

THE EFFECT OF EXERCISES WITH HIGH-INTENSITY FREQUENT TRAINING ON SOME PHYSICAL ABILITIES AND THE EFFECTIVENESS OF THE TABLE TENNIS ATTACK

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ABSTRACT

Table tennis is a highly significant sport that is widely played by individuals across all social classes. It encompasses various elements, including a multitude of variables at different skill levels, physical and mental aspects, and specific skill sets. The skill aspect holds great importance in determining performance levels in this game. These skills encompass a range of techniques such as transmission, attack, defense, and their respective subcategories. The significance of research in the advancement of exercise programs involving regular high-intensity training is crucial for the enhancement of specific physical talents and skills among table tennis players. Regarding the problem of research, it has been observed by researchers that the utilization of expert opinions and specialist insights in the realm of gaming has revealed certain shortcomings in the physical capabilities and offensive efficacy of numerous young players. These limitations impede player mobility and have a detrimental impact on overall performance. Consequently, the researchers have undertaken a study to address this problem and enhance the scientific and academic standards in this domain. The research aims to develop exercises that incorporate high-intensity frequent training for specific physical abilities and evaluate the efficacy of the table tennis attack. Additionally, the study seeks to analyze the statistical variances between pre- and post-tests of both the control and experimental groups in terms of physical abilities and the effectiveness of the table tennis attack. Furthermore, the research intends to identify any statistical disparities between the control and experimental groups in the post-test results for the physical abilities and the effectiveness of the table tennis attack. The researchers used the experimental method in the style of two equivalent groups (experimental and control), regarding the research population and sample, the study focused on a specific community of young athletes enrolled in a specialized table tennis center located in the Nasiriyah district. The participants were between the ages of 16 and 18, representing the youth category. The total number of players in this community was 20, out of which 12 were deliberately selected based on their commitment to regular exercise, constituting 60% of the original population. To ensure randomization, the sample was divided into two groups, namely the experimental and control groups, using a

lottery-style random assignment. Each group consisted of 6 players. The most important conclusions are that the frequent high-intensity exercises prepared by the researchers contributed to the development of some of the physical abilities of table tennis players.

Keywords: Exercises. High-Intensity, Frequent Training, Physical Abilities, Table Tennis.

INTRODUCTION

Sports training, grounded in scientific principles and fundamental rules, plays a pivotal role in enabling individuals to attain the utmost levels of performance across various athletic disciplines (Cereda, 2023). Developed nations have placed significant emphasis on constructing, honing, and enhancing athletic capabilities to achieve optimal outcomes (Patel, 2020). Attaining exceptional athletic accomplishments and securing top positions in international competitions has emerged as a paramount objective, as it serves as a barometer for a nation's progress in physical, technical, and strategic domains (Rick & Li, 2023). The primary objective of sports training is to adequately equip individuals, facilitating behavioral modifications and enhancing the execution of precise motor patterns, hence attaining a specific standard of motor performance (Stenum et al., 2021). High intensity frequent training (HIIT) is a contemporary training method that involves organizing cardiorespiratory training through repeated bouts of short exercise periods (Dolci et al., 2020). This training approach combines high-intensity exercises with intervals of low intensity, allowing individuals to perform at maximum capacity during the high-intensity segments, which typically exceed 80% of their maximum heart rate (Kunz et al., 2019). HIIT exercises can encompass various outdoor activities such as running, cycling, utilizing running equipment, as well as indoor activities like climbing stairs or using stationary bikes (Sultana et al., 2019). High-intensity interval training (HIIT) necessitates a substantial exertion level within a brief timeframe, typically ranging from thirty seconds to two minutes (Soltani, Aghaei Bahmanbeglou & Ahmadizad, 2020). Table tennis is a highly significant recreational activity that is widely engaged in by individuals from various social classes. This game encompasses a multitude of variables across different skill levels, encompassing both physical and mental aspects (Arslan, Orer & Clemente, 2020). Notably, skill proficiency plays a pivotal role in determining performance levels in table tennis, with various specific aspects such as transmission, attack, and defense being integral components of this skill set (Torma et al., 2019). Proficiency in executing frontal and rear strikes is a pivotal skill that significantly impacts the level of accomplishment (Nikolakakis et al., 2020). This skill necessitates the integration of numerous aspects to ensure the optimal execution of these two techniques, hence enhancing their overall efficacy. The physical abilities in table tennis play a crucial part in enhancing skill level and physical performance. These abilities are designed to cultivate specific physical characteristics that significantly contribute to a player's mastery of skills (Vincze & Jurchiş, 2022). The importance of research resides in the development of high-intensity, frequent training exercises to improve the physical and skill abilities of table tennis players.

