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The Effect of Snorkel Training on Respiratory Circulatory Adequacy and 100m Freestyle Achievement Level

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ABSTRACT

The aim of this study was to identify the effect of snorkeling on respiratory system adequacy and the level of achievement of 100 meters freestyle among budding swimmers. The experimental method with an experimental design based on both groups (experimental and control) was used to suit the nature of the research. The study sample consisted of (12) emerging swimmers, who were randomly divided into two equal groups: an experimental group (n=6) who underwent training using snorkel, and a control group (n=6) I used the traditional method without snorkeling, and the experiment lasted for 8 weeks with 3 training units per week.

The following variables were measured before and after the implementation of the training curriculum: cardiorespiratory endurance using the swimming test (PWC170), maximum oxygen consumption (VO2max), maximum exhalation capacity (PEF), forced expiratory volume in the first second (FEV1), as well as the completion time of the 100-meter freestyle.

The results of the statistical analysis showed that there were statistically significant differences between the pre- and post-measurements in favor of the experimental group in all variables, which indicates that the use of snorkeling had a positive effect on developing the efficiency of the respiratory circulatory system and improving the time performance of the 100-meter freestyle race, and the study recommends the inclusion of snorkel training within the training curricula directed to emerging swimmers because of its effectiveness in developing physiological indicators, performance and level of achievement .

Introduction:

Swimming is one of the sports that relies heavily on the functional efficiency of the circulatory and respiratory systems, due to the delicate balance between physical effort and the provision of oxygen to the working muscles. The 100-meter freestyle is a short race that combines strength, speed and short endurance, making training of swimmers in breathing techniques and aerobic control one of the key factors in improving performance.

In the modern sports field, it has become necessary to introduce auxiliary training methods that contribute to the development of sports performance at the technical and physiological levels. Among these methods, the training snorkel stands out, a breathing tube that is fixed in the middle of the face, and is used to allow swimmers to breathe from the mouth while swimming without the need to turn the head, and a hole is a plastic tube with a thickness of (0.5-0.1) cm and a width of (19-23) and an appropriate length of (35-45) cm from the center of the mouthpiece to the end end, and equipped with ejection valves and the upper end of the snorkel is open diagonally or with a lip Round, and fixed with a clip in the form of a metal ring with a rubber band attached to the head of the swim, and the end of the tube is placed in the swimmer's mouth while swimming and the other end is tilted out of the water. (ابراهيم, نهى يحيى، 2016)

Physical capacity at a pulse of 170 (PWC170) is an important indirect indicator used to assess the efficiency of the circulatory respiratory system, as measured by the amount of mechanical capacity an individual can exert when their heart rate is 170 beats/minute. This value is used as an indicator of cardiorespiratory endurance and the efficiency of delivering oxygen to the muscles.

Maximum oxygen consumption (VO2max) is one of the most important direct indicators of an individual's aerobic efficiency and expresses the maximum amount of oxygen that the body can consume during intense exercise. This value increases as the efficiency of the cardiorespiratory and muscular systems improves.

One of the most important indicators that reflect the efficiency of the respiratory system are: PEF (Peak Expiratory Flow), which is the maximum exhalatory flow that an individual can achieve when forced exhalation, and it is an indicator of the strength of the exhalation muscles and the speed of air flow from the lungs, which is related to the effectiveness of the elimination of carbon dioxide during physical

exertion, and (Forced Expiratory Volume in 1second) FEV1 is the volume of air that can be forcibly expelled during the first second of exhalation, and is an accurate measure of the efficiency and capacity of the airways, and their ability to adapt to the requirements of high performance, these two indicators (PEF and FEV1) together represent the cornerstone of the assessment of lung efficiency, and enable the measurement of improvement in the efficiency of pulmonary ventilation after training programs, especially those that involve a repetitive respiratory load such as in snorkel training.

The achievement of the 100-meter freestyle is one of the most important indicators used to evaluate the competitive performance of swimmers, as it reflects the ability to combine top speed, technical control, and short endurance. This achievement is seen as a direct result of the integration of physical and physiological fitness elements, foremost among which is the efficiency of the respiratory circulatory system.

The researcher reviewed the previous studies that used snorkel as a training tool, such as a study entitled (The Effect of Training Using Snorkel in Swimming on the Development of Endurance and Digital Achievement), and the most important results were that training using the Snorkel tool led to an improvement in both physical variables and digital achievement, and he conducted a study entitled (The Effect of Using a Breathing Tube (Snorkel) in Swimming Training on the Efficiency of the Respiratory Circulatory System and the Digital Achievement of 12-Year-Old Swimmers) and the most important results were It is an improvement in the level of digital achievement of swimming the 400m abdominal crawl, as well as an improvement in the measurements of the efficiency of the respiratory circulatory system.(2009 ،مصطفى محمود احمد ,دويدار)(2012 ،هيثم ماهر حسين ,البلك)

One of the foreign studies was a study entitled (Pulmonary Ventilation Response in the Use of Air Produced by Snorkeling), the most important results were an increase in the volume of breathing and carbon dioxide, and a study entitled (The Use of Snorkel in Swimming on Metabolic Tests) and the most important results were a substantial effect on all respiratory functions and the maximum oxygen consumption in swimmers.(Kayserilio A.S toklu, 2003)(keskinen, Rodrigues k.l., 2008)

These studies emphasize the importance of incorporating tools such as snorkeling into swimming training curricula, but most of them focused on the working effects without a direct link between the efficiency of the circulatory respiratory system of

swimming and the level of achievement in speed races, which is what this research seeks to explore systematically.

