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Effect of a training program using TRX ropes to develop the efficiency of the arm muscles in front crawl swimmers

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Abstract
The research seeks to ascertain the configuration of TRX rope exercises and assess their influence on certain factors. The muscular efficiency of the arms being studied in freestyle players. The researchers employed the experimental approach and selected a planned research sample comprising two control and experimental groups of Amarah Club and Almajar Alkabir Club players aged under 19 years for the sports season 2022/2023. A total of 20 players were included in the study, and they were evenly divided into two groups: an experimental group and a control group, each consisting of 10 players. The TRX rope training program was implemented for a duration of 8 weeks. Additionally, 4 players were selected for the exploratory experiment. The findings demonstrated that the suggested program had a beneficial impact on the arm muscle performance being studied. Moreover, the comparative analysis of improvement percentages indicated that the experimental group had more favorable results. An essential recommendation is to prioritise TRX attachment rope training based on the specific characteristics, patterns, and demands of each specialized sport, as it directly affects performance. Additionally, it is crucial to carefully consider the construction and design of TRX rope training, incorporating concepts, equipment, and techniques derived from the fundamental skills of various sports to the greatest extent possible.

Keywords: Training program, TRX ropes, efficiency, arm muscles, front crawl, swimmers

Introduction
The performance of sports motor skills is defined by the intricate and intricate nature of movement, whether it be during training or competition. When executing a specific motor task, involves the involvement of multiple joints and muscles working in unison to successfully accomplish the desired movement objective. Kos and Umek (2018) [23] argue that physical fitness is a crucial factor in swimming performance. It is particularly important in determining the outcome of competitions, especially when skill levels among players are similar. Swimming requires a wide range of physical abilities, which must be at a high level (Hulteen *et al*., 2018) [16]. These abilities include precise and fast movements, as well as the exertion of different forms and amounts of strength. Mountain exercises are widely recognized in the realm of fitness. Rope exercises involve keeping one limb (either hands or legs) stationary while performing movements such as knee bends, lifting weights from the ground, or pressing with the arms (Crowley, 2020) [9]. In these exercises, the feet remain fixed. On the other hand, stabbing exercises or jumping rope are considered open chain exercises. All exercises utilizing training devices are classified as closed chain exercises, in which one limb is consistently fixed during the execution (Oliva-Lozano & Muyor, 2020) [32]. It is important to note that in this type of exercise, individuals can surpass resistance or lift a load more effectively compared to open-chain exercises. Additionally, closed chain exercises allow for the isolation and independent training of specific muscles or muscle groups, separate from the engagement of other muscles (Kwok *et al*., 2021) [25]. Regarding exercises with an open chain, they provide greater freedom of movement for all limbs, such as jumping and skipping rope drills, various ball exercises, and certain Swedish exercises (Baechle & Earle, 2019) [6]. This allows individuals to diversify their workout routine, preventing monotony (Steel & Morrice-West, 2019) [39].

The researcher asserts that incorporating devices and tools into training processes, particularly for enhancing physical aspects, has become an essential prerequisite in various sports activities. This is due to their role in augmenting the efficacy and success of training. As a result, a training method known as suspended training (Total Body Resistance Exercise or TRX) has emerged (Schaffert *et al*., 2019) [38]. TRX utilizes a system of ropes and ligaments that enable athletes to work and train by exerting resistance against their own body weight. Campa *et al*., (2021) [8] and Marquina *et al*., (2021) [27] suggest that suspended training, a relatively new fitness training method, utilizes the body's own weight instead of gym equipment. Its primary goals are to enhance athletic performance and gain a competitive edge. This form of resistance training, which does not require weights, aims to develop muscle strength in various ways and is suitable for beginners (Jafari *et al*., 2022) [17]. This activity is distinguished by its simplicity and is not easily accomplished, since it may be measured on a scale from low to high intensity. Its purpose is to enhance balance, flexibility, coordination, and physical strength (Alhenawy, 2023) [3]. Pratt (2015) [35] asserts that attachment training is crucial for enhancing flexibility and stability, both in playgrounds and in daily life. Moreover, it is regarded as the most effective and versatile training tool, as it can be utilized in any location, at any time, and by anyone (Mohamed, 2016) [29]. Notably, the principles underlying its application differ from other exercises, as it involves the integration of the tool and the body as a unified entity. The process involves installing the device at the designated location and ensuring that the body makes contact with the ground (Garber *et al*., 2016) [13]. The workouts are specifically intended to target the muscles that are activated by the body's center of gravity during each training session (Janot *et al*., 2013) [18]. The researcher believes that this method of attachment exercises, combined with closed chain training, leads to more effective and efficient results in a shorter period of time compared to traditional programs lasting 30 minutes. This approach effectively enhances physical aspects and challenges the player to push their own abilities, while also promoting individual training - a key principle for achieving goals. The player solely relies on the resistance of their own body, completely independent of any assistance from teammates or other training equipment, a feature that is not commonly found in other training tools and technologies. Based on this premise, the researcher posits that utilizing the TRX pregnancy device for training purposes can yield numerous advantages and training improvements. Consequently, the researcher recognizes the significance of conducting this study to ascertain the impact of employing closed chain exercises with the TRX pregnancy device on specific physical variables in swimming.

