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# The Effect of Doing Regular Moderate Physical Exercise on Some Hormones and Oxidative Stress Indicators Levels in Women

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## Abstract

Physical training is an indispensable part for good health and is beneficial factor of lifestyle. Physical exercises can lower the severity of some diseases, such as the risk of endocrine, cardiovascular, immune system diseases and many others. The study aimed to study the effect of continuous moderate physical exercises on the levels of some hormones and oxidative stress indicators in young women by the determination of follicle‑stimulating hormone "FSH", Luteinizing hormone "LH", Prolactin, Progesterone, Estradiol, Testosterone, and Thyroid stimulating hormone "TSH" and oxidative stress state (estimation total antioxidant capacity "T-AOC" and malondialdehyde "MDA") in serum of young women who do constant moderate physical training and compared with same parameters for young women who are not making constant moderate physical training. The study was conducted in College of Physical education and sports sciences and College of Science, University of Diyala, for the period 1-30 May 2022**.** The study includes 160 unmarried young women, 76 girls have been chosen from College of Physical education and sports sciences as group 1 (do regular moderate Physical exercise) and 84 girls have been chosen from College of Science as control group "group 2" (non-make physical exercise), the ages of two groups were in range18-23 yrs.

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The samples of blood were collected from each participant during the morning of the second day of menstruation. Hormones levels were measured by cobas E411 analyzer (Roche, Germany) for hormones determination. The total antioxidant capacity (T-AOC) was measured by using T-AOC Elisa Kit (Radix, England). Malondialdehyde (MDA) was measured by using Beuge and Aust method. The results of FSH, Estradiol, Prolactin and T-AOC have been showed differences with significant elevation($P<0.05$) between group1 in comparison with the group2, while LH, Progestegrone, TSH, and MDA were higher in group1 compared with group2 but without significant differences ($P> 0.05$). Testosterone was lower in group1 compared to group2 but also without significant differences ($P>0.05$). The regular moderate physical exercises in women may contribute to total increase of sex female hormones, in addition there is an increase in total capacity of anti-oxidants and that may decrease free radicals' formation**.**

**Keywords:** Physical training, Sex hormones, Anti-oxidants capacity, Malondialdehyde.

## تأثير ممارسة التمارين البدنية المعتدلة بانتظام على بعض الهرمونات ومستويات مؤشرات الإجهاد التأكسدي لدى النساء

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### الخلاصة

تشكل التمرينات الرياضية جزء اساسي لصحة بدنية جيدة وهي عامل مفيد لأسلوب حياة جيدة. التمرينات الرياضية يمكن ان تقلل شدة بعض الامراض مثل أمراض الغدد الصماء، امراض القلب، امراض الجهاز المناعي وغيرها. دراسة هدف البحث الى دراسة تأثير التمرينات الرياضية معتدلة الشدة المستمرة على مستوى بعض الهورمونات وعلى عوامل جهد الاكسدة لدى النساء الشابات من خلال تقدير هرمون محفز الحويصلات "FSH" ، الهورمون اللوتيني "LH"، البرولاكتين، البروجيستيرون، الاستيراديول، التستوستيرون وهرمون محفز الرقية "TSH"، وقياس حالة جهد او شدة الاكسدة( من خلال تقدير سعة الاكسدة الكلية "T-AOC"، وقياس المالون ثنائي الالديهايد "MDA") في مصل دم النساء الشابات اللائي يؤدين تمرينات رياضية معتدلة الشدة باستمرار ومقارنتها مع نفس العومل لنساء شابات لا يؤدين تمرينات رياضية. اجريت الدراسة في كلية التربية البدنية وعلوم الرياضة وكلية العلوم \ جامعة ديالى للفترة 1-30 من شهر ايار سنة 2022. شملت