The importance of the research lies in the preparation of a proposed training curriculum that carries with it the possibility of improving the efficiency of the circulatory respiratory system, which is represented by (physical adequacy for swimming at pulse 170 PWC170, maximum oxygen consumption VO2 max, maximum exhalatory flow PEF, forced expiratory volume in the first second FEV1) and the level of achievement of 100 m freestyle swimming through the use of a breathing tube (snorkel), hoping that this study will contribute to helping trainers build more effective curricula using simple tools such as snorkeling without the need for expensive techniques, so the researcher decided to delve into this topic and benefit from the results of this study and employ it in a way that serves the training process and develop the level of achievement of 100 m freestyle, as a scientific addition in this field.

Research Problem:

The junior stage is one of the critical and essential stages in the training of swimmers, as it builds physical, skillful, and physiological abilities that are the basis for future development at the higher levels. Many coaches face challenges related to the development of respiratory and cyclic efficiency in this category, especially in sprint races such as the 100-meter freestyle, which require a high balance between aerobic and anaerobic endurance, as well as technical proficiency in performance.

Through the field observation of the researcher being a teacher of swimming and sports physiology at the university, and reviewing with the coaches of the National Center for Sport Talent in Baghdad, it was found that there is a relative weakness in the respiratory and cyclic efficiency of some young swimmers, which reflects negatively on their performance in the 100-meter freestyle. It was also noted that the use of assistive training aids, including the snorkel, is limited, despite the great benefits of this tool in improving the quality of the snorkel. Physical and physiological performance.

Based on this, the research problem is determined by the following question:

What is the effect of snorkeling training on the efficiency of the respiratory system and the level of achievement of the 100 meters freestyle among the juniors of the National Center for Sports Talent in Baghdad?

Research Objectives:

1- To identify the effect of snorkeling training on improving (Physical Fitness of Swimming at Pulse 170 PWC170, Maximum Oxygen Consumption VO2 max , Maximum Exhalation Flow PEF, Forced Exhalation Volume in the First Second FEV1).
2- Identify the impact of snorkeling training on improving the level of achievement of the 100m freestyle.

Research Hypotheses:

1. There are statistically significant differences between the pre- and post-measurement of the experimental and control groups and in favor of the dimensional measurement in the variables (PWC170, VO2 max , PEF, FEV1).
2. There are statistically significant differences between the pre- and post-measurement in the level of achievement of the 100 m freestyle.
3. There are statistically significant differences between the dimensional measurements of the experimental and control groups and in favor of the experimental group in the variables (PWC170, VO2 max , PEF, FEV1).
4. There are statistically significant differences between the dimensional measurements of the experimental and control groups and in favor of the experimental group at the level of achievement of the 100m freestyle.

Research Terms:

- **Snorkel:** A tube that allows a swimmer to breathe in the water without lifting his face out of the water.
- **Physical Adequacy (PWC):** It means "the adequacy of the productivity of the circulatory and respiratory systems, blood and muscle adequacy on oxygen consumption and energy production" (Abul Ela Ahmed & Mohamed Sobhi, 1997).
- **Pulse Rate 170 (PWC170):** This test stands for PWC170 and the number 170 indicates the amount of physical load that can be performed when the heart rate is 170 beats/minute. (Abul Ela Ahmed & Mohammad Sobhi, 1997)
- **Maximum Oxygen Consumption (VO2max):** The measurement of the maximum amount of oxygen consumed per person per minute is one of the measurements used to determine physical adequacy in terms of aerobic capacity, and the result of this measurement is expressed as the term Maximum Oxygen Consumption (Abul Ela Ahmed & Ahmed Nasreddine, 2003), **(VO2max),** which is "the maximum rate of oxygen consumed in liters per minute." Bahaa El-Din Salameh, 1999).
- **Peak Exhalatory Flow (PEF):** It is the maximum expiratory speed of a person, measured by a peak flow meter, which is a small handheld device used to monitor a person's ability to expel air, measures the flow of air

through the airways, thus determining the degree of obstruction in them, the peak expiratory flow is usually measured in units of liters per minute l/d.

- **Forced Exhalation Volume (FEV):** The volume of air that an individual can exhale during forced breathing in seconds, usually represented by FEV , **Forced Exhalation Volume in One Second (FEV1):** This is the maximum amount of air a person can forcibly expel during the first second after maximum inhalation.

Research Procedures:

Research Methodology:

"The method is that intellectual organization that overlaps in the scientific study or it is the intellectual steps that the researcher has to solve a certain problem", the researcher adopted the experimental method by designing the experimental and control groups, "as experimentation is a method to detect the causal relationships between phenomena", and by the method of pre- and post-tests to suit the nature of the research problem.(مهند عبد الستار عبد الهادي ، وسن حنون علي، 2009)(الشوك، 2008)

Research Sample:

"The goals set by the researcher for his research and the procedures he will use will determine the nature of the sample he will choose", as the research sample was deliberately selected from the swimmers of the Specialized Center for the Care of Sports Talent in Baghdad, and the sample consisted of 24 swimmers under the age of 16, as it consisted of 8 swimmers to conduct the survey experiment, 4 swimmers who were excluded due to irregularity in training, and 12 swimmers to conduct the main experiment, and the sample was randomly divided into two groups:(مهند عبد الستار عبد الهادي ، وسن حنون علي، 2009)

- 6 Swimmers for the experimental group: Snorkel training was used.
- 6 swimmers for the control group: Exercises were used without snorkeling.

