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Comparison of the Severity of Primary Dysmenorrhea Between Athletic and Non-athletic Females: A Cross-sectional Study

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Abstract:

Purpose: This study was conducted to compare the severity of primary dysmenorrhea between athletic and non-athletic females.

Methods: A cross-sectional study was conducted on 628 athletic and non-athletic females complaining of primary dysmenorrhea; their ages ranged from 18 to 28 years old, their body mass index was below 30 kg/m^2, all were virgins, and they didn't take any medications for menstrual pain. They were divided into two groups. The athletic group consisted of 314 females selected from different clubs in Egypt. They were performing exercises for more than 3 days/week for at least 6 months. The non-athletic group of 314 females was selected from Benha and Cairo University students, they didn't participate in any type of sport. The outcome measures involved visual analogue scale (VAS) to evaluate pain intensity and WaLLID scale to assess the integrated features of dysmenorrhea once during the study. Analgesic requirements were also detected during the study.

Results: There was a statistically significant difference between both groups in the mean value of VAS and WaLIDD scale (p=0.001). The severity of dysmenorrhea and requirements of analgesics were higher in the non-athletic group.

Conclusion: Accordingly, it can be concluded that the severity of primary dysmenorrhea was lower in the athletic group, who also reported less use of analgesics.

Key words: Primary dysmenorrhea, Athletic females, Non-athletic females.

1.Introduction:

Primary dysmenorrhea, the medical term for menstrual cramps, represents a painful condition during menstruation. It typically begins within two years after menarche and occurs when no pelvic abnormalities or pathology are present (1). It is characterized by intense and irregular contractions of the uterine endometrial muscles, accompanied by an increase in baseline muscle tone. These painful uterine contractions often begin a few hours before menstrual onset and persist for a period ranging from 8 to 72 hours (2).

Females who experience primary dysmenorrhea commonly undergo recurring lower abdominal (suprapubic) pain, often described as cramping, colicky spasms, or pelvic discomfort. This pain may occur with or without radiation to the back, inner thighs, or legs. Additionally, it could be linked

to symptoms like headaches, nausea, vomiting, diarrhea, fatigue, or low back pain (3). It exerts a significant negative impact on their daily activities and relationships, including those with family, friends, and partners. Furthermore, it can detrimentally affect academic performance at school and in higher education, often leading to reduced concentration (4). Females with dysmenorrhea are also more likely to exhibit higher levels of absenteeism compared to those without the condition (5-6). In addition, it may be associated with a decline in various aspects of everyday living, involving daily tasks, leisure time, sports activities, and the quality of sleep. It may also contribute to increased levels of anxiety and depression (3).

Primary dysmenorrhea represents a widespread gynecological disorder among women in their reproductive years (7). Its prevalence varies across global populations and is dependent upon factors such as geographic location, cultural practices, and access to healthcare (1). Accurately estimating its prevalence can be challenging, as many women who experience primary dysmenorrhea do not seek medical assistance, making it underreported. Consequently, the reported prevalence of primary dysmenorrhea varies widely, showing percentages anywhere between 17% and 91% (8). A meta-analysis conducted by Wang in 2022, covering studies conducted between 1991 and 2021, estimated the prevalence of primary dysmenorrhea to be 66.1%, with 31.1% describing it as mild dysmenorrhea, 25.7% as moderate, and 8.3% as severe. Wang's analysis also revealed an increase in the prevalence of primary dysmenorrhea over the years, with estimates rising from 58.8% before 2010 to 68.5% after 2010, ultimately reaching 71.5% from 2015 to 2021 (9).

The pathophysiology of primary dysmenorrhea remains uncertain, but evidence supports the role of elevated prostaglandins ($PGF_{2\alpha}$). Prostaglandins stimulate uterine contractions and vasoconstriction in the uterus. Women with primary dysmenorrhea exhibit abnormal uterine contractions induced by prostaglandins, with higher PGF2α levels observed during menstruation. These levels correlate with pain severity. Non-steroidal anti-inflammatory drug (NSAID) utilization can lower $PGF_{2\alpha}$ levels and alleviate symptoms (10).

