Some basic and hormonal profile for selection of short distance swimmers

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Abstract: The aim of this study was to investigate some basic and hormonal profiles for selection of short distance swimmers. It is hypothesized that the basic and hormonal profiles of short distance swimmers might help in the sound selection of short distance swimmers in Egypt. The Researcher used the descriptive method for a sample of a high level short distance swimmers participating in the study, from different clubs in Cairo (aged 17.8y) height (176.8 cm), weight (73.8 kg). Basic variables of heart rate, lactate, respiratory rate and vital capacity were determined, together with hormonal profile of growth hormone, testosterone, cortisol, T_3, T_4 using ELISA technique in the peripheral blood. The results indicated that basic variable determined were better results compared to the average levels of normal person, also the mean hormones were exceeding the average levels of normal concentrations. It may be concluded that the basic variables (heart rate, lactate, respiratory rate and vital capacity, also metabolic and growth hormone detected might be a good indicators for selection of short distance swimmers in Egypt.
[Hussein Dorrie Abaza**. Some basic and hormonal profile for selection of short distance swimmers.** *Life Sci J* 2017;14(8):67-72]. ISSN: 1097-8135 (Print) / ISSN: 2372-613X (Online). http://www.lifesciencesite.com. 10. doi:10.7537/marslsj140817.10.

Keywords: Basic, hormonal profile, short distance swimmers, selection.

Introduction

The anterior pituitary gland secretes a number of hormones which in turn led to secretion of hormones from other endocrine glands as example: Adrenocorticotrophic hormone stimulate cortisol secretion from adrenal cortex, thyroid stimulation hormone stimulate T_3, T_4 from the thyroid gland, Also growth hormone is related to Insulin growth factor (1) (somatomedin), gonadotrophins stimulate testosterone secretion from the testis (sex hormone), the hypothalamus play an important role in regulating anterior pituitary gland secretion ***(Barrett et al., 2010).***

Growth hormone affect growth and produces a positive nitrogen balance, and increase in body lean mass, decrease in body fat together with stimulation of metabolism and decrease plasma fat ***(Ayuk and Sheppard, 2006).***

Sports activities are an important element of influencing human development. The forms and kind of exercise must be adjusted to the interests as well as needs of athletes.

The physiological effect of aquatic exercise on hormonal, neural and circulatory functions is huge and could potentially affect executive function of swimmer. The physical attributes for the aquatic environment drive the requirement for variance of muscular contractions and coordination, and the increase in circulatory function, increased cerebral circulatory function, increased cerebral circulation which has been seen to promote hormonal and neural structure maintenance and growth. Studies support a higher level of exercise continuation when exercise is performed in water, due to sensation of security and the reduction in pain by hydrostatic pressure or off loading of the joints ***(Maglisho, 2003).***

Testosterone is the male sex hormone secreted in the testis and adrenal gland, it is responsible for masculine feature and its functions can be summarize in:

1. Development of secondary sexual characters.
2. Cause growth of body hair.
3. It induces the masculine voice.
4. Develops protein formation and muscles.
5. It induce bone matrix and calcium retention.
6. Increases basal metabolism.
7. Increases red blood cells compare to female.
8. It increases electrolytes and blood and extra cellular fluid volumes as 5 to 10 percent ***(Riggs et al., 2002).***

Thyroid hormones T_3, T_4 are secreted by the thyroid gland, they are fat soluble and can penetrate the cell membrane of the target cell. The main functions of the thyroid hormones T_3, T_4 is a metabolic and growth functions of most cells of the body, they produces lipolysis and increase fat utilization by the cells, increase rate of amino acid transport inside the cells with subsequent protein synthesis. Also increase heart rate and force of cardiac contractions and facilitate nerve transmission and shorten the reaction time for reflexes, and help heat production and is important for athlete for energy production and growth and stimulate O_2 consumption by most of the cells in the body. Thyroid gland also secrete calcitonin, a hormone that regulate circulating levels of calcium ***(Peter et al.,***

2006).