Then the researcher managed the equivalence of the morphological and physiological research variables and the level of achievement of the 100 m freestyle, and Table (1) shows that

Table (1)
The Significance of the Differences between the Experimental and Control Groups in the Pre-Measurement of the Equivalence Procedure for the Research Variables

***The tabular t-value is 2.228 at the significance level of 0.05.**

It is clear from Table (1) that there are no statistically significant differences between the experimental and control groups, which indicates the equality of the research sample in morphological and physiological variables and the achievement of the 100m freestyle.

Data Collection Tools and Tools:

"It is the means through which the researcher can collect data and solve the problem to achieve the research goals, regardless of those tools, such as data, samples, and devices" The researcher relied on the use of the following tools: (digital clock, tape measure, medical scale, snorkel tool, floating boards, restameter device, device, spirometer) (كريم، 2009)Symbicort) with the help of three assistants.

Measurements used in the research:

1. **Physical Fitness by Swimming at Pulse 170(PWC170):** (الخفاجي, وفاء صباح محمد، 2005)

Measurement Procedures:

Two lambs of different intensity are used in swimming as follows: See Appendix (1)

Significance Level	Calculated t* value	Control Group		Experimental Group		Unit of Measurement	Variabl
		on	Going to	on	Going to		
Non-D	0.78	4.01	15	4.35	15.5	year	lifetim
Non-D	0.29	3.56	164	3.86	165.5	poison	Length
Non-D	1.24	5.88	57.1	6.14	58.5	kg	Weigh
Non-D	0.22	0.49	3.5	0.40	3.40	year	Trainin Age
Non-D	0.31	0.67	1.05	0.84	1.00	Kgm/s	PWC17
Non-D	1.08	56.5	3288	75.81	3242	MeltTir/M/S	VO2ma
Non-D	1.31	4.98	289.5	4.74	280.9	L/min	PEF
Non-D	0.18	0.27	0.90	0.101	0.88	litre	FEV1
Non-D	1.38	5.30	72.5	5.99	72.20	second	Complet of 100 r xfree ya

1. **First load**: The laboratory swims at a regular speed of (200) meters, so that the average of each (50) meters is in the range of (50-60) seconds, thus the total time to mute (200) meters is from (3.20 – 4) minutes.

- At the end of the pregnancy performance, the heart rate is recorded by palpation to determine the pulse rate of the carotid cervical artery within the first (5) seconds after the performance ends.
- Measure the load performance time with the stopwatch.
- Rest between the two pregnants from (3.5 – 5) minutes.

Second Load: The laboratory performs a distance of (300) meters swimming at a slightly higher speed than the first load, so that the average time of each (50) meter is in the range of (40 – 50) seconds, so that the total time to mute the distance is (3.20 – 5) minutes.

- At the end of the second pregnancy, your heart rate is also recorded in the same way.

2. The speed of transmission is extracted by dividing the distance by time for the first load and the second load.
3. We use the $PWC_{equation\ 170}$ (V) and it is measured in meters/second.
4. We use the $PWC_{equation\ 170}$ (V) and it is measured in meters/second.

$$PWC170\ (V) = V1 + (V2 - V1) \times \frac{170 - F1}{F2 - F1} \quad \text{.....(1)}$$

where: $V1 = = \frac{\text{Distance (1) 200m}}{\text{Time (1) N1 s}}$ and at a pulse rate of F_1 after the first pregnancy

$V2 = \frac{\text{Distance (2) 300m}}{\text{Time (2) } n_2 \text{ seconds}} =$ and at a pulse rate of F_2 after the second pregnancy

- The higher the equation output, the better the swimmer's physical fitness state.

2. Maximum Oxygen Consumption VO2max : (الخفاجي, وفاء صباح محمد، 2005)

Maximum oxygen consumption (VO2max) is measured indirectly using Karpman's endurance equation to measure aerobic capacity to normal levels that depend on the physical work adequacy of swimming at pulse 0170 PWC170 (V).

VO2 max = 1.7 X PWC170 (V) + 1240 …….(1)

3. Bioamplitude measurements: This was done using a Symbicort (dry) spirometer to identify the following variables:

- **Peak Exhalatory Flow (PEF):** The highest forced expiratory flow measured by the peak flow meter.
- **Forced Exhalation Volume per Second (FEV1):** This is the dynamic oG volume of forced exhalation from the first second, and is an indicator of the strength of the breathing muscles and the integrity of the pulmonary system

4. Measuring the level of achievement of 100 m freestyle.

The first reconnaissance experiment :

An exploratory experiment is "a miniature experiment of the basic experiment and must meet the same conditions as the main experiment as possible in order to obtain its results." (2009 ،الدليمـي)، The first survey experiment was conducted for the purpose of applying the measurements of the research variables, on Tuesday, 24/12/2024, at nine o'clock in the morning at the Al-Qadisiyah swimming pool in Baghdad, on a sample of 8 swimmers from juniors under 16 years old who were registered in the National Center for the Care of Sports Talent in Baghdad, who were excluded from the main experiment sample, and the goal of the experiment was to identify the difficulties that may face the researcher, discover and address the deficiencies, and ensure the validity of the tools. The devices used in the research, and the renewal of the time spent on making the measurements, as well as training on how to use the breathing instrument (snorkel), training the assistant team, distributing them to work, and conducting scientific transactions for the measurements used in the research.

