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Impact of stress and physical activity level on menstrual disorders among university female athletes

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Abstract

Female university athletes are highly vulnerable to stress due to the demands of academic work, examinations, sports training, competitions, and other social interactions. Both psychological and physiological thresholds can directly affect their menstrual cycle and can direct to different menstrual disorders. Hence, the objective of the current study is to identify the prevalence of menstrual disorders and the effect of stress and physical activity level on menstrual disorder types among female university athletes in Sri Lanka. A cross-sectional survey was carried out recruiting 167 (n=167) female university athletes age ranged from 20 to 29 years. A purposive sampling technique was used to select participants who actively engaged in university sports. Modified Rhinessa Women's Questionnaire was used to gather the data on menstrual disorders and the Perceived Stress Scale was used to identify the stress among participants while the International Physical Activity Questionnaire was used to identify the physical activity level of the participants. Data were analyzed using SPSS software (version 22.0). Data were not normally distributed, hence non-parametric tests were employed to analyze the data. Results revealed that 86.8% of the participants were having normal menstrual cycles while 13.2% reported menstrual irregularities. From that, 4.8% of the participants reported primary amenorrhea, 4.8% showed oligomenorrhea, 3.0% showed secondary amenorrhea, and 0.6% showed polymenorrhea. Furthermore, 5.4% of the participants who had normal menstrual cycles reported dysmenorrhea. A considerable percentage (13.2%) of the participants showed menstrual irregularities and the prevalence was high in primary amenorrhea, oligomenorrhea, and secondary amenorrhea irregularity types. Female university athletes showed moderate levels of perceived stress (19.10 ± 4.56) during the data collection period. Kruskal Wallis test revealed that there is no significant difference between perceived stress and menstrual disorder types among female university athletes ($p > 0.05$). Furthermore, the Kruskal Wallis test revealed that there is a significant difference between physical activity level and menstrual disorder types among female university athletes ($p < 0.05$). Menstrual disorders may negatively affect the health of female athletes. Since there is a very limited number of studies have been conducted using university female athletes and the effect of perceived stress and physical activity level on menstrual disorders, more research is needed to confirm the present outcome. High physical activity levels may be the reason for these irregularities. Thus, more research is needed to conclude the present results.

Keywords: Female Athletes; Menstrual Disorder Types; Physical Activity Level; Perceived Stress.

INTRODUCTION

Representing the university as a university athlete is never an easy task for university students. They need to cope with university-related demands, such as attending lectures, completing continuous assessments, and facing exams. In addition to that, they must take care of personal well-being and handle interpersonal relationships. Further, if they are freshmen, they must face many life adjustment issues, such as adapting to the university system and building new social relationships. As competitive athletes, they have to engage in athletically related tasks like participating in regular training sessions and competitions, building a relationship with teammates and coaches, preventing and taking care of injuries and meeting performance demands [1].

Therefore, female university athletes are very much vulnerable to stress due to many reasons. Females experience more stress than males and consistently report more physical and somatoform symptoms[2]. Researchers have found a few issues females face while participating in sports, such as economic problems, lack of self-confidence, greater emphasis on self-comparison, and negative comments from adults than males [3]. All these things are stressful conditions for a female athlete, and they can lead to many health problems.

When considering females, the menstrual cycle plays a major role in their lives. The menstrual cycle can be shown as a complex physiological phenomenon. In some females, even though physical and psychological changes happen, no changes happened to their menstruation[4]. Indeed, the female menstrual cycle

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represents a complex interplay of hormones. The hypothalamus secretes gonadotropin-releasing hormone (GnRH) which then stimulates the secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LH). Then the ovaries in females stimulate the secretion of estrogen and progesterone. Puberty starts as the hypothalamic-pituitary-gonadal (HPG) axis awakens. It can be characterized by very specific changes in the patterns of gonadotropin pulsatility. When it comes to the menstrual cycle length, during the adolescent years, the female cycle length is between 20 and 45 days. Then it decreases to 24-38 days with increasing maturity. In addition to that, menstrual flow can last between 2-7 days and the average blood loss during a period is about 30 ml in an adult [5].

