதி /கல்லூரி/பள்ளி உயர்நிலை/பள்ளி :
(யாவரும்நிறைவுசெய்தல்வேண்டும்) முதன்மையான/அதற்குமேலான

3. தகப்பனாரின் வேலை வாய்ப்பு : அரசு/வெளிநிறுவன ஓய்வு பெற்ற/தனியார்/
வேலை இல்லாதவர்

4. தாயாரின் வேலை வாய்ப்பு: அரசு/வெளிநிறுவன ஓய்வு பெற்ற/தனியார்/
வேலை இல்லாதவர்

5. வேலைவாய்ப்பு வேலை வாய்ப்பு : அரசு/வெளிநிறுவன ஓய்வு பெற்ற/தனியார்/
வேலை இல்லாதவர்

6. குடும்ப வருமானம் _____ ரூ மாதம் :
(அ) <10,000 (ஆ)10,001-20,000 (இ)20,001-
30,000 (ஈ)>30,000

7. தினசரி வருமானம் _____ரூ :

8. குழந்தைகளின் எண்ணிக்கை வாய்ப்பு : 0/ 1/ 2/ <2
(எழுதவும் யாவரும்நிறைவுசெய்தல்)

9. குழந்தைகளின் வயது :

10. குழந்தைகளின் கல்வித்தகுதி :

11. வகு : யொந்த வீடு/ வீடு/ வாடகை /

பகுதி –II(உணவுப்பழக்கம்)

1. உணவு பழக்கமுறைகள் முட்டை/+அசைவம்/அரைசைவம்/சைவம் :

2. உணவு வகைவாரியான பழக்கம் : தினமும்/வாரம்பலமுறை/அடிக்கடி/
வாய்ப்பில்லாதது இல்லவேவே

3. துரித உணவு உட்கொள்ளுதல்/அடிக்கடி/வாய்ப்பில்லாதது/தினமும்:
வாய்ப்பில்லாதது இல்லவேவே

4. காய்கறிகள் ,ஈ , :>5/ 3-4/ 1-2/ 0

5. பால் மற்றும் பால் சார்ந்த பொருட்கள் உணவிலுள்ளது :

>200ml100-200ml/<100ml/உணவில்லவேவே

6. நரம் மறறும திரவ உணவு :<1 l / 1-1.5 l / 1.5-2 l / 72 l

7. பழவகைகள உடகொளளுதல : <100g/50-100g/<50g/ உணபதஇலலை

8. காயகறி வகைகள :<100g/50-100g/<50g/உணபதஇலலை

9. கீரை வகைகள :>100g/50-100g/<50g/ உணபதஇலலை

10. காரபன உளள குளிரபானஙகள உடகொளவதன வபரிய :
ஒரு நாளில பலமுறை/ஒருநாளில்ஒருமுறை/எபபொழுதாவது/அபூரவமாக

11. சமையல எணணெயை ஒரு மாதத்திறகு எவள பயன படுத்துய
அளவு:_____லிட்டர்

12. எநத வகை சமையல எணணெயை வாஙகுவரகள?
_____

13. டாலடா?உபயோகிபபரகள? அடிகடி எணணெயை மாறறுவத ,
ஆயஇலலை/

பகுத –III மருத்துவ வரலாறு

1. மாதவிடாய சுழறசி : /நாடகள்2628நாடகள்/30நாடகள்/
சீராக இலலை

2. மாதவிடாய நாடகள் : 3/5/7/<7

3. மாதவிடாய சுழறசியில வலி ஏறபடஇலலை/ஆம ?

4. ஆம எனில அதன வரிய :

5. மருத்துவரிட ஆலோசன வடடிரகள்இலலை/ஆம ?

6. மருநது உடகொளகிறரகள்?நாடகளாக எவவளவ ?

பகுத –IV

(அ) உடல அளவுகள்

1. உயரம 2. எட

3. வயறு சுறறள/ 4. BMI

பகுத -V

மாதவிடாய முன வலி ஏறபடுவத வரிய

தயவுசெது நமகள் சரி என எணணுய வரைடலில வடடெழுதவும

1. மாதவிடாய முன வலி எனபது?

(அ வலி)தாமத (ஈ) உலவுசெல மன (இ)சரவலு ஆபரா(ஆ) மறறும (
அறிகுறிகள

2. அதன காரணம?

(அதூழறறல (மாறறம வெபப உடல (ஆ)

(இ மாறறத்தால வறாரபாயம (அழுத்த மன(ஈ)

3. அது ஏற்படுவது?
முன் வினைகளுக்கு மாத(அ) பின் மாதவிலக்குகளுக்கு (ஆ)
ஒரு மாதவிலக்குகளை(இ) நான்கு பின் வினைகளுக்கு மாத (ஈ)

4. அது ஏற்படுவது ?வயதில் _____
(அ)1 -25 (ஆ)25-30 (இ)35-4 5(ஈ வேலைக்கு மாறினாலும் எப்போழுது (ம

5. அதன் அறிகுறிகள் ?கொள்ளாறுகள் _____
யாவும இவை(ஈ) ர தியான சமூக(இ)ர தியான மன(ஆ) ர தியான உடல் (அ)

6. இதன் அறிகுறிகள் மாறுவது?
முடிந்ததுடன் மாதவிலக்கு (ஆ) ஆரம்பத்துடன் மாதவிலக்கு(அ)
எதுவுமில்லாமல் (ஈ) நடுவில் மாதவிலக்கு (இ)

7. மாதவிடாய அறிகுறி தவிர்க்க இருந்தால்?
எச்சரிக்கை சிகிச்சை (ஆ) பாதுகாப்பு வேலையை தின (அ)
எதுவுமில்லாமல் (ஈ) இருக்காது பாதிப்பு (இ)

8. அதன் அறிகுறிகள் அதிகரிப்பது?
பழகுதல் புண் (ஆ) அழுத்தத்தால் மன (அ)
எல்லாவற்றாலும இவை (ஈ) அருந்துவதால் மது (இ)

9. இதனால் இதை அதிகமாக உணவை ஆசை ஏற்படும?
உணவு நார்ச்சத்து (ஈ) தவிர்க்க (இ) பால் (ஆ) உணவு தூய்த (அ)

10. மாதவிடாய்க்கு முற்றுதல் கொள்ளு இதனால் அறிகுறிகள் /
?சமாளிக்கலாம
(அ) உடற்பயிற்சி (ஆ) காய்ச்சல் மாத்திரை (இ) மருத்துவம் (ஈ)
இல்லையாவும]

Appendix – II (Part-VI)

PREMENSTRUAL DAILY SYMPTOM DIARY

NAME:_____ MONTH _____

Write the date in the first row starting with today. Circle the days of menstrual periods.
Each day rate the severity of your symptoms 1=no symptom; 2= mild ; 3=moderate and 4=severe

Date																															
Days of the month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
IRRITABILIY OR TENSION																															
ANGER /SHORT TEMPER																															
ANXIETY / NERVOUSNESS																															
DEPRESSION/SADNESS																															
CRYING / TEARFULNESS																															
RELATIONSHIP PROBLEM																															
TIERDNESS/LACK OF ENERGY																															
INSOMNIA/SLEEPLESSNESS																															
CHANGES IN SEXUAL INTEREST																															
FOOD CRAVING / OVER EATING																															
DIFFICULTY IN ONCENTRATING																															
FEELING OVERWELMED																															
HEADACHES																															
BREAST TENDERNESS AND SWELLING																															
BACK PAIN																															
ABDOMINAL PAIN																															
MUSCLE AND JOINT PAIN																															
WEIGHT GAIN																															
NAUSEA																															
OTHERS (SPECIFY)																															
OTHERS (SPECIFY)																															

Appendix - III

QUESTIONNARIE FOR PHASE-IV

OBJECTIVE: The objective of the questionnaire is to gather information on the height, weight, biochemical assessment and knowledge on Premenstrual Syndrome only. It is taken only for the PhD study purpose of the investigator. The details given by you will be kept confidential. Kindly go through the details and write the appropriate details for each question.

நோக்கம் : இந்த நோக்கம் தங்களைப் பற்றிய தகவலை மற்றும் மாதவிடாய் முற்பட்ட காலத்தில் ஏற்படும் பிரச்சனை பற்றி தங்கள் புரிதலை தெரிந்து கொள்வதே. உங்களுடைய தகவல்கள் யாவும் ரகசியமாக வைக்கப்படும். அத்துடன் அத்தகவல்கள் எனது படிப்பிற்கு மட்டுமே பயன்படுத்தப்படும் என தெரிவிக்கின்றேன்.

PART-1

1. NAME பெயர் :

2. Age வயது :

3. MARITAL STATUS திருமண விவரம் : மணமானவர்/ஆகாதவர்/விதவை/பிரிந்து வாழ்பவர்

4. NO OF CHILDREN (IF MARRIED) குழந்தைகள் (திருமணமானவராயின்):

5. EDUCATIONAL STATUS கல்வித்தகுதி:

6. பூப்பெய்திய வயது AGE AT MENARCHE :

7. DURATION OF MENSUS மாதவிடாய் நாட்கள்:

8. MENSTRUAL CYCLE DAYS மாதவிடாய் சுழற்சி நாட்கள்:

9.WORKING/NON-WORKING வேலை செய்பவர்/செய்யாதவர்

PART-II

HEIGHT

WEIGHT BMI

WAIST/HIP RATIO

PART-III BIOCHEMICAL ASSESSMENT

1. SERUM CALCIUM

2. SERUM MAGNESIUM

3. SERUM FERRITIN

4. TIBC

5. SERUM IRON

PART-IV CLINICAL ASSESSMENT-Nutrition Assessment Schedule

Serial No.	Date :
Name :	Age :
Address :	Sex :
District :	Village :

CLINICAL :

(1) General appearance	:	Normal built/Thin built/Sickly
(2) Hair	:	Normal/lack of lustre/dyspigmented/thin and sparse/easily pluckable/flag sign
(3) Face	:	Diffuse depigmentation/naso-labial dyssebacea/moon face
(4) Eyes	:	Conjunctiva – normal/dry on exposure for ½ min/dry and wrinkled/bitot's spots/ brown pigmentation/angular conjunctivitis/pale conjunctiva Cornea – normal/dryness/hazy or opaque
(5) Lips	:	Normal/angular stomatitis/cheilosis
(6) Tongue	:	Normal.pale and flabby/red and raw/fissured/geographic
(7) Teeth	:	Mottled enamel-caries/attrition
(8) Gums	:	Normal/spongy/bleeding
(9) Glands	:	Thyroid enlargement/parotid enlargement
(10) Skin	:	Normal/dry and scaly/follicular hyperkeratosis/petechiae/pellagrous dermatosis/flanky paint dermatosis/scrotal and vulval dermatosis
(11) Nails	:	Koilonychia
(12) Oedema	:	In dependent parts
(13) Rachitic changes	:	Knock-knees or bow legs/epiphyseal enlargement/beading of the ribs/ pigeon chest
(14) Internal systems	:	Hepatomegaly/psychomotor change/mental confusion/sensory loss/muscle wasting/motor weakness/loss of position sense/loss of vibration sense/loss of ankle and knee jerks/calf tenderness/cardiac enlargement/tachycardia.

PART-V DIET SURVEY

DAY	BREAKFAST		MID MORNING		LUNCH		MID LUNCH		TEA		DINNER	
	ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY	ITEM	QTY
I												
II												
III												

PART-VI

CALENDER OF PREMENSTRUAL EVENTS (COPE)

NAME:_____MONTH / YEAR _____ AGE:_____

UNIT: _____

Begin your calendar on the first day of your menstrual cycle. Enter the calendar date below the cycle day. Day 1 is your first day of bleeding. Shade the box above the cycle day if you have bleeding Put an X for spotting.

If more than one symptom is listed in a category, i.e. nausea, diarrhea, constipation, you do not need to experience all of these. Rate the most disturbing of symptoms on the 1-3 scale. Weight: Weigh yourself before breakfast. Record weight in the box below date.

Symptoms: Indicate the severity of your symptoms by using the scale below. Rate each symptom at about the same time each evening. O-none (symptom not present)
1-mild (noticeable but no troublesome) 2-moderate (interferes with normal activities)
3-severe (intolerable and unable to perform normal activities) Other symptoms: If there are other symptoms you experience, you list and indicate severity Medication: List any medication taken, put X on the corresponding day (s)

Bleeding																															
Cycle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Date																																
Weight																																
Symptoms																																
Acne																																
Bloatedness																																
Breasttenderness																																
Dizziness																																
Fatigue																																
Headache																																
Hot flashes																																
Nausea, diarrhea, constipation																																
Palpitation																																
Swelling (hands																																
ankles, breast)																																

Angry outburst, violent tendercies																															
Anxiety, nervousness, tension																															
Confusion, difficulty in concern trating																															
Crying easily																															
Depresion																															
Food craving (sweet, salt)																															
Forgetfunless																															
Irritability																															
Increased appetite																															
Mood swings																															
Over sensitive																															
Wish to be alone																															
Other symptoms 1. 2.																															
Medications 1.																															

PART-VII

BDI

Below are given twenty one items, read them carefully and encircle any one of the four alternatives given below each item. There are no right or wrong answers. Your responses will be kept confidential and are strictly meant only for research purpose.

கீழேக் கொடுக்கப்பட்டுள்ள ஏதாவதொரு விவரங்களைக் கவனமாகப் படித்து அந்தந்த விவரங்களின் கீழ் கொடுக்கப்பட்டுள்ள பதில்களில், உங்களுக்குப் பொருத்தமான ஏதாவதொன்றை தேர்ந்தெடுத்து அந்தப் பதிலுக்கு நேர் எதிரேயுள்ள எண்ணை வட்டமிடவும். இந்தப் பதில்களில் சரியான பதில் என்றோ, தவறான பதில் என்றோ எதுவும் கிடையாது.

எந்தவிதத் தயக்கமுமின்றி, வெளிப்படையாகக் கேளிவிகளுக்குப் பதில் அளிக்கவும், உங்களது பதில்கள் ரகசியமாக வைத்துக் கொள்ளப்படுவதுடன், ஆராய்ச்சி விவரங்களுக்கு மட்டும் தான் பயன்படுத்தப்படும்.

1.	**Sadness** 0) I do not feel sad 1) I feel sad 2) I am sad all the time and I can't snap out of it 3) I am so sad or unhappy that I can't stand it	வருத்தம் 0) நான் வருத்தப்படுவதில்லை 1) நான் வருத்தமாக இருக்கிறேன் 2) அ. நான் எந்நேரமும் வருத்தமாயிருக்கிறேன். என்னால் அந்நிலையிலிருந்து விடுபட முடியவில்லை. ஆ. நான் மிகவும் வருத்தமாகவும், மகிழ்ச்சியின்றியும் இருக்கிறேன் அது மிகவும் துன்பத்தை அளிக்கிறது. 3) நான் மிக வருத்தமாகவம், மகிழ்ச்சியின்றியும் இருக்கின்றேன், அதை என்னால் தாங்க முடியவில்லை.
2.	Pessimism nothing to look forward to 0) I am no particularly discouraged about the future 1) I feel discouraged about the future 2) I feel I have	2. தோல்வி மனப்பான்மை 0) எனக்குக் குறிப்பாக எதிர்காலத்தைப் பற்றித் தோல்வி மனப்பான்மையோ அல்லது நம்பிக்கையின்மையோ இல்லை 1) எதிர்காலத்தைப் பற்றி
	3) I feel that the future is hopeless and that things cannot improve	எதுவும் இல்லை. தொல்லையிலிருந்து நான் என்றாவது மீள்வேன் என்று தோன்றவில்லை. 3) எனக்கு எதிர்காலம் பயனற்றதாகவும், எந்தக் காரியங்களிலும், முன்னேற்றமிருக்காது என்றும் கருதுகிறேன்.
3.	**Sense of Failure** 0) I do not feel like a failure 1) I feel I have failed more than the average person 2) As I look back on my life, all I can see is a lot of failure 3) I feel I am complete failure as a person.	**தோல்வியுற்ற மனநிலை** 0) எனக்கு எதிலும் தோல்வியில்லை என்று நினைக்கிறேன். 1) பிறரின் சாதாரணத் தோல்விகளை விட நான் அதிகம் தோல்வி அடைந்ததாகக் கருதுகிறேன். 2) அ. நான் இதுவரை எதுவும் சொல்லக்கூடிய அளவுக்கு அல்லது குறிப்பிடத்தக்க அளவுக்கு எதையும் சாதிக்கவில்லை என்று கருதுகிறேன். ஆ.நான் என்பது வாழ்க்கையைத் திரும்பிப் பார்க்கும்போது எனக்குத் தோன்றுவனவெல்லாம் அதிகமாகத் தோல்விகள் தான்

		3) இதுவரை எனது வாழ்க்கையில் அனைத்துமே தோல்விதான் என்று கருதுகிறேன். (ஒரு தாயாகவோ, தந்தையாகவோ, மனைவியாகவோ, கணவனாகவோ)
4.	Dissatisfaction 0)U get as nycg satisfaction out of things as I used to 1) I don't enjoy things the way I used to 2) I don't get real satisfaction out of anything anymore 3) I am dissatisfied or bored with everything	**திருப்தியின்மை** 0) குறிப்பிடத்தக்க அளவுக்கு நான் திருப்தியில்லாமல் இல்லை 1) பெரும்பாலான வேளையில் நான் சலிப்பாக இருக்கிறேன். 2)அ. முன்பு அனுபவித்தது போன்று இப்போது என்னால் அனுபவிக்க முடியவில்லை ஆ. தற்போது எந்த விஷயத்திலும் என்னால் திருப்பதியடைய முடியவில்லை. 3) எல்லாவற்றிலுமே எனக்கு அதிருப்திதான்
5.	**Guilt** 0) I don't feel particularly guilty 1) I feel guilty a good part of the time 2) I feel quite guilty most of the time 3) I feel guilty all of the time	**குற்ற உணர்வு** 0) எதிலும் குறிப்பிடத்தக்க குற்ற உணர்வு இல்லை. 1) நான் பெரும்பாலான வேளையில் கெட்டவன், தகுதியற்றவன் என்று உளர்கிறேன். 2) அ. நான் மிகவும் குற்றவுணர்வு உடையவனாக இருக்கிறேன். ஆ. எந்நேரமும் கெட்டவன் தகுதியற்றவன் என்ற உணர்வோடு இருக்கிறேன். 3) நான் மிகவும் கெட்டவன், ஒரு தகுதியும் அற்றவன் என்பதைப் போன்ற உணர்வு ஏற்படுகின்றது.
6.	**Expectation of punishment** 0) I don't feel I am being punished 1) I feel I may be punished 2) I expect to be punished 3) I feel I am being punished	**தண்டனையை எதிர்பார்த்திருத்தல்** 0) நான் தண்டனை அடைவது போன்ற உணர்வு எனக்கு ஏற்படவில்லை. 1) ஏதோ ஒரு கெடுதல் ஏற்படப் போகின்றது என்ற உணர்வு ஏற்படுகின்றது. 2) ஏதோ ஒரு தண்டனையை அடைந்து கொண்டிருக்கிறேன் அல்லது அடையப்போகி என்ற உணர்வு ஏற்படுகின்றது 3) .. நான் தண்டனை அடைவதற்கு ஏற்றவன் தான் என்று உணர்கிறேன் ஆ. நான் தண்டனை அடைய வேண்டும்.
7.	**Self-Dislike** 0) I don't feel disappointed in myself 1) I am disappointed in myself 2) I am disgusted with myself 3) I hate myself	**சுய வெறுப்பு** 0) என்னைப் பற்றியே எனக்கு ஏமாற்றம் ஏதுமில்லை 1) அ. என்னைப் பற்றி நான் ஏமாற்றம் அடைகிறேன் ஆ. என்னையே நான் விரும்பவில்லை 2) என்னைப்பற்றி எண்ணங்கள் எனக்கு மனக்சஞ்சலத்தை ஏற்படுத்துகிறது. 3) என்னையே நான் வெறுக்கிறேன்.
8.	**Self-Accusations** 0) I don't feel I am ay worse than anybody else 1) I am critical of myself for my weakness or	**சுய குற்றச்சாட்டு** 0) மற்றவர்களைவிட எந்த அளவிலும் நான் மோசமானவன் என்று எண்ணுவதில்லை 1) என்னுடைய பலவீனங்கறுக்கும், தவறுகளுக்கும் என்னையே குறை கூறுகின்றேன். 2) என் தவறுகளுக்கு என் மேலேயே பழியைச்

