AEROBIC SWIMMING TRAINING'S EFFECTS ON SOME PHYSICAL AND PHYSIOLOGICAL PARAMETERS IN SEDANTARY WOMEN[3]

Halil TANIR[1]
Yakup Akif AFYON[2]
Abdurrahman BOYACI[1]
Hilal KILIN[2]

ABSTRACT

The sample of the present research, which studies the effects of 6-week aerobic swimming training on the body composition and some physiological parameters among sedentary women, consists of 21 volunteering 19-47 years old women. Before and after aerobic swimming training, some measurements such as height, body weight, body fat percentage, endomorphy, mesomorphy, ectomorphy and vital capacity were taken in order to define body composition and some physiological parameters of the participants. According to the statistical analyses, there aren't any significant differences between pre-test and post-test body composition and some physiological parameters of the participants (p>0.05). Accordingly, 6-week aerobic swimming training doesn't have a significant effect on body composition and some physiological parameters among sedentary women. For this reason, it is considered that longer term and more comprehensive aerobic swimming trainings can contribute to the development of body composition and some physiological parameters among sedentary women.

Keywords: Sedentary, swimming, aerobic exercise, body composition, physiological parameter

AEROBİK YÜZME ANTRENMANLARININ SEDANTER KADINLARDA BAZI FİZİKSEL VE FİZYOLOJİK PARAMETRELERE ETKİLERİ

ÖZ

Sedanter kadınlarda 6 haftalık aerobik yüzme antrenmanlarının vücut kompozisyonu ve bazı fizyolojik parametreler üzerine etkisinin değerlendirildiği çalışmanın örneklemini 19-47 yaşlarındaki 21 gönüllü kadın oluşturdu. Aerobik yüzme antrenmanlarının öncesinde ve sonrasında deneklerin boy uzunluğu, vücut ağırlığı, vücut yağ yüzdesi, endomorfi, mezomorfi, ektomorfi ve vital kapasite gibi vücut kompozisyonu ve bazı fizyolojik parametrelerini belirlemeye yönelik ölçümler gerçekleştirildi. Yapılan istatistiki analizlerden deneklerin vücut kompozisyonu ve bazı fizyolojik parametrelerine ilişkin ön test ve son test sonuçları arasında anlamlı bir farklılığın olmadığı bulgusu elde edildi (p>0.05). Bu bulgudan 6 haftalık aerobik yüzme antrenmanlarının sedanter kadınlarının vücut kompozisyonu ve bazı fizyolojik parametreleri üzerinde herhangi bir etkisinin olmadığı sonucuna ulaşıldı. Bu nedenle daha uzun süreli ve kapsamı daha geniş aerobik yüzme antrenmanların sedanter kadınların vücut kompozisyonu ve bazı fizyolojik parametrelerinin gelişimine katkı sağlayabileceği düşünülmektedir.

Anahtar kelimeler: Sedanter, yüzme, aerobik egzersiz, vücut kompozisyonu, fizyolojik parametre

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[1] İstanbul Gelişim University
[2] Muğla Sıtkı Koçman University Faculty of Sport Sciences
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INTRODUCTION

Swimming is a branch of cyclic sport, which requires the conducting of specific movements with the correct technique (Okičić et al., 2007). The horizontal movements in the water, and the effort not to sink and to move in the water against gravity makes it difficult to breathe (Warburton et al., 2006). Accordingly, it is important that swimmers have developed maximal oxygen consumption levels (VO_2max) (Gastin, 2001; Figueiredo et al., 2011). Libicz et al., (2005) stated that the most important indicator of performance in swimming was aerobic fitness. On the other hand, some trainers believe that the most important factor affecting performance in swimming is body composition.

Swimming requires physical and perceptual motor skills and developed general health along with an ideal body composition (Pietraszewska and Jakubowski, 2013). Anderson, et al., (2008) reported that due to its contribution to keeping afloat and preserving the position, swimmers should have an amount of body fat.

Somatotype is a structural factor that contributes to the aerobic fitness of swimmers for long distance races. Factors, such as body dimensions, explosiveness, endurance and arm and body strength affect performance in swimming (Smerecká, 2014). Additionally, developed technical skills, multi-limb coordination, glenohumeral joint, femoral joint, flexibility of the body and ankle can be listed as others determiners of performance in swimming (Grasgruber and Cacek, 2008). According to another view, high performance among swimmers depends on the combination of technical (movement technique, coordination, start and turn) physical competency (aerobic-anaerobic endurance, flexibility and strength) and psychological factors (stress control and motivation) (Olbrecht, 2015). For this reason, the scope of swimming trainings for both experienced swimmers and sedentary individuals should be able to result in metabolic, physical and physiological changes (Barbosa et al., 2010).