Young females often experience a variety of menstrual-related problems including primary amenorrhea, secondary amenorrhea, dysmenorrhea, oligomenorrhea, polymenorrhea, and menstrual-related mood changes. Among those, pre-menstrual syndrome (PMS) is a common complaint[6]. Pre-menstrual syndrome or PMS is common among females in their reproductive age. This causes a set of distressing physical, mental, and behavioural changes which occur again during the luteal phase of the menstrual cycle. PMS is experienced by some females before their menstrual period while some are experienced in the age range of 25 to 35 years. The diagnosis criteria of the syndrome are the recurrence of symptoms at least two consecutive menstrual cycles. The symptoms of PMS can be divided into two categories of physical changes like headaches, muscle aches, fatigue, weight gain, and breast pain and psychological symptoms and mood disorders like depression, anxiety, anger, crying for no reason, and impaired daily functioning[7]. If there was no onset of menses by age 15, it is diagnosed as primary amenorrhea while secondary amenorrhea is diagnosed when there was no menstruation for 6 months, or for more than three times the previous menstrual cycle length. If menstrual periods occur more than 35 days apart, it is described as oligomenorrhea. Polymenorrhea is diagnosed in the case of menses with a frequency of fewer than 21 days. In the disorder of dysmenorrhea, there is pain with menstruation, typically involving abdominal cramps[6]. Though the conditions of some are higher than those in the general population, probably all types of menstrual disorders occur among female athletes. When it comes to amenorrhea, it is obvious, persistent, distressing, and symptomatic of many organic diseases. Therefore, amenorrhea has been studied most intensively in athletes. All amenorrheic athletes should be diagnosed with a full endocrine workup to ensure that they are treated properly [8].

Menstruation may be altered by stress[9]. Several studies have identified that stress is one of the key factors responsible for those menstrual disorders[10,2]. Stress can be eustress or distress. Eustress is “good stress” that acts as a motivation for a person to complete a particular task. Distress means “bad stress”. It leads to bad conditions like depression, anxiety, or other personality disorders[2]. Stress can be further defined as a feeling of emotional or physical tension. Stress has direct and indirect effects on the menstrual cycle length of females. Stress can change menstrual patterns also. Further, stress may play an important role in causing some disorders or missed periods in a female. The menstrual cycle can occur for a longer period, or it can temporarily stop periods for a while due to moderate psychological stress. Indeed, stress is the factor that all stressors have in common in their impact on the body and the hypothalamic-pituitary-adrenal axis is activated by stressors. Those stressors disturb the menstrual cycle. Gajapriya et al., have mentioned in their study that during different phases of the menstrual cycle, the effect of stress on erythrocyte deformities varies. Variation in the sex hormone which is caused by the effect of stress cause early or late periods. Further, academic stress has two-timed chance of having menstrual disorders. Longer duration of menstrual bleeding and menstrual cycle irregularities can be occurred due to major depression. There is a chance to temporarily stop the menstrual period when stress levels rise and that is called secondary amenorrhea. The monthly cycle of a female is regulated by hormones. When this hormone balance is disturbed by stress, then it can interfere with menstrual periods. One of the stress hormones called cortisol impacts the production of estrogen and progesterone. Having too much cortisol can affect everything from the flow and the length of the menstrual cycle of females [10].