About the metabolic role of the thyroid hormones, on protein metabolism leading to positive nitrogen balance, they stimulate growth. In case of carbohydrate metabolism, thyroid hormones, increase blood sugar, and glucose utilization and glucose absorption. While thyroid hormones increase lipolyses thus increasing free fatty acid and lipogenesis, also thyroid hormones affect colorigenic action by increasing oxygen consumption and oxygen co-efficient of almost all active tissues leading to increase heat production and at the same time increase basal metabolic rate (BMR), this means the more the physiological concentration of the thyroid hormones the increase in energy and heat production increased. Testosterone develop male reproduction and skeletal muscle growth, promote proteins synthesis, testosterone concentration increase in case of athletes compare to non athletes, this result is reported in this data, and other scientific reportes ***(Tietz, 1995; Wasserman, 1996; Ying et al., 2008).***

They stated that cortisol and testosterone are derivative of cholesterol, testosterone promote protein anabolism and cortisol increased by stress and exerts a catabolic effect and is essential for resisting stress.

Cortisol is a hormone secreted by the adrenal cortex and have different effects on the body:

1. Stimulate gluconcogenesis, which is formation of carbohydrate from proteins and other substance.
2. Decreased glucose utilization: this may help sparing glucose during stress.
3. Elevate blood glucose concentration which may be caused from the two previous functions.
4. Reduction in cellular protein, which may act as a catabolic agent but increased liver and plasma protein.
5. Mobilization of fatty acid from adipose tissue, this may shift the metabolic systems of the cells from utilization of glucose for energy to utilization of fat in times of stresses like exercise or starvation.
6. Also increased obesity and is important to resist stress and inflammation.
7. It may decrease immunity ***(Gastin, 2001; Guyton and Hall, 2006).***

Sport selection is a continuous dynamic process by which the best athlete males or females are chosen depending on principles and basics scientific elements.

Abou El Ella (1986) reported the basic purposes of selection by:

1. Exploring the talented athletes possessing the highest qualifications to reach the highest physical performance.
2. To direct the players to the suitable play that suit them.
3. To point the ideal characteristics for the selected sport.
4. To concentrate different means from effort to economic in the process of learning and training to reach the highest athletic performance in the future.
5. To direct the training processes to develop the physical and psychological characteristics of the player to reach the target.
6. To enhance the selection processes from the effectiveness and regulatory point of view.

Selection of talented athletes depends on several principles as stated by ***Zakia Fathi (2006); Mohamed Taha (2002); Sobhy (1995)*** reported the basic purposes of selection by:

1. Biological principles.
2. Psychological principles.
3. Special principles.

As for the biological factors, selection depends on:

a) Genetic characteristics.
b) Stages of growth.
c) Biological ages and duration of training.
d) Body composition.
e) Basic physical properties.
f) Physiological properties.
g) Health state.

Psychological factors depends on:

a) Mental abilities including intelligence.
b) Visual, auditory, motor perceptions.
c) Moods.
d) Courage and self confidence.

As for the special factors depends on the ability of the athlete to gather special type of efficiency due to interest on special sport and given the suitable training.

Research problem:

Swimming is a competitive sport, that appear a very fast development in international scoring in relation to the low Egyptian record level. This need the use of updated method of selection and preparing the swimmers physically, mentally and physiologically through new methods and know how and to provide the trainers and coaches with information that may help to reach a higher level in short distance swimming, as an example to use the most important and needed hormones, specially metabolic and growth promoter hormone to reach this target such as growth hormone, thyroid hormones, testosterone and cortisol, all these hormones play an important role to provide the swimmers with energy needed to reach a higher level in short distance swimming competency and develop the Egyptian record level in short distance.

The aim of this study was to investigate some basic and hormonal profiles *for selection* of short distance swimmers.

It is hypothesized that the basic and hormonal profiles of swimmers might help in the sound selection of short distance swimmers in Egypt.

Research procedure:

The researcher used the descriptive method for its suitability for the research aim.

The research sample:

Nine healthy male swimmers aged (17.8 y), Height (176.8 cm), weight (73.8 kg), with a practical swimming history of (9 y), were participating in the study of high level swimmers from different clubs in Cairo.

All participants were asked to fill out their healthy history, they were free from contagious diseases, they refrained from caffeine and medications and supplements.

Table (1): Their basic characteristic feature.

Variables	Mean	SD	Skewness
Age (year)	17.8	0.25	1.4
Height (cm)	176.8	3.8	- 0.26
Weight (Kg)	73.3	3.1	0.19
BMI (Kg/m^2)	23.2	0.53	0.56

Table (1): indicated that the Skewness ranged between (±3) indicating that the samples are Homogene.

Data collection tools:

Height using (Restameter).

Weight using (Medical Scale).