The problem of the study

Swimming, like other sports, demands a high level of effort and relies on various interconnected factors (Morris *et al*., 2019) [30]. These factors include tailored training for optimal performance, the swimmer's physical and functional capabilities, the ability to execute proper technique, and the utilization of modern training methods (Lima-Borges *et al*., 2022) [26]. Crawling swimming on the abdomen, often known as freestyle, is a sort of competitive swimming that relies on the swimmer's ability to maintain a streamlined body position on the water's surface and generate forward propulsion (Andersen, 2019) [5]. The distribution of driving force in freestyle swimming is influenced by various studies, such as the research conducted by Mullen (2018) [31]. These studies suggest that approximately 80-85% of the driving force comes from the arms, while the legs contribute around 15-20%. It is worth noting that the arms are stronger than the legs, making them the primary source of propulsion in freestyle swimming. This information is supported by the expertise of swimming researchers in Misan Governorate, as well as coaches from Amarah Club and Almajar Alkabir Club. The researchers opted to execute a suggested training regimen aimed at enhancing arm muscular strength in freestyle swimming. The objective was to assess the program's influence on skill performance and digital achievement in freestyle at Amarah Club and Almajar Alkabir Club. Muscular strength plays a crucial role in executing motor tasks and developing other physical attributes. In freestyle swimming, the arms primarily facilitate forward movement and contribute significantly to overall balance. According to Guignard *et al*. (2019) [15], the key to improving a swimmer's speed is to enhance both the distance and frequency of arm movements. In a study conducted by Miyashita in 1975, it was discovered that there exists a strong positive association between the pulling power exerted solely by the arms and the swimming speed of individuals. Keiner *et al*., (2021) [22] discovered a strong positive association between the pulling power exerted by the arms and the swimmer's speed. Consequently, the researchers contemplated posing the following inquiry: Do the suggested specialized exercises have an influence on the enhancement of arm muscle strength in freestyle swimmers from Amarah Club and Almajar Alkabir Club?

Objective of the study

Design a training program using TRX ropes to develop the efficiency of the arm muscles in forward crawl swimmers.

Research hypotheses

1. There are statistically significant differences between the average pre- and post-measurement of the experimental group in the efficiency of the arm muscles of the front crawl swimmers.
2. There are rates of improvement between the mean of the two-dimensional measurements of the experimental group in the efficiency of the arm muscles of the forward crawl swimmers in favor of the telemetry.

Research Areas

Human Area

Players from Amarah Club and Almajar Alkabir Club, for the 2022/2023 sports season.

Spatial Area: Swimming Crane Land Entertainment Misan.

Temporal Area: Period from (1/6/2023) to (1/10/2023).

Research Methodology

The researchers employed the experimental technique to address the research topic, fulfil its aims, and test its hypotheses. The experimental design involved two groups: experimental and control groups. The measurement was conducted in both pre and post-tests.

Research Community
The research community represents the 19 youth players in Misan Governorate, namely the players from Amarah Club and Almajar Alkabir Club, for the 2022/2023 sports season.

Research Sample
The researchers intentionally chose a research sample consisting of 20 players from the Amarah Club and Almajar Alkabir Club under 19 young people. The sample was divided into two groups, each consisting of 10 players - one as the experimental group and the other as the control group.

Distribution of the members of the research sample
The researchers determined the extent to which the members of the control and experimental groups were balanced in terms of the following variables:
The study examines the growth rates of height, weight, and age, as well as other physical factors. Table (1) presents the findings of this research.

