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ORIGINAL ARTICLE

Biochemical Markers of Ovarian Reserve in Females, Effect of Exercise on Such Reserves

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ABSTRACT

Background: Female who are in fertile period of their life and prefer a sedentary life style rather than performing regular physical exercise, whether light or heavy exercise show different hormonal pattern which effect their physical health. Such hormonal changes are directly related to the level of ovarian reserve of hormones which are negatively affected by lack of exercise. The ovarian pool of hormones decline with age and also lack of physical exercise. Among the large pool of biochemical markers AMH (anti-mullerian hormone) appears to be the most important and helpful indicator of ovarian reserve.

Inclusion criteria: Healthy females between 25 to 35 years of age were included in the study.

Exclusion criteria: Females below 25 years and above 35 years of age were excluded from the study, in addition those females having some medical problem or using some medication were also excluded from the study.

Material and Methods: 20 females consented to participate in the study who were divided in two groups. These females were living a sedentary life before they joined the gymnasium. One group was subjected to light aerobic exercise and other group to heavy physical exercise. Tests before the start of study were conducted and were repeated after 08 weeks of study to observe the effect of both exercises on the ovarian reserves of different hormones.

Results: The comparison between both groups were observed, the values before and after exercise has a remarkable difference, a decrease in values were observed in body weight, BMI, waist and hip ratio after exercise.

Slight reduction in E2 and FSH level after aerobic exercises was observed. Whereas in heavy exercise group significant difference i.e. increase in level of FSH was observed at the same time, significant decrease in AMH level was also observed. The difference between E2 and LH had no significance in heavy exercise group.

Conclusion: Those females who were living sedentary life and performed light aerobic exercise, even for a longer time period did not showed significant change in the E2, LH, FSH and AMH level of hormones. However, heavy exercise reduces the level of AMH and increases the level of FSH. These finding suggest heavy exercise may affect fertility in a negative way especially in females with low ovarian reserves.

Keywords: Exercise, spinning, ovarian reserve, AMHh anti-mullerian hormone.

INTRODUCTION

Those females who prefer sedentary life style rather than to be physically active in their life are presumed to have a negative hormonal effects on their body, which usually are not studied as it is supposed that such activities have nothing to do with ovarian cycles or other hormonal imbalance(1, 2). This study is conducted to observe the negative effect of ovarian reserves due to lack of exercise(3).

The ovarian follicle pool reflects the ovarian reserve which declines as age increase(4, 5). This reduces the fertility in the female population. A general consensus is that female fertility is at decline after the age of 30 years, this does not include individual variations(5). So chorological age cannot be a good marker for ovarian reserves.

A large number of biochemical markers are used for estimation of ovarian reserves such as FSH (follicle stimulating hormone), AMH (anti-mullerian hormone), inhibin B, E2 (estradiol) and AFC (antral follicle count). During the reproductive period of female these biochemical markers are commonly used to ascertain ovarian reserves(6).

The onset of menopause and early loss of ovarian follicle have been associated with AMH, which is used as a reliable predictor of ovarian reserve(7). In addition to its use as an ovarian reserve marker, it is used quite extensively in clinical use also. During IVF i.e. in vitro fertilization it is used as a prognostic tool, it is also used for premature ovarian failure and polycystic ovarian syndrome as a diagnostic tool(8, 9). The diversity of use of AMH makes it a good and reliable biochemical marker for reserve of ovaries.

Improve metabolic function and weight loss have been observed with regular exercise. Regular exercise also significantly improves fertility and hormonal functions in females. Positive effect on fertility have also been observed with exercise in females(10, 11).

The study was aimed to observe the negative effect of various exercises (light aerobic and heavy exercises) on female living a sedentary life which effect their ovarian reserves.

