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The effectiveness of specialized exercises in enhancing certain physiological variables and achieving success in the 100 m freestyle

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Abstract

The research aimed to understand the effectiveness of exercises that include various tools and aids. These exercises, conducted both on land and in water, focus on improving the achievement of the 100 m freestyle swimming distance, as well as the index of forced exhalation per second and vital capacity. This is achieved through various resistances in the water against the body's forward movement and on land. The study investigates the impact of these resistances, the different tools used, and their effect on completing the 100 m freestyle distance. To achieve the goal of the study, ten participants who continued to train with the swimming coach were deliberately selected .

They were divided into two teams, consisting of five male and five female swimmers. Both teams performed the training curriculum prepared by their coach. However, the research group, in addition to the coach's curriculum, performed various exercises on the water floor, utilizing aids that were incorporated into their daily training units. The researcher conducted pre- and post-tests over an 8-week period, with three training sessions per week. The results obtained were statistically analyzed for both groups. The researcher found that the time taken to complete the 100 m freestyle swimming distance improved in the group that included the platform and auxiliary tools during their exercise performance, in addition to enhancing the efficiency of physiological variables.

As a result, the researcher suggested introducing a variety of tools during the course. Additionally, the significance of land and water training with auxiliary methods and their effect on increasing body efficiency and accomplishment level are highlighted.

Keywords:

100 m freestyle, exercise, land and water.

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1: Definition of Research:

1-1: Introduction and Importance of Research:

The use of various methods in training has resulted in a qualitative transition by determining the appropriate type of training, the exercises used, and the training tools. These tools help to enhance physical and physiological fitness, achieving the lowest time and the highest score for each stage of the race. This is accomplished through the use of body weight and various weights out of the water, as well as fins, resistance paddles, rubber bands, and other equipment that increase resistance during training.

Thus, the basic qualities required for each of the swimming sport events are developed. Specific types of training, such as training with speed resistors, are used to enhance speed for short and medium races. Understanding physiological variables is essential to assess the effectiveness of exercise at the physical level. Physiological variables provide precise answers to any imbalances in performance and the onset of fatigue. This knowledge allows for the identification of the long-term impact of the training curriculum.

Additionally, the importance of training physiology lies in providing the coach with a realistic picture of the athlete's true capabilities and abilities. By conducting tests to quantify the training load, including heart rate measurements, coaches can determine the level of intensity of the physical load from a physiological perspective.

Where there is a direct relationship between the heartbeat (pulse) and physical loads, a low-intensity pregnancy has a pulse rate of less than 130 beats per minute. When the heart rate increases further, this load becomes the maximum load.

The 100-meter freestyle swimming event is one that requires both physical and physiological efficiency, particularly in the heart's ability to deliver oxygen to all parts of the body and remove carbon dioxide. Additionally, the volume of forced exhalation in the first second is an important indicator that reflects the adequacy of the respiratory system. To achieve a clear understanding of the respiratory system, it is necessary to know the vital capacity of the lungs, which indicates how well the lungs adapt to physical exertion.

The requirements for swimming differ from those in other sports events due to the unique medium in which the body moves, necessitating a force to overcome the resistance of water. Therefore, swimming demands high physiological and physical efficiency. The importance of this research lies in understanding the effectiveness of exercise in enhancing the efficiency of the heart and respiratory system, particularly in the context of the 100-meter freestyle swimming event for students.

1-2: The Problem of Research:

This study was conducted by a university professor specializing in swimming. He also monitors the results of sports clubs in swimming, analyzing test outcomes to determine who will participate in upcoming events. It was observed that there was a significant time to complete the 100 m freestyle. One reason for the subpar performance was the reliance on traditional training methods. Furthermore, the swimmer's time was viewed as the sole indicator of their potential for success, neglecting the importance of diversifying training methods, introducing

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auxiliary tools, and utilizing physiological variables as indicators to assess the effectiveness of the exercises. In addition to the distance time, it is crucial to align this with the level of development in swimming race times.

This approach is vital for evaluating training curricula aimed at enhancing performance by reducing swimming distance times. Consequently, the researcher developed various exercises to improve physiological efficiency and to enhance the completion of the required distance, which had previously not met desired results.

