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PHYSIOLOGICAL ANTHROPOMETRIC AND MOTOR VALUES IN RELATION TO 500 METRES RUNNING

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Abstract

The primary purpose of this paper is to determine and prove the impact of loads with different intensities on the treadmill on the heart frequency, as well as to prove the relationship and impact of some anthropometric and motor parameters on the physiological one in the manifest space. In harmony with the purpose of the research, three basic hypotheses have been presented that cover the anthropological research fields. In this paper, 19-year-old students of the Faculty of Sports Sciences are included. To achieve the purpose of the paper, a sample of 80 students who were regular students during the year 2022/2023 was included. Four anthropometric variables, three motor tests (running tests) and four physiological tests (pulse at rest and during loads) are included in this paper. For the three groups of the system of variables, the basic statistical and distribution parameters for each variable, as well as the measures of asymmetry and normal distribution, were calculated. Then the correlations between the variables in the manifest space, as well as the correlations between the system of variables. In order to determine the relationship between predictor variables (anthropometric and motor characteristics) and criterion variables (results of functional skills), regression analysis was applied in the manifest space. The processing of the results shows that the obtained values do not deviate from the normal distribution, which completes their metric characteristics. The impact of morphological and motor factors on heart rate results has not been proven.

Key words: anthropometric characteristics, motor skills, physiological, regression analysis.

Introduction

Arazi, H., et al. described that anthropometric characteristics is a prerequisite to success against any competition or tournament which is independent from sport type. Knowing the mentioned characteristics is one of the determinant factors affecting athlete's performance. Being aware of these characteristics is a prominent issue for comparing an athlete's results to his previous achievements as well as other athletes, finding the weak points and correct them and finally, basic and accurate training planning in order to gain maximal results and to achieve determined goals (Arazi, Hosseinzadeh, &Izadi, 2016). Athletics affects the strengthening of health, during active participation with walking, walking-running and running, in different cross country of individual and massive character, which develop regularly. Runnings the most universal mean of comprehensive preparation of the athlete, but it also occupies a very important place in the training of other types of sports. (Rashiti N., Ramabaja Q., Bekolli L., Gontarev S., Ramadani L. 2021) Athletic operates on the basis of a particular system of knowledge that has in its content the theoretical and methodological foundations of sport training (Rashiti N, Nika F, Bekolli L, Heta G. 2017). The benefits of regular physical exercise are widely debated and include reducing the risk of obesity (Saint-Maurice, P.F et al., 2022) or cardiovascular diseases (Guazzi, M et al.,2016)On the other hand, improperly performed training with excessive intensity may negatively affect the organism's homeostasis and increase the risk of injury (Bull, F.C et al., 2020). However, trained runners may have similar VO2MAX values and thus other physiological indexes can contribute for the success of predominantly aerobic events such as RE and lactate threshold (Kipp et al., 2019). The physiological effects of exercise have prompted many further studies since Cooper's original work. It is now generally considered that the effects of exercise on overall metabolic rate (post-exercise) are relatively small and the greatest effect occurs only for a few hours. Although endurance training increases many people's VO2 max, there is considerable variation in the degree to which it increases VO2 max among individuals Cooper studied the training effect in the late 1960s and popularized the term "training effect" even though this term had been used before. (Cooper, K. 1985). The relationship between anthropometric parameters and sport performance in addition to other factors is well-established. Numerous studies have been carried out by many researchers, in all-around the world related to the various body characteristics of different sports activities found that strong relationship exist between structure and performance (Bale, Bradbury, & Colley, 1986; Chhina, Singh, & Kaur, 2018;Kalayci,Guleroglu,&Eroglu,2016).

THE PURPOSE OF THE PAPER

The problem of this research presents the analysis of some anthropometric, motor and physiological parameters in the manifest space of the students of the Faculty of Sports Sciences. The problem that is addressed in this paper is of particular importance, because from the obtained results we can evaluate and give a real overview of this field. Also, we provide a more realistic overview of the impact of various morphological and motor factors in the determination of physiological indicators.

SAMPLE ENTITIES

Students aged 19 ± 6 years of the Faculty of Physical Education and Sports are included in this paper. The number of the entity included 80 regular students of FPHE and Sport in Pristina. The research was conducted over the course of the year, October 2022/2023 at the Research Institute of the Faculty of Physical Education and Sports.
The basic criterion for the inclusion of students in testing is:

a) to be regular in practical lessons during the year;

b) who have not previously been ill.

VARIABLES SAMPLE

Four anthropometric variables, three motor tests (running tests) and four physiological tests (pulse at rest and during loads) are included in this paper.

Sample of Anthropometric Variables

The following morphological variables were used for the realization of this research:

- Body weight (BW), Body height (BH), Chest circumference (CHC), Arm circumference (AC).

Sample of motor variables (runnings)

To carry out this research, the following variables were used:

- Running 500 meters (R500M), Running 1000 meters (R1000M), Running 1500 meters (R1500M).