The Second Survey Experiment:

The second survey experiment was conducted on the second day of the first survey experiment on the same sample and on the time and place of making the same measurements, and the aim of this experiment was to implement the vocabulary of snorkel training, i.e. the application of a complete training unit, in order to know the number, time, intensity of exercises and the duration of rest, and to discover the shortcomings in the application of the proposed method and try to avoid them, and the researcher believes that it is important not to start the main experiment before confirming. Completely from the safety and correctness of all the procedures set up.

Scientific Parameters of the Measurements Used:

The researcher applied the scientific parameters to the sample of 8 swimmers, as the scientific parameters were previously applied to measure physical fitness by swimming at a pulse of 170. (PWC170) And the maximum Hajj for the consumption of oxygen (VO2max) In the researcher's doctoral study in 2005, where it was applied for the first time in Qatar to hypoxic training, and it obtained high scientific results of treatments.(2005 ،الخفاجي, وفاء صباح محمد)

- **Honesty:** The researcher followed the method of self-truthfulness, and it is measured by means of the square root of the test stability coefficient. , as shown in Table (2).(1999 ،باهي)
- **Constancy:** The researcher applied the physiological and physical measurements of the research variables and then re-encircled them again after a period of one week from the first application, and found that the measurements have a high degree of stability, as shown in Table (2).(1995 ،حسانين)
- **Objectivity:** Since the measurements used in the research are easy, clear, uninterpretable, and far from self-evaluation through what the results of the stability coefficient (Pearson correlation) showed, the measurements used in the research are highly objective.

Table (2)

Shows the correlation coefficient of physical physiological measurements between the first and second application to know the stability of the thias and the second objective

Tabular T Value*	Self-Honesty Factor	Stability Coefficient	Unit of Measurement	Variables	
0.81	0.95	0.91	Kgm/s	PWC170	1
	0.98	0.96	Milliliters/m/s	VO2max	2
	0.97	0.95	L/D	PEF	3
	0.96	0.94	litre	FEV1	4
	0.93	0.88	second	Achievement of the 100m freestyle	5

*** At a degree of freedom (n-2) and a significance level (0.05).**

It is clear from Table (2) that there is a significant correlation between the application of the measurements and their reapplication, which indicates that the measurements used are highly consistent.

Tribal Measurements:

The pre-measurements of the research sample, which are (12) swimmers from the National Center for Sports Talent Care, were conducted on Thursday, 2/1/2025, as the measurements were conducted at the Al-Qadisiyah swimming pool in Baghdad Governorate.

Main Experience:

The researcher prepared the proposed training curriculum using (snorkel) exercises, and added some updates based on his experience as a teacher of the subject of swimming and physiology, as well as following up on modern scientific sources, especially (the Internet), and benefiting from some opinions of experts and specialists in the field of sports training, see Appendix (2).

The snorkel exercises were prepared taking into account the age stage and skill level of the National Center for the Care of Sporting Talent Juniors under 16 years old, as the breathing tube was used for the experimental group, while the control group did not use a breathing tool (snorkel), and the researcher supervised the training of the two groups under the same conditions to control the variables that may affect the results of the research.

The application of the snorkel training curriculum took from 4/1/2025 to 26/2/2025 for 8 weeks, with 3 training units per week, with a total of 24 training

units, each training unit takes about (45-60) minutes, and in the special preparation stage, focusing on the use of the breathing tube (snorkel) to improve the efficiency of the respiratory system and the level of achievement of 100 m freestyle, and the researcher took into account how to use the snorkel as follows:

- Start with simple exercises: We start with short exercises that focus on breathing and relaxation.
- Focus on underwater exhalation: Make sure to expel all the air underwater in the form of bubbles to avoid carbon dioxide buildup.
- Gradual training: Gradually increasing the duration and intensity of exercises to improve endurance.

General Structure of the Training Module:

General and private warm-up (10-15 minutes): Various swimming, no tools (100-200 m), flexibility exercises and activation of the breathing muscles, out-of-water breathing and aerobic control exercises.

The main part with snorkeling (35–40 minutes): Gradually gradual by week and includes:
Arm and Snorkel Kicking Exercises, Air Endurance Exercises with Snorkel, Partial Speed Swims with Snorkel (25m, 50m), Light Resistance Training (Using a Plank with Snorkel)
Cooling down (5–10 minutes): light swimming without snorkeling, **relaxation** breathing exercises and stretching.

Time Scale in Training Load:

Main Part Content Using Snorkel	Main Objective	The week
Static Technical Exercises - Short Swims 25–50m	Snorkel Adaptation - Improve Posture and Breathing	1-2
50–75m swimmers – gradually reduce rest	Developing Respiratory Efficiency and Aerobic Endurance	3-4
Medium Swim Training (75-100m) – Speed Split Training	Raising the pneumatic voltage intensity and technical speed	5-6
Full 100m Swim – Race Simulation with Snorkel – Trial Test	Competitive swimming and performance stimulation	7-8

Dimensional measurements:

After the completion of the application of the snorkel exercises, the dimensional measurements of the physiological and physical variables were conducted on Saturday, 1/3/2025, and the researcher was keen to meet the same conditions in which the pre-measurements were conducted in terms of place, time, tools, method of implementing the measurements and calculating the scores in the presence of the same assistant team.

