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Premenstrual syndrome and premenstrual dysphoric disorder among female students in Northern Border University, Arar City, Saudi Arabia

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Premenstrual Syndrome (PMS) and its severe form the Premenstrual Dysphoric Disorder (PMDD) constitute a noticeable health problem in young girls worldwide, which can adversely affect their life. However, researches on PMS/PMDD in Saudi Arabia, particularly the Northern zone are lacking. This study aimed to estimate the prevalence and determinants of PMS/PMDD and their impact on academic performance, social relationships, and Quality of Life (QOL) of female students in the Northern Border University. This cross-sectional study was conducted on female students at the Northern Border University, Arar City. A self-administered structured questionnaire was used to collect data on socio-demographic characteristics, menstrual data, academic activities and interpersonal relationships. PMS was evaluated using the American College of Obstetricians and Gynaecologists (ACOG) diagnostic criteria for PMS. Screening for PMDD was carried out using the criteria of the Diagnostic and Statistical Manual of Mental Disorders 5th edition. QOL of the University students was assessed using the World Health Organization Quality of Life- BREF (WHOQOL-BREF). The study recruited 496 female students. Of these, 68.8% and 29% had PMS and PMDD, respectively. PMSs were likely in medical students ($P=0.001$), those with positive family history of premenstrual symptoms ($P<0.001$), limited physical activity ($P=0.01$), unemployed mothers ($P=0.001$) and dysmenorrhea ($P<0.001$). PMS/PMDD students were more likely to report poor quality of life ($p=0.02$) and unsatisfactory health status ($P=0.03$). PMDD students had lowered physical health ($P<0.001$) and psychological health ($P=0.006$) scores compared to PMS students. PMS/PMDD associated with inadequate educational activities and poor interpersonal relationships. Premenstrual syndromes (PMSs) are common health problems in University students. PMSs were associated with positive family history of premenstrual symptoms, limited physical activity, dysmenorrhea and medical colleges. PMSs associated with poor educational activities, social relationships and unsatisfactory QOL.

Keywords: Pre-menstrual Syndrome; PMS; Pre-Menstrual Dysphoric Disorder; PMDD; University students; Saudi Arabia

INTRODUCTION

Premenstrual disorders

The Saudi Arabian's Vision 2030 stresses on Saudi women as an important element of the Saudi Strength. The Kingdom is keen to support women's talents, investment of their energies and help overcome difficulties to increase women's participation in the labour market and contribution to the development of the society and economy. (The Minister of Labour and Social Development, 2018) Women's health is considered as one of their obvious rights and one of the main goals of social and economic development of societies. Therefore, paying attention to problems and diseases that threaten women's physical, social and mental health, such as premenstrual symptoms, is among health priorities.

Premenstrual Syndrome (PMS), was defined as the periodic recurrence of a combination of physical, psychological, and behavioural changes in the luteal phase of menstrual cycle. It is one of the prevalent problems among women. (Ryu and Kim, 2015) PMS was first described by Hippocrates, who believed that headaches and heaviness before menstruation is an anxious blood that is looking for a way to exit. (Babazadeh and Keramat, 2011) Premenstrual Dysphoric Disorder (PMDD) has been considered a severe form of PMS. The diagnosis of PMDD requires the presence of one or more mood symptoms, symptoms are not related to other pre-existing disorders and are very severe for functional impairment to occur, and are recorded for two successive menstrual cycles. (Teng et al. 2005)

PMS comprises a group of physical and psychiatric symptoms, which can adversely affect women 'social, academic/work performance. These symptoms are experienced the week before menses and become improved within a few days after the onset of menses. (American College of Obstetricians and Gynecologists, 2014) PMDD is considered a severe form of PMS with predominant psychiatric symptoms. (American Psychiatric Association, 2013)

Premenstrual disorders affect all age groups from menarche to menopause; however, the most common age group is 25–45 years. The prevalence of PMS showed wide variations in the different regions, 41% in Europe, 46% in Asia, 61% in South America, and 83% in Africa, with an overall prevalence of 48%. The minimal

prevalence of PMS was reported in Switzerland (10%), while the highest prevalence was in Iran (98%). (Direkvand-Moghadam et al. 2014) This was associated with increased costs of health care such as ambulatory visits up to \$59 per patient compared to PMS-free women. (Borenstein et al. 2005) Fewer females meet the more rigorous diagnostic criteria for PMDD; its prevalence ranged from 1.3% in USA (Gehlert et al. 2009) to 5.3% among German Young women. (Wittchen et al. 2002)

In Saudi Arabia, the prevalence rates of PMS among medical students were 78.5% (n.=135) at Al-Qassim University, with 5.9% of them (n.=8) had a severe form of PMS (Al-Batanony and Alnohair, 2014), 35.6% (n.=89) in Al-Ahsa, with 22.4% of them had severe PMS (Balaha et al. 2010) and 56.4% (n.=66) at Taibah University (Muhtaseb, 2015). In Riyadh, the prevalence of PMS among students from Princess Nourah Bint Abdul Rahman University was 47.08% (n.=129) with two-thirds of them from health college. (Bakhash et al. 2020) PMDD was reported in 36.5% of medical student at Umm Al-Qura University. (Alhajaji et al. 2016)

