The effect of a training tool in Score level and some physiological Parameters of butterfly swimmers

Wael Abdel Moati Khalafalla

Department of Swimming, Faculty of Physicsal Education, El Azhar University. Egypt.
wwaa702000@hotmail.com

Abstract: Research aims: 1. knowing the changes in score levels of butterfly swimmers before and after monofin training program. 2. Knowing the changes in some physiological parameters under investigation of butterfly swimmers before and after monofin training program. **Research Methods:** Experimental approach was used, by experimental design of one group of swimmers in a pre and post measurement. **Participants:** After a full explanation of the aim of the study and of the experimental procedures, 8 male swimmers from El Azhar University in the year (2013-2014), **Procedures:** Before experiments, swimmers were asked to abstain from smoking or medicament and caffeine. They were participating in training using Monofin at Saraya El Kobba youth center in swimming pool. They started with warming up for 10 minutes, trained using Monofin for 60 minutes at the end of the training they were practise cooling down for 10 minutes. The training period was between 1/10 – 31/12/2013 for 12 weeks, during the training they were always motivated and encouraged to finish their task. A the end of the training program, 100 meters butterfly swim was timed and the record level was assessed and recording the time of each participant. Blood samples were drawn at rest and after 100 meters butterfly swim, before and after the 12 weeks training course, together with B/P, pulse rate and Vo_2 max, which was performed using the Ergometer and Astrand Nomogram. **Results:** Hemoglobin, RBCs, hematocrit revealed an increased levels after the training program, which means that the Monofin training increased oxygen capacity of the participants. The increased WBCs and cortisol levels after the training period indicated a better immunity and health change following Monofin training, this result was also recorded in case of the increased CD4, CD8 after Monofin training. CD8 occurs on the surface of cytotoxic T cells, while CD4 occurs on he surface of helper T cells. Both foster Lymphocite development and immunity Vo2 max increased after monofin training program and land exercise from 38.2 ± 1.9 to 45.4 ± 1.7 ml/kg/min. **Conclusion:** 1. Monofin enhance swimmers speed, performance and score levels. 2. Monofin led to positive results affecting VO2 max, pulse rate, B/P. 3. The training program affect positively Hemoglobin, RBCs, Hematocrit and increased oxygen carriers. 4. The training program affect positively the immunological variables and health state of the swimmers.

[Wael Abdel Moati Khalafalla. **The effect of a training tool in Score level and some physiological Parameters of butterfly swimmers.** *J Am Sci* 2015;11(2s):6-12]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 2

Keywords: effect; tool; Score; physiological Parameter; swimmer

Introduction and Research Problem

The word “swimming is derived from the old English term “swimmin”. Although the origin of swimming is not Really known, people probably learned how to swim from watching animals. Mosaics unearthed in Pompeii show men navigating water under their own power, and a bas-relief in a tomb from the 2000 B.C. period in Egypt shows a swimmer doing what appears to be a crawl stroke (American Red Cross, 1992).

Through the ages swimming has become an extremely popular as well as a necessary skill. Once the fear of water is removed, most people experience a certain exhilarating feeling from submerging in water. Absence of the normal pull of gravity can have a relaxing and tension – removing effect on the physical and mental state. Also the heart, lungs, muscles and body systems need regular and vigorous exercise. Through swimming, most of the muscles are used and by acting against the resistance of the water they gain strength. (Vickers and Vincent, 1994).

The butterfly stroke has become the second fastest stroke known, but because of its extreme difficulty, it is rarely perfected by non-competitive swimmers. Because it is the most exhausting form of swimming, one must be in excellent condition to perform the butterfly stroke for any length of time. The butterfly is done by pulling both arms, simultaneously and parallel to each other. The arms are then recovered over the water, simultaneously and parallel to each other, back to the extended position. A double leg kick is accented at the start and again at the completion of each arm pull (Maglischo, 1992).

As for swimming records, swimmers have shown an amazing ability to break records. Olympic record times have declined at a faster rate for swimming than for any other sport. Times for the 100 meter swim dropped four times that much by 6.6 seconds between 1960 and 1992. One factor is a better understanding of the physic of the fluids, how to maximize propulsion and minimize resistance. Another factor was that there had been revolutionary advances in swimming

technique, nutritional, physical, mechanical, psychological or pharmacological procedures or aid to improve physical work capacity and swimmer performance. (Zumerchik, 1997).