In addition to stress, physical activity levels also influence menstrual disorders. With the increased participation of females in sports and with the increased competition, the demand for physical preparation also increased[11]. Thereby, the number of health concerns including disordered eating and menstrual disorders are increased. Many female athletes are pressured by their coaches to maintain low body weight for performance purposes and sometimes female athletes who play weight-category sports tend to maintain their body weight to stay in their respective weight category. This can lead to the development of disordered eating[12]. Further, training intensities are also altered by coaches and athletes to meet competition-related demands. Several studies have confirmed that intense exercises cause luteal phase defects like oligomenorrhea and other menstrual dysfunction and amenorrhea. Moderate exercises cause a slightly increased probability of longer cycles [13]. Some studies have stated that young female athletes who participate in ballet, running, gymnastics, and figure skating are at risk of developing hypothalamic amenorrhea due to excessive exercise and the inability to meet the energy needs of their bodies. Most women present with previously regular menstrual cycles can be changed due to multiple factors like weight changes, stress, and exercise [14]. Generally, when the training volume and training intensity increase and energy balance is not maintained, menstrual cycle disturbances can occur whereas when training is increased gradually and energy balance is maintained, they will not face such conditions [15].

Accordingly, the effect of physical and psychological factors can be identified as some of the causes of irregular menstrual cycles among female athletes. The present study mainly focuses on identifying the effect of stress and physical activity level on menstrual disorders among female university athletes in Sri Lanka.

MATERIAL AND METHODS

The population of the current study was female university athletes in Sri Lankan state universities who were participating in Inter-University Games or Sri Lanka University Games (SLUG). All the participants should be in the inclusion criteria to be eligible for the proposed study. Only included undergraduates from state universities who actively engaged in sports and represented the university at the inter-university games or SLUG. Athletes who have done sports only at the school level and currently do not actively engage in sports were excluded from the study. The independent variables are perceived stress and physical activity levels. The dependent variable is menstrual disorder types. This quantitative intervention used a cross-sectional research design where the effect of two independent variables on one dependent variable was analyzed. The participants were recruited voluntarily to the present study and written consent was taken from all the participants stating their willingness to participate. A purposive sampling technique was used to select 167 female university athletes as the sample of this study (n = 167). Hence, athletes from all 16 universities were considered in this study and randomly selected participants according to their consent. The study was carried out according to the declaration of Helsinki.

Procedure

After written informed consent was obtained, three questionnaires were distributed among the participants. For measuring the perceived stress level Perceived Stress Scale (PSS), which was developed by Sheldon Cohen in 1983, was used. The questions in the PSS are about the feelings and thoughts that a person experienced during the last

month. In each question, respondents should answer how often they felt a certain way. In other words, this scale measures one's perception about recent stressful situations and their degree of rating on a five-point Likert Scale where 0 is equal to 'Never' and 4 is equal to 'Very Often'. There are different versions of the PSS inventory such as 14 items, 10 items, and 4 items versions. However, 10 items version is known to be more brief and reliable than the other versions and it was recommended by Cohen, Kamarck, and Mermelstein (1983). Therefore, the present study used the 10-item version. Perceived Stress Scale scores are calculated by reversing responses (eg: 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0) to the four positively stated items (items 4, 5, 7, 8) and then summing across all scale items. Individual scores on this scale can range from 0 to 40. Higher scores indicate higher perceived stress.

The International Physical Activity Questionnaire (IPAQ), which was developed by a group of Physical Activity Assessment Experts in 1998 was used for measuring the physical activity levels of athletes. IPAQ includes 5 sets of questions. Those questions ask about the time that a person spent being physically active in the last 7 days. To identify menstrual disorders, the Menstrual Irregularities Questionnaire which is known as the "Rhinessa Women's Questionnaire" was utilized. The modified Rhinessa Women's Questionnaire included questions on menstrual irregularities, and it was translated forward and backwards between English and Sinhala languages a pilot test was conducted before distribution. The questionnaires included questions regarding demographic characteristics such as age, height, weight, BMI, and training age.

Statistical Analysis

Data were analyzed using SPSS (version 22.0) statistical software. All the data was entered into the SPSS software and coded accordingly. A normality test was conducted for all studied parameters. Descriptive statistics (means ± standard deviation) were used to interpret the dependent variable data. The relationship between variables was measured using a correlation test. The significance level was set at p = 0.05. when the values are less than the significant value the researcher accepted the alternative hypothesis.

RESULTS

Data of the 167 university female athletes were entered for the analysis and the demographic information of the participants including the minimum and maximum ranges of age, weight, height, Body Mass Index (BMI), and training age and their mean value and the standard deviation (SD) are shown in Table 01.