The Problem of The Study

Table tennis is a sport renowned for its rapid pace and dynamic nature, necessitating a high degree of physical aptitude (Yamasaki, 2022). Consequently, it serves as a catalyst for skill enhancement and development, achieved through the adoption of contemporary training techniques and methodologies that effectively enhance the physical and technical capabilities of players (Oagaz, Schoun & Choi, 2021). Therefore, the research problem revolves around the observation made by the researchers regarding the utilization of expert opinions and specialist insights within the realm of gaming. The researchers have identified a deficiency in certain physical capabilities and offensive efficacy among numerous young players, resulting in restricted mobility and detrimental consequences on performance outcomes. Consequently, the researchers have undertaken a study to address this issue and enhance the scientific and academic standing in this domain.

The Objectives of The Study

1. Preparing exercises with high-intensity frequent training in some physical abilities and the effectiveness of the table tennis attack.
2. Identify the statistical differences between the pre- and post-tests of the control and experimental groups for some physical abilities and the effectiveness of the table tennis attack .
3. Identify the statistical differences between the control and experimental groups in the post-test of some physical abilities and the effectiveness of the table tennis attack.

The Hypotheses of The Study

1. There are significant statistical differences between the pre-posttests of the control and experimental groups in some physical abilities and the effectiveness of the table tennis attack .
2. There are significant statistical differences between the control and experimental groups in the post-test in some physical abilities and the effectiveness of the table tennis attack .

The Areas of The Study

Human field: Players of the Specialized Center for Table Tennis in Thi Qar, youth category from (16-18) years.

Time Area: For the period from 11/10/2022 – 21/1/2023

Spatial Area: The sports hall of the specialized center in Thi Qar.

Methodology

Research Methodology

The researchers employed an experimental design with two comparable groups, namely the experimental group and the control group. This strategy allows for the utilization of multiple groups, ensuring that there is equivalence between the two groups in all variables that may have an impact on the dependent variable in the experiment (Rogers & Revesz, 2019).

Community and Sample Research

The study involved a group of young table tennis players, aged 16-18 years, who were part of a specialized center in the Nasiriyah district. These players represented the youth category and consisted of 20 individuals. From this group, 12 players were deliberately selected based on their commitment to training, representing 60% of the original community. The sample was then divided into two groups, namely the experimental and control groups, using a random allocation method similar to a lottery. Each group consisted of 6 players.

Sample Homogeneity

Statistical techniques, such as the arithmetic mean, standard deviation, and coefficient of variation, were employed to assess the presence or absence of differences in morphological measurements. Table 1 provides an illustration of these findings.

Table 1: Shows the homogeneity of the research sample in age, height and weight using the coefficient of variation, which shows values less than 30% .

