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# RESULTS AND DISCUSSION

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

**PHASE - I : Prevalence of Premenstrual Syndrome**

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

**PHASE – II: Evaluation of health mix cookies**

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

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

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

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

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

a. Depression level

b. Premenstrual Symptom assessment using COPE

c. Relationship between biochemical parameters and individual PMS symptoms

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

A. Assessment of knowledge on PMS

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

## PHASEI

**Prevalence of premenstrual syndrome**

**A. Demographic profile of the selected participants**

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

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

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

**Table - XI**

**Demographic profile of families of the selected participants**

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

*Source-HUDCO Income Classification (2012)

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

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

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

**i. Educational status of the families of the selected participants**

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

**i. Occupational status of the families of the selected participants**

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

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

**b. Background information of the selected families**

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

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

**Table-XII**

**Background information of the selected participants**

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

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

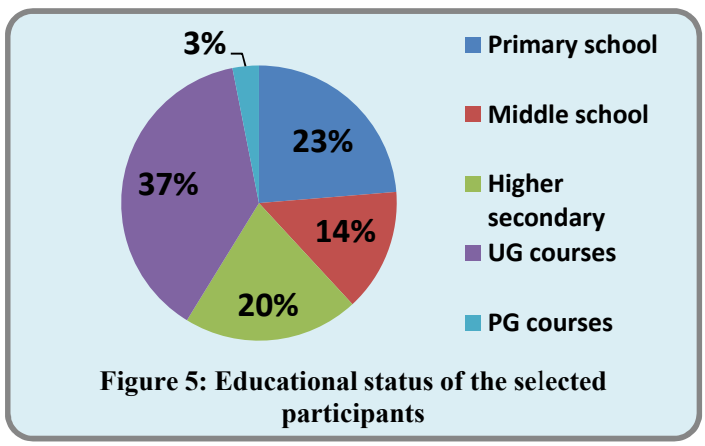


**Figure 5: Educational status of the selected participants**

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

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

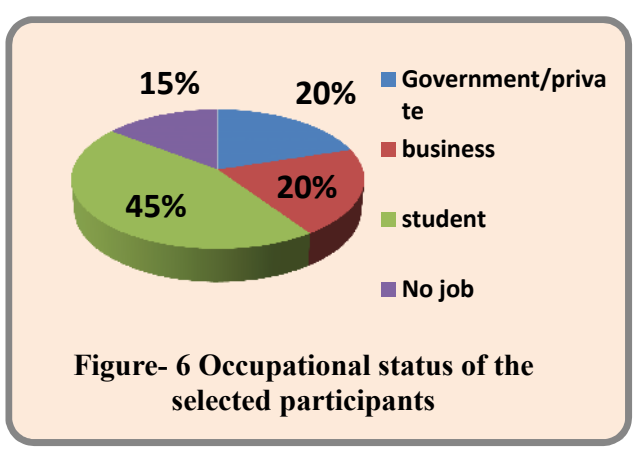


**Figure- 6 Occupational status of the selected participants**

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

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

**B. Dietary pattern of the selected participants**

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

**a. Food expenditure pattern**

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

**Table - XIII**

**Food expenditure pattern**

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

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

**b. Dietary habits**

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

**c. Meal planning**

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