On the other side, a neural hypothesis suggests decreased pain threshold and hypersensitivity in pain nerve endings, particularly type C pain neurons, due to elevated prostaglandins (11). This sensitization of pain fibers in the pelvic region leads to increased pain perception during menstruation (12).

Exercise and physical activity offer significant benefits for individuals with primary dysmenorrhea. They enhance the production of progesterone and estrogen while reducing cortisol and serum aldosterone levels. These hormonal changes contribute to decreased prostaglandin production, resulting in pain reduction. Additionally, exercise elevates endorphin levels, thereby increasing the pain threshold, which in turn enhances uterine blood flow, optimizes metabolism, diminishes the sympathetic response, and enhances the parasympathetic response, resulting in an improvement in the symptoms of primary dysmenorrhea (13). Different forms of exercise yield various benefits. Low-intensity activities like yoga and tai chi reduce cortisol levels (14). While moderate to vigorous aerobic exercises like cycling, swimming, and running boost anti-inflammatory cytokines and reduce prostaglandin levels (15), intensive exercise can reduce menstrual flow and alleviate pain intensity (16). Moreover, aerobic exercise facilitates the release of endorphins, which act as prostaglandin synthesis inhibitors and enhance pain tolerance, further contributing to pain relief (17).

The severity of dysmenorrhea varies, and any woman, regardless of age, can be affected. Studies show that 17% to 91% of females are affected (8), with 16% to 29% reporting significant impairment in quality of life (18). In some areas, up to 40% of adolescent girls suffer severely from these menstrual problems (19).

Dysmenorrhea not only affects personal well-being but also leads to economic losses due to missed work or school and reduced productivity (8). Poor lifestyle habits, mental stress, and inadequate exercise are linked to the increase in the intensity of dysmenorrhea. Making changes to one's lifestyle could be an effective way to control this condition (20). Previous research shows that athletes tend to experience dysmenorrhea less frequently than non-athletes (39.44% in the athlete group against 43.88% in the non-athlete group) (21), though this difference wasn't significant. However, another research indicated that non-athletes not only encounter dysmenorrhea more often but also with greater severity, and this finding was significant (22).

This has prompted the recommendation of regular physical activities to alleviate symptoms. These activities have been shown to alleviate pain, boost overall health, and enhance the quality of sleep (4).

The current study was conducted to explore the differences in dysmenorrhea severity between athletic and non-athletic females. The hypothesis proposed no noticeable difference in primary dysmenorrhea severity between athletes and non-athletes.

2.Patients and Methods:

2.1. Study participants and recruitment criteria:

Six hundred twenty-eight athletic and non-athletic females complaining of primary dysmenorrhea participated in this study. Each participant provided written informed consent after

being briefed on the study's objectives and their right to withdraw from the study at any time, as indicated by signing the relevant informed consent documents. To qualify for participation in the study, individuals had to meet the following criteria: they were diagnosed with primary dysmenorrhea (WaLIDD score ≥ 1). All females were virgins, aged between 18 and 28 years, had a body mass index (BMI) below 30 kg/m², and did not utilize any drugs to manage menstrual pain. The athletic group (314 athletic females) was recruited from Benha, Tanta, Wadi-Degla, and Maadi clubs, through social media and club announcements, and coordinated with the sports activity managers at each club.

They are practicing exercises regularly for 3-6 days/week for at least 6 months. The non-athletes (314 females) were recruited from Banha and Cairo University students, through social media and announcements posted at the universities. They hadn't participated in any type of sport. Participants were excluded from the study if they had any pelvic pathology, gynecological disease, or history of chronic illness.

2.2. Study Design:

A descriptive, cross-sectional study was conducted on six hundred twenty-eight females. The study obtained ethical approval from the Institutional Review Board of the Faculty of Physical Therapy at Cairo University before commencement (approval number P.T.REC/012/004091) and was registered with the ClinicalTrials.gov Protocol Registration and Results System (registration number NCT06075654). The study conformed to the guidelines outlined in the Declaration of Helsinki for human research ethics. Data were gathered over a period of seven months, starting in March 2023 and ending in September 2023.

