ABO BLOOD GROUPS AND MOTORICAL CAPABILITIES OF STUDENTS

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Abstract
This research task has had the primary goal to determine the differences between motorical capabilities, endurance of students with different blood groups. The sample had been made of 96 young and healthy persons which are volunteer blood donors (N A = 36, N O = 27, N B = 23, N AB = 10). Motorical capabilities are estimated by implementing 8 standardized tests (4 dynamometric and 4 non- laboratory), working capability is estimated by the Cooper's test, and from body dimensions body mass, height and Body Mass Index (BMI) are measured. The phenotype's influence on differences between motorical and morphological variables in four sub-samples had been tested by implementing the variance's analysis. Results had shown up that for the majority of motorical tests and for all three body dimensions no statistically significant differences were found between the survey participants with different blood group type. Significant differences are observed only for in-the-field (non-laboratory) tests (such as long jump, number of push-ups, and the Cooper's test). Results provided pinpoint to the conclusion that the blood groups do not significantly influence motorical capabilities of young persons and the differences obtained are probably incidental.

Key words: *blood groups, motorical capabilities, youngsters.*

Introduction

Every type of kinesiological activities requires planning no matter if it's about education, sport, the sport recreation (Mraković, 1997; Milošević, Mudrić, Jovanović, Amanović, Dopsaj, 2005; Milošević, Milošević, 2014). That's important to the reason that that's the way to resolve the goals of workout previously set-up. Of course before previously determined procedures (choice and distribution of the workout's content, volume and methods) special attention should be paid on constraining and impeding factors which can influence the process of workout.

Surely in context of ever more significant discussions about the importance of ABO blood groups on affinity towards different illnesses (Yamamoto, Yamamoto, Blancher, 2012; Fagherazzi, Gusto, Clavel-Chapelon, et al., 2015; Franchini, Lippi, 2015), type of diet which suits to each single blood group (D'Adamo,Whitney, 1996, 2012; Christiano, 2008; D'Adamo, Richards, 2010), which kinesiological activity is preffered (D' Adamo, Whitney, 1996; Christiano, 2008; Cvjeticanin, Marinkovic, 2009; Lippi, Gandini, Salvagno et al., 2017), as well as the psychological profile (Tsuchimine, Saruwatari, Kaneda, Yasui-Furukori, 2015; Sharifi, Ahmadian, Jalali, 2015; Vuk Pisk, Vuk, Ivezić et al., 2019), the phenomena is worth of attention. According to Peter Adamo and Joseph Christiano, two nutriopatic doctors, as well as according to the other advocates of specific diets and the ways of workouts, each blood group possess unique features in the sense of health and general condition of an individual. Based on these differences they recommend different type of diet and particular style of workout for each single blood group to reach optimal results in achieving and/or maintaining the healthy body weight and the level of physical capabilities.

Blood groups are fundamental and provide the confirmation that each human being is something completely unique. Blood group, whether it is A, B, O, or AB can provide the picture about the influence of different features which can identify an individual for sure such as DNA analysis.

Thus ABO blood groups can fall into the endogenous factors of constraints of a controlled workout process at which attention should anyway be paid, with that that when it comes to the controlling of effects and changes in sense of development, renewing and the maintaining of given and the possible level of capabilities and features, must be governed by individual approach and training should be adopted to the each single subject according to his (her) genetic capacities (Mraković, 1997; Milošević i sar. 2005; Milošević, Milošević, 2014; Amanovic, Baic, Nikac, Ljubisavljevic, 2015). Idea as well as empirical observations (D'Adamo, 1996) that humans of different blood groups require different forms of physical activities today is widely accepted.

That anyway gives the inspiration for the scientific estimation of these phenomena. The goal of this study is to (1) quantify the influence of the blood group on variability of motoric capabilities of the participants and (2) the bodies' dimensions influence.

Methods

Sample
The sample is consisted of 96 students of the Criminalist-police University in Belgrade. All participants are male, aged from 19 to 21. All respondents are volunteer blood donors (N A = 36 or 34.56%, N O = 27 or 25.92%, N B = 23 or 22.08%, N AB = 10 or 9.6%) and all of them submitted their personal written permission before participation in the survey. Respondents had undergone through the medical check-up and psychological testing which both confirmed their full physical and mental health.