**d. Meal pattern**

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

**e. Skipping of meals**

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

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

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

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

**Table-XIV**

**Consumption of water and beverages**

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

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

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

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

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

**g. Consumption pattern of junk and fast foods**

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

**Table - XV**

**Consumption pattern of junk or fast foods**

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

*Multiple responses

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

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

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

**h. Consumption of Iron rich foods**

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

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

**Table-XVI**

**Consumption of Iron rich foods**

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

*Multiple responses

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

### i. Consumption of Vitamin C rich foods

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

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

**Table -XVII**

**Consumption of Vitamin C rich foods**

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

*Multiple responses

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

**j. Consumption of Calcium rich foods**

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

**Table -XVIII**

**Frequency of Calcium rich foods consumption**

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

*Multiple responses

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

### k. Consumption of fats and oils

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

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

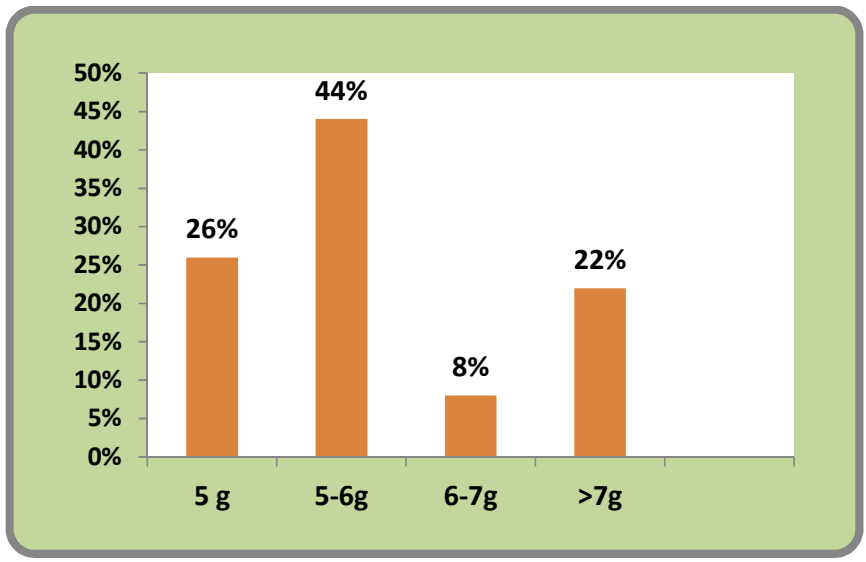


**Figure-7 Per capita oil consumption/ day**

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

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

**Table –XIX**

**Types and frequency of fats and oils consumption**

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

*Multiple responses

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

**l. Consumption of dietary fibre**

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

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

**C. Menarche and menstrual cycle details of the selected participants**

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

**a.Age at the onset of menarche**

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

**Table-XX**

**Age at the onset of menarche**

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

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