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الدراسة 160 نساء شابات غير متزوجات، ستة وسبعون 76 منهم اختيروا من كلية التربية البدنية وعلوم الرياضة كمجوعة اولى والتي تؤدي التمرينات الرياضية المعتدلة الشدة بصورة مستمرة، واربعة وثمانون 84 فتاة اختيروا من كلية العلوم كمجموعة ضابطة لا تؤدي التمرينات الرياضية، وكانت اعمار المجموعتين بمدى 18-23 سنة. جمعت عينات الدم من المشاركات بالدراسة في صباح اليوم الثاني من نزول الدورة الشهرية لكل فتاة متطوعة بالدراسة. تم قياس مستويات الهورمونات باستخدام جهاز Cobas E411 (شركة روش – المانيا). تم قياس السعة الكلية للاكسدة T-AOC عدة الايزة Elisa Kit لتقديرT-AOC (شركة راديكس-انكلترة). تم تقدير المالون ثنائي الالديهايد "MDA" باستخدام طريقة بيوك و اوست (Beuge and Aust method) . اظهرت النتائج وجود ارتفاعات ذات فروقات معنوية (P<0.05) في قيم FSH، الاستيراديول، البرولاكتين، وT-AOC بين المجموعتين. بينما قيم LH، البرجيستيرون، TSH وMDA كانت مرتفعة في المجموعة الاولى مقارنة بالمجوعة الضابطة ولكن هذا الارتفاع لم يظهر فروقات ذات قيمة معنوية (P> 0.05). التيستوستيرون كان اقل في المجموعة الاولى مقارنة بالمجموعة الثانية. ولكن الانخفاض لم يظهر فروقات ذات قيمة معنوية (P> 0.05). مثل التمارين السويدية والهرولة. ان التمرينات الرياضية معتدلة الشدة المستمرة لدى النساء قد تساهم في زيادة عامة للهورمونات الانثوية وزيادة السعة الكلية لمضادات الاكسدة وقد تؤدي الى خفض تكون الجذور الحرة.

**الكلمات المفتاحية:** التمرينات الرياضية، الهرمونات الجنسية، السعة الكلية للاكسدة، قياس المالون ثنائي الالديهايد.

## Introduction

Physical exercise is defined as any body movement resulted from the contraction of skeletal muscles and led to increases energy expenditure, like Swedish exercises and jogging. Generally, physical exercise is associated with decreasing the risk of diseases [1]. It is beneficial agent for a lifestyle and is seen as an indispensable part for good health, capable to decrease the risk of several disorders including: Cardiovascular disease, Obesity, cancer neoplasms, Osteoporosis, Type 2 diabetes mellitus, and the protection of ovarian function [2], and a programmed moderate physical training has been reported to be therapeutic in the adulthood and aging and offers many health benefits, because it is capable of promoting fitness. Physical training can also affect endocrine and hormones and can alleviate the negative effects caused by free radicals [3]. Free radicals are reactive species liberated through normal cellular process of all living beings [4,5]. Increase free radicals can be harmful to the body, since they can act as toxic compounds [6]. Excess of free radicals in the body leads to a state called “oxidative stress” or also called “oxidative damage”, since free radicals can damage a many of biomolecules by

oxidation [7]. Oxidative stress has a role in evolvement of aging and degenerative diseases [8-12]. Most free radicals belong to two classes of chemically-reactive molecules; Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS), both classes are referred to as Reactive oxygen and nitrogen species (RONS). The majority of RONS carries unpaired electrons and so-called free radicals [13]. ROS can cause lipid peroxidation. Lipid peroxides are unstable and decompose to form a series of compounds, as reactive carbonyl compounds, which is the most abundant is malondialdehyde (MDA) [14-16]. Therefore, estimation of malondialdehyde is widely used as an indicator of oxidative stress. This study aimed to show the alteration in levels of some hormones and state of oxidative stress in body of women who are doing moderate continuous physical exercise, and if they can get benefits from a constant activity.

## Methods

The study has been conducted in Diyala University for a period of 1-30 May 2022. 160 unmarried volunteer young women (student girls of Diyala University) were recruited through a random selection, they chosen without any problems related to menstruation. 76 girls were selected from College of Physical education and sports sciences as group 1 (Physical exercise group) and 84 girls were selected from College of Science (control group "group 2" (none physical exercise group), the ages of two groups where 18-23 yrs. Participants received a letter explaining the goal of the study and a short eligible questionnaire.

