ORIGINAL ARTICLE

Effect of dysmenorrhea on the academic performance among students studying in Princess Nourah Bint Abdulrahman University, Riyadh

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ABSTRACT

Background: Primary dysmenorrhea (PD) is a common problem in young women. It affects several aspects of their daily activities, and the academic performance is no exception. The present study was done to assess the effect of PD on students' academic performance at the largest university dedicated to women's education in the world

Methodology: A cross-sectional study was conducted, including female students from different colleges at Princess Nourah Bint Abdulrahman University, Riyadh. A structured, self-administered questionnaire was used to collect participants' data regarding sociodemographic and menstrual characteristics, pain characteristics, and the effects of pain on academic performance parameters. Menstrual pain was assessed using A Visual Analogue Scale.

Results: In a total of 500 students [median (interquartile range) age: 21 (19-22)] years, (52.4% studied at health colleges), the prevalence of PD was 92% (57.6% had moderate-to-severe pain). PD was a significant predictor of reduced physical activity [adjusted odds ratio (AOR) = 8.48, p = 0.0001], low concentration, submitting incomplete homework (AOR = 5.67, p = 0.0001), reduced concentration (AOR = 3.68, p = 0.001), and falling asleep during lectures (AOR = 2.73, p = 0.02). Considering mild PD as a reference, all indicators of poor academic performance were predicted by moderate/severe pain, including absenteeism, reduced concentration, reduced physical activity, submitting incomplete homework, impaired relationships with friends, getting low exam grades, and falling asleep during lectures.

Conclusion: The detrimental effects of PD on academic performance among university students highlight the need to increase the students' awareness regarding menstrual pain and improve their perceptions about treatment approaches to mitigate the educational process's negative impact.

Keywords: Dysmenorrhea, prevalence, outcome and visual analogue scale, absenteeism, school performance.

Introduction

Pain is an unpleasant experience occurring in the context of actual or potential tissue damage, and it is frequently a significant source of morbidity and disability with substantial costs to healthcare settings [1]. In women, most females experience variant degrees of cyclic pain and distress [2]. Primary dysmenorrhea (PD), defined as painful cramps immediately before or during menstruation in women with normal pelvic anatomy, is predominantly associated with excessive uterine prostaglandins production and a consequent increase in the uterine tone [3]. On the other hand, menstrual pain with concomitant pelvic pathology is referred to as

secondary dysmenorrhea. Symptomatic women usually experience fatigue, dizziness, backache, headache, sweating, nausea, vomiting, and diarrhoea. In essence,

DISCOVER

PD occurs only in ovulatory cycles, and it is commonly observed within 6 to 12 months after menarche. It has been estimated that up to 80% of women would have cyclic pain of PD at some point in their life [4]. PD is variably prevalent among university students, ranging from 41.7% to 89.1% in different regions worldwide, and the resultant pain was rated as "severe" in 5%-20% of girls [3]. In Saudi Arabia, cross-sectional studies revealed a high prevalence of PD, 85.7%, and most university students have been reluctant to seek medical treatment [5]. Importantly, PD has significantly impaired multiple domains of the students' quality of lives, including role limitation due to emotional health and physical health, pain, and health changes [6]. Although PD is not a life-threatening condition, it may impact the daily activities and the affected women's work productivity. Indeed, the variation of PD's physiological and pathological etiologies may be associated with unfavourable psychological consequences, such as anxiety, fear, confusion, shame, anger, and depression [2]. Moreover, PD has been identified as a leading cause of work or school absenteeism in women of the reproductive age [5]. Additionally, considering the most commonly affected age group, PD may influence university students' academic performance. Identifying and investigating the modifiable factors that affect academic performance would help tailor specific programs to raise students' awareness and start relevant managemental plans accordingly. However, studies carried out in Saudi Arabia have primarily focused on the epidemiological aspects rather than the effects of PD on academic performance [6]. Such a topic is particularly relevant in the largest university dedicated to female education globally, namely Princess Nourah Bint Abdulrahman University (PNU) in Riyadh. In this context, we sought to explore the impact of PD on the students' academic performance at PNU.