Objective: To ascertain the effect of exercise on the ovarian reserve in fertile females.
Inclusion criteria: A very strict criteria was followed for the study; healthy females between 25 to 35 years of age were included in the study.
Exclusion criteria: Females more than 35 years of age, less than 25 years of age, pregnancy, premature ovarian failure, medication affecting reproduction, surgical issues such as hysterectomy, pelvic surgery, ovarian masses were not included in the study. Females using drugs of addiction such as alcohol, smoking, systemic diseases such as diabetes, heart disease, autoimmune diseases, thyroid diseases were also not included in the study.
Duration of study: Study was conducted over a period of 08 weeks in 2019.

Study was conducted at a gymnasium in Lahore where females maintain their physical fitness. Consent from the owner of the gymnasium was taken to conduct research study.

MATERIAL AND METHODS

After following the inclusion criteria 20 females with sedentary life style were included in the study who voluntarily consented to participate in the study. These females were divided in two groups, light aerobic exercise (n=10 AE) and heavy exercise (n=10 HE).

Both groups were subjected to different exercises of 60 minutes each for 08 weeks for 04 days per week. The duration of exercise for each group was not more than 01 hours per day for 04 days per week. First 10 minutes were warm up exercises and last 10 minutes were for cool down, main exercise was for 30-40 minutes. This routine was followed by both groups.

During this period different measurements were recorded at specified time for both the groups. Height was recorded in cms, weight was measured in kgs and body mass index was calculated, waist hip rate (WHR) was calculated from measurements of hip circumference and waist circumference.

Blood samples were taken twice during this study one at baseline and other after 08 weeks. Sample of blood were taken after an overnight fasting in the early follicular phase between 2 to 5 days. Serum was analyzed after centrifuging on daily bases for (FSH) follicular stimulating hormone, (LH) luteinizing hormone and (E2) estradiol hormone by ECLIA method. Analysis of AMH was also done on weekly bases by ECLIA technique.
Statistical analysis: All data was analyzed using SPSS software. After analysis data was expressed in means and standard deviation. Continuous variables distribution for normality was tested using Shapiro-Wilk test. Within each group data evaluation of data was made by paired samples-t test. Statistical significance was accepted as $p<0.01$ and $p<0.05$.

RESULTS

Table-1 Characteristics of both groups, mean and standard deviation

	Aerobic exercise group (n=10)	Heavy exercise group (n=10)
Age (years)	32.0 ± 2.1	31.9 ± 2.2
Height (m)	1.61 ± 4.6	1.62 ± 3.21
Weight (kg)	67.2 ± 7.51	68.0 ± 4.13
BMI (kg/m^2)	25.19 ± 2.4	25.5 ± 2.15

Table-2 Measurements (anthropometry) of baseline and after 8 weeks of both groups

	Aerobic exercise group (n=10)		Heavy exercise group (n=10)	
	Baseline	8 weeks	Baseline	8 weeks
Weight (cm)	66.19 ± 7.5	63.65 ± 8.34	68.4 ± 4.20	64.24 ± 5.75
BMI (kg/m^2)	25.25 ± 2.49	24.01 ± 2.79	25.56 ± 2.13	24.31 ± 1.78
Waist (cm)	85.22 ± 6.78	82.20 ± 7.21	84.21 ± 7.1	81.14 ± 7.42
Hip (cm)	109.33 ± 5.53	104.84 ± 5.15	109.8 ± 5.21	104 ± 5.32
WHR (cm)	0.80 ± 0.71	0.77 ± 0.71	0.69 ± 0.49	0.68 ± 0.79

Table-2 shows the comparison between both groups, the values before and after exercise has a remarkable difference, a decrease in values were observed in body weight, BMI, waist and hip ratio ($p<0.01$ and $p<0.05$).

Table-3 Ovarian reserve among both groups at baseline and 8 weeks after exercise.

