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# The effect of impact exercises and electrical stimulation upon certain anaerobic lactational ability and upon the skill of smashing in badminton for advanced female players.

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**Abstract:** The research aims at detecting the impact of exercises with electrical stimulation on the anaerobic ability and the skill of smashing for advanced badminton players as well as the effect of impact exercises without electrical stimulation on anaerobic ability and smashing skill for badminton female players. The experimental approach adopted the two equal experimental groups on a sample of (8) advanced badminton players in Kirkuk Governorate, distributed to the clubs of (Sulaf Sports and K-1 Sports), participating in the sports season (2021-2022). After defining the tests and experimentation for (8) consecutive training weeks, (3) units a week to enhance the muscular extension that produces the explosive ability of the legs and arms by making use of training tools suitable for the specifics of female badminton players. With regard to the direction of muscle contractions, emphasis was directed to the function of the key muscle groups identified as being necessary to accomplish this ability. These muscle groups are similar to their motor pathways. One training unit EMS (Electrical Muscular Stimulation) lasts for 10 to 15 minutes. As for the frequencies used during electrical stimulation, they depended on the gradient from 150 Hz to 250 Hz. After completing this experiment, the results were processed by using (SPSS) system to form conclusions and applications. Applying the impact training and electrical stimulation contributes to developing the anaerobic and non-lactic ability. As they work to build and strengthen each of them, advanced badminton players who exercise with trainings without electrical stimulation can increase their forward smashing abilities. When experienced badminton players use training and electrical stimulation, it will be vital to pay attention to the use of joint physiological testing in the lab to monitor their training state.

**Keywords:** Impact training, electrical stimulation, anaerobic lactic ability, badminton

**Introduction and importance of the research:**

Physiologists of training are still looking for training strategies, techniques, and tools that help athletes enhance their physical skills and performance in accordance with the demands of various sports. Hence, they are increasing their capacity to perform trainings skillfully. The skill of smashing is one of the basic offensive skills in badminton in which the player needs the explosive ability. Of these exercises that have found applications in various games and activities, were the impact exercises, which were known as "reflexive muscular strength exercises. This name was derived from plyometric exercises." (Gambetta, 2005:14). It was also defined as “one of the types of plyometric training in which performance is evaluated based on the time with the ground. It must be performed through a set of bounces without delay in the time of landing on the ground, with a rapid continuation of the cycle of lengthening and shortening the working muscles.” (Khairiya and Muhammad, 2005 : 38) Based on a scientific reality that the muscle can produce greater power or effort if it is extended before action, impact exercises are a targeted intensive muscular activity that help people increase their degree of strength." (Shereen, 2019: 75). The cycle of extending and shortening, which is a unique technique for creating explosive force, is used to improve the elasticity of muscular strength. In a dynamic action like a rebound leap, it depends on the moments of acceleration and halting that happen because of the body weight. (Shereen, 2019: 76).

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The electrical muscular stimulation is a modern term in training and a technical supplement in sports training to contribute to developing muscle strength, which has a peculiarity in skillful performance. Recently, there has been a noticeable interest in making use of electrical muscle stimulation as a method of qualitative training, especially after the success of electrical stimulation in the therapeutic aspect, and in psychological treatments for many types of deficiencies in the nervous and muscular systems. In terms of quantity, quality, and timing, this kind of exercise represents one of the greatest levels of specialization in the development of muscular strength. This approach is based on electrical muscular stimulation, in which the length, intensity, and muscle regions that must be stimulated to contract are all regulated. (Talha, 1994: 211) Anaerobic capacity is defined as "the efficiency of the muscle to produce anaerobic energy that the athlete uses to perform strong and fast movements" required by playing conditions." (Abu El-Ala and Ibrahim, 1994: 219). When kinetic performance requires muscular work at maximum speed or maximum force, the processes of directing oxygen to the working muscles cannot meet the need for rapid muscular work of energy. Accordingly, the production of energy is made without oxygen through an anaerobic manner. (Abu Ela and Ibrahim, 1993: 87).