Subjects and Methods

A descriptive, cross-sectional, survey-based study was conducted at PNU, Riyadh, Saudi Arabia between December 2017 and April 2018. PNU is a comprehensive university for women, which contains 18 colleges and institutes and approximately 39,000 students in undergraduate and postgraduate programs. In addition to the colleges of health sciences, there are colleges for sciences, humanities, and the community. The study was approved by the Institutional Review Board (IRB) of the PNU, and all the procedures were carried out in compliance with the norms of the research ethics. Informed consent was obtained from each participant before completing the questionnaire, and the collected data were kept confidential and used for research purposes exclusively. The participants were female undergraduate students studying at PNU who had experienced dysmenorrhea without an underlying pathology (PD). Students with secondary dysmenorrhea and those who have provided questionnaires with incomplete responses were excluded. Students were recruited using a convenient sampling technique. The sample size was calculated using the G*Power program. Considering a level of confidence of 95% and a power of 80%, the minimum required sample size was 500 students. A self-administered, structured questionnaire was adapted from previous studies that validated questionnaires [7-9]. The survey consisted of five domains (42 items): 1) sociodemographic characteristics, including age, college, and marital status; 2) characteristics of menstrual cycles, including the duration and regularity of menstrual cycles, age at menarche, the flow of the menstruation (pads per day), and having menstrual pain; 3) characteristics of pain in students with PD, including the intensity of pain, the duration of pain (days), the site of pain, other associated symptoms, the changes in the pain in married participants; 4) the impact of PD on the academic performance, including missing classes (absenteeism), loss of concentration during lectures, adverse effects on exam grades, falling asleep during studies, inability to complete the homework, and reduced physical activity; and 5) self-care strategies to alleviate pain, including the use of hot showers, analgesics, massage, herbal remedies, etc. A Visual Analogue Scale (VAS) was used to assess menstrual pain intensity, which ranged from 0 (no pain) to 10 (very severe pain). The pain was further categorized as mild (1-3), moderate (4-6), and severe (7-10). The questionnaire's validity was initially tested on 20 students (a pilot stud) recruited from the student service centres at PNU (A4 station, A10 station, and the students' house). Gynaecology experts performed the content validity at King Abdullah Bin Abdulaziz University Hospital, PNU, and the internal consistency of the questionnaire was further confirmed by Cronbach's α ($\alpha = 0.798$ for all items). The Statistical Package for Social Sciences version 26.0 for Windows was utilized to perform the statistical analysis (SPSS Inc., Chicago, IL). Frequencies and percentages were used to present categorical variables. Tests of normality were performed to assess pain scores' distribution, revealing p values of <0.0001 for both the Kolmogorov-Smirnov and Shapiro-Wilk tests. Consequently, pain scores were presented as medians and interquartile ranges (IQRs). The significant factors and predictors of poor academic performance were analyzed by univariate and multivariate logistic regression analyses, respectively using the enter method. Participants' responses "often" and "always" indicated a poor academic performance "yes"; otherwise, the responses were labelled "no". Such binomial responses were then entered in the regression models as dependent variables. The existence of menstrual pain (yes versus no) and pain severity (moderate/severe versus mild) were regarded as the independent variable (univariate) in addition to sociodemographic and menstrual characteristics (multivariate). Results were expressed as odds ratios (ORs) and 95% confidence intervals (95% CIs). A p-value of < 0.5 indicated statistical significance.

Results

Sociodemographic and menstruation characteristics

The valid responses of 500 students were analyzed. The mean age (IQR) of the participants was 21 (19-22) years (55.6% aged more than 20 years), and more than half of them (52.4%) have been studying at the colleges of health sciences. The majority of the respondents aged 12-15 years at menarche (86.8%), had regular menstrual periods (70.4%) and had no history of gynaecological diseases (79.6% Table 1).

Characteristics of PD

In general, 460 participants (92%) declared that they had experienced menstrual pain. Of these, mild, moderate, and severe pain was reported in 42.4%, 18.7%, and 38.9% of the participants, respectively. The median (IQR) score of menstrual pain was 5.0 (3.0-8.0). More than half of the respondents with PD reported that the pain had occurred before the beginning of the menstrual flow (59.8%), the pain lasted for 1-2 days (57.6%), and it did not disappear with the beginning of the menstrual flow (62.8%). The most frequently reported site of pain included the lower abdomen/the back (79.6%), and it was commonly associated with fatigue and weakness (63.7%) and nausea (34.8%). Focusing on married participants ($n = 37$), the severity of pain had not changed in 43.2% and 56.8% of respondents after marriage and birth, respectively (Table 2).

