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Prevalence of Reproductive Disorders in Sportswomen

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Abstract: *Sport pertains to any form of competitive physical activity or game that aims to use, maintain or improve physical ability. In women, the reproductive system is used to produce eggs (ova) to be fertilized and to provide the space along with conditions to allow a baby to develop. The present study aimed to examine the prevalence of reproductive disorders in sportswomen. One hundred sportswomen with an age range between 18-25 (mean age= 23.7± 2.05) of various games and events like volleyball, athletics, swimming, shot put, hockey, handball, tennis, football, cricket and boxing were selected as a sample size from the Women Sports Department, University of the Punjab, Lahore. The findings of this study expressed that 46% of players were suffering from various gynaecological disorders after they participated in sports, whereas 54% of respondents were having normal functioning of their reproductive cycle. In conclusion, moderate physical activity and regular exercise can improve the reproductive health of female but heavy and strenuous exercise without appropriate rest is one of those factors which may endanger the normal functioning of the female reproductive cycle.*

Key Words: Eumenorrhea, Ovulation, Gonadal Sex Steroid Hormones, Menarche

Introduction

Over the past several decades, women are participating more frequently in sports and games (Heiss *et al.*, 2018). Any kind of physiological or psychological stress influences the endocrine equilibrium, which is responsible for the maintenance and regulation of reproductive functions in women (Zwolinsky *et al.*, 2016). The endocrine equilibrium depends on the rate at which the hormones are being produced, metabolized and cleared out of the body. Various factors of sports like the stress of competition, dieting, reduction of body fat and body weight may lead to the disruption in hormonal balance (Mosavat *et al.*, 2013). The female who gets involved in regular high-intensity physical activity may develop menstrual disturbance such as delayed menarche, oligomenorrhea, dysmenorrhea, amenorrhea and impaired production of gonadotrophin (Trois *et al.*, 2018).

Puberty is one of the stages of life in which the at the age of 10 to 14 years the development of secondary sex characteristics occurs, such as menarche in female (Mao *et al.*, 2018). Menarche is the occurrence of menstruation in females for the first time (Baker *et al.*, 2018). Reproductive cycle or menstrual cycle is the series of events which take place regularly in female every 26 -30 days throughout the reproductive age (Smith, 2018). In the menstrual cycle, predictable changes occur concurrently in uterine walls and ovaries following the hormonal concentration present in the blood (Regan *et al.*, 2018). Hormones secreted in the blood are regulated by a negative feedback mechanism. Gonadotrophin releasing hormones (GnRH) which are secreted from the hypothalamus gland, stimulate the anterior pituitary gland to release follicle-stimulating hormones(FSH) and luteinizing hormones (LH) (Crisóstomo, 2018). FSH causes the maturation of the ovarian follicles and the release of estrogen, leading to ovulation. Whereas LH triggers ovulation, stimulates the development of corpus luteum and secretion of progesterone (Zwick *et al.*, 2018). The average length of the menstrual cycle is about 28 days. The menstrual phase is extending from 5-7 days. This is followed by the proliferative phase, which is also

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known as the follicular phase (about 10 days), then by the secretory phase, which is also known as luteal (about 14 days) (Nguyen *et al*., 2018).

In females, exercise-associated reproductive disorders generally arise from the dysfunctioning of the hypothalamus gland. Different kinds of reproductive health disorders have been observed in a large number of females participating in prolonged and vigorous physical activity (Koru, 2018). As women participating in ballet, long-distance running, gymnastics and figure skating, their hormonal profile expressed hypoestrogenism, which is caused by the disruption of the hypothalamic-pituitary-ovarian axis (Sabel *et al*., 2018). Especially due to inhibition of pulsatile release of GnRH from the hypothalamus (every 60-90 min), which limits the release of LH and FSH from the anterior lobe of the pituitary gland, which, in turn, limits the ovarian stimulation and estradiol production, in response of low LH delayed menarche occurs. In case of severity, primary or secondary amenorrhea may also be observed (Uadia *et al*., 2017).

