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Investigation of the effect of basic swimming education course on some respiratory parameters of university students

Investigación del efecto del curso de educación básica de natación en algunos parámetros respiratorios de estudiantes universitarios

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Abstract

In this study, the effect of 12-week basic swimming training of sports science students on some respiratory parameters was determined. In the 2nd, 3rd and 4th grades of Gümüşhane University School of Physical Education and Sports, 64 (111) male students who did not take swimming lessons and 47 who took swimming lessons participated voluntarily. The experimental group was given breath work for 12 weeks during the course content and for 10 minutes at the end. Measurements were taken from the students twice before and after the 12-week education. SPSS 25.0 program was used in the analysis of the data collected within the scope of the research. Independent comparison of age, height and body weight measurements of the athletes in the experimental and control groups. Samples T Test was used. In the comparison of time, group, group x time changes of FVC, MVV, VC and FEV1 measurements, Repeated Measures ANOVA analysis was used. Statistical significance level was taken as (p<0.05). As a result of the research, a significant result could not be reached in FVC and FEV1 values between Tests, Groups and Group x time intervals, whereas VC was only between tests. However, statistically significant differences were found between MVV and VC Tests, Groups and Group x Time values. In short, it has been shown that students who take swimming lessons have statistically higher lung volumes than students who do not take the lesson. However, swimming activity can be recommended to increase respiratory efficiency of university students.

Keywords

Swimming Training; Respiration Parameters; University students

Resumen

En este estudio, se determinó el efecto del entrenamiento básico de natación de 12 semanas de estudiantes de ciencias del deporte sobre algunos parámetros respiratorios. En los grados segundo, tercero, cuarto de la Escuela de Educación Física y Deportes de la Universidad de Gümüşhane, 64 (111) estudiantes varones que no tomaron clases de natación y 47 que tomaron clases de natación participaron voluntariamente. Al grupo experimental se le dio trabajo de respiración durante 12 semanas durante el contenido del curso y durante 10 minutos al final de la lección. Se tomaron pruebas de los estudiantes dos veces antes y después de la educación de 12 semanas. Se utilizó el programa SPSS 25.0 (Samples-T test) en el análisis de los datos recolectados dentro del alcance de la investigación. Comparación independiente de las medidas de edad, altura y peso corporal de los atletas en los grupos experimental y de control. En la comparación de los cambios de tiempo, grupo, grupo x tiempo de las mediciones de FVC, MVV, VC y FEV1, se utilizó el análisis ANOVA de medidas repetidas. El nivel de significancia estadística se tomó como (p<0,05). Como resultado de la investigación, no se pudo alcanzar un resultado significativo en los valores de FVC y FEV1 entre Pruebas, Grupos y Grupo x intervalos de tiempo, mientras que la VC fue solo entre pruebas. Sin embargo, se encontraron diferencias estadísticamente significativas entre los valores de MVV y VC Tests, Groups y Group x Time. En resumen, se ha demostrado que los estudiantes que toman lecciones de natación tienen volúmenes pulmonares estadísticamente más altos que los estudiantes que no toman la lección. Sin embargo, se puede recomendar la actividad de natación para aumentar la eficiencia respiratoria de los estudiantes universitarios.

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Palabras clave
Entrenamiento de natación; parámetros respiratorios; estudiantes universitarios

Introduction

In general, sports in swimming teaching and training is the process of evaluating motor parameters through physiological indicators, in addition to the application of professional exercise tools to improve academic success and results. In order to increase the indicator system, teaching and training effectiveness, it is necessary to adjust the amount of exercise and appropriate training methods (Tuong, 2022). Swimming refers to cyclic sports and is used as a way of physical development in higher education institution students. Swimming has a versatile effect on the human body, improving endurance and mobility in the joints. In addition, the health effect on the musculoskeletal system is very beneficial for the body of a young student. The wide spread of swimming exercises within the framework of physical education of a student helps to increase the functional abilities of the body (Yehor & Kseniia, 2019). Especially for children and young people, swimming is directly related to physical and physiological development as well as its social and psychological contributions. In fact, arranging the training system and frequency specific to the athletes in order to improve the existing talent, condition and performance level of the young athletes and to obtain the desired efficiency is one of the main ways to ensure sportive success for the swimming branch (Avan, 2020).