Statistical Methods:

The researcher used the appropriate statistical methods that serve the research as follows:

- Arithmetic Mean - Standard Deviation - Pearson's Law of Simple Correlation
- T . test law for contrasting samples - T. test law for independent samples.
-

View Results:

Table (3)
The significance of the differences between the pre- and post-measurements of the experimental and control groups in the variables (FEV1, PEF, VO2max, PWC170)

Significance Level	Tabular T*value	Calculated t-value	P.H.	P	Collection	Unit of Measurement	Va
D Moral	2.571	3.14	0.07	0.22	Experimental	Kgm/s	P
D Moral		3.33	0.03	0.1	Officer		
D Moral		2.61	455	1190	Experimental	Milliliters/m/s	V
D Moral		2.80	197	552	Officer		
D Moral		2.66	5504	147.81	Experimental	L/D	
D Moral		2.91	23.11	67.4	Officer		
D Moral		2.65	0.44	1.17	Experimental	litre	
D Moral		3.30	0.23	0.76	Officer		

*** At a degree of freedom (6-1) = 5 and a significance level of (0.05).**

It is clear from Table (3) that there are statistically significant differences between the pre- and post-measurements of the experimental and control groups in the variables (FEV1, PEF, VO2max, PWC170) in favor of the dimensional measurement, as the calculated t-value was higher than the tabular t-value at the degree of freedom of 5 and the significance level of 0.05.

Table (4)

The significance of the differences between the pre- and post-measurements of the experimental and control groups in the level of achievement 100m Freestyle

Significance Level	Tabular T*value	Calculated t-value	P.H.	P	Collection	Unit of Measurement	Vari
D Moral	2.571	3.40	1.85	6.3	Experimental	second	Achiev of 1 free
D Moral		3.13	0.99	3.1	Officer		

*** At a degree of freedom (6-1) = 5 and a significance level of (0.05).**

It is clear from Table (4) that there are statistically significant differences between the pre- and post-measurements of the experimental and control groups in the level of achievement of the 100 m freestyle swimming for juniors under 16 years old and in favor of the telemetry, as the calculated t-value was higher than the tabular t-value at the degree of freedom of 5 and the significance level of 0.05.

Table (5)

The significance of the differences between the experimental and control groups in the dimensional measurement of variables (FEV1, PEF, VO2max, PWC170)

- **The tabular t-value is 2.228 at a degree of freedom (12-2) = 10 and a significance level of 0.05.**

It is clear from Table (5) that there are statistically significant differences between the experimental and control groups in the results of the variables (FEV1, PEF, VO2max, PWC170) and in favor of the experimental group, as the calculated t-value was higher than the tabular t-value at 10 degrees of freedom and the significance level of 0.05.

Table (6)

The significance of the differences between the experimental and control groups in the telemetry of the level of achievement of the 100m freestyle

- **The tabular t-value is 2.228 at a degree of freedom (12-2) = 10 and a significance level of 0.05.**

Significance Level	Calculated t* value	Control Group		Experimental Group		Unit of Measurement	Variables	t
		on	Going to	on	Going to			
D Moral	2.31	0.53	1.09	0.33	1.22	Kgm/s	**PWC170**	1
D Moral	16.06	59.23	3840	68.14	4432	MeltTir/M/S	**VO2max**	2
D Moral	4.20	28.90	35609	30.25	428.71	L/min	**PEF**	3
D Moral	2.47	0.14	1.75	0.48	2.05	litre	**FEV1**	4

It is clear from Table (6) that there are statistically significant differences between the experimental and control groups in the level of achievement of 100 m freestyle swimming and in favor of the experimental group, as the calculated t-value was higher than the tabular t-value at 10 degrees of freedom and the significance level of 0.05.

Significance Level	Calculated t* value	Control Group		Experimental Group		Unit of Measurement	Variables	t
		on	Going to	on	Going to			
D Moral	6.47	28.13	70.89	30.37	65.9	second	**Achievement of 100m freestyle**	1

Mixed Results:

It is clear from the results presented in Tables (3 and 4) that show the differences between the averages of tribal and post-tribal measurements, that there is a difference between the pre- and post-measurements of the experimental and control

groups in favor of the dimensional measurements of the variables (FEV1, PEF, VO2max, PWC170) and the level of achievement of 100 m freestyle, i.e. the two groups have achieved their goal in the moral effect on improving the efficiency of the respiratory circulatory system and the level of achievement of 100 m freestyle swimming despite the appearance of differences in the percentages of The improvement between them, i.e., a significant improvement in morality occurred despite the different exercise methods followed by the experimental and control groups, and this achieves the first and second hypotheses of the research, and the researcher attributes these results to many factors, including:

