IMPACT OF CALCIUM AND MAGNESIUM DIETARY CHANGES ON WOMEN PAIN AND DISCOMFORT FROM PREMENSTRUAL SYNDROME AT THE FACULTY OF PHARMACY-GAZA STRIP

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ABSTRACT
This research has revealed the relationship between Calcium and Magnesium contents, dietary changes, health remedies and occurrence of PMS among students at the college of pharmacy-Al Azhar University –Gaza (Palestine). The study included 49 Cases of PMS and 49 controls. On PMS scale, more than 82% don’t have PMS complications. The results show that; students who suffer from such complications are influenced by many variables by different ratios such as dietary changes, natural health remedies, and lifestyle. Also the research has strongly revealed that there is a strong relationship between Calcium and Magnesium with Premenstrual Syndrome; since the reduction of Ca or Mg levels will increases the score of Premenstrual Syndrome.

Keywords:-Premenstrual Syndrome, Calcium, Magnesium, Gaza Strip.

INTRODUCTION
Premenstrual symptoms occur in 95% of women of reproductive age. Severe, debilitating symptoms (PMS) occur in about 5% of those women. There is no consensus on how symptom severity should be assessed, which has led to a wide variety of symptoms scales, making it difficult to synthesize data on treatment efficacy.¹

The exact cause of PMS is still unknown. However, it is thought that the hormones produced by the ovaries, particularly progesterone, provoke PMS symptoms by using chemical messengers- neuro-transmitters’ in the brain. Many enzymes, vitamins and minerals are involved in this, leading to speculation and research into the role vitamins and minerals may
play in helping to ease PMS. Unfortunately, so far results from studies haven’t been very conclusive.²

Two main minerals play important roles in this regard; since calcium regulates numerous cellular events including gene transcription, muscle contraction, exocytosis and cell survival. Magnesium is involved in more than 300 essential metabolic reactions, including energy production, DNA and RNA synthesis. The deficiency of these metal ions is considered to be a potential health hazard. Indeed, calcium deficiency has been implicated in skeletal abnormalities and hypertension. Magnesium deficiency leads to an increased incidence of cardiovascular diseases, including hypertension, stroke and atherosclerosis and gastrointestinal disorders, including loss of appetite, nausea and vomiting.³ Calcium Ovarian hormones influence calcium, magnesium, and Vitamin D metabolism, and estrogen regulates calcium metabolism and intestinal calcium absorption as well as parathyroid function and gene expression. Several clinical trials have suggested that calcium supplementation can improve mood and somatic symptoms in PMS.⁴ Magnesium because low levels of red cell magnesium have been correlated with women experiencing PMS; magnesium supplementation has been studied as adjunctive therapy for women with PMS. Researchers show in small trials were included that compared magnesium and placebo. It was noted that the trials although randomized with adequate methodological quality were small with poor measurement and reporting outcomes. One of the larger studies included data on the levels of prostaglandin F2 alpha. Women taking the magnesium therapy had substantially lower levels of prostaglandin F2 (PGF2) alpha in their menstrual blood than those on the placebo (P < 0.05); these lower levels correlated with a decrease in pain by the participants. A possible biological rationale for the effectiveness of magnesium is the inhibition of PGF2 alpha and the promotion of muscle relaxation and vasodilatation.⁵

Dietary manipulation is often used for PMS symptoms, although no food-based strategy has been properly evaluated to date. Based on findings by Abraham that women with PMS typically consume more dairy products, refined sugar, and high-sodium foods than women without PMS, many clinicians recommend reducing or eliminating these foods for women with severe symptoms. Limiting caffeine intake is often recommended as well, based on the findings in at least 2 studies associating increased intake of caffeine-containing beverages with increased prevalence and severity of PMS symptoms. High estrogen levels are believed to be correlated with PMS symptoms in some women. Because diets higher in fat are
believed to contribute to higher estrogen levels, and because high-fiber diets are believed to help reduce estrogen levels based on their effect on intestinal flora, another common approach in clinical practice is to recommend a relatively low-fat, high fiber diet. Although the rationale for all of these dietary approaches is appealing, and in fact such a diet is health promoting for many people for other reasons, none of these dietary manipulation strategies has to date been adequately studied for efficacy in women with PMS.6

Goal
The aim of this study is to reveal the relationship between dietary changes, health remedies and occurrence of PMS in the college of pharmacy.

Objectives
1. To reveal the effect of dietary behavior on premenstrual syndrome.
2. To identify the relationship between serum Mg and PMS.
3. To identify the relationship between serum Ca and PMS.
4. To explore the effect of Ca, Mg on improving the symptoms.
5. To suggest ideas and recommendation of dietary intakes and exercise for women with PMS.

Hypothesis
There is relationship between Dietary Changes and natural health remedies and Women's pain and discomfort from premenstrual syndrome.

Problem statement
According to the many studies estimates that as many as one-third of women suffer from PMS-related symptoms as their hormones fluctuate in the last week or two of their monthly cycle. While some women may experience these symptoms intermittently, about one in 10 experiences them every month; PMS can become so severe that it causes general depression in daily life, according to New Choices In Natural Healing by Prevention Magazine. So why do some women suffer more than others, and what can these women do to stop PMS from interrupting their lives? The answer may be found in nutrition and natural health remedies. Increasing evidence shows premenstrual syndrome might also be triggered by dietary deficiencies in certain vitamins or minerals, especially magnesium."Magnesium deficiency is strongly implicated as a causative factor in premenstrual syndrome. Red blood cell magnesium levels in PMS patients have been shown to be significantly lower than in normal
subjects," Also previous studies showed there is relationship between dietary factors, lifestyle, hormonal changes and Premenstrual syndrome, therefore, the study aims to clarify this relationship.