The samples of blood were collected from girls' participants in the study in the morning of the second day of menstruation (beginning Follicular growth phase of ovulation cycle) before training for each volunteer girl. The samples of blood were collected with drawing 5ml of venous blood on day 2 of the menstrual cycle using a 10 ml disposable syringes. The sample was dispensed into a plain Gel-containing tubes and allowed to clot for 15-30mins, then centrifuged at 3000rpm for 5mins. Serum stored at -20°C until analysis.

Hormones levels were measured by Cobas E411 analyzer (Roche, Germany) for hormones determination. The total antioxidant capacity(T-AOC) was measured by use T-AOC ELISA Kit

(Radix, England), and malondialdehyde (MDA) was measured using Beuge and Aust method. Statistical analysis: Data were analyzed for tabulated results using SPSS version 20. The significant p-value was taken at $P \leq 0.05$.

## Results

Table1 below represents the Mean ± Standard Deviation (M±SD) values for age, Weight, Length and body mass index (BMI) in group1 as compared with group2. There was no significant difference in the ages, Weights, Lengths and body BMI ($P > 0.05$) between two groups. This mean group1 and group2 were matched in age and body mass index (BMI).

**Table 1**: Characteristics of study subjects.

| Parameter | M ± SD of group1 (n=76) | M ± SD of group2 (n=84) | P-value |
|---|---|---|---|
| Age (years) | 0.16±20.99 | 0.21± 21.38 | 0.143 |
| Weight Kg | 0.79± 59.13 | 0.82±57.96 | 0.308 |
| Length M | 0.01±1.61 | 0.01±1.60 | 0.656 |
| BMI(Kg/m$^2$) | 0.31±22.97 | 0.32± 22.64 | 0.454 |

As shown in table 2 below, FSH, Estradiol, Prolactin and T-AOC have been showed differences with significant elevation ($P < 0.05$) between group1 in comparison to group2, while LH, Progesterone, TSH, and MDA were higher in group1 compared with group2 but without significant differences ($P > 0.05$). Testosterone was lower in group1 compared to group2 but also without significant differences ($P > 0.05$).

**Table 2**: The mean (±SD) values for variable with their significance in study group

| Parameter | M± SD of group1 (n=76) | M ± SD of group2 (n=84) | P-value |
|---|---|---|---|
| FSH(mlU/ml) | 6.565± 0.262 | 6.296±0.232 | 0.014* |
| LH (mlU/ ml) | 5.432±0.308 | 5.275±0.237 | 0.350 |
| Estradiol (pg /ml) | 48.70 ± 2.20 | 35.63 ±1.70 | 0.000* |
| Progesterone (ng/ml) | 0.394±0.037 | 0.390±0.022 | 0.351 |
| Testosterone (ng/ml) | 0.303±0.022 | 0.316±0.026 | 0.609 |
| Prolactin (ng /ml) | 16.78± 1.06 | 13.63± 0.61 | 0.017* |
| TSH (µIU/mL) | 1.86±0.12 | 1.68±0.11 | 0 .728 |
| T-AOC (pg /ml) | 13.01±0.483 | 8.00±0.361 | 0.000* |
| MDA µmol/L | 3.02±0.146 | 3.15±0.199 | 0.795 |

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Table 3 below represented the correlations between studied parameters in Physical exercise group. as shown in table there was a positive significant correlation between Testosterone with Estradiol and progesterone, and also there was positive significant correlation between FSH with LH and prolactin. The prolactin also has positively significant correlation with TSH.