	mistakes 2) I blame myself all the time for my faults 3) I blame myself for everything bad that happens	சுமத்திக் கொள்கிறேன். 3) என்ன கெடுதல் நடந்தாலும் அது என்னால் தான் என்று என் மேலேயே பழியைச் சுமத்திக் கொள்கிறேன்
9.	**Suicidal Thoughts (Self harm)** 0) I don't have any thoughts of killing myself 1) I have thoughts of killing myself, but I would not carry them out 2) I would like to kill myself 3) I would kill myself if I had the chance	**தற்கொலை எண்ணங்கள்** 0) எனக்கே கெடுதல் செய்து கொள்ளும் எண்ணம் எனக்கில்லை 1) எனக்கே கெடுதல் செய்து கொள்ளும் எண்ணங்கள் எனக்கிருந்ததாலும் அதை நான் செயல்படுத்த மாட்டேன் 2) அ. நான் இறந்து விட்டால் மேல் என்று தோன்றுகிறது ஆ. நான் இறந்து விட்டால் என் குடும்பம் இப்பொழுது இருப்பதை விட நன்றாக இருக்குமென்று நினைக்கிறேன் 3) அ. எனக்குத் தற்கொலை செய்து கொள்ளத் திடமான எண்ணங்கள் இருக்கின்றன. ஆ. என்னால் முடிந்தால் என்னையே கொன்று கொள்வேன்.
10.	**Crying Spells** 0) I don't cry any more than usual 1) I cry more now than I used to 2) I cry all the time now 3) I used to be able to cry, but now I can't cry even though I want to	**அழுதல்** 0) நான் சாதாரணமாக அழுவதை விட அதிகமாக இப்போது அழுவதில்லை 1)நான் சாதாரணமாக அழுவதை விட இப்போது சற்று அதிகமாக அழுகிறேன். 2) நான் தற்போது எந்நேரமும் அழுது கொண்டிருக்கிறேன். என்னால் அதை நிறுத்த முடியவில்லை 3) முன்பெல்லாம் என்னால் அழ முடியும். ஆனால் தற்போது அழ நினைத்தாலும் அழ முடிவதில்லை.
11.	**Irritability** 0) I am more irritated now than I ever am 1) I get annoyed or irritated more easily than I used to 2) I feel irritated all the time now 3) I don't get irritated at all by the things that used to irritate me	**சிடுசிடுப்பு** 0) எனக்கு எப்போதும் ஏற்படும் சிடுசிடுப்பை விட இப்பொழுது அதிகமாக சிடு சிடுப்பு ஏற்படவில்லை 1) அளவுக்கு அதிகமாக சிடுசிடுப்பும் எரிச்சலும் அடைகிறேன். 2) என்நேரமும் எனக்குச் சிடு சிடுப்பாகவே இருக்கிறது. 3) சிடுசிடுப்பு அடைய வேண்டிய விஷயங்களுக்குக் கூட இப்போது சிடுசிடுப்பு அடைவதில்லை.
12.	**Social Withdrawal** 0) I have not lost interest in other people. 1) I am less interested in other people than I used to be 2) I have lost most of my interest in other people 3) I have lost all of my interest in other people	**சமூகத் தொடர்பின்றி பின் வாங்குதல்** 0) பிறரிடமுள்ள அக்கறையை நான் இடக்கவில்லை. 1) வழக்கத்திற்கு மாறாக நான் தற்போது பிறரின் மேல் குறைந்த அளவில் அக்கறை காட்டுகிறேன். 2) எனக்கு மற்றவர் மேலுள்ள அக்கறை பெரும்பாலும் குறைந்து விட்டது. அவர்கள் பால் கொண்ட உணர்வுகள் குறைந்துவிட்டன. 3) மற்றவர்களைப் பற்றி அக்கறையே கொள்வதில்லை. மற்றவர்களைப் பற்றி

		கவலைப்படுவதுமில்லை.
13.	**Indecisiveness** 0) I make decision about as well as I ever could 1) I put off making decisions more than I used to 2) I have greater difficulty in making decisions than I used to	**தீர்மானம் செய்ய இயலாமை** 0) எப்பொழுதும் போலவே இப்பொழுதும் சுலபமாகத் தீர்மானம் செய்ய முடிகிறது. 1) தீர்மானங்கள் எடுப்பதை ஒத்திப் போட முயல்கிறேன் 2) தீர்மானங்கள் செய்ய எனக்கு மிகவும் சிரமமாக இருக்கிறது. 3) என்னால் இனிமேல் எந்த முடிவும் எடுக்க முடியாது.
14.	**Body Image Change** 0) I don't feel I look any worse than I used to 1) I am worried that I am looking old or unattractive 2) I feel that there are permanent changes in my appearance that make me look unattractive 3) I believe that I look ugly.	**உடல் தோற்றம்** 0) என் உடல் தோற்றம் முன்னை விட மோசமாக இருப்பதாக எண்ணவில்லை 1) நான் வயதானவனாகவும், கவர்சிசயற்றவனாகவும் இருப்பதாக நிகைத்துக் கவலைப்படுகிறேன். 2) எனது தோற்றத்தில் நிரந்தரமான மாற்றங்கள் இருப்பதாக உணர்கிறேன். 3) நான் விகாரமான அல்லது அருவருப்பான தோற்றத்தைக் கொண்டிருப்பதாக உணர்கிறேன்.
15.	**Work Difficulty (work Retardation)** 0) I can work about as well as before 1) It takes an extra effort to get started at doing something 2) I have to push myself very hard to do anything 3) I can't do any work at all	**வேலையில் பின் தங்குதல்** 0) முன்பு போல என்னால் வேலை செய்ய முடிகிறது. 1) அ. ஏதாவதொரு வேலை செய்யத் தோடங்க அதிக முயற்சி எடுக்க வேண்டியதாக இருக்கிறது. ஆ. முன்பு செய்ததைப் போல என்னால் இப்போது வேலை செய்ய முடியவில்லை. 2) எதையாவது ஒன்றை செய்ய நான் என்னை கட்டாயப்படுத்தி உந்த வேண்டியுள்ளது. 3) என்னால் எந்த வேலையும் செய்ய முடியவில்லை.
16.	**Sleep Disturbance**) I can work about as well as before 1) It takes an extra effort to get started at doing something 2) I have to push myself very hard to do anything 3) I can't do any work at all	**உற்சாகமின்மை** 0) என்னால் எப்பொழுதும் போலத் தூங்க முடிகிறது. 1) காலையில் தூங்கி எழும்போது எப்போதையும் விட அசதியாக இருக்கிறது. 2) எப்பொழுதையும் விட 1, 2 மணி நேரம் முன்னதாகவே எழுந்து விடுகின்றேன். அதன் பின் மீண்டும் உறங்க முடியவில்லை. 3) நான் மிகவும் அதிகாலையில் எழுந்து விடுகின்றேன். என்னால் 5மணி நேரத்திற்கு மேல் தூங்க முடிவதில்லை.
17.	**Fatigability** 0) I don't get more tired than usual 1) I get tired more easily than I used to	**அசதியடைதல்** 0) எப்பொழுதையும் விட இப்பொழுது அதிகமாக அசதி அடைவதில்லை 1) நான் எப்பொழுதையும் விட இப்பொழுது மிக எளிதில் அசதி அடைகிறேன்

	2) I get tired from doing almost anything 3) I am too tired to do anything	2) நான் எந்தச் செயலைச் செய்தாலும் அசதி அடைகிறேன் 3) எதையும் செய்ய முடியாமல் மிகவும் அசதி அடைகிறேன்.
18.	**Anorexia** 0) My appetite is no worse than usual 1) My appetite is not as good as it used to be 2) My appetite is much worse now 3) I have no appetite at all anymore	**பசியின்மை** 0) பசி எப்பொழுதும் போலவே இப்பொழுதும் ஏற்படுகிறது 1) முன்பு போல் பசி நன்றாக இருப்பதில்லை 2) தற்போது பெரும்பாலும் பசி எடுப்பதில்லை 3) இப்பொதெல்லாம் எனக்குப் பசியே எடுப்பதில்லை
19.	**Weight Loss** 0) I haven't lost much weight, if any, lately 1) I have lost more than 5 kilos 2) I have lost more than 10 kilos 3) I have lost more than 15 kilos	**எடை குறைதல்** 0) சமீபத்தில் என் எடை ஏதும் குறையவில்லை 1) 5 கிலோ எடைக்குமேல் குறைந்திருக்கிறேன் 2) 10 கிலோ எடைக்கு மேல் குறைந்திருக்கிறேன் 3) 15 கிலோ எடைக்கு மேல் குறைந்திருக்கிறேன்
20.	**Somatic Preoccupation** 0) I am no more worried about my health than usual 1) I am worried about physical problems such as aches and pains, or upset stomach or constitpation 2) I am very worried about physical problems and it is hard to think o much else 3) I am so worried about my physical problems, that I cannot think about anything else.	**உடல் நிலைப் பற்றிய எண்ணங்கள்** 0) நான் எப்பொழுதையும் விட என் உடல் நலத்தைப் பற்றி அதிகம் கவலைப்படுவதில்லை. 1) நான் உடல்வலி, வயிற்றுக்கோளாறு, மலச்சிக்கல் ஆகியவை பற்றிக் கவலைப்படுகிறேன். 2) நான் உடல்நிலையைப் பற்றியே நினைத்துக் கொண்டிருப்பதால் மற்றவற்றைப் பற்றி நினைக்க முடிவதில்லை. 3) நான் முழுமையாக உடல் நிலை பற்றியே எந்நேரமும் ஆழ்ந்த சிந்தனையில் இருக்கிறேன்.
21.	**Loss of Libido** 0) I have not noticed any recent change in my interest In sex 1) I am less interested in sex than I used to be 2) I am much less interested in sex now 3) I have lost interest in sex completely	**பால் உணர்ச்சி இழப்பு** 0) என்னுடைய பாலுணர்வு அக்கறையில் எனக்குச் சமீபத்தில் எந்த மாறுதலும் இல்லை 1) முன்பை விட பாலுணர்வில் சிறிதளவு அக்கறை குறைந்து விட்டது. 2) எனக்கு பாலுணர்வில் உள்ள அக்கறை பெரும்பாலும் குறைந்து விட்டது. 3) எனக்குப் பாலுணர்வில் அக்கறை அறவே இல்லை.

PART VII - Questionnaire - Knowledge on Premenstrual syndrome

1. Have heard of the term PMS
   a. Yes b. No
2. PMS means symptom occurring
   a. Before periodsb. After periods c. During periods d. Always
3. Symptoms of PMS include _____ disturbance.
   a. Physical b. Social c. Emotional d. All
4. The hormone linked to PMS is
   a. oestrogen b. Progesterone c. Insulin d. TSH
5. Common symptoms noted in PMS
   a. fluid retention b. Diahorrea c. Giddiness d. Vomiting
6. Most of the women experience PMS between _____ days of menstrual cycle
   a. 7-14 b. 9-10 c. 3-5 d. 20-25
7. Prevalence of PMS commonly reported is
   a. 80% b. 30% c. 60% d. 100%
8. Age group affected by PMS is
   a. 15-20yrs b. 20-40 yrs c. 40-45 yrs d. All age
9. PMS occurs in which stage of menstrual periods
   a. Ovulation b. Fertilization c. Luteal d. All stages
10. Very common physiological symptom of PMS is
    a. Fatigue b. Obesity c. Weight loss d. Over eating
11. Emotional symptoms of PMS like anger, anxiety, tension, irritability may be due to low levels of _____ in blood.
    a. Serotonin b. Calcium c. Iron d. Water
12. Food craving may lead to the intake of high
    a. Carbohydrate b. Protein c. Both d. None
13. In PMS food craving is commonly noted for
    a. Sweet b. Salt c. Sour d. Bitter
14. Mood swing, depression and isolation are due to low levels of serum
    a. Magnesium b. Calcium c. Iron d. Protein
15. Women with moderate to severe symptoms fo PMS have lower levels of
    a. Iron b. Fibre c. Protein d. Vit A
16. Vitamin involved in the reduction of PMS symptoms is
    a. B1 b. B6 c. B12 d. B2
17. Possible risk factor for PMS
    a. Stress b. Heredity c. Life style d. All
18. Diet change recommended to reduce PMS is increased intake of
    a. Fruits & veg b. Fried items c. Chips and pastry d. Sweets
19. In severe form PMS many
    a. Affect eating b. Affect regular activity c. Make you lazy d. None
20. Common supplementary treatment followed include
    a. Calcium b. Evening primrose oil c. Magnesium d. All

Appendix - IV

Score card for the sensory evaluation of the formulated health mix

Characteristics	1	2	3	4	5	6	7
Appearance	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much
Colour	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much
Texture	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much
Taste	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much
Flavour	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much
Mouth feel	Disliked very much	Disliked moderately	Disliked slightly	Neither liked nor disliked	Liked Slightly	Liked Moderately	Liked very much

Signature of the panel member

Appendix - V

NUTRITION AND HEALTH EDUCATION MODULE FOR PREMENSTRUAL SYNDROME



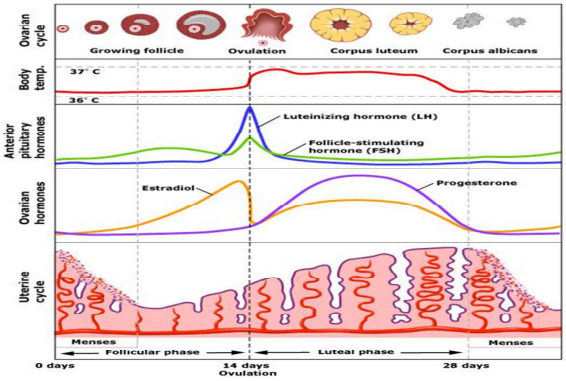
PMS is used to describe physical, cognitive, affective and behavioural symptoms that occur cyclically during the luteal phase of the menstrual cycle and resolve quickly at or within a few days of theonset of menstruation (Braverman , 2007).

Meaning of PMS: The term premenstrual syndrome refers to a cluster of mood, physical and cognitive symptoms that occur during the luteal phase of menstrual cycle and subside with the onset of menstruation.

Symptoms that indicate Premenstrual syndrome

- **occur between ovulation and first day of menstrual bleeding**
- **stop after bleeding**
- **are not present for at least 7 days after your menstrual period.**

What is luteal phase of menstrual cycle?



Changes happening in luteal phase:

1. increase in the body temperature
2. reduction on oestrogen level
3. increase in progesterone level
4. soft spongy uterus

The bodily changes due to hormonal change:

- In luteal phase, endomorphin level falls drastically in some women that causes pain, uneasiness and nausea.
- Increased progesterone levels hinders the usual relaxation pattern of your brain. This causes anxiousness, irritability, restlessness and tension.
- Imbalance in hormone levels affects kidneys leading to fluid retention and salt retention. This leads to weight gain and some negative self-perceptions emotionally.
- Reduction in appetite and craving to eat unhealthy foods. This leads to drop in vitamin B6 and vitamin A and E levels.
- Reduction in vitamins leads to tiredness physically and emotionally.

Prevalence:

Many studies state the prevalence rate between 60-90% fewer studies report lesser percentage also. According to ACOG as many as 80% of the women of reproductive age suffer premenstrual emotional and physical changes.

It affects all age group starting from menarche.But many studies report a higher prevalence in adult stage 25-40 years.

Causes:

In luteal phase, endomorphin level falls drastically in some women that causes pain, uneasiness and nausea.

Increased progesterone levels hinders the usual relaxation pattern of your brain. This causes anxiousness, irritability, restlessness and tension.

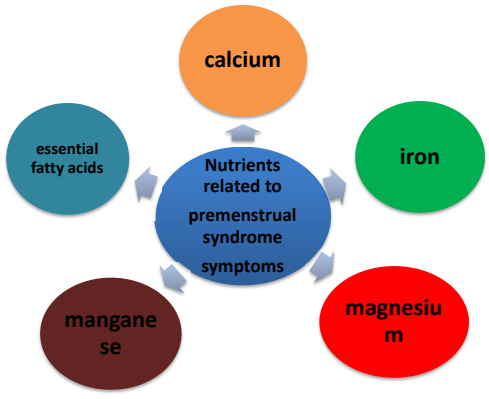
Imbalance in hormone levels affect kidneys leading to fluid retention and salt retention. This leads to weight gain and some negative self-perceptions emotionally.

Reduction in appetite and craving to eat unhealthy foods. This leads to drop in vitamin B6 and vitamin A and E levels.

Reduction in vitamins leads to tiredness physically and emotionally.

Relationship between nutrients and Premenstrual syndrome:

- PMS may serve as a clinical marker of low calcium status perhaps reflecting an underlying abnormality in calcium metabolism and it may serve as an early warning sign to **young women of a possible risk to osteoporosis**. Low calcium levels were associated with low **back pain, abdominal cramping and aches and pains all over body.**
- Magnesium is involved in the activity serotonin and other neuro- transmitters. Lower levels of which lead to mental disturbances may **like irritation, anger.**
- It has been hypnotized that PMS is linked to a deficiency of serotoninergic activity.
- Lower manganese levels are associated with increases **mood and pain symptoms.**
- Iron found in plant foods and supplements, non-heme iron reduced a woman's chance of developing PMS. Heme iron from animals like red meat and poultry did not have similar effect.
- Essential fatty acids also reduce the symptoms of PMS to a great extent.



PMS symptoms:

The symptoms can be categorised into four types as physical, emotional, behavioural and pain symptoms**.**

Physical changes include:

- Breast swelling and tenderness
- bloating,
- water retention (in extremities and abdomen)
- weight gain
- acne
- nipple discharge when nipples and breasts are pressed
- decreased sexual desire
- food cravings, especially for sweet and salty foods
- sleep pattern changes (sleeplessness)
- fatigue,
- lack of energy.

Emotional and cognitive symptoms:

- depression,
- sadness,
- hopelessness
- anger
- anxiety
- mood swings
- reduced alertness, inability to concentrate.

Behavioral changes

- aggression
- withdrawal from family and friends

Pain includes

- headaches or migraine
- breast tenderness
- aching muscles and joints
- cramps and low back pain
- prior to menstrual bleeding.

Treatment:

Common method of treatment used is

1. hormone therapy: supplementation of the oestrogen
2. supplementation of higher level of calcium (1200 mg)

3. supplementation of evening prim rose

Other remedial measures under research:

- supplementation of magnesium a t higher level
- supplementation of iron
- supplementation with vitamin E
- herbal remedies

Why non-pharmacological measures:

- The desire for safe and effective non-drug alternative has prompted many women to consider the use of dietary supplement for PMS.
- Women with mild to moderate symptoms may be reluctant to use medications that they consider unnatural in an effort to control symptoms associated with a natural biological function.

Non-pharmacological measures:

- adequate intake of water
- reducing intake of tea, coffee
- reducing intake of excess salt and sweetness
- reducing intake of non-heme iron like chicken
- adequate exercise
- adequate intake of balanced diet with green leafy vegetables and other vegetables

Role of exercise and yoga:

Regular physical exercise and yoga help in the secretion of serotonin which a natural anti-depressive chemical. Exercise even in mild form regularly helps us in having emotional harmony.