PMS is one of the most prevalent psychosomatic disorders which remarkably disrupts women's lives. Premenstrual disorders which involve changes and disruption in women's mood or emotional states is highly significant because mood states play an essential role in determining lifestyle. Most women experience discomfort before menstruation. Women with PMS choose not to go to work more than ever, sometimes they get injured and need to be hospitalized in a hospital, they experience mental discomfort, and they may even attempt to commit suicide. If they have to participate in an exam or job interview during these days, the score obtained by them will drop by 13% on average. (Karami et al. 2015)

The cause of premenstrual disorders has remained unknown, and the research results refer to multiplicity of its causes. Genetic factors, familial inheritance, the role of and changes in sex hormones, neurotransmitters (endorphins, GABA and serotonin), environmental factors, depression, migraine, lack of social and emotional support, advancing age, personality profile, level of stress, childhood sexual abuse and others can affect the development and intensity of the symptoms. (Halbreich, 2003; Braverman, 2007)

The treatment of menstruation related disorders focuses on relieving physical and psychiatric symptoms. Many of the medications used address the body's hormonal activity through suppression of ovulation, whereas others affect the concentration of neurotransmitters such as serotonin, norepinephrine, or dopamine in the brain. Other remedies such as herbal preparations and acupuncture were also used. Selective Serotonin Reuptake Inhibitors (SSRIs) are approved for primary treatment of premenstrual disorders. (Marjoribanks et al. 2013)

Aims and objectives

Despite the high prevalence of premenstrual disorders and their adverse effects on the personal and social life of women, research on PMS/PMDD in Saudi Arabia particularly the Northern zone is limited. This study aimed to minimize the problem of premenstrual disorders and mitigate its impacts on the University female students in order to enable them to enjoy a good quality of life and improve their academic performance. The specific objectives of the study were to estimate the prevalence of PMS and PMDD in female students at the Northern Border University in Arar City, Saudi Arabia, to identify determinants of premenstrual disorders among the University students, and to assess the impacts of PMS/PMDD on educational activities, social relations and QOL of the University female students.

MATERIALS AND METHODS

This cross-sectional study was conducted on female students at the Northern Border University, Arar City, Saudi Arabia, over the period between September and December 2019.

Study population

The target population comprised a sample of female students at the Northern Border University in Arar City, who agreed to take part in the study. Students with irregular menses, psychiatric and thyroid disorders or used oestrogen and progesterone during the preceding six months were excluded from the study.

The minimal sample size for the study was calculated according to the following equation:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}$$

Where

$Z_{1-\alpha/2}$ is the standard normal variate at 5% type 1 error ($P < 0.05$); it is 1.96.

P = the expected proportion based on previous studies.

d = the absolute error (0.05)

The expected proportion of PMS was considered 47.08%. (Bakhash et al. 2020) Allowing for 10% non-response rate, the calculated sample size was 421 (383+ (383%).

Ethical considerations

This study was approved by the Local Committee of Bio Ethics (HAP-09-A-043) at the Northern Border University (no.=42/40/H). An informed ethical consent was obtained from all participants. This contains information on the topic of the study, objectives, methods, data required, confidentiality, and that participants can stop participating at any time, even after they have started with no penalty or loss of rights.

Tools of data collection

A self-administered structured questionnaire was used to collect data on personal data and socio-demographic characteristics (age, residence, faculty, marital status, parents' education and occupation, family income and family history of PMS/PMDD), habits of medical importance (coffee consumption, cigarette smoking, physical activity, and oral contraceptive use), menstrual data (age of menarche, length of menstrual cycle, duration of menstruation, amount of menstrual flow, regularity of the cycle, presence of dysmenorrhea, and the administration of treatments/remedies to relief), educational activities (concentration, motivation, individual and collaborative work performance, scores, absenteeism, and difficulties), and interpersonal relationships with friends and family, and social withdrawal.

Participants reported their weight and height, and their Body Mass Index (BMI) was calculated as follows:

$$\text{BMI} = \text{weight (kg)} / (\text{height in meter})^2$$

The Premenstrual Syndrome was evaluated using the American College of Obstetricians and Gynaecologists (ACOG) diagnostic criteria for PMS. (American College of Obstetricians and Gynecologists, 2014) Screening for Premenstrual Dysphoric Disorder was carried out using the criteria of the Diagnostic and Statistical Manual of Mental Disorders 5th edition. (American Psychiatric Association, 2013) The Quality of Life of involved students was assessed using the World Health Organization Quality of Life- BREF (WHOQOL-BREF). (World Health Organization, 2018)

Data management and analysis

The collected data were summarized as frequency and percentage for categorical data and mean \pm Standard Deviation (SD) and range for numerical data. The study participants were classified into three groups (PMS group, PMDD group and free group). Comparisons between the study groups were carried out using the Chi-square test (X^2) and the Fisher Exact Test (FET) to compare categorical data as appropriate. The Mann-Whitney test (MW) was used to compare two groups and the Kruskal Wallis test (KW) was used to compare more than two groups of numerical data followed by post-hoc tests using the Bonferroni method to detect differences in pairs.