**Significance of the Study**
Because previous studies stated that the premenstrual syndrome related nutrients, the current study could reveal this relationship and another to reduce the risks and complications through food and natural health remedies. By this study will give baseline information to describe the relationship between nutritional status and the premenstrual syndrome.

**Relationship between calcium, magnesium and premenstrual syndrome**
Some studies have suggested that mineral deficiency may be related to PMS. Magnesium deficiency may be an important factor for PMS. The severity and prevalence of symptoms, both physical and mental, may differ.7 Few studies in PMS have focused on subjects in late adolescence or young adulthood.8 However, few studies of this issue have been conducted in Asian countries, and very few have included dietary factors and younger women.9 Reviews the literature on the variations in energy intake (EI), energy expenditure (EE) and the factors which may affect the fluctuations in EI across the menstrual cycle. While no significant changes in body weight and body fat percentage have been noted across the cycle, increases in EI and EE have been well documented during the luteal phase in lean women.10 Zohre Mahmoodi Study results revealed that PMS and its symptom's intensity (mood, behavioral and physical) decrease significantly by using carbohydrate–rich supplements and diets (p=0.00), but supplement was more effective (p=0.00). Both had same effect on anger, depression and appetite.11

Researchers suggested that the intake of skimmed or low-fat milk was also associated with a lower risk (P <0.001). A high intake of calcium and vitamin D may therefore reduce the risk of PMS but large-scale clinical trials addressing this issue are required. At present, the only interventional data are from small trials.12 Some authors suggest that a relationship between vitamin D and PMS is possible, though larger studies are needed to further evaluate this relationship and to investigate whether 25-hydroxyvitamin D3 levels in the follicular or early luteal phases of the menstrual cycle may be related to PMS risk.13

Walker investigate the effect of a daily supplement of 200 mg of magnesium (as MgO) for two menstrual cycles on the severity of premenstrual symptoms in a randomized, double-
blind, placebo-controlled, crossover study, the result of this study shows that a daily supplementation of 200 mg of Mg (as MgO) reduced mild premenstrual symptoms of fluid retention in the second cycle of administration.\textsuperscript{14} Reed study also demonstrated that women with PMDD showed an increased desire for food items that were high in fat during the luteal phase of the menstrual cycle.\textsuperscript{15} A study suggested that magnesium supplementation may improve certain symptoms in women with PMS; in an open-label study assessed the efficacy and safety of a patented-modified-release magnesium 250mg tablet for improving symptoms in women affected by PMS.\textsuperscript{16}

The results show that PMS symptoms improved during magnesium treatment. After 3 months, the mean total PMS score (primary endpoint), as assessed by the investigator using Moos’ Modified Menstrual Distress Questionnaire, was significantly lower than before therapy (p <0.0001). During the same period, the mean PMS scores, as recorded in 21 patients’ diaries (secondary efficacy variables), also showed significant improvements (p<0.0001 for all subscales). The relative decreases in total PMS scores, as assessed by investigator and patient, were 35.1% and 33.5%, respectively. The magnesium tablet was well tolerated, with vertigo the only treatment-related adverse event reported. Coffee study suggest that blood calcium and vitamin D levels are lower in women with PMS and that calcium supplementation may reduce symptom severity, but it is unknown whether this may prevent the initial development of PMS. A case-control study within the Nurses’ Health Study II cohort found that women with the highest intakes of calcium from food (median=1,283mg/day) and vitamin D (median=706IU/day) had a lower risk of PMS than those with the lowest intakes. In Freeman study, after adjustment for risk factors, found that women in the highest quintile of total vitamin D intake had a relative risk of 0.59 (95% confidence interval, 0.40-0.86) compared with those in the lowest quintile (P ¼ 0.01 for trend). The intake of calcium from food sources was also inversely related to PMS. Magnesium may also be helpful in PMS. A double-blind, placebo-controlled study of 32 women found that magnesium taken from day 15 of the menstrual cycle to the onset of menstrual flow could significantly improve premenstrual mood changes. Another small double-blind preliminary study found that regular use of magnesium could reduce symptoms of PMS-related fluid retention. In the study, 38 women were given magnesium or placebo for 2 months. One small double-blind study (20 participants) found that magnesium supplementation with vitamin B6 might help prevent menstrual migraine.\textsuperscript{17} Raymond study compared the levels of 18 red cell elements and 22 hair elements in 46 patients (median age: 36.2 years). The results show highly significant Mg/Ca
ratio in blood cells may be indicative of a more complex relationship between PMS and magnesium and calcium than either element alone. The significantly lower blood cell calcium level found in these studies may provide additional evidence that PMS may be related to a calcium-deficiency state or a metabolic defect involving calcium. While Sternfeld reported that the PMS severity score decreased with each year of age.\textsuperscript{18}