Conclusion: A healthy balanced diet with adequate level of serum iron, calcium, magnesium, vitamins and exercise can help us overcome the painful symptoms of PMS.

Things to be avoided









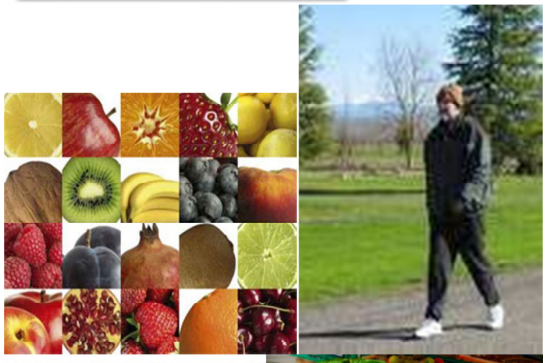
thing





Things to be followed

















Foods to be avoided

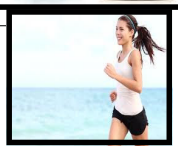


Foods to be included liberally



Role of exercise:

Exercising regularly helps in the secretion of serotonin which is a natural anti-depressive chemical. Exercise even in mild form regularly helps us in having emotional harmony.





Conclusion: A healthy balanced diet with adequate level of serum iron, calcium, magnesium, vitamins and exercise can help us overcome the painful symptoms of PMS.



Appendix-VI a

BOOKLET ON PREMENSTRUAL SYNDROME

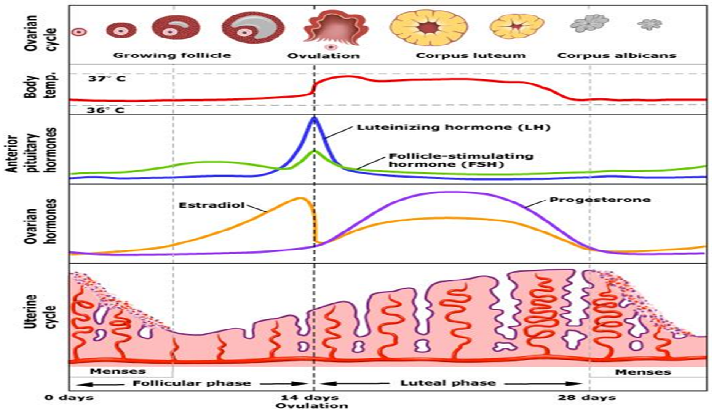
PMS is used to describe physical, cognitive, affective and behavioural symptoms that occur cyclically during the luteal phase of the menstrual cycle and resolve quickly at or within a few days of the onset of menstruation .



Meaning of PMS:

Premenstrual syndrome refers to a cluster of mood, physical and cognitive symptoms that occur during the luteal phase of menstrual cycle and subside with the onset of menstruation.

Luteal phase of menstrual cycle





Changes happening in luteal phase:

- increase in the body temperature
- reduction on oestrogen level
- increase in progesterone level
- soft spongy uterus

The bodily changes due to hormonal change:

- In luteal phase, endomorphin level falls drastically in some women that causes pain, uneasiness and nausea.
- Increased progesterone levels hinders the usual relaxation pattern of your brain. This causes anxiousness, irritability, restlessness and tension.
- Imbalance in hormone levels affects kidneys leading to fluid retention and salt retention. This leads to weight gain and some negative self-perceptions emotionally.
- Reduction in appetite and craving to eat unhealthy foods. This leads to drop in vitamin B6 and vitamin A and E levels.
- Reduction in vitamins leads to tiredness physically and emotionally.



Symptoms that indicate Premenstrual syndrome:

- occur between ovulation and first day of menstrual bleeding
- stop after bleeding
- are not present for at least 7 days after **your menstrual period.**

Non-pharmacological measures:

- adequate intake of water
- reducing intake of tea, coffee
- reducing intake of excess salt and sweetness
- reducing intake of heme iron like chicken
- adequate exercise
- adequate intake of balanced diet with green leafy vegetables and other vegetables







Treatment are

Common method of treatment used is

- Hormone therapy: supplementation of the oestrogen
- Supplementation of higher level of calcium (1200 mg)
- Herbal-Supplementation of evening prim rose (a flower petal oil extract)



Emotional and cognitive symptoms:

- depression,
- sadness,
- hopelessness
- anger
- anxiety
- mood swings
- reduced alertness
- inability to concentrate.

Behavioral changes

- aggression
- withdrawal from family and friends

Pain includes

- head aches or migraine
- breast tenderness
- aching muscles and joints

cramps and

- low back pain

prior to menstrual bleeding.

Prevalence:

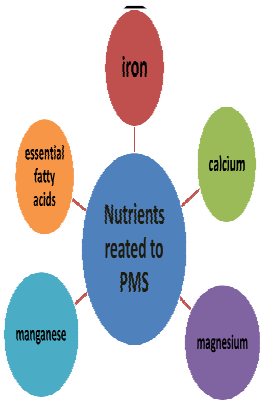
- Many studies state the prevalence rate between 60-90% fewer studies report lesser percentage also.
- According to ACOG as many as 80% of the women of reproductive age suffer premenstrual emotional and physical changes.
- It affects all age group starting from menarche. But many studies report a higher prevalence in adult stage 25-40 years.

Causes:

- In luteal phase, **endomorphin level falls** drastically in some women that causes **pain, uneasiness and nausea**.
- Increased **progesterone level hinders** the usual relaxation pattern of our brain. This causes **anxiousness, irritability, restlessness and tension.**
- **Imbalance in hormone** level affects kidneys leading to **fluid retention and salt retention**. This leads to **weight gain** and some negative self-perceptions emotionally.
- **Reduction in appetite and craving** to eat unhealthy foods. This leads to drop **in vitamin B6 and vitamin A and E levels**.
- Reduction in vitamins leads to **tiredness physically** and emotionally.

Relationship between nutrients and Premenstrual syndrome:

PMS may serve as a clinical marker of low calcium status perhaps reflecting an underlying abnormality in calcium metabolism and it may serve as an early warning sign to **young women of a possible risk to osteoporosis**.



Low calcium levels were associated with low **back pain, abdominal cramping and aches and pains all over body.**

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It has been hypnotized that PMS is linked to a deficiency of serotoninergic activity.

Lower manganese levels are associated with increases **mood and pain symptoms.**

Iron found in plant foods and supplements, non-heme iron reduced a woman's chance of developing PMS. Heme iron from animals like red meat and poultry did not have similar effect.

Essential fatty acids also reduce the symptoms of PMS to a great extent.



PMS symptoms:

The symptoms can be categorised into four types as physical, emotional, behavioural and pain symptoms**.**

Physical changes

- Breast swelling and tenderness
- bloating,
- water retention,
- weight gain
- acne
- nipple discharge when nipples and breasts are pressed
- decreased sexual desire
- food cravings, especially for sweet
- and salty foods
- sleep pattern changes
- fatigue,
- lack of energy.

Appendix-VIb

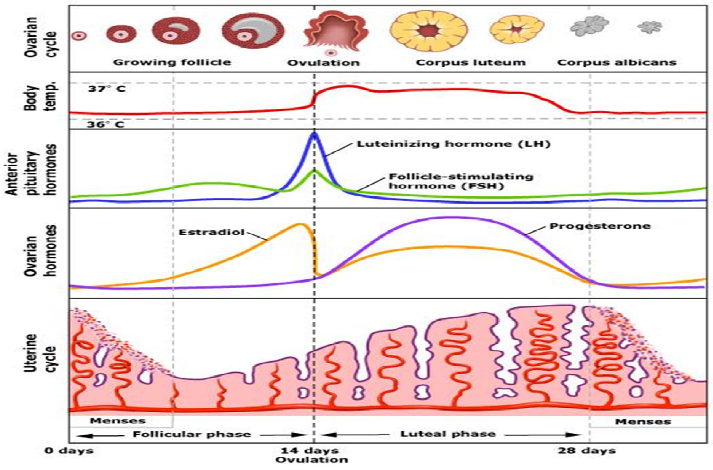
மாதவிலக்குக்கு முந்தைஅறிகுறி பற்றிய ஊட்டச்சத்து மற்றும் சுகாதார கல்வி

PMS மாதவிடாய் சுழற்சியின் முந்தை கட்டத்தின் போது சுழற்சியை ஏற்படுத்துகின்ற உடல், அறிவாற்றல், செயல்திறன் மற்றும் நடத்தை அறிகுறிகளை மாதவிலக்குக்கு முந்தைஅறிகுறி என்று சொல்ல முடியும். இது மாதவிடாய் துவங்குவதற்கு ஒரு சில நாட்களுக்குள் விரைவில் மறைந்துவிடும்



PMS பொருள்: இது கொத்தன மனநிலையின் மாற்றங்கள், அறிவாற்றல் திறன் மற்றும் உடல் அறிகுறிகள் மாதவில க்குக்கு முந்தைஅறிகுறி என்று சொல்ல முடியும். இது மாதவிடாய் துவங்குவதற்கு ஒரு சில நாட்களுக்குள் விரைவில் மறைந்துவிடும்.

மாதவிடாய் சுழற்சியின் முதுமை நிலை (luteal phase)



தவிர்க்கப்பட வேண்டிய உணவுகள்



உணவுகள் தாராளமாக சேர்க்கப்பட வேண்டிய உணவுகள்





உடற்பயிற்சி பங்கு:

ஒரு இயற்கையான எதிர்ப்பு மன அழுத்தம் கொண்ட [illegible] தொடர்ந்து உதவுகிறது. லேசான வடிவில் உடற்பயிற்[illegible]ச்சிப் இணக்கத்தைத் தொடர்ந்து நமக்கு உதவுகிறது.



முடிவு: இரும்பு, கால்சியம், மெக்னீசியம், வைட்டமின்கள் மற்றும் உடற்பயிற்சி, போதுமான அளவில் ஆரோக்கியமான சீரான உணவு உட்கொள்ளல் நமக்கு மாதவிலக்குக்கு முந்தைஅறிகுறி உதவுகிறது லாம்.





மாதவிடாய் சுழற்சியின் முதுமை நிலை ஏற்படும் மாற்றங்கள்:

- உடல் வெப்பநிலையில் அதிகரிக்கும்
- ஈஸ்ட்ரோஜன் அளவு குறைப்பு
- புரோஜெஸ்டிரோன் அளவு அதிகரிக்கும்

ஹார்மோன் மாற்றத்தின் காரணமாக உடல் மாற்றங்கள்:

- மாதவிடாய் சுழற்சியின் முதுமை நிலை எண்டோமோர்பின் நிலை அதிகரிக்கும்,சில பெண்களில் வலி, கடுமையாக குமட்டலை ஏற்படுத்தும்
- அதிகரித்த புரோஜெஸ்ட்டிரோன் அளவு உங்கள் மூளையின் வழக்கமான தளர்வு முறையைத் தடுக்கிறது. இது கவலை, எரிச்சல், அமைதியின்மை மற்றும் பதற்றம் ஆகியவற்றை ஏற்படுத்துகிறது.
- ஹார்மோன் அளவுகளில் சமநிலையின்மை திரவ பராமரிப்பு மற்றும் உப்பு தக்கவைக்கும் வழிவகுக்கும் சிறுநீரகங்களை பாதிக்கிறது. இது எடை அதிகரிப்பு மற்றும் சில எதிர்மறையான உணர்வுகளுக்கு வழிவகுக்கிறது.
- பசி குறைப்பு மற்றும் ஆரோக்கியமற்ற உணவுகளை ஏங்கி சாப்பிட வழிவகுக்கிறது. .

இததனால் வைட்டமின் B6 மற்றும் வைட்டமின் A மற்றும் E அளவுகளில் குறையும்.வைட்டமின்களில் குறைபாடு காரணமாக உடல் மற்றும் உணர்வுபூர்வமாக சோர்வு ஏற்படுகிறது.

மாதவிடாய் சுழற்சியின் முதுமை நிலை குறிக்கும்அறிகுறிகள்

- அண்டவிடுப்பின் மற்றும் மாதவிடாய் இரத்தப்போக்கு முதல் நாள் இடையே ஏற்படும்.
- விரைவில் மறைந்துவிடும்

மருந்துகள்அல்லாத நடவடிக்கைகள்:

- போதுமான நீர் உட்கொள்ளல்
- தேநீர், காபி உட்கொள்ளும் குறைப்பு
- அதிகமாக உப்பு மற்றும் இனிப்பு உட்கொள்ளும் குறைப்பு
- கோழி போன்ற ஹீம் இரும்பு உட்கொள்ளல் குறைகிறது
- போதுமான உடற்பயிற்சி
- பச்சை இலை காய்கறிகள் மற்றும் பிற காய்கறிகளுடன் சீரான உணவு உட்கொள்ளும் போதுமான அளவு உட்கொள்ளல்





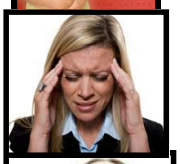


சிகிச்சை:

பொதுவாக பயன்படுத்தப்படும் சிகிச்சை முறை:

- ஹார்மோன் சிகிச்சை: ஈஸ்ட்ரோஜின் கூடுதல்
- அதிக அளவு கால்சியம் (1200 மி.கி.)
- மாலை ப்ரிமின்ஸ் எண்ணெய்

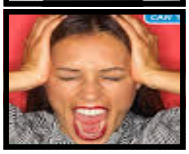












<u>உணர்ச்சி மற்றும் அறிவாற்றல் அறிகுறிகள்</u>:

- மன அழுத்தம்,
- சோகம்,
- நம்பிக்கையின்மை
- கோபம்
- பதட்டம்
- மனம் அலைபாயிகிறது,
- குறைந்த விழிப்புணர்வு,

<u>கவனம் செலுத்தஇயலாமை.</u>

<u>நடத்தை மாற்றங்கள்</u>

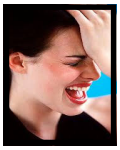
- ஆக்கிரமிப்பு
- தனிமைப்படுதல்

<u>வலி</u>

- தலை வலிகள் அல்லது தலைவலி
- மார்பக மென்மை
- வலிக்கிறது தசைகள் மற்றும் மூட்டுகள்
  - பிடிப்புகள் மற்றும்
  - முதுகுவலி.

- PMS விகிதம் : ACOG படி, 80% இனப்பெருக்க வயது பெண்களில் மாதவிடாய் சுழற்சியின் முதுமை நிலை குறிக்கும்அறிகுறிகள் (உணர்ச்சி மற்றும் உடல் ரீதியான) மாற்றங்கள் ஏற்படுகின்றன.
- இது பூப்பூஅடைந்ததிலிருந்து அனைத்து வயதினரையும் பாதிக்கிறது. ஆனால் பல ஆய்வுகள் 25-40 வயதுடைய வயதுடைய நிலையில் அதிக பாதிப்புகளை கொடுக்கிறது.

<u>காரணங்கள்:</u>



- ஹார்மோன் மாற்றக .
- வைட்டமின் குறைபாடு
- கால்சியம் மற்றும் இரும்பு குறைபாடு
- மன அழுத்தம்
- ஆரோக்கியமற்ற வாழ்க்கை முறை
- மோசமான உணவு பழக்கம்
- போதுமான நீர் உட்கொள்ளல் இல்லாமை.
- அதிக கொழுப்பு உணவு

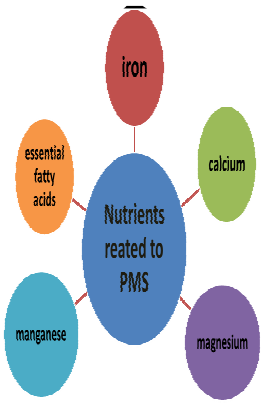
<u>ஊட்டச்சத்துக்கள் மற்றும்</u> மாதவிடாய் சுழற்சியின் முதுமை குறிக்கும்அறிகுறிகள்

கால்சியம் வளர்சிதை மாற்றம் ஒரு அது ஒரு சாத்தியமான ஆபத்து

இளம் பெண்கள் ஒரு எச்சரிக்கை அறிகுறி பணியாற்ற கூடும்.

குறைந்த கால்சியம் நிலையை ஒரு மருத்துவ மார்க்கர் பணியாற்றம்

ஆஸ்டியோபோரோசிஸ்

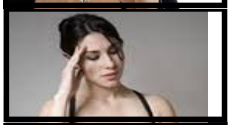


- குறைந்த கால்சியம் அளவுகள் குறைந்த முதுகுவலியுடன், வயிற்றுப் பிளவு மற்றும் வலிகள் மற்றும் வலிகள் அனைத்திலும் தொடர்புடையது.
- மெக்னீசியம் செயல்திறன் செரோடோனின் மற்றும் பிற நரம்பு டிரான்ஸ்மிட்டர்களில் ஈடுபட்டுள்ளது. மனத் தொந்தரவுக்கு வழிவகுக்கும் இததனால்எரிச்சல், கோபம் போன்றவை வரலாம்.
- PMS செரோடோனினேஜிக் செயல்பாடு குறைபாடுடன் தொடர்புடையது.
- குறைந்த மாங்கனீசு அளவு கோபம் அதிகரிக்கும் மனநிலை மற்றும் வலி அறிகுறிகளுடன் தொடர்புடையது.
- தாவர உணவு இரும்பு (ஹீம்அல்லாத இரும்பு) PMS கட்டுப்பாட்டிற்கு நல்லது,
- ஹீம் இரும்பு PMS அறிகுறிகளுடன் தொடர்புடையது..
- அத்தியாவசிய கொழுப்பு அமிலங்கள் PMS இன் அறிகுறிகளை பெரிய அளவில் குறைக்கின்றன.













PMS symptoms:

அறிகுறிகள் நான்கு வகைப்படுத்தலாம்

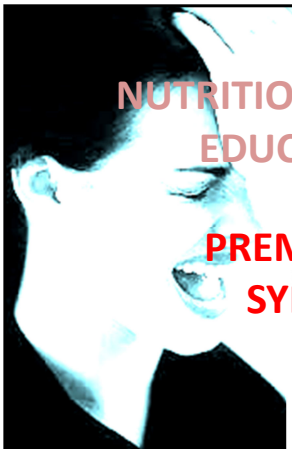
உடல், உணர்ச்சி, நடத்தை போன்ற வகைகள்

மற்றும் வலி அறிகுறிகள்.

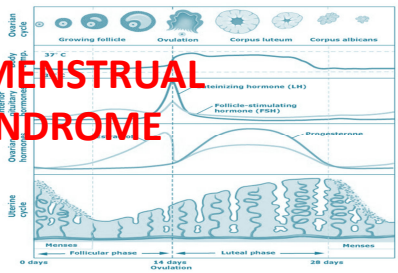
உடல் மாற்றங்கள் பின்வருமாறு:

- மார்பக வீக்கம் மற்றும் மென்மை
- வீக்கம்,
- நீர் தேக்கம்,
- எடை அதிகரிப்பு
  - முகப்பரு
- முலைக்காம்புகளும் மார்பகங்களும் அழுத்தும் போது முலைக்காம்பு வெளியேற்றும்
- பாலியல் விருப்பம் குறைந்துவிட
- உணவு ஏங்கி சாப்பிட - குறிப்பாக இனிப்புக்கு மற்றும் உப்பு உணவுகள்
- தூக்கம் இல்லாமை
  - சோர்வு,
  - ஒய்வின்மை

Appendix- VII a

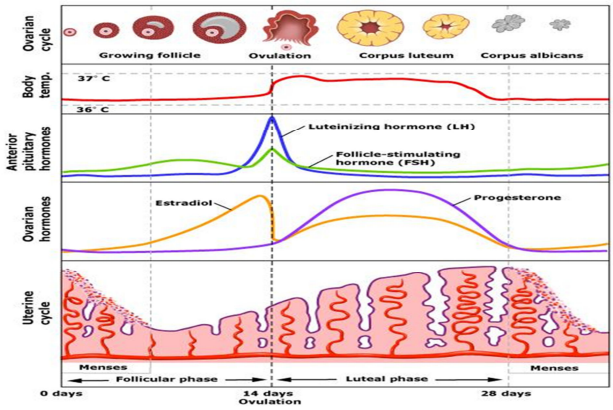


NUTRITION AND HEALTH EDUCATION ON



PREMENSTRUAL SYNDROME

MENSTRUAL CYCLE



MEANING

Meaning of PMS:

The term premenstrual syndrome refers to a cluster of mood, physical and cognitive symptoms that occur during the luteal phase of menstrual cycle and subside with the onset of menstruation.