All statistical tests were performed two-sided and statistical significance was accepted at $P < 0.05$. Statistical analyses were carried out using STATA/SE version 11.2 for Windows (STATA Corporation, College Station, Texas).

RESULTS

This study was conducted on 496 female students from the Northern Border University, Arar City. Their ages ranged between 17 and 37 with a mean 22 (± 2.6) years. Premenstrual symptoms were reported by 97.8% ($n = 485$). PMS was detected in 68.8% ($n = 341$) and PMDD was in 29% ($n = 144$).

Table 1 shows socio-demographic and lifestyle variations between students with PMS, PMDD and those without pre-menstrual symptoms. The proportion of students who were living with their families were higher among PMDD students (90.3%) compared to PMS students (79.8%) and those without premenstrual symptoms (81.8%). These differences were statistically significant at $P = 0.04$.

The proportions of students whose mothers were employed were 36.8%, 40.8% and 72.7% for PMDD students, PMS students and students without premenstrual symptoms, respectively. These were statistically significant ($P = 0.001$).

Positive family history for PMS/PMDD was higher in PMDD students compared to PMS students and students without premenstrual symptoms (54.9%, 30.5% and 0.0%, respectively; $P < 0.001$). Unlimited physical activity was more likely in students without premenstrual symptoms compared to those with PMS and PMDD (81.8%, 51.9% and 41.7%, respectively; $P = 0.01$).

There were significant differences in how

much students like their study ($P = 0.005$).

PMS and PMDD were more likely in students from medical students (students from Faculties of Medicine, Nursing, Applied Medical Sciences and Pharmacy), while all students who did not report premenstrual symptoms were from non-medical faculties (Faculties of Business Administration, Computer Sciences, Economics, Islamic Sciences, and Education & Literature and Technology) (Figure 1, Panel A; $P = 0.001$). PMDD was more frequent among students of the fourth-sixth study years compared to those of the first-third years (Figure 1, Panel B; $P < 0.001$).

Table 2 shows comparisons between PMS students, PMDD students and those without premenstrual symptoms. PMDD students were more likely to report dysmenorrhea than PMS students and students without premenstrual symptoms (87.5%, 68% and 54.6, respectively; $P < 0.001$). The number of years with premenstrual symptoms was higher among PMDD students compared to PMS students (5.9 ± 3.4 vs. 4 ± 3.4 ; $P < 0.001$). There were significant differences between the different groups regarding the duration of menstruation ($P = 0.02$) and the amount of menstrual flow ($P = 0.001$).

PMDD students were more likely to suffer from lack of concentration ($P < 0.001$), lack of motivation ($P < 0.001$), poor individual and collaborative work performance ($P < 0.001$), low educational scores ($P = 0.01$), absenteeism and difficulty in working and educational activities ($P < 0.001$) than PMS students and those without premenstrual symptoms (Table 3). Poor interpersonal relationships with friends, family and social withdrawal were more frequent in PMDD students compared to PMS students and students without premenstrual symptoms ($P = 0.003$, $P < 0.001$ and $P < 0.001$, respectively).

There were significant differences between the different groups in how they rate their quality of life ($P = 0.02$) with the highest proportion of students who reported poor/very poor quality of life in PMS students (61.0%) followed by PMDD students (52.8%) and the least proportion in students without premenstrual symptoms (18.2%).

PMDD students had the highest proportion of students who were dissatisfied/ very dissatisfied with their health than PMS students and students without premenstrual symptoms (20.1%, 12.6% and 9.1%, respectively; $P = 0.03$).