According to the body composition hypothesis, body fat should be more than 17% of body weight for the onset of menarche and more than 22% for the regular continuation of the menstrual cycle (Shakya, 2018). Leptin hormone is produced by the adipocytes, is a protein product of the obesity (ob.) gene, may be a significant mediator of reproductive functions (Pinheiro, 2018). The level of Leptin hormone may fluctuate following fat stores and energy availability. Leptin receptors are present in hypothalamic neurons, which are used to control the GnRH pulse generator. Leptin signals low energy availability to the reproductive axis, which is essentially required to maintain the vitality of reproductive organs (Logue *et al*., 2018).

The young girls who are involved in physical training (such as ballet training for ballet dancers), which emphasizes low body weight, may have gonadotrophin (LH and FSH) secretions, minimum thelarche (breast development) and during adolescence may have prolonged prepubertal state (Tangseefa *et al*., 2018). In athletes, when the LH and FSH are abnormally decreased, the gonadotrophin profile reverts to a premenarchial pattern, and amenorrhea occurs (Kurgan *et al*., 2018). The reversion of secondary amenorrhea has been observed among the athletes during the adequate rest period (Stefanadi, 2018). The severe forms of exercise-associated menstrual disturbance (EAMD) are severe menstrual disturbance, amenorrhea, oligomenorrhea. Luteal phase defects, anovulation, suppressed follicular growth and oocyte maturation, poor endometrial quality, spontaneous abortion and infertility are the clinical reproductive consequence of EAMD (Odle *et al*., 2018). Exercise-associated menstrual disturbance (EAMD) can be prevented by gaining adequate weight and reversing energy deficiency (Sylvia *et al*., 2018). Hypoestrogenism leads to failure to attain peak bone mass, and bone loss predisposes the hypoestrogenic athlete to osteopenia and osteoporosis, along with the increased risk of scoliosis and bone fracture. For hypoestrogenic post-menopausal women, weight-bearing exercises are beneficial to improve bone density. However, during the critical adolescent period, hypoestrogenic amenorrhea affects bone accretion as well (Glazier, 2018).

The main objective of the present study was to examine the prevalence of reproductive disorders in sportswomen.

Material and Method

Research Design

The design intended for existing research was an exploratory, descriptive study. The research method adopted in the existing study was a quantitative survey. In which, a paper-pencil survey method was used to find out the opinion of sportswomen about the prevailing reproductive disorders among female players of the University of Punjab.

Population

The population of this study was the female student-athletes of various games which were selected for the existing study from the Women Sports Department, University of the Punjab, Lahore. The sportswomen who have participated one or more than one time in HEC (Higher Education Commission) or national level games competitions.

Sample and Sample Size

The sample size consisted of a total of 100 female athletes with an age group 18-25 years (mean age=23.7± 2.05) through purposive sampling, which is the type of non-probability sampling. The respondents were the players of various games and track & field events such as volleyball, shot put, swimming, hockey, handball, tennis, football, cricket and boxing (Table 1.1).

Table 1. Presents the Distribution of Respondents by Game and Athletics Events

Game	Frequency	Percentage
Volleyball	11	11%
Athletics	9	9%
Swimming	6	6%
Shot put	3	3%
Hockey	15	15%
Handball	13	13%
Tennis	3	3%
Football	15	15%
Cricket	17	17%
Boxing	8	8%

Data Collection

The data used for this study was obtained through the survey method. The data collection tool was a questionnaire that consisted of simple and understandable twenty (20) statements constructed by the researcher under the supervision of concerned field experts and approved by the supervisor. The questionnaire was circulated personally by the researcher for data collection. Each statement of the questionnaire was assessed on 5 points Likert scale ranging from 1 strongly disagree to 5 strongly agree. The statements of the questionnaire were clear and simple to avoid ambiguity and technical details. The respondents were requested to place checkmarks against the appropriate response, rank on a scale of 5-1.