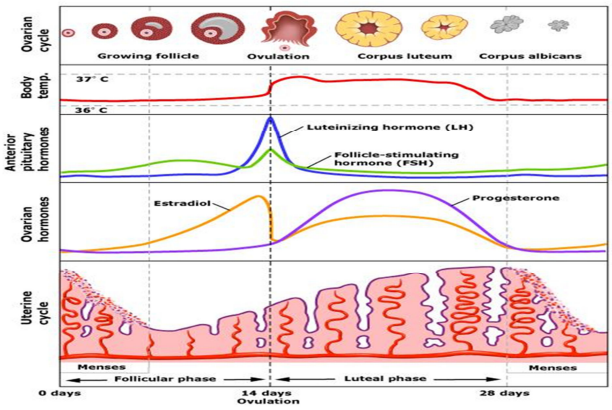
PROBLEM OF PMS





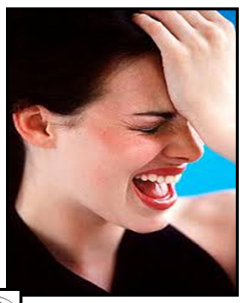


MENSTRUAL CYCLE



PROBLEM OF PMS

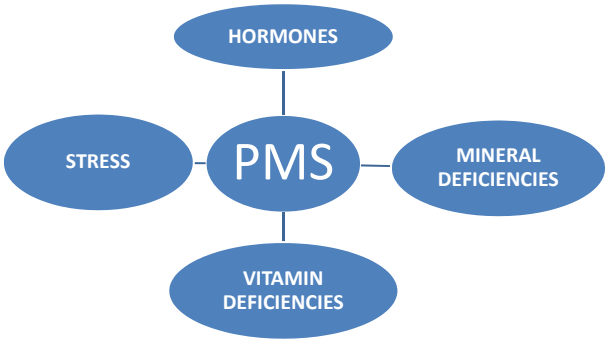








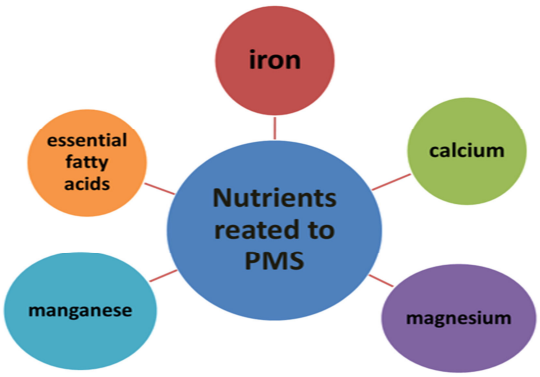
CAUSES OF PMS



SYMPTOMS OF PMS



NUTRIENTS RELATED TO PMS



TREATMENT

Common method of treatment used is

- hormone therapy: supplementation of the oestrogen
- supplementation of higher level of calcium (1200 mg)
- supplementation of evening prim rose

MANAGEMENT



MANAGEMENT- YOGA



MANAGEMENT- EXERCISE





FOODS GOOD FOR PMS



FOODS AGGRAVATING PMS









Conclusion

A healthy balanced diet with adequate level of serum iron, calcium, magnesium, vitamins and exercise can help us overcome the painful symptoms of PMS.



Appendix-VIII

NUTRITION AND HEALTH EDUCATION ON PREMENSTRUAL SYNDROME

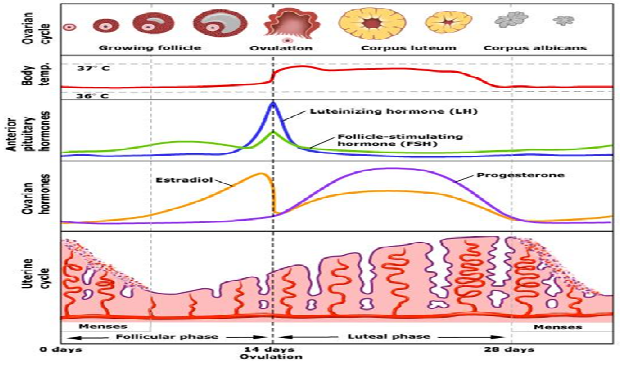
PMS is used to describe physical, cognitive, affective and behavioural symptoms that occur cyclically during the luteal phase of the menstrual cycle and resolve quickly at or within a few days of theonset of menstruation

Meaning of PMS: The term premenstrual syndrome refers to a cluster of mood, physical and cognitive symptoms that occur during the luteal phase of menstrual cycle and subside with the onset of menstruation.

What is luteal phase of menstrual cycle?

Changes happening in luteal phase:

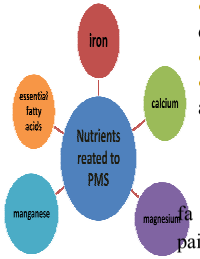
increase in the body temperature reduction on oestrogen level increase in progesterone level
soft spongy uterus



Prevalence:

Many studies state the prevalence rate between 60-90% fewer studies report lesser percentage also. According to ACOG as many as 80% of the women of reproductive age suffer premenstrual emotional and physical changes.

It affects all age group starting from menarche.But many studies report a higher prevalence in adult stage 25-40 years.



Relationship between nutrients and Premenstrual syndrome: PMS may serve as a clinical marker of low calcium status perhaps reflecting an underlying abnormality in calcium metabolism and it may serve as an early warning sign to **young women of a possible risk to osteoporosis**. Low calcium levels were associated with low **back pain, abdominal cramping and aches and pains all over body.**Magnesium is involved in the activity serotonin and other neuro- transmitters. Lower levels of which lead to mental disturbances may **like irritation, anger.**It has been hypnotized that PMS is linked to a deficiency of serotoninergic activity.Lower manganese levels are associated with increases **mood and pain symptoms.**Iron found in plant foods and supplements, non-heme iron reduced a woman's chance of developing PMS. Heme iron from animals like red meat and poultry did not have similar effect.

Essential fatty acids also reduce the symptoms of PMS to a great extent.

Symptoms that indicate Premenstrual syndrome:

- occur between ovulation and first day of menstrual bleeding
- stop after bleeding
- are not present for at least 7 days after **your menstrual period.**

Causes: In luteal phase, endomorphin level falls drastically in some women that causes pain, uneasiness and nausea.

Increased progesterone levels hinders the usual relaxation pattern of your brain. This causes anxiousness, irritability, restlessness and tension.

Imbalance in hormone levels affect kidneys leading to fluid retention and salt retention. This leads to weight gain and some negative self-perceptions emotionally.

Reduction in appetite and craving to eat unhealthy foods. This leads to drop in vitamin B6 and vitamin A and E levels.

Reduction in vitamins leads to tiredness physically and emotionally.

PMS symptoms:

The symptoms can be categorised into four

types as physical, emotional, behavioural

and pain symptoms**.**

Physical changes include:

Breast swelling and tenderness
bloating,
water retention,
weight gain
acne
nipple discharge when nipples and breasts are pressed
decreased sexual desire
food cravings, especially for sweet and salty foods
sleep pattern changes
fatigue,
lack of energy.

Emotional and cognitive symptoms:

depression,
sadness,
hopelessness
anger
anxiety
mood swings
reduced alertness, inability to concentrate.

Behavioral changes

aggression
withdrawal from family and friends

Pain includes

head aches or migraine
breast tenderness
aching muscles and joints
cramps and low back pain

Treatment:

Common method of treatment used is

hormone therapy: supplementation of the estrogen
supplementation of higher level of calcium (1200 mg)
supplementation of evening prim rose

Why non-pharmacological measures:

The desire for safe and effective non-drug alternative has prompted many women to consider the use of dietary supplement for PMS.

Other remedial measures under research:

supplementation of magnesium a t higher level
supplementation of iron
supplementation with vitamin E

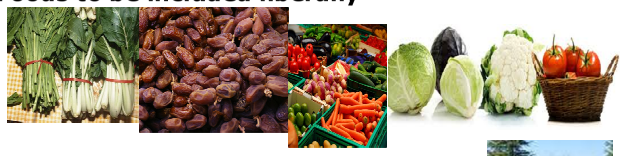
Non-pharmacological measures:

- adequate intake of water
- reducing intake of tea, coffee
- reducing intake of excess salt and sweetness
- reducing intake of non-heme iron like chicken
- adequate exercise
- adequate intake of balanced diet with green leafy vegetables and other vegetables

Foods to be avoided



Foods to be included liberally



Role of exercise: Exercising regularly helps in the secretion of serotonin which a natural antidepressive chemical. Exercise even in mild form regularly helps us in having emotional harmony.



Conclusion: A healthy balanced diet with adequate level of serum iron, calcium, magnesium, vitamins and exercise can help us overcome the painful symp-



Appendix - IX

ANTHROPOMETRIC MEASUREMENTS OF THE SELECTED PARTICIPANTS

SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO
1	156	55	24	1.028	51	156	50	21	0.667	101	156	45	18	0.872	151	150	50	22	0.821
2	140	49	25	1.2	52	154	42	18	0.6	102	161	54	21	0.818	152	150	66	29	0.821
3	158	78	31	1.028	53	152	38	16	0.831	103	152	41	18	0.814	153	125	36	23	0.821
4	153	60	26	1.212	54	162	57	22	0.636	104	154	39	16	0.837	154	152	62	27	0.81
5	158	45	18	1.077	55	152	60	26	0.722	105	150	54	24	0.771	155	156	78	32	0.865
6	180	63	19	1.028	56	162	47	18	0.667	106	146	43	20	0.855	156	157	55	22	0.839
7	168	48	17	1.2	57	153	48	21	0.645	107	147	50	23	0.819	157	150	64	28	0.889
8	174	60	20	1.028	58	158	60	24	0.649	108	149	44	20	0.875	158	141	51	26	0.865
9	168	58	21	1.212	59	154	47	20	0.753	109	143	43	21	0.77	159	155	63	26	0.839
10	150	54	24	1.077	60	154	47	20	0.753	110	151	35	15	0.77	160	165	56	21	0.839
11	162	65	25	1.028	61	162	60	23	0.75	111	157	65	26	0.77	161	150	52	23	0.821
12	162	63	24	1.2	62	151	56	25	0.873	112	147	43	20	0.875	162	157	56	23	0.964
13	156	50	21	1.028	63	134	45	25	0.873	113	162	35	13	0.875	163	125	52	33	0.862
14	160	80	31	1.212	64	146	51	24	0.873	114	147	65	30	0.814	164	157	48	19	0.899
15	165	67	25	1.077	65	156	61	25	0.667	115	144	55	27	0.837	165	156	46	19	0.899
16	156	64	26	0.857	66	159	65	26	0.676	116	147	49	23	0.771	166	168	55	19	0.899
17	153	50	21	1.077	67	142	59	29	0.96	117	150	53	24	0.855	167	145	60	29	0.821
18	157	55	22	0.857	68	150	70	31	0.96	118	154	59	25	0.819	168	152	55	24	0.81
19	148	60	27	0.865	69	153	47	20	0.847	119	161	61	24	0.875	169	160	40	16	0.865
20	166	55	20	0.865	70	170	65	22	0.622	120	150	60	27	0.77	170	155	55	23	0.839
21	156	46	19	0.899	71	159	73	29	0.814	121	158	55	22	0.77	171	153	48	21	0.889
22	155	58	24	0.857	72	155	45	19	0.837	122	162	45	17	0.77	172	152	52	23	0.81
23	145	60	29	0.865	73	160	50	20	0.771	123	158	51	20	0.875	173	153	56	24	0.865
24	134	56	31	0.865	74	140	31	16	0.855	124	152	48	21	0.875	174	148	38	17	0.839
25	135	52	29	0.899	75	153	51	22	0.819	125	147	48	22	0.875	175	160	59	23	0.636
26	150	52	23	0.865	76	150	65	29	0.875	126	152	50	22	0.875	176	160	39	15	0.636
27	165	63	23	0.899	77	151	81	36	0.77	127	143	48	23	0.875	177	163	50	19	0.727
28	141	51	26	0.889	78	151	46	20	0.77	128	151	77	34	0.887	178	153	50	21	0.857
29	152	56	24	0.91	79	151	46	20	0.77	129	159	50	20	0.776	179	156	64	26	0.732
30	152	53	23	0.792	80	132	52	30	0.875	130	150	60	27	0.776	180	165	67	25	0.899
31	145	67	32	0.825	81	135	45	25	0.875	131	151	81	36	0.77	181	157	39	16	0.821
32	153	55	23	0.824	82	147	49	23	0.859	132	156	60	25	0.851	182	160	45	18	0.81
33	152	47	20	0.667	83	168	61	22	0.889	133	154	46	19	0.77	183	155	55	23	0.865
34	152	40	17	0.68	84	152	64	28	0.955	134	146	34	16	0.77	184	162	73	28	0.839
35	149	72	32	0.881	85	159	60	24	0.78	135	150	40	18	0.77	185	152	48	21	0.889
36	125	60	38	0.874	86	135	47	26	0.78	136	180	57	18	0.875	186	155	58	24	0.81
37	157	79	32	0.825	87	130	37	22	0.78	137	146	42	20	0.875	187	148	60	27	0.899
38	153	41	18	0.859	88	154	44	19	0.727	138	159	63	25	0.814	188	150	62	28	0.821
39	150	55	24	0.686	89	133	62	35	0.944	139	135	59	32	0.837	189	144	49	24	0.81
40	150	69	31	0.86	90	155	62	26	0.881	140	130	50	30	0.771	190	161	50	19	0.865
41	152	55	24	0.884	91	145	64	30	0.881	141	135	47	26	0.821	191	146	55	26	0.839
42	147	61	28	0.877	92	158	75	30	0.944	142	150	69	31	0.81	192	158	42	17	0.889
43	153	55	24	0.863	93	154	67	28	0.881	143	140	41	21	0.865	193	163	47	18	0.81
44	143	72	35	0.905	94	147	54	25	0.872	144	135	70	38	0.839	194	143	36	18	0.899
45	155	42	17	0.855	95	177	84	27	0.944	145	135	41	23	0.889	195	144	44	21	0.821
46	161	57	22	0.847	96	153	54	23	0.881	146	143	51	25	0.821	196	143	47	23	0.81
47	149	38	17	0.719	97	154	43	18	0.881	147	160	47	18	0.81	197	150	50	22	0.865
48	149	38	17	0.775	98	153	50	21	0.944	148	145	69	33	0.865	198	149	59	27	0.839
49	149	42	19	0.842	99	156	50	21	0.881	149	150	59	26	0.839	199	144	56	27	0.889
50	149	42	19	0.842	100	158	46	18	0.872	150	150	50	22	0.839	200	145	53	25	0.81

SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO
201	146	42	20	0.813	251	157	79	32	0.825	301	130	37	22	0.761	351	146	42	20	0.857
202	165	52	19	0.798	252	153	41	18	0.859	302	154	44	19	0.761	352	159	63	25	0.865
203	147	52	24	0.857	253	150	55	24	0.686	303	133	62	35	0.847	353	135	59	32	0.865
204	142	49	24	0.81	254	150	69	31	0.86	304	155	62	26	0.761	354	130	50	30	0.899
205	152	42	18	0.899	255	152	55	24	0.884	305	145	64	30	0.761	355	135	47	26	0.857
206	152	42	18	0.821	256	147	61	28	0.877	306	158	75	30	0.944	356	150	69	31	0.865
207	154	46	19	0.81	257	153	55	24	0.863	307	154	67	28	0.881	357	140	41	21	0.865
208	150	46	20	0.865	258	143	72	35	1.118	308	147	54	25	0.872	358	135	70	38	0.899
209	153	48	21	0.839	259	155	42	17	0.855	309	177	84	27	0.821	359	135	41	23	0.865
210	157	48	19	0.889	260	161	57	22	0.847	310	153	54	23	0.81	360	143	51	25	0.899
211	160	80	31	0.81	261	149	38	17	0.719	311	154	43	18	0.865	361	160	47	18	0.889
212	152	52	23	0.81	262	155	42	17	0.719	312	153	50	21	0.839	362	145	69	33	0.91
213	158	64	26	0.899	263	149	42	19	0.842	313	153	50	21	0.889	363	150	59	26	0.792
214	155	64	27	0.821	264	149	44	20	0.842	314	158	46	18	0.81	364	150	50	22	0.825
215	139	35	18	0.81	265	156	50	21	0.667	315	156	45	18	0.81	365	150	66	29	0.824
216	154	54	23	0.865	266	154	42	18	0.6	316	161	54	21	0.899	366	150	55	24	0.667
217	161	45	17	0.839	267	152	38	16	0.831	317	152	41	18	0.821	367	156	60	25	0.68
218	161	45	17	0.889	268	162	57	22	0.636	318	154	39	16	0.81	368	154	56	24	0.881
219	151	45	20	0.81	269	152	60	26	0.722	319	156	44	18	0.865	369	154	55	23	0.874
220	153	52	22	0.81	270	162	47	18	0.667	320	158	45	18	0.839	370	160	63	25	0.825
221	147	51	24	0.899	271	153	48	21	0.645	321	160	55	21	0.889	371	159	58	23	0.859
222	156	48	20	0.821	272	158	60	24	0.649	322	162	52	20	0.81	372	154	48	20	0.686
223	145	42	20	0.81	273	154	47	20	0.753	323	164	53	20	0.81	373	150	54	24	0.86
224	151	36	16	0.865	274	154	47	20	0.753	324	151	35	15	0.899	374	153	65	28	0.884
225	154	60	25	0.839	275	162	60	23	0.75	325	157	65	26	0.821	375	158	58	23	0.877
226	135	47	26	0.889	276	151	56	25	0.873	326	157	65	26	0.81	376	158	50	20	0.863
227	150	69	31	0.81	277	134	45	25	0.873	327	162	62	24	0.865	377	156	59	24	0.905
228	140	41	21	0.81	278	146	51	24	0.812	328	155	52	22	0.839	378	158	58	23	0.855
229	135	70	38	0.899	279	156	61	25	0.667	329	147	54	25	0.889	379	154	42	18	0.847
230	135	41	23	0.821	280	159	65	26	0.676	330	147	49	23	0.899	380	156	59	24	0.719
231	143	51	25	0.81	281	142	59	29	0.96	331	150	53	24	0.973	381	158	42	17	0.775
232	160	47	18	0.865	282	150	70	31	0.829	332	154	59	25	0.865	382	160	65	25	0.842
233	145	69	33	0.839	283	153	47	20	0.847	333	161	61	24	0.839	383	154	58	24	0.842
234	150	59	26	0.889	284	170	65	22	0.622	334	161	61	24	1.028	384	153	63	27	0.667
235	156	46	19	0.899	285	159	73	29	0.814	335	158	60	24	1.2	385	156	52	21	0.6
236	155	58	24	0.973	286	155	45	19	0.837	336	162	45	17	1.028	386	159	57	23	0.831
237	145	60	29	0.865	287	160	50	20	0.771	337	158	51	20	1.212	387	152	50	22	0.636
238	134	56	31	0.839	288	140	31	16	0.855	338	152	48	21	1.077	388	154	63	27	0.722
239	135	52	29	0.889	289	153	51	22	0.819	339	152	48	21	1.028	389	143	50	24	0.667
240	150	52	23	0.899	290	150	65	29	0.819	340	152	50	22	1.2	390	160	60	23	0.645
241	165	63	23	0.973	291	151	81	36	0.77	341	143	48	23	1.028	391	156	63	26	0.649
242	141	51	26	0.889	292	151	81	36	0.77	342	151	77	34	1.212	392	155	63	26	0.753
243	152	56	24	0.91	293	151	81	36	0.77	343	159	50	20	1.077	393	155	63	26	0.753
244	152	53	23	0.792	294	132	52	30	0.875	344	150	60	27	1.028	394	158	42	17	0.75
245	145	67	32	0.825	295	135	45	25	0.875	345	151	81	36	1.2	395	158	42	17	0.873
246	153	55	23	0.824	296	147	49	23	0.875	346	156	60	25	1.028	396	158	42	17	0.873
247	152	47	20	0.667	297	168	61	22	0.78	347	154	46	19	1.212	397	158	42	17	0.873
248	152	40	17	0.68	298	152	64	28	0.78	348	146	34	16	1.077	398	151	73	32	0.667
249	149	72	32	0.874	299	159	60	24	0.78	349	150	40	18	0.857	399	152	70	30	0.676
250	125	60	38	0.874	300	135	47	26	0.847	350	180	57	18	1.077	400	146	52	24	0.96

SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo	HEIGHT	WEIGHT	BMI	SNo	HEIGHT	WEIGHT	BMI	W/H RATIO	SNo
401	160	60	23	0.96	451	158	78	31	46	501	180	57	18	40
402	152	67	29	0.85	452	153	60	26	41	502	146	42	20	45
403	150	66	29	0.62	453	154	44	19	30	503	159	63	25	50
404	154	50	21	0.81	454	133	62	35	25	504	135	59	32	38
405	152	60	26	0.84	455	155	62	26	119	505	130	50	30	45
406	140	49	25	0.77	456	145	64	30	126	506	135	47	26	36
407	158	78	31	0.86	457	158	75	30	107	507	150	69	31	50
408	153	60	26	0.82	458	154	67	28	45	508	140	41	21	50
409	158	45	18	0.88	459	147	54	25	50	509	135	70	38	40
410	152	67	29	0.77	460	177	84	27	38	510	135	41	23	45
411	151	73	32	0.77	461	153	54	23	45	511	143	51	25	50
412	152	70	30	0.77	462	154	43	18	36	512	160	47	18	38
413	146	52	24	0.88	463	153	50	21	50	513	145	69	33	45
414	160	60	23	0.88	464	153	53	21	50	514	150	59	26	36
415	152	67	29	0.86	465	158	46	18	40	515	150	50	22	40
416	155	48	20	0.89	466	156	45	18	45	516	150	66	29	37
417	150	54	24	0.96	467	161	54	21	50	517	150	55	24	38
418	153	65	28	0.78	468	152	41	18	38	518	156	60	25	45
419	158	58	23	0.78	469	154	39	16	45	519	154	56	24	36
420	159	50	20	0.78	470	154	46	19	36	520	154	55	23	40
421	158	59	24	0.73	471	154	45	19	50	521	160	63	25	37
422	158	58	23	0.94	472	154	54	23	50	522	159	58	23	36
423	154	42	18	0.88	473	153	41	18	40	523	154	48	20	40
424	154	59	25	0.88	474	152	39	17	45	524	150	54	24	40
425	158	42	17	0.94	475	151	35	15	50	525	153	65	28	46
426	160	65	25	0.88	476	157	65	26	38	526	158	58	23	41
427	165	58	21	0.87	477	157	65	26	45	527	158	50	20	30
428	150	63	28	0.94	478	162	63	24	36	528	156	59	24	25
429	154	52	22	0.88	479	162	62	24	40	529	158	58	23	119
430	159	57	23	0.88	480	162	44	17	37	530	154	42	18	40
431	152	50	22	0.94	481	147	49	23	38	531	156	59	24	37
432	154	63	27	0.88	482	150	53	24	45	532	158	42	17	36
433	143	50	24	0.87	483	154	59	25	36	533	160	65	25	40
434	161	60	23	0.87	484	161	61	24	40	534	154	58	24	40
435	154	63	27	0.82	485	161	61	24	37	535	153	63	27	46
436	154	63	27	0.81	486	158	60	24	36	536	156	52	21	41
437	154	63	27	0.84	487	162	45	17	40	537	159	57	23	30
438	158	42	17	0.77	488	158	51	20	40	538	152	50	22	25
439	158	42	17	0.86	489	152	48	21	46	539	143	50	24	119
440	158	42	17	0.82	490	152	48	21	41	540	160	60	23	119
441	158	42	17	0.88	491	152	50	22	30	541	156	63	26	119
442	151	73	32	0.77	492	143	48	23	25					
443	152	70	30	0.77	493	151	77	34	119					
444	146	52	24	0.77	494	159	50	20	45					
445	160	60	23	0.88	495	150	60	27	50					
446	152	67	29	0.88	496	151	81	36	38					
447	150	66	29	0.81	497	156	60	25	45					
448	154	50	21	0.84	498	154	46	19	36					
449	152	60	26	0.77	499	146	34	16	50					
450	140	49	25	0.86	500	150	40	18	50					

Appendix - X

HAEMOGLOBIN LEVELS OF THE SELECTED PARTICIPANTS

SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB	SNo	HB
1.	11	51	9	101	12	151	10	201	8	251	10	301	9	351	10	401	0	451	13	501	13
2.	12	52	12	102	12	152	7	202	8	252	10	302	9	352	12	402	12	452	10	502	12
3.	13	53	12	103	15	153	15	203	7	253	10	303	9	353	11	403	10	453	12	503	9
4.	13	54	10	104	10	154	16	204	7	254	10	304	8	354	11	404	9	454	11	504	9
5.	12	55	8	105	13	155	13	205	7	255	11	305	7	355	10	405	8	455	10	505	9
6.	11	56	9	106	10	156	10	206	7	256	11	306	8	356	14	406	7	456	11	506	9
7.	11	57	8	107	10	157	10	207	9	257	11	307	8	357	9	407	8	457	10	507	8
8.	11	58	10	108	16	158	12	208	9	258	11	308	8	358	4	408	9	458	7	508	8
9.	13	59	10	109	12	159	12	209	9	259	11	309	14	359	9	409	12	459	10	509	8
10.	14	60	9	110	9	160	12	210	9	260	11	310	12	360	12	410	12	460	7	510	8
11.	13	61	8	111	8	161	13	211	10	261	11	311	13	361	12	411	15	461	12	511	7
12.	11	62	10	112	8	162	13	212	11	262	11	312	13	362	10	412	10	462	12	512	7
13.	14	63	10	113	12	163	10	213	11	263	12	313	12	363	8	413	13	463	13	513	7
14.	11	64	9	114	11	164	9	214	11	264	12	314	11	364	9	414	10	464	10	514	7
15.	13	65	7	115	11	165	9	215	11	265	12	315	11	365	8	415	10	465	10	515	9
16.	13	66	11	116	10	166	10	216	12	266	12	316	11	366	10	416	16	466	12	516	9
17.	12	67	12	117	7	167	9	217	12	267	12	317	13	367	10	417	12	467	12	517	9
18.	14	68	9	118	10	168	10	218	12	268	12	318	14	368	9	418	9	468	12	518	9
19.	11	69	10	119	15	169	9	219	13	269	13	319	13	369	8	419	8	469	13	519	10
20.	12	70	12	120	9	170	10	220	13	270	13	320	11	370	10	420	8	470	13	520	11
21.	11	71	11	121	7	171	9	221	13	271	13	321	14	371	10	421	12	471	10	521	11
22.	13	72	11	122	7	172	10	222	13	272	14	322	11	372	9	422	11	472	9	522	11
23.	11	73	10	123	7	173	10	223	9	273	14	323	13	373	7	423	11	473	9	523	11
24.	13	74	14	124	10	174	12	224	9	274	14	324	13	374	11	424	10	474	10	524	12
25.	14	75	9	125	9	175	13	225	9	275	14	325	12	375	12	425	7	475	9	525	12
26.	8	76	12	126	8	176	13	226	9	276	14	326	14	376	9	426	10	476	10	526	12
27.	11	77	12	127	11	177	14	227	9	277	15	327	11	377	10	427	15	477	9	527	13
28.	10	78	11	128	11	178	15	228	9	278	12	328	12	378	12	428	9	478	10	528	13
29.	11	79	8	129	15	179	15	229	9	279	12	329	11	379	11	429	7	479	9	529	13
30.	11	80	8	130	11	180	16	230	9	280	12	330	13	380	11	430	7	480	10	530	13
31.	13	81	8	131	12	181	14	231	9	281	12	331	11	381	10	431	7	481	10	531	9
32.	13	82	10	132	8	182	13	232	9	282	11	332	13	382	14	432	10	482	12	532	9
33.	10	83	7	133	9	183	12	233	9	283	11	333	14	383	9	433	9	483	13	533	9
34.	13	84	8	134	10	184	11	234	9	284	11	334	8	384	12	434	8	484	13	534	9
35.	9	85	10	135	11	185	15	235	9	285	11	335	11	385	12	435	11	485	14	535	9
36.	10	86	7	136	11	186	12	236	9	286	11	336	10	386	11	436	11	486	15	536	9
37.	9	87	10	137	9	187	13	237	8	287	11	337	11	387	8	437	15	487	15	537	9
38.	10	88	12	138	13	188	11	238	8	288	11	338	11	388	8	438	11	488	16	538	9
39.	7	89	8	139	13	189	12	239	8	289	11	339	13	389	8	439	12	489	14	539	9
40.	10	90	8	140	12	190	12	240	8	290	12	340	13	390	10	440	8	490	13	540	9
41.	12	91	8	141	14	191	11	241	8	291	12	341	10	391	7	441	9	491	12	541	9
42.	9	92	9	142	13	192	11	242	8	292	11	342	13	392	8	442	10	492	11	542	
43.	10	93	0	143	13	193	13	243	8	293	12	343	9	393	10	443	11	493	15	543	
44.	12	94	12	144	10	194	12	244	8	294	12	344	10	394	7	444	11	494	12	544	
45.	11	95	10	145	12	195	9	245	8	295	12	345	8	395	10	445	9	495	13	545	
46.	11	96	9	146	11	196	9	246	8	296	13	346	10	396	12	446	13	496	11	546	
47.	10	97	8	147	10	197	9	247	8	297	11	347	7	397	8	447	13	497	12	547	
48.	10	98	7	148	11	198	9	248	8	298	9	348	10	398	8	448	12	498	12	548	
49.	9	99	8	149	10	199	8	249	11	299	9	349	12	399	8	449	14	499	11	549	
50.	10	100	9	150	7	200	8	250	10	300	6	350	9	400	9	450	13	500	11	550	

Appendix - XI

ANXIETY AND SELFESTEEM SCORES OF THE SELECTED PARTICIPANTS (N=541)

S.No	Stai	Sta-i	Self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem
1	2.15	3	3	51	1.7	1.85	2.6	101	2.6	2.3	2.9	151	2.3	2.5	2.8	201	2.3	3.8	3.3
2	2	2	3	52	2.5	2.7	1.5	102	2.5	3	3.2	152	2.15	3.15	3.3	202	1.6	2.25	3.2
3	2.35	3.1	2.6	53	2.5	1	1.5	103	2.6	2.65	2.2	153	2.3	2.4	2.4	203	2.6	2.5	2.8
4	2.5	2.3	2.9	54	1.65	1.3	2.5	104	2.45	2.8	3.8	154	2.25	2.9	2.7	204	3.2	2.65	2.4
5	2.45	2	2.1	55	1.62	2	1	105	2.3	2.3	3.1	155	2.45	2.3	3.3	205	2	2	2
6	2.6	2.25	2.4	56	2.35	2.5	2.5	106	2.3	2.2	3.3	156	3	3	3	206	1	2.1	2.4
7	2.3	3.1	2.7	57	2.35	1.68	1.5	107	1	2.25	3.1	157	2.05	2.35	3.1	207	2.1	1.7	2
8	2.4	1.8	2.5	58	2.4	2.5	3.5	108	2.4	2.5	3.6	158	2.95	2.95	3.1	208	0.85	0.95	2.8
9	3.9	1.8	2	59	2.45	2.85	2.7	109	2.25	2.2	3.1	159	1.2	1.8	3	209	2.4	2.35	2.8
10	2.15	2.2	2.5	60	2.2	2.3	2.7	110	1.6	2.6	2.8	160	3	2.65	2.7	210	1.75	1.95	3
11	1	1.8	1	61	2.1	2.5	2.8	111	2.5	2.15	2.5	161	2.15	2	3.5	211	2.5	2.25	2.7
12	4.5	1.6	2.2	62	2.45	2.45	2.5	112	2.1	2.35	2.5	162	2.25	2.9	2.7	212	1.75	1.95	3
13	2.2	3.4	2.1	63	2.1	1.4	2.7	113	2.5	2.5	2.2	163	2.45	2.3	3.3	213	2.35	3	1.3
14	2.45	2.25	3.2	64	2.35	2.3	2.8	114	2.15	2.25	3.1	164	3	3	3	214	1.65	1.9	2.6
15	1.85	1.75	2.6	65	2	1	1.8	115	1.7	2.3	2.9	165	2.05	2.35	3.1	215	2.6	3.5	1.3
16	2.1	3	2.2	66	2.35	1.5	2.2	116	2.1	2.4	2.3	166	2.95	2.95	3.1	216	2.45	1.65	1
17	1.85	2.45	2.4	67	2.55	1.65	2.8	117	2.6	2.25	2.4	167	1.2	1.25	2.5	217	2.3	2.9	3.2
18	2.15	2.4	2.5	68	1.95	1.9	2.3	118	2.45	2.1	2.2	168	2.65	2.5	3.1	218	2.3	3.2	2.9
19	2.3	3.8	3.3	69	1.85	1.95	2.4	119	2.25	2.2	2.3	169	2.2	2.6	2.8	219	1.6	2	2.7
20	1.6	2.25	3.2	70	2.5	2.7	1.6	120	2.5	2.9	2.8	170	2.5	2.25	2.7	220	3.5	3.5	2.9
21	2.6	2.5	2.8	71	2.25	2.3	2.4	121	2.5	2.2	2.3	171	3	2.5	2.6	221	2.5	2.5	3.5
22	3.2	2.65	2.4	72	2.3	3.15	2.9	122	2.3	2.7	2.8	172	3	2.6	2.8	222	2.2	1.9	3.3
23	2	2.5	2	73	2.15	2.27	3.2	123	2.45	2.5	2.1	173	2.75	2.75	2.2	223	2.5	1.2	0.3
24	1	2.1	2.4	74	2.05	2.5	3.6	124	2.45	2.01	2.1	174	2.55	3.1	2.9	224	1	2.1	1.3
25	2.1	1.7	2	75	2.65	2.8	2.8	125	2.45	2.2	2.3	175	2.65	3	2.2	225	1	2.1	1.3
26	0.85	0.95	2.8	76	2.95	2.85	2.6	126	2	2.4	2.25	176	4.8	3.4	2.7	226	1	2.1	1
27	2.4	2.35	2.8	77	1.8	1.25	2.2	127	2.5	2.55	2.5	177	2.7	3.6	2.9	227	1	2.45	2
28	1.75	1.95	3	78	1.7	1.85	2.2	128	2.35	2.4	2.4	178	1.4	1.85	2.4	228	3	2.45	2.5
29	2.5	2.25	2.7	79	1.25	0	2.4	129	2.55	2.45	2.4	179	2.9	2.55	2.8	229	2.4	2.25	2.9
30	1.75	1.95	3	80	2	2.2	1.1	130	2.55	2.5	2.6	180	3.2	3.25	2.9	230	2.13	1.85	1.7
31	2.35	3	1.3	81	2.45	2.5	1.7	131	2.4	2.5	2.4	181	3	3	3	231	2.25	2.5	1.7
32	1.65	1.9	2.6	82	2.2	2.3	2.8	132	2.45	2.45	2.45	182	2.15		3	232	1.7	1.85	2.6
33	2.6	3.5	1.3	83	2.45	2.3	3.3	133	2.05	2.45	2.45	183	2	2	3	233	1.7	1.85	2.5
34	2.45	1.65	1	84	2	2.3	2.4	134	2.6	2.2	2.3	184	2.35	3.1	2.6	234	2.5	2.7	1.5
35	2.3	2.9	3.2	85	2.4	1.85	2.9	135	2.5	2.5	2.5	185	2.5	2.3	2.9	235	2.5	1	1.5
36	2.3	3.2	2.9	86	2.25	2.75	3.4	136	2.45	2.1	2	186	2.45	2	2.1	236	1.65	1.3	2.5
37	1.6	2	2.7	87	2.35	2.8	2.7	137	2	2.1	2.3	187	2.6	2.25	2.4	237	1.65	2	1
38	3.5	3.5	2.9	88	1.85	4.55	2.6	138	2.3	2.4	2.5	188	1.7	1.85	2.6	238	2.35	2.5	2.5
39	2.5	2.5	3.5	89	1.85	4.55	2.6	139	2.3	2.35	2.4	189	1.7	1.85	2.5	239	2.35	1.68	1.5
40	2.2	1.9	3.3	90	1.75	1.55	2.6	140	2.05	2.55	2.5	190	2.5	2.7	1.5	240	2.4	2.5	3.5
41	2.5	1.2	0.3	91	2.25	1.15	2.5	141	2.3	2.4	2.5	191	2.5	1	1.5	241	2.4	2.5	3.5
42	1	1.2	0.3	92	2.7	2.6	2.8	142	2.3	2.4	2.5	192	1.65	1.3	2.5	242	3	2.6	2.8
43	1	2.1	13	93	2.7	2.6	2.8	143	2.3	2.4	2.5	193	1.65	2	1	243	2.75	2.75	2.2
44	1	2.1	13	94	1.9	1.75	2.2	144	2.4	2.5	2.4	194	2.35	2.5	2.5	244	2.55	3.1	2.9
45	1	2.1	13	95	2.5	1.2	3	145	2.4	2.5	2.4	195	2.35	1.68	1.5	245	2.65	3	2.2
46	3	2.45	2.5	96	3	3	3	146	2.4	2.5	2.4	196	2.4	2.5	3.5	246	4.8	3.4	2.7
47	2.4	2.25	2.9	97	1.15	2.4	2.1	147	2.6	2.65	2.5	197	2.4	2.5	3.5	247	2.7	3.6	2.9
48	2.13	1.85	1.7	98	2.95	2.65	3.2	148	2.05	1.75	1.7	198				248	1.4	1.85	2.4
49	2.25	2.5	1.7	99	2.95	2.55	2.8	149	2.6	2.45	3.2	199	1.7	1.85	2.6	249	2.9	2.55	2.8
50	1.7	1.85	2.6	100	1.7	1.85	2.6	150	2.15	2.4	2.2	200	1.7	1.85	2.5	250	3.2	3.25	2.9