2.3. Methods:

A protocol of assessment was explained for each patient. Each patient signed a consent form before conducting the study. Before enrollment in the study, each female participant underwent a thorough medical history assessment, which was documented on a recording data sheet, and BMI was calculated according to BMI (kg/m^2) = Weight (kg) / Height^2 (m2). A detailed history of the type of sport, days of training/week, and hours of training/day were taken from the athletic group. The Visual Analogue Scale (VAS) and the WaLLID scale were used to assess dysmenorrhea pain intensity on the first day of menstruation, aiming to reduce recall bias by measuring pain at a single point during the study. Additionally, the use of analgesics was monitored as a secondary outcome throughout the study period.

2.4. Outcome measures:

Primary Outcome Measure:

. 2.4.1. Visual analogue scale (VAS):

A 10 cm straight line is used to measure pain severity, with 0 equating to no pain and 10 equating to the worst possible pain. Patients mark their pain level on this line. Scores of 0 represent no dysmenorrhea, 1-3 represent mild dysmenorrhea, 4-6 signify moderate dysmenorrhea, and 7-10 signify severe dysmenorrhea. This scale has been widely employed in dysmenorrhea studies for assessing pain severity, demonstrating validity and reliability, with a strong ICC with a Numeric rating scale (23).

2.4.2. WaLIDD score/ Work ability, location, intensity/ Wong-Baker, and days of pain of dysmenorrhea):

This assessment tool was utilized to evaluate various aspects of dysmenorrhea, including: 1) the number of different anatomical locations experiencing pain (none, lower abdominal area, lumbar area, lower extremities, inguinal area), 2- Wong–Baker pain range (does not hurt, hurts a little, hurts a little more, hurts even more, hurts a lot, hurts a lot more), 3- number of days of pain during menses (0, 1–2, 3–4, ≥ 5) and 4- frequency of pain hindering daily activities (never, almost never, almost always, always). Each variable within the tool was assigned a score from 0 to 3, resulting in an overall score ranging from 0 to 12 points. An overall score of 0 indicated the absence of dysmenorrhea, while scores of 1 to 4, 5 to 7, and 8 to 12 indicated mild, moderate, and severe dysmenorrhea, respectively. It also presented an adequate internal consistency (24-25).

Secondary Outcome Measure:

Each female in both groups was asked about the use of analgesics to alleviate pain.

3.Data Analysis:

Calculation of sample size:

G*POWER statistical software (version 3.1.9.2; Franz Faul, Universität Kiel, Germany) [26], was performed prior to the study to calculate sample size and it was determined that the optimal sample size for this study was N=628 (with 314 subjects allocated to each group), resulting in an observed power of 0.8. The calculations were made using α=0. 05, β=0.2, an effect size of 0.4, and an allocation ratio of N2/N1 = 1

Statistical Analysis:

The findings are presented either as mean values with their corresponding standard deviations or as numbers with percentages. To compare various variables between the two groups, an unpaired t-test was employed. For comparing categorical data, such as numbers and percentages, the Chi-square test was utilized. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software, version 19 for Windows. A significance level of $p \leq 0.05$ was statistically significant.

4. Results:

There was no statistically significant difference between the two groups as regards age (t=0.937, p=0.349), height (t=1.040, p=0.299), weight (t=0.220, p=0.826), BMI (t=0.315, p=0.753), menarche age (t=0.702, p=0.483), menstrual cycle length (t=0.707, p=0.480) and average days of menstruation (t=-0.686, p=0.493), respectively, as shown in **Table 1.**

All females in the athletic group [314 (100%)] were practicing exercise regularly in the last 6 months. **Table 2** illustrates the number of days of practice/week and the hours of practice/day by athletic group. **Table 3** illustrates the type of sport exercised by the athletic group.