Variables	Unit of measurement	M	SD	Torsion coefficient
Age	Month	199	8,02	4.03%
Height	CM	183.75	7.73	4.20%
Weight	Kg	69	6.14	8,89%
Training Age	Month	38.16	5.07	13.28%

Equivalence of the Two Research Groups

One crucial aspect that researchers must adhere to is ensuring comparability between the control and experimental groups in all variables and indicators. It is imperative to account for differences in the experimental factor, hence maintaining equivalence between the two groups (Somaraju, Nye & Olenick, 2022). Hence, statistical techniques such as calculating the arithmetic mean, standard deviation, and conducting an independent samples t-test were employed prior to implementing the research approach, as depicted in Table 2.

Table 2: Shows the arithmetic media, standard deviations, calculated (T) value and (Sig) value for the experimental and control groups in the pre-test .

Variables	Unit of measurement	Control		Experimental		T	Sig
		M	SD	M	SD		
Age	Month	200	9.79	198	6,57	0.41	0.68
Height	CM	182.33	4.81	185.16	5.71	0.10	0.91
Weight	Kg	69.83	7.57	68.16	4.91	0.45	0.66
Training Age	Month	38	7.93	38.33	7.99	0.61	0.55
Explosive power of the arms	Meter	6.17	0.29	6.88	0.315	0.77	0.45
The explosive power of the legs	Meter	2.60	1.20	1.22	1.01	0.58	0.57
Speed power of the arms	Reiteration	10	0.707	10.60	0.894	0.91	0.38
The power characteristic of the speed of the legs	Reiteration	9.20	0.836	9.60	1.02	1.04	0.32
Attack effectiveness	Degree	5.36	0.420	5.49	0.98	0.21	0.83

Means Of Data Collection:

- Arab and foreign sources.
- Personal Interviews
- Observation and analysis.
- Experimentation.
- Testing and measurement.

Field Research Procedures:

The researchers conducted personal interviews with specialists in the field of sports training and table tennis to identify the suitable physical abilities and the abilities are (explosive power of the arms, explosive power of the legs, force characteristic of speed of the arms, power characteristic of speed of the legs).

Skill tests under study:

1. 3kg overhead medicine ball push test forward (Stockbrugger & Haennel, 2001).
2. Long jump test from standstill position (Ah Sue et al., 2017).
3. Test the characteristic strength of the speed of the arms (Hamano, 2015).
4. The speed power of the two legs is half a bear half squat (10 seconds) (Young, Jenner & Griffiths, 1998).
5. **Table tennis attack effectiveness test:** The efficacy of the offensive maneuver is a crucial factor in determining success in the game of table tennis, as it is in other sports. An attack is considered effective when the attacking player is able to directly score a point or disorient the opponent to such an extent that they are compelled to engage in random defensive actions, resulting in the dispersion of the ball in a manner that increases the likelihood of scoring a point in the subsequent offensive maneuver. Therefore, the researchers opted to develop a methodology to assess the efficacy of the attack by presenting video clips to an expert. The expert would then rate the effectiveness on a scale of 1 to 10, drawing upon their personal experience and the information provided to them. This approach can be considered somewhat restrictive, as it adheres to the fundamental principles of an effective attack, such as the location of the ball's descent, its launch velocity, rotation, and height above the net. The test entails the exhibition of video segments before a panel of specialists, with each expert being provided with a grading sheet to assess each clip following both the slow and regular presentations. Additionally, the experts are required to indicate when they no longer require the clip to be replayed. To minimize the influence of judgments from any individual expert, each expert is seated separately from the others during the examination.

Exploratory Study

First Exploratory Study: The exploratory experiment was conducted on Monday, October 17, 2022, at 9:00 AM in the sports hall of the specialized center. The sample consisted of six players from the research community and additional players from outside the sample were included to apply for the tests. After a period of seven days, the tests were repeated using the same procedures, time, and place. The objective of this experiment is to identify the negative aspects and variables that may arise during the study, as well as to ensure the following:

1. Finding the scientific foundations of the tests.
2. Know the appropriate tools and devices to conduct these tests .
3. Know the appropriate time and place to conduct it .
4. Ensure the adequacy of the assistant staff.
5. Define the assistant staff in how to apply these tests.
6. Know the difficulties and problems faced by the researchers in applying these tests before applying them in the main experiment .