Table 1: Demographic Information of the Participants

Parameter	Minimum	Maximum	Mean ± SD
Age (years)	20.00	29.00	23.77 ± 1.38
Weight (kg)	36.00	90.00	53.83 ± 8.94
Height (cm)	125	178	1.59 ± 0.07
BMI (kg/m^2)	16.02	36.63	21.43 ± 3.34
Training Age (years)	0.50	21.00	8.75 ± 4.84

Participants answered a question in the Menstrual Irregularity Questionnaire which was asked to gather information on the present menstrual cycle condition. Accordingly, among all the participants, only one participant (0.6%) had stopped menstrual periods and all the others (99.4%) had menstrual periods regular or irregular basis. In addition to that, the Menstrual Irregularity Questionnaire has questioned how old the athlete was when the athlete had her first period. Accordingly, 82 % of the participant started their menarche at age 7 to 14 years and 4.2% of the participants reported that their menarche started after age 15. Of all the participants, 57.5 % stated that they are having regular menstrual cycles while 36.5% of them are having irregular menstrual cycles. The majority of the participants are having 27 to 29 days menstrual cycle.

Table 02: Basic Menstrual Details among the Participants

Components	Prevalence (%)
Onset of Menarche	
– 0 to 6 years	0.0
– 7 to 14 years	82.0
– 15 years	13.8
– 16 years to up	4.2
Regularity/Irregularity	
– Regular menstrual cycles	57.5
– Irregular menstrual cycles	36.5
– Never had regular menstrual cycles	6.0
Intervals between Menstrual Periods	
– Less than 21 days	1.2
– 21-26 days	14.4
– 27-29 days	44.9
– 30-32 days	28.1
– 33-35 days	6.0
– More than 35 days	5.4

The prevalence of menstrual disorder types among the participating athletes is shown in Figure 01. According to that, 81.4% of athletes had no menstrual disorders and the rest of the athletes had different types of menstrual disorders. Among the participants, primary amenorrhea was found in 4.8% of participants, secondary amenorrhea was found in 3.0% of athletes, dysmenorrhea was found in 5.4% of participants, oligomenorrhea was found in 4.8% of participants, and polymenorrhea was found in 0.6% of athletes.