Table 1 : Socio-demographic and lifestyle characteristics of the study groups

Characteristic		None (no.=11)		PMS (no.=341)		PMDD (no.=144)		Total (no.=496)		Test	P
		No.	%	No.	%	No.	%	No.	%		
Age (years)	Mean ±SD; (range)	23.27±3.35; (21-33)		22.1±2.7; (17-37)		21.71±2.05; (18-30)		21.98±2.57; (17-37)		KW=2.81	0.24
Residence	Rural	0	0.0	15	4.4	1	0.7	16	3.2	FET	0.10
	Urban	11	100.0	326	95.6	143	99.3	480	96.8		
How do you like your study?	Like it very much	0	0.0	84	24.6	27	18.7	111	22.4	FET	0.005
	Like it	8	72.7	178	52.2	99	68.7	285	57.5		
	Hate it	3	27.3	77	22.6	17	11.8	97	19.6		
	Indifference	0	0.0	2	0.6	1	0.7	3	0.6		
Whom do you live with?	Family	9	81.8	272	79.8	130	90.3	411	82.9	FET	0.04
	Dormitory	2	18.2	60	17.6	11	7.6	73	14.7		
	Others	0	0.0	9	2.6	3	2.1	12	2.4		
Marital status	Single	9	81.8	280	82.11	123	85.4	412	83.1	FET	0.74
	Married	2	18.2	51	15.0	16	11.1	69	13.9		
	Divorced	0	0.0	10	2.9	5	3.5	15	3.0		
BMI (kg/m ²)	Mean ±SD; (range)	27.5±14.6; (17.8-69.1)		23.3±4.8; (13.6-64.1)		23.2±5.0; (13.1-61.3)		23.4±5.3; (13.1-69.1)		KW=0.11	0.95
Father Educational level	Illiterate	0	0.0	18	5.3	9	6.2	27	5.4	FET	0.27
	Low	1	9.1	58	17.0	21	14.6	80	16.1		
	Middle	1	9.1	129	37.8	57	39.6	187	37.7		
	High	9	81.8	136	39.9	57	39.6	202	40.7		
Mother Educational level	Illiterate	2	18.2	37	10.8	14	9.7	53	10.7	FET	0.17
	Low	0	0.0	58	17.0	18	12.5	76	15.3		
	Middle	1	9.1	113	33.1	49	34.0	163	32.9		
	High	8	72.7	133	39.0	63	43.7	204	41.1		
Father occupation	Unstable job	1	9.1	23	6.7	5	3.5	29	5.8	FET	0.12
	Employed	10	90.9	216	63.3	91	63.2	317	63.9		
	Professional	0	0.0	20	5.9	3	2.1	23	4.6		
	Worker	0	0.0	13	3.8	5	3.5	18	3.6		
	No job	0	0.0	69	20.2	40	27.8	109	22.0		
Mother occupation	Unstable job	1	9.1	28	8.2	4	2.8	33	6.6	FET	0.001
	Employed	8	72.7	139	40.8	53	36.8	200	40.3		
	Professional	0	0.0	10	2.9	0	0.0	10	2.0		
	Worker	1	9.1	7	2.1	1	0.7	9	1.8		
	No job	1	9.1	157	46.0	86	59.7	244	49.2		
Family income ^a	Unsatisfactory	2	18.2	55	16.2	19	13.2	76	15.3	FET	0.83
	Satisfactory	5	45.4	181	53.1	75	52.1	261	52.6		
	More than satisfactory	4	36.4	105	30.8	50	34.7	159	32.1		
Family history of PMS/PMDD	Yes	0	0.0	104	30.5	79	54.9	183	36.9	FET	<0.001
	No	1	9.1	111	32.6	15	10.4	127	25.6		
	Do not know	10	90.9	126	36.9	50	34.7	186	37.5		
Coffee consumption	Yes	6	54.6	263	77.1	103	71.5	372	75.0	FET	0.12
	No	5	45.4	78	22.9	41	28.5	124	25.0		
Number of cups /days	Mean ±SD; (range)	1.7±0.5; (1-2)		2.3±1.1; (1-7)		2.2±1.1; (1-5)		2.3±1.1; (1-7)		KW=3.72	0.15
Cigarette smoking	Yes	0	0.0	37	10.8	8	5.6	45	9.1	FET	0.14
	No	11	100.0	304	89.1	136	94.4	451	90.9		
Physical activity ^b	Limited	2	18.2	164	48.1	84	58.3	250	50.4	X ² =8.92	0.01
	Unlimited	9	81.8	177	51.9	60	41.7	246	49.6		
Oral contraceptive use	Yes	2	18.2	46	13.5	11	7.64	59	11.9	FET	0.11
	No	9	81.82	295	86.51	133	92.36	437	88.1		

PMS: Premenstrual Syndrome; PMDD: Premenstrual Dysphoric Disorder; BMI: Body Mass Index; KW: Kruskal Wallis test; X²: Chi-square test; FET: Fisher Exact Test; ^a unsatisfactory family income ≤6000SR, satisfactory: or normal daily requirements and emergency, more than satisfactory: allow saving and investment; ^b limited physical activity: <3 times/week, unlimited: ≥ 3 times/week.

