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

a. Healthy dietary pattern
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**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)

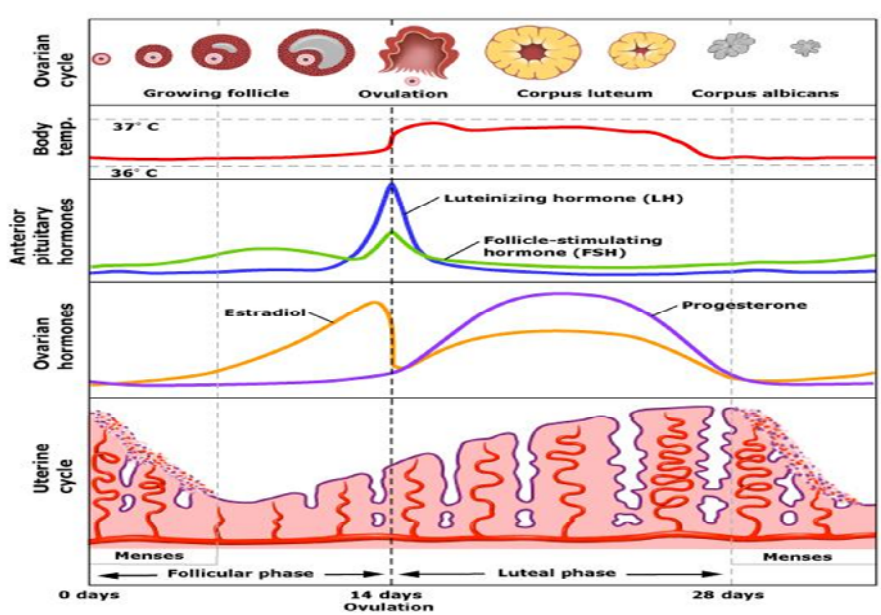


**Figure – 1. Histology of Menstrual cycle**

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<br>➢ Back pain<br>➢ Breast pain, tenderness, and/or swelling<br>➢ Headache<br>➢ Muscle aches<br>➢ Weight gain | ➢ Aggression<br>➢ Changes in sexual interest<br>➢ Dizziness<br>➢ Fatigue<br>➢ Food cravings or Over eating<br>➢ Insomnia | ➢ Anger<br>➢ Anxiety<br>➢ Confusion<br>➢ Crying and tearfulness<br>➢ Decreased self-esteem<br>➢ Depressed mood<br>➢ Difficulty in concentration<br>➢ Forgetfulness<br>➢ Irritability<br>➢ Loneliness<br>➢ Mood swings<br>➢ Restlessness<br>➢ 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, Vitamin$B_6$ 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, Vitamin$B_6$ 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***