Second Exploratory Study: The second exploratory experiment took place on Wednesday, October 19, 2022, at 10:00 AM in the sports hall of the specialized center. The research sample, which consisted of the experimental group, was subjected to exercises that involved high-intensity frequent training. The objective of these exercises was as follows:

1. Rationing these exercises and finding the components of pregnancy for them (intensity, size and rest).
2. Find out how well the sample can apply these exercises.
3. Know the time required to apply these exercises .
4. Knowing the assistant and trained staff in how to apply these exercises because it is not the right of researchers to apply them themselves because it is considered bias for currency .
5. Knowing the difficulties and problems faced by the researchers in applying these exercises before applying them in the main experiment .

Scientific Foundations of the Tests:

1. **Honesty of the Test:** In order to assess the honesty of the tests, the researchers evaluated the sincerity of the arbitrators and obtained the sincerity of the test. This was accomplished by administering the tests to experts and specialists in the field of sports through personal interviews. The high levels of agreement among these individuals regarding the validity of the tests are presented in Table (3).
2. **Stability of the Test:** The initial examination took place on Monday, October 17, 2022, at 9:00 AM, involving a sample of six participants from both the research community and individuals outside the sample. This examination was subsequently repeated on Monday, October 24, 2022, also at 9:00 AM. The researchers determined the stability coefficient by calculating the Pearson correlation coefficient between the results of the first examination and the results of the second examination. The significance of the correlation was established based on the correlation coefficient values, indicating a strong level of stability in the tests. As seen in Table 3.
3. **Objectivity of the Test:** The objective test is the one in which there is no discrepancy between the opinions of the arbitrators if the arbitration of the individual tester more than one referee, as the researcher found the coefficient of objectivity for each of the skill tests by finding a simple correlation coefficient (Pearson) between the results of the two arbitrators in the first application conducted during the exploratory experiment, and the correlation coefficients were high, which indicates the objectivity of the tests used in the research, and Table (3) shows that.

Table 3: Shows the practical bases of the tests used in the research .

Tests	Validity of the test	Objectivity of the test
Explosive power of the arms	0.88	0.89
The explosive power of the legs	0.91	0.91
Speed power of the arms	0.89	0.89
The power characteristic of the speed of the legs	0.90	0.89

Main Experience

Pre- Tests:

The tests and pre-measurement of the experimental and control groups were administered by the researcher prior to commencing the implementation of the training curriculum on Tuesday, January 11, 2022, at 9:00 AM in the Specialized Center for Table Tennis. All twelve members of the research sample, who were players, were present.

Exercise with high-intensity frequent training: Based on an extensive examination of the existing body of literature on sports training, as well as a comprehensive survey conducted among esteemed experts and specialists in the field of training, a series of exercises has been devised specifically tailored for the regular training regimen of table tennis players between the ages of 16 and 18. The exercise program commenced on Thursday, March 11, 2022, and concluded on Thursday, December 29, 2022, spanning a duration of eight weeks. The program consisted of three training sessions per week, specifically on Sundays, Tuesdays, and Thursdays. The curriculum emphasized the enhancement and refinement of capabilities and offensive effectiveness. The researchers and the assistant work team provided supervision for the research sample; the following are elucidations pertaining to physical exercise:

First: General principles of exercises:

1. The main objective of preparing frequent exercises is to develop offensive capabilities and effectiveness .
2. The scientific sequence was taken into account in the priority of training the capabilities under study.
3. The recurring exercise management system is based on the station system (i.e. the player finishes the training station in all its details and then moves to the other station.
4. The researchers intended that the organization of stations within the exercises is different from one training unit to another in terms of sequence with the stability of the goal of that training in order to avoid boredom that afflicts learners due to the repetition of the continuous routine of training.
5. The proposed frequent method included force-specific exercises if applied in a manner that serves the development of the offensive effectiveness to be developed in the training unit.
6. The researchers took into account the gradation from easy to difficult, in addition to the use of guidance and follow-up for each station from exercise stations with frequent training.