Sample of physiological variables (pulse)

The following physiological tests were used for the realization of this research:
Pulse at rest (PR), Pulse during exercise 500m (P500M), Pulse during exercise 1000m (P1000M), Pulse during exercise 1500m (P1500M).

RESULTS INTERPRETATION AND DISCUSSION

Table 1. Basic statistics indicators of anthropometric, motor and physiological parameters among students.

Tab.1.	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
PULQET	80	65.00	98.00	78.6250	7.26423	.481	.126
P500M	80	101.00	159.00	128.7750	13.32550	.093	-.163
PU1000M	80	121.00	180.00	161.6000	13.60249	-.642	.013
P1500M	80	170.00	203.00	190.8125	5.84417	1.069	.904
APESHA	80	61.00	92.00	75.2000	6.23059	.084	-.128
ALART	80	1.67	1.91	1.8016	.05063	-.086	-.165
PEGJOK	80	61.00	77.20	68.3919	3.49859	.290	-.188
PEKRAH	80	22.00	36.00	27.7500	2.73051	.614	.654
M500M	80	1.23	2.31	1.5099	.32161	1.154	-.044
M1000M	80	2.05	3.55	2.8195	.39309	-.464	-.463
M1500M	80	4.56	5.34	5.0433	.18165	-.799	.599

Table 1 shows the basic statistical parameters of the anthropometric parameters in athletes aged 19, arithmetical means are presented, maximum score, standard deviation, distribution or asymmetry parameters (Skewness - bias, asymmetry) and the degree of extension of the peak of the result distribution curve (Kurtosis – convexity). All physiological, anthropometric and motor variables in this distribution have a normal range.

RESULTS OF RELATIONSHIPS OF PHYSIOLOGICAL, ANTHROPOMETRIC AND MOTOR VARIABLES

Table 2. Intercorrelation coefficients of anthropometric, motor and physiological variables

	1	2	3	4	5	6	7	8	9	10	11
PULQET	**1**	**.155**	**.320****	**.249***	.055	.040	.140	-.058	-.005	-.006	.072
P500M	**.155**	**1**	**.692****	**.482****	.264*	.163	.077	-.039	.171	-.083	-.141
PU1000M	**.320****	**.692****	**1**	**.621****	.231*	.181	.122	-.100	.029	-.244*	-.151
P1500M	**.249***	**.482****	**.621****	**1**	.205	.089	.087	.016	.128	-.003	-.080
5APESHA	.055	.264*	.231*	.205	**1**	**.611****	**.725****	**.685****	.124	-.098	-.058
6ALART	.040	.163	.181	.089	**.611****	**1**	**.200**	**.013**	.104	-.200	.132
7PEGJOK	.140	.077	.122	.087	**.725****	**.200**	**1**	**.645****	.087	-.109	-.066
8PEKRAH	-.058	-.039	-.100	.016	**.685****	**.013**	**.645****	**1**	.034	-.093	.019
M500M	-.005	.171	.029	.128	.124	.104	.087	.034	**1**	**.514****	**.432****
M1000M	-.006	-.083	-.244*	-.003	-.098	-.200	-.109	-.093	**.514****	**1**	**.577****
M1500M	.072	-.141	-.151	-.080	-.058	.132	-.066	.019	**.432****	**.577****	**1**

*** Correlation is significant at the 0.01 level (2-tailed).*
** Correlation is significant at the 0.05 level (2-tailed).*

In the following text, simple linear correlation coefficients of anthropometric variables will be presented and analyzed. Due to the better reflection of the table and to more clearly observe the important correlations of the different levels of connectivity, the coefficients in question are highlighted with the Asterix sign. Therefore, statistically significant coefficients of variables with a higher degree of statistical inference ($p<0.01$) are marked with two Asterix signs. For easier criteria of statistical inference ($p<0.05$), the correlation coefficients are marked with an asterisk.
The matrix of inter-correlation of anthropometric variables is given in Table 2.
The interpretation of the simple linear correlation coefficients, as is known in most cases, depends on the number of the tested, respectively, more precisely to the degree of freedom.
Analyzing the intercorrelation matrix, we notice that almost all the physiological variables are in average statistical relationship, with a high positive average. It can be seen that the physiological parameters related to the heart's response to the loads or simply speak for a long distance running have higher correlations. These are heart rate variables during the 500m run, with heart rate tests after the 1000m and 1500m runs. This relationship shows the reaction of the heart during loads, which in terms of intensity and structure of motion are similar. The anthropometric parameter of body length is in a very high correlation ($p<0.01$) with body weight. It is obvious that the taller the person, the heavier he is. In the following, we see that anthropometric variables that were supposed to measure body volume have a very high correlation between them ($p<0.01$). ($p<0.01$). Three