S.No	Stai	Sta-i	Self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem	S.No	stai	sta-i	self esteem
251	2.15	3	3	301	1.7	1.85	2.6	351	2.6	2.3	2.9	401	2.4	2.2	1.2	451	2.95	2.5	3.3
252	2	2	3	302	2.5	2.7	1.5	352	2.5	3	3.2	402	2.65	2.25	2.8	452	2.3	2.5	2.8
253	2.35	3.1	2.6	303	2.5	1	1.5	353	2.6	2.65	2.2	403	1.85	2.3	0.9	453	2.15	3.15	3.3
254	2.5	2.3	2.9	304	1.65	1.3	2.5	354	2.45	2.8	3.8	404	2.6	2.45	3.2	454	2.3	2.4	2.4
255	2.45	2	2.1	305	1.62	2	1	355	2.3	2.3	3.1	405	2.4	2.5	3.8	455	2.25	2.9	2.7
256	2.6	2.25	2.4	306	2.35	2.5	2.5	356	2.3	2.2	3.3	406	1.9	2.35	3.1	456	2.45	2.3	3.3
257	2.3	3.1	2.7	307	2.35	1.68	1.5	357	1	2.25	3.1	407	2.95	2.5	3.3	457	3	3	3
258	2.4	1.8	2.5	308	2.4	2.5	3.5	358	2.4	2.5	3.6	408	2.3	2.5	2.8	458	2.05	2.35	3.1
259	3.9	1.8	2	309	2.45	2.85	2.7	359	2.25	2.2	3.1	409	2.15	3.15	3.3	459	2.95	2.95	3.1
260	2.15	2.2	2.5	310	2.2	2.3	2.7	360	1.6	2.6	2.8	410	2.3	2.4	2.4	460	1.2	1.8	3
261	1	1.8	1	311	2.1	2.5	2.8	361	2.5	2.15	2.5	411	2.05	1.75	1.7	461	3	2.65	2.7
262	4.5	1.6	2.2	312	2.45	2.45	2.5	362	2.1	2.35	2.5	412	2.6	2.45	3.2	462	2.15	2	3.5
263	2.2	3.4	2.1	313	2.1	1.4	2.7	363	2.5	2.5	2.2	413	2.15	2.4	2.2	463	2.25	2.9	2.7
264	2.45	2.25	3.2	314	2.35	2.3	2.8	364	2.15	2.25	3.1	414	2.4	2.2	1.2	464	2.45	2.3	3.3
265	1.85	1.75	2.6	315	2	1	1.8	365	1.7	2.3	2.9	415	2.65	2.25	2.8	465	3	3	3
266	2.1	3	2.2	316	2.35	1.5	2.2	366	2.1	2.4	2.3	416	2.3	2.7	2.8	466	2.05	2.35	3.1
267	1.85	2.45	2.4	317	2.55	1.65	2.8	367	2.6	2.25	2.4	417	2.45	2.5	2.1	467	2.95	2.95	3.1
268	2.15	2.4	2.5	318	1.95	1.9	2.3	368	2.45	2.1	2.2	418	2.45	2.01	2.1	468	1.2	1.25	2.5
269	2.3	3.8	3.3	319	1.85	1.95	2.4	369	2.25	2.2	2.3	419	2.45	2.2	2.3	469	2.65	2.5	3.1
270	1.6	2.25	3.2	320	2.5	2.7	1.6	370	2.5	2.9	2.8	420	2	2.4	2.25	470	2.2	2.6	2.8
271	2.6	2.5	2.8	321	2.25	2.3	2.4	371	2.5	2.2	2.3	421	2.5	2.55	2.5	471	2.5	2.25	2.7
272	3.2	2.65	2.4	322	2.3	3.15	2.9	372	2.3	2.7	2.8	422	2.35	2.4	2.4	472	3	2.5	2.6
273	2	2.5	2	323	2.15	2.27	3.2	373	2.45	2.5	2.1	423	2.55	2.45	2.4	473	3	2.6	2.8
274	1	2.1	2.4	324	2.05	2.5	3.6	374	2.45	2.01	2.1	424	2.55	2.5	2.6	474	2.75	2.75	2.2
275	2.1	1.7	2	325	2.65	2.8	2.8	375	2.45	2.2	2.3	425	2.4	2.5	2.4	475	2.55	3.1	2.9
276	0.85	0.95	2.8	326	2.95	2.85	2.6	376	2	2.4	2.25	426	2.45	2.45	2.45	476	2.65	3	2.2
277	2.4	2.35	2.8	327	1.8	1.25	2.2	377	2.5	2.55	2.5	427	2.7	3.6	2.9	477	4.8	3.4	2.7
278	1.75	1.95	3	328	1.7	1.85	2.2	378	2.35	2.4	2.4	428	1.4	1.85	2.4	478	2.7	3.6	2.9
279	2.5	2.25	2.7	329	1.25	0	2.4	379	2.55	2.45	2.4	429	2.9	2.55	2.8	479	1.4	1.85	2.4
280	1.75	1.95	3	330	2	2.2	1.1	380	2.55	2.5	2.6	430	3.2	3.25	2.9	480	2.9	2.55	2.8
281	2.35	3	1.3	331	2.45	2.5	1.7	381	2.4	2.5	2.4	431	3	3	3	481	3.2	3.25	2.9
282	1.65	1.9	2.6	332	2.2	2.3	2.8	382	2.45	2.45	2.45	432	2.15		3	482	3	3	3
283	2.6	3.5	1.3	333	2.45	2.3	3.3	383	2.05	2.45	2.45	433	2	2	3	483	2.15	2.65	3
284	2.45	1.65	1	334	2	2.3	2.4	384	2.6	2.2	2.3	434	2.35	3.1	2.6	484	2	2	3
285	2.3	2.9	3.2	335	2.4	1.85	2.9	385	2.5	2.5	2.5	435	2.5	2.3	2.9	485	2.35	3.1	2.6
286	2.3	3.2	2.9	336	2.25	2.75	3.4	386	2.45	2.1	2	436	2.45	2	2.1	486	2.5	2.3	2.9
287	1.6	2	2.7	337	2.35	2.8	2.7	387	2	2.1	2.3	437	2.6	2.25	2.4	487	2.45	2	2.1
288	3.5	3.5	2.9	338	1.85	4.55	2.6	388	2.3	2.4	2.5	438	1.7	1.85	2.6	488	2.6	2.25	2.4
289	2.5	2.5	3.5	339	1.85	4.55	2.6	389	2.3	2.35	2.4	439	1.7	1.85	2.5	489	2.3	3.1	2.7
290	2.2	1.9	3.3	340	1.75	1.55	2.6	390	2.05	2.55	2.5	440	2.5	2.7	1.5	490	2.4	1.8	2.5
291	2.5	1.2	0.3	341	2.25	1.15	2.5	391	2.3	2.4	2.5	441	2.5	1	1.5	491	3.9		2
292	1	1.2	0.3	342	2.7	2.6	2.8	392	2.3	2.4	2.5	442	1.65	1.3	2.5	492	2.15	2.2	2.5
293	1	2.1	13	343	2.7	2.6	2.8	393	2.3	2.4	2.5	443	1.65	2	1	493	1	1.8	1
294	1	2.1	13	344	1.9	1.75	2.2	394	2.4	2.5	2.4	444	2.35	2.5	2.5	494	4.5	1.6	2.2
295	1	2.1	13	345	2.5	1.2	3	395	2.4	2.5	2.4	445	2.35	1.68	1.5	495	2.2	3.4	2.1
296	3	2.45	2.5	346	3	3	3	396	2.4	2.5	2.4	446	2.4	2.5	3.5	496	2.45	2.25	3.2
297	2.4	2.25	2.9	347	1.15	2.4	2.1	397	2.6	2.65	2.5	447	2.4	2.5	3.5	497	1.85	1.75	2.6
298	2.13	1.85	1.7	348	2.95	2.65	3.2	398	2.05	1.75	1.7	448				498	2.1	3	2.2
299	2.25	2.5	1.7	349	2.95	2.55	2.8	399	2.6	2.45	3.2	449	1.7	1.85	2.6	499	1.85	2.45	2.4
300	1.7	1.85	2.6	350	1.7	1.85	2.6	400	2.15	2.4	2.2	450	1.7	1.85	2.5	500	2.15	2.4	2.5

S.No	Stai	Sta-i	Self esteem
501	2.00	2.00	3.00
502	2.35	3.10	2.60
503	2.50	2.30	2.90
504	2.45	2.00	2.10
505	2.60	2.25	2.40
506	2.30	3.10	2.70
507	2.40	1.80	2.50
508	3.90	1.80	2.00
509	2.15	2.20	2.50
510	1.00	1.80	1.00
511	4.50	1.60	2.20
512	2.20	3.40	2.10
513	2.45	2.25	3.20
514	1.85	1.75	2.60
515	2.10	3.00	2.20
516	1.85	2.45	2.40
517	2.15	2.40	2.50
518	2.30	3.80	3.30
519	1.60	2.25	3.20
520	2.60	2.50	2.80
521	3.20	2.65	2.40
522	2.00	2.50	2.00
523	1.00	2.10	2.40
524	2.10	1.70	2.00
525	.85	.95	2.80
526	2.40	2.35	2.80
527	1.75	1.95	3.00
528	2.50	2.25	2.70
529	1.75	1.95	3.00
530	2.35	3.00	1.30
531	1.65	1.90	2.60
532	2.60	3.50	1.30
533	2.45	1.65	1.00
534	2.30	2.90	3.20
535	2.30	3.20	2.90
536	1.60	2.00	2.70
537	3.50	3.50	2.90
538	2.50	2.50	3.50
539	2.20	1.90	3.30
540	2.50	1.20	.30
541	1.50	2.00	2.70

Appendix - XII

PMS SYMPTOM SCORE AND PMS KNOWLEDGE SCORE OF THE SELECTED PARTICIPANTS (N=541)

s.no	pms score	PMS knowledge score	s.no	PMS score	PMS knowledge score	s.no	PMS score	PMS knowledge score	s.no	PMS score	PMS knowledge score	s.no	PMS score	PMS knowledge score	s.no	PMS score	PMS knowledge score
1.	2	4	51	2.5	2	101	1	1	151	2	2	201	2	1	251	1	2
2.	2	4	52	2.5	4	102	2	0	152	2	1	202	2	2	252	3	3
3.	3	2	53	2	1	103	4	3	153	2	0	203	2	2	253	3	3
4.	1.4	8	54	2	4	104	2	3	154	2	5	204	2	2	254	3	3
5.	3	1	55	2	3	105	2	2	155	2.5	4	205	2	2	255	4	2
6.	3.06	1	56	1	4	106	2	3	156	2	3	206	2	4	256	3	3
7.	2	5	57	1	3	107	2	3	157	2.5	5	207	2	5	257	3	3
8.	2	5	58	0	2	108	1	10	158	3	2	208	3	1	258	1	1
9.	2.3	4	59	2	2	109	2	5	159	2.6	1	209	3	3	259	3	3
10.	2.5	4	60	2	3	110	2	4	160	2.35	4	210	2	1	260	1	3
11.	2	2	61	3	2	111	2	5	161	3	2	211	3	8	261	1	6
12.	2	2	62	2.5	2	112	2	6	162	3.3	3	212	3	1	262	1	4
13.	3	1	63	0.25	6	113	2	3	163	2.1	3	213	2	1	263	1	3
14.	3.06	8	64	0.25	4	114	2	3	164	0	1	214	3	1	264	1	3
15.	2.3	5	65	1	6	115	2	1	165	4	2	215	1	2	265	2	3
16.	2.5	5	66	1	2	116	2	1	166	2.5	4	216	2	2	266	3	4
17.	2.3	4	67	1	0	117	2	2	167	3	2	217	2	2	267	2	1
18.	2.5	4	68	2.4	0	118	2	2	168	3	1	218	2	1	268	3	2
19.	2	2	69	2	8	119	1	8	169	2	1	219	2	1	269	2	3
20.	2	2	70	1	8	120	2	3	170	3	1	220	3	1	270	1	4
21.	4	1	71	2.2	3	121	2	4	171	2	2	221	2	2	271	1	3
22.	3	2	72	1	2	122	2	3	172	2	2	222	2	4	272	1	2
23.	2.5	4	73	2	3	123	2	4	173	2	1	223	2	3	273	2	2
24.	3	1	74	2	3.6	124	2	5	174	2	4	224	0	3	274	3	3
25.	3.3	3	75	2	3.6	125	2	3	175	3	1	225	3	1	275	3	2
26.	2.35	4	76	1	2	126	2	1	176	2	1	226	1.8	2	276	2.5	2
27.	3	2	77	2	2	127	2	1	177	3	4	227	1.8	2	277	2.5	2
28.	2.5	5	78	2	3	128	3	4	178	3	5	228	2	2	278	3	2
29.	2.5	2	79	3	2	129	2	4	179	2	5	229	0	1	279	3	6
30.	4	1	80	2.5	2	130	2	4	180	2	1	230	2.5	1	280	2	2
31.	4	3	81	0.25	6	131	3.5	1	181	2	1	231	2.5	1	281	0	1
32.	3	4	82	0.25	4	132	3.5	1	182	2	5	232	3	2	282	2.4	1
33.	1	2	83	1	6	133	3.5	1	183	2	2	233	2.65	2	283	1	1
34.	1	4	84	1	2	134	3.5	1	184	2	1	234	2.5	3	284	1	0
35.	1	5	85	1	0	135	3	3	185	4	2	235	1	1	285	2.2	3
36.	1	2	86	2.4	0	136	2	3	186	2	2	236	4	2	286	3	2
37.	1	3	87	2	8	137	2	4	187	2	3	237	2.5	4	287	2.5	2
38.	3	3	88	1	8	138	2	3	188	2	1	238	2.6	1	288	0.25	3.6
39.	3	3	89	2.2	3	139	3.25	2	189	2	1	239	3.3	3	289	0.25	3.6
40.	3	3	90	1	2	140	3.85	2	190	2	1	240	2.35	4	290	1	2
41.	4	2	91	2	3	141	1.8	2	191	2	3	241	3	2	291	3.5	0
42.	3	3	92	2	3.6	142	1.8	2	192	2	1	242	2.5	5	292	2	1
43.	3	3	93	2	3.6	143	2	2	193	2	2	243	3	2	293	3	1
44.	0	1	94	1	2	144	0	1	194	2	3	244	4	1	294	3	1
45.	3	3	95	2	2	145	2.5	1	195	2	1	245	1	3	295	3	1
46.	1	4	96	2	3	146	2.5	1	196	2	1	246	3	4	296	4	2
47.	1	6	97	3	2	147	3	2	197	2	1	247	1	2	297	4	3
48.	1	4	98	2.5	2	148	2.65	2	198	2	2	248	1	3	298	4	2
49.	0	3	99	0.25	6	149	2.5	3	199	2	1	249	1	4	299	3	1
50.	0	3	100	0.25	4	150	2.5	2	200	2	2	250	1	3	300	3	3

Appendix - XIII

ANTHROPOMETRIC MEASUREMENTS OF THE CONTROL GROUP BEFORE AND AFTER INTERVENTION (N=50)

	BEFORE				AFTER			
SNo	height	weight	BMI	W/H ratio	height	weight	BMI	W/H ratio
1.	154	44	29	1.540	154	44	19	0.775
2.	143	72	50	1.430	143	72	25	0.841
3.	159	75	47	1.590	159	75	25	0.841
4.	159	62	39	1.590	159	62	21	0.667
5.	149	60	40	1.490	149	60	20	0.600
6.	150	47	31	1.500	150	47	20	0.831
7.	150	47	31	1.500	150	47	18	0.636
8.	148	48	32	1.480	148	48	18	0.722
9.	149	48	32	1.490	149	48	18	0.667
10.	155	48	31	1.550	155	48	20	0.645
11.	143	72	50	1.430	143	72	23	0.649
12.	150	35	23	1.500	150	35	21	0.752
13.	154	47	31	1.540	154	47	16	0.752
14.	154	44	29	1.540	154	44	15	0.750
15.	154	44	29	1.540	154	44	17	0.873
16.	146	46	32	1.460	146	46	15	0.873
17.	170	63	37	1.700	170	63	21	0.873
18.	165	52	32	1.650	165	52	16	0.667
19.	152	48	32	1.520	152	48	20	0.676
20.	145	52	36	1.450	145	52	17	0.960
21.	155	58	37	1.550	155	58	19	0.960
22.	145	58	40	1.450	145	58	25	0.847
23.	155	58	37	1.550	155	58	20	0.622
24.	145	52	36	1.450	145	52	21	0.814
25.	158	59	37	1.580	158	59	23	0.837
26.	160	35	22	1.600	160	35	21	0.771
27.	160	45	28	1.600	160	45	15	0.855
28.	153	42	27	1.530	153	42	24	0.819
29.	153	54	35	1.530	153	54	18	0.875
30.	153	51	33	1.530	153	51	17	0.770
31.	149	43	29	1.490	149	43	14	0.770
32.	155	48	31	1.550	155	48	16	0.770
33.	156	52	33	1.560	156	52	17	0.875
34.	145	58	40	1.450	145	58	19	0.875
35.	162	55	34	1.620	162	55	18	0.859
36.	145	64	44	1.450	145	64	21	0.889
37.	152	43	28	1.520	152	43	18	0.955
38.	150	42	28	1.500	150	42	18	0.780
39.	149	41	28	1.490	149	41	16	0.780
40.	153	56	37	1.530	153	56	19	0.780
41.	154	35	23	1.540	154	35	21	0.727
42.	152	43	28	1.520	152	43	18	0.944
43.	151	43	28	1.510	151	43	18	0.881
44.	162	71	44	1.620	162	71	24	0.881
45.	163	45	28	1.630	163	45	15	0.944
46.	159	42	26	1.590	159	42	14	0.881
47.	158	41	26	1.580	158	41	14	0.872
48.	156	50	32	1.560	156	50	17	0.944
49.	161	49	30	1.610	161	49	16	0.881
50.	149	52	35	1.490	149	52	20	0.881

Appendix - XIV

ANTHROPOMETRIC MEASUREMENTS OF EXPERIMENTAL GROUP BEFORE AND AFTER INTERVENTION

	BEFORE				AFTER			
SNo	height	weight	BMI	W/H ratio	height	weight	BMI	W/H ratio
1.	154	50	19	.944	154	50.00	19.00	0.94
2.	155	50	21	.881	155	50.00	21.00	0.88
3.	154	53	22	.872	154	53.00	22.40	0.87
4.	144	52	25	.872	144	52.00	25.00	0.87
5.	144	52	25	.818	144	52.00	25.00	0.82
6.	154	51	21	.814	154	51.00	19.00	0.81
7.	154	50	21	.837	154	50.00	21.00	0.84
8.	165	57	21	.771	165	57.00	20.90	0.77
9.	154	54	23	.855	154	54.00	23.30	0.86
10.	160	64	25	.819	160	60.00	25.00	0.82
11.	155	68	29	.875	155	60.00	20.00	0.88
12.	154	44	18	.770	154	50.00	20.00	0.77
13.	155	44	18	.770	155	50.00	19.00	0.77
14.	154	52	23	.770	154	52.00	22.60	0.77
15.	154	38	16	.875	154	40.00	20.00	0.88
16.	154	50	20	.875	154	50.00	20.00	0.88
17.	154	48	20	.814	154	48.00	20.30	0.81
18.	160	70	27	.837	160	65.00	27.30	0.84
19.	160	70	27	.900	160	59.00	22.00	0.77
20.	157	63	26	.855	157	59.00	25.60	0.86
21.	157	60	24	.819	157	58.00	24.40	0.82
22.	157	58	24	.875	157	58.00	23.60	0.88
23.	156	50	26	.900	156	50.00	26.00	0.77
24.	152	37	16	.900	152	40.00	20.00	0.77
25.	154	50	19	.900	154	49.00	19.00	0.77
26.	155	50	21	.875	155	49.00	21.00	0.88
27.	154	53	22	.875	154	51.00	22.00	0.88
28.	144	52	25	.875	144	52.00	25.00	0.88
29.	144	52	25	.875	144	52.00	25.00	0.88
30.	154	51	20	.875	154	45.00	20.00	0.88
31.	154	50	21	.887	154	45.00	21.00	0.89
32.	165	57	21	.776	165	50.00	21.00	0.78
33.	154	54	23	1.000	154	54.00	23.00	0.78
34.	160	64	25	1.000	160	53.00	25.00	0.77
35.	155	68	28	1.000	155	51.00	28.00	0.85
36.	154	44	18	1.000	154	51.00	19.00	0.77
37.	154	44	18	.770	154	44.00	18.00	0.77
38.	154	52	22	1.000	154	51.00	22.00	0.77
39.	154	38	16	.875	154	50.00	16.00	0.88
40.	154	38	16	.875	154	51.00	16.00	0.88
41.	154	48	20	.814	154	50.00	20.30	0.81
42.	160	70	27	.837	160	55.00	27.00	0.84
43.	154	70	30	.771	154	55.00	27.00	0.77
44.	157	63	27	.821	157	55.00	24.00	0.82
45.	157	60	24	.810	157	57.00	24.40	0.81
46.	157	58	24	.865	157	58.00	23.60	0.86
47.	156	50	26	.839	156	50.00	25.50	0.84
48.	154	50	20	.889	154	55.00	20.00	0.89
49.	154	45	18	.821	154	50.00	18.20	0.82
50.	154	45	18	.810	154	50.00	18.20	0.81