Data Analysis

Data were analyzed by statistical Package for Social Sciences (SPSS) 22.0 for the window evaluation version. Item analysis (Chi-Square test) was used to find out the opinion of respondents on each statement of the questionnaire.

Results Summary

S. No	Statement	F%	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	X^2	P-value
1	I do vigorous physical activity without adequate rest.	Frequency	3	17	20	40	20	34.900.	0.0001
		Percentage	3%	17%	20%	40%	20%		
2	Caloric intake (balanced diet) is poor.	Frequency	5	12	28	36	19	30.500.	0.0001
		Percentage	5%	12%	28%	36%	19%		
3	Periods occur after less than 21 days.	Frequency	3	8	30	49	10	73.700.	0.0001
		Percentage	3%	8%	30%	49%	10%		
4	Periods occur after more than 35 days.	Frequency	2	9	20	46	23	56.500.	0.0001
		Percentage	2%	9%	20%	46%	23%		
5	Missed three or more consecutive periods.	Frequency	4	8	21	37	30	39.500.	0.0001
		Percentage	4%	8%	21%	37%	30%		
6	Periods occur infrequently.	Frequency	10	17	31	22	20	19.760.	0.0001
		Percentage	10%	17%	31%	22%	20%		
7	Feel painful periods and severe menstrual cramping	Frequency	3	14	25	45	13	51.200.	0.0001
		Percentage	3%	14%	25%	45%	13%		
8		Frequency	13	28	19	24	16	27.320.	0.0001

S. No	Statement	F%	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	X^2	*P*-value
	Besides the menstruation, faced abnormal uterine bleeding.	Percentage	13%	28%	19%	24%	16%		
9	Having periods that last longer than 7days.	Frequency Percentage	19 19%	19 19%	28 28%	30 30%	4 4%	44.960.	0.0001
10	Periods are accompanied by pain ,cramping ,nausea or vomiting	Frequency Percentage	13 13%	30 30%	7 7%	19 19%	31 31%	22.000.	0.0001
11	Bleeding or spotting occurs between periods	Frequency Percentage	4 4%	15 15%	33 33%	38 38%	10 10%	43.700.	0.0001
12	Do not take rest even during periods	Frequency Percentage	12 12%	19 19%	23 23%	34 34%	12 12%	16.700.	0.0001
13	Feel psychologically depressed due to menstrual irregularities	Frequency Percentage	3 3%	20 20%	32 32%	37 37%	8 8%	43.300.	0.0001
14	Feel depressed, hot flashes and mood swings.	Frequency Percentage	4 4%	16 16%	26 26%	38 38%	16 16%	32.400.	0.0001
15	Feel cramping ,muscular pain and bone pain	Frequency Percentage	4 4%	9 9%	25 25%	42 42%	20 20%	44.300.	0.0001 0.0001
16	Having pain in bones due to heavy exercise	Frequency Percentage	10 10%	26 26%	20 20%	27 27%	17 17%	9.700.	0.0001
17	Increased absents from training due to pain in bones	Frequency Percentage	9 9%	14 14%	18 18%	36 36%	23 23%	21.300.	0.0001
18	My siblings(sisters) ,who don't perform the heavy exercise,are having a regular menstrual cycle	Frequency Percentage	4 4%	20 20%	20 20%	17 17%	39 39%	31.300.	0.0001
19	The performance of the reproductive system was normal before I started a regular intensive exercise	Frequency Percentage	5 5%	25 25%	22 22%	17 17%	31 31%	19.200.	0.0001
20	Taking treatment for normal functioning of the reproductive system	Frequency Percentage	26 26%	11 11%	24 24%	32 32%	7 7%	22.300.	0.0001