**Research problem**

Researchers accompanied the players of Sulaf Sports Club and K-1 Sports Club in Kirkuk Governorate tracking over the exercises the players conducting in the club and for the championship that took place in Erbil Governorate for the classification and nomination for the national team for the sports season (2021) bringing many coaches to know the methods and techniques of their training. They noticed their focus was directed to traditional methods when developing anaerobic lactational ability. This is mirrored in the weakness in the advanced player's smashing skill. This may be the reason for the insufficient means and methods of exercises for the game requirements. Hence, it is vital to prepare and apply exercises that are compatible with the nature of performance and the privacy of the advanced players. This prompted the researchers to detect, investigate and make a scientific attempt to try to raise the level of the anaerobic ability and the skill of smashing. The researchers tended to study the use of the exercises accompanying the electrical stimulation mediated by the (EMS) device to influence it as an attempt to contribute to supporting the game with scientific research, to upgrade it and reach the best levels.

**Research objectives:**

1. Recognizing the effect of impact exercises and electrical stimulation on the anaerobic ability and the female badminton player's smashing skill.
2. Recognizing the effect of impact exercises without electrical stimulation on the anaerobic ability and the badminton player's smashing skill.

**Research hypotheses:**

1. There are statistically significant differences among the results of the pre-test and post-tests of the two experimental research groups in the anaerobic non-lactic ability and the skill of smashing for badminton players.
2. There are statistically significant differences among8 the results of the post-tests of the two experimental research groups in the anaerobic ability and the skill smashing for badminton players.

**Research methodology:** Based upon the determinants of the research problem, the experimental method was adopted, which was defined as the method in which we treat and control an independent variable to see its effect on a dependent variable, noting the resulting changes and doing their interpretation, whether the experiment includes an independent variable and a dependent variable or more than an independent variable or a dependent one . (Majdy, 2019). In accordance with what was hypothsized in the current research and the two independent research variables, the experimental design was chosen in addition to two equal experimental groups with tight control in the pre and post tests.

**The research community and sample:** The limits of the community are represented by (8) advanced badminton players in the Kirkuk governorate, distributed to the two clubs (Sulaf Sports and K-1 Sports), who were participating in the league (2021-2022). The main total sample of the research was selected from these two sport clubs with a percentage of (100%) out of their community. They were treated as one total sample and then divided into two experimental groups of equal number

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**Measurement and procedures:**

The following tests were adopted: a test of lactic Phosphagenic ability (Ghosoun, 2006: 81-82), and a test of the skill of forward smashing with a shuttlecock for 20 attempts on a court divided into (5) areas with (100) maximum degrees (Ma'in, 2001: 65). The experiment was conducted for the players of the first experimental group with exercises and electrical stimulation, while for the players of the second experimental group, the experiment was conducted with exercises without electrical stimulation for (8) consecutive training weeks of (3) units per week. The impact exercises included movements to improve the muscle elongation that produces the explosive power of the legs and arms by using training tools suitable for the specifics of female badminton players. Attention was paid to the work of the most important muscle groups specified to perform this skill, and they were similar to their motor paths in terms of the direction of muscle contractions.

The stimulation time (EMS) ranges from (10-15) minutes in one single training unit. As for the frequencies used during electrical stimulation, they depend on the gradient from (150) Hz to (250) Hz to stimulate the largest possible number of muscles to strengthen their work and synergy. The player's ability and the extent of their acceptance of such type of electrical stimulation must be taken into account by adopting the principle of gradient in the degree of electrical stimulation. These waves reach the muscle in the form of regular impulses, not continuously. After finishing the experiment, the results were processed and verified by the researchers through using the Statistical Package of Social System (SPSS), to calculate the percentage values, the mean, the standard deviation, the Leven test for equivalence of variance, the t-test for correlated samples, and the (Leven) test for equivalence of variance, and the (t-test) for uncorrelated samples

