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Comparison of selected health and morphological parameters between classic swimming and synchronized swimming

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Abstract

Swimming and synchronized swimming are two similar sports, different in required patterns of movements, but with similar predispositions in important motor abilities, functional capacities and morphology. First goal in this study is to determine the differences between female girls in two age groups, actively engaged in classic and synchronized swimming in chosen health and morphological parameters, as well se to forecast body mass index (BMI) in overall sample of active athletes with same parameters as the predictors. The data are collected from routine medical examinations of the athletes in the Polyclinic for Occupational Health and Sport in Zagreb, including sample of female athletes: swimmers (N=46) and synchronized swimmers (N=15), in two age groups: 7-13 years and 13-15 years. The results showed that the differences between swimmers and synchronized swimmers are not found, except in the age group 7-13 years, where diastolic blood pressure and hematocrits showed higher mean values in synchronized swimmers, as compared to the swimmers. BMI could be successfully predicted on the base of three statistically significant predictors (systolic blood pressure, leukocyte and sedimentation). Results offer the guidelines for improving the training process for both sports.

Keywords: anthropometry, functional capacities, swimming, training

Introduction

The swimming and synchronized swimming are two similar sports. This study is conducted to determine the differences among chosen health and morphological parameters, in young female athletes engaged in these two sports. In order to enhance their physical and mental potential, girls who are exercising (either as amateur or top athletes) should use the scientific knowledge, to develop and maintain their strength, flexibility, coordination and endurance (Wells, Fasting & Dahm, 2013). Swimming is a life-long sport, one of the basic sports, an important marker of health in children and adolescents (Ortega, Ruiz, Castillo & Sjöström, 2008; Gisladottir, Haga & Sigmundsson, 2013), and affects the proper physical and mental development of the child (Sindik, 2009; Badrić et al., 2014). Swimming is one of the cyclic sports, in which dominate relatively simple movements, which are constantly equal and alternately repeated, during swimming specific techniques (Bartlet, 2007). Synchronized swimming is a sport that consists of aesthetically designed swimming movements, positions, figures and compulsory and free compositions that swimmers perform in water, in line with each other and with the music. In other words, synchronized swimming is a combination of swimming, sports and rhythmic gymnastics, ballet and dance in the water (Skender, Grčić-Zubčević & Gričar, 2009). Among the **morphological** characteristics, body height and weight strongly influences on the success of the athletes in these two sports, giving clear criteria for the selection of athletes in general (Claessens Lefevre, Beunen & Malina, 1999). In the synchronized swimming, the problem about these criteria arises in those minor acrobatics and body need for better buoyancy in the water, which does not allow high muscularity or very low levels of body fat (Lundy, 2011). Desirable body height is similar to the population norms of the average population, but the body weight and body mass index (BMI) must be quite low (Bante Bogdanis, Chairopoulou & Maridaki, 2007). Therefore, recommended measures of desirable height and body composition in swimming and synchronized swimming should be average height with low body weight, in relation to the height. It seems that longer limbs are desirable characteristics for synchronized swimmers, because they can achieve a higher height out of the water with long skinny legs and with longer hands: with these predispositions, thrust is better, creating a higher altitude and higher speed (Lundy, 2011). Since swimming is activity that takes place in water, desirable composition of the body has to be as buoyant as possible, which can create a greater propulsive force, simultaneously with as small as possible frontal resistance (Leko, Šiljeg & Mikulić, 2011). Swimming requires a certain structure of the body that will allow better navigability, and yet enough strength for operating of the required task (Katić & Rogulj, 2005). Among **functional** capabilities important for swimmers, the transfer of oxygen depends the most of the features of pulmonary system (Volščanšek, 2002). The swimmers quickly lose their functional capacity, which, however, can be maintained with considerably less work than it is needed to achieve it (Petković, Petković & Grčić-Zubčević, 2003). When analyzing the performance of synchronized swimming, it can be presumed that the movements in this sport are the combination of highly complex **motor** patterns (Perić, Petrić & Žižić, 2007). Therefore, it is important to determine motor skills and knowledge important for successful engagement in synchronized swimming. Biological age is one of the main motor suppressing impact on the swimmers in general in early adolescent age (Antulov, Ćavar & Zenić, 2007). As the motor skills are affected equally by physiological and anatomical factors, the assumption is that in both types of swimming and synchronized swimming, similar motor skills are equally important. Both swimming and synchro swimming require certain flexibility that is developing to a maximum of 12-years of age (Sekulić & Metikoš, 2007). Thus, it could be concluded that the swimming and synchronized swimming are different only in (some) required patterns of movements, but both sports have the similar predispositions in important motor abilities, functional capacities and morphology.