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

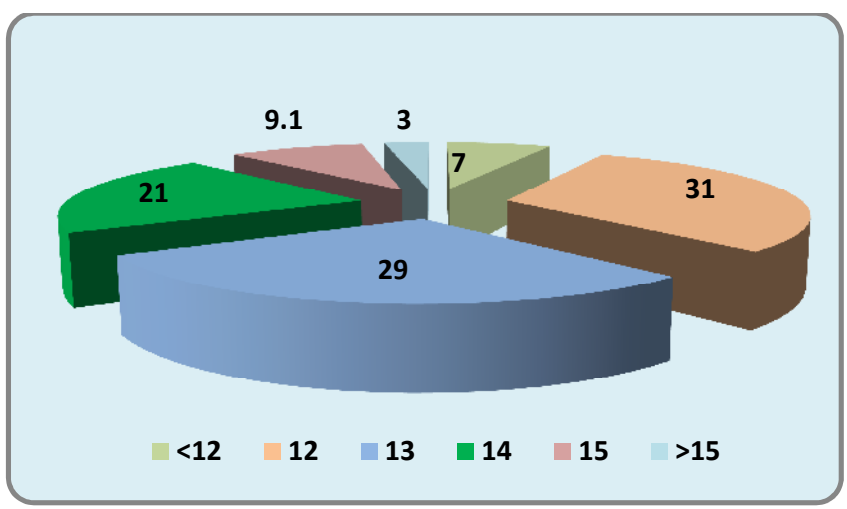


**Figure – 8 Age at menarche**

**b. Information related to menstrual flow**

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

**Table - XXI**

**Information related to menstrual cycle**

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

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

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

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

**c. Foods included at the time of menarche or puberty**

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

**Table - XXII**

**Foods included in menarche**

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

*Multiple responses

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

**d. Foods avoided at the time of menarche**

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

**D. Nutritional status of the selected participants**

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

a. **Anthropometric measurements**

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

**i. Height**

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

**Table - XXIII**

**Height of the selected participants**

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

*ICMR 2012

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

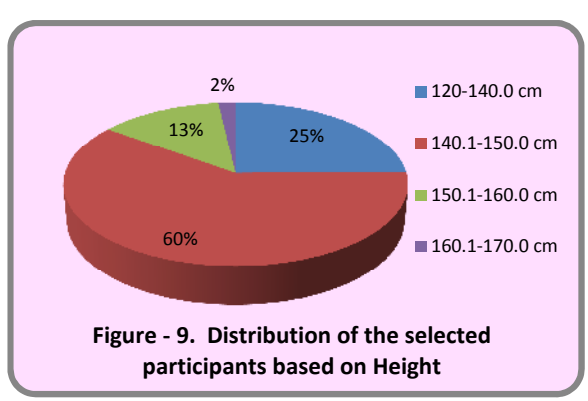


**Figure - 9. Distribution of the selected participants based on Height**

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

**ii. Weight**

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

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

**Table-XXIV**

**Weight of the selected participants**

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

*ICMR 2012

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

**iii. Computation of Body Mass Index**

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

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

**Table-XXV**

**Body Mass Index**

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

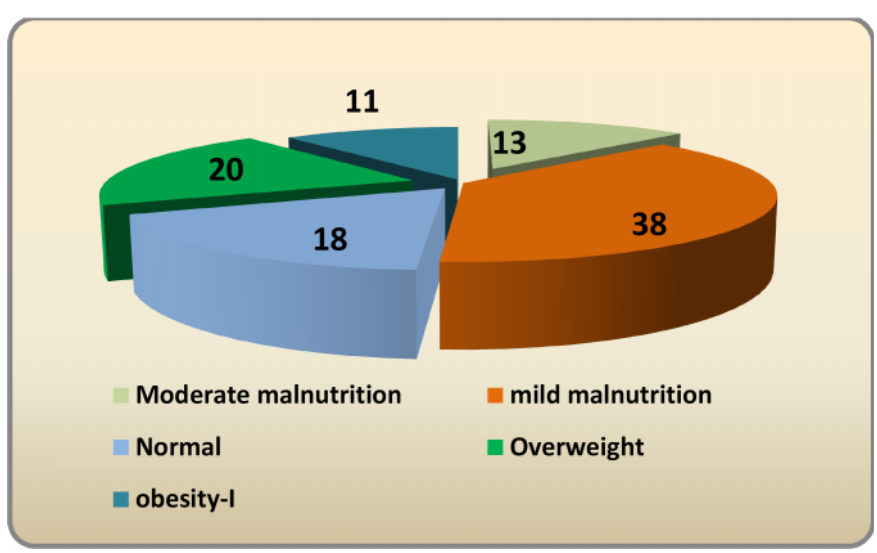


**Figure-10 Distribution of selected participants based on their BMI values**

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

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

**iv. Waist/Hip ratio**

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

**Table-XXVI**

**Waist/Hip ratio**

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

*Normal 0.85 for women

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

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

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

**b. Biochemical Estimation**

**Haemoglobin level**

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

**Table-XXVII**

**Blood Haemoglobin profile**

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

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

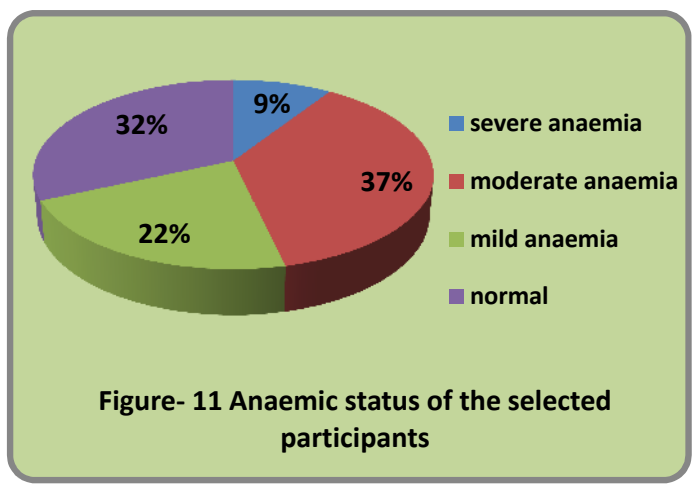


**Figure- 11 Anaemic status of the selected participants**

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