**Results**

Table (1) shows the results of the pre-tests for the equivalence of the two experimental research groups in the dependent variables

| Tests | (Sig) | (t) | (Sig) | (Liven) | Standard deviation | Arithmetic mean | Group | Significance |
|---|---|---|---|---|---|---|---|---|
| Phosphogenic ability | .925 | .098 | .393 | .848 | 3.791 | 32.073 | (1) exp | Non-sig. |
| | | | | | 3.216 | 32.315 | (2) exp | |
| Forward smashing skill | .963 | .048 | .438 | .689 | 5.598 | 63 | (1) exp | Non-sig. |
| | | | | | 3.77 | 62.75 | (2) exp | |

**Strd Dev = (4) In each group, the degree of freedom (Strd Dev 1 + Strd Dev 2-2) = (6) is not significant if the degree of (Sig) is < (0.05)**

Table (2) shows the results of the pre and post tests for the two experimental groups

| Test and measuring unit | (Sig) | (t) | Deviation of differences | Mean of difference | Standard deviation | Arithmetic mean | Comparison | Group | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Phosphogenic ability (kilowatt) | 0.006 | 6.859 | 3.667 | 12.578 | 3.791 | 32.073 | Pre | exp (1) | Sig. |
| | | | | | 0.129 | 44.65 | Post | | |
| | 0.014 | 5.129 | 2.681 | 6.875 | 3.216 | 32.315 | Pre | exp (2) | |
| | | | | | 0.914 | 39.190 | Post | | |
| Smashing skill (degree) | 0.010 | 5.784 | 5.965 | 17.25 | 5.598 | 63 | Pre | exp (1) | Sig. |
| | | | | | 0.957 | 80.25 | Post | | |
| | 0.040 | 3.481 | 6.608 | 11.5 | 8.77 | 62.75 | Pre | exp (2) | |
| | | | | | 2.217 | 74.25 | Post | | |

**(4)For each group, (Sig) ≥ (0.05) at the level of significance (0.05) and the degree of freedom (n) -(1)**

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Table (3) shows the results of the post tests between the two experimental groups

| Test and measuring unit | Degree (Sig) of | Calculated -T | Standard deviation | Arithmetic mean | Number | Group | Significance |
|---|---|---|---|---|---|---|---|
| Phosphogenic ability (kilowatt) | 0.000 | 11.828 | 0.123 | 44.65 | 4 | (1) exp | Sig. |
| | | | 0.914 | 39.19 | 4 | (2) exp | |
| Smashing skill (degree) | 0.003 | 4.968 | 0.957 | 80.25 | 4 | (1) exp | Sig. |
| | | | 2.217 | 74.25 | 4 | (2) exp | |

Significance of difference (Sig) ≥ (0.05) at significance level (0.05) and degree of freedom (std.dev1 + std.dev 2-2) = (6)

Referring back to the results of Table (2), it is clear that the advanced players in the two experimental research groups all enhanced the level of non-lactogenic phosphagenic ability and improved their skill of impact in the results of the post tests than what it was in the results of the pre-tests. By reviewing the results of Table (3), it is clear that the advanced female players in the first experimental group outperformed the advanced players in the second experimental group in the development of the level of non-lactic phosphagenic ability and showed an improvement in their smashing skill. The researchers attributed the results of such development in this physiological ability between the pre and post tests of the two research groups to the positive impact of the role of exercises in facilitating the processes of muscle contraction and sliding of threads in the muscle fibers through the lengthening and shortening cycle. In addition, the training tools of throwing medical balls were used in accordance with the impact exercises and boxes for the lower limbs, which enabled the players to master the lengthening and shortening cycle while saving the energy needed for this physical effort in these exercises.