Bendich contributions to elucidating the roles of nutrients in optimizing human health included the support of research in the areas of women's health and immune function. Several essential nutrients have been shown to affect women's health throughout the different life stages.\textsuperscript{19} Jacobs strongly suggests that PMS represents the clinical manifestation of a calcium deficiency state that is unmasked following the rise of ovarian steroid hormone concentrations during the menstrual cycle.\textsuperscript{20} Researchers demonstrated reduced premenstrual and menstrual symptoms in women consuming diets providing 1,336mg calcium/day compared with 587mg/day.\textsuperscript{21} These trials were followed by a large US multi-center clinical trial in which 466 women with PMS received 1,200mg calcium or placebo for three menstrual cycles. By the third treatment cycle those receiving calcium showed an overall 48% reduction in total symptom scores compared with a 30% reduction in the placebo group. Doses used in these studies are well within safety limits. ULs set by different authorities range from 1500-2500mg daily. Bendich says that many types of dietary supplements have been advocated for the reduction of certain symptoms of premenstrual syndrome (PMS). However, only one supplement—calcium—has been demonstrated to be of significant benefit in a large, rigorous, double-blind, placebo-controlled trial. Limited evidence suggests that magnesium, vitamin E and carbohydrate supplements might also be useful, but additional research is needed to confirm these findings. The efficacy of these products is uncertain because of a lack of consistent data from scientific studies. Health professionals should be aware of the possible use of these supplements and ask those with PMS about their use of such products and counsel them based upon the totality of evidence.\textsuperscript{22} Several reports anecdotally suggest symptom relief. In 1989, Thys-Jacobs S made a small randomized crossover trial demonstrated a significant reduction in premenstrual symptoms after supplementation with calcium 1000mg/day.\textsuperscript{23} Mortola et al found the following symptoms most prevalent: drowsiness, tiredness (92%), irritability (91%), mood changes (81%), depression (80%), low tolerability of noise (65%), low self-esteem (65%), anxiety (65%), decreased libido (65%), fear of the future (65%), and lack of concentration (47%). The most prevalent somatic symptoms were: abdominal distention (90%), mastalgia, mastodynia.
(85%), acne, seborrhea (71%), excessive appetite and thirst (70%), headaches and vomiting (70%), cardiac arrhythmia (13%), vascular lesions (13%), and dizziness (13%).

**METHODOLOGY**

**Study Design:** A Case Control study.

**Target Population and Sampling**

The total target population is 120 students in college pharmacy with PMS and students without any suspicion of PMS who are the same age. They will be recruited according to the inclusion criteria in the study after getting their consent. A purposeful, non-random sample will be used. Participants divided into two groups according to the inclusion criteria. Students (n = 120) will be allocated into two groups: group A (n = 60) students with PMS; group B (n = 60) students without any suspicion of PMS.

**Materials and Methods**

Blood samples will be withdrawn to assess serum Mg and Ca Levels. Information on dietary intake of Mg and Ca will be obtained by using a semi-quantitative Food Frequency Questionnaire (FFQ). Participants will be asked about their average frequency of different food consumption, over a period of one year before the onset of symptoms for the premenstrual syndrome. Data on the supplemental intake of Mg, Ca, minerals and other preparations will be taken into account.

**Eligibility Criteria**

**Inclusion Criteria**

I. **Cases** :- Students with premenstrual syndrome who are 18-25 years with normal menses.

II. **Controls** :- Students without any suspicion to have PMS who 18-25 years with no any history of health problem related to the ovary and with normal menses.

**Exclusion Criteria:** Those diagnosed with ovary cyst, liver or Kidney diseases Diabetes Mellitus, hyperthyroidism or hyperparathyroidism, post recent acute infection, recent trauma or surgical intervention with metabolic disorder and lactating women.

**Ethical Consideration**

1. Approval of Dean of postgraduate studies & research affairs.
2. Approval letters from Dean of college of pharmacy.
3. Consent of the volunteer.
Data Collection

1. Face to Face Interview Questionnaire
A questionnaire will be used to collect the following data from each participant: socioeconomic and demographic data.

Anthropometric Measurements
Weight, Height, Body Mass Index (BMI), Waist Circumference.

Diet History:-Food Frequency Questionnaire (FFQ): Data will be collected about food sources of macronutrients and micronutrients especially Magnesium, Calcium, Sodium, and fat.

Lifestyle:-Physical activity, smoking and stress Coping.

Biochemical Measurements:-Serum Magnesium, serum calcium

Data Analysis
1. Define variables.
2. Data entry.
3. Data cleaning.
4. Data analysis using SPSS (V.19) analysis package.

RESULT AND DISCUSSION

General Health Status of the Student
The general health status is investigated via checking the experience of students with eight diseases as listed and analyzed. The majority of students do not suffer from chronic stress problems, chronic depression, Feeling panicked, renal disease, migraine, anemia or colon disorder; furthermore sample subjects are distributed almost equally between the control and case group. Association tests are not calculated for renal disease and Anemia because none of the sample subjects were experienced any of them. There is insignificant association between any of the diseases and the group at 0.05 level of significant. These findings coincide with the conclusion of the previous section toward the homogeneity of the subjects of control and case groups.

Health Status Before, During and After the Menstrual Cycle
To understand the distribution of sample according the PMS scale, the results show that; distribution of sample subjects according to their group and level at PMS scale. As expected all students at the control group 49 (50%) do not have PMS, while the students at the case group are divided between the remaining four levels of PMS scale, 26 (26.5%) of students
belong to (Borderline to Mild PMS), 16 (16.3%) of students belong to (Mild to Moderate PMS), 6 (6.1%) of students belong to (Moderate to severe PMS) and only 1 (1.0%) student belong to (Moderate to severe PMS) level. There is a significant association between the group and the category of PMS scale.