Rejman and Borowska (2008) stated that the technique of monofin swimming consists of the oscillatory movements of the trunk and legs in the sagittal plane, while in a prone position. The scope of movement increases, from the shoulders in the direction of the centre of the swimmer's mass and feet, which transfer torque to the monofin's surface. This being approximately twenty times greater than on the surface of feet, producing. Propulsion, in swimming without fins. The dimension of the monofin and the structure of the swimming movements are the reason why average speed in monofin swimming exceeds the speed of crawl swimming.

Many studies have been using Monofin to increase performance, score level, physical components and physiological one namely Mohamed Saida (2011), Dina Metwaly (2004), Mohamed Mostafa (2004) Mostafa Salah Eldin (1992) together with Kostich (2002) to aboost swim strength and technique, Sereni et al (1999) recorded the physiopathology of fin swimming, Zamparo et al (2002) revealed how fins affect the economy and efficiency of human swimming. All Studies conducting studies related to Monofin and recommended to use this tool in training to raise the level of performance skills.

As for the steps of Monofin basic mechanism:

1-Streamline with extended arms

2-Hunch the neck and shoulders

3-Speed drive the legs

4-Slide hips upward

5-Slide hips forward.

(El Kot, 1998).

The health benefits from sports training becomes more evident but what is the training tool needed to reach these health benefits?

To answer this question, the researcher tried to conduct this study to reach the optimum tool, through monofin to affect some physiological parameters of butterfly swimmers

Research aims:

1- Knowing the changes in score levels of butterfly swimmers before and after monofin training program.

2- Knowing the changes in some physiological parameters under investigation of butterfly swimmers before and after monofin training program.

Research hypothesis

1- There are statistically significant differences between pre and post measurement in score level (100 meter) butterfly swimming for the favor of post training program

2- There are statistically significant differences between pre and post measurement in some physiological parameters for the sake of post measurements.

Terms in the study

Pull: an action of the arms imparting force on the water toward the body to propel a person through the water.

Push: an action of the arms or legs that propels person through the water by impairing force on the water away from the body.

Stroke: a complete cycle of the arms and legs in a coordinated manner to propel a person through the water.

Kick: to propel the body though the water with the legs.

Finning: an action of the arms like the fins of a fish, resulting mostly from the movement of the elbow and the wrist in and out from the body, in a press and recovery action.

(Vickers and Vincent, 1994).

Monofin: at in new technology, helping in the style used by warming the body and strings the internal muscle and help in flexibility and ankle and trunk , it is a marvel tool for dolfin movement of swimmers.

Research Methods:

Experimental approach was used, by experimental design of one group of swimmers in a pre and post measurement

Participants: After a full explanation of the aim of the study and of the experimental procedures, 8 male swimmers from El Azhar University in the year (2013-2014), signed a written informed consent form prior to the study. Swimmers were regularly competing into local meeting of swimming, they were all clinically healthy with no previous history of disease or injuries. They were selected among short distance swimmers. The investigation was conducted during non-competitive training period.

Table (1) indicated subjects characteristics

Variables	Participants
Age (years)	21.7 ± 1.3
Height (cm)	179 ± 0.7
Weight (kg)	76.4 ± 4.2
BMI	22.2 ± 1.6

Values are mean ± SD(±3)

$P < 0.05$; N = 8 swimmers

Procedures:

Before experiments, swimmers were asked to abstain from smoking or medicament and caffeine. They were participating in training using Monofin at Saraya El Kobba youth center in swimming pool. They started with warming up for 10 minutes, trained using Monofin for 60 minutes at the end of the

training they were practise cooling down for 10 minutes. The training period was between 1/10 – 31/12/2013 for 12 weeks, during the training they were always motivated and encouraged to finish their task. A the end of the training program, 100 meters butterfly swim was timed and the record level was assessed and recording the time of each participant. Blood samples were drawn at rest and after 100 meters butterfly swim, before and after the 12 weeks training course, together with B/P, pulse rate and Vo_2 max, which was performed using the Ergometer and Astrand Nomogram.

