

Investigation of the endometrial thickness and estrogen level in athletes and sedentaries

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Summary

Background: The present study aims to examine the effect of estrogen level between volleyball player's and sedentary women's endometrial thickness with regular exercise. **Materials and Methods:** Seventeen athletes taking place in the 3rd Turkish Women Volleyball League and 17 sedentary women participated in this study. The mean age of athletes was 20.70 ± 2.11 and sedentaries 21.70 ± 0.77 years has been identified. In the period between 10 and 11 days of their menstrual cycle, 2 cc venous blood was taken from the subjects. Data calculation was done using the SPSS 21 statistical package program. Descriptive statistics included the arithmetic averages of data and standard deviations (SD) and the error level of $p < 0.05$ was considered to be significant. **Results:** No statistically significant relation was found between the sports and sedentary women's mean age and BMI values (age: $p = 0.076$, BMI: $p = 0.134$ and $p > 0.05$). No significant differences were found between the two groups' estradiol and endometrial thicknesses (estradiol: $p=0.01$, endometrial thicknesses: $p = 0.01$ and $p < 0.05$). **Conclusions:** The results showed that the average thickness of the endometrium and estrogen levels of athletes are lower than in sedentaries, and these results indicate that sports may have a preventive effect against uterine cancer and endometrial thickening.

Key words: Estrogen; Athletes; Volleyball.

Introduction

Men and women also differ from one another with regards to their physical limits and performance [1]. The most important physiological difference that separate women from men is the menstrual cycle, which has an effect on performance [2]. It is characterized by cyclical bleeding from the uterus. The regularity of these cycles depends on the coordination between the hypothalamus, the hypophysis, and the ovaries, and on the cyclical changes in the endometrium, the target organ which reacts to the coordination between these three [3].

The endometrium is an important component of women's reproduction; its receptivity helps determine the fecundability of a given cycle and its thickness, differentiation, and molecular structure are important to implantation, placentation, and gestation. The thickness of the endometrium has been implicated as an important component of pregnancy success in spontaneous and assisted cycles [3]. In many women, two-thirds of the endometrium will bleed during the menstrual cycle, which is regenerated approximately 500 times during a women's lifetime. The lifetime total loss of blood induced by normal endometrial bleeding is between 10 to 20 liters, or sometimes even more. This amount represents at least one-third of an adult women's total iron capacity [4].

Endometrium thickening which is associated with menstrual cycle is regulated by estrogen [5], which is biologically the most potent endogen. Estrogen is a steroid group hormone that plays a role in women's menstrual cycle, as well as in other important biological processes. Its levels tend to be very high among reproductive age women. Estradiol promotes the actions of the proliferative phase of the endometrium, and primes progesterone receptors for their role in the secretory phase; progesterone receptors cannot be expressed without first being primed by estradiol [6]. Estradiol also has a critically important effect on bone and other organs [7] and estrogens facilitate the growth of bone tissue by stimulating osteoblasts [8]. The most significant factors affecting the level of ossification are nutrition, health, and hormone levels [9]. Excess estrogen also leads to vascular occlusion in the leg veins, the migration of clots into the lung, the formation gallbladder stones, and an increase in blood pressure [5].

Estrogen transforms an infantile uterus to an adult uterus by promoting the development of the endometrium, the vascularization of the uterus, and an increase in muscle mass. The growth of the uterus during pregnancy depends primarily on estrogen [10].

During the menstruation period, physiological and psychological effects can also have a negative impact on per-

Table 1. — *The Endometrial thickness (mm) and Estradiol Level of Sportswomen and Sedentary Women (pg/ml) values*

Variable	n	Sportsman	Sedentary	p
		\bar{x}	\bar{x}	
Endometrial Thickness (mm)	17	10,00	13,00	p<0.05
Level of Estradiol (pg/ml)	17	71,70	180,40	p<0.05

formance [11]. Although many sportswomen have commented that their sports performance decreases during certain periods of their menstrual cycle, only a few studies have actually been conducted on the relationship between performance and the menstrual cycle among sportswomen, most of which had found rather contradictory findings [12]. Furthermore, while many assisted reproduction studies have sought to determine a threshold endometrial thickness or degree of endometrial receptivity under which pregnancy is unlikely to occur, there appears to be a great degree of interindividual variation in endometrial thickness and physiological activity that leads to implantation success and pregnancy, thereby confounding the search for a reliable threshold value [3].