**Lifestyle**

In order to investigate the association between the life style and PMS status, four lifestyle issues are discussed in this section, namely, smoking status, Practicing physical activities, kind of physical activity and sleeping period length. About two-thirds of the sample 68 (69.4%) considered themselves as non-smokers, while none of them declared that she is an active smokers. There is a significant association between smoking status and group at 0.05 level of significant, where 73.3% of the passive smokers are cases. Around 60% of sample subjects are practicing one type of sport, with 44 (72.1%) of them are used to walk and 17 (27.9%) are doing Swede, but none of them join any specialized club. There is a significant association between practicing physical activities status and group at 0.05 level of significant, where 73.3% of the passive smokers are cases, where 64.1% of those who are not practicing any physical activities are cases. Furthermore, there is insignificant association between the type of physical activities and group at 0.05 level of significant. More than half of the sample 57 (58.2%) are sleeping less than 8 hours, and there is a significant association between sleeping mode and group at 0.05 level of significant, where 73.2% of those who are sleeping more than 8 hours belong to the control group.

**Diet**

Results show that, the majority of the sample 81 (82.7%) do not follow any diet regimen, with almost equally distribution of students between control and case groups. Thus, there is insignificant association between diet statuses (yes/no) and the group at 0.05 level of significant. Among those who followed a diet regimen, 27.8% consulted nutritionists, 11.1% consulted doctors while 61.1% consulted other than Pharmacist or traditionalist. Furthermore, there is insignificant association between diet consultancy and the group at 0.05 level of significant. With respect to the main meal, the majority of sample subjects (82.7%) consider the lunch as the main meal, while only 3.1% consider the dinner as the main one. There is insignificant association between main meal and the group at 0.05 level of significant. Over 81% of the sample declared that they take snacks between meals, with insignificant association between taking snacks status (yes/no) and the group at 0.05 level
of significant. Those who are taking snacks are distributed based on their favorite snack as given in the "kind of snack" cell in among those who are taking snacks between meals, 45% of them eat fruits and only 1.3% takes sweet. There is a significant association between the kind of snake and the group at 0.05 level of significant, where 58.3% of those who are eating fruits belong to the control group, and 75.0% of those who prefers sandwiches belong to the case group. More than half of the sample 57 (58.2%) like to have fast food, with insignificant association between taking fast food status (yes/no) and the group at 0.05 level of significant. More than one-thirds of the sample 37 (37.8%) consider the fruit juice as their preferred drink, while 5 (5.1%) prefer milk. There is a significant association between the preferred drink and the group at 0.05 level of significant. 67.6% of those who prefer fruit juice belong to the control group, while 65.0% and 76.5% of those who prefer tea and coffee respectively are from the case group. About three quarters of the sample 73 (74.5%) takes their drink with natural sugar, while only 7 (7.1%) prefer artificial sugar, with insignificant association between drinks sugar (without sugar, natural or artificial) and the group at 0.05 level of significant. The majority of the sample 93 (94.9%), used to cook with vegetables oil, while none of them use butter in cooking, with insignificant association between type of fat (vegetable oil, margarine butter) and the group at 0.05 level of significant. Thigh and chest is the most preferred organ of poultry, with insignificant association between organs and the group at 0.05 level of significant.

**Anthropometric and Biochemical Measurements**
The scale of PMS, four anthropometric variables and two biochemical variables are considered.

The mean of PMS scores for cases (19.69) significantly higher than control subjects (4.08). The mean weight of control subjects is (60.95 kg) which is more than the mean weight of cases (58.92 kg). The mean height of control subjects is (1.63 m) which is less than the mean height of cases (1.93 m). The mean BMI of control subjects is (22.73 kg/m2) which are less than the mean BMI of cases (27.77 kg/m2). The mean waist circumference of control subjects is (72.10 cm) which is less than the mean waist circumference of cases (73.45 cm). None of the Anthropometric measurements show a significant difference between the mean of control and cases group subjects at 0.05 level of significant. The mean of serum calcium level for control (9.26 mg/dl) and case (8.45 mg/dl). Furthermore, there is a significant difference between the means of serum magnesium level for control (2.34 mg/dl) and case (1.44 mg/dl).
Food frequency intake

In this section we summarize and test the significance difference between the mean daily intake of several groups of food, namely: grains, meat and legumes, vegetables, fruits, milk and dairy products, drinks and juices, nuts and seeds. Results indicate that there are insignificant differences between the mean daily intake of all types of grains for case and control groups at 0.05 level of significant, except for the rice where the mean daily intake for control (0.24 cup/day) which is twice the mean daily intake for case group with significant difference at 0.05 level of significant. Results show that there are significant differences between the mean daily intake for some meat and legumes categories namely (poultry, fish, falafel, white beans, green beans and egg) of control and case groups at 0.05 level of significant, where the mean of control is higher than the mean of case and insignificant difference between the mean daily intake for other categories (meat, homos, lentil) of control and case groups.

Results show also that there are significant differences between the mean daily intake of all types of vegetables for case and control groups at 0.05 level of significant, with higher mean daily intake for control compare to case, except for two types of vegetables (okra and broccoli) the differences between the means of control and case group are insignificant at 0.05 level of significant.