Pilot Study

This was conducted at Saraya El Kobba youth center on a sample of 4 swimmers; outside the study sample. They must have the will to accomplish the study, to train the assistants to be familiar with the different devices, to know and understand the nature of the research and the correct application, identify the obstacles and difficulties during the experiment.

The program design must meet the following:

- It must be suitable to the objectives of study
- Training program must be flexible
- The continuity and regularity of participant to training.
- The basis of the program in water were accompanied with resistant training to improve the training purpose and health and score level.
- Take into account individual variation also the diversity of the contents of program.
- Take into account the diversity of training and principles.

Resistant training was included to the Monofin training. As, the American College of Sports Medicine (ACSM) 2006, recommends the inclusion of strength training in training routines that aim the health control and fitness.

Materials used:

- Medical scale for measuring weight.
- Restameter for measuring the body height.
- Stop watch to record the nearest second.
- Syringes 5 ml, cotton, spirit, tubes for blood sampling.
- Coulter counter for cells determination.
- Flowcytometer for CD4, CD8 detection.
- Kit for cortisol.
- Pulse rate meter for pulse rate.
- Apparatus for B/P, sphygmomanometer, stethoscope.
- Box with ice for tubes transport to the lab .
- Plaster for the wounds.
- Ergometer and Astrand Nomogram for Vormax.
- Monofin for training.

Water training program

The water training program lasted for 12 weeks, the swimmers trained using monofin 3 times weekly.

The training set was composed of warm up 10-15 min.

Training period 60 min.

Cooling down 10-15 min.

The complete training set duration 80-90 min.

The land training program:

- The lands training was composed for strength training (RT) for 90 minutes, of warm up (10 min), principal part (60-70-min.), cooling down (10 min.).
- Flexibility of different muscle types of shoulder, arms joints trunk, leg muscles and joints.
- The land training consist of general preparation period.
- Also weight training to develop strength of the muscle swimmers.
- Vo_2 max development was done through running and swimming training. The land training period was executed 3 times weekly.

5ml blood samples were collected in special tubes containing EDT, Rbcs, Hemoglobin, hematocrit percent were analysed using coulter counter. Also CD4, CD8 were recorded using flowcytometry method, together with cortisol level by enzyme immunoassay technique using commercial kit. All laboratory assays were assessed in special lab. Some physiological values were estimated. Heart rate together with blood pressure and Vo_2 max before and after the training course at rest and after 100 meters trials.

Statistical Analysis:

All statistical analyses were conducted with a specific statistical software package (SPSS). Paired Student's t-test was applied to assess differences between pre and post swim measurement, and before and after the training course using Monofin to assess adaptation of the training course on the different parameters mean ± standard deviation, probability $P<0.05$.

Results:

All swimmers completed the 100 meters butterfly swimming in 62 ± 1.1 seconds before the training program, the same distance was ended in 57 ± 0.9 seconds after the training program, which revealed a better score level. As for the pulse rate and systolic and diastolic B/P, there was a decreased levels at rest after the training period for 12 weeks which indicated that the Monofin training led to a higher fitness level.

Hemoglobin, RBCs, hematocrit revealed an increased levels after the training program, which means that the Monofin training increased oxygen capacity of the participants. The increased WBCs and cortisol levels after the training period indicated a better immunity and health change following Monofin training, this result was also recorded in case of the

increased CD4, CD8 after Monofin training. CD8 occurs on the surface of cytotoxic T cells, while CD4 occurs on the surface of helper T cells. Both foster Lymphocite development and immunity Vo2 max increased after monofin training program and land exercise from 38.2 ± 1.9 to 45.4 ± 1.7 ml/kg/min.