	Aerobic exercise group (n=10)		Heavy exercise group (n=10)	
	Baseline	8 weeks	Baseline	8 weeks
E2 (pg/ml)	40.11 ± 29.20	36.0 ± 25.25	40.11 ± 17.33	43.14 ± 18.52
LH(IU/L)	7.10 ± 3.39	8.78 ± 8.55	6.80 ± 4.24	7.80 ± 3.69
FSH(IU/L)	5.21 ± 1.89	4.89 ± 1.73	4.62 ± 1.59	5.97 ± 2.09
AMH(ng/dL)	2.13 ± 3.11	2.2 ± 2.39	4.10 ± 2.98	3.39 ± 2.29

Table-3 shows slight reduction in E2 and FSH level after aerobic exercises, however, no gross difference was observed before and after exercise. Same observation was noticed in the level of LH and AMH before or after exercise ($p>0.05$).
Whereas in heavy exercise group significant difference i.e. increase in level of FSH was observed ($p<0.01$) at the same time significant decrease in AMH level was also observed ($p<0.05$).
The difference between E2 and LH had no significance in heavy exercise group ($p>0.05$).

DISCUSSION

The study is conducted to observe the effect of aerobic and heavy exercise on a group of healthy females who were not used to such exercise and were living a sedentary life style, during a time span of 08 weeks focusing ovarian reserves.

The study shows a significant reduction in weight, BMI, waist and hip circumference in both group of females who performed exercise. Studies conducted previously also supports the present study, study conducted by Di Santolo M, Stel G, Banfi G, Gonano F, Cauci S in 2008 and by Cannavò S, Curto L, Trimarchi F supports the present study(12, 13).

Previous studies have shown a positive effect of weight reduction on fertility although not significantly, a study conducted in 2008 by Zain MM, Norman RJ supports our study(14). Similarly, light aerobic exercises of 3-4 week reduces waist circumference which facilitate ovulation due to reduction in visceral fat, a study conducted in 2008 by Agarwal A, Aponte-Mellado A, Premkumar BJ, Shaman A, Gupta S is consistent with the present study(15).

Current study has shown ovarian reserve parameters are not affected by exercise, however, waist circumference, BMI and body weight were reduced significantly.

AMH levels were not affected even with the reduction of BMI with heavy exercise. In some previous studies also BMI reduction was not associated with AMH levels in the body of females less than 30 years of age, a study conducted by Freeman EW, Gracia CR, Sammel MD, Lin H, Lim LC-L, Strauss III JF in 2007 and another study conducted by Buyuk E, Seifer DB, Illions E, Grazi RV, Lieman H in 2011 are supporting the current study(16, 17).

In the present study E2 and FSH levels were reduced to some extent but not significantly before aerobic exercise these finding are consistent with another study conducted in 2003 by Warren MP, Goodman L (18). In the same group, the levels of FH and AMH were not significantly affected ($p>0.05$). In the heavy exercise group FSH level increased from 4.62 ± 1.59 ± 5.97 ± 2.09. AMH level decreased from 4.10 ± 2.98 to 3.39 ± 2.29 with showed significant difference.

The study is consistent with the finding that regular exercise of at least half an hour per day reduces the risk of infertility associated with ovulation in fertile females it is supported by a study conducted in 2012 by Tonekaboni M, Peeri M, Azarbayjani M (19). However, excessive exercise has negative effect on infertility by affecting primary and secondary amenorrhea by suppressing the level of LH and FSH hormones, these finding are supported by a study conducted by Bonen A, Ling W, MacIntyre K, Neil R, McGrail J, Belcastro A (20). The present study produces result which are quite close to the results of the study conducted in 2017 by Al-Eisa et al (21). 08 weeks of exercise which is of moderate level reduces weight, increases the level of FSH and reduces AMH level in females living sedentary life.

CONCLUSION

Those females who were living sedentary life and performed light aerobic exercise, even for a longer time period did not showed significant change in the E2, LH, FSH and AMH level of hormones. However, heavy exercise reduces the level of AMH and increases the level of FSH. These finding suggest heavy exercise may affect fertility in a negative way especially in females with low ovarian reserves.

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