Table 1: Arithmetic mean, median, standard deviation and torsion coefficient of growth rates and physical variables under research for the control and experimental research groups (n = 20)

Variables	Unit of measurement	Experimental group			Control group		
		M	SD	Coefficient	M	SD	Coefficient
Age	Year	19.20	1.20	0.35	19.88	1.27	0.33
Height	Meters	1.75	0.07	0.08	1.73	0.09	0.09
Weight	Kg	77.60	8.72	0.25	76.66	9.04	0.24

The data presented in Table (1) shows that the torsion coefficient values for both the control and experimental groups were confined within a range of (3) to (3) for each growth rate being analyzed. This suggests that the distribution of players in those variables was moderate.

Therefore, the participants in the study were divided into two equal groups to ensure that the experimental and control groups had similar pre-tests of the variables being studied. To achieve this, the researchers utilized the independent samples t-test, as indicated in Table 2.

Table 2: Shows the results of the test (T) for equivalence on the pre-test between the members of the experimental and control groups in the muscular strength of the arms in freestyle swimming among swimmers of Amarah Club and Almajar Alkabir Club in Misan Governorate (n=20)

Variables	Unit of measurement	Control		Experimental		T	Sig
		M	SD	M	SD		
Aqla within (10) seconds	Repeat	5.24	0.93	5.20	0.76	0.850	0.001
Lifting the greatest weight	Kg	78.15	11.01	77.95	77.95	0.530	0.000
Freestyle Frequency arms	Repeat	37.49	2.07	36.88	36.88	0.120	0.001
Freestyle arms	M/Snd	1.11	0.18	1.14	1.14	0.080	0.002
Freestyle Full Compatibility	Second	19.72	2.25	20.01	2.33	0.110	0.000

Means of data collection
First: Arabic and foreign references
The researchers examined the specialized scientific references, including both Arabic and international works, that were relevant to the research topic. They aimed to utilize these references to enhance the quality of their own research.

First Exploratory Study
The preliminary investigation was carried out on the sample of preliminary research from Friday 16, 2023 to Saturday, June 17, 2023. The objective of this study was:
1. Verify the authenticity and reliability of the instruments and technologies utilized.
2. Familiarize yourself with the timing and duration of the tests.
3. Identifying scientific publications relevant to the study experiments on honesty and stability.

Second Exploratory Study
This study was conducted from Friday 23/6/2023 to Saturday 24/6/2019 to identify and address any challenges that the researcher may face during the application process. The goal was to resolve these obstacles prior to commencing the main experiment and ensure smooth execution. Attachment exercises are currently being researched. The initial three components of the exercises were tested on a sample of participants in an exploratory research study. The findings of the study showed:

1. The researcher ensured that the participants of the research sample comprehended the instructions for executing various workouts.
2. Comprehend and grasp the responsibilities and assignments of their assisting roles.
3. The optimal time for performing exercises was found to be immediately after the warm-up and prior to the main portion of the session, in order to align with the preparedness of the neurological and motor systems for carrying out the exercises.

Steps to carry out the research
Pre-tests
The researchers administered the pre-test to both the control and experimental groups on Friday and Saturday, June 23 and 24, 2017. The researcher ensured that all members of the research sample were tested in a consistent manner.

Implementation of the training content
The area series exercises were conducted using the proposed TRX rope device for a duration of 8 weeks, specifically during the team's general preparation period. The exercises started July 26, 2023 and concluded on August 29, 2023. The experimental group, which consisted of team members, underwent three training sessions per week on Sundays, Tuesdays, and Thursdays. During each session, the experimental group performed exercises on the TRX rope device as the experimental variable. These exercises were done at the beginning of each training session, immediately

after warming up. In contrast, the control group performed free exercises and sacked exercises openly, without any restrictions on the number of groups or repetitions, and without any specific intervals between groups. The exercises were performed collectively by the control group at the same time as the experimental group.

The training material and duration of the pilot program

The researchers utilized a pre-existing training program. The 6 Exercise Pro application is a specialist exercise software designed for sports training. It allows users to select exercises based on research and then train different body areas. Furthermore, apart from the warm-up exercises including the concept of divorce from external sources, the program includes a total of 70 training exercises, which are distributed as follows

- Strange warm-up using the beauty of attachment and its numbers (1) to (6).
- Abdominal exercises and their numbers from (7) to (14).
- Arm exercises and their numbers from (15) to (21).
- Thigh exercises and their numbers from (22) to (30) (65) (66).
- Lumbar exercises and their numbers from (31) to (33) (67) (68).
- Chest and shoulder exercises and their numbers from (34) to (64).
- Torso exercises and their numbers (69- 70).