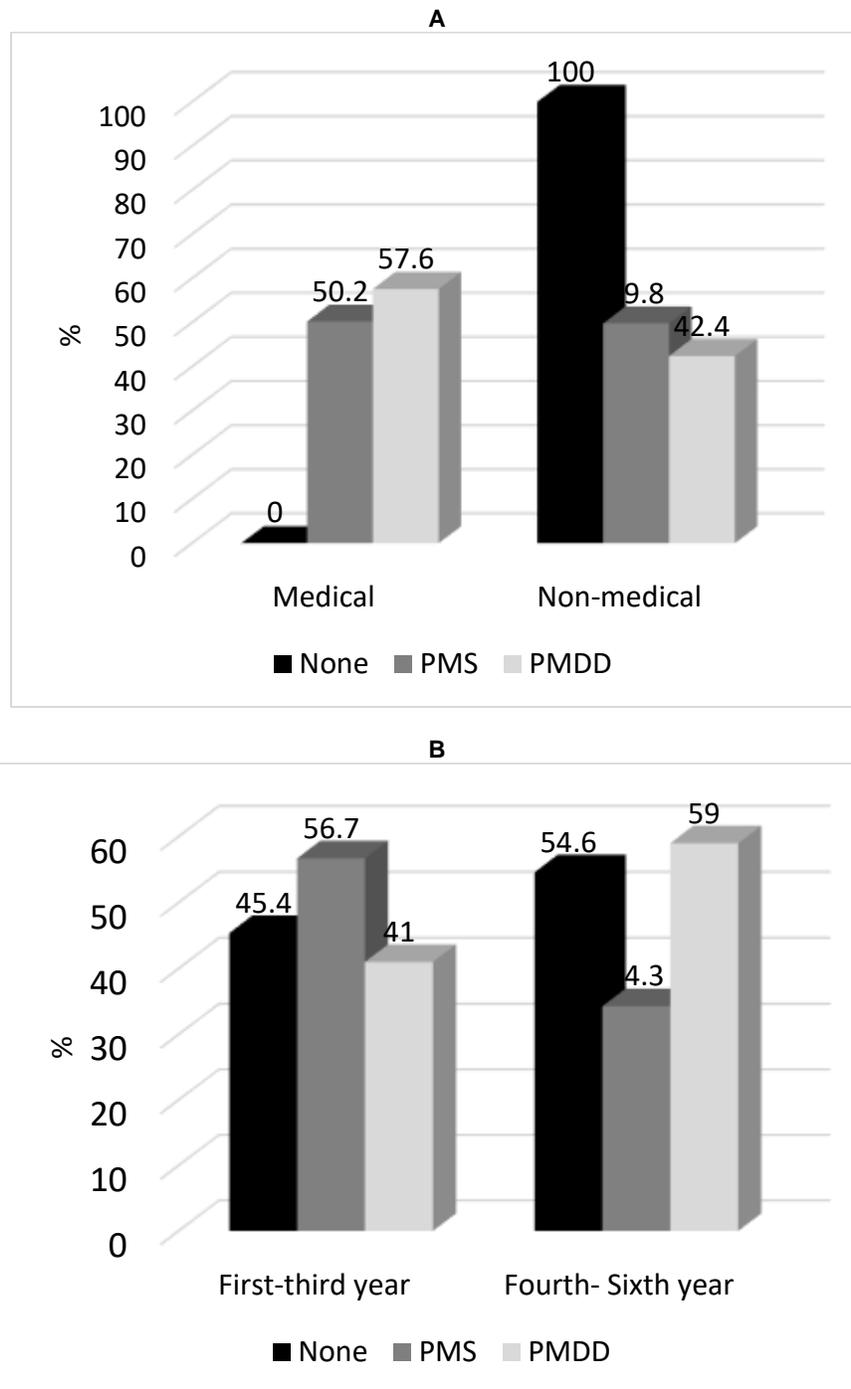


Figure 1: Frequency distribution of Premenstrual Syndrome (PMS) and Premenstrual Dysphoric Disorder (PMDD) in students from medical and non-medical faculties (Panel A; P=0.001 using the Chi-square test) and in the different study years (Panel B; P<0.001 using the Fisher Exact Test).

Medical Faculties: Faculties of Medicine, Nursing, Applied Medical Sciences and Pharmacy
 Non-Medical Faculties: Faculties of Business Administration, Computer Sciences, Economics, Islamic Sciences, and Education & Literature and Technology

Table 2 : Menstrual data of the study groups

Characteristic		None (no.=11)		PMS (no.=341)		PMDD (no.=144)		Total (no.=496)		Test	P
		No.	%	No.	%	No.	%	No.	%		
Age of menarche (years)	≤12	8	72.7	151	44.3	61	42.4	220	44.3	X ² = 3.82	0.15
	>12	3	27.3	190	55.7	83	57.6	276	55.6		
Length of cycle (days)	<21	8	72.7	196	57.5	81	56.2	285	57.5	FET	0.57
	21-35	3	27.3	124	36.4	49	34.0	176	35.5		
	>35	0	0.0	21	6.2	14	9.7	35	7.1		
Duration of menstrual bleeding (days)	<3	2	18.2	39	11.4	7	4.9	48	9.7	FET	0.02
	3-7	4	36.4	230	67.4	103	71.5	337	67.9		
	>7	5	45.4	72	21.1	34	23.6	111	22.38		
Menstrual flow	Minimal	3	27.3	62	18.2	8	5.6	73	14.7	FET	0.001
	Moderate	6	54.6	235	68.9	119	82.6	360	72.6		
	Heavy	2	18.2	44	12.9	17	11.8	63	12.7		
Regularity of menstruation	Regular	8	72.7	209	61.3	89	61.81	306	61.69	FET	0.80
	Irregular	3	27.3	132	38.7	55	38.2	190	38.3		
Presence of dysmenorrhea	Yes	6	54.6	232	68.0	126	87.5	364	73.4	FET	<0.001
	No	5	45.4	109	32.0	18	12.5	132	26.6		
Number of years with premenstrual symptoms	Mean ±SD; (range)			4.0±3.4; (0.4-18)		5.9±3.4; (0.3-16)		4.6±3.5; (0.3-18)		MW= 5.96	<0.001
Do you take treatment/ remedies to relief premenstrual symptoms?	Yes	-	-	187	54.8	88	61.1	275	56.7	X ² = 1.62	0.20
	No	-	-	154	45.2	56	38.9	210	43.3		
How often do you take treatment/ remedies?	Every cycle	-	-	76	22.3	41	28.5	117	24.1	X ² = 2.28	0.32
	Occasional	-	-	158	46.3	59	41.0	217	44.7		
	Do not take	-	-	107	31.4	44	30.6	151	31.1		

PMS: Premenstrual Syndrome; PMDD: Premenstrual Dysphoric Disorder; MW: Mann-Whitney test; X²: Chi-square test; FET: Fisher Exact Test.