anthropometric parameters, body weight, chest circumference, and arm circumference are included here. The motor variables that were intended to measure running speed, are in a very high correlation among them ($p<0.01$). The intercorrelation coefficients show that the coefficients of the running variables have the same structure of the execution, but it is the speed of the execution. The first group includes anthropometric parameters that were intended to measure height and body volume. All these correlation coefficients have very high correlation values at the reliability level ($p=0.01$). The second group includes anthropometric parameters, that were intended to measure heart rate, the correlation coefficients of which are moderately high and statistically significant at the reliability level ($p=0.01$). The second group includes anthropometric parameters, that were intended to measure heart rate, the correlation coefficients of which are moderately high and statistically significant at the reliability level ($p= 0.01$). The third group in terms of the height of the value of the correlation coefficient is formed by the parameters that were intended to measure running speed and have a reliability level ($p=0.01$).

Table 3. Regression analysis - correlation and influence of physiological, anthropometric and motor parameters on the criterion variable (PU500M)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.723[a]	.523	.454	9.84811

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1272.509	10	127.051	6.217	.000[a]
Residual	1527.678	69	23.140		
Total	2799.187	79			

Model	Unstandardized Coefficients	Standardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-13.220	63.360		-.209	.835
PULQET	-.134	.165	-.073	-.812	.420
PU1000M	.674	.116	.688	5.789	**.000**
P1500M	.087	.252	.038	.346	.731
APESHA	.194	.201	.091	.965	.338
ALART	2.893	25.354	.011	.114	.909
PEGJOK	-.063	.220	-.025	-.285	.777
PEKRAH	.131	.421	.027	.312	.756
M1000M	2.834	3.070	.084	.923	.359
M1500M	-1.303	6.434	-.018	-.203	.840

a. Dependent Variable: **PU500M**

According to the regression analysis, the value of the correlation among the group of independent predictor variables (motor anthropometric variables and three physiological tests) and the criterion dependent variable (test for measuring heart rate at rest) was determined. The correlation of the entire system of independent predictor variables (anthropometric and motor variables) and dependent criterion variable (heart rate measurement test), shows that the multiple correlation coefficient has the value R = 0.723, which explains the common variability between the system and criterion variables of about 52% (DELTA = 0. .523). We must emphasize that the F-test is valid (6.217 since the multiple correlation is high, in the specific case of this paper it is significant (Sig = .0.000). Since the multiple correlation (R) is valid, it is necessary to make a description of the impact of the predictor variables on the criterion, table 3. Based on the anthropometric characteristics, we did not find any that had an impact on the heart rate, nor did we find any from the motor running tests. Through regression analysis, the value of the correlation between the group of independent predictor variables (motor anthropometric variables and three physiological tests) and the dependent criterion variable (the test to measure heart rate at rest) has been proven.

CONCLUSION

In order to realize the objective of the paper, the purpose of the research has been presented. The main goal of this paper was to determine and validate the impact of loads of different intensity on the treadmill on the heart rate, as well as to validate the relationship and impact of some anthropometric and motor parameters on the physiological one in the manifestation space. 19-year-old students of the Faculty of Physical Education and Sports are included in this paper. To achieve the purpose of the paper, a sample of 80 students, who were regular students during the 2022/2023 year, was included. In this paper, four anthropometric variables, three motor tests (running tests) and four physiological tests (pulse at rest and during loads) are included. Among the three groups of the system of variables, the basic statistical and distribution parameters for each variable, as well as the measures of asymmetry and normal distribution, were calculated. Then the correlations between the variables in the manifest space, as well as the correlations between the systems of variables. In order to determine the relationship between predictor variables (anthropometric and motor characteristics) and criterion variables (results of functional skills), a regression analysis was applied in the manifest space.

The results obtained based on the statistical programs show that:

- Statistical processing shows that the obtained values of the anthropometric, motor and physiological variables do not deviate from the normal distribution. Although they do not deviate from the normal distribution, they indicate improper motivation of students during the execution of measurements and poor conditions during testing.

- Correlation and intercorrelation values indicate a connection within the group of tests that have similarities in the nature of the measurements and the nature of the variables.
- The insufficient impact of motor tests (running) on the heart rate shows the very sensitive nature of the tests during testing and the measures that should be taken to reduce and avoid them.

However, the increase in efficiency is assumed, not only the increase in the amount of work, but first of all the best organization of the training process, the best choice of tools and methods, the most rational order of loading and rest during a training process, then several processes, stages and times of training and all this while constantly taking care of the condition of the athlete.

Nowadays, the level of achievement in elite sport is so high that athletes during training systems can only reach or exceed it by increasing training efficiency. In summary, according to the outcomes presented in this study, it can be concluded that maximal aerobic performance prediction depends 71% on VO_{2MAX} and RE at 500 m. However, we suggested that further studies should be carried out with these and other physiological and biomechanical variables to determine performance in ecological conditions (e.g., athletics track tests) or during endurance running competitions.

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