The researchers carefully considered the exercise selection for the research, ensuring that they were arranged in a graded manner from easy to difficult and from simple to complex, based on the existing sequence.

Regarding the allocation of pregnancy components, the distribution is as follows

Prior to developing the program and implementing its functionality, the researcher considered the overarching principles and guidelines typically followed in the design of training programs. Additionally, they adhered to the specific principles and regulations that are typically considered when incorporating attachment training methods. The intensity of training is a crucial component of the training load, along with size, comfort, and intensity. It is determined by the degree of intensity, which is measured by the number of repetitions, rest periods between them, and the executed groups. The degree and strength of resistance in the exercises also play a role. TRX attachment ropes are influenced by the player's body weight and the constant force of gravity. These factors cannot be altered during the program. The researcher aims to standardize the workout by determining the volume of work and the desired number of repetitions, sets, and praise, while also considering the installation of the equipment. The speed of performance and implementation for each repeat is measured by the average time taken per repetition, as specified in the default instructions. Program 6 is a facial recognition software. The researcher successfully achieved the implementation and execution of the attachment activities being studied, as stated by Kosmata (2014) [24], who was:

When the training sessions consisted of certain groups and repetitions: During the first and second week of training, there is one repetition each set. In the third and fourth week, there are 8 repetitions assigned for each training session. Perform ten repetitions of each exercise during the fifth and sixth week of training. During weeks seven and eight, the training program consists of performing 12 repetitions for each exercise. The ninth and tenth week consist of two sets of 14 repetitions for each training session, totaling 14 repetitions in each set. The rest period between sets is a total cessation of activity lasting 25 seconds.

Vector Resistance Principle: Which is to increase resistance by moving the body away from the fulcrum of the device and then returning to the fulcrum.

Stability Principle: Which is to perform exercises based on one arm or one foot instead of relying on both legs.

Pendulum Principle: In which the movement depends on the shape of the pendulum of the clock, that is, moving away from the fulcrum of the device, then returning through the fulcrum, then moving to the other side from one side to the other side - from the front and then backwards.

Post-tests: The researchers conducted the post-test of the research sample on August 24th and 25th, 2023, using the same methodology, settings, and procedures as the pre-test.

Statistical treatments used in the research

The researchers collected, organized, and statistically analyzed the data using several statistical approaches. The results were then extracted and interpreted: arithmetic mean, standard deviation, torsion coefficient, correlation coefficient, T-test, percentage of improvement (change), at the level of significance (0.005).

Results

Presentation and discussion of results

Are there statistically significant differences, with a significance level of $\alpha \leq 0.05$, between the pre- and post-tests among the control group members in the influence of the proposed workouts on the variable of muscle strength of the arms in freestyle swimming among swimmers in the Almajar Alkabir Club? In order to determine the disparities between the pre- and post-tests among the individuals in the control group and address this inquiry, the researchers employed the Test-T-samples, as illustrated in Table 3.

Table 3: Test results (T) to indicate the differences between the pre **-**and post**-**tests among the members of the control group in the muscular strength of the arms in freestyle swimming among swimmers Almajar Alkabir Club n= (10)

Variables	Unit of measurement	Pre-test		Post-test		T	Sig
		M	SD	M	SD		
Aqla within (10) seconds	Repeat	5.18	0.76	5.74	1.02	2.16	0.005
Lifting the greatest weight	Kg	75.76	5.50	79.24	5.22	4.20	0.003
Freestyle Frequency arms	Repeat	33.15	1.79	37.49	1.72	4.23	0.003
Freestyle arms	M/Snd	1.02	0.04	1.10	0.06	6.11	0.005
Freestyle Full Compatibility	Second	20.94	1.16	19.54	1.32	5.04	0.005