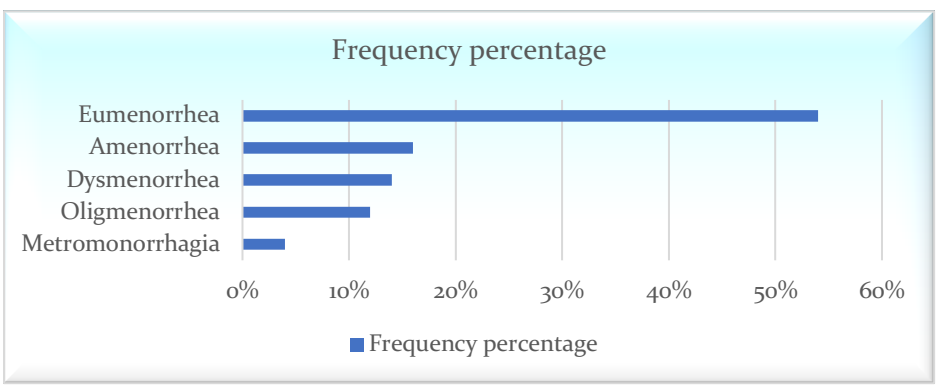

Figure 1: Showing the Graphical Presentation of the Existing Condition of the Reproductive Cycle

Figure 1 is demonstrating the graphical presentation of the existing condition of the reproductive cycle as based on the clinical manifestations of the respondent. Of 100 respondents, 54% reported eumenorrhea, which is a condition in which the female reproductive cycle is functioning efficiently and effectively. 16% of respondents were suffering from amenorrhea, which is the complete absence of menstruation. There were 14% of respondents who were suffering from dysmenorrhea which is painful

menstruation. There were 12% of respondents who were suffering from oligomenorrhea, which means there is insufficient bleeding during menstruation. And 4% of respondents were suffering from metromenorrhagia, which is prolonged, irregular and excessive uterine bleeding.

Discussion

The main purpose of this study was to find out the prevailing reproductive disorder among female players of the University of Punjab. This study was limited to university students. The main research questions were formulated about the objectives of the study, which was to view the effects of intense exercise on the female reproductive system. A questionnaire consisted of twenty statements was used as an instrument to collect data from respondents. The modern study demonstrated that moderate exercise on a regular basis has a positive effect on the female reproductive system. Regular exercise decreases the concentration of prostaglandin, which is an inflammatory substance, causes uterine muscular contraction and cramps.

The adverse effects of vigorous physical activity on the female reproductive system have received much attention in recent years. This research revealed that high-intensity exercises affected the performance of reproductive organs. The women engaged in sports requiring low weight, such as figure skating and gymnastics, suffered from hypoestrogenism due to disruption of the hypothalamic-pituitary-ovarian axis. After each 60 -90 minutes, the hypothalamic gland releases GnRH in pulsatile nature secretion; due to heavy exercise, this process gets interrupted, as a result, the pituitary gland does not release adequate LH and FSH, which, in turn, limits the production of ovarian hormones whereas some of the researches revealed that hyperandrogenism had been observed in athletes engaged in sports requiring thinness. A high level of androgens affects muscle mass positively.

Any physiological or psychological stress impacts negatively on the performance of reproductive organs; 6-79% of the women engaged in athletic activity are suffering from delayed menarche, primary amenorrhea, secondary amenorrhea and oligomenorrhea.

Dr Mona M. Shangold, a New York obstetrician and gynaecologist, says that exercise does not influence as much bad as it is considered to be affecting. Two third of the women who ran marathon races in 1977 New York City reported that they did not suffer from any menstrual irregularity both before and during the marathon training. Only one woman reported her disturbed menses during training.

Menarche is the first onset of menstruation. The intensity of exercise may lead to delayed menarche. To determine the effects of intense training on menarche, 15 Ballet dancers gaining 13-15 years were followed for four years. Delayed occurring at a mean of 15.4 years, significantly different ($P<0.01$) from the control group (12.5). Delayed menarche occurs when intensive physical training is being done along with low body fat, low body weight, dietary factors (specifically caloric restriction from protein and cholesterol, which is the building block of estrogen hormone) and stress level.

