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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.