

## ANALYSIS OF MORPHOLOGICAL CHARACTERISTICS OF PE FEMALE STUDENTS

Dragana ALEKSIC, Jadranka KOCIC, Vesko MILENKOVIC

**Abstract:** *The knowledge about the interest and the importance of knowing the structure of human body dates from the distant past. When sportsmen and sport are taken into consideration, it should be mentioned that Philostratus Flavius wrote down in 300 A.D., that persons who go in for physical activities must have an appropriate structure of the body, if they want to achieve certain success in those activities. Nowadays, it is impossible to imagine some serious planning of any kind of mobile activity without having the knowledge of the morphological structure, its influence on a given activity, as well as the influence of that activity on the development of the morphological characteristics. The specific system of basic anthropometrical latent dimensions is usually considered as morphological characteristics of anthropological status of man. A certain number of factors were identified, based on numerous researches of morphological space. Those factors gave the initial information about the specific structure of the morphological dimensions. The four basic factors, which determine the morphological structure of man, were identified. Those factors are: the longitudinal dimensions of the skeleton, the transversal dimensions of the skeleton, body volume and body mass, the subcutaneous fatty tissue. The information about the structure of the morphological characteristics is very important when their transformations are taken into consideration.*

**Keywords:** *sportsmen, body structure, body mass, females, gymnastics*

### 1 Introduction

Namely, the morphological characteristics are under the influence of genetic and environmental factors. This is the reason why the structure of the morphological variables is different all over the world, considering the genetic and eco-social factors. The results of the factor analysis of other populations cannot be used in order to evaluate our population. There were periods in the past when indicators of the morphological status determined the influences of certain forms of physical exercise. In addition, particular dispositions for sport activities and other kinds of activities were

determined. In addition, the results were programmed and prognosticated. During the last decades, the understanding has basically changed, and the researches have been directed in this sphere, so we can perceive the real sense and importance of this area. The influence of genetic factors is not the same for all the latent dimensions. The innate coefficient for the dimensions of the skeleton is approximately .98, for body volume is about .90, and for the subcutaneous fatty tissue is .50. Therefore, the biggest transformation under the influence of exogenous factors (physical activity, the process of sports training) is possible when the subcutaneous fatty tissue is concerned, and then with body volume. On the other hand, the transformation is almost negligible when the transversal dimensions of the skeleton are concerned (Kurelic, 1975).

In this research, the indexes of physical development are applied, in order to evaluate the morphological characteristics. The indexes of physical development represent the mutual relationships of anthropometrical parameters (Djuraskovic, 1996). They are used in order to estimate physical growth and development. This method of estimation of physical growth and development was given a great attention for a long time. However, as this method is not perfect and as it is methodologically formulated in a wrong way, people do not pay a great attention to it nowadays. Certain indexes are used as an approximate method for estimation of physical development in sports-medical practice. Indexes can be used for estimation of physical growth and development of persons whose growth has finished. The indexes that are used are those which can help us in sports-medical and pedagogical practice. They are used to estimate the effects of training processes and the effects of physical education on growth and development, as well as on the selection for specific branches of sports.

## **2 The researches made so far**

The researches of the problems, which are concerned with physical education female students, since they enrol the faculty until they finish it, are connected to a number of fields that have been, more or less, processed. In spite of the fact that there are a lot of studies and considerations connected to the population of students and to the educators of physical culture, we still do not have enough scientific works that research these problems in a complex way (Aleksic, 2005).

Popovic and Aleksic (2006a) made a research in order to determine the degree and quality of the connection between general success during the studies of physical culture and

specific segments of morphological space of physical education female students. Thirty-four female students took part in a research at the University of Pristine (dislocated in Kosovska Mitrovica). Six parameters were used for the evaluation of certain segments of morphological space. Those parameters were defined as anthropometrical measures: 1) Body height; 2) Body weight and the indexes for the evaluation of body composition; 3) Lorenzo's index of perfect body weight; 4) Kettle's body mass index; 5) Body Mass Index; 6) Devenport-Cup's index. The results of the research were processed with the help of the statistical program SPSS for the computer data processing. The canonical correlative analysis is applied in order to determine the connection between the specific segments of the morphological space of physical education female students (as a multidimensional set of major variables) and success during the studies (as a multidimensional set of criteria variables ) which are determined according to special calculation of achieved grades: 1) educational subjects;

2) specialized subjects in the general sense; 3) specialized subjects in the narrower sense and 4) general success during the studies of physical culture (average grade). Not even one statistically significant pair of canonical factors ( $\lambda=.377$ ) has been determined. The pair which would allow us, without any reserves, to confirm the assumptions about the significant relations between morphological space and success during the studies of physical culture.