Variables
Variables are divided into 5 groups:
ABO phenotype (one independent variable): 4 modalities (A, B, O, AB),
Variables of force (4 dynamometric tests): maximal force (F max) of the left hand and the right hand's squeeze, the maximal force (F max) of the body's extensors and maximal force (Fmax) of the legs' extensors,
Variable dynamical force (4 non-laboratory tests): "sit and reach" 30 seconds (SR30), long jumb from the site (SDM), the number of vertical push-ups in 10 second period (ZG10), and the number of push-ups in 10 second period (SK10),
One test of general endurance: the Cooper's 12-minute running test (K12),
Three anthropometrical variables: the body mass (BM), the body height (BH), and the body mass index (BMI = TM/TV 2).

The maximal mascular force (F max) is measured by the Belt's method of isonometric dynamometry by using the hardware-software system for measuring "Program engineering, Belgrade" (Milosevic et al., 1997). In-the-field tests of dynamic muscular strain (SR30, SDM, ZG10,SK10) are realized by using of standardized protocol (Amanović, Milošević, Mudrić, 2004; Milošević et al. 2005; Milošević, Milošević, 2014). The Cooper's test results are expressed with meters passed. Anthropometrical measurements are realized according to the International biological program (IBP).

The Methods of Statistical Data Processing
The data obtained are processed by using descriptive and comparative statistical procedures by using application program SPSS 17.

For each of single variable the arithmetical mean value (Mean) and the standard deviation (Std.Dev) are computed. Significance of the differences between average values of the respondents with different types of the blood group is tested by using of the variance's analysis (One-way ANOVA).

For determination of the independent variable's influence (the effect size) the Eta-squared is used, and for the analysis of variability the Turkey Post-Hoc procedure is used.

Results

The values obtained in all types of analysis (Tables 1-6) pinpoint to great reliability of the survey results obtained. Descriptive analysis had shown up that the standards' deviations values are low to all variables followed up, in fact less than 15% of average values, and the error of average values in the population is pretty low and is less than 5% of the average value in the sample.

Significance of differences between average value of the respondents (three morphological and eight motorical variables) with different ABO blood groups is tested by using of the variances' analysis. Based on the data presented in the tables 1-6 we can spot that generally there are no significant differences except in three variables such as the long jump from the site, number of push-ups in 10 second period and the Cooper's test ($p<0.05$).

Table 1: Descriptive data for morphological variables.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
Body height (m)	O	27	**1,84**	,066	,013	,640	,591	,02
	A	36	**1,83**	,066	,011			
	B	23	**1,84**	,058	,012			
	AB	10	**1,86**	,046	,014			
Body mass (kg)	O	27	**85,22**	12,065	2,322	,113	,952	,00
	A	36	**86,36**	10,173	1,696			
	B	23	**86,37**	8,975	1,871			
	AB	10	**84,90**	6,045	1,912			
BMI (kg/m^2)	O	27	**25,19**	2,480	,477	,922	,434	,03
	A	36	**25,77**	2,453	,409			
	B	23	**25,44**	1,776	,370			
	AB	10	**24,53**	1,304	,412			

Table 2. Descriptive data for Fmax, the hand's squeeze.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
Fmax squeeze the left hand (daN)	O	27	**55,64**	6,344	1,221	,938	,426	,03
	A	36	**54,92**	7,296	1,216			
	B	23	**57,58**	8,890	1,854			
	AB	10	**58,49**	8,799	2,782			
Fmax squeeze the right hand (daN)	O	27	**59,20**	6,027	1,160	,538	,658	,02
	A	36	**58,76**	7,825	1,304			
	B	23	**60,50**	8,946	1,865			
	AB	10	**55,64**	6,344	1,221			

Table 3. Descriptive data for the force and the body's strength.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
Fmax the extensor back (daN)	O	27	**171,92**	23,680	4,557	,198	,897	,01
	A	36	**167,08**	20,736	3,456			
	B	23	**168,77**	27,174	5,666			
	AB	10	**170,58**	39,072	12,356			
The body's lift up in 30 second	O	27	**27,70**	2,569	,494	,932	,428	,03
	A	36	**27,00**	2,608	,435			
	B	23	**26,65**	2,080	,434			
	AB	10	**26,70**	1,947	,616			

Table 4. Descriptive data for the force and the strenght of the leg.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
Fmax Extensor legs (daN)	O	27	**173,37**	22,069	4,247	1,090	,357	,03
	A	36	**163,89**	20,424	3,404			
	B	23	**165,10**	23,959	4,996			
	AB	10	**174,58**	43,203	13,662			
Long jump from site (cm)	O	27	**240,81**	12,064	2,322	4,870*	,003	,14
	A	36	**230,19**	12,441	2,074			
	B	23	**234,26**	11,779	2,456			
	AB	10	**228,80**	8,417	2,662			