*****df Significance level ($\alpha \leq 0.05$), tabular (3.25)

The results of Table (3) indicate that there are statistically significant differences, with a significance level of $\alpha \geq 0.05$, between the pre- and post-tests among the members of the experimental group. These differences favor the post-test in terms of muscular strength in the arms for freestyle swimming among swimmers at the Almajar Alkabir Club. These differences apply to all variables, and the percentage change of the variables is as follows: The maximum weight that can be lifted is 10.81% per second per watt per second, with a 4.63% increase. The frequency of arm movements in freestyle swimming is 13.09%. The arm movements in freestyle swimming account for 7.84% of the whole movement. The full compatibility of freestyle swimming is 7.16%. Overall, the findings of this study align with the findings of Massey *et al*. (2020) [28] and Puce *et al*. (2019) [36], which demonstrated a beneficial impact of the traditional program on the physical and skill variables among the control group participants. These effects were observed in the majority of individuals in the control group of the current study. The researcher posits that the cause of this phenomenon can be attributed to the inherent characteristics of the coach's conventional training program, the specific content implemented within it, the consistency of training sessions, and the regular practice of swimming. These factors collectively contribute to the development of certain fitness components in the player. They participated in an 8-week aquatic training program, which resulted in improvements in all studied variables except for mental performance. Mental performance improvement relies on efficient energy production in the oxygen system and the presence of strength endurance. It is worth noting that the percentage of improvement in mental performance was relatively small, ranging from 4.63% to 13.09%.

Second

Findings pertaining to the second inquiry Is there a statistically significant difference, with a significance level of $\alpha < 0.05$, between the pre- and post-tests of the experimental group members in terms of the influence of special exercises on the variable of arm muscular strength in freestyle swimming among swimmers from Al-Amara Sports Club? In order to address this inquiry and discern the disparities between the pre- and post-tests within the experimental group participants, the researchers employed the Test (T) for paired samples (Test-T-Paired), and the findings are depicted in Table (5).

Table 5: Test results (T) to indicate the differences between the pre-and post-tests among the experimental group members in the muscular strength of the arms in freestyle swimming among swimmers of Al-Amara Sports Club (n=10)

Variables	Unit of measurement	Pre-test		Post-test		T	Sig
		M	SD	M	SD		
Aqla within (10) seconds	Repeat	5.24	0.93	7.11	0.87	8.63	0.001
Lifting the greatest weight	Kg	78.51	11.01	87.32	10.70	7.83	0.000
Freestyle Frequency arms	Repeat	33.94	3.07	37.32	2.92	8.09	0.000
Freestyle arms	M/Snd	1.12	0.51	1.22	1.11	4.99	0.001
Freestyle Full Compatibility	Second	19.71	2.29	17.31	1.81	4.07	0.002

*Significance level ($\alpha \leq 0.05$), tabular (3.25)

The findings from Table (5) indicate that there are statistically significant disparities, with a significance level ($\alpha \geq 0.05$), between the pre- and post-tests among the participants in the experimental group. These differences favor the post-test in terms of muscular strength in the arms for freestyle swimming among the swimmers of Al-Amara Sports Club. These disparities are observed across all variables, and the percentage change for each variable is as follows: Weight during a 10-second interval increased by 35.68%. The maximum weight lifted on the bench was 11.12 kilograms. The freestyle swimming stroke was performed with both arms at a frequency of 9.95 times per unit of time. The arms were used in the freestyle stroke at a rate of 8.92 times per second. The freestyle stroke was executed with full compatibility at a rate of 13.86 times per second. The effective implementation of a well-designed TRX rope training program, along with carefully calibrated training loads that are appropriate for the age and stage of the research sample, has demonstrated its positive impact on enhancing physical capabilities. Consistent training, conducted with measured intensity and optimal rest periods between repetitions, leads to significant improvements in performance as outlined in the proposed research program. The study posits that this enhancement is both rational and inherent, as it enhances physical capacities through the external stress imposed by TRX rope training, a suitable method for improving and cultivating physical abilities. According to Garber *et al*. (2016) [13], TRX rope training has various applications, including its use in sports injury rehabilitation clinics, gyms, and military organizations. In various activities and sports, there is a practice of enhancing physical fitness and reducing the risk of sports injuries. This is achieved through modifying exercises by adjusting the load, muscular stability, and implementation on different sides of the body. Additionally, exercises can target either the upper or lower body. The findings of the present investigation align with prior investigations accessible to the researcher, including the study conducted by Steven Sealer. Elashram *et al*. (2024) [10] and Gaedtke and Morat (2015) [12] both concluded that the proposed programs utilizing TRX rope exercises are beneficial. It is evident from the above information that all physical and skill variables have shown significant improvement. This is attributed to the implementation of the suggested specialized exercises on the participants of the experimental group. These exercises primarily targeted the enhancement of various aspects related to the swimmer's performance and timing, with a particular emphasis on strengthening the arm muscles. The arm movements contribute around 85-70% of the propulsive forces that propel the body forward in the water during freestyle swimming (Kadhim, Salman & Hammad, 2018) [19], and in a manner the findings of this study align with the findings of previous studies conducted by Eskiyecek *et al*. (2020) [11], Al-Fassih *et al*. (2022) [2], and Omar (2024) [3], all of which unanimously concluded that the proposed training program had a favorable influence on the participants in the experimental group.