Results show that there are significant differences between the mean daily intake of all types of fruits for case and control groups at 0.05 level of significant, with higher mean daily intake for control compare to case, except for grapefruit the difference between the means of control and case group is insignificant at 0.05 level of significant. Results show that there are significant differences between the mean daily intake of all types of milk and dairy products for case and control groups at 0.05 level of significant, with higher mean daily intake for control compare to case. Results indicate that there are significant differences between the mean daily intake of all types of drinks and juices for case and control groups at 0.05 level of significant. There are significant differences between the mean daily intake for (popcorn, cashews, almond, Sesame and Tahini) of control compare to cases at 0.05 level of significant, with larger mean of control, while there is a significant difference between the mean daily intake for chocolate of control and case groups, with larger mean of cases. Table 1 presents the results of Fisher's exact test of association between the PMS and the status of
serum calcium, it is obvious that there is a significant association between the PMS scale and status of serum calcium at 0.05 level of significant.

Table 1:- Fisher exact test for association between PMS and serum Calcium

<table>
<thead>
<tr>
<th>Serum Calcium</th>
<th>PMS Scale</th>
<th>Test Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t have PMS</td>
<td>Border line to Mild PMS</td>
<td>Moderate To severe PMS</td>
<td>Severe PMS</td>
</tr>
<tr>
<td>Normal (8.6-10.3)</td>
<td>46 (82.1%)</td>
<td>3 (5.4 %)</td>
<td>5 (8.9 %)</td>
</tr>
<tr>
<td>Not normal</td>
<td>3 (7.1 %)</td>
<td>23 (54.8 %)</td>
<td>11 (26.2 %)</td>
</tr>
<tr>
<td>Total</td>
<td>49 (50.0%)</td>
<td>26 (26.5%)</td>
<td>16 (16.3%)</td>
</tr>
</tbody>
</table>

*Statistically significant at 0.05 level of significance

Table 2 presents the results of Fisher's exact test of association between the PMS and the status of serum magnesium, it is obvious that there is a significant association between the PMS scale and status of serum magnesium at 0.05 level of significant.

Table 2:- Fisher exact test for association between PMS and serum Mg

<table>
<thead>
<tr>
<th>Serum Magnesiu m</th>
<th>PMS Scale</th>
<th>Test Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t have PMS</td>
<td>Border line to Mild PMS</td>
<td>Moderate To severe PMS</td>
<td>Severe PMS</td>
</tr>
<tr>
<td>Normal (1.9-2.5)</td>
<td>41 (89.1 %)</td>
<td>1 (2.2 %)</td>
<td>3 (6.5 %)</td>
</tr>
<tr>
<td>Not normal</td>
<td>8 (15.4 %)</td>
<td>25 (48.1 %)</td>
<td>13 (25.0 %)</td>
</tr>
<tr>
<td>Total</td>
<td>49 (50.0 %)</td>
<td>26 (26.5%)</td>
<td>16 (16.3%)</td>
</tr>
</tbody>
</table>

*Statistically significant at 0.05 level of significance

There is a significant inverse correlation between the PMS scale and the serum calcium level at 0.05 level of significant, and also there is a significant inverse correlation between the PMS scale and the serum magnesium level at 0.05 level of significant, in other words, the
reduction of Ca or Mg levels increases the score of PMS. Results in Table 3 show that the correlation between PMS scale and the serum calcium level (-0.474) is stronger than the correlation between PMS scale and serum magnesium level (-0.221).

Table 3: Pearson correlation between PMS and biochemical variables

<table>
<thead>
<tr>
<th>Biochemical Variables</th>
<th>Correlation coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum calcium level</td>
<td>-0.474</td>
<td>0.000*</td>
</tr>
<tr>
<td>Serum magnesium level</td>
<td>-0.221</td>
<td>0.029*</td>
</tr>
</tbody>
</table>

*Statistically significant at 0.05 level of significance

DISCUSSION

The results could evaluate the association between the groups (control/case) and categories of different variables considered in the questionnaire, and to highlight the homogeneity of the subjects in the control and case groups with respect to some socioeconomic variables and their experience to 8 different diseases. The sample of study includes two groups; the first represents students with PMS which considered as the case group, and the other represents students without any suspicion of PMS which will be called the control group. The sample is considered as purposive non probability sample. Total of 98 students were selected according to the inclusion criteria in the study after getting their consent. They were divided equally into two groups (control and case). Two participants were excluded from the analysis due to the incompleteness of PMS scale. Therefore, the remaining sample consists of 49 students in the case group and 49 students in the control group. However, it can be concluded that the results were matched with other similar studies in some findings and contradicted with another according to the type of feedings. The current study followed a systematic analysis, thus we can comment the following issue

General Health Status of the Student

The general health status is investigated via checking the experience of students with eight diseases which is chronic stress problems, chronic depression, feeling panicked, mood swings, renal disease, migraine, anemia, and colon disorders.