Body Mass Index: (BMI = weight/ $Height^2$).

Lactic acid using (Accusport).

Pulse rate using pulse meter, syringes, test tubes, centrifuge, vortex, alcohol, hormonal determination using 5 ml, spirometer for vital capacity determination.

Blood containing anticoagulant EDTA for evaluation of hormones using commercial kits and ELISA technique:

- Growth hormone.
- Thyroid hormone.
- Cortisol.
- Testosterone.

The hormone were determine in a specialized lab (Clinilab.)

- Blood was transported in iced Coleman.
- Put in deep refrigerator.

Statistical Analysis:

Using (SPSS) including:

- Arithmatic mean.
- Median.
- Standard deviation.
- Skewness.

4. Discussion

Table (2) revealed a lactate concentration of the swimmers at rest around 1 mmol/L which is the concentration cited by ***Mougios (2006)*** and other researchers, inspite of the fact that in case of polluted area like under developing countries lactate concentration may exceed the limit of 1mmol/L (reach 1.5 mmol/L).

After exercise of high intensity, lactate can go over 20 mmol/L. as reported by ***Mougios (2006),*** within one half munite.

Also, there are other factors affecting lactate level apart exercise intensity, duration and program as it depends on heredity, nutrition, training state and age ***(Greenhaff and Timmons 1998; Biosseau and De La marche, 2000; Fitts 2004).***

In fact, the possible cause of increasing lactate concentration may be oxygen shortage or decrease oxygen concentration. As ***Sorichter et al., (1999)*** reported that muscle fatigue is associated with lactate plus H ion concentration, chronically stressed skeletal muscle shows abnormally increased biochemical substances like lactate, creatine phosphate and activated enzymes.

Table (2) revealed a lower level of pulse rate of swimmers (66 count/min) compared to normal values of pulse rate (70-80 count/min).

This result is in accordance with that of ***Zahran (2016).***

It is suggested that fit persons present a lower pulse rate at rest, which may be due to a raised parasympathetic activity ***(Aubert et al., 2001)*** or lower sympathetic activity ***(Chacon et al., 1998).***

Exercise-induced bradicardia can be due to intrinsic adaptation of the sinus node ***(Calai et al., 2002).*** In addition, long term adaptation responses include hypertrophy of the cardiac muscles, increasing in size. This hypertrophy increases the muscle mass of the ventricles, allowing greater force to be exerted with each beat of the heart ***(Wilmore and Costill, 1994).***

Table (2) denotes that at rest swimmers breathes less than 13 times a minute (12 breath/min) compared to average (12-15 breath/min) and their vital capacity exceeded 5,5 L. (average 4,5 L.) which indicated a sound lung function due to the regular swimming working, which affect the respiratory muscles leading to a better utilization of oxygen and delay the process of fatigue. This result is in accordance with ***Ahmed (2017).***

This opinion agree with researchers, as ***Hatfield (2013),*** stated that conditioned athletes have the

capability to inhale more air and sustain the process for longer periods, due to strength muscle surrounding the lungs, also the swimmers lungs may be larger due to their size. Also, the usable portion of the lung which is the vital capacity, may be larger than normal (5.5 – 4.56 L) as the swimmers may have a vital capacity equalling 75% of the total lung capacity, So, the training effect can decrease normal breathing per minute, increasing vital capacity and transform the lungs to a more efficient organ capable of processing more air and extracting more of the essential oxygen. This was in accordance with the data of the research and accordance with the opinion of ***Barrett et al., (2010).***

Table (3) revealed a higher growth hormone concentration of the swimmers compared to the average growth hormone level (6.33 to 4.5 ng/ml). This higher level of growth hormone may help the status of the swimmers in reaching higher levels which is in accordance with researchers in the success of swimmers, as indicated by ***Hatfield (2013)*** who stated that growth hormone is the most abundant hormone produced by the pituitary gland and the largest and most complex protein created by the pituitary gland and its secretion reaches its peak in the body during adolescence. This secretion help to stimulate muscle growth. Also additional influences like exercise, stress, a low plasma glucose concentration and sleep can effect the secretion of growth hormone as well. He also added that growth hormone stimulate tissue uptake of amino acids, the synthesis of new protein, and long bone growth. Growth hormone spares glucose by opposing the action of insulin, increasing the mobolization of fatty acids, therefore earning growth hormone the reputation as being the fountain of youth.

