

The Impact of Some Types of Physical Activity on the Level of Releasing Serotonin Hormone (A Comparative Study)

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Abstract

The current study aimed to identify the impact of practicing some types of physical activity (moderate intensity aerobic exercise, moderate intensity resistance exercise, and moderate intensity badminton) on the level of Serotonin hormone. The researchers adopted the descriptive method as it fits the nature of the study. The study sample consisted of (3) groups: group (A) consisted of Yarmouk University long-distance athletics team players and their number is (5) / males, Group (B) consisted of the Jordanian national weightlifting team players and their number is (5) males and group (C) consisted of Jordan national badminton team players and their number is (5) males. All of the groups are homogeneous concerning age with arithmetic (21.40₋ 3.6). The researchers used the Nag. Blood Test to

measure the level of Serotonin among the players before doing any physical activity and after doing the specialized physical activity for an hour. After collecting and analyzing data the results showed an increase in the level of releasing Serotonin hormone between pre-tests and post-tests among players of (aerobic exercise and intensity resistance exercise), where the variances were in favor of the post-measurements. The results also showed that there was no statistically significant increase at the level of releasing Serotonin hormone between the pre-tests and post-tests among the badminton players, and that the rate of increase in the level of releasing Serotonin hormone between the pre-test and the post-test among players of players of aerobic exercises was higher than the one for resistance exercises and badminton, whereas the rate of increase in the level of releasing Serotonin for badminton players was higher than the one for resistance exercises. The researchers recommend the importance of educating community members about the importance of practicing periodic respiratory endurance exercises since they have a major role in improving the level of releasing Serotonin hormone, as well as to conduct studies dealing with high intensity sports to show their impact on releasing Serotonin hormone.

Keywords: Serotonin Hormone, Aerobic Exercises, Moderate Intensity Resistance Exercises, Badminton.

أثر بعض أنواع النشاط البدني على مستوى إفراز هرمون السيروتونين
(دراسة مقارنة)

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ملخص

هدفت هذه الدراسة التعرف إلى أثر ممارسة بعض أنواع النشاط البدني (التدريبات الهوائية متوسطة الشدة، تدريبات المقاومة متوسطة الشدة، ولعبة الريشة الطائرة متوسطة الشدة) على مستوى إفراز هرمون السيروتونين، وقد استخدم الباحثون المنهج الوصفي لملائمته لطبيعة الدراسة، وتكونت عينة الدراسة من (3) مجموعات: مجموعة (A) تكونت من لاعبي منتخب جامعة اليرموك لألعاب القوى المسافات الطويلة وعددهم (5) / ذكور، مجموعة (B) تكونت من لاعبي المنتخب الوطني الأردني لرفع الأثقال وعددهم (5) / ذكور، و مجموعة (C) تكونت من لاعبي المنتخب الوطني الأردني للريشة الطائرة وعددهم (5) / ذكور، وجميع المجموعات متجانسة من حيث العمر بمتوسط حسابي (21.40_+3.6)، وقد استخدم الباحثون إختبار الدم/**Nag** لقياس مستوى السيروتونين (Serotonin) لدى اللاعبين قبل القيام بأي نشاط بدني وبعد القيام بالنشاط البدني التخصصي لديهم لمدة ساعة. وبعد جمع البيانات وتحليلها أظهرت النتائج زيادة في مستوى إفراز هرمون السيروتونين بين الاختبارات القلبية والاختبارات البعدية لدى ممارسي (التدريبات الهوائية، تدريبات المقاومة)، وكانت الفروقات لصالح القياسات البعدية، كما أظهرت النتائج عدم وجود زيادة دالة إحصائياً على مستوى إفراز هرمون السيروتونين بين الاختبارات القلبية والاختبارات البعدية لدى ممارسي لعبة الريشة الطائرة، وأظهرت النتائج أيضاً أن نسبة زيادة مستوى إفراز هرمون السيروتونين بين الاختبار القبلي والبعدى لدى ممارسي التدريبات الهوائية أعلى من تدريبات المقاومة ولعبة الريشة الطائرة، فيما كانت نسبة زيادة مستوى إفراز هرمون السيروتونين لدى لاعبي الريشة الطائرة أعلى من نسبة الزيادة لدى ممارسي تدريبات المقاومة. ويوصي الباحثون بأهمية توعية أفراد المجتمع بأهمية ممارسة تدريبات التحمل الدوري التنفسي لما لها من دور كبير في تحسين مستوى إفراز هرمون السيروتونين وأيضاً إجراء دراسات تتناول الرياضات ذات الشدة المرتفعة لبيان تأثيرها على هرمون السيروتونين.