- The effect and effectiveness of the proposed snorkel exercises and the approved exercises without snorkel in improving the level of respiratory system adequacy and the level of achievement of 100 m freestyle, so the success of educational or training exercises is measured by the extent of progress achieved by the athlete in the type of activity practiced through the skill, physical and physiological level, and this depends on the adaptation achieved by the individual to the program he applies. The researcher believes that the various and continuous exercises that the control group performs with the experimental group at the same time and the same training, but without the use of the snorkel tool, caused the development and improvement of the achievement of swimmers under 16 years old.(القط، 2005)
- The effectiveness of training on the assistive tools used in the water to improve and develop the level of respiratory system adequacy and the level of achievement of the 100 m freestyle in the experimental and control groups, as it has been proven by experiment that the effect of using these different types of means then affects the digital level that develops and advances as a result of the improvement of performance specifications (technique). He also stressed that "the technical auxiliary tools used in the water contribute to raising the efficiency of the swimmer's own and ensure full mobilization and functionality."(الخفاجي, وفاء صباح محمد، 2000)(راتب، 1999)
- The success of the process of organizing the proposed and approved exercises in a scientific way, especially the snorkel training, which affected the increase in the physiological ability of the swimmer through the imprinting of his organs on the optimal performance, as the structured training results in an increase in the ability of the individual as a result of performing the exercises for several days, weeks or months, and this is the way the body systems are imprinted on the optimal performance of those exercises, and to be more economical in the performance of the intensity of the work. .(الخفاجي, وفاء صباح محمد، 2000)
- The success of the adaptation process that occurred to the sample members of the emerging swimmers under 16 years during the implementation of the exercises for 8 weeks and at the rate of 3 training units per week and the balance of the sample members had a clear effect on the level of imprinting of the functional devices significantly for the experimental and control groups, and thus improving the level of achievement, if the swimmer trains for a certain period and regularly, we find that he can travel a certain distance for the same time that he was achieving at the

beginning. The program does not exert great effort or shows the same high degree of changes that it appeared in at the beginning of the program, and this explains the success of the adaptation process through the successful educational-training program and its sound plans. (1994 ، الفتاح، تدريب السباحة للمستويات العليا)

- The success of the method of using repetition as an educational and training method and an effective and effective approach in the implementation of the proposed exercises (snorkeling) and approved exercises (without snorkeling), "the more repetition of the skill, the more automatic it becomes, the less tension decreases, and the movement becomes more perfect and efficient."(1988 ،امين)

- The results presented in Tables (5 and 6) that show the differences between the mean of the dimensional measurements, show that there are differences between the dimensional measurements between the experimental and control groups and in favor of the experimental group of variables (FEV1, PEF, VO2max, PWC170) and the level of achievement of 100 m freestyle, i.e. the experimental group has achieved its goal in the moral effect on improving the adequacy of the respiratory cycle and the level of achievement of 100 m freestyle swimming is better than the control group, and this confirms the third and fourth hypotheses. For research.

The researcher attributes these results to the contribution of the training method represented by snorkel training, as it had a clear effect on the development of the results of the physical sufficiency value of swimming at pulse 170 (PWC170This is to improve the work of the heart and blood circulation, which leads to the development of the guest state of the cardiovascular system physiologically, this is what he pointed out that "regular sports training clearly affects the hospitality adequacy of the cardiovascular system, and with the improvement of the functional status, the athlete is able to perform the greatest work with the energy economy exerted", and experiments have shown that "physical adequacy increases its level in relation to increasing the efficiency of the circulatory system", in addition to " The equation product of the swimming physical adequacy test at the pulse is 170 (PWC170)(حسين، 1991)(محمد حسن علاوي ، ابو العلا عبد احمد الفتاح، 2000) This indicates an improvement in the physical fitness of the swimmer, and this is what we see in the results of the research. (2000 ،محمد حسن علاوي ، ابو العلا عبد احمد الفتاح)

Improve the results of (PWC170) plays an important role in improving many physiological variables and the skill performance of swimmers, as it emphasizes that "improving physical efficiency leads to improving pulse rates and increasing the ability of the heart muscle to pump the largest amount of oxygenated blood during performance, and adds that higher physical efficiency contributes to improving the skill performance of swimmers." (2000 ،محمد)

Since (PWC170) is one of the tests for predicting maximum oxygen consumption (VO2maxTherefore, the increase in its level expresses the improvement of the body's ability to consume oxygen, as it confirms that "physical efficiency is related to the increase in the maximum consumption of oxygen and its delivery processes to the working muscles", and for the maximum oxygen consumption, it has required an improvement in physical efficiency and the fitness of the respiratory system, and

the possibility of swimmers continuing to perform high-intensity loads during the test to reach a pulse rate of 170 beats/minute, as it is stated that the efficiency of physical performance ((Passett & Howley, 2000)(1997 ،خريبط)PWC170) is directly proportional to the amount of mechanical work that the athlete is able to accomplish with high intensity."