The effects of exercise on growth hormone and other metabolic hormone help to stimulate these hormone to release and hence the increased muscle growth and increased strength leading to a positive nitrogen and may lead to a higher fitness and standard and strength gain, which is important in swimmers selection and reaching a higher scores ***(Heyward, 1991; Howley & Franks, (1992); Petterson & Bryant, (1995); Wilmore, 1982; Zatsiorsky, 1995).***

Table (3) indicated a higher resting cortisol concentration in swimmers compared to the average concentration of the hormone (119.3 to 110 ng/ml). Testosterone hormone reported in case of swimmers at rest was higher compared to the average concentration (7,23 to 5.65 ng/ml). This indicate the positive effect of swimming training on both hormones and their functions.

Mougios (2006) reported that cortisol enhance gluconeogenesis, glycogen synthesis and protein synthesis in the liver and raise glucose concentration and proteolysis in muscle. Also, cortisol increase physical and mental stress. ***Mougios*** added that athletes have higher resting cortisol than non athletes, and measuring cortisol at rest may aid in estimating physical and mental stress.

This result agree with the research concentration of the data of ***Williams (2012); Overgaard & Dzavik (2011) and MacCardle et al., (2000).***

Table (2): Basic physiological variables of short distance swimmers.

Variables samples	**Pulse rate Normal 70-80 count min.**	**Lactate Normal 1-1.5 mmol/L.**	**Respiratory rate Normal 12-15 times/min**	**Vital Capacity Normal 4.4-4.8 L.**
1	66	1.0	12	5.5
2	68	1.1	13	5.0
3	66	1.0	12	5.6
4	66	1.2	12	5.4
5	68	0.8	11	5.3
6	66	0.9	12	5.5
7	44	1.0	12	5.4
8	66	1.1	12	5.0
9	64	0.9	12	5.4
Mean	**66**	**1**	**12**	**5.3**

* Normal values according to ***Barrett et al., (2010).***

Basic physiological variables indicated that the mean level exceed the average of normal level.

Table (3) indicated the thyroid hormones concentrations (T_4, T_3) (T_4 117.1 to 90 ng/ml), (T_3 1.66 to 1.3 ng/ml). The results exceeds the average levels of T_4, T_3, with an increased levels of thyroid hormones compared to the average indicated a higher metabolic role of the thyroid hormones and that the increased physiological level of the thyroid hormone may affect growth and metabolism.

Researchers are in agreement that the thyroid hormones induce anabolic and metabolic action in almost tissues of the body ***(Zhang & Lazar (2000); Dayan, (2001); Yen, (2001); Basser & Thorner, (2002); Burger (2004)).***

Chatherjea and Shinde, (2006) added that thyroid hormone T_4 is converted to T_3 in the periphery and that T_3 is 3 – 5 times more active than T_4 and has a more rapid onset of action in the body.

The discussion indicated that the basic and hormonal profile of short distance swimmers might help in the sound selection meaning that the hypothesis has been realized.

Table (3): Short distance swimmers. Hormonal Profile

Hormones	**Growth hormone ng/ml**	**Testosterone Hormone ng/ml**	**Corticosteroide Hormone ng/ml**	**T_4 Hormone ng/ml**	**T_3 Hormone ng/ml**
Sample	Normal 0.5-8	Normal 2.5-8.8	Normal 60-160	Normal 50-130	Normal 05-2.1
1	6.5	7.6	122	114	1.8
2	6.1	6.7	119	110	1.6
3	5.9	6.9	110	118	1.5
4	6.4	7.3	126	121	1.7
5	6.7	7.7	120	119	1.4
6	6.3	7.5	115	112	1.9
7	6.0	6.9	123	120	1.7
8	6.5	7.4	121	118	1.8
9	6.6	7.1	118	122	1.6
Mean	**6.33**	**7.23**	**119.3**	**117.1**	**1.66**

Hormonal profile indicated that the mean hormone concentration exceed the average of normal concentration.

Conclusion:

The basic variables (pulse rate, lactate, respiratory rate and vital capacity) together with metabolic and growth hormones (growth hormone, thyroid hormones, cortisol and testosterone) might be a good indicators for selection of short distance swimmers in Egypt.

Recommendations:

It is recommended to use these basic and hormonal profile in conjunction with other methods of selections such as anthropometric and genetic and psychological methods of selections of short distance swimmers.

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8/21/2017