**Table 3:** Show the Correlations of parameters for group1

| | | MDA | T-AOC | TSH | Testosterone | Prolactin | Progesterone | LH | FSH |
|---|---|---|---|---|---|---|---|---|---|
| Estradiol | r | 0.170 | 0.066 | -0.065 | 0.275*0.001 | 0.010 | 0.108 | -0.135 | -0.012 |
| | Sig | 0.071 | 0.423 | 0.440 | | 0.906 | 0.214 | 0.110 | 0.889 |
| FSH | r | 0.155 | -0.110 | 0.157 | -0.117 | 0.167* | -0.047 | 0.440* | 1.000 |
| | Sig | 0.091 | 0.170 | 0.054 | 0.152 | 0.046 | 0.582 | 0.000 | |
| LH | r | 0.163 | -0.008 | -0.036 | -0.136 | 0.151 | -0.067 | 1.000 | |
| | Sig | 0.078 | 0.920 | 0.665 | 0.101 | 0.076 | 0.440 | | |
| Progesterone | r | -0.001 | 0.095 | -0.163 | 0.349*0.000 | 0.009 | 1.000 | | |
| | Sig | 0.994 | 0.257 | 0.057 | | 0.922 | | | |
| Prolactin | r | 0.182 | -0.093 | 0.178* | 0.024 | 1.000 | | | |
| | Sig | 0.054 | 0.268 | 0.036 | 0.774 | | | | |
| Testosterone | r | -0.053 | 0.014 | -0.015 | 1.000 | | | | |
| | Sig | 0.572 | 0.863 | 0.855 | | | | | |
| TSH | r | 0.056 | -0.081 | 1.000 | | | | | |
| | Sig | 0.554 | 0.320 | | | | | | |
| T-AOC | r | -0.039 | 1.000 | | | | | | |
| | Sig | 0.670 | | | | | | | |

## Discussion

As shown in table1 the group1 and group2 were matched in weight, BMI and ages. The Comparison of the hormones of the group1 with control group of same weight, BMI and ages showed, generally, there were increasing in hormones of physical exercise group compared to control group as shown in table2. This result disagreed with several studies, which showed there were decreasing in hormones of women of physical exercise compared to sedentary lifestyle women, but in these studies, there were loss and difference in weight and BMI between studied groups [18-20]. We think between these studies and our study is not reach physical exercise group (group1) in our study to negative energy balance, which may have a negative effect on these hormones. So, the moderate or physical exercise without weight loss has a positive effect on studied hormones.

The result of our study was in line with of Warburton et. al. which showed that the moderate physical activity has positive effect on estradiol [21]. The testosterone hormone has no significant alteration. Some studies showed increasing in testosterone directly after physical exercise then it returns to it is level after 2hours [22-25]. Prolactin Hormone has been showed significant elevation this result agreed with some previous studies that showed Prolactin increases with exercise [25-26]. TSH showed no significant elevation and this result was in line with previous showed the moderate physical activity is correlated with increase TSH [27].

As illustrated in table2 the T-AOC "Total antioxidant capacity" value in serum of studied group expressed in pg/ml showed high significant($p=0.000$) in group1 compared to group2, the M± SD of T-AOC in group1 was 13.01±0.483 and in group2 was 8.00±0.361. In table2 also, the level of MDA (in µmol/l) was3.02±0.14 in group1 and was 3.15±0.199 in group2 but the decreases was without statistical significant ($P=0.795$). The oxidative stress is a state of disruption of the physiological balance between oxidants and antioxidants (increase the

oxidants versus the antioxidants). The determination of T-AOC is more useful than determination of specific antioxidants as monitoring to oxidative stress. T-AOC in serum is the ability of serum (serum capacity) to eliminate free radicals [28]. The determination of MDA was to show and indicate the extent of the damage of lipids. The results of T-AOC and MDA were in line somewhat with the study of Sharifi et. al. which demonstrated non-significant elevation in T-AOC and significant decrease in MDA in exercise trained women in comparison to none trained [29]. In addition to other studies which abstracted that the regulated physical exercise makes persons stronger against oxidative stress and increase antioxidants [30-32].

## Conclusion

Moderate persistent physical training in women may contribute to alteration of female hormones. Also the regulated persistent physical training increase total capacity of anti-oxidants and decrease free radical formation**.**

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