The respiratory system is one of the main factors that provide general endurance in sports. O2 intake must therefore be high, as all body muscles are needed for movement through the water . If the swimmer's face is submerged in water, swimming technique ie stroke cycles etc. breathing is restricted. In addition, in normal (out of water) breathing, only inhalation is active and exhalation is passive , due to the relaxation of the muscles that provide the inhalation . In water, exhalation must be forced with the involvement of exhalation -producing muscles (Zakharova, Gorelov, & Miasnikova, 2020). Lung function is an important indicator of a healthy life and physical capacity (Yilmaz & Özdal, 2019). Special improvements in pulmonary function are reported in competitive swimmers by higher than predicted spirometry findings. During swimming the breathing pattern is different from the

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free breathing during land-based sports. While swimming, the inspiratory phase of the breathing cycle is timed to coincide with arm strokes, which limit the duration of inhalation. Therefore, to provide adequate airflow to the lungs during swimming, the special dynamics of breathing occur by a rapid inhalation near total lung capacity (TLC), negative pressure during inhalation and prolonged exhalation into water due to the necessity to coordinate breathing with the upper limb cycle (Päivinen, Keskinen & Tikkanen, 2021). Increased work of respiratory muscles can lead to their fatigue and a sense of dyspnoea, which, in turn, can impair the ability to perform physical exercise (Szczepan et al., 2020).

It is known that swimmers can produce high levels of maximal respiratory pressures and can increase this power by doing a few exercises with specific exercises (Tzelepis et al ., 1999; Sonetti et al., 2001). Specifically, it is stated in the literature that the effects of respiratory muscle training on training performance are positive.

As a result of the examinations, it is thought that basic swimming training may be beneficial in terms of respiratory parameters as well as learning to swim. The aim of the study is to examine some respiratory parameters of male university students who take basic swimming lessons.

Materials and Methods

Participants

The study was carried out at Gumushane University School of Physical Education and Sports 2. In the 3rd and 4th grades, 64 (111) male students who did not take swimming lessons and 47 (111) took swimming lessons participated voluntarily. Participants were informed about the study and participated voluntarily. The studies were carried out in Gümüşhane University Swimming Pool.

Measurement Methods and Tests to be Applied in the Research

Height Weight

The height (m) of the subjects was measured using an anthropometric set (Holtain brand) with a precision of 1 mm when bare feet, feet flat on the ground, heels together, knees tense and body upright. Body weight (kg) Inbody 270 model body composition analyzer was used. Measurements were taken and noted by following the

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instructions of the device. It was determined that the subjects did not have any disability that could affect the study during or before the study, by obtaining their consent.

Respiratory

Fvc , Mvv , Vc , Fev1

Vital Capacity Measurement (VC): Volunteers were asked to breathe slowly but as deeply as they could while performing their normal work of breathing, and then to fully exhale the inhaled air . The test was repeated 3 times and the best value was accepted as the study data if the difference between the 2 best results was less than 200 ml.

Forced Vital Capacity Measurement (FVC): After a maximum inspiration , he will be asked to exhale as fast and as strong as possible, not shorter than 6 seconds . Here too, the best test result was taken into consideration, provided that the difference between the best FVC values was not more than 200 ml.

Maximal Voluntary Ventilation Measurement (MVV): In order to determine the volume of air that the person can take in in one minute (lt / min) , it was asked to breathe quickly and forcefully while sitting for 12 seconds . The best of the 2 repeated tests was accepted (Medicine , 2013).

Experimental Design

The study was completed by considering the curriculum of Gumushane University Physical Education and Sports School and giving basic swimming training 2 hours a week for 12 weeks. Basic Swimming Training was applied as follows.

Week	Study Content
1th	Basic scientific and biomechanical principles of swimming - Breathing exercises
2th	Fundamentals of water safety and first aid - Breathing exercises
3th	Getting used to water - Breathing exercises
4th	Progression and staying on the water surface - Breathing exercises
5th	Water slide and kick in the supine technique - Breathing exercises
6th	Arm pull in supine technique – Breathing exercises
7th	Foot, arm coordination in supine technique – Breathing exercises
8th	Foot in free technique – Breathing exercises

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9th	Foot and arm coordination in free technique – Breathing exercises
10th	Breathing and arm pull in free swimming technique – Breathing exercises
11th	Foot-arm coordination in free swimming technique – Breathing exercises
12th	Diving and general repetition – Breathing exercises

Statistical analysis

SPSS 25.0 program was used in the analysis of the data collected within the scope of the research . Independent comparison of age, height and body weight measurements of the athletes in the experimental and control groups. Samples T Test was used. In the comparison of time, group, group x time changes of FVC, MVV, VC and FEV1 measurements, Repeated Measures ANOVA analysis was used.