Table 3 :Effects of Premenstrual Syndrome (PMS) and Premenstrual Dysphoric Disorder (PMDD) on education activities, interpersonal relations and Quality Of Life of the study population

Effects		None (no.=11)		PMS (no.=341)		PMDD (no.=144)		Total (no.=496)		P
		No.	%	No.	%	No.	%	No.	%	
Educational activities	Lack of concentration	0	0.0	98	28.7	85	59.0	183	36.9	<0.001
	Lack of motivation	0	0.0	60	17.6	53	36.8	113	22.8	<0.001
	Poor individual work performance	0	0.0	55	16.1	69	47.9	124	25.0	<0.001
	Poor collaborative work performance	2	18.2	31	9.2	47	32.6	80	16.1	<0.001
	Low scores	1	9.1	37	10.8	33	22.9	71	14.3	0.01
	Absenteeism (missed class or examination)	0	0.0	66	19.3	54	37.5	120	24.2	<0.001
Interpersonal relationship	Difficulty in working and activities	2	18.2	88	25.8	86	59.7	176	35.5	<0.001
	Poor relationships with friends	1	9.1	82	24.1	57	39.6	140	28.2	0.003
	Poor relationships with family	1	9.1	105	30.8	74	51.4	180	36.3	<0.001
How would you rate your quality of life?	Social withdrawal	0	0.0	155	45.4	100	69.4	255	51.4	<0.001
	Poor/very poor	2	18.2	208	61.0	76	52.8	286	57.7	0.02
	Neither poor nor good	5	45.4	81	23.7	42	29.2	128	25.8	
Good/very good	4	36.4	52	15.2	26	18.1	82	16.5		
How satisfied are you with your health?	Dissatisfied/very dissatisfied	1	9.1	43	12.6	29	20.1	73	14.7	0.03
	Neither satisfied nor dissatisfied	6	54.6	117	34.3	58	40.3	181	36.5	
	Satisfied/very satisfied	4	36.4	181	53.1	57	39.6	242	48.8	

PMS: Premenstrual Syndrome; PMDD: Premenstrual Dysphoric Disorder
Comparisons were carried out using the Fisher Exact Test

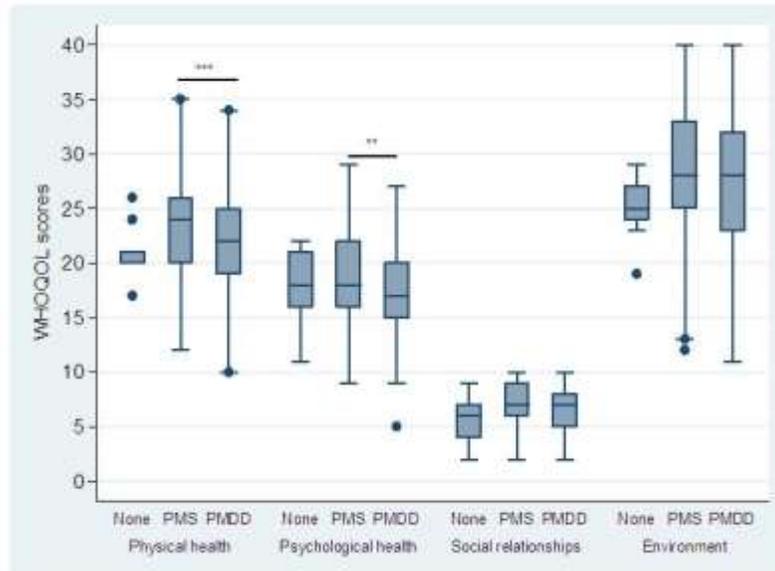


Figure 2 : Relationships between Premenstrual Syndrome (PMS) and Premenstrual Dysphoric Disorder (PMDD) and the WHO Quality Of Life (WHOQOL) domains

Comparisons were carried out using the Kruskal Wallis test and post-hock testing using the Bonferroni method, where *** $P < 0.001$; ** $P < 0.01$.

Figure 2 shows differences in the QOL domains scores between students with PMS, PMDD and those without premenstrual symptoms. There were significant differences between them in physical health ($P < 0.001$) and psychological health ($P = 0.006$). PMDD students had lower scores compared to PMS students for physical health (21.8 ± 4.7 vs. 23.4 ± 4.4) and psychological health (17.6 ± 4 vs. 18.9 ± 4.1). Similarly, PMDD students had lower scores for social relationships and environment, however, these differences were non-significant.

DISCUSSION

Premenstrual symptoms constitute a common complain of University female students, which can interfere with their academic performance, social relationships and impair their quality of life. This study was carried out to investigate the extent and impacts of premenstrual syndromes among University students from the Northern Border University in Arar City, KSA.

