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THE RELATIONSHIP BETWEEN PREMENSTRUAL SYNDROME AND THE QUALITY OF SLEEP AMONG EGYPTIAN WOMEN: AN OBSERVATIONAL STUDY

Dalia M. KAMEL[1]✉, Sayed A. TANTAWY[2,3], Noor ALSAYED[4], Amira HASSAN BEKHET[5], Nehal ELBKERY[5], Alaa KHAIRY[5]

[1] Department of Physical Therapy for Women's Health, Faculty of Physical Therapy, Cairo University, Egypt
[2] Department of Physiotherapy for Integumentary Problems, Faculty of Physical Therapy, Deraya University, Menia, Egypt
[3] Department of Physiotherapy, Centre of Radiation Oncology and Nuclear Medicine, Cairo University, Egypt
[4] Department of Mathematical Sciences, College of Arts and Science, Ahlia University, Bahrain
[5] Medical Research Group of Egypt, Faculty of Physical Therapy, Cairo University, Giza, Egypt

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Abstract

Introduction. Premenstrual syndrome (PMS) is a disorder characterized by physical, psychological and behavioural symptoms. These symptoms can affect the women's quality of life on different aspects.
The objective of the study was to investigate the relationship between PMS and sleep quality among women of reproductive age.
Materials and methods. This is a cross sectional study on 768 women of reproductive age, who answered a self-reported questionnaire. This questionnaire consisted of three parts: demographic data sheet, premenstrual syndrome scale (PMSS) and Pittsburg Sleep Quality Index (PSQI). The primary outcome was the prevalence and severity of PMS and sleep quality, in addition to the correlation between PMS and PSQI. The demographic characteristics of participants and their impact on the PMS and PSQI were secondary outcomes.

Résumé

La relation entre le syndrome prémenstruel et la qualité du sommeil chez les femmes égyptiennes: une étude observationnelle

Introduction. Le syndrome prémenstruel (SPM) est un désordre comprenant des symptômes physiques, psychologiques et comportementaux. Ensemble, ces symptômes peuvent affecter la qualité de vie des femmes sous différents aspects.
L'objectif de l'étude était d'étudier la relation entre le syndrome prémenstruel (SPM) et la qualité du sommeil chez les femmes en âge de procréer.
Matériel et méthodes. L'étude est transversale, avec un échantillon de 768 femmes en âge de procréer qui ont répondu à un questionnaire autodéclaré. Ce questionnaire compilé comprenait trois parties de la fiche de données démographiques, l'échelle du syndrome prémenstruel (PMSS) et l'indice de qualité du sommeil

✉ Address for correspondence: Dalia M. KAMEL
Faculty of Physical Therapy, Cairo University, Egypt
Address: El-Tahrir st. Dokki – Giza, Giza, P.O. Box 11432, Egypt
E-mail: dr_daliakamel@cu.edu.eg; Phone: +201223515161

Results. PMS was reported in 90.5% of participants, with intensity ranging between moderate to very severe. There was a significant positive correlation between PMS and PSQI (p< 0.01). PMS did not show any correlation (P> 0.05) with the demographic characteristics, while the age and body weight only showed significant difference with reference to PSQI.
Conclusion. The correlation between PMS and PSQI is significant and should be investigated in women with PMS, to develop a coping strategy regarding the sleep quality.

Keywords: premenstrual syndrome, sleep quality, reproductive age, menstrual cycle.

List of abbreviations
PMS – premenstrual syndrome
EEG – electroencephalogram
BMI – body mass index
PMSS – premenstrual syndrome scale
PSQI – Pittsburgh sleep quality index

Résultats. Le syndrome prémenstruel a été signalé chez 90,5% des participants avec une intensité allant de modérée à très sévère. Il y avait une corrélation positive significative entre le SPM et le PSQI (p <0,01). Le syndrome prémenstruel n'a montré aucune corrélation (P> 0,05) avec les caractéristiques démographiques, tandis que l'âge et le poids corporel ne présentaient qu'une différence significative par rapport au PSQI.
Conclusion. Il y avait une corrélation significative entre le SPM et le PSQI et cette corrélation devrait être mise en évidence et étudiée chez les femmes atteintes de SPM, pour développer une stratégie d'adaptation concernant la qualité du sommeil.

Mots-clés: syndrome prémenstruel, qualité du sommeil, âge de procréation, cycle menstruel

Introduction

Premenstrual syndrome (PMS) is a set of physical, psychological and behavioural symptoms that occur during luteal phase, and are relieved within few days following the start of menses. Food craving, back pain, abdominal cramps, aches, headache, fatigue, mood swings, increasing anxiety, difficulty of concentration and lack of interest in activities are symptoms reported by women with PMS[1-5]. At least one of the PMS symptoms is experienced by 91% of women during menstruation period, regardless of the severity[2].