Third

The findings pertaining to the third inquiry Are there any statistically significant differences, with a significance level of $\alpha \leq 0.05$, in the post-test results between the members of the experimental and control groups regarding the impact of the proposed special exercises on the variable of arm muscle strength in freestyle swimming at Al-Amara Sports Club and Almajar Alkabir Club? In order to address this inquiry, the Test T samples were utilized, and the findings presented in Table 6 demonstrate this.

Table 6: Shows the results of the test (T) to indicate the differences in the post-test between the members of the experimental and control groups in the muscular strength of the arms in free swimming at Al-Amara Sports Club and the Almajar Alkabir Club (n = 20)

Variables	Unit of measurement	Control		Experimental		T	Sig
		M	SD	M	SD		
Aqla within (10) seconds	Repeat	5.74	1.02	7.11	0.87	3.94	0.001
Lifting the greatest weight	Kg	79.24	5.22	87.32	10.70	2.24	0.000
Freestyle Frequency arms	Repeat	37.49	1.72	37.32	2.92	3.22	0.001
Freestyle arms	M/Snd	1.10	1.06	1.22	1.11	2.27	0.002
Freestyle Full Compatibility	Second	19.54	1.32	17.31	1.81	3.68	0.000

*Significance level ($\alpha \leq 0.05$), tabular (2.84), df (20)

The findings from Table (6) demonstrate that there are statistically significant disparities, with a significance level of $\alpha \geq 0.05$, in the post-test results between the participants of the experimental and control groups. These differences favor the members of the experimental group across all variables related to muscular strength in the arms during free swimming among swimmers from Al-Amara Sports Club and Almajar Alkabir Club.

The researcher attributed the greater improvement rates observed in the experimental group compared to the control group to the adaptation process resulting from the regular training with TRX rope exercises. This training had a positive effect on the physical test results in the experimental group, as opposed to the control group. The researcher attributes this to the beneficial effects of the TRX rope exercises being studied. These exercises have been found to enhance physical qualities by considering various dynamic movements and their impact on specific muscle groups. As a result, the experimental group showed improved fitness elements compared to other groups. The program may consist of numerous exercises using varied and intricate motor pathways. These workouts prioritize individual performance and are defined by a diversified composition, suspense, and incentive towards achieving optimal physical performance. As a result, there was a beneficial effect on all the physical characteristics being studied. The experimental group showed greater improvements in both the average scores of the post-tests and the rates of improvement compared to the control group. This aligns with the inherent qualities and attributes of closed chain exercises, which enable the isolation of specific muscles or muscle groups for independent training. This objective is accomplished by carefully creating and selecting TRX rope exercises that target specific muscle areas (abdomen / arms / thighs / lumbar region / chest and shoulders / torso). The findings of the present investigation align with the research conducted by Elashraml *et al*. (2024) [10] and Garber *et al*. (2016) [13], which demonstrated an enhancement in arm muscular strength with push-up training utilizing TRX ropes, as opposed to using weights for the same training. According to Butrameev and Konovalov (2021) [7], TRX rope training has gained popularity among athletes as a training approach that is both enthusiastic and successful in enhancing performance. One of its purposes is to enhance joint mobility and flexibility by mitigating the effects of gravity and facilitating movement. This method enhances the efficiency of joint training by allowing for a complete range of motion while performing exercises at a slow pace. It also provides the option to gradually increase the level of difficulty during training, resulting in improved joint flexibility that cannot be attained through other training methods or tools. Additionally, it is regarded as a crucial instrument for training profound sensory receptors. Proprioception training involves performing closed motor chain exercises on non-fixed surfaces to stimulate deep sensory receptors within skeletal muscle groups. This type of training replicates the effects of repeated training using tools such as foam rubber foam rollers, balance plates, and other equipment designed to improve balance and motor stability.

Conclusion

Within the limits of the research problem and its importance, in light of its objective ,hypotheses ,and the nature of the sample, and in the framework of statistical treatments, interpretation and discussion of the results, the researcher was able to reach the following conclusions*:*

1. The proposed exercises have positive effects with a clear indication of the development and development of muscular strength of the arms.
2. The proposed exercises used by the experimental group led to the development of the physical variables under study and significantly outperformed the traditional program.
3. Exercises with rubber ropes are somewhat similar in that they affect the pressure exerted on the muscles while performing a crawling swim on the abdomen.
4. The validity of the proposed special exercises in the development of physical and skill variables in addition to the muscular strength of players in swimming.