**E. Prevalence of premenstrual syndrome among the selected participants**

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

**Table-XXVIII**

**Prevalence of Premenstrual Syndrome**

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

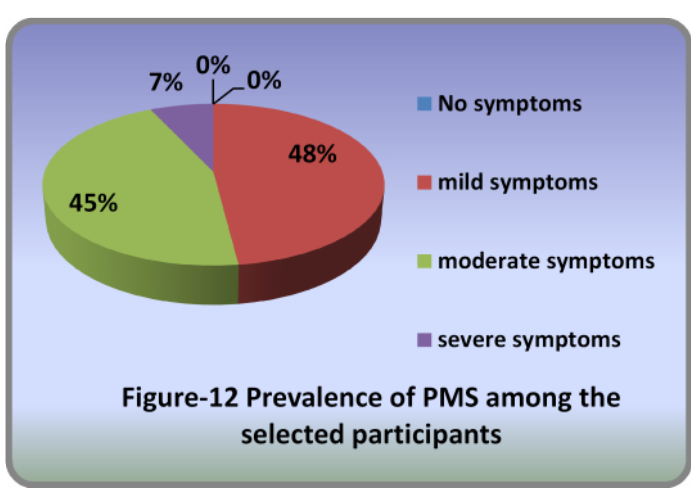


Figure-12 Prevalence of PMS among the selected participants

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

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

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

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

**Table-XXIX**

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

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

*Multiple responses

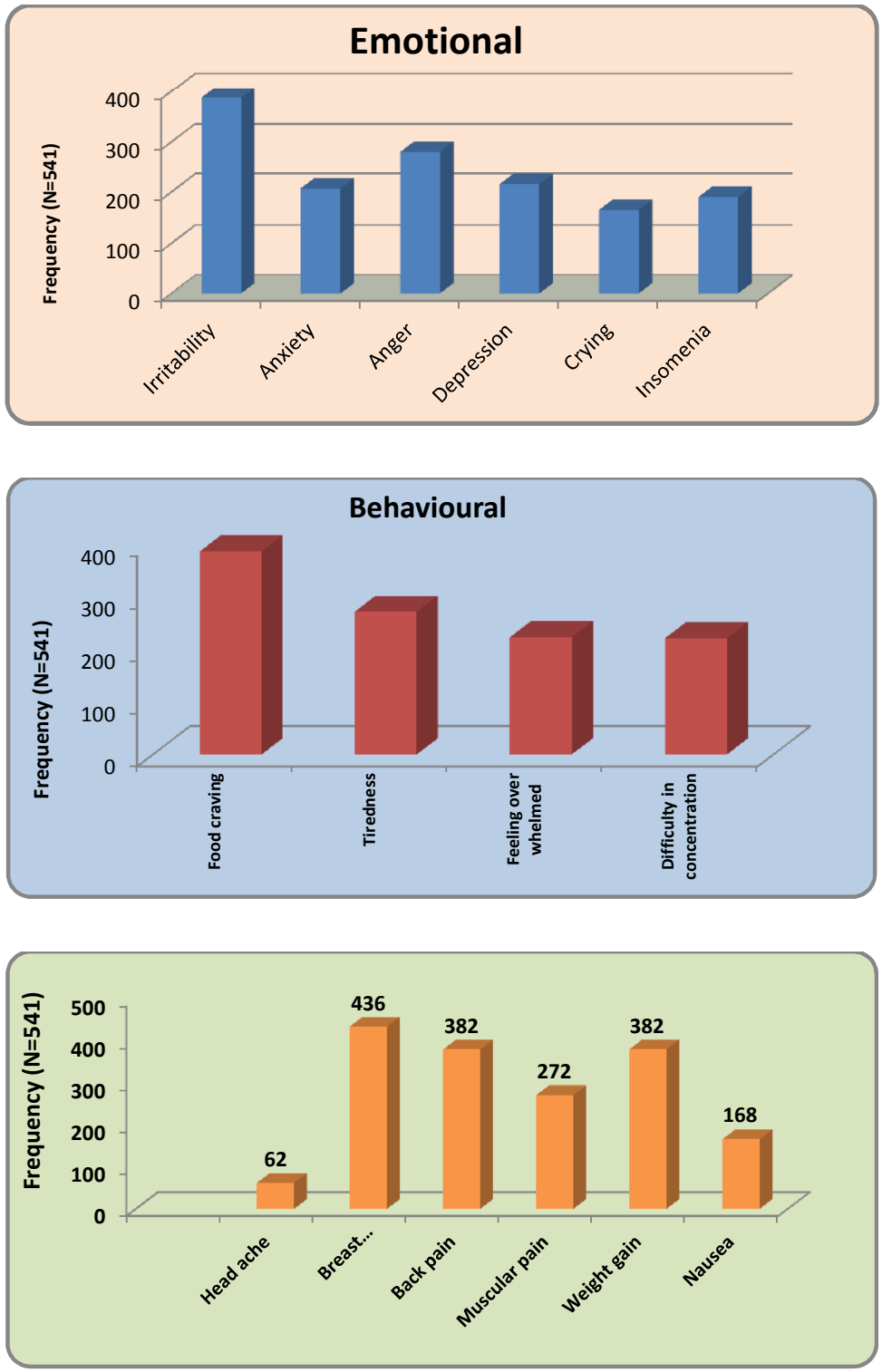


**Figure 13 Prevalence of physical, behavioural and emotional symptoms of PMS among the selected participants**

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

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

a. **Physical symptoms**

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

**Table - XXX**

**Level of physical symptoms of PMS**

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

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

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

**b. Behavioural symptoms**

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

**Table-XXXI**

**Level of behavioural symptoms of PMS**

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

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

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

**c. Emotional symptoms**

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

**Table-XXXII**

**Level of emotional symptoms of PMS**

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

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

**F. Anxiety level of the selected participants**

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

**Table-XXXIII**

**Anxiety and Self Esteem level of the selected participants**

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

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

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

**G. Knowledge on PMS**

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

**Table-XXXIV**

**Level of knowledge on PMS**

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

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

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

**Table-XXXV**

**Distribution of the correct knowledge scores**

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

*Multiple responses

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

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

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

### a. Relationship between PMS and demographic characteristics

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

**Table-XXXVI**

**Relationship between demographic characteristicsand PMS**

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

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