Delayed menarche is also known as primary amenorrhea. One Harvard study by Dr Rose E Frish and his colleagues researched that 10 percent of ballet dancers were not menstruating even at the age of 18 years. At Colorado State, Dr Frisch found that at least 17 percent of body fat is required for menarche. It is difficult for a woman to conceive when she lacks adequate energy. She believes that estrogen is the essential female reproductive hormone that may become deficient when there is inadequate fat stored in the body. From the total estrogen present in the body, one-third is made fat tissue, whereas two-third is produced in the ovaries. For the continuation of the regular menstrual cycle, 25-28 percent body fat is essential to the body weight of a female. Researches revealed that some women menstruate normally, even with fat less than 17% of their body weight. So, a female's fat level is not the complete answer to the effects of physical activity on menstruation.

Vigorous exercise is also associated with the absence of menstruation who have already begun to menstruate; this condition is known as secondary amenorrhea. The condition in which periods occur only one to six times a year is known as oligomenorrhea. Sometimes, prolonged untreated anovulation may lead to infertility. Dr Christopher E. Cann, a radiologist at the University of California, San Francisco, revealed through their research that exercise-induced amenorrhea might lead to premature bone loss due to diminished production of estrogen hormones. She found premature bone loss in six runners who

were suffering from amenorrhea. This problem has been observed among the women who are gymnasts, cyclists, figure skaters and bodybuilders.

From the total number of women involved in vigorous physical activity,7-10 percent are affected by exercise-related amenorrhea and menstrual irregularity. Those women who are more vulnerable to exercise-related disruption have been suffering from menstrual irregularity in the past as well. According to research at the University of California, women who suffered from menstrual irregularity are those who were doing intensive exercises along with the restricted diet intake to reduce body weight.

Dr M Shangold, a New York obstetrician and gynaecologist, describes that it is not the only heavy or intensive exercise that is detrimental for the functioning of the reproductive system, but restricted caloric intake is more dangerous to create a hormonal imbalance. Dr Edwin Dale from the department of gynecology and obstetrics at Emory University School of Medicine in Atlanta suggests that the patient should have undergone the medical examination before assuming that her menstrual irregularity was caused by exercise. She should be recommended for the pregnancy test, recent weight loss, any medicine which is being taken by her. And the occurrence of ovulation is determined by a daily record of basal body temperature for six months. He describes that the use of contraceptive methods other than birth control pills can also be a reason for anovulation in exercising women.

Hormone replacement therapy is recommended to female athletes for bone loss. To rehabilitating the athletes suffering from menstrual irregularity, Dr Dale suggests athlete must cut back their exercise, gain some weight and take a healthy diet. Dr.D. Patricia Gray from the University of Utah College of Nursing suggested that female athletes should eat better, increase cholesterol intake (300 milligrams a day), and running with slow speed without cutting back in the distance is a useful technique to avoid reproductive system disorders.

Conclusions

It has been indicated that various kinds of reproductive disorders are prevailing in female players. Low leptin level and high-stress hormone concentration following prolonged or strenuous exercise interrupt the HPO axis and disturb the female reproductive hormones. This interruption may lead to an abnormal menstrual cycle associated with luteal phase deficiency and anovulation. It is needed to further investigate the possible interventions which may be beneficial to reduce or prevent the impacts on reproductive health among female athletes following prolonged and high-intensity exercise.

Recommendations

- Exercise provides substantial health benefits; intensive exercise is also associated
- with unique sets of risks for female athletes.
- Coaches should keep in mind that athletes should move from lighter to heavier exercise gradually rather than abruptly.
- All the training principles should be followed during a training session.
- The athletes engaged in heavy activity should balance diet after taking suggestion from sports nutritionist.
- Players should have adequate knowledge about the effects of their strenuous activity on their reproductive system.
- Athletes should avoid physical activity during the period of menstruation.
- If an athlete develops any reproductive disorder, she should get treatment for that as soon as possible.
- Utilize the effects of intense exercise on the female reproductive system in upcoming researches in Pakistan.

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