Second: Principles of Exercises Integrated with Frequent Training:

1. The duration of the exercises is two months.
2. The training stage that fits the curriculum (special preparation stage) .
3. The number of training units per week is (3) units .
4. The total number of training units is (24) training units.
5. Training days (Sunday, Tuesday, Thursday).
6. The time of the main section is (45-85) minutes.
7. Type of training unit in terms of time (short and medium).
8. Use submaximum and maximum intensity.
9. The training method was used (high-intensity, recursive).
10. The average intensity of the experimental group was extracted to standardize the intensity and start with a single initiation line.
11. Gradient in increasing intensity weekly, where the researcher used the principle of gradient intensity incrementally.
12. The approach adopted comprehensiveness in the goal (explosive power, force characteristic of speed).
13. The researcher took into account the scientific foundations in the relationship between the components of the training load (intensity, size and comfort).

Post-Tests For the Research Sampl

The post-tests for the study sample were administered on Monday, February 1, 2022, in the hall of the Specialized Center. This was done after the completion of an 8-week period of curriculum implementation. The researchers ensured that the conditions and procedures for the pre-tests were followed.

RESULTS

Presentation, Analysis and Discussion of Results

Presentation and analysis of pre- and post-tests for the control group

Table 4: Shows the arithmetic means, standard deviations, and the calculated value of (T-test), and their statistical significance for the pre-posttests of the control group .

Variables	Unit of measurement	Pre-test		Post-test		T	Sig
		M	SD	M	SD		
Explosive power of the arms	Meter	6.97	0.92	7.81	0.53	2.88	0.004
The explosive power of the legs	Meter	1.20	2.60	1.25	2.07	5.97	0.004
Speed power of the arms	Reiteration	10	0.77	11.60	0.89	4.10	0.016
The power characteristic of the speed of the legs	Reiteration	9.20	0.83	10.40	0.0	5.12	0.011
Attack effectiveness	Degree	5.36	0.24	6.16	0.64	3.54	0.003

The results of the pre- and post-tests of the control group were analyzed using a statistical test for correlated samples (T-test). Table 4 presents these results, indicating significant differences between the pre- and post-tests of the control group. Specifically, the post-tests showed higher scores compared to the pre-tests, with a level of significance below 0.05.

Presentation and analysis of pre- and post-tests of the experimental group :

Table 5: Shows the arithmetic means, standard deviations, and the calculated value of (T-test), and their statistical significance for the pre-posttests of the experimental group .

Variables	Unit of measurement	Pre-test		Post-test		T	Sig
		M	SD	M	SD		
Explosive power of the arms	Meter	6.88	0.315	8.18	0.567	6.26	0.003
The explosive power of the legs	Meter	1.22	1.01	1.33	0.023	22.35	0.000
Speed power of the arms	Reiteration	10.60	0.894	12	1.41	5.71	0.005
The power characteristic of the speed of the legs	Reiteration	9.60	1.02	11	0.707	3.50	0.025
Attack effectiveness	Degree	5.49	0.98	7.94	1.45	6.89	0.000

The results of the pre- and post-tests for the experimental group were analyzed using the (T) test for correlated samples, as presented in Table 5. The statistical analysis revealed significant differences between the pre- and post-tests for the experimental group. Specifically, the post-tests yielded higher scores compared to the pre-tests, with a level of significance below 0.05.

Presentation and analysis of post-tests for the control and experimental groups:

Table 6: Shows the arithmetic means, standard deviations, and the calculated value of (T-test), and their statistical significance for the post-tests of the control and experimental groups .