The researcher attributes regularity in swimming training, especially snorkeling exercises, which leads to an improvement in the efficiency of the circulatory and respiratory systems, which is reflected in the improvement of the maximum oxygen consumption (VO2max"Since regularity in swimming training gives the athlete's body some functional adaptations that are represented in increasing the efficiency of the circulatory and respiratory systems, the functional adaptations resulting from the training of swimmers for short distances lead to an increase in the maximum consumption of oxygen (VO2maxand increasing the effectiveness of the lung function", which he pointed out as "there is a mutual and reliable correlation between maximum oxygen consumption and training intensity, the more the athlete is able to fill the lack of oxygen, which leads to an improvement in the level of ability in training".(1996 ،الراوي)(2005 ،وفاء صباح محمد ,الخفاجي)

Also, the use of the interval training method in the snorkel training method in swimming had a clear effect on the functional improvement of the circulatory and respiratory systems through improvement (VO2max) and an improvement in vital capacity, as interval training is a typical way to increase the efficiency of cardiac work, and the most important feature of it is the improvement of aerobic capacity, and "the use of interval training has led to an increase in ((اسامة كامل راتب و علي محمد 1980 ،زكي)VO2max) and reduce the amount of lactic acid accumulated in the muscles and blood. (2005 ،القط)

The researcher attributes the regularity in swimming training, especially snorkel training, which leads to an improvement in the efficiency of the circulatory and respiratory systems, which is reflected in the increase in vital capacity, especially the peak of forced flow (PEFand the size of forced exhalation in the first second (FEV1), as it is one of the important indicators to improve the efficiency of the respiratory system, and that the improvement in the vital capacity resulting from swimming training is due to the adequacy and strength of the breathing muscles, as the results showed that the regularity in the swimming training curricula resulted in a substantial increase in the size of the lungs, which is closely related to the digital level of swimmers, as a result of the increase in the strength of the breathing muscles resulting from swimming training, which makes it one of the main activities that lead to improvement and performance. Lungs and respiratory system."(الخضري، 1997)

Also, the contribution of snorkeling training method to the development of respiratory efficiency by improving the ability of the lungs to absorb a larger amount of air, which increases the vital capacity, especially (PEF) and (FEV1"The most important feature of interval training is the improvement in vitality capacity because the recovery periods enable the heart to reach the highest level of blood

pumping", and the improvement of physiological responses and adaptation as a result of snorkel training for the experimental group and compensating for the lack of oxygen for the control group by increasing the ability of the respiratory system to exchange and transport gases, as well as increasing the strength and depth of breathing and increasing the elasticity of the pectoral muscles in stretching and increasing their size. The vital capacity is affected by the athletic training of swimmers as a result of the swimmer's adaptation to the water environment." (اسامة كامل راتب و علي محمد زكي، 1980)(الفتاح، بيولوجيا الرياضة وصحة الرياضي الطبعة الأولى، 1998)

The researcher believes that the improvement in the (PEF) index reflects the increase in the maximum expiration strength and speed, which is a vital indicator of the improvement of bronchial elasticity and a decrease in internal respiratory resistance, and this improvement is likely due to the adaptation of the respiratory system to the resistance imposed by the snorkel tube during breathing, as the chicken increases to generate a higher exhalatory pressure to expel air through a narrow tube, and the improvement in the (FEV1) index) refers to the increased ability of the lungs to expel air quickly during forced exhalation, which is a sign of increased flexibility of the lung tissues and the strengthening of the exhalatory muscles, and this is directly related to the increase in the effectiveness of pulmonary ventilation in terms of physical stress and a gap that reflects positively on athletic performance, especially in short swims with high respiratory requirements.

The researcher attributes these results to the contribution of the training curriculum represented by snorkel training, as it had a clear impact on the development of the results of the level of achievement of the 100 m freestyle, because the use of the snorkel in swimming represents one of the practical aids on which the positive practice is based to improve the skill performance of swimming methods and in a way that is reflected in the improvement of the digital level of swimmers, if he pointed out that swimming improves the performance time of swimming a certain distance, as he found from his study, that the swimmer's speed By using the breathing tube, it was faster compared to normal swimming (without the breathing tube) by up to 5%", while it was stated that "the use of the breathing tube enables the swimmer to focus on important parts to improve performance in addition to working to increase inhalation and exhalation power, so the breathing tube is an important tool to deepen the breathing process and increase the gas exchange rate in the lungs, and scientific facts confirm that swimming has an effective effect on the work of the circulatory and respiratory systems", and the use of a breathing tube Snorkel breathing allows swimmers to perform technical exercises without the need to rotate or raise their head to breathe, which contributes to improving performance efficiency, distributing effort and increasing the swimmer's speed, as "the presence of snorkel during training leads to easy breathing, which helps to enjoy the movement of the body inside the water and leads to the speed, stability and smoothness of the leg strokes", and "the use of snorkel leads to an increase in the swimmer's speed, through concentration. The

correct performance of body movements and postures, the harmony between those movements, and the relaxation of the leg strokes and the movements of the arms, which reduces the burden on the shoulders during breathing and the fall of the sat and feet to increase the flow of movement."(Poirier-Leroy, n.d.)(Bottom, n.d.)(Poirier-Leroy, n.d.)

The results of the current research support the findings of previous research, which confirm that the use of a breathing apparatus (Snorkel) improves the measurements of respiratory circulatory adequacy, especially (FEV1, PEF, VO2max, PWC170), and the level of digital achievement of swimmers as a study, study and study.(toklu, 2003)(البلك, هيثم ماهر حسين 2009 ،احمد محمود مصطفى ,دويدار) ،2012)

Conclusions:

1. The training using a snorkel contributed to improving the aerobic ability of swimming, and the results of the PWC170 test for swimming showed an increase in the efficiency of cardio-aerobic work at a pulse of 170 beats/minute.
2. Snorkel training showed a clear effectiveness in improving the efficiency of the respiratory circulatory system in young adults, through a significant increase in the results of (VO2max) compared to the control group.
3. The use of snorkel exercises improved respiratory lung function, with the experimental group recording a clear superiority in the Forced Peak Flow (PEF) and Forced Exhalation Volume in the First Second (FEV1) tests.
4. The improvement in respiratory and aerobic indicators was reflected positively on the level of the achievement of the 100m freestyle, as the experimental group achieved a better moral time improvement compared to the control group.
5. The results indicate that the integration of snorkeling as a regular training tool within the freestyle swimming training curriculum contributes to the development of the physiological aspects and the level of achievement of the juniors effectively.