Table 5. Descriptive data for the strenght of hands and shoulder zone.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
The number of accomplished push-ups in 10 sec.	O	27	**12,30**	1,251	,241	3,373*	,022	,10
	A	36	**12,72**	1,221	,204			
	B	23	**13,49**	1,436	,299			
	AB	10	**12,84**	1,676	,530			
The time needed for realization 10 vertikal push-ups (sec.)	O	27	**15,38**	3,313	,638	1,909	,134	,06
	A	36	**17,57**	4,294	,716			
	B	23	**17,40**	3,904	,814			
	AB	10	**17,73**	4,661	1,474			

Table 6. Descriptive data of aerobical capabilities.

Variable	*Group*	*N*	*Mean*	*Std. Dev.*	*Std. Error*	*F*	*Sig.*	*Eta*
The Cooper's test (m)	O	27	**2809,44**	135,251	26,029	8,113*	,000	,21
	A	36	**2674,44**	84,361	14,060			
	B	23	**2716,74**	139,240	29,034			
	AB	10	**2823,00**	160,489	50,751			

Despite statistical significance, real difference of the mean values of the groups (O,A,B and AB) is very small. The size of that difference is expressed using the indicators of the influence's size – eta squared and totals: 0.01 or 1% of explained variation regards to the back extensor's Fmax variable, 0.02 or 2% of the right hand's Fmax, 0.02 or 2% regards to the body height's variable, 0.03 or 3% of the left hand's variable regards to the body's lift up over the 30 second time period and 0.03 or 3% regards to the legs' extensors and 0.03 or 3% regards to the Body mass index (BMI) variable, which according to the Coen's criteria tells that the influence of the difference is small, 0.06 or 6% regards to the variable of time necessary for 10 vertical pushups accomplishment and 0.10 or 10% regards to the variable of number of push-ups accomplished for the 10 second period as middle influence, 0.14 or 14% regards o the variable of the long jump from the site and 0.21 or 21% regards to the Cooper's test variable as large influence.

Aftermath comparisons by using the Tuckey's HSD test show that regarding the variable of long jump from the site middle value of the blood group o (M =240.81, SD = 12.064) significantly differs from the middle value of the blood group A (M = 230.44, SD =12.064, p = 0.00) and the blood group's AB (M = 228.80, SD =8.417, p = 0.03). The group B (M = 234.26, SD =11.779) does not differ from the group O. When it comes to the variable of the number of push-ups accomplished over the 10 second period middle values of the O group (M = 12.30, SD =1.251) does differ significant from the group B (M = 13.49, SD =1.221, p=0.01) and the group O does not differ significantly from the group A (M =12.72, SD=1.221) and the group A B (M =12.84, SD = 1.676). Also when it comes to the variable which represents general endurance (the Cooper's test) the comparisons by the Tukey's HSD test show that the middle values of the blood group O (M = 2809.44, SD = 135.55) differ significantly from the middle values of the group A (M = 2674.44, SD = 84.361, p=0.00) and the group B (M =2716.74, SD = 139.240, p =0.04). Also the group A's middle values (M=2674.44,SD =84.361) and the blood group's AB's middle values (M =2823.00, SD =160.489, p=0.00) do significantly differ too. The blood group AB (M =2823.00, SD =160.489) does not significantly differ from neither of groups A or B.

Discussion

Today is almost sure that the prevalence of some human disorders (cardiovascular, infective and the others) can be related with the ABO blood group, for which there are proofs in the science literature (Franchini, Mannucci, 2014; Fagherazzi, et al., 2015; Franchini, Lippi, 2015; Franchini, Mengoli, Bonfanti, Rossi and Lipi, 2016). There are many scientific works that were dealing with with the ABO blood group connection and psychological profil, psychological disorders and related (Zonda, Lester, 2002; Tsuchimine, et al., 2015; Sharifi, et al., 2015; Vuk, et al., 2019). However almost there is no significant scientific works that are dealing with the ABO group and physical features of humans. Right in our work we have researched possible relations between the phenotype ABO and basic motorical capabilities that are founded on the D'Adamo's hypothesis that different blood groups require different forms of physical activities (D'Adamo, Whitney, 1996). In the experiment the group of four different modalities of the ABO's phenotype (A, B, AB and O), nine motorical variables and three morphological variables.

The cause of motorical variables is chosen in the way such to represent basic motorical status which is determined in the fields of the contractibility of the muscular tissue and the energetic potentials. The contractivity of the muscular tissue is estimated with the level of generating of different aspects of muscular force in both static and dynamic regimes of working. Energetic potentials are estimated by the aerobic work capability.