1-3: Research Objectives:

- Identify the effectiveness of exercises with aids in achieving swimming performance in the 100 m freestyle.
- Identify the effectiveness of assisted exercises in improving physiological variables.

1-4: Research Assignments:

- There are significant differences in the development of race distance time in the distance tests, favoring the experimental group in the 100 m freestyle swimming event.
- There is a positive effect of auxiliary means as a tool to increase endurance and, consequently, enhance the efficiency of physiological variables.

1-5: Research Areas:

1-5-1: Human Field: A sample of swimmers from the Middle Euphrates clubs.

1-5-2: Mandatory Period: From 5/9/2023 to 5/11/2023.

1-5-3: Spatial Area: Marina indoor swimming pool (Babylon Governorate) (50 m).

2 -: Research Methodology and Field Procedures:

2.1: The Method Used:

The corresponding experimental method was employed to address the problem.

2.1.1: Research Sample:

The research sample was selected using the intentional method. It comprised 10 swimmers specializing in the 100 m freestyle. Based on the characteristics of the research sample, the researcher divided them into two groups: the first experimental group and the second control group. Each group consisted of 5 swimmers, determined by the average time achieved and the standard deviation from the pre-test in the 100 m freestyle. This selection was made randomly. In selecting the research sample, the researcher considered the homogeneity of the members in both groups concerning the research tests.

The homogeneity of these variables was assessed using appropriate statistical methods. The research subjects in these tests were equivalent to the tribal tests, allowing the search to commence from a common point for both groups, as illustrated in Table 1.

Table (1)
Displays the equivalence and homogeneity between the two research groups

Test	Unity	experimental unit		is controlled		F	sig	T	sig.	The significance
		S	A	S	A					
HRrest	%	70.50.50	0.776	70.700.700	1.14	0.550	0.476	0.316	0.762	gerdal
VC	L	4.55	0.26	4.53	0.23	0.001	0.976	0.083	0.939	non-Dal
FEV1	%	89.170	1.052	88.18.180	0.674	0.152	0.306	0.519	0.168	Non d
100m	MD / s	62,50,50	1.53	62,15	1.29	0.157	0.703	0.931	0.382	non-d

Morale 0.05 and degrees of freedom 8.

The table demonstrates that there are no significant differences between the variables under investigation, which serves as a starting point for the experiment.

2.2: Research Devices and Tools:

A - An electronic watch.

B - The work team.

C - Swimming paddles.

D - Different weights.

E - Resting heart rate measuring device (jumper-type device), German-made.

F - Electric spirometer device (spirometer).

2.3. Field Research Procedures:

Testing and measuring are some of the most essential procedures employed in scientific study. With their assistance, the relevant information is gathered and used in research and studies. They provide solutions to many of the issues confronting scientific advancement.

- 100-meter freestyle swimming test:

The test is done when the laboratory has warmed up for 15 minutes and rested properly. Following that, the freestyle swimming event takes place over a 100-meter course at top pace. During the test with the study sample, the researcher considered the competitive element. To verify that the participants swam the distance at their maximum pace, each of the four students was tested independently.

- Measurement of Physiological Variables:

A. Heart Rate Measurement:

The heart rate was measured using a medical device (jumper) for all subjects during rest time before performing any physical effort.

Test Method:

The method of measuring the heartbeat with the JUMPER device is one of the simple and common procedures. It was conducted using this German-made device.

- ❖ To begin, raise the palm open at the level of the heart.
- ❖ Next, open the clip and place a finger on the rubber pads of the clip (ensure the finger is positioned correctly).
- ❖ Then, insert the index finger into the device.
- ❖ Do not shake the finger and remain comfortable during the operation.
- ❖ At the same time, it is not recommended for the human body to move.
- ❖ Finally, obtain information directly from the display screen.
- ❖ This device provides a simultaneous reading of heart rate and oxygen saturation.

B - Measurement of Vital Capacity

- ❖ Vital capacity is measured using a spirometer.
- ❖ The tester stands opposite the device and places the hose into their mouth while standing.
- ❖ Then, they take an introductory inhale and exhale naturally and fairly deeply 1 to 3 times.
- ❖ After that, they inhale the largest amount of air possible.
- ❖ The patient then exhales as forcefully as possible into the tube of the device. Three attempts are allowed, and the best result is chosen.