The etiology of PMS is not clear yet. There are associations between PMS and other factors such as diet (fast food, deserts, alcohol, caffeine consumption), psychoactive drugs, hypercholesterolemia, arterial hypertension, and a low level of physical activity. Disturbances in serotonin function and progesterone are other causes of PMS. PMS impairs women's lives, family responsibilities, work productivity, daily life activities and social relationships[2,6,7].

The prevalence of PMS was investigated in different countries and showed different results. A study performed in El Minia University (Egypt) showed a prevalence of 80.2%[4]. Other study, in a Health Sciences Faculty in Northern Ethiopia revealed a prevalence of 83.2%[5]. In Turkey, the prevalence of PMS varies between 5-79.9%[5,7], while among Iranian women is 70.8%[8].

This variation of PMS prevalence may be attributed to the PMS diagnosis criteria, screening tools and the selected population sample, as most studies of PMS were done on young females in comparison with adolescent girls, social and culture context and level of education[6,7].

Women aged 18-50 years complain of sleep difficulties during premenstrual week more than any other time, those including increased sleep latency, waking up during night and poor quality of sleep. In women's life cycle there are marked changes in the quality and duration of sleep, depending on external and internal factors, along PMS[1]. However, in studies using electroencephalogram (EEG) and polysomnography as assessment methods, the authors found that women with PMS have an efficient sleep and sleep for longer time[9,10]. However, there were differences between sleep waves in follicular and late luteal phase in women with PMS, in addition to slower sleep wave, than in women without PMS[11].

The association between PMS and a poor quality of sleep may have similar explanation as a psychomotor disorder; these women have a low level of melatonin, that disturbs the sleep-wake cycle and increases the slow wave sleep or changes in hormones levels throughout menstrual cycle[10-12]. Other hypotheses suggest that women's perception of sleep quality is more influenced by stress and social relationships than PMS itself[13]. So, there are debatable results regarding the PMS impact on the sleep quality. In addition, studies to explore the prevalence of PMS, its

associated factors and relationship with sleep quality among Egyptian women are lacking.

The objective of the study was to investigate the association between PMS and quality of sleep of different women age groups and to evaluate the demographic factors that may associate with both PMS and quality of sleep, as the knowledge of such association would help in therapeutic management and raise the awareness about the effects of the PMS.

Materials and methods

Study design

An observational, cross-sectional design was approved by the Ethics Committee of Physical Therapy Faculty, Cairo University, Egypt (no. P.T.REC/012/001948). The research was designed according to the STROBE guidelines.

Participants

Egyptian females in the reproductive age, with no history of any disease, completed the self-administered questionnaire voluntarily, after signing a consent form. The exclusion criteria were any depressive thoughts, anxiety, amenorrhea, menorrahgia. Data were collected between December 2017 and April 2018.

Demographic characteristics

This part of the questionnaire consisted of 15 questions, included socio-demographic and individual characteristics such as name, age, and occupation, characteristics of the menstrual periods, symptoms, obstetrical history, contraception, dysmenorrhea, cycle length (frequency) and junk food consumption. The participants' heights and weights were reported according to the participants' own statements. Weight was divided by the square of the height (kg/m^2) for calculation of the body mass index (BMI).

Premenstrual syndrome

Information on premenstrual symptoms was collected through using the Premenstrual Syndrome Scale (PMSS), with an inter-rater reliability between 0.81 and 0.97[14]. The PMSS consists of 40 items with 5-point Likert- type scale (Never, Rarely, Sometimes, Very often, Always). It consists of three subscales: physical symptoms, psychological symptoms and behavioural symptoms. PMSS has a scoring system from 1-5, as 1 for rarely and 5 for always, accordingly. The lowest scale score is 40 and the highest score is 200. A total score estimated as 80 points or above indicates PMS. The increase in the scores indicates PMS severity increase[14].

Sleep quality

Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI), one of the commonly used sleep questionnaires, that captures areas of sleep disturbance[15]. This questionnaire evaluates the quality of sleep during the past month through 19 self-rated questions. The items use variable response categories, recording usual bedtime, number of actual hours slept and number of minutes to fall asleep, and usual wake time. Questions are answered by a Likert-type scale (0–3). The sum of all answers is converted into a global score (0–21), where the higher score indicates less sleep quality. A total score greater than 5.0 points is related to poor sleep quality[15]. The PSQI has shown high validity and test-retest reliability[16].