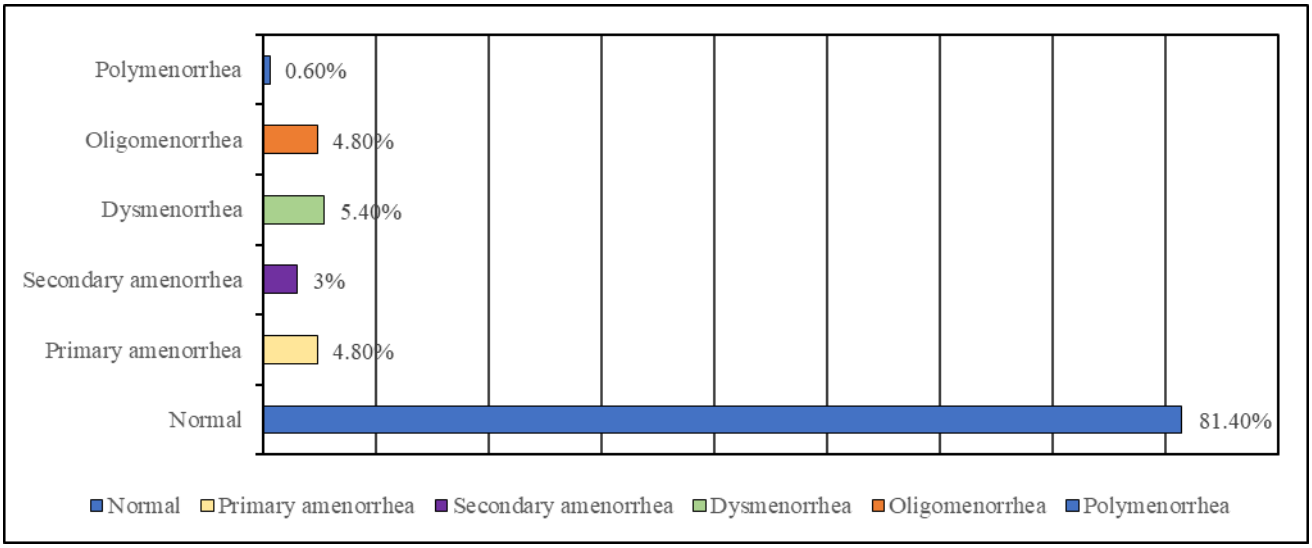

Figure 1: Prevalence of menstrual disorder types

Kruskal Wallis Test was conducted to identify the impact of stress on menstrual disorder types. According to that, there is no significant difference in perceived stress on menstrual disorder types (p = 0.63). However, the participating athletes who had high-stress levels had polymenorrhea, primary amenorrhea, and oligomenorrhea (Table 03). Furthermore, participants showed moderate levels of perceived stress (19.10 ± 4.56) during the data collection period.

Table 3: Effect of perceived stress on menstrual disorder types

Menstrual Disorder Type	Number of Athletes	Mean Rank
Normal	136	82.20
Primary amenorrhea	8	102.81
Secondary amenorrhea	5	89.80
Dysmenorrhea	9	74.22
Oligomenorrhea	8	97.19
Polymenorrhea	1	132.00
Total	167	

Kruskal Wallis Test was conducted to identify the impact of physical activity level on menstrual disorder types. According to that, there is a significant difference in physical activity levels in menstrual disorder types (p = 0.004). However, the athletes who had high physical activity levels had higher mean ranks and they had secondary amenorrhea, dysmenorrhea, or oligomenorrhea (Table 04).

Table 4: Effect of physical activity level on menstrual disorder types

Menstrual Disorder Type	Number of Athletes	Mean Rank
Normal	136	81.09
Primary amenorrhea	8	41.69
Secondary amenorrhea	5	108.70
Dysmenorrhea	9	112.22
Oligomenorrhea	8	127.38
Polymenorrhea	1	94.00
Total	167	

DISCUSSION

A female's menstrual cycle generally follows a 28-day cycle. It ends with the shedding of the uterine lining leading to bleeding. A normal menstrual cycle indicates a healthy hypothalamic-pituitary axis with a normal uterus and proper hormonal functioning. However, this normal menstrual cycle can be influenced by various conditions, such as stress, over-exercising, sudden weight loss, and medical conditions[16]. In addition to that, menstrual changes or menstrual dysfunction are a part of the female athlete triad. The female athlete triad includes disordered eating, amenorrhea, osteoporosis, or in other words, insufficient energy availability, menstrual disorders, and decreased bone mineral density. The prevalence of female athlete triad depends on the type of sport and is more frequently associated with sports that require low body mass. There are some common menstrual-related problems such as primary amenorrhea, secondary amenorrhea, dysmenorrhea, oligomenorrhea, polymenorrhea, and menstrual-related mood changes. Menstrual disorders are more prevalent among athletes than the general population and it may be a huge problem for their health and well-being [12]. According to the literature, both psychological and physiological thresholds can directly affect their menstrual cycle and can cause different menstrual disorders. The effect of stress and intensive exercises on the menstrual cycle is evidenced by much research. There are several studies on perceived stress[17], the impact of stress on menstrual function[10], menstrual disorders in athletes[18], and the impact of intensity training on menstrual function[11].