This study aims to investigate the changes in endometrial thickness and estradiol levels in regularly exercising female volleyball players and women who lead a sedentary life.

Material and Methods

A total of 34 women participated to the study, which included seventeen athletes playing at the Ordu Telekom Sports Club and the Samsun Gazi High School Sports Clubs from the Turkish Women's Volleyball 3rd League, as well as 17 sedentary women. Approval for this study was obtained from the Ondokuz Mayıs University Clinical Research Ethical Committee. Two groups were therefore formed in this study: an exercise group and a control group.

For the exercise group, the inclusion criteria were: volleyball training for at least two or three times a week, not having disease or serious injury, no surgery in the last six months, no polycystic ovary or ovarian cysts, and no pathological condition relating to the uterus, endometrium, and ovaries. For the control group (the sedentary group), the inclusion criteria were: no regular training, no disease or serious injury, no surgery in the last six months, no polycystic ovary or ovarian cysts, and no pathological condition relating to the uterus, endometrium, and ovaries.

On the day the study procedures were to be performed (between 08.00 am - 12.00 pm), all participants were asked not to use any drugs before the measurements, and to also avoid any other activities outside of their daily routine. From the exercise and control group subjects, who were all women, 2 cc of venous blood were taken in the early morning hours at the main laboratory of the Samsun Ondokuz Mayıs University, on a day corresponding to the 10th and 11th day of the subjects' menstrual cycle. The blood was transferred from the injector to the anticoagulant-free red cap biochemical vacuum tube and allowed to clot. After coagulation, the whole blood samples were centrifuged for five minutes at 4,000 rpm under +4°C using a centrifuge device. The obtained serums were transferred to Eppendorf tubes and stored in a deep freezer at -80°C until the day of study.

The serum samples were first brought to +25°C (room temper-

ature) before commencing the study procedures. Serum estrogen levels were determined with the electro chemiluminescence immunologic test (ECLIA) method by using a hormone analyzer and progesterone II kits. Results were given as ng/mL.

In addition, the endometrial thickness of all the subjects in exercise and control groups were measured on the 10th-11th day of their menstrual period with an ultrasound device. Endometrial thickness measurements were taken from the abdominal area; the subjects were informed beforehand that they should have a full bladder for this measurement.

The Chi-squared test, Mann Whitney U test, and Student *t*-test were used to evaluate the data, and the statistical significance level was accepted as $p < 0.05$. Study data was evaluated using the SPSS 21 statistical package program.

Results

Seventeen athletes (aged: 20.70 ± 2.11 years, BMI: 19.81 ± 2.05 kg/m²) playing at the Ordu Telekom Sports Club and the Samsun Gazi High School Sports Club from the Turkish Women's Volleyball 3rd League were included into the study along with 17 sedentary (aged: 21.70 ± 0.77 years, BMI: 21.22 ± 3.14 kg/m²) women. Thus, a total of 34 women participated in the study.

No statistically significant relation was found between the sports women and sedentary women's mean age and BMI values (age: $p = 0.076$, BMI: $p = 0.134$ and $p > 0.05$). No statistically significant difference was found between the groups with regards to the average values of their answers to the questions on (1) whether they had menstrual cycle irregularity, and (2) whether they had pain during the menstrual cycle (menstrual cycle irregularity $p = 0.072$, pain during the menstrual cycle $p = 0.105$ and $p > 0.05$).

In comparing sports women and control group, estradiol and endometrial thicknesses, there was significant differences between the two groups (estradiol: $p = 0.01$, endometrial thicknesses: $p = 0.01$ and $p < 0.05$).

Discussion

The study reached the following results by examining the endometrial thickness and estradiol levels of women who do not play sports regularly and sports women who regularly play at Turkish Women Volleyball 3rd League.