الكلمات الافتتاحية: هرمون السيروتونين، التدريبات الهوائية، تدريبات المقاومة متوسطة الشدة، الريشة الطائرة (badminton)

Introduction and importance of the study:

People face existential challenges over the years each time they develop their living methods according to their conditions and adapt with their environments. In our modern era, we have comfort aspects and the help of machines and technology does most of our hard jobs; where practicing the various sports activity plays an important role in relieving the stresses of life. Spending time in practicing sports keeps people away from thinking of the concerns of life and its complexities, and allows them to feel happy and make balance.

Practicing physical activity positively influences the quality of life, and helps people to relieve the stresses of daily life. Sports and movements influence the level of hormones in body such as the Serotonin, endorphins and dopamine, which are among the hormones responsible for human mood. Running sports and other sports games make us feel comfortable and relax; because the body gets rid of muscle stress and works on balance the levels of hormones in the body (Penedo, 2005). Hassan and his colleagues (Hassan et al., 2005) point to that secretion of these hormones increases the result of physical exertion, so we feel comfortable and quiet, and people are able to resist a new stress.

(Biali, 2020) in a study published in Journal of Psychological Sciences in (2008) pointed to that some inherited genes represent (50%) from our happiness, where hormones and neurotransmitters are responsible for our happy or bad feelings, and there are five of the major hormones and neurotransmitters in people, among of them are dopamine, serotonin, oxytocin, progesterone, and estrogen.

Hormones change in response to sports exercises, which are considered as factors of endocrine system stress, and they cause noticeable changes in hormone concentration (Surati, et al., 2012). The sports exercises play a major role in mental health of the practitioners. (Abdulrasool et al., 2020) mentioned that physical games have influence in causing some physiological changes that serve

mental and intellectual health, and help to get rid of depression feeling, reduces psychological stress and pessimistic view of life, in addition to reduce the level of forgetfulness, tiredness and anxiety like serotonin.

Serotonin hormone which is shortly called (Hydroxytryptamine) HT-5 is considered a monoamine neurotransmitter that is synthesized in serotonergic neurons in the central nervous system and in endogenous chromaffin cells in the gastrointestinal tract (Jones, 2003).

(Yong, 2007) pointed in his study to that the amount of effort and money spent in searching for drugs that change the percentage of serotonin in blood is much greater than what is spent on non-pharmacological methods such as sports exercise; since sports exercises increases the function of serotonin in human brain. Regular physical activity leads to increase firing of serotonergic neurons that make physical activity practitioners feel fun, and gives their bodies more amount of energy.

Therefore, sports exercises have a similar role to antidepressants through providing more serotonin, which reduces life distresses (Wipfli et al., 2011). (Yong, 2007) pointed to that aerobic exercises lead to create a state of better mood among players; because they lead to increase of hormone serotonin secretion, whereas (Dunn et al., 2001) mentioned that aerobic, resistance, light, medium and strong exercises may reduce the symptoms of depression and anxiety as they are considered to increase the neurotransmitters responsible for our moods.

The results of various studies revealed that aerobic and anaerobic exercises lead to increase beta-endorphin in the blood. The level of this hormone secretion responds to the intensity and type of exercise (Sharifi et al., 2018), where high intensive sports exercise increase serotonin hormone secretion, which indicates that some influences depend on changes resulted from the intensity of practicing sports in secreting serotonin (Zimmer et al., 2016).