It is predicted that aerobic swimming training among sedentary individuals contributes to the development of technical skills, physical and physiological features and performance. Accordingly, the findings of the present research, which was conducted to study the effects of 6-week aerobic swimming training on some physical and physiological parameters among sedentary women, are considered to the functionality of the training programs to be prepared for sedentary individuals. This study is also important on prevention of the probability of obesity, diabetes and metabolic diseases of sedentary women by making use of aerobic swimming exercises and contributing the literature.

METHOD

The present research adopted experimental design with pre-test and post-test control group. The participants were 21 sedentary 19-47 years old women. The participants attended 2-hour aerobic swimming training two days a week, for 6 weeks.

The 6-week swimming training program (2 hours a day, 2 days a week) implemented on sedentary women is presented in Table 1.

Table 1. Swimming Training Program Conducted on Sedentary Women

Weeks	Training Program			
1.Week	Freestyle kick exercise	Right pull exercise	Left pull exercise	Two pulls one breath on the wall (technique exercise)
2. Week	Freestyle kick exercise	Two pulls one breath on the wall (technique exercise)	150 m freestyle kick exercise with board	150 m freestyle technique exercise with board
3. Week	Two pulls one breath on the wall (technique exercise)	Freestyle kick exercise	150 m freestyle kick exercise	150 m freestyle technique exercise with board
4. Week	Right pull exercise	Left pull exercise	150 m freestyle technique exercise with board	Diving exercise
5. Week	Freestyle kick exercise	Two pulls one breath on the wall (technique exercise)	200 m freestyle technique exercise with board	Diving exercise
6. Week	150 m freestyle kick exercise with board	150 m freestyle pull exercise with board	200 m two pulls one breath with board (technique exercise)	200 m two pulls one breath (technique exercise)

In order to define some physical and physiological parameters of participants before and after 6-weel swimming training, scientifically valid laboratory and field tests were used. The tests were conducted in Muğla Sıtkı Koçman University Faculty of Sport Sciences physiology laboratory two times, as pre-test and post-test.

Height measurement: Heights of the participants were measured with Seca 220 brand height measure. Before the measurement, the participants were asked to take off their shoes and socks and wear clothes as light as possible. During the measurements, the participants were asked to take a deep breath, joint their ankles, keep their body straight and head at frankfort plane, and preserve their position (Özer, 2009).

Body Weight and Body Fat Percentage Measurement: Body weight and body fat percentage (BFP) of the participants were measures with Tanita (Innerscan BC532/ Japan) brand bioelectrical impedance analysis scale. Subjects stood on the metal sole plates of the machine wearing only their swimwear. All measurements were made after a period of at least 10 minute standing to minimize potential errors from acute shifts in fluid distribution. After entering gender, height, age data were on the scale, the measurements were taken (Jebb et al., 2000).

Vital Capacity Measurement: Flow-metre was used to measure participants' vital capacity. During the measurements, the participants were asked to stand, to hold flow-metre horizontally, grab with their lips and breathe out as strong as possible. The same procedure was repeated twice. The highest of three measurements was recorded (Vongsavan and Matthews, 1993)

Skinfold Measurement: Holtain skinfold calliper, which provides 10 g/sq m pressure for every angle, was used for skinfold measurements. Skinfold measurement were taken from the right side of the body. The folding procedure was done between thumb and index finger in a way that there was no muscle tissue between the folded skin. The calliper was placed 1cm away from the area folded between fingers. Without releasing the fingers folding the skin, the measurements were read between 2-4 seconds and then recorded. Each measurement was conducted twice (Kürkçü et al., 2009).

Triceps Skinfold Thickness: The participant was in standing and arms swinging on both sides position, and the skin on the back middle line of right upper arm, on the vertical plane on the middle point between acromion and olecranon was folded with left hand and the measurement was conducted with the calliper in the right hand (Tamer, 2000).

Subscapular Skinfold Thickness: The participant was in standing and arms swinging on both sides position, and the measurement was done with a 45 degree diagonal angle to the body right below the scapula from the inferior angle (Tamer, 2000).

Suprailiac Skinfold Thickness: The participant was in standing and arms swinging on both sides position, and the skin over the iliac crest was folded with 45-degree angle and the measurement was done (Tamer, 2000).