The relevant literature describes an association between obesity and endometrial cancer [13-16]. In the present study, no statistically significant difference was found between the BMI values of sports women and sedentary women ($p > 0.05$). The current authors believe that this difference with these studies stems from a variety of factors, such as the number of years the group has been practicing sports, the intensity with which they play sports, and their nutrition, race, and hereditary features.

In the present study, the answers about feeling paining during menstrual cycle was yes for 40% of them, no for 42.5%, and sometimes for 17.6%. For the sedentary group, the answer to the same question was yes for 60% of them,

no for 19.4%, and sometimes for 20.6%. Demir *et al.* observed that 91.7% of women had either mild or strong pain symptoms during the premenstrual phase, and that 82.3% experience menstrual pain [17]. Fillingim *et al.* suggested that the increased level of estrogen during the ovulation phase increases the sensation of pain [18]. As the increase in estrogen levels during the ovulation phase enhances the sensation of pain, the current authors believe that since sports women have lower estrogen levels than sedentary women, they consequently experience less pain during their menstrual cycle.

The study found that the sports women group's estradiol level was 71.70 pg/ml, while in the sedentary women group it was 181.40 pg/ml. There was a significant difference between the two groups ($p < 0.05$). The increased level of estrogen has a positive effect on bone thinning, coronary artery diseases, etc. [1, 19]. Although it was found that regular exercise has positive effects on bone density, the low estradiol levels observed in the regularly exercising group was a somewhat contradictory finding [20, 21].

The present study determined that the average endometrial thickness of the sports women group and sedentary group to be 10 mm and 13 mm, respectively. There was a significant differences between the two groups ($p < 0.05$). Telli *et al.* previously measured the average endometrial thickness of 15 patients with postmenopausal vaginal bleeding, and found a mean thickness value of 12.4 mm. They also determined that, independently of whether there was postmenopausal vaginal bleeding, all patients with a measured endometrial thickness of less than 6 mm had normal histological results, while a patient with adenocarcinoma was found to have an endometrial thickness of 18 mm [22]. In their study conducted on 244 Japanese female patients, Douchi *et al.* found no significant correlation between endometrial thickness and BMI. They described that this correlation was independent from factors such as age or menopause age [13]. Malpani *et al.* examined the records of 90 patients histologically identified with endometrial hyperplasia, and determined that their average endometrial thickness was 18.8 mm. The average endometrial thickness of the control group consisting of 126 subjects with normal endometrial histology was found to be 5.4 mm. Taking 10 mm as the endometrial thickness cut-off value, they determined the sensitivity and specificity of endometrial hyperplasia diagnosis to be 81% and 100%, respectively [23]. In their study on 120 patients, Botris *et al.* identified an average endometrial thickness of 16.6 mm in endometrial cancer, of 9.5 mm in endometrial hyperplasia, and of 3.2 mm in atrophic endometrium [24]. Estrogen is believed to be the most important risk factor in the development of endometrial cancer.

Conclusions

According to the study results, endometrial thickness was thinner among women who play sports, indicating that sports may have a preventive effect against uterine cancer and endometrial thickening. However, reduction of endometrial thickness may also lead to fertility problems among professional sports women by disrupting endometrial receptivity. On the other hand, avoidance of excessive exercise among infertile patients might have a positive effect on their fertility.