The impact of dysmenorrhea on academic performance

As demonstrated in (Table 3), PD was a significant predictor of reduced physical activity at the university [adjusted odds ratio (AOR) = 8.48, 95%: 3.63-19.80, $p = 0.0001$), submitting incomplete homework (AOR = 5.67, 95%: 2.17-14.82, $p = 0.0001$), reduced concentration (AOR = 3.68, 95%: 1.65-8.23, $p = 0.001$), and falling asleep during lectures (AOR = 2.73, 95%: 1.18-6.36, $p = 0.02$). Regarding pain intensity, considering mild pain as a reference, moderate/severe pain was an independent predictor of all domains of poor academic performance ($p = 0.0001$ for all), including absenteeism (AOR = 5.72, 95%: 3.1-10.6), reduced concentration (AOR = 4.6, 95%: 3.1-7.0), decreased physical activity (AOR = 3.9, 95%: 2.6-5.9), submitting incomplete homework (AOR = 3.68, 95%: 2.4-5.6), impaired relationships with friends and family members (AOR = 3.1, 95%: 2.3-4.6), getting low exam grades (AOR = 3.0, 95%: 1.8-4.9), and falling asleep during lectures (AOR = 2.5, 95%: 1.6-3.8, Table 4).

Table 1. Sociodemographic and menstrual characteristics of students at PNU (n=500).

Variable	Category	Frequency	Percentage
Age	≤ 20	222	44.4
	> 20	278	55.6
College	Health sciences	262	52.4
	Others	238	47.6
Marital state	Single	461	92.2
	Married	37	7.4
	Divorced/widow	2	0.4
Age of menarche	<12 years old	76	15.2
	12-15 years old	380	76
	16-19 years old	41	8.2
	>19 years old	3	0.6
Menstruation duration	<3 days	8	1.6
	3-7 days	434	86.8
	>7 days	58	11.6
Pad/day	≤ 3 pads	188	37.6
	4-6 pads	274	54.8
	> 6 pads	38	7.6
Menstrual regularity	Regular	352	70.4
	Irregular	148	29.6
Gynecological diseases	Yes	33	6.6
	No	398	79.6
	Don't know	69	13.8

Table 2. *Characteristics of dysmenorrhea in a subset of participants with menstrual pain (n = 460).*

Variable	Category	Frequency	Percentage
Onset of pain	Before the beginning of the menstrual flow	275	59.8
	After the beginning of the menstrual flow	181	39.3
	Unspecified	4	0.9
Pain disappears with the beginning of the menstrual flow	Yes	163	35.4
	No	289	62.8
	Unspecified	8	1.7
Duration of pain	<1 day	45	9.8
	1-2 days	265	57.6
	3-4 days	121	26.3
	> 4 days	26	5.7
	Unspecified	3	0.7
Pain description	Colicky pain	196	42.6
Region of pain[b]	Lower abdomen/back	366	79.6
	Thighs and feet	177	38.5
Other symptoms	Vomiting	67	14.6
	Nausea	160	34.8
	Fatigue and weakness	293	63.7
	Headache	126	27.4
Using contraceptives[a]	Yes	10	27.0
	No	22	59.5
	Unspecified	5	13.5
Pain had been changed after marriage[a]	Yes, decreased	7	18.9
	Yes, increased	9	24.3
	No change	16	43.2
	Unspecified	5	13.5
Pain had been changed after giving birth[a]	Yes, decreased	6	16.2
	No change	21	56.8
	Unspecified	10	27.0

[a]Data reported by married participants (*n* = 37).
[b]A multiple response variables; thus, the numbers do not total to 460.