Recommendations

In light of the objectives and results of the study ,the researcher recommends the following

1. Giving the muscles of the arms great importance when developing training programs for their direct impact and raises the level of achievement.
2. Circulating the results of the current study to swimming coaches, and providing values and references for the measurements under study to evaluate the training programs and the training situation.
3. Using the proposed training program in the development of physical variables among the student majoring in swimming in universities, club swimmers and elite.

4. Conducting studies similar to the current study on various other team and individual games to study the effectiveness of the proposed training program in developing the physical and skill variables of swimmers.
5. Conducting studies similar to the current study on different age groups and for both sexes.

References

1. Al Behadili HJH, Kasim MA. Effects of a training program for the plyometric on the harmonic abilities and muscular ability of football players. European Journal of Interdisciplinary Research and Development. 2022;6:60-69.
2. Al-Fassih R, Fashi M, Ahmadizad S, Abuzari N. The effect of four weeks of total-body resistance training (TRX) on muscular function and performance of young female swimmers. Journal of Sport and Exercise Physiology. 2022;15(1):21-32.
3. Alhenawy SM. Eight weeks of TRX suspension training effects on muscular power and performance level of some kip skills in gymnastics. The International Scientific Journal of Physical Education and Sport Sciences. 2023;11(1):95-114.
4. Ali HFS, Kasim MA. The effect of using the cooperative learning and blended learning method in improving the level of students' performance in learning volleyball for secondary school students. American Journal of Interdisciplinary Research and Development. 2022;11:231-242.
5. Andersen JT. Movement characteristics of front crawl swimming at sprint pace and middle-distance pace: establishing demands on the torso muscles [Doctoral dissertation]. 2019.
6. Baechle TR, Earle RW. Weight training: steps to success. Human Kinetics; c2019.
7. Butrameev AV, Konovalov VN. Motor abilities training of 9-11-year-old track-and-field athletes with the use of the conjugate influence method. Modern Issues of Biomedicine. 2021;5(3):134.
8. Campa F, Schoenfeld BJ, Marini E, Stagi S, Mauro M, Toselli S, *et al*. Effects of a 12-week suspension versus traditional resistance training program on body composition, bioimpedance vector patterns, and handgrip strength in older men: A randomized controlled trial. Nutrients. 2021;13(7):2267.
9. Crowley E. The specificity of dry-land resistance training exercises to swimming performance [Doctoral dissertation]. University of Limerick; c2020.
10. Elashram NM, El Shafay P, Amin A, Ebrahim MB. The effect of training using TRX ropes on some physical variables of female wrestlers. Journal of Theories and Applications of Physical Education Sport Sciences. 2024;10(1):1-16.
11. Eskiyecek CG, Gül M, Meşeci B, Gül GK. The effect of upper extremity TRX training on the number of strokes and swimming degrees in 10-12 year swimmers. International Journal of Applied Exercise Physiology. 2020;9(6):39-48.
12. Gaedtke A, Morat T. TRX suspension training: a new functional training approach for older adults-development, training control and feasibility. International Journal of Exercise Science. 2015;8(3):224.
13. Garber M, Johnson K, Henry R, Robichaud K. Effect of TRX equipment use on muscle activation in an overweight and obese population. Modern University Sport Science. 2016;47.
14. Guignard B, Rouard A, Chollet D, Bonifazi M, Dalla Vedova D, Hart J, *et al*. Coordination dynamics of upper limbs in swimming: effects of speed and fluid flow manipulation. Research Quarterly for Exercise and Sport. 2020;91(3):433-444.
15. Guignard B, Rouard A, Chollet D, Bonifazi M, Dalla Vedova D, Hart J, *et al*. Upper to lower limb coordination dynamics in swimming depending on swimming speed and aquatic environment manipulations. Motor Control. 2019;23(3):418-442.
16. Hulteen RM, Morgan PJ, Barnett LM, Stodden DF, Lubans DR. Development of foundational movement skills: a conceptual model for physical activity across the lifespan. Sports Medicine. 2018;48:1533-1540.
17. Jafari F, Asgari N, Askari MH, Hekmatipour N, Roodposhti ME. The effect of total-body resistance exercise on muscle endurance of female students. International Journal of Medical Investigation. 2022;11(2):83-92.
18. Janot J, Heltne T, Welles C, Riedl J, Anderson H, Howard A, *et al*. Effects of TRX versus traditional resistance training programs on measures of muscular performance in adults. Journal of Fitness Research. 2013;2(2):23-38.
19. Kadhim TH, Salman SH, Hammad AF. Use modern techniques and applications to recognize the relation of the driving force of the arms and legs with the athletic achievement of the swimmer 50 m chests. 2018.
20. Kasim MA. Effects of together learning on university students to achievement motivation. Open Access Repository. 2022;8(5):57-65.
21. Kasim MA. Evaluation implementing cooperative learning in Physical Education College programs to basic handball skills learning in universities Iraqi. ResearchJet Journal of Analysis and Inventions. 2022;3(4):289-297.
22. Keiner M, Wirth K, Fuhrmann S, Kunz M, Hartmann H, Haff GG, *et al*. The influence of upper-and lower-body maximum strength on swim block start, turn, and overall swim performance in sprint swimming. The Journal of Strength & Conditioning Research. 2021;35(10):2839-2845.
23. Kos A, Umek A. Wearable sensor devices for prevention and rehabilitation in healthcare: swimming exercise with real-time therapist feedback. IEEE Internet of Things Journal. 2018;6(2):1331-1341.
24. Kosmata A. Functional exercise training with the TRX suspension trainer in a dysfunctional, elderly population [Doctoral dissertation]. Appalachian State University; 2014.
25. Kwok WY, So BCL, Tse DHT, Ng SSM. A systematic review and meta-analysis: biomechanical evaluation of the effectiveness of strength and conditioning training programs on front crawl swimming performance. Journal of Sports Science & Medicine. 2021;20(4):564.
26. Lima-Borges DS, Portilho NO, Araújo DS, Ravagnani CFC, Almeida JA. Anthropometry and physical performance in swimmers of different styles. Science & Sports. 2022;37(7):542-551.