According to the results of the present study, there is no significant difference in perceived stress on menstrual disorder types (p = 0.63). However, the participants who had high-stress levels had polymenorrhea, primary amenorrhea, and oligomenorrhea. Some previous studies have shown that there is no association between stress levels and menses patterns[9]. Similar findings were reported by Clarvit 2012. In her study, she also found that there is no association between the above variables. Accordingly, these findings fit with the present findings. However, some researchers have found that there is a significant association between the level of stress and the presence of premenstrual symptoms. Accordingly, higher stress is associated with painful periods and the presence of premenstrual symptoms[2]. However, the present study shows a relatively low association. Findings of the study of Gajapriya et al. have revealed that stress is one of the reasons for irregular periods and 78% of participants in their study get back to their normal periods after getting relieved from stress[10]. Accordingly, previous literature has concluded that there is an association between stress and menstrual disorders. The reason for the difference between previous literature results and the present results

may be because of the time gaps in the data collected. Nagma et al. have found in their study that there is no association in students with PSS > 20 with dysmenorrhea, long cycle length, and short cycle length. However, they could establish an association between high-stress levels (PSS > 20) and irregular menstrual cycles[16]. The present study also confirms this, revealing that high-stress levels cause polymenorrhea, primary amenorrhea, and oligomenorrhea. Identifying the effect of perceived stress on menstrual disorder types among female university athletes was a major objective of the present study. Under the above findings, this objective could be successfully achieved.

The findings of the present study show that there is a significant difference in physical activity levels in menstrual disorder types (p = 0.004). However, the athletes who had high physical activity levels had higher mean ranks and they had secondary amenorrhea, dysmenorrhea, or oligomenorrhea. According to the previous literature, the prevalence of secondary amenorrhea was three times higher in female athletes than non-athletes whereas the prevalence of dysmenorrhea was twofold lower in female athletes than non-athletes. Further, the prevalence of primary amenorrhea was substantially higher in female athletes than in non-athletes[11]. However, the results revealed that the participants who had high physical activity levels had secondary amenorrhea, dysmenorrhea, or oligomenorrhea. Accordingly, the present study confirms the findings of the previous studies revealing that the prevalence of secondary amenorrhea is higher in female athletes. However, the present study does not agree with some of the findings of Dusek (2001). Though that study revealed the prevalence of dysmenorrhea was twofold lower in female athletes than non-athletes, the present study revealed that dysmenorrhea is high in female athletes. Identifying the effect of physical activity levels on menstrual disorder types among female university athletes was a major objective of the present study. Under the above findings, this objective could be successfully achieved.

Identifying the prevalence of menstrual disorders among female university athletes was a specific objective of the present study. Findings of the study of Bachmann and Kammann have revealed that the prevalence of amenorrhea was 2.6% and the prevalence of oligomenorrhea was 11.3%[19]. However, the present findings revealed a lower percentage of prevalence of oligomenorrhea than the previous literature revealed.

Furthermore, among the participants, most of the athletes had their menarche in the age category between 7 to 14 years. According to the results of the study by Torstveit and Sundgot-Borgen (2005), the age at menarche that occurred later was higher in elite female athletes than non-athletes [20]. Further, the study of Dusek (2001) has concluded that high-intensity training before menarche postpones its onset [11].

Since there is a very limited number of studies have been conducted using university female athletes and finding the effect of perceived stress and physical activity level on menstrual disorders, more research is needed to confirm the present outcome. Menstrual disorders may negatively affect the health of female athletes.

The findings of this research will contribute to the current knowledge of athletes, coaches, and parents on the perceived stress, physical activity level, and menstrual disorders of athletes. To increase awareness of exercise and stress-related menstrual disorders, it is important to design complete and comprehensive education and awareness programs for female athletes, their parents, their coaches, and other relevant authorities. To promote the psychological as well as physiological health and well-being of female athletes, sports administrators, coaches, and parents should work together.

CONCLUSION

There is no significant effect of perceived stress on menstrual disorder types and there is a significant effect of physical activity level on menstrual disorder types among female university athletes. The prevalence of menstrual disorder types shows a higher prevalence in dysmenorrhea and a lower prevalence in polymenorrhea. Due to the physical activity level effects on menstrual disorder types, coaches, trainers, and other relevant authorities should pay special attention when planning training sessions for female athletes.

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Conflicts of Interest

The authors report no conflicts of interest in this work.

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