References

- [1] Joyce B.J., Meurs S.C.E.: "Association of 5' estrogen receptor alpha gene polymorphisms with bone mineral density, vertebral bone area and fracture risk". *Hum. Mol. Genet.*, 2003, 12, 1745.
- [2] Sevim Y.: *Training Information*. Ankara: NOBEL Publications, 2002, 7.
- [3] Clancy K.B.H., Ellison P.T., Jasienska G., Bribiescas R.G.: "Endometrial thickness is not independent of luteal phase day in a rural Polish population". *Anthropological Sci.*, 2009, 117, 157.
- [4] Cunningham F.G., Norman F., Gant K.J., Leveno L.C., Gilstrap J.C., Hauth K.D., *et al.*: *Doğum Bilgisi*. Ankara: Nobel Tıp Kitabevi, 1989, 66.
- [5] Vardar M., Çetin T., Burgut R., Demir C.: "Assessment of luteal phase in clomiphene citrate or HMG / HCG induced cycles: short luteal phase, luteal phase failure". *J. Obstet. Gynecol.*, 1993, 9, 127.
- [6] Clancy K.B.H.: "Reproductive ecology and the endometrium: physiology, variation, and new directions". *Am. J. Phys. Anthropol.*, 2009, 140, 137.
- [7] Guyton A.C., Hall J.E. (eds). *Guyton & Hall textbook of medical physiology*, 11th ed. Saunders Elsevier, 2005.
- [8] Dökmeci İ.: *Basic Concepts of Pharmacology*. Istanbul: Medical Publishing, 2007, 42.
- [9] Günay M., Kara E., Cicioğlu İ.: *Endocrinological Compliance to Exercise and Training*. Ankara: Baran Ofset., 2006, 240.
- [10] Junqueira L.C., Carneiro J.: *Basic histology*. Ankara: Nobel Tıp Kitabevleri, 2006, 400.
- [11] Karacan S., Çolakoglu F., Ersöz G.: "Menstrual status differences of elite Turkish female athletes from various team sports". *Niğde University Journal of Physical Education and Sport Sciences*, 2013, 7, 82.
- [12] Wearing M.P., Yuhsz M.D., Campbell R.: "Effect of the menstrual cycle on tests of physical fitness". *J. Sports Med. Phys. Fitness*, 1972, 12, 38.
- [13] Douchi T., Yoshinaga M., Katanozaka M., Mitani M., Nagata Y.: "Relationship between body mass index and transvaginal ultrasonographic endometrial thickness in postmenopausal women". *Acta Obstet. Gynecol. Scand.*, 1998, 77, 905.
- [14] Warming L., Ravn P., Christiansen C.: "Visceral fat is more important than peripheral fat for endometrial thickness and bone mass in healthy post menopausal women". *Am. J. Obstet. Gynecol.*, 2003, 188, 349.
- [15] Serin I.S., Ozcelik B., Basbug M., Ozsahin O., Yilmazsoy A., Erez R.: "Effects of hypertension and obesity on endometrial thickness". *Eur. J. Obstet. Gynecol. Reprod. Biol.*, 2003, 109, 72.
- [16] Andolf E., Dahlander K., Aspenberg P.: "Ultrasonic thickness of the endometrium correlated to body weight in asymptomatic post menopausal women". *Obstet. Gynecol.*, 1993, 82, 936.
- [17] Demir B., Algül L.Y., Güven E.S.G.: "Investigation of the incidence of premenstrual syndrome and factors affecting health workers". *J. Turk. Soc. Obstet. Gynecol.*, 2006, 3, 262.
- [18] Fillingim R.B., Maixner W., Girdler S.S., Light K.C., Harris M.B., Sheps D.S.: "Ischemic but not thermal pain sensitivity varies across the menstrual cycle". *Psychosom Med.*, 1997, 59, 512.

- [19] Eiken P., PorsNielsen S., Kolthoff N.: "Effects on bone mass after eight years of hormonal replacement therapy". *Br. J. Obstet. Gynaecol.*, 1997, 104, 702.
- [20] Chien M.Y., Yang R.S., Tsao J.Y.: "Home-based trunk- strengthening exercise for osteoporotic and osteopenic postmenopausal women without fracture-a pilot study". *Clin. Rehab.*, 2005, 19, 28.
- [21] Rikli R.E., McNanis B.C.: "Effect of exercise on bone mineral content in postmenopausal women". *Res. Q. Exerc. Sport.*, 1990, 61, 243.
- [22] Telli E., Dökmeci F., Koç A., Dündar İ., Aytaç R., Çanga A.: "Postmenopausal Endometrium Transvaginal Ultrasonography". *Ankara Tıp Mecmuası (The Journal of the Faculty of Medicine)*, 1994, 47, 251.
- [23] Malpani A., Singer J., Wolverson M.K.: "Endometrial hyperplasia: value of endometrial thickness in ultrasonographic diagnosis and clinical significance". *J. Clin. Ultrasound*, 1990, 18, 173.
- [24] Botris D., Kassanos D., Pyrgioits E.: "Vaginalsonography of the endometrium in postmenopausalwomen". *Clin. Exp. Obstet. Gynecol.*, 1992, 19, 189.

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