Table (2): Clinical characteristic of the study subjects at baseline and after 100 meter butterfly swimming before training program N=8

Variables	**Before** (M ± SD)	**After** (M ± SD)	**T value**	**Sig.**
Score level In second	–	62 ± 1.1		
Pulse rate (C/min.)	68 ± 3.6	158 ± 3.4	30	S
Syst. B/P mm/Hg	122 ± 4.4	126 ± 5.1	0.9	Non S.
Dist B/P mm/Hg	82 ± 3.2	84 ± 6.4	1.9	Non S.
Hemoglobin (g/dl)	14.2 ± 1.1	15.6 ± 1.4	3	S
RBCs M/C.mm	4.9 ± 0.4	5.3 ± 0.3	3.5	S
Hematocrit %	45 ± 1.3	46 ± 1.9	3.7	S
WBCs total Thous/C. mm.	5.3 ± 1.4	5.7 ± 1.7	4	S
Cortisol mg/dl	13.8 ± 1.8	24.3 ± 2.1S	15	S
(Cell ul) CD4	400.2 ± 5.6	610 ± 6.4	40	S
(Cell ul) CD8	220.6 ± 4.8	240 ± 3.9	13	S

Values are expressed as mean ± standard deviation P < 0.05 = 2.365

Table (3): Clinical characteristic of the study subjects at rest and after 100 meter butterfly swimming after training program N = 8

Variables	**Before** (M ± SD)	**After** (M ± SD)	**Sig.**	**T Sig.**
Score level (se.)	-	57 ± 5.6	-	-
Pulse rate (C/min.)	64 ± 2.4	148 ± 5.4	32	S
Syst. B/P mm Hg	120 ± 3.6	124 ± 4.8	1.1	Ns
Diast. B/P mm/Hg	80 ± 2.6	82 ± 3.2	1.8	Ns
Hemoglobin g/dl	15.4 ± 1.4	16.8 ± 1.8	3.1	S
RBCs M/C.mm	5.2±0.5	5.6 ± 0.4	2.8	S
Hematocrit %	46 ± 1.6	47 ± 1.2	8	S
WBCs total thous/c.mm	5.8 ± 1.1	6.9±1.8	3.4	S
Cortisol ug/dl	16.4 ± 1.6	28.4 ± 2.4	16	S
CD4 number	420.4 ± 4.8	680 ± 5.8	42	S
CD8 number	342.2± 4.8	464 ± 5.6	38	S

Values are expressed as mean ± standard deviation
P < 0.0.5 = 2,365

Table (4): Clinical characteristic of the study subjects at rest before and after the training program N= 8

Variables	**Before** (M ± SD)	**After** (M ± SD)	**T value**	**sign**
Vo_2 max/ml/kg/min.	38.2 ± 1.9	45.4 ± 1.7	8.9	S
Pulse rate c/m	68 ± 3.6	64 ± 2.4	6.2	S
Syst. B/P mm/Hg	122 ± 4.4	120 ± 3.6	0.8	Ns
Diast. B/P mm/Hg	82 ± 3.2	80 ± 2.6	1.8	Ns
Hemoglobin g/dl	14.2 ± 1.1	15.4 ± 1.4	1.6	Ns
Rbcs M/c.mm	4.9 ± 0.4	5.2 ± 0.5	1.5	Ns
Hematocrit %	45 ± 1.3	46 ± 1.6	1.16	S
Wbcs total Thous/.mm	5.3 ± 1.4	5.8 + 1.1	0.59	S
Cortisol ug/dl	13.8 ± 1.8	16.4 ± 1.6	6.7	S
CD4 numbers	400.2 ± 5.6	420.4 ± 48	9.8	S
CD8 numbers	220.6 ± 4.8	342.2 ± 5.2	22.43	S

Values are expressed as mean ± Standard deviation
P < 0.05 = 2,365

Table (5): Clinical characteristic of the study subjects after 100 meter butterfly swimming before and after the training program N = 8

Variables	Before Prog (M±SD)	After Prof (M±SD)	T value	sign
Score levels seconds	62 ± 1.1	57 ± 0.9	18,74	S
Pulse rate (c/min)	158. ± 3.4	148 ± 5.4	9,2	S
Syst. B/P mmHg	126 ± 5.1	124 ± 4.8	1,5	Ns
Dist. B/P mm/Hg	84 ± 6.4	82 ± 3.2	1,7	Ns
Hemoglobin g/dl	15.6 ± 1,4	16,8 ± 1.8	3,4	S
RBCs M/.mm	5,3 ± 0.3	5,6 ± 0.4	4,2	S
Hematocrit %	46 ± 1.9	47 ± 1, 2	8.5	S
Wbcs total Thous/c.mm	6.7 ± 1.7	6,9 ± 1,8	6.9	S
Cortisol Ug/ddl	24.3 ± 2.1	28.4 ± 2.4	22	S
CD4 (cell ul)	610 ± 6.4	680 ± 5.8	46.3	S
CD8 (cell ul)	240 ± 3.9	464 ± 5.6	41.5	S

