The Effect of Combined Training on Some Physiological and Physical Variables of 100Meter Butterfly Swimmers

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Abstract

This study aimed to describe some physiological and physical changes in response to a combined training (aerobic and resistance) of 100-meter butterfly swimmers.
The study included: (19) butterfly swimmers under 18 years. The Researcher used the experimental method (pre-post) of one experimental group. Venous blood was drawn (5ml) to determine blood content, testosterone, T. Protein, and physical performance tests speed endurance, strength speed, blowing strength, and transient speed. The joint training program was applied for eight weeks, 3days per week, 24 training units, and 80 minutes of training unit time.
The analysis of different variables occurred pre-post combined training.
The results reveal a statistically significant change in different variables for post combined training program. The combined training positively affects testosterone, T. protein, and blood content together with physical performance, which indicates that the combined training improved the physiological and physical state of participants' butterfly swimmers. It is recommended to use the combined training to benefit the swimmers.

Keywords: Butterfly swimmers, combined training, physiological, physical variables, muscle performance.

Introduction:

Aerobic exercises are activities in which oxygen from the blood is required to fuel the energy mechanism of muscle fibers; examples are running, cycling, and swimming. Aerobic exercises have both acute and chronic effects on various body components, mainly the cardiovascular system, skeletal and muscular system, nervous system, blood and immune system, and almost all systems of the body (Barker et al. 2010) (Liu-Ambrose et al., 2010). Also, the acute and chronic effects

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of aerobic exercises enhance the immune condition of the brain improve neural plasticity and cardiovascular fitness and improve performance.

Resistance training is a modality of exercise according to its role in improving athletic performance by increasing muscular strength, power, speed, hypertrophy, muscular endurance, motor performance balance, and coordination (Kraemer and Ratamess, 200). Resistance training is performed by athletes for muscle gain and for health benefits for both young and elderly or people with cardiomuscular or neuromuscular disease. Appropriate program design is needed for successful resistance training. The program design includes exercise instructions such as technique, correct use of equipment, and others, and resistance training should be supervised by professionals to prevent injuries. (American College of Sports Medicine, 2002).

Athletes who are willing to reach a higher degree of improvement must be involved in combined resistance and aerobic training. Physiological variations in stimuli resulting in a more diverse manifestation of body system improvements must be considered, such as improvement in fitness strength range of motion, and VO2 max (Farrell, 2011). By using two training modalities, a different body system adapts better and benefits more than the use of one type of training. The body uses both types of training for more improvement than one modality of exercise training. (Komulainen et al., 2010).

To reach a higher level of performance, Wilmore and Costill (2005), players must use different types of training to develop the muscle strength needed for physical performance.100-meter butterfly swimmers must be involved in resistance and aerobic exercises related to the physiological changes of muscle strength as muscle hypertrophy needs more muscle mass and increased blood supply through angiogenesis and oxygen supply by red blood corpuscles and hemoglobin. Testosterone hormone plays a vital role in muscle growth and hypertrophy as it also increases total protein, which is needed to increase muscle fibers.

Many researchers stressed the effect of RBCS and HB for oxygen transport to the active muscle for energy production. Also, the role of WBCS in immunity to diseases (Ganong,2000).

Aim of the study:

This study aimed to describe some physiological and physical changes in response to combined training (aerobic and resistance) of 100-meter butterfly swimmers.

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Hypothesis:

It was hypothesized that in response to a combined training of the 100-meter butterfly, swimmers would show benefits and improvements in some physiological and physical variables.

Research procedures:

Research method: the researchers used the experimental procedure (pre-post) of one practical group due to the suitability nature of the study.

Research sample:

(19) 100-meter butterfly swimmers were chosen from Port-Said clubs under (18) years for participants in the study. (14) swimmers for the main study and (5) swimmers for the pilot study.

Table(1)

Basic characteristics of the sample

Variables	Mean	SD	Skewness
Age (years)	17.1	0.33	1.1
Height (cm)	174.1	3.5	-0.25
Weight(kg)	69.6	3.6	0.19
Training experience (Y.)	7.4	0.58	0.91
BMT (kg/m²)	21.9	0.6	0.71

Table (1) reported that skewness was between (±3) indicating homogeneity of the sample.

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Data collection tools:

Height: using restameter.

Weight: using a medical scale.

Body Mass Index: weight/height²

Variables tested: 5ml of blood withdrawn before and after the combined training (aerobic and resistance).

Blood cells: RBCS, HB, platelets, WBCS, neutrophil, lymphocyte, monocyte using colter counter.

Testosterone: using Elisa technique.

T. protein, creatinine: using spectra-photometer.

Physical fitness tests:

Speed endurance(s.).

Strength speed (Meter).

Blowing strength (Meter).

Transient speed (s).