As shown in **Table 4**, in the athletic group the number of females who suffered from severe pain on the VAS scale was 11.6%, which was statistically less than in the non-athletic group (39.8%) (Chi square value=78.369, p=0.001). There was a statistically significant difference between both groups in the mean value of VAS (t=10.082. p=0.001) (the severity was higher in the non-athletic group). In the athletic group, the number of females with severe WaLIDD score [34 (10.8%)] was statistically less than in the non-athletic group [118 (37.6%)] (Chi square value=70.693, p=0.001). There was a statistically significant difference between both groups in the mean value of the WaLIDD score (t=12.386, p=0.001) (the severity was higher in the non-athletic group).

In the athletic group, the number of females who required analgesics (24.8%) was statistically less than in the non-athletic group (55.4%) (Chi square value=72.554, p=0.001) **(Table 5**).

Table 1. Demographic data of patients in both groups

	Athletic Group (314)	Non-athletic Group (314)	Comparison	
	Mean ± SD	Mean ± SD	t-value	p-value
Age (years)	22.81 ± 3.28	23.05 ± 3.19	0.937	0.349
Height (m)	1.66 ± 0.08	1.67 ± 0.08	1.040	0.299
Weight (kg)	70.50 ± 12.00	70.83 ± 12.08	0.220	0.826
BMI (kg/m^2)	25.10 ± 2.70	25.23 ± 2.73	0.315	0.753
Menarche age (years)	12.79 ± 1.25	12.86 ± 1.36	0.702	0.483
Menstrual cycle length (days)	25.32 ± 3.01	25.49 ± 2.98	0.707	0.480
Average days of menstruation	4.49 ± 1.11	4.43 ± 1.10	-0.686	0.493

SD, standard deviation; p-value, probability value.
t value: Unpaired t value; BMI: Body Mass Index

Table 2. Athletic activity items in the athletic group

	Minimum	Maximum	Mean	SD
Days of practice/week	3	6	3.87	1.077
Hours of practice/day	1	4	1.83	0.831

SD, standard deviation

Table 3. Type of sport exercised by the athletic group

	Number	Percent
Volleyball	56	17.83
Swimming	48	15.29
Karate	48	15.29
Basketball	30	9.55
Kung fu	24	7.64
Ballet	22	7.01
Gymnastic	20	6.37
Kickboxing	15	4.78
Handball	14	4.46
Football	13	4.14
Boxing	13	4.14
Judo	11	3.50

Table 4. VAS and WaLIDD severity in the two studied groups.

Items		Athletic Group (n= 314)	Non-athletic Group (n= 314)	Comparison	
		Number/ percentage	Number/ percentage	Chi square value	p-value
VAS Severity	Mild	154 (49.0%)	73 (23.2%)	78.369	0.001
	Moderate	124 (39.5%)	116 (36.9%)		
	Severe	36 (11.5%)	125 (39.8%)		
Total VAS score		Mean ± SD	Mean ± SD	t-value	p-value
Mean VAS	Total score	3.99 ± 2.20	5.91 ± 2.57	10.082	0.001
WaLIDD Severity	Mild	155 (49.4%)	80 (25.5%)	70.369	0.001
	Moderate	125 (39.8%)	116 (36.9%)		
	Severe	34 (10.8%)	118 (37.6%)		
Total WaLIDD score		Mean ± SD	Mean ± SD	t-value	p-value
Mean WaLIDD	Total score	4.67 ± 1.71	6.66 ± 2.28	12.386	0.001

SD, standard deviation; p-value, probability value; t value: Unpaired t value

Table 5. Analgesic consumption in two groups.

		Athletic Group	Non-athletic Group	Chi square value	p-value
		Number/ percentage	Number/ percentage		
Analgesic consumption	No	212 (67.5%)	107 (34.1%)	72.55	0.001
	Yes	24 (7.6%)	33 (10.5%)		
	Sometimes	78 (24.8%)	174 (55.4%)		

p-value, probability value

5. Discussion:

Primary dysmenorrhea, a frequently encountered condition in gynecology, manifests as menstrual pain or cramps without any underlying organic pathology (1).