Variables	Unit of measurement	Control		Experimental		T	Sig
		M	SD	M	SD		
Explosive power of the arms	Meter	7.81	0.53	8.18	0.567	3.58	0.002
The explosive power of the legs	Meter	1.25	2.07	1.33	0.023	7.07	0.000
Speed power of the arms	Reiteration	11.60	0.89	12	1.41	6.58	0.000
The power characteristic of the speed of the legs	Reiteration	10.40	0.0	11	0.707	4.98	0.001
Attack effectiveness	Degree	6.16	0.64	7.94	1.45	5.45	0.000

The results of the post-tests for the control and experimental groups were analyzed using the independent samples t-test, as shown in Table 6. The analysis revealed significant differences between the post-test scores of the control and experimental groups, with the experimental group performing better. This conclusion is supported by the level of significance being less than 0.05.

DISCUSSION OF RESULTS

The researchers posit that regular high-intensity training has the potential to enhance the development of various specific physical attributes, contingent upon the intensity of the exercise and the prescribed training schedule. This diversity in sports performance is considered a fundamental element in achieving a balanced physical integration (Peterson et al., 2008). Furthermore, it is suggested that such training also fosters an increased motivation to engage in further training, thus validating the initial hypothesis and aligning with the findings of the study. The researchers carefully considered various factors during the development of the training curriculum, including the proper progression of training, the effective execution of

exercises, and the understanding of the kinetic path involved in each exercise. This concept is discussed by Satyanarayana, Mohan, and Pallavi (2020), who emphasize that an individual's motor qualities significantly influence their level of performance. Regarding the explosive power and speed power characteristics, it is worth noting that there has been a discernible advancement and notable enhancement in the development of these attributes. Researchers attribute this progress to the influence of the curriculum on the cultivation of these traits, which in turn positively affects the proficiency of motor skills in the specific contexts being examined. This developmental process aligns with the inherent nature of muscle contraction during exercise performance. The researchers ascribe the sample's exceptional performance in developing physical characteristics to the efficacy of regular exercises prescribed for this purpose. Tahir and Hatim (2023) argue that special exercise is not a substitute for training but rather a crucial component that cannot be overlooked, playing a significant role during the period of specialized preparation. Furthermore, the implementation of high intensity and repetition protocols in scientific training, along with a frequency of three training sessions per week, significantly contributed to the advancement of the sample's development. The careful selection of exercises that align with the physical capabilities of the activity contributes to optimizing performance in the practiced activity. By utilizing standardized exercises that are suitable for the players' abilities and skills, the overall level of physical aptitude is enhanced, enabling them to effectively meet the demands of the sports activity being undertaken. The researchers posit that the efficacy of high-intensity frequent training lies in the quality of the exercises employed. These exercises, characterized by maximum or semi-maximum intensity, contribute to the development of speed-related strength in the leg and arm muscles. This development is crucial for athletes as they require the ability to swiftly execute motor skills that involve rapid and frequent muscle contractions specific to their specialized activities. Consequently, the relationship between force and speed, and the resulting strength characteristic of speed, plays a significant role in motor performance. When this relationship is maximized, whether in terms of strength or speed, it has a notable impact on the performance of the tool, such as a ball. Specifically, it enhances the speed at which the tool is launched, thereby increasing the likelihood of scoring points.

CONCLUSIONS

Based on the findings and further analysis, the researchers arrived at the following conclusions:

1. The high-intensity frequent exercises prepared by the researchers contributed to the development of some physical abilities of table tennis players.
2. The high-intensity frequent exercises prepared by the researchers contributed to the development of the attack effectiveness of table tennis players.

RECOMMENDATIONS

1. The use of high-intensity frequent exercises in the development of special physical abilities as well as the level of skill performance.
2. The need for trainers to pay attention to the development of physical and skill abilities of the youth category, who are the basis for the training process .

3. Emphasizing the abilities that have a direct impact on the accuracy of the player's skill performance during the training units.

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