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

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

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

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

**b. Impact of dietary habits on the premenstrual symptom score**

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

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

**Table- XXXVII**

**Relationship between dietary habits and premenstrual symptom score**

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

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

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

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

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

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

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

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

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

**Table - XXXVIII**

**Relationship between the menarche and menstrual cycle and PMS symptom score**

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

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

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

**d. Relationship between anthropometric measurements and PMS symptom score**

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

**Table-XXXIX**

**Anthropometric measurement and its association with premenstrual symptom score**

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

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

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

**e. Correlation between haemoglobin level and PMS symptom score**

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

**Table-XL**

**Correlation between Haemoglobin level and PMS symptom score**

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

NS- Not Significant

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

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

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

**Table-XLI**

**Correlation between the psychological factors and PMS symptom score**

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

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

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

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

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

**Table-XLII**

**Relationship between PMS knowledge score and PMS symptom score**

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

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

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

**h. Correlation of dietary indices with individual Premenstrual symptoms**

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

**Table-XLIII**

**Relationship between of dietary indices with individual PMS symptoms**

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

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

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

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

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

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

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

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

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

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

**Table-XLIV**

**Correlation of obstetric and gynaecological indices with individual PMS symptoms**

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

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

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

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

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

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

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

**Table-XLV**

**Correlation of Waist-Hip Ratiowith individual PMS symptom scores**

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

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

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

**k. Correlation of the anxiety levelswith individual PMS symptom scores**

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

**Table-XLVI**

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

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

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

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

## PHASE-II

### EVALUATION OF HEALTH MIX COOKIES

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

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

**A. Sensory evaluation**

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

**Table - XLVII**

**Comparison between the scores of standard and formulated cookies**

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

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

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

**B. Physical properties**

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

**Table-XLVIII**

**Physical properties of standard and formulated cookies**

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

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

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

**C. Nutrient content**

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

**Table-IL**

**Nutrient content of standard and formulated cookies (100 g)**

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

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

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

**D. Estimation of microbial count**

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

**Table-L**

**Microbial count of the formulated health mix cookies**

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

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

**E. Calculation of cost effectiveness**

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

**Table - LI**

**Cost effectiveness of the Health mix cookies**

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