This study was conducted to compare primary dysmenorrhea severity between athletic and non-athletic females. The study's findings revealed a statistically significant difference between both groups, athletes and non-athletes, in the mean value of the VAS and WaLIDD scale (p=0.001) and the values were lower in the athletic group. The percentage of athletic females who suffered from severe dysmenorrhea was 11.6% that was significantly lower than 39.8% for the non-athletic group, and the percentage of females who suffered from mild dysmenorrhea was significantly higher in the athletic group (49%) compared to 23.2% for the VAS scale in the non-athletic group. In addition, for the WaLIDD score, 10.8% suffered from severe dysmenorrhea in the athletic group compared to 37.6% in the non-athletic group, while 49.4% reported mild dysmenorrhea in the athletic group compared to 25.5% in the non-athletic group. There was a statistically significant difference in analgesic requirements between both groups (more requirements in the non-athletic group) (p=0.001).

The results of this study are consistent with those reported by Momma et al. (22), showing, in addition to the greater prevalence of dysmenorrhea in non-athletes (90.5%) than in athletes (85.6%), severe dysmenorrhea was more common in non-athletes (61.6%) compared to athletes (52.9%), while a lower percentage of athletes (21.2%) experienced no or

mild dysmenorrhea, against 27.8% in non-athletes. Furthermore, dysmenorrhea severity did not significantly vary with the level of competition, or the type of sport involved.

Also, Matin et al. (21) showed that non-athletes experienced dysmenorrhea more frequently than athletes, although the difference was not statistically significant (p=0.39). Furthermore, the use of medication for pain and dysmenorrhea symptoms was less common among athletes. This reduced reliance on pain relief among athletes may be due to their generally higher pain tolerance .

Additionally, Vannuccini et al. (27) found that, although heavy menstrual periods were more prevalent among elite athletes, they experienced dysmenorrhea less frequently. There was also a notable difference in dysmenorrhea intensity between athletes and non-athletes, with the athletes experiencing milder symptoms and a better physical quality of life than the non-athletic control group. There was insignificant variation in the severity of dysmenorrhea across different types of sports, but there was a decrease in pain during training and competitions (28).

Furthermore, Kishlali et al. (28) noted a marked decrease in dysmenorrhea symptoms among athletes during sports competitions .

Moreover, Idayanti et al. (29) observed a reduction in menstrual pain among 8th-grade students after participating in gymnastics therapy designed for dysmenorrhea. The effectiveness of these gymnastics' exercises, which are tailored to alleviate dysmenorrhea, can be attributed to their role in reducing muscle tension, minimizing inflammation, and enhancing overall comfort. It's important to note that individual responses to these exercises can vary, affecting the extent of pain relief experienced.

A review conducted by Kumalasari et al. (30) analyzed 14 studies and consistently found significant reductions in menstrual pain due to dysmenorrhea gymnastics. All studies in the review reported a p-value of less than 0.05, indicating a substantial average reduction in pain. The success of these exercises is believed to arise from their ability to boost β-endorphin levels, improve blood flow, and alleviate both physical and psychological menstrual symptoms. Furthermore, for the most effective results, regular practice of these exercises, especially in the evenings to align with the body's natural endorphin production, is suggested.

Corroborating these findings, Koushkie et al. (31) demonstrated that a structured physical fitness regimen could alleviate both physical and mental premenstrual symptoms, including dysmenorrhea. This improvement was attributed to heightened endorphin levels due to physical activity, resulting in significant reductions in depression and alterations in mood and pain perception.

Consistent with these findings, the systematic review by Samperio et al. (32) underlined the consensus across various studies that physical exercise serves as an effective treatment for primary dysmenorrhea, positively impacting a range of symptoms. The majority of these studies reported reductions in both the severity and duration of menstrual pain, with noted improvements in menstrual distress scores and overall quality of life and functionality. Interestingly, a substantial number of these studies also reported a decreased reliance on analgesics among women who participated in exercise interventions.

Exercise influences hormone levels in the body, leading to higher levels of progesterone and estrogen and lower levels of cortisol and aldosterone. This is partly due to decreased renin levels, resulting in reduced prostaglandin production. Since prostaglandins are associated with pain, their lower levels contribute to diminished pain (17). Additionally, exercise enhances the release of neurotransmitters like endorphins and dopamine, known for alleviating primary dysmenorrhea symptoms (33). This increase in endorphins not only reduces pain sensitivity but also contributes to a sense of well-being and satisfaction after exercising, helping to ease other common dysmenorrhea symptoms (34).