Appendix - XV

BIOCHEMICAL PROFILE OF THE CONTROL GROUP BEFORE AND AFTER INTERVENTION

BEFORE							AFTER					
S.No	Haemoglobin	Calcium	Magnesium	ferritin	Iron	TIBC	Haemoglobin	Calcium	magnesium	Ferritin	Iron	TIBC
1	9.6	9.3	1.5	35.07	44.4	282	9.2	8.8	1.7	32.8	54.3	381
2	9.4	9.6	1.7	16.52	69.4	426	9.5	9	1.7	16.99	65.4	473
3	9.1	9.4	2	14.99	78	425	9.1	8.2	1.9	17.96	130.6	361.9
4	9.8	9.1	1.8	17.71	54.5	336	9.7	8.8	1.9	17.4	55	373.3
5	9.8	9.8	1.8	11.43	52	395	9.4	8.6	1.8	10.48	35.8	433.7
6	9.4	9.8	1.9	30	52.5	465	9.6	8.7	2	31.09	142.7	334.5
7	9.4	9.4	2.1	11.1	105.1	322	9.3	9.2	2	17.95	30.3	372.3
8	9.5	9.4	2.1	30.01	123.8	460	9.2	8.7	1.8	30.89	123.6	391.5
9	9.2	9.5	1.7	35.12	79.5	285	9.5	8.5	1.8	28.33	81.9	440
10	9.3	9.2	2	12.51	38.5	391	9.1	9.1	1.6	12.29	127.7	355.3
11	9.4	9.3	2.1	23	100.4	281	9.7	8.5	2	22.09	92.3	337.9
12	9.7	9.4	2.3	44.08	54.6	395	9.4	9.2	1.8	44.08	105.8	369
13	9.4	9.7	1.9	56.15	116	244	9.6	9	2	55.77	64.2	339
14	9.4	9.4	1.8	55.75	56.2	283	10	8.7	2.1	52.61	81.1	412.5
15	9.7	9.4	2	19.28	29.4	402	10	8.8	1.8	18.29	38.8	397.3
16	9.2	9.7	2.1	24.44	60.3	459	10	9	1.9	26.35	135.9	338.4
17	9.5	9.2	2	44.4	94.4	253	9.2	9	2	10.03	34.3	464.3
18	9.1	9.5	2	16.16	64.1	352	9.5	8.9	1.9	45.05	142.9	392
19	9.7	9.1	1.9	86	177.1	303	9.1	8.8	2	82.89	112.2	395.3
20	9.4	9.7	2.2	45.13	134	250	9.7	8.8	2	46.6	106.6	250
21	9.6	9.4	2	48.78	92.2	308	10	8.8	2.2	44.31	45.2	473.5
22	9.3	9.6	2.3	25.73	36	393	10	8.7	1.9	21.99	80.8	300
23	8.9	9.3	2.1	31.76	47.9	302	9	8.4	2	5.04	30.2	381
24	9.3	8.9	2.1	12.82	18.2	452	9	8.6	1.8	12.51	56.9	250
25	9.2	9.3	1.7	12.43	87.4	284	9.3	8.4	1.9	13.39	69.7	280
26	9.6	9.6	1.7	16.52	69.4	426	9.6	9	1.7	16.99	65.4	473
27	9.4	9.4	2	16.99	78	361	10	8.2	1.9	17.96	130.6	352
28	9.1	9.1	1.8	17.71	54.5	336	10	8.8	1.9	19.4	55	373.3
29	9.8	9.8	1.8	11.43	52	395	9	8.6	1.8	10.48	35.8	390
30	9.8	9.8	1.9	27.44	52.5	330	9.8	8.7	2	31.09	142.7	334.5
31	9.4	9.4	2.1	17.1	105.1	322	9.4	9.2	2	17.95	30.3	372.3
32	9.4	9.4	2.1	32.67	23.8	360	9.4	8.7	1.8	30.89	123.6	391.5
33	9.5	9.5	1.7	35.12	79.5	285	10	8.5	1.8	28.33	81.9	200
34	9.2	9.2	2	12.51	38.5	391	11.2	9.1	1.6	12.29	127.7	355.3
35	9.3	9.3	2.1	22.55	100.4	281	12.3	8.5	2	22.09	92.3	290
36	11	9.4	2.3	44.38	54.6	395	12.9	9.2	1.8	44.08	105.8	369
37	9.7	9.7	1.9	56.15	116	244	12.7	9	2	55.77	64.2	250
38	9.4	9.4	1.8	55.75	56.2	283	9.2	8.7	2.1	52.61	81.1	380
39	9.4	9.4	2	19.28	29.4	402	9.5	8.8	1.8	19.76	38.8	397.3
40	9.7	9.7	2.1	24.44	60.3	459	9.1	9	1.9	26.35	135.9	338.4
41	9.2	9.2	2	44.4	94.4	253	9.7	9	2	40.03	34.3	300
42	9.5	9.5	2	46.16	64.1	352	9.4	8.9	1.9	45.05	142.9	392
43	9.1	9.1	1.9	86.16	177.1	303	9.6	8.8	2	82.89	112.2	395.3
44	9.7	9.7	2.2	45.13	134	250	9.3	8.8	2	46.06	106.6	301.6
45	9.4	9.4	2	28.78	92.2	308	12.4	8.8	2.2	24.31	45.2	340
46	9.6	9.6	2.3	25.73	36	393	10	8.7	1.9	21.99	80.8	448.1
47	9.3	9.3	2.1	31.76	47.9	302	9.3	8.4	2	35.04	30.2	381
48	8.9	8.9	2.1	1.82	18.2	459	9	8.6	1.8	12.51	56.9	420
49	9.3	9.3	1.7	12.43	67.4	284	10	8.4	1.9	13.39	69.7	302
50	9.2	9.2	2	24.9	127.5	317	11.3	9	1.7	15.69	134	307.3

Appendix - XVI

BIOCHEMICAL PROFILE OF THE EXPERIMENTAL GROUP BEFORE AND AFTER INTERVENTION

	BEFORE						AFTER					
Sno	Haemoglobin	Calcium	Magnesium	Ferritin	Iron	TIBC	Haemoglobin	Calcium	Magnesium	Ferritin	Iron	TIBC
1	10	8.9	1.9	23.61	84.2	360	10	8.9	1.8	28.19	111	511.4
2	10	9	2	28.42	116.4	245	10	9.6	2.1	38.7	165.9	378.6
3	10	8.5	2.4	10.96	70	305	10	8.8	2	8.35	39.3	409
4	10	8.9	2.1	21.49	75.9	379	10	8.9	2.1	20.19	118.7	449.8
5	10.05	9	1.9	44.47	95.6	281	10	9	2	41.52	73.5	308.7
6	10.05	9	2.1	50.49	81.6	281	10	8	2.1	34.58	92.3	440.3
7	10.06	8.7	2	23.92	117.4	327	10	8.7	1.9	23.14	86.5	358.6
8	10.05	8.9	1.9	17.09	43	431	9	8.9	1.7	14.53	46	361.9
9	9.6	8.9	1.8	26.93	91.5	284	10	8.9	1.7	26.12	72.3	405.7
10	11	8.7	2	40.3	77.8	275	11	8.5	2.2	42.37	151.9	413.3
11	11	9.1	1.9	19.38	65.2	357	10	9.1	1.8	15.55	49	349.8
12	11	8.6	1.8	30.33	82	304	10	8.6	1.8	40.02	59.9	340.2
13	12	9	1.8	24.54	134.4	286	10	9	1.9	20.72	102.5	362.1
14	11	8.8	2.1	23.03	69.4	372	10	8.8	2.2	31.83	96.3	442.8
15	10	8.5	2.1	115.7	85.9	247	10	8.5	2.2	66.01	50.4	357.9
16	10	8.5	2.1	7.17	31.7	507	10	8.5	2.2	8.24	38.3	389.3
17	9.4	9	1.9	57.31	71.8	345	11	9	2.2	46.75	75	425.9
18	10	10	1.9	29.35	120.1	269	11	9.4	1.9	17.43	74.3	343.2
19	10.3	8.9	1.9	57.64	157.2	214	10	8	2	76.28	91.6	366.6
20	10.5	8.4	2	3.56	18.4	521	11	8	1.8	5.36	23.5	378.2
21	10	8.8	1.8	8.25	38.6	469	10	8	2.1	11.66	39.1	330.8
22	11	8.6	2	23.09	58	381	10	9	2	23.09	58	455.2
23	10.5	8.3	2.3	7.29	27.5	459	9	10	2.3	7.29	27.5	368.9
24	10	8.5	1.9	5.61	23.8	470	9	9	1.9	5.61	23.8	338.7
25	10	8.8	1.7	35.07	44.4	282	9.3	8.5	1.5	32.8	54.3	381
26	9.4	8.9	1.9	23.61	84.2	360	9.6	8.9	1.8	28.19	111	511.4
27	9.1	9	2	28.42	116.4	245	10	9	2.1	38.7	165.9	378.6
28	9.8	9	2.4	10.96	70	305	10	9	2	8.35	39.3	409
29	9.8	8.9	2.1	21.49	75.9	379	9	9	2.1	20.19	118.7	449.8
30	9.4	9	1.9	44.47	95.6	281	9.8	8.5	2	41.52	73.5	308.7
31	9.4	9	2.1	50.49	81.6	281	9.4	9.2	2.1	34.58	92.3	200
32	10	8.7	2	23.92	117.4	327	9.4	8.7	1.9	23.14	86.5	110
33	10	8.9	1.9	17.09	43	431	10	8.6	1.7	14.53	46	361.9
34	10	8.9	1.8	26.93	91.5	284	11.2	9.05	1.7	26.12	72.3	300
35	12	8.7	2	40.3	77.8	275	12.3	8.9	2.2	42.37	151.9	300
36	10	9.1	1.9	19.38	65.2	357	12.9	9.9	1.8	15.55	49	349.8
37	9.9	9	1.8	30.33	82	304	12.7	9	1.8	40.02	59.9	340.2
38	11	9.1	1.8	24.54	134.4	286	11.4	9.8	1.9	20.72	102.5	200
39	11	8.8	2.1	23.03	69.4	372	11.4	9	2.2	31.83	96.3	220
40	11	8.5	2.1	115.7	85.9	247	12.7	9.2	2.2	66.01	50.4	357.9
41	9.5	8.5	2.1	7.17	31.7	507	11	9.4	2.2	8.24	38.3	389.3
42	9.1	8.7	1.9	57.31	71.8	345	12.5	9	2.2	46.75	75	335
43	9.7	9.1	1.9	29.35	120.1	269	11.1	9.4	1.9	17.43	74.3	343.2
44	9.4	10	1.9	57.64	157.2	214	10	9	2	76.28	91.6	300
45	9.6	8.4	2	3.56	18.4	521	12.4	9.3	1.8	5.36	23.5	378.2
46	9.3	9.5	1.8	8.25	38.6	469	10	9	2.1	11.66	39.1	400
47	10	8.6	2	23.09	58	381	9.3	9	2	23.09	58	300
48	10	8.3	2.3	7.29	27.5	459	9	9	2.3	7.29	27.5	400
49	9.2	8.5	1.9	5.61	23.8	470	10	8.5	1.9	5.61	23.8	400
50	9.2	9	1.7	8.25	38.6	469	11.3	9.3	1.5	32.8	54.3	381

Appendix - XVII

MEAN NUTRIENT INTAKE OF THE CONTROL GROUP BEFORE AND AFTER INTERVENTION (BEFORE)

Sno	Calorie	Protein	CHO	FAT	Calcium	Magnesium	Iron	Beta carotene	Thiamine	Riboflavin	Niacin	Vit C
1.	1200.00	43.00	339.80	34.84	350.00	900.00	32.90	1200.00	.50	1.00	1.49	20.00
2.	1236.00	43.00	216.00	20.90	350.00	550.00	30.00	1236.00	.10	1.50	1.55	20.00
3.	1236.00	43.00	300.00	20.90	350.00	550.00	30.00	1236.00	.10	1.50	1.55	2.00
4.	1500.00	43.00	239.00	29.90	350.00	950.00	25.90	1500.00	.60	.22	1.00	15.00
5.	1255.00	43.00	286.30	25.90	350.00	680.00	15.65	1255.00	.20	1.20	1.20	15.00
6.	1255.00	43.00	342.60	30.50	350.00	1180.00	17.96	1255.00	.10	1.80	1.33	15.00
7.	1621.10	40.68	248.33	35.35	350.00	965.00	10.11	1621.10	.40	1.30	2.05	20.00
8.	2110.00	45.90	265.00	32.90	350.00	750.00	16.60	2110.00	.50	1.20	.17	20.00
9.	1989.01	44.00	320.00	32.00	350.00	870.00	20.40	1989.01	.30	1.50	.25	20.00
10	1536.00	44.00	350.00	35.00	350.00	780.00	6.00	1536.00	.50	1.80	.01	15.00
11	1236.00	44.00	251.00	18.00	350.00	900.00	11.70	1236.00	.11	1.30	.45	15.00
12	1050.00	48.70	230.00	25.00	350.00	950.00	31.39	1050.00	.50	1.25	.28	15.00
13	1500.00	45.00	355.00	45.60	650.00	955.00	50.60	1500.00	.70	1.02	.36	12.00
14	1050.00	50.10	304.00	35.00	600.00	990.80	15.40	1050.00	.60	1.09	.55	12.00
15	1505.00	29.60	365.50	54.20	793.00	780.00	23.48	1505.00	.30	1.20	.47	12.00
16	1500.00	40.00	355.00	28.00	856.00	880.00	19.00	1500.00	.50	1.00	1.80	12.00
17	1549.00	46.38	350.00	25.00	315.80	1112.00	8.12	1549.00	.70	.02	1.50	12.00
18	1036.00	50.60	392.00	35.50	626.30	995.00	10.10	1036.00	.90	.06	1.30	10.00
19	1048.00	44.00	254.00	25.30	825.30	885.40	14.03	1048.00	.80	.12	.75	2.00
20	2150.00	44.00	325.00	29.00	800.00	955.20	17.00	2150.00	.10	1.10	.22	2.00
21	1020.00	44.00	321.40	20.10	755.00	990.70	16.60	1020.00	.80	1.35	2.00	2.00
22	1202.00	44.00	248.00	10.50	335.00	795.14	20.00	1202.00	.11	.58	.85	2.00
23	1500.00	44.00	339.80	34.84	335.00	900.00	32.90	1500.00	.50	1.00	1.49	2.00
24	1503.00	44.50	392.00	20.90	335.00	550.00	30.00	1503.00	.10	1.50	1.55	10.00
25	1503.00	44.50	216.00	20.90	335.00	550.00	30.00	1503.00	.10	1.50	1.55	10.00
26	1020.00	49.00	239.00	29.90	335.00	950.00	25.90	1020.00	.60	.22	1.00	1.50
27	1300.00	49.00	286.30	25.90	335.00	680.00	15.65	1300.00	.20	1.20	1.20	11
28	1030.00	49.00	342.60	30.50	335.00	1180.00	17.96	1030.00	.10	1.80	1.33	51
29	999.00	49.00	248.33	35.35	335.00	965.00	19.00	999.00	.40	1.30	2.05	65
30	1100.00	49.00	265.00	32.90	335.00	750.00	16.60	1100.00	.50	1.20	.17	3.60
31	1200.00	49.00	320.00	32.00	335.00	870.00	20.40	1200.00	.30	1.50	.25	1.50
32	1600.00	45.90	350.00	35.00	335.00	780.00	20.00	1600.00	.50	1.80	.01	1.85
33	1672.00	44.00	251.00	18.90	335.00	900.00	11.70	1672.00	.11	1.30	.45	1.23
34	1500.00	48.70	238.50	25.00	335.00	950.00	31.39	1500.00	.50	1.25	.28	1.90
35	1022.00	65.00	355.00	30.00	335.00	955.00	25.00	1022.00	.70	1.02	.36	2.00
36	1200.00	43.00	304.00	35.00	335.00	990.80	15.40	1200.00	.60	1.09	.55	2.50
37	1500.00	29.60	365.50	34.00	335.00	780.00	23.48	1500.00	.30	1.20	.47	1.00
38	1900.00	40.00	355.00	28.00	335.00	880.00	19.00	1900.00	.50	1.00	1.80	1.52
39	1549.00	46.38	397.00	28.00	335.00	1112.00	28.00	1549.00	.70	.02	1.50	1.54
40	1550.00	45.00	315.00	35.50	335.00	995.00	22.00	1550.00	.90	.06	1.30	2.00
41	1060.00	47.00	254.00	25.30	250.00	885.40	14.03	1060.00	.80	.12	.75	2.15
42	1200.00	44.00	325.00	29.00	250.00	955.20	17.00	1200.00	.10	1.10	.22	2.63
43	1200.00	56.60	321.40	20.10	250.00	990.70	16.60	1200.00	.80	1.35	2.00	1.05
44	1530.00	55.00	248.00	10.50	250.00	795.14	20.00	1530.00	.11	.58	.85	6.0
45	1549.00	46.38	197.30	65.28	250.00	1112.00	16.00	1549.00	.70	.02	1.50	1.54
46	2000.00	44.00	301.00	35.50	250.00	995.00	21.00	2000.00	.90	.06	1.30	2.00
47	1876.00	42.00	254.00	25.30	250.00	885.40	14.03	1876.00	.50	1.00	1.80	1.52
48	1987.00	43.00	325.00	29.00	250.00	955.20	17.00	1987.00	.70	.02	1.50	1.54
49	1200.00	46.00	321.40	20.10	250.00	990.70	16.60	1200.00	.90	.06	1.30	2.00
50	1758.90	45.00	248.00	10.50	200.00	795.14	20.00	1758.90	.80	.12	.75	2.15

NUTRIENT INTAKE OF THE CONTROL GROUP INTERVENTION (AFTER)