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

## PHASE-III

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

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

**a. Anthropometric measurements**

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

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

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

**Table - LII**

**Mean anthropometric measurements**

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

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

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

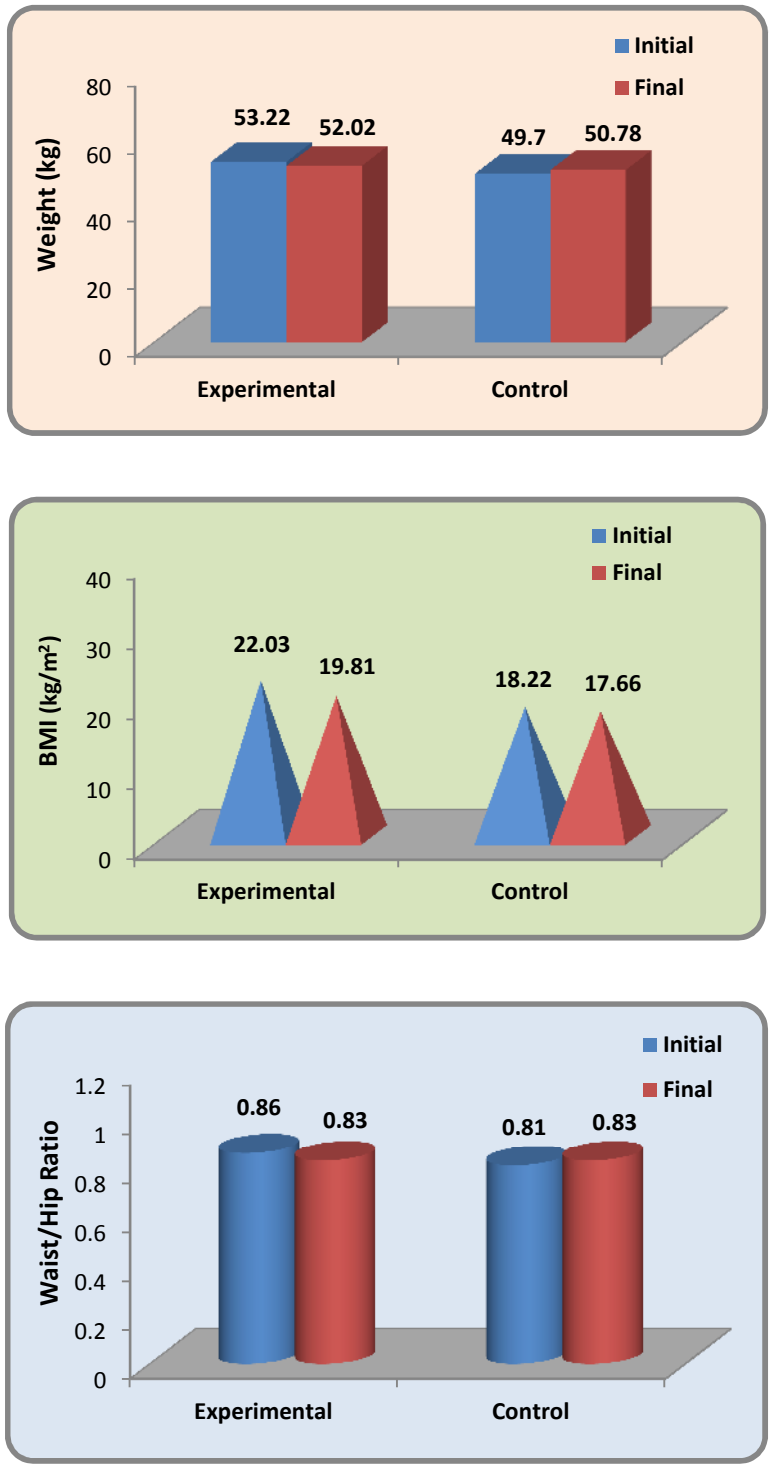


**Figure- 14 Mean anthropometric measurements of the selected participants**

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

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

**b. Biochemical estimation**

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

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

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

**Table-LIII**

**Mean biochemical profile**

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

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

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

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

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

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

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

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

**c. Clinical examination**

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

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

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

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

**Table-LIV**

**Per cent prevalence of clinical signs and symptoms**

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

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

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

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

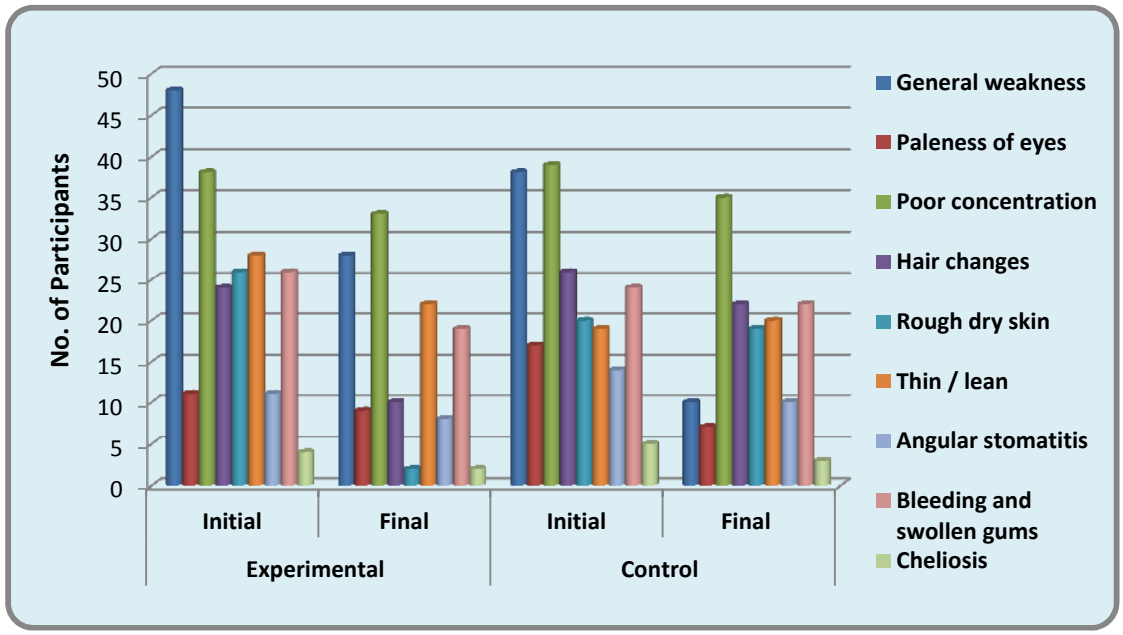


**Figure-15 Per cent prevalence of clinical signs and symptoms among the selected participants**

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

### d. Individual dietary intake

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

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

**Table-LV**

**Mean nutrient intake**

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

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

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

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

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

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

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

## B. Impact dietary intervention on the symptoms of PMS

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

### a. Depression Level

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