First goal in this study is to determine the differences between female girls (aged from 7 to 13), as well as early adolescent girls (aged from 13 to 15), who are active athletes in classic swimming (total 365 girls from eight clubs in Zagreb) and synchronized swimming (total 103 girls from four clubs in Zagreb), in chosen health and morphological parameters. Second goal is to forecast body mass index (BMI) in overall sample of active athletes in classic and synchronized swimming, with chosen health and morphological parameters as the predictors.

Method

Sample and procedure

The data collected from the Polyclinic for Occupational Health and Sport in Zagreb have been used in this study, include intentional sample of female athletes: swimmers (N=36) and synchronized swimmers (N=11), in the age group ranging from 7-13 years, and swimmers (N=10) and synchronized swimmers (N=4) (age group 13-15 years). It has to be mentioned that overall population of active synchronized swimmers aged 7 -15 years in Zagreb clubs is 103 (according to the data from http://www.croatiasynchro.hr/), while in overall Croatian Swimming Federation (http://www.hrvatski-plivacki-savez.hr/) is registered only 365 girls in the same age. Thus, these samples should be quite representative for Zagreb active swimmers' population. All data (height, weight, body mass index, blood pressure (diastolic and systolic), pulse rate, hemoglobin, hematocrit, leukocyte, thrombocyte and sedimentation), were collected using standard medical procedures during routine medical examinations in years 2011 and 2012. The study was approved by institutional Ethics Committee, within the project while and appropriate informed consent.

Statistical analyses

The Mann Whitney U test was used to identify the potential differences among swimmers and synchronized swimmers in chosen set of morphological and health indicators, separately for each age group. Categorical regression (CATREG) is used instead of standard linear (multiple) regression analysis, because of nonlinear relationships in relatively small sample of participants (swimmers and synchronized swimmers in both age groups). Nonlinear transformations allow variables to be analyzed at a variety of levels to find the best-fitting model. All analyses were performed using SPSS 20.0.

Results and Discussion

In Table 1 it is evident that only two significant differences between swimmers and synchronized swimmers age group 7-13 years in selected anthropometric and laboratory variables are found. For the diastolic blood pressure and for the hematocrits, significantly higher values of means are found in synchronized swimmers, as compared to the swimmers ($p < 0.05$). None statistically significant differences are found between swimmers and synchronized swimmers in the age group 13-15 years in selected anthropometric and laboratory variables.

Table 1 - Differences between swimmers (N = 36) and synchronized swimmers (N = 11) (age group 7-13 years), as well as in swimmers (N = 10) and synchronized swimmers (n = 4) (age group 13-15 years) in selected anthropometric and laboratory variables

		age group 7-13 years			age group 13-15 years		
	Sport	Mean	Std. Deviation	Mann Whitney U test (p)	Mean	Std. Deviation	Mann Whitney U test (p)
body height (cm)	swimming	152.150	9.290	0.538	164.050	6.269	
	synchronized swimming	153.410	8.074		165.125	9.784	1.000
body weight (kg)	swimming	42.970	8.033	0.081	55.950	7.704	
	synchronized swimming	50.910	14.387		54.000	7.757	0.539
pulse rate (beats per minute)	swimming	69.640	9.274	0.571	69.200	12.354	
	synchronized swimming	73.090	11.406		60.500	6.608	0.240
blood pressure systolic	swimming	96.860	10.315	0.365	108.300	7.832	
	synchronized swimming	105.270	13.447		110.750	1.500	0.539
blood pressure diastolic	swimming	60.560	6.308	**0.041**	67.800	7.239	
	synchronized swimming	63.090	5.907		70.000	8.165	0.635
hemoglobin	swimming	130.250	6.830	0.204	131,400	7,351	