The results of the current study revealed that 68.8% of participants had PMS and 29% had PMDD. The prevalence of premenstrual syndromes among Saudi females has been recorded among University medical students and varied in the different studies according to the diagnostic tool used and the characteristics of participants. A high prevalence rate of 96.6% was reported by a cross-sectional survey of 464

female medical students from Dammam, KSA, with 37.5% having severe symptoms. (Rasheed and Al-Sowielem, 2003) PMS was detected in 78.5% of 172 medical students at Al-Qassim University, KSA. Of these, 45.2%, 48.9% and 5.9% had mild, moderate and severe symptoms, respectively. (Al-Batanony and Alnohair, 2014) The investigation of 117 junior female medical students at Taibah University was carried out to determine the prevalence and severity of premenstrual symptoms and revealed that 56.4% had PMS. Of these, borderline, mild, moderate, severe and disabling symptoms were identified in 28.8%, 25.8%, 22.7%, 16.6% and 6.1%, respectively. (Muhtaseb, 2015) The prevalence rate of PMS was 47.08% of 274 females >18 years of age from Riyadh as identified by a premenstrual symptoms screening tool (PSST). (Bakhash et al. 2020) Premenstrual symptoms were reported by 46.7% of 738 medical students from Imam Abdulrehman Bin Faisal University, Dammam. (Rafique and Alsheikh, 2018) PMS was diagnosed in 37% of 400 female students at governmental secondary schools in Jeddah. (Salem et al. 2020) The prevalence of PMDD in 183 medical students in Umm Al-Qura University was estimated as 36.6%. (Alhajaji et al. 2016)

The results showed that PMS/PMDD were more likely in senior students from medical faculties. This might be due to the high level of stress associated with medical education, which

increased the susceptibility to PMSs. In addition, medical students are more aware of premenstrual symptoms and their impacts, thus they were more likely to report premenstrual symptoms more than non-medical students. In line with these results, PMS was more likely in third year secondary schools students than in first and second year students ($P < 0.001$). (Salem et al. 2020) this can be due to the stress of the study among medical students and in the last year of secondary school which is considered the bottle neck for the future career. In addition PMS/PMDD are more likely in elder menstruating females as was supported by the higher frequency of PMS in females of 20-30 years age (55.8%) followed by those <20 years age (39.5%). (Bakhash et al. 2020) Globally, PMDD is commonly encountered in late twenties to mid-thirties. (MGH center for women's mental health reproductive psychiatry resource and information center, 2018)

A significant positive correlation between BMI and PMS severity ($r = 0.368$ & $P < 0.001$) was reported among Egyptian University students. (ElBanna et al. 2019) The relationship between BMI and PMS was suggested to be due to the effect of adipose tissues on oestrogen metabolism leading to more free-oestradiol levels. High oestradiol level can cause PMS manifestations such as stress, anxiety, depression, poor sleep and inactivity and more weight gain. In addition, oestrogen increases salt and water retention, which contributes to weight gain. (Rad et al. 2018) However, in our study, there were no significant difference in BMI between students with PMS/PMDD those without. Moreover, PMS students had significantly lower BMI compared to non-PMS students among secondary schools' students ($P = 0.03$) (Salem et al. 2020) and University students ($P = 0.001$) (Mohebbi et al. 2017). Similarly PMS was unlikely in overweight/obese students ($P = 0.007$) (Sahin et al. 2014). The reduced BMI in PMS young females can be due to anxiety and stress as well as their craving for ideal body shape.

Cigarette smoking was more frequent among PMS secondary schools students ($P < 0.001$). (Salem et al. 2020) Similarly, PMS was more likely in smoker students ($P = 0.005$) (Sahin et al. 2014). However, there were no significant differences between PMS/PMDD students and free students as regards smoking in the present study. This can be due to the conservative nature of Saudi society, where only few females smoke.

In the present study, the vast majority of PMDD students were living with their families,

which was statistically significantly higher than PMS students and those without premenstrual symptoms. This can be due the anxiety, depression and social withdrawal symptoms in PMDD students. However, there was no significant differences between PMS and PMS-free students in Turkey as regards the place where they stay. (Sahin et al. 2014)

In this study, students with PMS/PMDD were more likely to have unemployed mothers compared to students without premenstrual symptoms. This can be explained by the lower socio-economic standard in families with unemployed mothers. PMDD was associated with low socioeconomic status (de Carvalho et al. 2018). However there were no significant differences between PMS and PMS-free students regarding the educational level and employment status of their parents. (Sahin et al. 2014)

Our results showed that students with PMS/PMDD were more likely to have positive family history for PMS/PMDD. Similarly, positive family history of PMS was associated with increased risk of PMS in medical students (Odds Ratio; 95% Confidence Interval: 1.39; 1.17-3.85). (Al-Batanony and Alnohair, 2014) Alongside, severe premenstrual symptoms were more likely in women whose mothers had positive history of PMS. (Rasheed and Al-Sowielem, 2003) Similarly, in Turkey, PMS was more likely in students with positive family history of premenstrual symptoms (Sahin et al. 2014).