Badminton is considered one of the sports games distinguished within racket games at the level of competition and entertainment, as it has witnessed a great development in the recent times, and great efforts were spent that helped in

spreading it. It is among sports that may be practiced at the level of individuals and groups with their various age categories and physical abilities. But this sport is considered one of the extreme sports at the level of competition; the higher the level of performance of the players and the competitive position, the greater the demands on their shoulders in terms of physical requirements such as endurance and strength, and psychological requirements such as competition anxiety and concentration (Telfah & Bani Melhim, 2017) conducted a study on a group of untrained females for (8) weeks, where the results of the study showed that badminton training may improve a group of healthy indicators, as badminton practice led to entertainment.

Medium intensity resistance exercises are defined as the muscle's ability to work against low external resistance to medium one (65 -75 %) and to a long period with tiredness delay (Qawqaza, 2019). (Tsutsumi et al., 1997) indicated that both the high resistance programs and low density have a significant role in improving fitness and psychological performance. (Hamedinia et al., 2017) also indicated that resistance exercises have a positive influence on serotonin hormone secretion, but this study did not define the intensity that the study sample has practiced.

We conclude that most studies agreed on that sports improves mood (Al-Ajrab et al., 2015); Bartholomew et al, 2005 & Rokka et al, 2010; Berger et al,2000; Ensari et al, 2017), and increases the ratio of neurotransmitters (serotonin, endorphins, etc.) (Sharifi et al, 2018; Hassan et al, 2011 ; Oliveira,et al, 2007), but the studies didn't deal enough with differentiating among the various sports in the ratio of these hormones secretion, and which is better the aerobic exercises, medium intensity resistance exercises or fun games such as table tennis, badminton and football. The researchers chose the badminton since this sports became popular in our current era, and many of the society members practice it at the entertainment level. There was also a great demand to these sports by players. Here the study came to compare the ratio of serotonin hormone secretion among the aerobic exercises, intensity resistance exercises, and

badminton exercises as an entertainment game, and which is better in increasing serotonin secreting as they are considered to improve mental health of people.

This study attempts to compare the level of serotonin secretion between exercisers of aerobic training, resistance exercises and badminton as a recreational game, and which one is better in the level of serotonin secretion as potential triggers for decreased anxiety and depression associated with exercise through the effect of these sports on the level of serotonin secretion.

Methods:

Participants:

The researchers adopted the descriptive method since it fits the nature of the study on a sample consisted of (3) groups: group (A) consisted of the Yarmouk University long-distance athletics team players(aerobic exercises), their number is (5) / males, and the average age was (21.4) years, group (B) consisted of the Jordanian national weightlifting team players (medium intensity resistance exercises), their number is (5) males and the average age was (20.9) years and group (C) consisted of Jordan national badminton team players(medium intensity badminton exercises), their number is (5) males and the average age was(22.5) years. All groups are homogeneous concerning age, experience, weight, height and mass index, table (1). The study used serotonin level measurement test (Nag. Blood) in Al-Arabi Medical Laboratories –Amman-Irbid among the players before and after doing specialized physical activity for one hour, while maintaining a heart rate of 65-75% (moderate intensity rate) within one hour of exercise.

Interviews with the study samples were conducted to obtain the players' consent to participate in this study. A questionnaire was distributed to the players including personal information, disease- free, injury-free, height, weight, age and years of experience. Instructions before the test were explained which included: avoid having some foods and drinks that increase serotonin hormone secretion a week before the test which are (eggs, cheese, pineapple, tofu, salmon, nuts, seeds, turkey, milk, coffee, ice cream, Avocado and milk drink, chocolate, hot pepper), not having sex, sleeping enough a day before the test and avoid having sedatives and

psychotropic drugs. On the day of the test, Al-Arabi Medical Laboratories took blood samples before practicing physical activity. After that, the players did the physical activities under study. The exercise intensity was controlled through watching the number of heart bulbs that should be between 65%-75% of the maximum heart rate to every player based on his age according to the equation (220 minus age). As for resistance exercises players, the exercise intensity was controlled through controlling weights and number of the heartbeats while exercising. The number of heartbeats were controlled every ten minutes of the exercise by a watch that the player wears while exercising. Exercises were conducted at the same time of the day to all groups, and the laboratory technician took a blood sample before and after practicing specialized physical activity under study.