Medial Calf Skinfold Thickness: The participant was in sitting, the soles completely touching the ground, legs bent with 90 degree angle position, the measurement was taken from the widest part of right calf from the medial vertically (Tamer, 2000).

Diameter Measurements: A sliding calliper of 0.01 cm sensitivity was used in diameter measurements. Before the measurements, measurement points were detected. For more reliable measurements, the edge of the sliding calliper was applied on the soft tissue with pressure as much as possible. Each measurement was taken twice (Tamer, 2000).

Humerus Epicondyle Diameter: The arm was in bent 90 degrees position, and the distance between the lateral and medial epicondyles of the humerus was measured. Because of medial epicondyle's position according to lateral epicondyle, the calliper was held with a 45-degree angle, not parallel to the epicondyles. The measurements were taken with a pressure on the soft tissue (Tamer, 2000).

Femur Epicondyle Diameter: The participant was in sitting with the knee joint bent 90 degrees position; the distance between the lateral and medial epicondyles of femur was measured with a 45-degree angle, with enough pressure on soft tissue (Tamer, 2000).

Perimeter Measurements: A flexible, non-elastic 7 mm wide measuring tape of 0.1 cm sensitivity was used for perimeter measurements. For perimeter measurements, "0" (zero) end of the tape was held in the left hand and the other hand in the right hand, then it was folded around the area to be measured, and the number over the "0" point was recorded. During the measurements, "0" (zero) point and the measured numbers were side-by-side on the tape. The tape was applied vertically on body parts (Tamer, 2000).

Calf Perimeter Measurement: The participant was in standing, feet 20 cm away, and the weight distributed on the feet in a balanced way position, the measuring tape placed on the widest part of extremity. During the measurement, the tape was parallel on both sides, and the tissue wasn't pinched. The measurement was recorded with 0.1 cm sensitivity (Tamer, 2000).

Biceps in Flexion Perimeter: The participant was in standing and the arms were in maximal flexion position, the measurement was taken from the middle point between the acromion and olecranon. The measurement was recorded with 0.1 cm sensitivity (Tamer, 2000).

Somatotype Detection: Heath-Carter formula was used to detect somatotypes of the participants.

Endomorphy: After participants' triceps, sub-scapula, and suprailiac skinfold thickness were detected in mm type, endomorphy was calculated with the formula below.

X = (Triceps sft) + (Suprailiac sft) + Subscapula sft)

Endomorphy= -0.7182 + 0.145X - $0.00068X^2$+ $0.0000014X^3$ (Özer, 2009).

Mesomorphy: Mesomorphy was calculated with the formula below.

E=Humerus epicondyle diameter (cm)

K=Femur epicondyle diameter (cm)

A=Corrected arm perimeter = Biceps Flexion perimeter (cm) Triceps sft÷10

C = Corrected calf perimeter= Calf perimeter (cm) – Medial calf sft ÷ 10

H = Height (cm)

Mesomorphy = 0.858(E) + 0.601 (K) + 0.188 (A) + 0.161 (C) – 0,131 (H) + 4.5 (Özer, 2009).

Ectomorphy: Ectomorphy was calculated using the ponderal index (RPI) which if calculated with relationship between height and weight.

RPI = H (height – cm) ÷3 w (body weight kg)

If RPI > 40.75, Ectomorphy = 0.732 RPI – 28.58

If 4.75 ≥ RPI > 38.25, Ectomorphy= 0.463 RPI – 17.63

If RPI ≤ 38.25, 0.1 was added to the result (Özer, 2009).

Arm span: The participants were asked to recline their back on the wall, spread their arms wide on both sides, and keep their arms parallel, palms facing the ground. The furthest distance between the right and left hand fingertips was recorded (Özer, 2009).

Statistical Analysis; For data analysis, SPSS 20.0 package software was used. Statistical analyses were conducted within 95% reliability range, and 0.05 and 0.01 error levels. Kolmogorov-Smirnov test as used to test whether data fit normal distribution. After finding out that the data distributed normally, Paired Sample T test was used to test the significance of the differences between the arithmetic averages of related two groups.