Even though there are quite small number of works which were dealing with this phenomena, respective to the ABO blood group and physical capabilities, our results with some caution confirm that the existence of those relations regarding to the three non-laboratory tests (the Cooper's test, the long jump test from the site and the number of push-ups in 10 second period). Lipi and associates (Lippi, Gandini, Salvagno et al., 2017) obtained similar results. Results of their study show up that recreational sportists with the O blood group show better results in half-marathon (21.1 km track length) in comparison to other blood group holders who doesn't come from the O blood group (10.1% of the explained variance). This findings can bolster the findings of our research that there is significant difference of mean values (21% of the explained variance) of results in test of general endurance (the Cooper's 12-minute test) of the O blood group's holders and the other blood groups (A and B), while the blood groups O and AB do not differ, what could be attributed to small number of respondents with the AB group (N AB =10). Coefficient of innate endurance h 2 = 0.50 (Pistotnik, 2003). Namely, some motorical capabilities are more, some are less congenital, genetically conditioned. Thus to some of them we can influence more, and to some of them less, which depends of coefficient of congenitence (h2) of some capabilities, sex and age.

What is interested is that Cvjetičanin i Marinković (Cvjetičanin, Marinković, 2009) have concluded in their populational – genetical study that the frequence of the O blood group is high (72.2%) of elite waterpolists from Serbia, world and European champions as well as the Olympic champions frequency of A and B blood groups are low, while the AB group is absent. Beside these observations, the results of our researches have shown up that great and middle influence to some more of our followed up variables, which had not been tested formally because there were no previous serious scientific studies which were dealing with relations between some variables of dynamical strength and the ABO blood group. Thus with the variable the long jump from the site, the size of influence is great (14%) which can be most likely be attributed to genotype, as elementary matrix. Namely, biologically looking, basic motorical capabilities are filogenical forms of moving inherent to all people, and their development is genetically determined (Perić, 2003). Thus, with the long jump's testing from the site we measure the strength, in this case we talk about the explosive leg's force. The congenitality of the explosive force is pretty high and totals h2=0.80.

By the variable of the number of push-ups in 10 second period the size of influence is middle (10%), as well as by the variable of the time necessary for 10 push-ups accomplishments (6%). In both of cases it's about the repetitive force of arms and shoulder belt (coefficient of congenitance is h2 =0.50). When it's issue about mascular force (Fmax) the size of influence for all variables followed up is small (1 to 3%). Generally strength or force does have small coefficient of congenitance (h 2=0.50) which relatively means that the influence to this motorical capability is possible o ver the entire life. Also in our work is quite small size of influence is determined when it comes to the variable of the body mass index (BMI) (3%) and the variable of the body height –BH (2%).

Based on these results, the ABO blood group can have the influence on variability of basic motorical capabilities of the respondents. This influence can be significant with some of motorical capabilities as well as the explosive force and general endurance, even though biological mechanisms which lay in foundation of blood group in these differences are still unknown.

Conclusion

Researches about the ABO blood groups had been advanced in the last few years and it's evident that the ABO has become the subject of multidisciplinary researches. However there is no scientific consent about relations and the influence of the ABO blood groups on anthropometrical capabilities of humans and while some of them support the theory of the ABO blood groups, the others doubt it most frequently due to small number of scientific works about that topic. In support of that, our results confirm the following: the results obtained have shown up that the size of influence, ie. the strength of relationship between the ABO blood group and some variables is small (Fmax of the leg extensors, Fmax of the left hand's squeeze and Fmax of the right hand's squeeze, Fmax of the leg's extensors and the body lift up in the 30 second period), and some variables is middle (the time necessary for 10 vertical push-ups accomplishment in the 10 second period), and some variables is high (the long jump from the site and the Cooper's test). Generally, the Tukey's HSD test results tell that middle values of the respondents of the O blood group do significantly differ from the respondents of other blood groups (A,B or AB) regarding the three used tests (the long jump from the site, the number of push-ups in the 10 second period, and the Cooper's test). Based on the results obtained it's possible to make comparison and discrimination of the variables regards to the parameters envisioned on that way and indirect determine the size of influence of the ABO blood group on some performance in some tests of basic motorical capabilities.

The results of our research should be considered as preliminary and should be interpreted with some caution, because the relationship between the ABO blood group and basic motorical capabilities in our study is quite weak and can be the consequence of pure coincidence. Further experimental researches are necessary to reveal the mechanisms which relate the ABO blood group and basic motorical capabilities.

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