C-measuring the volume of forced exhalation for the first second

This variable is assessed after the stage of complete hospitalization and rest. After downloading the information about the swimmer performing the test, a pinch is applied above the swimmer's nose to prevent breathing through the mouth via a tube connected to the device. The swimmer is then instructed to breathe deeply and exhale as quickly and forcefully as possible into the tube. The duration of exhalation must be at least six seconds for the device to function correctly. This test is typically repeated three times, with the best result from the three tests considered a measurement of lung function. The device will also measure the air volume in liters for the first second; the maximum blowing volume in one second is recorded, and then the device analyzes the information. The extracted capacities are displayed on the screen relative to the height and weight of the laboratory subject, and from three attempts, the best result is chosen.

2-4: Pre-tests:

The researcher and assistant team conducted tribal tests on May 9, 2023, at the Marina Water City closed swimming pool in the 100m freestyle event. They measured and recorded physiological variables related to the research. All members of the research sample underwent physiological testing simultaneously due to the gadgets' ability to provide data in real-time. After eight weeks of training, the remote testing of the two groups of the research sample was conducted on May 11, 2023, and the attained timings were recorded. The identical techniques were used to conduct the pre-tests.

2.4.1: Stomach Exercises :-

The researcher initiated the exercises using swimming paddles and rubber flippers. In addition to various weights outside the pool, these were incorporated into the training curriculum to enhance the resistance faced by the swimmer during their forward progression.

In the introduction of exercises and in accordance with the nature of the sample, both groups implemented the training curriculum in all its details except for one paragraph. Specifically, the experimental group utilized exercises with auxiliary equipment as outlined in Appendix (1).

The training curriculum spanned (8) weeks with three training sessions per week. The training volume ranged from (1500m) to (2500m) by the end of the seventh week. Gradually, the training loads were reduced in preparation for the post-test of the research sample. Additionally, the experimental group performed exercises with auxiliary equipment while executing the training vocabulary that permeated the program. This included a set of repetitions ranging from (450m) to (500m) in the form of repetitions (2×9×25m) or (10×50m) freestyle swimming, with intensity levels close to or exceeding those experienced during championship races.

Meanwhile, the control group performed the same exercises prepared by the same coach in swimming. These exercises included resistance training with weights in the water and an underwater arena using weighted tools, such as a weight load or ankle weights. Competitions were also conducted among the research sample, utilizing the fins of the feet once and the palms of the hands once.

2-5: Statistical Tools:

SPSS-20 was used to output the results:

- ❖ Arithmetic mean.
- ❖ Standard deviation.
- ❖ T-test for similar or equivalent samples.
- ❖ T-test for different samples.
- ❖ Levene's test.

Table (2)

The arithmetic mean (X), the standard deviation (P), and the value (V) between the two pre-tests of the control group for the variables under consideration

Variables		Unit used	before		and after		the calculated value (V)	sig	Statistical significance
			S	A	S	A			
Physiological variables	HRrest	HRrest N / D	70.50.50	0.776	67.20.20	0.70	13.79.79	0.000	significant
	VC	L	4.55	0.26	5.200	1.027	8.08	0.001	
	Fev1	%	89.170	1.052	104.061	4.272	7.42	0.002	
physical	100m free	D/tha	62.50.50	1.53	54.8.81	1.10	5.4.44	0.54	moral

By analyzing Table (2), we see that all tests are significant in the pre-and post-measurement, as the level of significance in each is less than (0.05), favoring the post-test.

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Table (3)
The arithmetic mean (X) and (V) calculated, tabulated, and denoting the differences between the results of the dimensional tests of the variables under consideration for the experimental and control groups

The variables examined		Units	are pre		dimensional-units		(V) calculated	sig	The denotation
			S	A	S	A			
functional	variables	HRrest(n/d)	70.700.700	1.14	69.40.40	1.130	3.501	0.015	significant
	VC	liters	4.53	0.23	4.88	0.68	3.26	0.021	
	FEV1	%	88.18.180	0.674	90.400.400	3.749	5.123	0.006	
skill	100m freestyle	D / s	62,15	1.29	60.50.50	0.54	3.51	0.51	

Through the analysis of Table (3), we find that all tests are significant in telemetry, with the level of significance in each being less than (0.05), favoring the experimental test.