27. Marquina M, Lorenzo-Calvo J, Rivilla-García J, García-Aliaga A, Refoyo Roman I. Effects on strength, power and speed execution using exercise balls, semi-sphere balance balls and suspension training devices: a systematic review. International Journal of Environmental Research and Public Health. 2021;18(3):1026.
28. Massey H, Kandala N, Davis C, Harper M, Gorczynski P, Denton H, *et al*. Mood and well-being of novice open water swimmers and controls during an introductory outdoor swimming programme: A feasibility study. Lifestyle Medicine. 2020;1(2):e12.
29. Mohamed TS. Effect of TRX suspension training as a prevention program to avoid the shoulder pain for swimmers. Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health. 2016, 16(2).
30. Morris KS, Jenkins DG, Osborne MA, Rynne SB, Shephard ME, Skinner TL, *et al*. The role of the upper and lower limbs in front crawl swimming: the thoughts and practices of expert high-performance swimming coaches. International Journal of Sports Science & Coaching. 2019;14(5):629-638.
31. Mullen JG. Swimming science: optimum performance in the water. Ivy Press; c2018.
32. Oliva-Lozano JM, Muyor JM. Core muscle activity during physical fitness exercises: a systematic review. International Journal of Environmental Research and Public Health. 2020;17(12):4306.
33. Omar FH. Effect of TRX suspension training on technical performance for artistic swimming figures. International Journal of Sports Science and Arts. 2024;26(1):7-19.
34. Popowych K. Partner workouts: training together for better results. Human Kinetics; c2021.
35. Pratt B. The complete guide to suspended fitness training. Bloomsbury Publishing; c2015.
36. Puce L, Marinelli L, Girtler NG, Pallecchi I, Mori L, Simonini M, *et al*. Self-perceived psychophysical well-being of young competitive swimmers with physical or intellectual impairment. Perceptual and Motor Skills. 2019;126(5):862-885.
37. Salih MMM, Hashim RS, Kasim MA. Forecasting achievement sports through cooperative learning in handball training in physical education. Annals of Applied Sport Science. 2021, 9(3).
38. Schaffert N, Engel A, Schlüter S, Mattes K. The sound of the underwater dolphin-kick: developing real-time audio feedback in swimming. Displays. 2019;59:53-62.
39. Steel C, Morrice-West A. A survey of trainers on the use of swimming and other water-based exercise for thoroughbred racehorses in Australia. Comparative Exercise Physiology. 2019;15(3):149-156.