Results

Table 1. Independent Comparison of the Age, Height, Body Weight Values of the Athletes Participating in the Research Between the Groups Samples T Test Results

Variable	Group	N	$\bar{X}$±SS	t	p
Age	Experiment	47	22.09 ± 1.93	-.179	,859
	Control	64	22.17 ± 2.89		
Size	Experiment	47	176.49 ± 5.28	-,741	,460
	Control	64	177.36 ± 6.66		
Body weight	Experiment	47	71.83 ± 10.05	-.235	,814
	Control	64	72.27 ± 9.34		

When Table 1 is examined, the mean age of the athletes in the experimental group was 22.09±1.93 years, the average height was 176.49±5.28 cm, the mean body weight was 71.83±10.05 kg, and the athletes in the control group were mean age was 22.17±2.89 years, average height was 177.36±6.66 cm, and average body weight was 72.27±9.34 kg. There was no statistically significant difference between the age, height and body weight of the athletes in the experimental and control groups (p>0.05).

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Table 2. Repeated Investigation of Respiratory Parameters Measurement Results of the Athletes Participating in the Study for Differences Between Tests, Between Groups and According to Group x Time Change Measures ANOVA Analysis Results

Measurement	**Group**	**Pre-Test ($\bar{X}$±SS)**	**Final Test ($\bar{X}$±SS)**	**Between Tests**	**Group**	**Group x Time**
FVC	Experiment	4.74±1.11	4.84±1.09	F=.104	F=.750	F=.966
	Control	4.97±0.85	4.92±0.95	p=.747	p=.388	p=.328
MVV	Experiment	173.85±39.15	181.00±25.90	F=5,160	F=17,123	F=.392
	Control	197.24±28.78	201.30±27.31	p =.025	p=.000	p=.533
VC	Experiment	4.42±0.95	4.49±0.96	F=1.930	F=4.668	F=6.054
	Control	4.94±0.87	4.70±0.97	p= .168	p=.033	p=.015
FEV1	Experiment	2.00±1.25	1.73±0.82	F=1.358	F=3.129	F=2.244
	Control	1.62±0.50	1.65±0.79	p =.246	p=.080	p= .137

FVC measurements increased by 0.10 in the experimental group and decreased by 0.05 in the control $_{group}$. p>0.05], between groups [F $_{(1, 109)}$ =.750; p>0.05], between group x time [F $_{(1, 109)}$ =.966; p>0.05], it is seen that there is no statistically significant difference.

In MVV measurements, there was a 7.15 increase in the experimental group and a 4.06 increase in the control $_{group}$. p<0.05], between groups [F $_{(1, 109)}$ =17,123; p<0.05], statistically significant difference between group x time [F $_{(1, 109)}$ =.392; p>0.05], it is seen that there is no statistically significant difference.

In VC measurements, an increase of 0.07 occurred in the experimental group and a decrease of 0.24 in the control $_{group}$. p<0.05], group x time between [F $_{(1, 109)}$ =6.054; p<0.05], statistically significant difference between tests [F $_{(1, 109)}$ = 1.930; p>0.05], it is seen that there is no statistically significant difference.

FEV measurements decreased by 0.27 in the experimental group and increased by 0.03 in the control $_{group}$. p>0.05], between groups [F $_{(1, 109)}$ =3,129; p>0.05], between group x time [F $_{(1, 109)}$ =2.244; p>0.05], it is seen that there is no statistically significant difference.

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Discussion

The aim of this research is to examine some respiratory parameters of male university students taking basic swimming training course. According to the results of the analysis, the respiratory parameters of FVC (forced vital capacity), MVV (maximal voluntary ventilation), VC (vital Capacity) and FEV1 (gas volume expelled from the lungs in the first second of forced expiration) were examined from the Experimental and Control Group students . As a result of the statistical analysis, a significant result could not be reached in FVC and FEV1 values between Tests, Groups and Group x time intervals , whereas VC between tests only . However, statistically significant differences were found between MVV and VC Tests, Groups and Group x Time values.