RESULTS

Table 2. Comparison of Pre-test and Post-test Results related to Participants' Body Composition and Some Physiological Features

Variables	Tests	N	Mean	Std Devi.	t	p
Height (cm)	Pre-Test	21	161.67	4.55	0.97	0.256
	Post-Test	21	161.98	35.21		
Body Weight (kg)	Pre-Test	21	60.69	9.84	1.19	0.056
	Post-Test	21	56.30	15.42		
Body Fat Percentage (%)	Pre-Test	21	28.36	5.61	1.00	0.068
	Post-Test	21	26.15	7.34		
Endomorphy	Pre-Test	21	4.34	1.30	0.42	0.112
	Post-Test	21	4.17	1.28		
Mesomorphy	Pre-Test	21	3.03	1.87	0.09	0.054
	Post-Test	21	2.98	1.90		
Ectomorphy	Pre-Test	21	1.99	1.21	-0.15	0.078
	Post-Test	21	2.05	1.27		
Vital Capacity(mL)	Pre-Test	21	350.95	46.14	-1.64	0.066
	Post-Test	21	373.81	46.52		

***Kg:** Kilogram,* ***Cm:** Centimeter,* ***mL:** Millimole*

According to Table 2, there was increase in some values related to participants' body composition and some physiological parameters; however there aren't any significant differences between pre-test and post-test results for any of these values (p>0.05).

DISCUSSION AND CONCLUSION

Some anthropometric and conditional features, such as body structure, arm and body strength, technical capacity, coordination, and shoulder flexibility can affect performance in swimming. For this reason, the purpose of swimming trainings is providing metabolic, physiological and psychological improvements among swimmers. Thus, Moraiset al., (2013) reported that taller swimmers with better mechanical features among 124 (n=62 female, n=62 male) swimmers were more successful. In accordance with this finding, similar studies found that taller swimmers were faster (Jurimaeet al., 2007; Joyner and Coyle, 2008; De Mello Vitor and Silveira Bohme, 2010).

The present research found that 6-week aerobic swimming training didn't have a significant effect on physical and physiological features among sedentary women (Table 2). It is considered that, this finding may have resulted from the short duration (6 weeks) and limited scope of aerobic swimming exercises. In a similar study conducted by Gobatto et al., (2001) in which loading scope was more comprehensive, mice were swum gradually increasing their loads in accordance with their body weight for 6 weeks, and it was found that there had been a significant decrease in blood lactate levels of mice.

The studies, which reported physical and physiological parameters of the swimmers after regular trainings, were the ones conducted for longer periods of time. Maglischo, (2003) reported that there could be 20-30% increase in VO_2max values among swimmers after 8-10 week swimming training. Sperlich et al., (2010) found that low intensity swimming training in which intense interval exercises and constant loading method was used resulted in a significant increase in swimmers' VO_2max levels. 8-week endurance training with children (12 years old) resulted in increase in VO_2max values and swimming speed and a 12% decrease in heart beat rates after a 12-minute swimming test (Zarzeczny et al., 2011).

Sideraviciute, Gailiüniene, Visagurskiene and Vizbareite, (2006) who conducted 28 trainings for 14 weeks with 14-19 year old 47 female (n=diabetic, n=28 healthy), reported that there hadn't been any changes in body mass index (BMI), but there had been significant decreases in BFP values. Additionally, they reported significant increases in healthy and diabetic swimmers' aerobic capacities at 0.01 and 0.05 levels respectively.

Pietraszewska and Jakubowski, (2013) reported that, according to 18-23 years old 33 swimmers' 9-year training data, systematic trainings resulted in improvement in upper extremity and decrease in BFP. Additionally, they observed that regular training contributed significantly to swimmers chest girth and respiratory system development.

Smerecká,(2014) reported that subcutaneous fat thickness was low among 35 (n=13 male, n=22; age average= 13.8) Slovak swimmers (11.8% among male; 16.2% among female). Additionally, more than half of the swimmers (51.4%) were ectomorph, and somatotype structures were calculated as 2.7-3.2 and 4.3 average for male, and 3.6-3.0 and 4.0 averages for female.

It was reported that after 16-week endurance, strength, flexibility and water training, BMI, waist–hip ratio (WHR) and BFP values decreased, and lean body mass (LBM) values increased among 24 swimmer and diver university students (n=18 swimmer, n=6 diver)(Petersen et al., 2006).

Cengiz et al., (2013) reported that 12-week basic swimming training (60 minutes, 3 days a week) had significant effects on anthropometric features and hand grab strength among 8-10 years old children (n=48).

As presented in the related literature, long-term and comprehensive swimming training contributes to body composition and the development of some physiological parameters among swimmers. However, according to the findings of the present research, 6-week aerobic swimming training doesn't have any significant effects on physical and physiological features among sedentary women. Accordingly, it is considered that longer term and more comprehensive swimming training can contribute to the development of physical and physiological features among sedentary women.

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