The majority of students do not suffer from chronic stress problems, chronic depression, feeling panicked, renal disease, migraine, anemia or colon disorder. Furthermore, samples subjects are distributed almost equally between the control and case group.
Association tests are not calculated for renal disease and Anemia because none of the sample subjects were experienced any of them. There is insignificant association between any of the diseases and the group at 0.05 level of significant. These findings coincide with the conclusion of the previous section toward the homogeneity of the subjects of control and case groups. Balaha study in 2010 indicated that limitations of activities were significantly more frequent among severe cases. And the prevalence of anxiety and depression was statistically more evident in the PMS group. Knauss study found that the prevalence of major depression was 11.3% in women screening positive for moderate PMS and 24.6% in women screening positive for severe PMS. Compared to women without any of these conditions, women who reported moderate to severe alcohol consumption had a lower risk for PMS. A higher relative risk to report both PMS and major depression compared to women without PMS or major depression was related to factors such as high psychological distress, low mastery, psychotropic drug consumption, and low self-rated health. There is limited research on the relationship between renal disease, migraine, and colonic disorders and premenstrual symptoms from studies with large sample sizes or from population-based studies.

Health Status Before, During and After the Menstrual Cycle

There is a significant association between the group and the category of PMS scale. The researcher here achieved the first objective which is to reveal the effect of dietary behavior on premenstrual syndrome. Audra study indicate that adjusting for age, education, passive and active smoking, and waist/height ratio, high stress (fourth quartile PSS) was associated with an increased risk of reporting ≥8 or more (OR 7.2, 3.3-15.8) and ≥5 (OR 2.5, 1.6-4.1) symptoms as moderate/severe during the premenstrual period compared with lower stress (quartiles one, two, and three). Stress scores were positively (p < 0.0001) associated with increased symptom severity scores for total, psychological, and physical symptoms. These analyses show that higher perceived stress precedes an increased severity of premenstrual symptoms. Stress reduction programs may be an effective, non-pharmaceutical treatment for physical and psychological symptom relief.

Lifestyle

The current results investigate the association between the lifestyle and PMS status, four lifestyle issues are discussed in this section, namely, smoking status, Practicing physical activities, kind of physical activity and Sleeping period length. Study findings show...
that about two-thirds of the sample (69.4%) considered themselves as non-smokers, while none of them declared that there are active smokers, where (73.3%) of the passive smokers are cases. There is a significant association between smoking status and group at 0.05 level of significant. Cheng study shows that PMS is prevalent among new female university students and that lifestyle and nutritional/metabolic factors may play a role in this disorder. A study in 2013, the study revealed that (80.2%) of the participants experienced various degrees of PMS symptoms which were significantly associated with a family history of PMS, physical inactivity, habitual excess consumption of coffee, BMI, frequent consumption of fast food, and smoking, but these factors explained only (52%) of the variability in the logistic regression model. These results agreed with Seehom study in 2013 which found that a significant relationship was observed between exposure to passive smoking and PMS, as (83.5%) of those who exposed to passive smoking had PMS compared to (66%) of those who did not expose to passive smoking. The results also agreed with Gold study in 2007, the study found that the current smoking (AOR = 1.60, p = 0.028) and passive smoke exposure (AOR = 1.56, p = 0.050) were positively associated with PMS.

In current study; results indicate that around (60%) of sample subjects are practicing one type of sport, with (72.1%) of them are used to walk and (27.9%) are doing Swede, but none of them join any specialized club. There is a significant association between practicing physical activities status and group at 0.05 level of significant, where (64.1%) of those who are not practicing any physical activities are cases. Furthermore, there is insignificant association between the type of physical activities and group at 0.05 level of significance.

These results agreed with Seehom study in 2013 which indicate that a significant relationship was observed between PMS and physical activity, and larger proportion of students who were sedentary (91%) had PMS compared to those women (49.2%) who were physically active, and larger proportion of students who were sedentary (91%) had PMS compared to those women (49.2%) who were physically active. Current study results indicate that more than half of the samples (58.2%) are sleeping less than 8 hours, and there is a significant association between sleeping mode and group at 0.05 level of significant, where (73.2%) of those who are sleeping more than 8 hours belong to the control group.

**Diet, During and After the Menstrual Cycle**

The current study results indicate that with respect to the main meal, the majority of sample subjects (82.7%) consider the lunch as the main meal, while only (3.1%) consider the dinner
as the main one. There is insignificant association between main meal and the group at 0.05 level of significant. Current study results found that (81.6%) of the sample declared that they take snacks between meals, with insignificant association between taking snacks status (yes/no), and the group at 0.05 level of significant. Those who are taking snacks are distributed based on their favorite snack as given in the "kind of snack" cell. The current study results also indicate that among those who are taking snacks between meals, (45%) of them eat fruits and only (1.3%) takes sweet. There is a significant association between the kind of snake and the group at 0.05 level of significant, where (58.3%) of those who are eating fruits belong to the control group, and (75.0%) of those who prefers sandwiches belong to the case group.