Table (1) Arithmetic means, standard deviations of the sample participants variables (height, weight, age and years of practice)

| Variable | Minimum Value | Maximum Value | Means | Standard deviation |
|-------------------------|---------------|---------------|--------|--------------------|
| Age/year | 20.00 | 25.00 | 22.50 | 2.07 |
| Height/cm | 167.00 | 180.00 | 172.60 | 5.98 |
| Weight/ Kg | 55.00 | 65.00 | 61.00 | 4.18 |
| Years of practice/ year | 2.00 | 10.00 | 4.60 | 3.13 |

Table (1) shows a description of the study sample participants through arithmetic and standard deviations. The arithmetic mean of the lengths of the sample members (172.60) and standard deviation was (5.98). The arithmetic mean of the weights of the sample participants was (61) and standard deviation (4.18). The average age of the sample participants was (22.50) and standard deviation (2.07). The average years of exercise was (4.60) and standard deviation (3.13).

Results:

First hypothesis: there are statistically significant differences at ($\alpha < 0.05$) in the level of serotonin hormone secretion between pre-tests and post-tests among practitioners of medium intensity aerobic exercises group (A), medium intensity resistance exercises group (B) and medium intensity badminton group (C).

To test this hypothesis, the Researchers was used Wilco-Kson test to compare between the pre-test and post-test of the groups (A, B, C), and table (2) shows that.

Table (2): Arithmetic means, standard deviations and Wilco-Kson test to compare the level of serotonin hormone secretion between pre-tests and post-tests among practitioners of (aerobic exercise, resistance exercises, badminton)

| Exercise | Test | Number | Average Rank | Sum of Ranks | Arithmetic Mean | Z | Statistical significant |
|-----------|------|--------|--------------|--------------|-----------------|-------|-------------------------|
| Group (A) | pre | 5 | 1.00 | 1.00 | 86.08/ Nag | -2.00 | *.033 |
| | post | 5 | 3.00 | 15.00 | Ng/ /150.56 | | |
| Group (B) | pre | 5 | .00 | .00 | Ng/ 108.14 | -2.02 | *.043 |
| | post | 5 | 3.00 | 15.00 | Ng/ /138.90 | | |
| Group (C) | pre | 5 | 1.00 | 1.00 | Ng/ 81.44 | -1.75 | .080 |
| | post | 5 | 3.50 | 14.00 | Ng/ 114.18 | | |

Table value of (z): 1.96 Group (A): aerobic exercises, group (B): resistance exercises, group (C): Badminton.

Table (2) shows values of arithmetic mean, standard deviation and (z) calculated value between the pre-measurement and post-measurement to compare the level of serotonin hormone secretion between pre-tests and post-tests. The results showed that there were statistically significant differences at the level of serotonin hormone secretion between pre-tests and post-tests to group (A) with a statistical significance (.033) and group (b) with a statistical significance (.043), and the differences were for the post-tests. The results also revealed that there were no statistically significant differences at the level of serotonin hormone

secretion between the pre-tests and post-tests among practitioners of group (C) with a statistical significance (.080).

Second hypothesis: There are statistically significant differences at ($\alpha < 0.05$) in the level ratio of serotonin hormone secretion among practitioners of (Medium intensity respiratory periodic endurance training, medium intensity resistance training, medium intensity badminton).

To answer this hypothesis, Kruskal-Wallis test was for comparison of the level ratio of serotonin hormone secretion among the groups (A, B, C) and table (3) shows that.