Table 3. *Univariate and multivariate binary regression analysis of the effect of dysmenorrhea (versus no dysmenorrhea) on the variables of reduced academic performance.*

Variables	Dysmenorrhea, n (%)		Univariate			Multivariate		
	Yes (*n* = 460)	No (*n* = 40)	OR	95% CI	*p*	OR	95% CI	*p*
Absenteeism	97 (21.1)	6 (15.0)	1.51	0.62-3.71	0.364	NA	NA	NA
Reduced concentration	222 (48.3)	8 (20.0)	3.73	1.68-8.27	0.001	3.68	1.65-8.23	0.001
Falling asleep during lectures	170 (37.0)	7 (17.5)	2.76	1.20-6.38	0.017	2.73	1.18-6.36	0.02
Submitting incomplete homework	209 (45.4)	5 (12.5)	5.83	2.24-15.15	<0.0001	5.67	2.17-14.82	<0.0001
Reduced physical activity	294 (63.9)	7 (17.5)	8.35	3.61-19.29	<0.0001	8.48	3.63-19.80	<0.0001
Impaired relationships with friends and family members	191 (41.5)	11 (27.5)	1.87	0.91-3.84	0.087	NA	NA	NA

CI: confidence interval; NA: non-applicable; OR: odds ratio.

Self-care practices used by the participants

During the menses, more than half of the respondents have frequently or constantly avoided washing the hair or drying the washed hair (64.0%), avoided performing the intense exercise (62.2%) and applied hot water bags to the lower abdomen (53.0%). Conversely, the least frequently used strategies (rarely or not used) included

Table 4. Univariate and multivariate binary regression analysis of the effect of moderate/severe menstrual pain (versus mild pain) on the variables of reduced academic performance.

Variables	Pain intensity n (%)		Univariate			Multivariate		
	Mild (n = 195)	Moderate/severe (n = 265)	OR	95% CI	p	OR	95% CI	p
Absenteeism	14 (7.2)	83 (31.3)	5.90	3.23-10.77	<0.0001	5.72	3.08-10.60	<0.0001
Reduced concentration	54 (27.7)	168 (63.4)	4.52	3.03-6.75	<0.0001	4.62	3.05-7.00	<0.0001
Obtaining low exam grades	27 (13.8)	88 (33.2)	3.09	1.91-5.00	<0.0001	3.00	1.84-4.91	<0.0001
Falling asleep during lectures	51 (26.2)	119 (44.9)	2.30	1.54-3.44	<0.0001	2.49	1.64-3.79	<0.0001
Submitting incomplete homework	55 (28.2)	154 (58.1)	3.53	2.38-5.25	<0.0001	3.68	2.44-5.55	<0.0001
Reduced physical activity	90 (46.2)	204 (77)	3.90	2.61-5.83	<0.0001	3.91	2.57-5.93	<0.0001
Impaired relationships with friends and family members	51 (26.2)	140 (52.8)	3.16	2.12-4.72	<0.0001	3.07	2.03-4.64	<0.0001

taking analgesics (39.4%) followed by wearing loose clothes (37.4%) and hitting the site of pain during the menstruation (37.4%).

Discussion

The academic performance of college students is a strong determinant of educational attainment. Studying the significant correlations and predictors of academic success is inevitably beneficial for setting up future strategic plans to promote education. Recurrent pain during the menstruation may influence students' quality of life, which would be reflected in their performance at colleges. In the present study, 92% of female university students had PD. They were more likely to experience reduced concentration, sleepiness during lectures, failure to submit the homework, and reduced physical activities in their colleges. Additionally, more than half of the participants (57.6%) had moderate to severe menstrual pain on the VAS scale. They had higher odds of all parameters of poor academic performance than those with mild pain after adjustment for the confounding variables. The reported PD prevalence in the present study was higher than that of other studies in the literature. For example, the reported prevalence of PD among female students was 60.9% among medical students in Jeddah [10], 70.6% among the students of the college of health science in Abha 85.7% in Dammam [5], and 88% in Al-Jouf [11]. Similarly, dysmenorrhea was reported among 51.1% of college students in other Asian countries [12], 71.8% in Africa [13,14], and 89.2% in Europe [15,16]. Globally, the pooled prevalence was 71.1%, as demonstrated in a recent meta-analysis of 20,813 women from different countries [17]. The variation in PD prevalence across studies may be explained by several factors, such as the differences in sociocultural and ethnic characteristics, discrepancies in lifestyle factors, variation in the subjective perception of pain, and the lack of a universally accepted method of identifying PD. In our analysis, several parameters of academic performance were significantly influenced by menstrual pain. Dysmenorrhea and increased pain intensity were strong

predictors of reduced physical activity, which is in line with the adverse effects of PD on physical and sporting activities in other studies [18]. Pain impedes students to carry out such activities at the university, presenting evidence for promoting education about dysmenorrhea in this age group. PD was also significantly associated with reduced concentration, which was similarly reported in national [10] and international studies [19]. Headache, dizziness, and abdominal pain may all mediate the effects of PD on concentration.