Blood samples were withdrawn by a specialist at a specialized Lab, in Port-Said.

Transient speed (s).

Blood samples were withdrawn by a specialist at a specialized Lab. In Port-Said.

Pilot study:

(5) 100-meter butterfly swimmers were the pilot study participants; they were from the same group of the study. For (2) days before the primary research to:

- Know the ability of the equipment.
- To solve the problem facing the research study.
- Determine the suitable way to perform the measuring and record data.

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The main study:

Blood and tests were performed pre-combined training of aerobic and resistance of swimmers.

The training program was applied for (8) weeks, three days of training per week, (24) training units, and 80 minutes of training unit time.

The training unit was composed of:

Warm-up (10min.): for preparation of the body by general exercises and stretches for blood pumping in vessels.

The central part (60min.) to execute the critical part of the program was to improve the swimmers' physical ability and was composed of aerobic and resistance training to develop physical skills.

Cooling down (10 min.) relaxes exercises to return the body system to the normal state and recovery.

Post-training measurements:

After the end of the proposed training program, post-measurement was performed for blood constituents and other blood tests together with tests for physical abilities.

The main principle of the training program:

- Determine the program target and each stage of execution
- Be aware of individual differences.
- Determine the main objectives of the training and degradation.
- The conveniences of the training program to age stage.
- Distribution and continuing of training.
- Equilibrium between general and special training.
- The flexibility of the training program for practical application.
- Suitability of the load of training to intensity, volume, and density.
- Graduation of increased load and development and wave shape.
- Be aware of the bases of warm-up and cool-down.
- Adaptation.

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Statistical analysis:

- Using (SPSS) including:
- Arithmetic mean.
- Medium.
- Standard deviation.
- Skewness.
- Wilcoxon signed-rank test.
- Student "t" test for the differences between pre-post program a level of 0.05 was used to indicate statistical differences less P>0.05 was considered significant statistically.

Results:

Table (2) testosterone, T. protein, creatinine Pre-post resistance and aerobic training of swimmers

Variables	Pre-training		Post-training		Sig
	M	SD	M	SD	
Testosterone ul/dl	612.6	112	774	104	*
T. protein (g/dl)	7.6	0.6	7.9	0.5	*
Creatinine (mg/dl)	1.21	0.3	1.45	0.4	*

Table (2) indicated a significant increase in testosterone. T. protein and creatinine concentrations after the combined training of 100-meter butterfly swimmers.

Significant changes of the variables post combined resistance and aerobic training of swimmers.

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Table (3) physical fitness tests pre-post combined training of 100meter butterfly swimmers

Variables	Pre		Post		Sig
	M	SD	M	SD	
Speed endurance (s)	44.06	2.43	39.45	2.33	*
Strength speed (Meter)	43.9	6.02	56.34	5.9	*
Blowing strength (Meter)	2.26	0.21	2.63	0.42	*
Transient speed (s)	4.6	0.15	3.89	0.13	*

Table (3) revealed that the combined training with 100-meter butterfly swimmers improved physical performance of speed endurance, strength speed, blowing strength, and transient speed. There are statistically significant for the sake of post-combined training of 100meter butterfly swimmers

Table (4) blood cells change pre-post combined training of swimmers

Variables	Pre		Post		Sig
	M	SD	M	SD	
Rbcs (Mil/ul)	4.9	0.1	5.4	0.6	*
Hb g/dl	13.6	0.9	14.4	1.1	*
Platelets (cells/ul)	221	23	251	2.6	*
Wbcs (cells/ul)	7006	101.2	8009	101.3	*
Neutrophil $\times 10^3$ ml	3.7	0.7	4.8	0.9	*
Lymphocyte %	24.9	1.4	19.4	1.3	*
Monocyte (cells/ml)	339	10.6	352	11.3	*

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Table (4) showed the blood cell changes of pre-post combined training of 100-meter butterfly swimmers, post-trained revealed significantly increased RBCS, HB, platelets, and WBCS (Neutrophil, Lymphocyte %, and monocyte). Significant changes in blood variables pre-post combined training of swimmers.

Discussion:

Table (2) indicated a significant increase in testosterone concentration, T. protein, and creatinine after combined exercise training of 100-meter butterfly swimmers.

These results denoted an increased growth and strength affecting organs of the body, especially muscles, the main effector of movement due to the action of exercises composed of aerobic and resistance training, leading to increased skeletal muscles' mass due to adaptation. (Thijssen,2006) (Mougios 2006) reported that regular exercises included, especially resistance and weight training.

Hypertrophy of the muscle fibers is due to hormonal growth such as testosterone, growth hormone, and IGF (1). Growth means the relative irreversible time changes in the measured dimensions. The dimensions include the size of the body and total weight (Murray et al., 2009).