Values are expressed as mean ± standard deviation; P < 0.05 = 2,365

Discussion

Rejmana nd Ochman (2007) indicated the key points of Monofin swimming technique:

• The one dimential structure of the monofin swimming creates favourable conditions to study the swimming technique.

• Monofin swimming modelling allows unequivocal interpretation of the propulsion structure. This further permits to define the mechanisms, which determine efficient propulsion.

• Monofin swimming technique, plays a crucial role in achieving maximal swimming speed. El Kot (1998) reported that Monofin is a serious training tool due to the following advantages:

- Led to develop streamline of swimmers.
- Adjust body movement in water.
- A better leg performance.
- Increase speed limit in different swim forms.

The immunological response described in the study (Table 2, 3, 4, 5) revealed an increased WBCs, CD4, CD8, and cortisol level after 100 meters swim as a response to the trial in both cases and before and after Monofin and land program s adaptation to the program.

The increased in immunological response and adaptation has been attributed to increased cortisol level (Pedersen, 1997 and Mackinnon, 1999). The presence of cortisol responders among subjects, the subject training status and resting cortisol concentration are factors which may affect the influence of cortisol on WBCs during rest and after exercise (Weicker and Werle, 1991).

Mougios (2006) added that measuring cortisol at rest may aid in estimating physical and mental stress, while measuring cortisol after exercise may show how the subject receives a particular load, because cortisol cause proteolysis in muscle.

Guyton and Hall (2006) reported that CD4 (Helper T) cells are the most numerous of the T cells. These cells help in the function of the immune system. They do this by forming lymphokines, that act on other cells of the immune system as well as bone marrow cells.

As for the cytotoxic T cells, CD8, is a direct attack cells that is capable of killing microorganisms, for this reason they are also called killer cells, because they secrete hole forming, proteins, called perforins, they form holes in the membrane of the attacked cells, which swollen and dissolves shortly thereafter (Hamed El Ashkar, 2014).

Both Nelson (2004) and Voet et al (2001) reported that hemoglobin concentration in average 13-14g/dl. It binds oxygen in the capillaries surrounding the alveoli of the lungs, thus becoming oxyhemoglobin. The erytherocytes then transport oxyhemolobin to all tissues. Hemoglobin as the transporter of oxygen is connected with aerobic capacity. This is expressed as maximal oxygen uptake (Vo2 max). Studies have shown that Vo2 max may depends on the total amount of hemoglobin in the body. Athletes with high aerobic capacity have a combination of hemoglobin concentration and blood volume producing a high amount of hemoglobin, along with optimal state of other features that affect Vo2 mat, such as cardiac function and body composition (Tietz, 1995, Carter, 2000).

Table (2,4,5) indicated an increased Vo2 max. after Monofin training program, which may refer to a higher fitness and performance levels pulse rate (Table 2,3,4,5) revealed a significant increased after 100 meter butterfly swim, before and after the training program, the increased pulse rate is higher in case of swimming trial before the program.

As for B/P (Table 2,3,4,5) there was a non significant increase after 100 meter butterfly swim, before and after the training program in systolic and diastolic B/P.

The study of Pugh et al (2014) stated that water and land based exercise were closely matched for Vo2 max, for water (13.1 ml/kg/min) and (13.5 ml/kg/min.) land exercise. Also HR was in close comparison between water exercise (95 bpm) and land exercise (96 bPM). This observations provides a rationale to investigate the impact of after and land exercise training on health.

Jacobs (1983) reported the factors that influence Vo2 max: a high proportion of slow twitch motor units, high central and peripheral cardiovascular capacities and the quality and duration of training. Saltin and Astrand (1967) recorded Vo2 max values in ill individuals (>20 ml/kg/min.) to those well trained and elite endurance (>70 ml/kg/min.