3: Results, Analysis, and Discussion:

3-1: Presentation of Results.

To confirm that the research objectives have been met by understanding the impact of exercise, it is essential to assess the performance level of the research sample in physiological variables and 100m freestyle swimming, as well as to ascertain the degree of dispersion from the average performance level in that test, represented by the standard deviation. This enables the researcher to detect, diagnose, and predict through the following tables:

Table (4)
The arithmetic mean (X), the standard deviation (P), and the value (V) between the pre- and post-tests of the experimental group in the variables under consideration.

Variables		Units	experimental		control units		T	sig	Semantics
			S	A	S	A			
Functionalism	HRrest	N/M	67.20.20	0.70	69.4040	1.130	4.001	0.004	Moral
	semantic CV	l	5.200	1.027	4.88	0.68	3.65	0.009	
	FEV1	%	104.061	4.272	90.400.400	3.749	2.621	0.031	
physical variable physical	100m free	M/S	54.8.81	1.10	60.50.50	0.54	6.224	0.000 moral	Moral

By analyzing Table (4), it is clear that all tests are significant in the pre- and post-measurements, as the level of significance in all cases is less than (0.05) and favors the post-test.

3 - 2: Discussion of Test Results:

Tables (2) and (3) indicate a significant difference in physiological variables. Besides the time taken for the 100 m freestyle swimming race in the pre- and post-tests, the experimental group showed notable benefits. The researcher attributes this to the effectiveness of the exercises, which clearly influenced the development of the swimmers' physiological and physical abilities, thereby affecting their race performance.

The researcher highlighted that the diversity of training vocabulary and the variety of exercises using aids, such as swimming paddles and other tools, contributed to an increase in the swimmers' efficiency.

According to Maglischo (2003), exercises that utilize various training methods to develop specific traits should be characterized by movement and speed similarities to those seen in competition. This was implemented by the experimental group during their training for the race distance, which included exercises designed within the training curriculum. Furthermore, this approach significantly impacted training adaptation and improved performance times.

The clear effectiveness of using auxiliary means was apparent. Simple or supportive situations involve utilizing aids to achieve speed, as well as employing the disability method. Any use of resistors in training, such as swimming exercises with resistors in the water, tools used during

training, swimming while wearing clothes, carrying weights, or using a weighted doll, proves beneficial.

Furthermore, swimming paddles, foot fins, and a buoyancy plate also add resistance during training for the swimmer, which consequently leads to an improvement in the performance time of the experimental group.

This enhancement was clearly demonstrated by the statistical significance in the results of the experimental group's pre- and post-tests concerning the performance time variable. There was an increase in the level of achievement in the 100m freestyle.

The calculated value of (t) for both groups exceeded the tabular value of (T), indicating a clear impact of the training method used when implementing the components of the training curricula.

With what Miyashita (1975) noted, "there is a high positive correlation between the tensile strength of only the arms and the speed of swimming." According to Conselman (1980), "the maximum efficiency of propulsion in water is achieved by pushing a large amount of water for the longest possible distance."

The researcher finds that the increased load achieved through the use of swimming paws has met the goal of their use. This explains why the performance level improved as a result of loading the experimental group. In addition, the resistance experienced by the swimmer increased compared to the load in the control group.

Regarding the results of physiological variables, pulse measurements at rest showed significant differences between the pre- and post-tests, favoring the post-test. This improvement is attributed to the sample's response to the effectiveness of exercise in developing this variable. The results indicated a clear improvement in heart rate. Additionally, the most notable development was the decrease in the pulse rate of the research sample at rest, as well as a quicker return to normal after exertion.

This indicates an enhancement in the respiratory system. Furthermore, the improvement in stroke rate contributed to an increase in the volume of blood delivered to the working muscles, along with the necessary percentage of oxygen required to perform physical exertion without fatigue.

Muhammad Ali a-cat has noted that several changes occur in the circulatory system during rest, including:

- Changes in heart size.
- A decrease in heart rate.
- An increase in stroke volume.
- An increase in blood and hemoglobin levels.

Debris highlighted that regular training conditions the heart for exertion. This results in a lower resting heart rate and a more efficient response to varying loads compared to individuals who do not exercise regularly. This is attributed to the increase in stroke volume and the enhanced efficiency from one heartbeat to the next.