These results agreed with Seedhom study in 2013 whom found that a significant association between PMS symptoms and intake of sweet-tasting foods. And the current results also agreed with Rasheed and Saad (2003) with the observations of who found this association, that a significant association between PMS symptoms and intake of sweet-tasting foods. The current study results indicated that more than half of the samples (58.2%) like to have fast food, with insignificant association between taking fast food status (yes/no) and the group at 0.05 level of significant. A similar observation was made by Pherson and L. Korfine in 2004 for students who consumed excess fast food as (71.4%) of them had PMS. Decreased intake of fruits and vegetables was significantly related to the occurrence of PMS. About (86%) of those without sufficient intake of fruits and vegetables had PMS versus (13.9%) who had not. And the results also found that more than one-thirds of the samples (37.8%) consider the fruit juice as their preferred drink, while (5.1%) prefer milk. There is a significant association between the preferred drink and the group at 0.05 level of significant. (67.6%) of those who prefer fruit juice belong to control group, while (65.0%) and (76.5%) of those who prefer tea and coffee respectively are from the case group. These results matched with Seedhom study in 2013, the result show a significant, positive, and independent effect on PMS by coffee drink. This was similar to the results of Rasheed and Saad in 2003 who found a significant positive effect on premenstrual symptom severity by total intake of caffeinated beverages in general and caffeinated coffee and cocoa-chocolate drinks in particular. Also the current study results are matched with Barone and Roberts that’s results showed that the observed effect of tea did not reach significant levels possibly due to a lower dose effect of caffeine per cup for these beverages compared to coffee. As per standard values, one cup (5-6 oz) of caffeinated coffee usually has 60–85 mg of caffeine while that for
tea and cola drinks is reported to be 20–30 mg and 18 mg per cup, respectively. The current study also agreed with Pherson and Korfine study which found that about (92%) of students with excess coffee intake had PMS compared to 7.7% who had not, and this difference was statistically significant (p<0.005). And excessive drinking of tea had no significant influence on the PMS in this study. The study results appear to show that about three quarters of the sample (74.5%) takes their drink with natural sugar, while only (7.1%) prefer artificial sugar, with insignificant association between drinks sugar (without sugar, natural or artificial) and the group at 0.05 level of significant. This current results disagreed with Seedhom study which indicated that excess intake of sweet-tasting food items such as chocolates, cakes, and deserts had a significant influence on the occurrence of PMS, as students who ate these food items frequently had PMS (88.5%) more than those (70.2%) who consumed them less often (p<0.0001) (Seedhom, 2013). The current study results indicate that the majority of the sample (94.9%) used to cook with vegetables oil, while none of them use butter in cooking, with insignificant association between type of fat (vegetables oil, margarine butter) and the group at 0.05 level of significant. The current study results indicate that the Thigh and chest is the most preferred organ of poultry, with insignificant association between organs and the group at 0.05 level of significant.

**Anthropometric and Biochemical Measurements**

The current study results indicate that the mean of PMS scores for cases (19.69) significantly higher than control subjects (4.08). The current study results found that the mean weight of control subjects is (60.95 kg) which is more than the mean weight of cases (58.92 kg). The current study results indicate that the mean height of control subjects is (1.63 m) which is less than the mean height of cases (1.93 m). The current study results showed that the mean BMI of control subjects is (22.73 kg/m²) which are less than the mean BMI of cases (27.77 kg/m²).

The current study results indicate that the mean waist circumference of control subjects is (72.10 cm) which is less than the mean waist circumference of cases (73.45 cm). None of the Anthropometric measurements show a significant difference between the mean of control and cases group subjects at 0.05 level of a significant. The current study results are disagreed with Gilany, it was found that there was a significant relation between BMI and the occurrence of PMS. As all the underweight female students had PMS and (93.4%) and (90.9%) of overweight and obese students, respectively, had PMS compared to (6.6%) and
(9.1%) who had no PMS, this difference was statistically significant (p<0.003). PMS was higher among students who had central obesity versus those who had not (92.9% versus 7.1%), but this difference was statistically not significant (p = 0.2) (Gilany, 2005). Adiposity may also be related to PMS through a variety of hormonal, neural, and behavioral mechanisms, and several studies have found women with PMS or menstrual symptoms more likely to be overweight and obese than women without PMS (Seedhom, 2013). The current study results disagreed with Bertone-Johnson, the study indicate a significant relation between BMI and the occurrence of PMS was detected. Also the study found that a strong positive relationship between BMI and the development of PMS. Women who were obese at baseline had significantly higher risks of developing PMS over 10 years follow up compared with lean women. BMI was also positively associated with risk of specific physical and emotional symptoms, including swelling of the extremities, backache, abdominal cramping, diarrhea/ constipation, mood swings, and food cravings.35

The current study result is matched with Seedhom study, the study was found that there was a significant relation between BMI and the occurrence of PMS. As all the underweight female students had PMS and 93.4% and 90.9% of overweight and obese students, respectively, had PMS compared to 6.6% and 9.1% who had no PMS, this difference was statistically significant. PMS was higher among students who had central obesity versus those who had not (92.9% versus 7.1%), but this difference was statistically not significant.

The current results show that there is a significant difference between the means of serum calcium level for control (9.26 mg/dl) and case (8.45 mg/dl). Furthermore, there is a significant difference between the means of serum magnesium level for control (2.34 mg/dl) and case (1.44 mg/dl). Bertone-Johnson study was a case-control study within the Nurses’ Health Study II cohort found that women with the highest intakes of calcium from food (median=1,283 mg/day) and vitamin D had a lower risk of PMS than those with the lowest intakes. 36

The researcher has achieved here the second and third objectives, which identify the relationship between serum Mg and PMS. And identify the relationship between serum Ca and PMS.
Food frequency intake