Cogan et al (1993) reported the increase in Vo2 max might be due increased mitochondrial volume and mass, increased in mitochondrial enzyme activity and increased in angiogenesis, pulse rate, indicated a significant increase after the trial before and after the program and it was higher in case of the trial before the program while B/P showed a non significant change after the trial before and after the training program.

Overgaard and Dzavik (2008) reported that the blood forced into the aorta during systole not only moves the blood in the vessels forward but also sets up a pressure wave that travels along the arteries, the pressure wave expands the arterial walls as it travels, and the expansion is palpable as the pulse, with exercise the pulse wave moves faster, as was noticed in the study, it is strong when stroke volume is large, for example, during exercise. When the pulse pressure is high, the pulse wave may be large enough to be felt.

Mougios (2006) reported that the lower the pulse rate of athletes the higher indication of his fitness as pulse rate might be used as marker of fitness level.

Semenza (2007) stated that the B/P in young adult at rest is approximately 120/70 mmHg. It is affected by conditions such as emotions and exercise and falls during sleep, he added that the lower the blood pressure within normal indicate a higher fitness and sound health.

Barett et al (2010) reported that the circulatory system supplies O_2 and substances absorbed from the gastrointestinal tract to the tissues, return Co_2 to the lung and other product of metabolism to the kidney, functions in the regulation of body temperature and distributes hormones and other agents that regulate cell function. They added that RBCs, Hemoglobin and hematocrit value are good markers for oxygen carriers, that help different organs, and the muscles to produce the energy needed to perform.

The table (2, 3, 4, 5) revealed that RBCs, hemoglobin and hematocrit values increased in response to 100 metre butterfly swim and the response increased more after the same trial, due to the action of adaptation to the ground and Monofin program, which indicate a positive result due to the program used.

Mougios (2006) and Gastin (2001) stated that the most suitable tissue for the biochemical assessment of exercising persons is the blood, and the parameters that are useful in the assessment of exercising persons are Hemoglobin, RBCs and hematocrit together with cortisol levels. They added that hemoglobin is the oxgen carrying protein, it is found in RBCs and Hematocrit, and constitutes the most abundant blood component (about 14% of the blood) next to water. Both the lower and upper limits rise in males than female due to the anabolic action of testosterone. Hemoglobin, RBCs, Hemaocrit increases during exercise as water exits the blood vessels to the sweat, this last maximally one hour.

The increased in hemoglobin and RBCs and Hemtocrit recorded in table (2, 3, 4, 5) after the training program, indicated that the exercise might stimulate erythropoietin to increase RBCs and Hemoglobin and hematocrit which results in increase athletic performance and also as the tables indicated the score levels of the swimmers. These results agreed with those of Mohamed Saida (2011), Nabil Moussa 92003) Ashraf Ibrahim (2000), Ayman Zein (2003), Hosam Ahmed (2004), Kostich (2002), Zambaro (2002).

Thus, the optimisation of leg and monofin movement technique is demonstrated in the extending of knee joint as quickly as possible in order to immediately flex the distal part of the monofin and therefore to position it perpendicular to the swimming direction. The continuation of the movement with maximum leg extension will allow extension of the amount of time a monofin will move, thus generating the maximum propulsion necessary to achieve maximum speed. Thorough the discussion of the results of the data, the two research hypothesis have been partly realized.

Conclusion:

1- Monofin enhance swimmers speed, performance and score levels.

2- Monofin led to positive results affecting VO2 max, pulse rate, B/P.

3- The training program affect positively Hemoglobin, RBCs, Hematocrit and increased oxygen carriers.

4- The training program affect positively the immunological variables and health state of the swimmers.