The current study found that PMS/PMDD was associated with limited physical activity, while unlimited physical activity was more frequent in students without premenstrual symptoms. Physical exercise has a moderating and relaxing effects that can protect against PMS. Thus, inactive females were more at risk of PMS. However, physically active women were more likely to have severe premenstrual symptoms than sedentary women (45.3% vs. 30.6%; $P < 0.01$). (Rasheed and Al-Sowielem, 2003). Moreover, regular exercise was associated with increased risk of PMS in Turkey (Odds Ration; 95% Confidence Interval: 1.71; 1.28-2.29; $P < 0.001$) (Sahin et al. 2014). This was explained by inadequate physical activity to reach a protective level. In addition, the cross-sectional nature of the study cannot distinguish between whether sedentary life leads to PMS or PMS cause physical inactivity.

It was found that coffee consumption was associated with severe premenstrual symptoms. (Rasheed and Al-Sowielem, 2003) However, in

the present study coffee consumption was more frequently reported by students with PMS and PMDD than students without premenstrual symptoms, but this difference was not statistically different.

The results of the present study showed higher prevalence of dysmenorrhea in students with PMDD and PMS than premenstrual symptoms-free students (87.5%, 68% and 54.6, respectively; $P < 0.001$). The majority of students with PMS/PMDD reported moderate or heavy menstrual flow and >3 days menstrual bleeding.

In agreement with these results, dysmenorrhea and the duration of menstruation were associated with increased risk of PMS (Odds Ratio; 95% Confidence Interval: 2.92; 1.18-7.21 and 1.69; 1.49-4.96, respectively). (Al-Batanony and Alnohair, 2014) Similarly, PMS was more likely in students with heavy menstruation ($P < 0.001$) and menstrual pain ($P < 0.001$). (Salem et al. 2020) Correspondingly, PMS was significantly more frequent in students who had dysmenorrhea ($P < 0.001$) (Sahin et al. 2014).

A comparative study among Egyptian University students revealed that a greater proportion of students with PMS reported that they had menarche under 12 years of age. (Elgzar and Hamdi, 2017) Again, PMS was more likely among Saudi students who had menarche at <12 years of age ($P = 0.001$). (Salem et al. 2020) However, in this study, there were no significant difference in the age of menarche between students with PMS/PMDD and those without.

The results of this study revealed higher prevalence of educational difficulties such as lack of concentration, lack of motivation, poor work performance, low educational scores, absenteeism and difficulty in working and educational activities in PMDD students and PMS students compared to those without premenstrual symptoms. Similarly, poor interpersonal relationships with friends, family and social withdrawal were more frequent in PMDD students and PMS students than students without premenstrual symptoms. Correspondingly, PMS females reported that their symptoms interfered with home responsibility (5.8%), relationships with families (5.2%), social life activities (4.2%), work efficacy (2.4%), and relationships with colleagues (2.2%). In addition, PMS was associated with absence from lecture or work and impaired academic achievements in 1.8% and 1.6% of PMS females, respectively. (Bakhash et al. 2020) Similarly, students with significant PMS were more likely to report fair/poor attention during

study, ability to work during practical training and total perceived academic achievement. In addition, 86.7% reported that their absenteeism days were modestly/severely affected because of PMS. (Elgzar and Hamdi, 2017)

This study showed that students with PMS/PMDD were more likely to rate their quality of life as poor/very poor and to be dissatisfied/very dissatisfied with their health compared to those without premenstrual symptoms. Students with PMDD were more likely to have lower scores of QOL domains compared to those with PMS. However, these differences were statistically significant for physical health domain ($P < 0.01$) and psychological health domain ($P = 0.001$).

Along with this, medical students with PMS had lower Short Form 36 (SF-36) subscales scores compared to PMS-free students and these differences were statistically significant except for the physical functioning subscale. Moreover, these scores became more lower in students with severe symptoms compared to those with mild or moderate symptoms particularly for role limitation due to physical problems, bodily pain, general mental health and vitality. (Al-Batanony and Alnohair, 2014). In Turkey, all subscales of SF-36 score were highly significantly lower in PMS students than PMS-free students ($P < 0.001$) (Sahin et al. 2014). Similarly, students with Clinically Significant PMS (CSPMS) were more likely to had fair/poor domains of Health-Related Quality of Life (HRQOL) except for bodily pain. Moreover, 86% and 12% of students with CSPMS were more likely to have fair and poor total HRQOL scores, respectively. Meanwhile, 49.3% and 50.7% of CSPMS-free students had good and fair quality of life respectively. (Elgzar and Hamdi, 2017)

In this study, 61.1% and 54.8% of students with PMDD and PMS, respectively reported taking treatment/remedies to relief premenstrual symptoms. Moreover, 71% ($n = 55$) of PMS females received medications for relieving PMS pain. (Bakhash et al. 2020)

This study is the first to investigate the problem of premenstrual symptoms and address their impacts on University students in the northern region of the Kingdom.

The main limitations of the study were due to the cross-sectional design which is unable to verify causal relation. In addition, assessment of premenstrual symptoms was based on a single time evaluation instead of a diary of symptoms to be completed by students during the luteal phase, which may inflate the results. The study

participants comprised a convenient sample, which can compromise the validity of the results.

CONCLUSION

Premenstrual syndromes are common health problems in University students. PMSs were associated with positive family history of premenstrual symptoms, limited physical activity, dysmenorrhea and medical colleges. PMSs interfered with academic performance, social relationships and satisfactory quality of life of University students.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to this work.

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