Recommendations:

1. Adopting snorkel training as an essential part of the training curricula for juniors in the special preparation stage because of its positive impact and effective role in improving the efficiency of the respiratory circulatory systems.
2. Inclusion of tests (VO2max, PWC170) in the periodic evaluation of swimmers because of their value in measuring the effectiveness of aerobic endurance and cardiorespiratory improvement.
3. The use of the breathing tube (snorkel) as a training tool to improve respiratory function (FEV1, PEF) especially in athletes or trainees with impaired breathing efficiency.
4. The use of snorkel in freestyle swimming training, which affects the improvement of performance and the level of achievement.

5. Conducting future studies that include larger specimens, different age groups, and on other types of swimming (breast, butterfly).

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Appendix (1)
Snorkel Training Curriculum

A proposed 8-week training curriculum, with an average of 3 training units per week, focuses on the use of a snorkel to improve the 100-meter freestyle swimming in terms of technique, aerobic capacity, and speed. Each training module lasts approximately 45–60 minutes.
Week 1-2: Focus on technique and continuous breathing
Objectives: Improve body posture, reduce water resistance, increase snorkel habit.
Module 1:
Warm-up: 200m freestyle with Snorkel 4 × 50m (25m arm technique + 25m full swim)
Main: 6 × 50m freestyle snorkel, focus on head position and alignment rest 15–20 seconds
Cooldown: 100m light back swim without snorkeling
Module 2:
Warm-up: Snorkeling skills: 4 × 25 m (pull only – no kicking) using the board and snorkeling4 × 25 m (kicking only – using the board)
Main: 4 × 100 m freestyle swimming using snorkel every 25 m with different concentration (sliding – pulling – kicking – speed)
Cooldown: 100m Optional Swimming
Module 3:
Warm-up: 300m continuous swimming using snorkel
Main: 4 × 75m at a moderate pace with an emphasis on stability in motion 4× 25m snorkeling
Cooldown: 100 m Back or Chest Week 3-4: Improve technique and increase aerobic endurance Exercises begin the repetition element intervention with rhythm and speed control.

Week 3-4: Improving Technique with Increased Aerobic Endurance
Goal: Combine technology and consistency in performance over longer distances.
Module 1:
Warm-up 200: 4×50m freestyle snorkel (25m drag / 25m full swim)
Main 3 × 100: Steady rhythm freestyle (60–70% effort) using snorkel Rest 15 seconds 6 × 25 m Work on technique with strong leg push
Soothing100: m Chest or Light Back
Module 2:
Technique 4 × 25 m: Head Lead Body Dolphin Drill, 4 × 25 m Catch-up with Snorkel
Main: 5 × 75m Freestyle with a focus on head and hands alignment
Cool-down 100 : m Light Freestyle
Module 3:
Warm-up: 300m continuous snorkeling at a slow pace
Main 2 × 100 m: Swimming with control of the number of movements per 25 m, 4 × 50 m gradient speed (from slow to fast)

Cooldown 100: m Freestyle Selection

Week 5-6: Focus on Speed and Anaerobic Endurance
Goal: Introduce short intense intervals and improve endurance while the technique remains intact.
Module 1:
200m warm-up: 4m snorkel freestyle 4 × 50m Rhythm change every 25m
Main 4 × 100: 70–80% freestyle, 6 × 25m sprint (90–95%)
Tempering 100: m Chest or Back

Module 2:
Advanced Technique Exercise 6 × 25: One Hand Swim (3 Right + 3 Left) Using Snorkel,
4 × 25 m RLRL Drill (Alternating Hands with Rhythm Focus)
Main 3 × 100: m divided into: (25m fast, 25m slow, 25m medium, 25m fast)
Cool-down 100: m Backstroke
Module 3:
300 Warm-Up : Continuous Snorkeling
Main2× 50: Fast,2× 100m Medium,2×25m Fast, *Repeat this series twice*
Temper 100: M Chest
Week 7-8: Combining Speed with Technique with a 100m Race Simulation
Objective: Final preparation with the integration of aerodynamics, speed, and full control of technique.
Module 1:
200m Warm-Up: 4m Freestyle × 50m Technique (Pull - Catch-Up - Two Legs - Full)
Main 4 × 75: m Speed Split: (25m Slow, 25m Medium, 25m Fast), Rest 20 Sec 4× 25m Fast Swim
Cool Down100: M Selection
Module 2:
Head Position Drill: 6 × 25
Main 3 × 100m: Mock Race Swim with Target Time, Sufficient Rest (at least 60 seconds), 6 × 25 m Rhythmic Swim
Cool-down 100: m Backstroke
Module 3:
200 m warm-up: continuous swim using snorkel
master: 100m freestyle test with snorkel with record time
then 2 × 50 m: analytical swim (fault monitor), 4 × 25 m error optimization
Cooldown: 100 m Light Freestyle