References:

1. American Red Cross (1992): Swimming and diving St. Louis, C.V. Mosby Co.
2. American College of Sports Medicine Recommendations (2006).
3. Ahsraf Ibrahim (2000): Effect of one load training and several ones on some physiological parameters and score level of young swimmer PhD, Fac. PE, Mansora Univ.
4. Ayman Zein (2003): Effect of training program for development of physical fitness and score level of young swimmers Master, Fac. P, Helwan Univ.
5. Barrett, K, Barman, S, Boitano. (200): Review of Medical PhysiologyLange, USA.
6. Carter, C (2000): Hematology and the risk of coronary heart disease. Am Heart J. USA.
7. Coggan, A., Abdiuljalil, A, Swansson, S. (1993): Muscle metabolism during exercise in young and older untrained and endurance trained men. J Appl. Physiol 75, 2125.
8. Dina El Metwaly (2004): Effect of training program using Monofin on agility and muscle capacity of legs and score level for competitor swimmers Master Thesis, Fac. P, mansora Univ.
9. El Kot, M., (1998): Swimming in theory and reality El Azizi Comp. Office, Zagazig.
10. Gastin, P (2001): Energy system interaction and relative contribution during maximal exercise Sports Medicine 31: 727.
11. Guyton, A. and Hall, E. (2006): Textbook of Medical PhysiologyEl Sevier Sadners.
12. Hamed El Ashkar (2014): Immunity Principle The Egyptian Organization of Book, 185.
13. Hosam Ahmed (2004): Effect of resistant training in water on performance of breast swimmers Master, Fac. Of PE, Alex Univ.
14. Jacobs, I (1983): Lactate in skeletal muscle after 10 and 30 seconds of supramaximal exercise. J. Appl. Physiol. 55, 365.
15. Kostich, A. (2002): Used properly fins can be a boost to your swim. Strength and technique http://www.active.com/storycfm.
16. MacKinnon, L. (1999): Advances in exercise immunity Human Kinetics, USA.
17. Maglisho, E. (1992): Swimming faster Mountain view, CA, Mayfield Pub. Co.
18. Mohamed Saida (2011): Effective training program for some special physical components on digital achievement for Monifin Junio Swimmer PhD Thesis, zagazig Univ. Fac. Of PE.
19. Mohamed Mostafa (2004): Effectiveness of fins on score level of Dolphin Swim Zagazig J for sport, Zagazig Univ.
20. Mostafa Salah El Din (1992): Effect of Fitness on score level and fitness of back swim PhD., El Mansora Univ., Fac. PE.
21. Mougios, V (2006): Exercise Biochemistry Human Kientics, USA.
22. Nabil Moussa (2003): Efficiency of a training program to develop special endurance and score level of young swimmers PhD, Zagazig Univ, Fac. of PE.
23. Nelson, D. (2004): Lehninger principles of biochemistry Freeman, New York.
24. Overgaard, C, Dzavik, V (2008): Review of physiology and clinical use in cardiovascular disease. Circulation, 118, 1047.
25. Pedersen, B (1997): Exercise immunity Landes Company, USA, 206.
26. Pugh, C., Sprung, V. Ono, K et al (2014): The impact of water immersion during exercise on cerebral perfusion 19th Am. Congress ECSS, Amsterdam.
27. Rejman, M and Borowska, G (2008): Searching for criteria in evaluating the monofin swimming turn from the perspective of coaching and improving technique J. Sports Sci. Med., 7, 67,.
28. Rejman, M and Ochman, B (2007): Functional moel of Monofin swimming technique based on the construction of neural net orks J. of Sports SC. and Medicine, 103.
29. Saltin, B, Astrand, P (1967): Maximal oxygen uptake in athletesJ Appl. Physiol. 25, 353.
30. Semenza, G. (2007): Vasculogenesis, angiogenesis and arteriogenesis. J. Cell Bioch. 102, 840.
31. Sereni, G, Reggiani, E, Odaglia, G (1999): Physiopathology of fin swimming Mihera Va Med, 1405.
32. Tietz, N. (1995): Clinical guide to laboratory tests. Saunders, USA.
33. Vickers, B, and Vincent, W. (1994): Swimming Brown and Benchmark Publ.
34. Voet, T, Voet, J, Pratt, C. (2001): Fundmental of Biochemistry Wiley, New York.
35. Weicker, H and Werle, E (1991): Interaction between hormones and the immune sysem. Int. J Sports Med 30.
36. Zamparo, P, Panergast, D, Termin, B, Minetti, A (2002): How fins affect the economy and efficiency of human swimming J Exp Biology, 266.
37. Zumerchik, J (1997): Encyclopedia of Sports Science Mac Millan Library, USA.

2/6/21/2015