Study sample size

The sample size was calculated using this equation $n=z^2\times (1-p)/d^2$, where n=required sample size, z=confidence level at 95% (standard value of 1.96), p=estimated prevalence of PMS in the study area (50%) and d=margin of error at 5% (standard value of 0.05). The snowball technique was used to recruit a convenient sample, with a total of 768 women either studying or working in Cairo University (Egypt), who were approached based on the sample size calculation; 688 responses were completed and included in the statistical analysis, with a response rate of 89.58%.

Statistical analysis

Data were rectified, coded, and entered in SPSS (The Statistical Package for Social Science) version 23 for analysis. In addition to descriptive statistics, Pearson's correlation was run between PSQI and PMSS total score and the different components of the score (physical, psychological and behavioural). One-way ANOVA was used to compare means of PMSS across the different age categories. Multiple linear regression models were also run to test: 1) the effect of demographic and anthropometric characteristics (including age, nationality, occupation, weight and height) on PMSS total score and 2) the effect of demographic and anthropometric characteristics (including age, nationality, occupation, weight and height) on PSQI. The level of significance was selected at 0.05.

Results

This study was completed by 688 women, with a mean age of 25.6±7.7 years. Most of the participants were Egyptians (98.4%), single (67.2%), students (60.8%). The mean age of menarche was 13.0±1.5, and a great number of participants have a regular period (79.8%) but suffer from dysmenorrhea (87.2%).

Table 1. Difference in PSQI between PMS and no PMS groups.

	PMS group Mean (SD)	No PMS group Mean (SD)	t-value	P-value
PSQI Score	7.60 (3.18)	7.22 (3.24)	-0.90	0.37
Component 1 subjective sleep quality	1.26 (0.81)	1.28 (0.80)	0.18	0.85
Component 2 sleep latency	1.63 (1.06)	1.37 (1.19)	-1.79	0.07
Component 3 sleep duration	1.30 (1.16)	0.92 (0.94)	-2.48	0.01*
Component 4 sleep efficiency	0.63 (1.08)	0.73 (1.22)	0.72	0.47
Component 5 sleep disturbance	1.53 (0.65)	1.47 (0.62)	-0.69	0.49
Component 6 use of sleep medication	0.38 (0.86)	0.37 (0.78)	-0.09	0.93
Component 7 day time dysfunction	1.58 (1.07)	1.10 (1.00)	-3.35	0.001**

** Significant at the 0.01 level
* Significant at the 0.05 level

Table 2. One-way ANOVA of different age groups in relation to PMSS and PSQI.

Scale	Score Mean(SD)	F value	p-value
PMSS	122.79 (29.95)	1.12	0.34
PSQI	7.57 (3.18)	13.96	0.001**
Physical Score	48.06 (11.63)	0.94	0.42
Psychological Score	40.68 (11.33)	1.88	0.13
Behavioural Score	34.05 (11.54)	1.19	0.31

** Significant at the 0.01 level

Most of the participants stated that they suffer from PMS (90.5%), with symptoms ranging from moderate (PMSS 81-120) to severe (PMSS 121-160) and very severe (PMSS 161-200). Also, the majority (78.6%) answered that they had a regular period cycle length, between 21-35 days. The married participants mainly used intrauterine device (63.7%) and contraceptive pills (36.3%) as contraception.

When it comes to sleep, 73.5% reported poor sleep, while 26.50% were good sleeper. The percentage of poor sleepers who suffer from PMS equals 92.50%, whereas poor sleepers without PMS were 7.70%. The good sleepers without PMS were 11.50% and with PMS were 88.80%.

Independent T tests for PSQI and PSQI components were run to test for the difference across the two groups (with PMS and without PMS). The difference is statistically significant in the third component, which is sleep duration (p=0.01) and the seventh component, which is daytime dysfunction (p=0.001) (Table 1).

There was a significant positive correlation between PSQI and PMSS (r=0.13, p=0.001). Furthermore, there were significant positive correlations between PSQI and the physical component of PMS (r=0.14, p=0.001), psychological component of PMS (r=0.09, p=0.02) and behavioural component of PMS (r=0.11, p=0.001).

Approximately half the participants were below 25 years old, so the data were categorized by age group into four categories: 1) below 20 years, 2) between 20 to 30 years, 3) between 30 to 40 years and 4) above 40 years. One-way ANOVA was run to compare means of PMSS across the different age categories and results indicated no statistical significance. The same observation was noted when comparing means PMSS subscales (physical, psychological and behavioural scores) across the different age categories. For PSQI scores across different age categories, the results indicated differences with statistical significance (F=13.95, p=0.001). The results indicated a statistically significant difference between age groups when it comes to PSQI, but not with PMSS (Table 2).