Hypothesis that exercise capacity and performance can be increased with the development of respiratory muscles has been extensively researched in the last decade (HajGhanbari , 2013). The development of respiratory muscles is expressed by hypertrophy of the diaphragm muscle, an improvement in the ratio of type I and II muscle fibers (Downey , 2007). In addition to the basic swimming training given to the study group, it is thought that breathing exercises may be an improvement in respiratory muscle groups and this development may have a positive effect on respiratory function in the participants.

The literature is examined, Şerifoğlu, Çetinkaya, & Kayatekin , (2021) found that as a result of six-week breathing exercises, forced vital capacity (FVC) between the groups, forced expiration in the first second. volume (FEV1), maximum voluntary ventilation (MVV), they could not detect a significant difference. Pehlivan et al ., (2018) used a respiratory exercise device in patients undergoing lung transplantation, starting with 30% pressure and increasing it up to 60% pressure, for three months, five days a week, twice a day, for 15 minutes, with respiratory muscle exercises FVC, FEV1 reported that there was no significant increase in their parameters. (Pehlivan et al ., 2018). According to the findings of Pişkin et al ., (2020), there was a significant increase in PEF and FEV1 values in favor of the post-test, although there was a statistical increase in favor of the post-test in the FVC value, this increase was not statistically significant. Cunha et al., found no significant difference between groups for forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) after 12 weeks

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of respiratory muscle training. However, they found a moderate increase in FVC and FEV1 for the experimental group (Cunha et al., 2019).

In the study in which some respiratory and circulatory parameters of the 11-13 age group students in the primary school teams were compared with the students who did not do sports , it was determined that the FVC values of the students in the school team were higher (Alpay, Altuğ, & Hazar, 2007). Becer and Eliöz (2005), in their study in which they examined the effect of 16-week core exercises on respiratory parameters in elite male swimmers, found a time-dependent change when they compared the pre-test and post-test values of the study and control groups ($p<0.001$). They found that the MVV value between the groups improved in the study group ($p=0.023$). As a result of the pretest and posttest values of VC, FVC, FEV1 parameters taken from the experimental group of 34 people aged 12 to 15, including elite and performance swimmers, and the control group of 17 people from the same age group, the increase in the elite and performance group was statistically significant. found it meaningless (Wells et al ., 2005). Sever et al ., (2021) observed that the forced vital capacity (FVC) value, which is one of the respiratory parameters of the swimming athletes in the 12-15 age development group , is related to the competition degrees and that the development of respiratory parameters is important in terms of increasing the performance of the athletes. Bağıran, Dağlıoğlu, & Bostancı, (2019) found significant differences in VC, FVC, FEV1 and FEV1/FVC % values after the respiratory muscle training program applied to the experimental group ($p<0.05$) (Bağıran, Dağlıoğlu & Bostancı, 2019). Kubiak Janczaruk (2005) found that the pretest and posttest values of VC, FVC, FEV1 parameters in adolescent swimmers were statistically significant. Doherty and Dimitrio (1997) conducted a study to compare the lung volumes of 159 swimmers, 130 athletes and 170 sedentary people. There are many studies showing that regular physical activities improve respiratory functions (Kalkan and Dağlıoğlu, 2018; Yılmaz and Dağlıoğlu, 2018). Studies have shown that respiratory muscle training has positive effects on respiratory muscles (Lomax and McConnell, 2009; Kilding et al., 2010). Another study said that although no statistical measures of variation or inferential statistics were reported, the control group (CG) could have had significantly higher spirometry values at baseline (Shei, 2018). Ohya et al., in a study in which they examined the effect of high-intensity inspiratory muscle strength training

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(IMST) for 6 weeks on maximal inspiratory mouth pressure (MIP) and swimming performance with elite competitive swimmers. They stated that it was sufficient to improve MIP and swimming performance under controlled-frequency breathing condition (Ohya et al., 2021). It is thought that the difference between our study and some of the studies in the literature is due to the differences in the study method or study groups.

Conclusions

Our results showed that students who took swimming lessons had statistically higher lung volumes than students who did not take the lesson. However, swimming activity can be recommended to increase respiratory efficiency of university students.

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