Sparring confirmed that the heart adapts during rest and quickly returns to normal during exertion. This is particularly noticeable among endurance and stamina athletes.

The gradient in exercise difficulty, from easy to hard, plays a crucial role in developing and applying exercises effectively for optimal results. Basil Abdul-Mahdi states, "The principle of gradation in building athletic physical abilities is closely tied to difficulty gradation." This

principle demonstrates that varying exercise intensity influences lung volume, positively impacting FEV1. These physiological changes indicate the swimmer's ability to enhance respiratory capacity through exhalation and inhalation. To counteract water resistance that constrains chest expansion during inhalation and hampers exhaled air, improving respiratory muscle efficiency is essential.

Monitoring inhalation, exhalation, and limb movements is essential in swimming training. Increasing lung volume enhances energy production and minimizes resistance for swimmers.

Raissan Khoraibet highlighted that deep, controlled breathing is vital for improving external respiration. Targeted exercises can boost vital capacity, leading to greater respiratory efficiency by enabling the lungs to take in more air due to increased elasticity of the pectoral muscles and rib cage.

Supporting this, Devries (1980) (Backman & Hervath) found that after four months of consistent training, swimmers experienced increased lung volume and capacity, as evidenced by reduced residual lung air.These findings indicate that this training approach positively affects the Vital Capacity Index, an important measure of respiratory function.

4: Conclusions and Recommendations:

4.1: Conclusions:

By reviewing the test results, the researcher arrived at the following conclusions:

1. The implementation of the vocabulary training prepared by the researcher has positively affected muscle strength, which helped propel the body forward and thus reduced the time for the 100-meter freestyle swimming distance.
2. There is a clear discrepancy between the results of the experimental and control groups in the 100-meter freestyle distance test, favoring the experimental group.
3. A noticeable improvement was observed in the physiological parameters of the experimental group that utilized special exercises.

4.2: Recommendations:

1. Emphasize the importance of variety in exercises using auxiliary means in swimming during training, as it has a direct impact on improving achievement levels.
2. Special exercises should be incorporated as an aid in training, as they are essential for enhancing the physiological efficiency of the body.

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Supplements

Training Modules Form

Sunday

Warm-up	200m freestyle+100m+ 4×50m	Continuous swimming time 10 min – heart rate 120-150 P/M
Swim bearing	6 ×100m (25m right + 25m left) use of swimming raft + 50m swimming	Periody – 2 minutes (performance + rest) intensity 75%*
	6×50 + 50m between each repetition of light swimming	Recursive 120 s (performance + rest) intensity up to 90%
	4×100m only two men	3.5 min (performance + comfort) 70% intensity
Overload	(8×50m) using swimmer's paws	Maximum intensity 120 sec(comfort + work) maximum intensity
	200m Gradient Light Swim	Continuous swimming time 3 m intensity below average
volume	2150 m	

Tuesday

Warm-up	200m freestyle + 100 swimming raft)	Continuous swimming time 10 min. pulse up to 160
Swim bearing	8×50m (25m right+25m left) pull arms buckle ropes	– 90 s (performance + rest) 80% intensity
Capacity Development	2(8×25m) Use of swimming paws	Max intensity 80s (performance + rest) maximum intensity
Swim bearing	4 ×100m only two legs fins	2. D (performance + comfort) intensity 78%
Anaerobic threshold	2 ×100m	Recursive 90s (performance + rest) sub maximum intensity
healing	2×100m mounting (increased distance travel time per iteration)	9 minutes intensity 55%
volume	1700 m	

Thursday

Warm	200m (50 Freestyle 50 m Butterfly 50 m Back 50 m Breast)	Continuous swimming time 12 min. pulse up to 160
Swim bearing	8 ×100 m (25 m) pull arms paws swim + 50 m swimming	2 minutes (performance + rest) intensity 80%
Lactic Training	4 (6×25 PM) Freestyle	120s (Performance + Comfort) + 4m 90% Intensity
Swim bearing	4×100m only two legs fins	3D (Performance + Comfort) 80% intensity
Overload Training	(4×50m) Use of swimmer's paws	Max intensity 120s (performance + work) maximum
Hospital	200m Light Descending Swim	Continuous swimming time 8 min
volume	2500m	