Multiple linear regression analysis was used to investigate the effect of demographic characteristics (including age, nationality, occupation, weight and height) on PMSS total score and showed that PMSS was not significantly affected by any of the characteristics (Table 3). Similarly, it was observed in PSQI score, except for age (p=0.01) and weight (p=0.03) (Table 4).

Discussion

The results of the study revealed that 90.5% of the participants suffer from PMS, ranging from moderate to very severe, and 87.2% had dysmenorrhea.

Table 3. Multiple linear regression of PMSS with subjects' demographic characteristics.

	Beta value	*t-value*	*P-value*
Age	-0.022	-0.440	0.660
Nationality	0.013	0.421	0.674
Occupation	-0.023	-0.496	0.620
Weight	0.053	1.438	0.151
Height	-0.048	-1.475	0.141
PMSS dummy	0.597	19.383	0.001**

Table 4. Multiple linear regression of PSQI with subjects' demographic characteristics.

	Beta value	*t-value*	*P-value*
Age	.091	2.161	.031*
Nationality	-.005	-.173	.863
Occupation	-.030	-.776	.438
Weight	.097	3.077	.002**
Height	-.045	-1.617	.106
PSQI dummy	.700	26.417	.000**

The worldwide prevalence of PMS was estimated between 5-76%[17-18], while the present findings showed higher values. The prevelance of dysmenorrhea in the current study is supported in the literature with similar percentages [17,19,20]

There was a positive correlation between PSQI and PMS in both total score and sub scores. Such correlation may be attributed to the physical, psychological and behavioural changes associated with PMS, that may impact the sleep quality. Studies have found that sleep disturbances associate with menstrual problems, with a great impact on the women's sleep quality[7,16,21,25].

The peak of sleep disturbance in relation to menstrual phase is debatable. The sleep disturbance was especially noted during the premenstrual week, in terms of increased sleep onset latency, number of awakenings and decreased sleep efficiency[22,23]. This disturbance was prominent in the luteal phase compared to follicular phase[24,25], while other studies revealed minimal differences in sleep parameters in relation to the phases of the menstrual cycle[26,27].

PMS sufferers frequently complain about poor sleep quality because of insomnia, hypersomnia, exhaustion, fatigue, difficulty of concentration, and nightmares. These complaints increase with the severity of PMS[1,11,28]. The same observation was noted in the present study, when comparing females with PMS and without PMS[7]. Furthermore, Baker and Colrain[11] stated that PMS leads to psychomotor retardation and women became more tired and daytime sleepy in the period when the symptoms increase.

92.30% of women with PMS were poor sleepers in our study, whereas only 7.60% of women without PMS were poor sleepers. When comparing between different PSQI components in both PMS and without PMS groups, the strongest difference was observed in component 3 (sleep duration, p=0.01) and component 7 (daytime dysfunction, p= 0.001). This is in contradiction with Karaman et al[1], who found the strongest association in component 5 (sleep disturbance).

The present study showed that PMSS was not significantly affected by any of the demographic characteristics, including age. The participants were grouped by age into four age groups, with non-significant correlation, although PMS affects especially young women[5,28,29]. This contradiction may be attributed to the different age range that was investigated in our study.

The PSQI was significantly affected by age and body weight. Adults <50 years old showed a negative linear relationship between sleep duration and BMI, whereas adults >50 years old demonstrated a U-shaped relationship, with short (<5 hours) and long (>8 hours) sleep associated with increased BMI[30]. Furthermore, on average, adults sleep less than the recommended 8 hours per night [31,32].

The limitation of the current study consists in representation of some demographic characteristics that might limit the generalization of the findings. Furthermore, objective sleep pattern assessment is needed and could be applied in different menstrual cycle phases.

Conclusions

There was a high PMS frequency among participants of the current study and this is negatively reflected on their sleep quality. Despite the association, the mechanism behind PMS and the sleep-wake cycle

is still unknown. However, it is clear that PMS plays a role in sleep, since women with PMS have a poor quality of sleep[33]. Regarding age and PMS, there was no statistical significance between the PMS and different age categories, despite the fact that age itself significantly influences sleep quality. Counselling, medical care and a good physical health are highly recommended for women with PMS, as these may improve their life quality in different aspects, including sleep quality.

Authors Contributions

Conceptualization, D.K. and S.T.; methodology, D.K.; software, A.H.; validation, N.E. and A.K.; formal analysis, N.A.; investigation, A.H., N.E., and A.K.; resources, A.K. and N.E.; data curation, D.K. and S.T.; writing – original draft preparation, A.H., N.E. and A.K.; writing – review and editing, S.T., D.K.; visualization, D.K., and S.T.; supervision, D.K.; project administration, D.K. All the authors have read and agreed with the final version of the article.

Compliance with Ethics Requirements:

„The authors declare no conflict of interest regarding this article"

„The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study"

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Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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