The increase in high kinetic energy work was offset by an economy in the energy spent in the phosphagenic system. Here, the matter is limited by the lack of internal resistances that were imposed on the working muscles, including muscle viscosity and improving the flow of neuromuscular stimulation according to what the work required of these alerts and the lack of random movements accompanying the contraction with excessive movements that require muscle contractions that consume energy causing a loss of vital energy. This is due to the proficiency of the players of the two groups of the cycle of lengthening and shortening, which was the result of the positive impact of the impact training, and high economic capacity. The effect of training on the efficiency of the motor system strengthens the nerve signal in the muscle, stimulates the movement centers in the cerebral cortex, and inhibits the centers of emotion, in addition to affecting the cycle in the muscles, reducing muscle viscosity, the efficiency of the metabolism process, and the elasticity of the connective tissue." (Seddik et al., 2014: 165)

Moreover, sports training leads to various physiological changes involving all vital body systems. These changes occur at the level of cells and tissues as well, and include anaerobic and aerobic changes to produce the energy needed for athletic performance. Owing to the breadth and depth of dealing with sports physiology during recent years, researchers have been able to obtain the important physiological information and facts that contributed to developing the sports training. (Omar, 2018: 43). Furthermore, it is possible to obtain maximum efficiency for muscle work once contracting the muscle at a moderate speed. In case of slow contraction or no kinetic output, large amounts of maintenance heat will be lost during the contraction process even though no work or some work is done. Thus, the adequacy of muscle contraction will be reduced, and the highest effectiveness is obtained when the rate of contraction reaches (30%). (Sylvia, 2001: 874).

In addition, when the electrical charge of the cross-bridges reaches to the muscular fiber, it will cause a change in the myosin heads and activates them or then binds these heads with actin, while changes occur in the myosin heads in their activated arrangement, which causes them to be removed. This causes the heads to be pulled from the thin filament, passing towards the center of the sarcomere. This work represents the electrical shock to the bridge-crossing cycle. The energy is spontaneously released leaving behind (ADP)

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and inorganic phosphate originating from the myosin heads, while its new ATP molecule binds to the myosin heads again." (Christian, 2007: 129)

As for the superiority of badminton players in the first experimental group over the players in the second experimental group in the development of phosphagenic ability, the researcher attributes this superiority to the role of local electrical muscular stimulation (EMS) for each of the muscles working in the stage of constant contraction that precedes the impact exercises. These exercises had a positive effect on the cellular metabolic system, especially increasing the efficiency of the effectiveness of the rapid reactions that occur in the sarcoplasm of the cell for the production of rapid force at the time of the first anaerobic phosphagenic system.

Impact training with stimulation supported these developments in the reactions responsible for energy production. The stimulations in static contraction were directed towards improving the contractions of protein molecules and non-kinetic bioenergy in electrical stimulation of static contractions. In addition, the recovery time that was between electrical stimulation and impact training was sufficient, as it had a role in bringing about metabolic balances to get rid of the residues of chemical reactions and recycle them to invest in the energy of phosphagenic power. When calcium and ATP are available in sufficient quantities, the filaments react to form actomycin and shorten by sliding over each other. When the electrical signal actively passes along and below the sarcolemma, the calcium pump will release calcium from the sarcoplasmic reticulum into the sarcoplasm, and subsequently activates and contracts the capillary row. This stimulation begins with the arrival of the nerve stimulus to the muscle membrane through the motor end plate (motor unit)." (Sylvia, 2001: 874). Training leads to physiological changes that include the body systems. The level of athletic performance progresses whenever these changes are positive in order to achieve adaptation, the physiology of the body systems, and then the physical load and skill performance." (Baha', 2018: 179)

**Conclusion and application.**

1. Applying the impact exercises and electrical stimulation helps in developing the anaerobic and non-lactactic ability of advanced female badminton players. It also contributes to developing each of them in advanced badminton players who train with impact exercises without electrical stimulation.
2. Applying the impact exercises and electrical stimulation contributes to improving the skill of forward smashing of advanced female badminton players. It also contributes to improving for advanced badminton players who train with impact training without electrical stimulation.
3. It is necessary to pay attention to adopting laboratory and joint physiological tests to track the training status of the advanced badminton players when they apply impact exercises and electrical stimulation.

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