S.no	Calorie	Protein	Cho	FAT	Calcium	Magnesium	Iron	Beta carotene	Thiamine	Riboflavin	Niacin	Vit C
1.	1502.20	40.53	336.00	20.00	500.00	650.00	25.00	800.00	1.00	.40	2.00	2.11
2.	1045.00	35.86	380.00	25.00	410.00	650.00	27.00	755.00	.11	.70	.85	3.00
3.	1054.00	35.86	380.00	25.00	200.00	650.00	27.00	755.00	.11	.70	.85	3.00
4.	1098.00	40.65	365.00	28.00	200.00	650.00	28.00	700.00	1.80	.11	.12	2.58
5.	1835.50	50.50	405.20	27.00	200.00	650.00	23.00	855.00	1.30	.54	1.02	2.00
6.	1920.00	50.45	363.00	26.00	200.00	450.00	24.30	655.00	1.50	.20	1.25	2.80
7.	1935.60	55.70	385.00	23.00	895.00	690.00	20.30	700.00	1.50	1.00	.22	.95
8.	1805.00	56.00	227.50	30.90	206.00	790.00	18.50	800.00	1.00	.55	.85	1.58
9.	1085.00	40.35	345.80	25.10	390.00	685.00	23.41	675.60	1.20	.47	.25	.23
10	1085.00	45.00	445.00	27.80	390.00	970.00	11.07	800.65	1.20	.60	.50	3.00
11	1379.00	45.00	227.80	30.54	390.00	850.00	19.25	715.50	.15	.30	.65	22.00
12	1085.00	45.00	295.50	26.56	390.00	670.00	20.18	550.70	.80	.40	.25	47.00
13	1085.00	45.00	394.60	32.45	390.00	850.00	15.65	1158.00	.60	.80	1.02	10.00
14	1085.00	45.00	350.00	20.10	390.00	750.00	18.00	850.60	1.00	.14	1.25	21.00
15	1350.00	45.00	444.90	25.00	390.00	655.00	15.80	795.80	1.00	.12	1.09	78.00
16	1085.00	45.00	369.90	22.70	390.00	895.00	16.90	800.00	.11	.58	1.00	.36
17	1200.00	45.00	363.00	23.89	390.00	955.00	20.19	784.90	.24	.98	.02	10.00
18	1520.00	40.60	385.00	20.67	390.00	910.00	11.07	800.00	1.20	1.02	.58	.47
19	1205.00	41.70	315.00	24.80	783.00	690.00	15.16	782.56	1.50	.02	.35	11.00
20	1035.00	60.70	340.00	23.10	210.00	865.00	19.70	745.90	1.60	.58	.74	.11
21	1500.00	58.89	365.00	30.67	401.00	450.00	20.40	789.60	1.20	.90	1.54	.90
22	1600.00	59.60	320.00	28.90	305.00	900.00	20.89	845.00	.45	.50	.60	2.00
23	1502.20	40.53	336.00	20.00	411.00	650.00	25.00	800.00	1.00	.40	2.00	2.11
24	1302.00	35.86	380.00	25.00	300.00	700.00	27.00	755.00	.11	.70	.85	10.00
25	1302.00	35.86	380.00	25.00	300.00	700.00	27.00	755.00	.11	.70	.85	10.00
26	1302.00	40.65	365.00	28.00	300.00	800.00	28.00	700.00	1.80	.11	.12	12.00
27	1302.00	50.50	305.00	27.00	300.00	970.00	23.00	855.00	1.30	.54	1.02	2.00
28	1302.00	50.45	363.00	26.00	300.00	450.00	24.30	655.00	1.50	.20	1.25	2.80
29	1302.00	55.70	385.00	23.00	300.00	690.00	20.30	700.00	1.50	1.00	.22	10.00
30	1203.00	56.00	227.50	30.90	401.00	790.00	18.50	800.00	1.00	.55	.85	1.58
31	1200.00	40.35	345.80	25.10	335.00	685.00	23.41	675.60	1.20	.47	.25	.23
32	1230.00	40.35	225.00	27.80	440.00	970.00	11.07	800.65	1.20	.60	.50	30.00
33	1379.00	40.35	227.80	20.00	200.00	850.00	19.25	715.50	.15	.30	.65	10.00
34	1320.00	40.35	295.50	22.00	290.00	670.00	20.18	550.70	.80	.40	.25	10.00
35	1320.00	40.35	294.00	21.00	440.00	850.00	15.65	1158.00	.60	.80	1.02	.10
36	1360.00	40.35	315.00	20.10	401.00	750.00	18.00	850.60	1.00	.14	1.25	.21
37	1360.00	40.35	225.00	21.00	800.00	655.00	15.80	795.80	1.00	.12	1.09	.78
38	1360.00	40.35	369.90	22.70	502.00	895.00	16.90	800.00	.11	.58	1.00	.36
39	1360.00	40.35	208.00	23.89	400.00	955.00	20.19	784.90	.24	.98	.02	10.00
40	1360.00	40.60	293.00	20.67	209.00	910.00	11.07	800.00	1.20	1.02	.58	10.00
41	1360.00	41.70	315.00	24.80	185.00	690.00	15.16	782.56	1.50	.02	.35	1.00
42	1500.00	60.70	305.00	23.10	689.00	865.00	19.70	745.90	1.60	.58	.74	1.00
43	1200.00	48.00	365.00	25.00	350.00	450.00	20.40	789.60	1.20	.90	1.54	11.00
44	1500.00	49.00	320.00	21.00	290.00	600.00	20.89	845.00	.45	.50	.60	2.00
45	1500.00	52.00	363.00	23.89	290.00	600.00	20.19	784.90	.24	.98	.02	.98
46	1888.90	40.60	342.00	20.67	290.00	600.00	11.07	800.00	1.20	1.02	.58	5.00
47	1876.00	41.70	315.00	24.80	290.00	600.00	15.16	782.56	1.50	.02	.35	5.00
48	1987.00	60.70	320.00	23.10	290.00	600.00	19.70	745.90	1.60	.58	.74	5.00
49	1900.00	49.00	295.00	23.00	290.00	600.00	20.40	789.60	1.20	.90	1.54	5.00
50	1758.90	57.00	320.00	28.90	350.00	600.00	20.89	845.00	.45	.50	.60	5.00

Appendix - VIII

MEAN NUTRIENT INTAKE OF THE EXPERIMENTAL GROUP BEFORE AND INTERVENTION (BEFORE)

S.No	Calorie	Protein	Cho	Fat	Calcium	Magnesium	Iron	Beta carotene	Thiamine	Riboflavin	Niacin	Vit C
1.	836.60	168.26	30.00	16.50	381.00	766.56	16.00	341.50	.81	.74	8.93	41.10
2.	1605.00	356.00	58.20	23.85	362.00	1137.00	16.00	179.70	1.10	.97	8.60	4.50
3.	1867.00	369.40	45.00	19.35	793.00	1656.00	16.00	302.03	1.66	2.50	9.50	10.10
4.	1867.00	369.40	45.00	19.35	362.00	1656.00	16.00	302.03	1.66	2.50	9.50	4.50
5.	1867.00	369.40	45.00	19.35	362.00	1656.00	16.00	302.03	1.66	2.40	9.50	4.50
6.	1605.00	356.00	58.00	23.85	800.00	1137.00	16.00	179.70	1.10	.97	8.60	20.00
7.	834.40	168.16	40.00	16.50	920.00	766.44	16.00	351.50	.81	.56	8.88	36.00
8.	834.40	168.16	40.00	16.50	1000.00	766.44	16.00	351.50	.81	.56	8.88	40.00
9.	834.40	168.16	27.81	16.50	381.00	766.44	16.00	351.50	.81	.56	8.88	41.10
10	1500.00	300.00	30.00	30.00	362.00	600.00	16.00	250.00	.80	1.00	7.00	4.50
11	817.00	139.60	20.80	21.70	793.00	652.00	16.00	1133.00	.36	.96	5.50	10.10
12	1070.00	144.00	25.00	42.00	362.00	800.00	16.00	415.00	1.05	1.70	8.00	4.50
13	834.40	168.16	27.81	16.50	362.00	766.44	16.00	351.50	.81	.56	8.88	4.50
14	834.00	168.16	27.81	16.50	800.00	766.44	16.00	351.50	.81	.56	8.88	20.00
15	836.60	168.26	28.21	16.50	920.00	766.56	16.00	341.50	.81	.74	8.93	36.00
16	1605.00	356.00	58.20	23.85	1000.00	137.00	16.00	179.70	1.10	.97	8.60	40.00
17	836.60	168.26	28.21	16.50	381.00	766.56	16.00	341.50	.81	.74	8.93	41.10
18	1605.00	356.00	58.20	23.85	362.00	1137.00	16.00	179.70	1.10	.97	8.60	4.50
19	836.60	168.26	28.21	16.50	793.00	766.56	16.00	341.50	.81	.74	8.93	10.10
20	1605.00	356.00	58.20	23.85	362.00	1137.00	95.00	179.70	1.10	.97	8.60	4.50
21	1867.00	369.40	40.00	19.35	362.00	1656.00	15.00	302.03	1.66	2.50	12.20	4.50
22	1867.00	369.40	40.00	19.35	800.00	1656.00	15.00	302.03	1.66	2.50	12.20	20.00
23	1867.00	369.40	40.00	19.35	920.00	1656.00	15.00	302.03	1.66	2.50	12.20	36.00
24	1605.00	356.00	58.00	23.85	1000.00	1137.00	15.00	179.70	1.10	.97	8.60	40.00
25	834.40	168.16	27.81	16.50	381.00	766.44	15.00	351.50	.81	.56	8.88	41.10
26	834.40	168.16	27.81	16.50	362.00	766.44	15.00	351.50	.81	.56	8.88	4.50
27	834.40	168.16	27.81	16.50	793.00	766.44	15.00	351.50	.81	.56	8.88	10.10
28	1500.00	300.00	30.00	30.00	362.00	600.00	15.00	250.00	.50	1.00	7.00	4.50
29	817.00	139.60	20.80	21.70	362.00	652.00	15.00	1133.00	.50	.96	5.50	4.50
30	1070.00	144.00	44.00	42.00	800.00	800.00	15.00	415.00	1.05	1.00	8.00	20.00
31	834.40	168.16	27.81	16.50	920.00	766.44	15.00	351.50	.81	.56	8.88	36.00
32	834.00	168.16	27.81	16.50	1000.00	766.44	15.00	351.50	.81	.56	8.88	40.00
33	836.60	168.26	28.21	16.50	381.00	766.56	15.00	341.50	.81	.74	8.93	41.10
34	1605.00	356.00	58.20	23.85	362.00	1137.00	12.00	179.70	4.42	.97	8.60	4.50
35	836.60	168.26	44.00	16.50	793.00	766.56	12.00	341.50	.81	.74	8.93	10.10
36	1605.00	356.00	58.20	23.85	362.00	1137.00	12.00	179.70	1.40	.97	8.60	4.50
37	836.60	168.26	48.00	16.50	362.00	766.56	12.00	341.50	.81	.74	8.93	4.50
38	1605.00	356.00	58.20	23.85	800.00	1137.00	12.00	179.70	1.50	.97	8.60	20.00
39	1867.00	369.40	45.00	19.35	920.00	1656.00	12.00	302.03	1.66	2.40	12.50	36.00
40	1867.00	369.40	45.00	19.35	1000.00	1656.00	12.00	302.03	1.66	.10	10.00	40.00
41	1867.00	369.40	45.00	19.35	381.00	1656.00	12.00	302.03	1.66	.90	10.00	41.10
42	1605.00	356.00	58.00	23.85	362.00	1137.00	12.00	179.70	1.20	.97	8.60	4.50
43	834.40	168.16	47.00	16.50	793.00	766.44	12.00	351.50	.81	.56	8.88	10.10
44	834.40	168.16	47.00	16.50	362.00	766.44	12.00	351.50	.81	.56	8.88	4.50
45	834.40	168.16	47.00	16.50	362.00	766.44	12.00	351.50	.81	.56	8.88	4.50
46	1500.00	300.00	39.00	30.00	800.00	600.00	12.00	250.00	.80	1.00	7.00	20.00
47	817.00	139.60	45.00	21.70	920.00	652.00	12.00	1133.00	.36	.96	5.50	36.00
48	1070.00	144.00	45.00	42.00	1000.00	800.00	12.00	415.00	1.05	1.50	8.00	40.00
49	834.40	168.16	30.00	16.50	381.00	766.44	12.00	351.50	.81	.56	8.88	41.10
50	834.00	168.16	27.81	16.50	362.00	766.44	12.00	351.50	.81	.56	8.88	4.50

AFTER

S.No	Calorie	Protein	Cho	Fat	Calcium	Magnesium	Iron	Beta carotene	Thiamine	Riboflavin	Niacin	Vit C
1.	1305.20	174.04	43.60000	26.55	697.81	570.00	26.01	727.55	1.44	2.53	10.27	51.20
2.	1476.50	121.50	56.25000	43.85	697.62	370.00	25.91	1127.00	1.20	2.65	10.36	4.01
3.	1842.00	166.60	51.00000	39.35	701.93	650.00	22.39	642.83	1.66	1.64	15.13	72.00
4.	1476.50	121.50	56.25000	39.35	697.62	250.00	25.91	1127.00	1.20	2.65	10.36	72.00
5.	1476.50	121.50	56.25000	39.35	697.62	440.00	25.91	1127.00	1.20	2.65	10.36	72.00
6.	1400.00	163.00	53.00000	43.85	900.00	450.00	25.01	713.00	1.46	3.31	9.66	4.01
7.	1485.00	59.80	54.10000	26.44	703.20	550.00	35.02	2465.00	1.62	2.74	9.06	50.00
8.	1365.00	222.00	43.00000	26.44	704.00	650.00	37.01	1063.00	2.66	3.10	10.40	50.00
9.	1305.20	174.04	43.60000	26.44	697.81	450.00	16.55	727.55	1.44	2.53	10.27	50.00
10	1476.50	121.50	56.25000	50.00	697.62	300.00	25.91	1127.00	1.20	2.65	10.36	62.00
11	1842.00	166.60	51.00000	41.70	701.93	450.00	22.39	642.83	1.66	1.64	15.13	16.00
12	1476.50	121.50	56.25000	62.00	697.62	350.00	25.91	1127.00	1.20	2.65	10.36	42.00
13	1476.50	121.50	56.25000	26.44	890.00	500.00	25.91	1127.00	1.20	2.65	10.36	50.00
14	1400.00	163.00	53.00000	26.44	702.00	650.00	25.01	713.00	1.46	3.31	9.66	50.00
15	1485.00	59.80	54.10000	26.55	703.20	571.00	35.02	2465.00	1.62	2.74	9.06	51.20
16	1365.00	222.00	43.00000	43.85	704.00	781.00	37.01	1063.00	2.66	3.10	10.40	4.01
17	1305.20	174.04	43.60000	26.55	697.81	650.00	26.01	727.55	1.44	2.53	10.27	51.20
18	1476.50	121.50	56.25000	43.85	697.62	658.00	25.91	1127.00	1.20	2.65	10.36	4.01
19	1842.00	166.60	51.00000	26.55	701.93	580.00	22.39	642.83	1.66	1.64	15.13	51.20
20	1476.50	121.50	56.25000	43.85	1200.00	300.00	25.91	1127.00	1.20	2.65	10.36	4.01
21	1476.50	121.50	56.25000	39.35	780.00	350.00	25.91	1127.00	1.20	2.65	10.36	72.00
22	1400.00	163.00	53.00000	39.35	702.00	380.00	25.01	713.00	1.46	3.31	9.66	72.00
23	1485.00	59.80	54.10000	39.35	703.20	550.00	35.02	2465.00	1.62	2.74	9.06	72.00
24	1365.00	222.00	43.00000	43.85	704.00	550.00	37.01	1063.00	2.66	3.10	10.40	4.01
25	1305.20	174.04	43.60000	26.44	697.81	336.00	26.01	727.55	1.44	2.53	10.27	50.00
26	1476.50	121.50	56.25000	26.44	697.62	436.00	25.91	1127.00	1.20	2.65	10.36	50.00
27	1842.00	166.60	51.00000	26.44	701.93	330.00	22.39	642.83	1.66	1.64	15.13	50.00
28	1476.50	121.50	56.25000	50.00	697.62	350.00	25.91	1127.00	1.20	2.65	10.36	62.00
29	1476.50	121.50	56.25000	41.70	697.62	550.00	25.91	1127.00	1.20	2.65	10.36	16.00
30	1400.00	163.00	53.00000	62.00	702.00	770.00	25.01	713.00	1.46	3.31	9.66	42.00
31	1485.00	59.80	54.10000	26.44	703.20	771.00	35.02	2465.00	1.62	2.74	9.06	50.00
32	1365.00	222.00	43.00000	26.44	704.00	781.00	37.01	1063.00	2.66	3.10	10.40	50.00
33	1305.20	174.04	43.60000	26.55	697.81	736.00	26.01	727.55	1.44	2.53	10.27	51.20
34	1476.50	121.50	56.25000	43.85	697.62	700.00	25.91	1127.00	1.20	2.65	10.36	4.01
35	1842.00	166.60	51.00000	26.55	701.93	450.00	22.39	642.83	1.66	1.64	15.13	51.20
36	1476.50	121.50	56.25000	43.85	697.62	330.00	25.91	1127.00	1.20	2.65	10.36	4.01
37	1476.50	121.50	56.25000	26.55	697.62	420.00	25.91	1127.00	1.20	2.65	10.36	51.20
38	1400.00	163.00	53.00000	43.85	702.00	330.00	25.01	713.00	1.46	3.31	9.66	4.01
39	1485.00	59.80	54.10000	39.35	703.20	450.00	35.02	2465.00	1.62	2.74	9.06	72.00
40	1365.00	222.00	43.00000	39.35	704.00	450.00	37.01	1063.00	2.66	3.10	10.40	72.00
41	1305.20	174.04	43.60000	39.35	697.81	350.00	26.01	727.55	1.44	2.53	10.27	72.00
42	1476.50	121.50	56.25000	43.85	697.62	550.00	25.91	1127.00	1.20	2.65	10.36	4.01
43	1842.00	166.60	51.00000	26.44	701.93	450.00	22.39	642.83	1.66	1.64	15.13	50.00
44	1476.50	121.50	56.25000	26.44	697.62	350.00	25.91	1127.00	1.20	2.65	10.36	50.00
45	1476.50	121.50	56.25000	26.44	697.62	440.00	25.91	1127.00	1.20	2.65	10.36	50.00
46	1400.00	163.00	53.00000	50.00	702.00	770.00	25.01	713.00	1.46	3.31	9.66	62.00
47	1485.00	59.80	54.10000	41.70	703.20	554.00	35.02	2465.00	1.62	2.74	9.06	16.00
48	1365.00	222.00	43.00000	62.00	704.00	781.00	37.01	1063.00	2.66	3.10	10.40	42.00
49	1305.20	174.04	43.60000	26.44	697.81	820.00	26.01	727.55	1.44	2.53	10.27	50.00
50	1476.50	121.50	56.25000	26.44	697.62	658.00	25.91	1127.00	1.20	2.65	10.36	50.00

INSTITUTIONAL HUMAN ETHICS COMMITTEE

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Institute for Home Science and Higher Education for Women
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24th December 2014

To
Ms. Suba G
Department of Food Science and Nutrition
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Madam,

Ref : Our letter dt. 21st February 2014 in response to your proposal No. AUW.IHEC.2013:18 entitled "Prevalence of premenstrual syndrome among the reproductive age group women and effect of supplementation of iron and calcium rich health mix on the selected subjects (20-45 years)"

With reference to the above letter, in continuation with the documents submitted by you in support of your proposal and the revisions made in the work plan, as per the suggestions made by the IHEC, the Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No.AUW.IHEC.2013:18 entitled "Prevalence of premenstrual syndrome among the reproductive age group women and effect of supplementation of iron and calcium rich health mix on the selected subjects (20-45 years)". The Approval number for the same is AUW/IHEC-13-14/FHP-01.

We wish you all the best in your research endeavours.

Regards,

Dr.P.R.Padma
Member Secretary

Institutional Human Ethics Committee

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)
Coimbatore - 641 043, Tamil Nadu, India
(Deemed University under Category 'A' by MHRD)
Re-accredited with 'A' Grade by NAAC

Certificate of Participation

This is to certify that Mrs. / Ms. Suba. G, Ph.D scholar

of Department of Food science and Nutrition *was a participant of Research Convention titled* **"Post Research Methods"** *held at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, during* 1st - 2nd August, 2014.

Parvathi

Dr. A. Parvathi
Dean, Faculty of Science

Gowri Ramakrishnan

Dr. Gowri Ramakrishnan
Registrar

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)
Coimbatore - 641 043, Tamil Nadu, India
(Deemed University under Category 'A' by MHRD)
Re-accredited with 'A' Grade by NAAC

Certificate of Participation

This is to certify that Mrs. / Ms. G. Subha, PhD (Part time)

of Food Science & Nutrition Department *was a participant of Research Convention titled* ***"Path Finder - Explore, Experiment, Elucidate Research"*** *held at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, during* 5th - 7th Feb 2014.

Dean, Faculty of Science

Gowri Ramakrishnan
Dr. Gowri Ramakrishnan
Registrar