Prostaglandin F2-alpha is released in the uterus, causing contractions and pain during menstruation. These contractions are due to the sympathetic nervous system causing spasms in the uterine blood vessels, leading to pain (35). Exercise helps by increasing blood flow to the uterus, improving the uterine environment, inhibiting sympathetic activity, and fostering parasympathetic activity. This helps lessen menstrual pain (36).

Our study further supports the belief that regular exercise can be a viable alternative to over-the-counter medicines or NSAIDs for relieving menstrual symptoms. This aligns with the findings of Motahari-Tabari et al. (37), who concluded that both stretching exercises and mefenamic acid demonstrated similar efficacy in treating primary dysmenorrhea. Additionally, our findings propose that exercise's advantageous influence on providing relief from menstrual discomfort could potentially amplify as time progresses.

In our study, it was found that 24.8% of athletes regularly used analgesics, in contrast to 55.4% of non-athletes. Additionally, 67.5% of athletes reported not using any analgesics, a figure significantly higher compared to only 34.1% of non-athletes. This finding contrasts with the research conducted by Ekenros et al. (38), which involved

1,086 athletes across 57 different sports. Their study highlighted that menstrual-related issues, such as dysmenorrhea and premenstrual syndrome (PMS), were common among athletes. Specifically, 68% of the athletes in their study experienced dysmenorrhea, with 72% of these individuals using medication to manage pain. Additionally, 13% of the athletes reported utilizing oral contraceptive pills as a strategy to manage dysmenorrhea and mitigate its impact on their sports performance.

Our study's results differ from those of Kartal et al. (39), who found that athletes experienced more dysmenorrhea pain than sedentary women. This might be because the sedentary group, mainly nursing students, used more pain relief methods and made healthier lifestyle choices. Their background in nursing could influence their ways of handling PMS and dysmenorrhea.

In another study comparing professional female gymnasts with sedentary women, the difference in menstrual pain severity between the two groups was insignificant. However, the athletes exhibited a slight increase in pain. Also, 10.26% of the athletes reported constant pain during their period, a condition not observed in the sedentary group (40).

Conclusion:

This study noted a significant difference in dysmenorrhea severity between athletes and non-athletes, with 11.6% of athletes experiencing severe dysmenorrhea compared to 39.8% in the non-athlete group for the VAS scale and 10.8% of athletes experiencing severe dysmenorrhea compared to 37.6% for the WaLIDD score. Additionally, 24.8% of athletes reported regularly using analgesics, indicating a lower severity of dysmenorrhea and less dependence on pain medication among the athletic group compared to 55.4% of nonathletes who reported using analgesics regularly.

Implications of the study:

The study suggests that regular exercise, as a safe and affordable non-pharmacological approach, can effectively reduce dysmenorrhea symptoms by lowering prostaglandin levels and enhancing uterine and pelvic blood flow and metabolism.

Strengths and Limitations of the study:

One of the primary strengths of this study lies in its robust sample size of 628 participants, equally divided between athletic and non-athletic females. This large sample size enhances the statistical power of the findings, allowing for more reliable and generalizable conclusions. Additionally, the use of validated measurement tools, such as the VAS and the WaLLID scale, ensures that the assessment of pain intensity and dysmenorrhea features is both accurate and consistent.

The study had limitations: the unequal distribution of participants across various sports made sport-specific comparisons impossible. We didn't record participants' levels of competition or professional status, nor their age when starting sports. Also, our data was limited to just one menstrual cycle. We did not closely look at how different amounts of training time affect dysmenorrhea symptoms. In addition, the study did not account for potential confounding factors, such as dietary habits, stress levels, or the use of hormonal contraceptives, which may influence dysmenorrhea severity.

Recommendations:

Future studies are needed to clarify dysmenorrhea severity in different types of sports and the relation between prolonged training hours and primary dysmenorrhea severity.

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