Table (3) Arithmetic means, standard deviation and Kruskal-Wallis test for comparison of the level ratio of serotonin hormone secretion among practitioners of (moderate intensity aerobic exercise, moderate intensity resistance exercise, and moderate intensity badminton).

| Exercise | Number | Mean Rank | average improvement rate | χ^2 | Statistical Significance |
|-----------|--------|-----------|--------------------------|----------|--------------------------|
| Group (A) | 5 | 12.60 | Ng %64.48 | 7.95 | .019 |
| Group (B) | 5 | 5.70 | Ng 30.76% | | |
| Group (C) | 5 | 5.70 | Ng 32.74% | | |

Group (A): Aerobic exercises, Group (B): Resistance exercises, Group (C): Badminton

Table (3) shows the arithmetic mean values, standard deviation and χ^2 value between the groups (A, B,C), where the results revealed that there were statistically significant differences in the level ratio of serotonin hormone secretion between the groups (A,B,C), where group (A) (aerobic exercise) came in the first rank with an arithmetic mean (Nag: 64.48%) in the increase ratio of serotonin hormone secretion. The level of serotonin hormone secretion of group (C) who are practitioners of medium intensity badminton exercises came in the

second rank with an increase ratio (Nag: 32.74%). The level of serotonin hormone secretion of group (B) who are practitioners of medium intensity resistance exercise came in the third rank, where the increase ratio was (Nag: 30.76%).

Discussion:

First hypothesis:

The results revealed statistically significant differences at the level of serotonin hormone secretion between the pre-tests and post-tests among the groups (A, B, C). These results due to that the physical activity practice affect the level of hormones secretion in people's body like serotonin as a pain reliever resulted from physical activity, where it helps balance these hormones (Hassan et al., 2011) (Penedo, 2005). (Abdulrasool et al., 2020) pointed to that regular physical activity leads to cause balance in secreting certain neurotransmitters like serotonin, which leads to improve mood after practicing physical activity. The study results agree with what (Wipfli et al., 2011) pointed to that the hypothesis of the increase of serotonin secretion is a physiological result of the regular physical activity that works to increase release of serotonergic neurons that make physical activity feel fun and happy and gives the body a great deal of energy (Yong, 2007).

As a result of physical and psychological stress in response to sports exercise, studies indicate that the anterior pituitary gland produces complex neurohormones reactions at the same time, as these neurotransmitters, including serotonin, stimulate protein, increase blood pressure and increase blood glucose, and this contributes to increasing strength production and the rate of muscle contraction and energy production (Sharifi et al., 2018). These results agree with what (Weyerer, et al., 1994) that the low and medium intensity physical activity improves mental health through releasing hormones such as serotonin and endorphin responsible for people mood.

The study results also agree with what (Sharifi et al., 2018) mentioned that resistance and aerobic exercise increase the serotonin hormone secretion, and they agree with the study results of (Rokka et al., 2010) that high and medium aerobic

exercise improve mood among adults with a preference for medium intensity aerobic exercise through increasing serotonin and endorphin hormones secretion.

The results reveal that the level of serotonin hormone secretion resulted from practicing medium intensity badminton is not statistically significant between the pre-test and post-test. The researchers due this to that mental, skill and physical requirements that fall on the shoulders of players whether on the level of exercise and competition which it can be the reason in not reaching the increase of serotonin hormone secretion between the pre-test and post-test to statistically significance. The reason behind that is probably the exercise and competitive positions among badminton players increase the requirements fall on players' shoulders such as physical requirements like strength and endurance and mental requirements such as competition anxiety and concentration. All of his seems to affect in some way the level of serotonin hormone among them especially since the sample of group (C) are national team players. And They are under great pressure that may reduce their enjoyment of activity, which may have an impact on the level of serotonin secretion, This result agrees with what was indicated by (Ismail, 2016) that badminton takes on a dynamic character which requires a continuous interaction by the player to deal with the various performance variables to achieve positive results including the player's ability and capabilities in good performance, while he mentioned that badminton players have a high level of flexibility and agility kinetic. All these physical and mental requirements put the player in a stress and relaxing state, which may have a negative influence on the levels of serotonin secretion.