They also added that increased (T) protein is an essential marker for the growth of muscle fibers as muscles are composed mainly of protein, for creatinine, which is a metabolite of protein metabolism, is another indication of increased protein in the blood filtered by the kidney.

Testosterone hormone develops muscle reproduction and skeletal muscle growth and promotes protein synthesis, testosterone concentration increases in the case of athletes compared to non-athletes, and resistance training stimulates both anabolic hormones and muscle strength (Willmore and Costill,2005), (Walfe, 2000), (Valpi et al., 2003). They also added that testosterone, a derivative of cholesterol, promotes anabolism and hypertrophy and increases the strength and mass of the skeletal muscle.

The data is also reported by (Takarada et al., 2002-2000) (Zahran, 2016) and (Tuch, 2006) and (Tsveel Apidot et al., 2005). (Thijssen, 2006) reported the vital role of stem cells in inducing growth and hypertrophy of the muscle together with the action of growth factor IGF (1), the integration action of satellite cells (Stem cells of the muscle and IGF (1) are significant factors indirect including growth and hypertrophy of muscles.

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Table (3) indicated significant changes in physical performance post combined training in different variables assessment of 100-meter butterfly swimmers. The improvement noticed in speed endurance, strength speed, blowing strength, and transient speed was due to the combined aerobic and resistance exercise training. The positive effect of the data indicated that the training program was designed for the benefit of the swimmers. It may increase total protein and muscle mass in conjunction with the sarcoplasmic calcium and increased oxygen available to the skeletal muscles, leading to increased strength and speed of the swimmers and improving physical performance and muscle abilities.

The results were following those of (Duke 2002) and (Duthie et al., 2002).

Researchers reported that the participants in combined strength and aerobic training regimens improved reliably greater than those in aerobic training alone. This may be due to the physiological variations in stimuli resulting in a more diverse manifestation of muscle improvement and fitness. Fitness improvement may be more achievable if athletes participate in the multimodal form of exercises such as aerobic training and resistance training (Komulainen et al., 2010).

The researchers agree that combined aerobic training with resistance training benefits the athlete when performing in the same training set. This combination of training induces more influence on the muscle fiber. It generates different stimuli that affect many ingredients, such as calcium and another mineral, such as sodium, which involves more strength and speed, leading to improved fitness and performance.

Table (4) showed the effects of the combined training exercise program on 100-meter butterfly swimmers, which revealed a significantly increased count of RBCs, Hb. It is well known that their function is the transport of oxygen to the different organs and systems of the body. In turn, it led to increasing oxygen supply and energy to the various parts of the body, especially the skeletal, and muscular system, which increases and improves their functions and skeletal, athletic abilities and hens performance. (Roshdy and Heshmat, 2012).

They also added that normal oxygen used by the body is 150ml/minute and may reach 1000ml/minute during moderate exercise. Oxygen induces many essential functions such as:

- 90% of the energy of the body is from oxygen. Nobody can live more than minutes when deprived of oxygen.
- Also, oxygen is vital for the health and well-being of the body and longevity.

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(Colcombe and Kraemer, 2003) added that improvement in fitness may be achieved by combined aerobic and resistance training, increasing Vo2 max. And performance. The same was reported by (Farrell 2011).

Table (4) revealed an increased number of Wbcs and neutrophil monocytes with a decreased number of lymphocytes after a combined training program.

The possible cause of increased Wbcs number may be to boost the body's immunity, as for the decreased numbers of lymphocytes. Researchers reported different results as increased numbers or decreases in lymphocyte count depending on exercise intensity and duration of exercises. (Kharlund et al., 2000) And (Kohut et al, 2006), (Gminder et al, 1998).

Table (4) also reported an increased platelet number after a combined exercise program by butterfly swimmers. The increased platelets reported may help in the hemostasis of the blood and participate in tissue injury response in cooperation with inflammatory cells of the blood as platelets adhere to the collagen of the blood vessel wall when injured to help cure injuries (Ganong, 2000).

The discussion indicated that the hypothesis had been realized.

Conclusion:

- The combined training positively affects the anabolic hormone testosterone and T. protein and metabolite of butterfly swimmers.

- The combined training affects blood components: RBCs, Hb, WBC, and platelets. These, in turn, improve oxygen supply to the muscles and improve health.

- The combined training indicated a significant change in physical performance, fitness, and physical abilities.

Recommendations:

It is recommended to:

- The benefit of the results of the research (Bio-chemical, blood) is to make use of the results to ration loads and training programs.
- Benefit from the results of swimmers' physical abilities and use them to ration loads and training programs.
- To use combined training for the sake of swimmers due to their benefits.
- To use combined training programs for other sports activities.

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- Direct the research results as a scientific base for other researchers for different biological assessments. To use combined training programs for other sports activities.
- Direct the results of the research as a scientific base for other researchers for different biological assessments.

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