The current study results summarized respectively the significance difference between the mean daily intakes of several groups of food, namely: grains, meat and legumes, vegetables, fruits, milk and dairy products, drinks and juices, nuts and seeds. The results indicate that there are insignificant differences between the mean daily intake of all types of grains for case and control groups at 0.05 level of significant, except for the rice where the mean daily intake for control (0.24 cup/day) is twice the mean daily intake for case group with significant difference at 0.05 level of significant. The current results show that there are significant differences between the mean daily intake for some meat and legumes categories namely (poultry, fish, falafel, white beans, green beans and egg) of control and case groups at 0.05 level of significant, where the mean of control is higher than the mean of case. The current results show that there is insignificant difference between the mean daily intake for other categories (meat, homos, lentil) of control and case groups. The current results indicate that there are significant differences between the mean daily intake of all types of vegetables for case and control groups at 0.05 level of significant with higher mean daily intake for control compare to case, except for two types of vegetables (okra and broccoli) the differences between the means of control and case group are insignificant at 0.05 level of significant. The current results found that there are significant differences between the mean daily intake of all types of fruits for case and control groups at 0.05 level of significant, with higher mean daily intake for control compare to case, except for grapefruit the difference between the means of control and case group is insignificant at 0.05 level of significant. The current results show that there are significant differences between the mean daily intake of all types of milk and dairy products for case and control groups at 0.05 level of significant, with higher mean daily intake for control compare to case. The current results also found that except for green tea and capatchino, there are significant differences between the mean daily intake of all types of drinks and juices for case and control groups at 0.05 level of significant. The mean daily intake for cases is larger for all types of drinks except for the natural fruit juice. Rossignol and Bonnlanders suggested that women suffering from PMS should avoid caffeine, in the form of soft drinks, coffee, or chocolate; refined sugars; sodium; and saturated fats. Drinking plenty of water is a complement to cutting back on sodium, and the consumption fruit juice and caffeine-free soda was related to the prevalence of the premenstrual syndrome among women with more severe symptoms. None of the associations was substantially altered when the daily consumption of beverages high in caffeine content was controlled for. Taken together, these data suggest that the consumption of foods and beverages that are high in sugar content or...
taste sweet is associated with prevalence of the premenstrual syndrome. The results of current study show that there are significant differences between the meandaily intake for (popcorn, cashews, almond, Sesame and Tahini) of control compare to cases at 0.05 level of significant, with larger mean of control, while there is a significant difference between the mean daily intake for chocolate of control and case groups, with larger mean of case. Ramcharan analysis showed that the frequent intake of sweet-tasting food items, fastfood, decreased vegetables and fruits, and caffeinated beverages explained 52% of the variation in the PMS.  

**Biochemical variables**

The current results show that there is a significant association between the PMS scale and status of serum calcium at 0.05 level of significant. The results of current study indicated that there are correlation between PMS scale and the serum calcium level (0.474) is stronger than the correlation between PMS scale and serum magnesium level (-0.221). The researcher has achieved the fourth objective of the current study. Some studies suggest that blood calcium and vitamin D levels are lower in women with PMS and that calcium supplementation may reduce symptom severity, but it is unknown whether this may prevent the initial development of PMS. In a recent case control study, after adjustment for risk factors, women in the highest quintile of total vitamin D intake had a relative risk of 0.59 (95% confidence interval, 0.40e0.86) compared with those in the lowest quintile (P ¼0.01 for trend). The intake of calcium from food sources was also inversely related to PMS. The intake of skimmed or low-fat milk was also associated with a lower risk (P < 0.001). A high intake of calcium and vitamin D may therefore reduce the risk of PMS but large-scale clinical trials addressing this is required. At present, the only interventional data are from small trials. The use of calcium supplements may therefore benefit women with PMS both by reducing their current symptoms and by promoting better bone health in later life.  

The results of this study also show that the status of serum magnesium, it is obvious that there is a significant association between the PMS scale and status of serum magnesium at 0.05 level of significant.

This study is supported by Sadler study in 2010, the study suggest that magnesium may also be helpful in PMS. A double-blind, placebo-controlled study of 32 women found that magnesium taken from day 15 of the menstrual cycle to the onset of menstrual flow could significantly improve premenstrual mood changes. The current results show that there are a significant inverse correlation between the PMS scale and the serum calcium level at
0.05 level of significant, and also there is a significant inverse correlation between the PMS scale and the serum magnesium level at 0.05 level of significant. In other words, the reduction of Ca or Mg levels increases the score of PMS. Dullo and Vedi study in 2008 show that the serum calcium level was highest in the follicular phase whereas the serum magnesium level was lowest in the follicular phase; the serum inorganic phosphorus levels was highest in the menstrual phase. The researcher has achieved the objective (no. 5) of the current study, which reveals to explore the effect of Ca, Mg on improving the symptoms.

This result is supported by Huo study in 2007 found that regular use of magnesium could reduce symptoms of PMS-related fluid retention. In this study, 38 women were given magnesium or placebo for 2 months. One small double-blind study (20 participants) found that magnesium supplementation with vitamin B6 might help prevent menstrual migraine.

**CONCLUSION**

This research indicated that PMS is influenced by many variables; since there is a strong relationship between Calcium and Magnesium with PMS. The dietary changes and natural health remedies and women's pain and discomfort from premenstrual syndrome are related to each other. Also there is a significant association between lifestyle and their smoking status, practicing physical activities, and sleeping. The effect of dietary behavior on premenstrual syndrome is significant with several types of foods. On PMS scale, more than 82% don't have PMS complications.

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