**Table-LVI**

**Depression score**

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

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

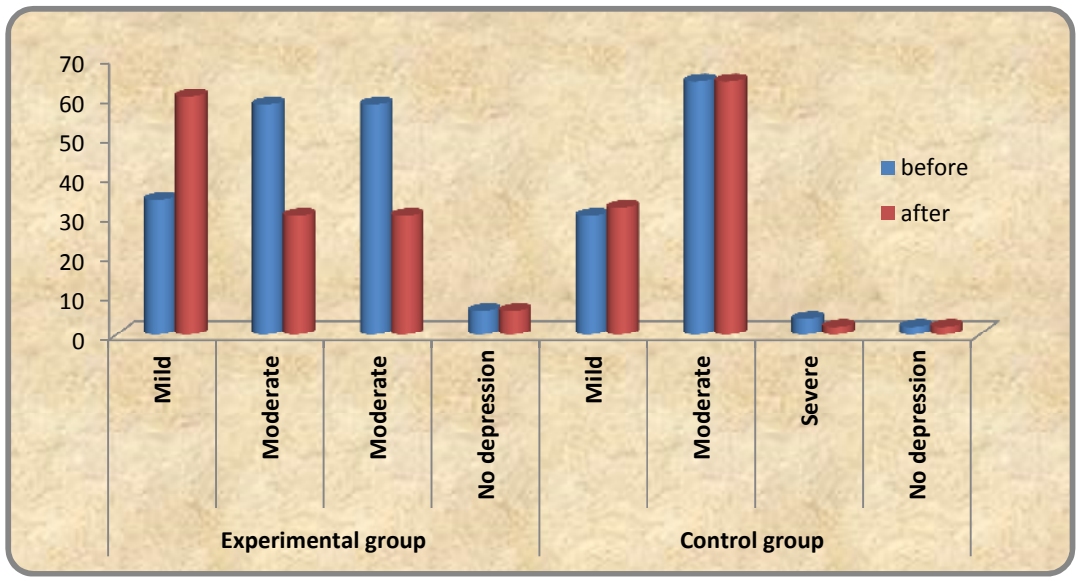


**Figure-16 Level of depression scores of the selected participants**

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

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

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

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

**b. PMS symptoms assessment using COPE**

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

**Table - LVII**

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

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

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

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

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

**c. Relationship between biochemical parameters and individual PMS symptom**

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

**Table-LVIII**

**Correlation of individual PMS symptom with biochemical parameters**

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

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

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

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

## PHASE- IV

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

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

### A. Assessment of knowledge on PMS

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

**Table-LIX**

**Mean PMS knowledge score**

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

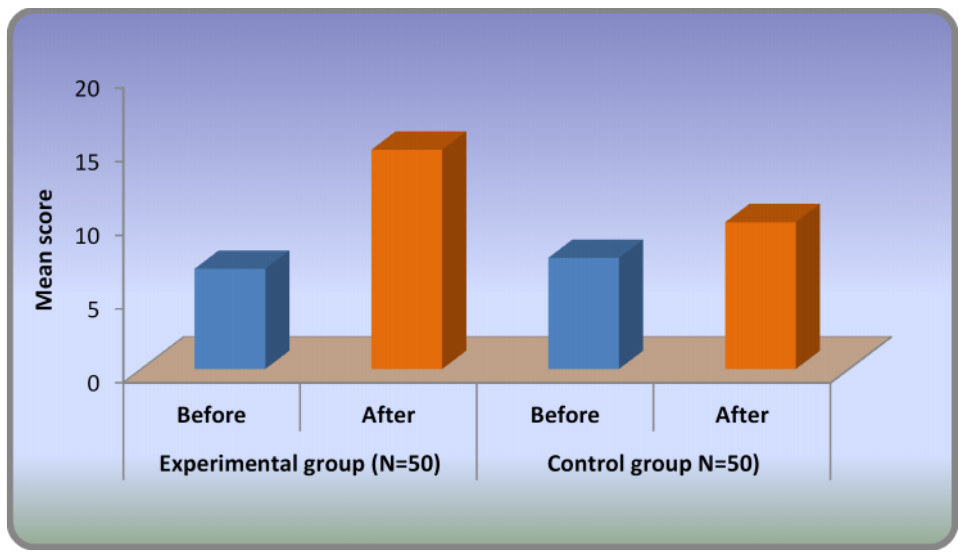


**Figure-17 Overall Mean PMS knowledge score among the selected participants**

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

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

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

**Table-LX**

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

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

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

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

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

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

**Table-LXI**

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

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

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

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

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

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

**Table-LXII**

**PMS symptoms noticed among experimental and control group after intervention**

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

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

**#Independent samples Mann-Whitney U test**

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

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

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

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

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