Second: hypothesis:

The results revealed statistically significant differences in the serotonin secretion level ratio among the groups (A, B, C), where group (A) came in the first rank, group (C) and group (B) came in the third rank. These results can be interpreted in that aerobic exercises group (A) reduce the absorption of amino

acids by increasing muscle absorption, which leads to an increase in the chances of crossing tryptophan (an amino acid that has a role in the formation of the irritating neurotransmitter serotonin) to the blood-brain barrier, and thus the brain has the ability to release serotonin (Patrick et al., 2015). In addition, medium intensity aerobic exercises work to increase the total volume of platelets, which in turn leads to an overall increase in serotonin levels in the blood plasma. It is scientifically known that medium intensity aerobic exercise activate glands' response particularly the pituitary and adrenal glands, and they stimulates them to secrete more neurotransmitters in response to exercise stress (Duclos et al., 1998). (Meeusen et al, 1995) indicates that the repetitive aerobic exercise for (30) minutes daily increases creating serotonin and Nutritional representation in the autonomic cortex and brainstem, and this supports the theory that aerobic exercises lead to higher levels in serotonin secretion. In general, it can be said that physical stress is associated with a decrease in cortisol levels, which is a steroid hormone that is secreted from the adrenal cortex in response to stress, where this hormone is a barrier to physical performance as its increased levels lead to muscle breakdown

While exercising. Therefore, reducing cortisol levels is ideal for the athlete (Bizlift, 2013).

The level of serotonin secretion of group (C), who are practitioners of medium intensity badminton exercises, came in the second rank with a percentage (Nag 32.74%). The researchers due this to badminton exercises work to regulate serotonin levels in our bodies, as badminton exercises lead to make cortisol under control, which is another hormone associated with stress that the body produces. Although of this, the level of mental and physical stress among badminton players is greater than free aerobic exercises such as walking and running because of physical, mental and skill requirements fall on players' shoulders while exercising and competing. Therefore, these stresses create more stress which in turn leads to secreting more serotonin which is a barrier to release more serotonin (Patel, 2020), and this agrees with what has indicated by (Telfah & Bani Melhim, 2017)

in that competitive and exercise positions among badminton players may increase the requirements falling on players shoulders such as physical requirements like endurance and strength and psychological ones like anxiety of competition and concentration. All of this seems to affect in a way on increase ratio of serotonin secretion level among them.

The ratio of serotonin secretion level of group (B), who are practitioners of medium intensity resistance exercises came in the third rank, where the increase ratio between the pre-test and post-test was (Nag%30.76). The researchers refer this to muscles' stress which is greater among medium intensity resistance exercise players, which indicates more cortisol that prevents big increase I secreting of neurotransmitters such as serotonin, as (Sharif et al., 2018) indicates that aerobic exercises are considered to be better than resistance ones in the ratio of secreting serotonin because of the great stress falling on muscles, as (Flora et al., 2016) indicated that strenuous exercises lead to reducing serotonin secretion through increasing the level of Cortisol hormone which opposite to aerobic exercises.

These results agree with what has been indicated by (Hassan et al., 2011) that aerobic increase secretion of neurotransmitters in body, and agree with what (Rokka et al., 2010) indicated that medium intensity aerobic exercises such as walking and running are considered better than stressed exercises in improving mood through releasing more serotonin.

Conclusion:

In light of the study results and discussion, the study concluded that practicing of aerobic exercise; resistance exercise and medium intensity badminton increase the level of serotonin hormone secretion. The level of serotonin hormone secretion in aerobic exercise is higher than resistance exercise and medium intensity badminton, while the level of serotonin hormone secretion in badminton is higher than medium intensity resistance exercise. In light of these conclusions,

the researchers recommend to encourage the society members to aerobic exercise since it has an important role in improving the level of serotonin hormone secretion as neurotransmitter which has a role in improving mood and reduce stress to people, conduct studies dealing with high intensity sports to show their impact on serotonin hormone and conduct similar studies of the influence of physical activity on other hormones such as endorphin and dopamine.

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