There was no difference in absenteeism between students with and without PD; this was relatively surprising since PD has been frequently cited as a significant factor that influences the rate of class attendance [5,20]. However, our study showed that the risk of missing lectures was more significant in students with severe pain. This is similar to other studies which demonstrated that the severity of pain was predictive of absenteeism [5,21]. Intriguingly, pain during menstrual periods can also impact sleep and sleep quality, leading to sleepiness during daytime [22]. Changes in the reproductive hormones during the menstrual cycle may affect sleep and circadian rhythms [23]. This would impact the daily life and general health of young women, yielding significant defects in students' academic performance as demonstrated in our study. The education of female students is paramount, and their attendance is important for their positive health and academic achievement, which would be reflected in the students themselves and the next generation. Miller et al. [24] have recently found that a high women's educational level was a significant predictor of improved children's health and increased household wealth. On the other hand, missing classes regularly would likely lead to academic underachievement and inferior prospects.

Female students in the present study used unusual strategies to mitigate pain during the menstrual period regarding managemental practices. More than one-third of them have rarely used analgesics, indicating a defect in their healthcare-seeking behaviours. Several reasons may explain these findings, such as assuming that the pain and other associated symptoms occur on

a physiological basis, self-managemental preferences, the lack of awareness regarding treatment options, embarrassment, and perceptions about the absence of the efficacy of analgesics [25]. Indeed, seeking healthcare for pain relief is necessary to avoid the unwanted delay of therapeutic interventions, particularly in those with secondary pathological conditions, such as uterine fibroids, endometriosis, and pelvic inflammatory diseases [25].

Women should be encouraged to report their symptoms during the menstruation via targeted awareness programs and initiate discussions with adolescents and young women. Furthermore, decision-makers are advised to implement screening programs for the detection of dysmenorrhea. These programs may be particularly relevant at the colleges and universities dedicated to women's education, such as PNU. However, initiating a discussion and participating in awareness programs about menstruation may be hindered by cultural and religious beliefs in Saudi Arabia. Relatives, including the mother and the sister, and healthcare providers, are significant information sources about menstruation [26]. Additionally, about 20% of female students could get information from the internet [26]. Therefore, it is necessary to promote students' awareness via web-based intensified campaigns, especially for students in non-health colleges. The present study is not without limitations. Causal relationships between different variables might have been affected by the cross-sectional design and self-reported data, where the latter could have led to reporting bias. The characteristics and severity of menstrual pain were collected at one-time point; thus, the responses were subject to recall bias. Future studies should employ a prospective design to allow appropriate follow-up of the participants. Additionally, cultural and religious factors were not assessed in our study, limiting the generalizability of the outcomes to other areas of the world. Finally, there is a need to reach a consensus regarding the definition and intensity of menstrual pain levels on the VAS scale to obtain reliable results based on universal insights. In conclusion, dysmenorrhea is highly prevalent among female university students at PNU, and menstrual pain was a significant determinant of students' concentration and physical activity, sleepiness during lectures, and homework completion. Also, increased pain intensity was a significant predictor of all parameters of poor academic performance. Health education for adolescents and young women should be an integral part of educational curricula at institutions dedicated to women's education. Additionally, internet-based campaigns should be regularly carried out on a large scale. This would ultimately increase women's awareness regarding pain, promote their health-seeking behaviours if necessary, and improve their perceptions regarding the medical treatment of dysmenorrhea.

List of Abbreviations

IQR	Interquartile range
IRB	Institutional Review Board
OR	Odds ratio
PD	Primary dysmenorrhea
PNU	Princess Nourah Bint Abdulrahman University
VAS	Visual analogue scale

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

Consent for participation

Informed consent was obtained from all the participants.

Ethical approval

Ethical approval was granted by Institutional Review board via reference number H-01-R-059 dated December 11,2017.

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