	synchronized swimming	132.180	12.828		128,000	2,944	0.733
hematocrits	swimming	0.397	0.018	**0.022**	0.400	0.014	
	synchronized swimming	0.403	0.026		0.390	0.014	0.240
leukocytes	swimming	6.006	1.129	0.085	5.510	1.018	
	synchronized swimming	6.464	2.397		5.750	1.420	0.733
thrombocyte	swimming	267.610	51.829	0.811	254.500	56.498	
	synchronized swimming	309.000	54.292		244.500	45.938	0.945
sedimentation	swimming	6.750	3.375	0.509	6.700	4.596	
	synchronized swimming	8.730	6.084		7.000	4.082	0.539
body mass index (BMI)	swimming	19.021	2.999	0.868	20.651	2.729	
	synchronized swimming	19.474	4.519		18.982	2.149	0.093

In Table 2, it is observable that the coefficient of multiple regression is statistically significant. So, BMI could be successfully predicted on the base of three statistically significant predictors (systolic blood pressure, leukocyte and sedimentation), with positive correlations with the criterion.

Table 2 - Multiple regression analysis (CATREG) for swimmers and synchronized swimmers, according to both age groups together (prediction BMI on the base of other variables)

Swimmers & Synchro Swimmers			
	BETA	**F**	**p(F)**
pulse rate	.123	.578	.562
blood pressure systolic	**.384**	19.054	**.000**
blood pressure diastolic	.104	.807	.448
hemoglobin	.252	1.233	.299
hematocrit	-.106	.201	.895
leukocyte	**.191**	4.547	**.004**
thrombocyte	-.108	.772	.464
sedimentation	**.231**	4.610	**.004**
Criterion: **BMI**	**R=0.559 Adj. R^2=0.238 F=4.191** (df=20)**		

As swimming and diving are actually base of synchronized swimming, because any synchro swimmer is required to be an excellent swimmer to be a synchronized swimmer. Thus, we have assumed that all parameters, collected in this research, might be similar. However, synchronized swimmers are involved in acrobatic components, and may have even more specific requirements. One reasonable explanation of the results obtained arise from the fact that synchronized swimmers in certain ages have longer periods of each training than classical swimmers (Chu, 1999), with potential consequences on higher aerobic capacity, and consequential on higher levels of diastolic blood pressure and hematocrits. On the other hand, positive correlations between BMI and systolic blood pressure, leukocyte and sedimentation, can be expected from previous studies. Namely, overweight multiracial schoolchildren are significantly more likely to have elevated systolic blood pressure (Resnicow et al., 1993). On the other hand, obese adolescents had higher total and differential leucocyte count when compared to normal weight individuals, and it is related with their lower level of physical fitness (Tenório et al., 2014). Sedimentation probably could be linked with BMI in terms of lower immune system, or just accidentally (according to small sample size). The advantage of this research is studying relatively representative samples of athletes, in fact all athletes which were included in routine medical examinations, in two consecutive years (2011 and 2012) in the Clinic for Sports and Occupational Medicine of the Zagreb Sports Association. Therefore, the possibility of generalization of these findings is good, but the main shortcomings arise from the fact that subsamples of athletes are small-sized, especially for synchronized swimming. The main shortcoming arise from the feature of routine medical examinations, which are really “routine” (very often superficial), without collecting all data for all the variables for each athlete. Particularly, the data about hemoglobin, thrombocyte and sedimentation are particularly deficient. In future research, the main directions are collecting more data in general, specific psychosocial profiles, and data that are more precise from medical and anthropometric examinations, as well. Practical implications are mainly diagnostically, but also selection-directed. Namely, for better defining training process for these two sports in certain age groups, researchers could identify the profiles of athletes who are disturbing from ‘ideal’ profiles in morphological variables, but also in their functional capacities and health status.

Conclusions

In most of the variables, as expected, the differences between swimmers and synchronized swimmers are not found. However, in age group 7-13 years, diastolic blood pressure and hematocrits showed significantly higher values of means in synchronized swimmers, as compared to the swimmers. Statistically significant multiple regression coefficient showed that BMI could be successfully predicted on the base of only three statistically significant predictors (systolic blood pressure, leukocyte and sedimentation). Results are explained in terms of duration of the training, which is something longer for synchronized swimmers.

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