Popovic and Aleksic (2006) made a research on student's population in order to determine the relationship between morphological characteristics and ability to learn the artistic gymnastics curriculum. Thirty-four female students between 21 and 22 years of age took part in this research. The research was realized with two generations of third year female students in 1998/99 and 1999/2000 academic years, at the Faculty of Physical Culture, the University of Pristine. Six parameters were used for the evaluation of certain segments of morphological space. Those parameters were defined as anthropometrical measures:

- 1) Body height;
- 2) Body weight and indexes for the evaluation of body composition;
- 3) Lorenzo's index of perfect body weight;
- 4) Kettle's body mass index (the index considers weight and height);
- 5) Body Mass Index; 6) Devenport-Cup's index.

The grade at the final exam was used in order to estimate a successful study of artistic gymnastics curriculum. The data analysis was realized with the help of the statistical SPSS package for data processing. The major importance of morphological space of physical education female students, for efficient artistic gymnastics curriculum learning, is determined by using the regressive analysis. The regressive analysis did not confirm the assumption that morphological characteristics determine, in a significant way, a successful completion of final exam when artistic gymnastics is concerned ( $p = .579$ ).

### **3 The subject of the research**

The subject, on which is the research directly aimed at, takes place within the analysis of morphological characteristics of physical education female students.

### **4 The goal and the tasks of the research**

The basic goal of this research is to determine the difference of morphological characteristics of physical education female students. For the goal, which is defined in this way, the realization of the following tasks is necessary:

1. The adequate indexes are to be applied for the estimation of physical Development of female examinees;
2. Determine the sample of female examinees (specially selected), who are Chosen from the physical education female students;
3. Apply the adequate methods for the statistical processing of received data;
4. Analyse and synthesize the received results of the research.

### **5 The hypotheses of the research**

Including the defined subject, the goal and tasks of the research, we can set the next hypothesis (original and derivative).

H1 There are no significant differences among the morphological characteristics of physical education female students in Niš and in Pristine.

A1 There are significant differences among the morphological characteristics of physical education female students in Niš and in Pristine.

## 6 Methods

### 6.1 The sample of the examinees

In order to get the answer to the already given hypotheses, the research will include the deliberate and specially selected sample of examinees, which are defined as physical education female students. (Those students, as we expected, possess the above average level of motor abilities).

The sample of physical education female students is chosen from the overall number of physical education female students at the University of Pristina and at the University of Niš. Consequently, the sample of students is divided into two groups.

The first group of students (from Pristina) includes two complete generations of third year female students. During the period of examination of the morphological characteristics, in 1997/98 and 1998/99 academic years, the students were twenty one years old. Some of them were six months older or younger. The number of students was thirty-two.

The other group of students (from Niš) includes third year physical culture female students from the University of Niš. During the period of examination of the morphological characteristics, in 2003/2004 academic year, the students were twenty- one years old. Some of them were six months older or younger. The number of students was twenty-eight.

### 6.2 The sample of the variables

The battery for the estimation of morphological characteristics consists of the six following measures:

- VIST- Body height (cm)
- MAST- Body weight (kg)
- LITM-Lorenzo's index (perfect body weight)  $LITM (kg) = (VT-100) - \frac{1}{4} (VT-150)$  x 0,25  
LITM (kg) – perfect body weight, VT- body height (cm)
- KION-Celt's index-body mass index KION- body weight(gr)/body height (cm)
- BMI N-body mass index BMI N-body weight (kg)/body height (m<sup>2</sup>)
- DVCI-Devenport-Cup's index-body mass index DVCI- body weight (gr)/body height (cm<sup>2</sup>)x100

### 6.3. Statistics

The possibility to solve the problem of the research in an objective way depends both on the applied procedure and measurement and on the chosen procedure for condensation and transformation of primary data and information. The problem of the research is defined by the goal of the research. Milan Dolga, the graduate mathematician from Novi Sad, suggested and made the choice and the order of the use of mathematical and statistical procedures and methods, as well as data processing. The results of the research were processed at the Multi-Variety- Analysis-Soft agency in Novi Sad. The data analysis was realized with the help of SPSS, which is the statistical package for data processing. The basic methods for the results processing were established according to the formulated hypotheses of the research. The basic descriptive, statistical parameters were established for all the variables, which are the subject of the research. The following things were calculated: the arithmetical mean (SR.VR.), the standard deviation ( ST.DV.), the coefficient of variation ( KO.VAR.%), the limits of span where we can find minimal (MIN) and maximal ( MAX) result, better to say the interval of entrust (INTERVAL). In order to determine the differences between the two groups of students ( from Pristine and Nis ), the mono-variant analysis of variable (ANOVA) and the multi-variant analysis of variable (MANOVA) are applied, as well as the discriminative analysis, which is believed to be a superior model for determination of differences between groups. Student's t-test for small independent samples will be applied, in order to illustrate the behaviour of students, grouped within special groups, and to evaluate their morphological characteristics.

## 7 Results

The whole sample of examinees (62) was divided into two groups: Nis (28) and Pristine (24), according to the already established plan for the research of morphological characteristics of examinees.

In this part of the research, in order to estimate the purpose of further examination of the research results and in order to determine directions and methodological priorities of their processing, the analysis will contain six characteristics. Consequently, the analysis MANOVA and the discriminative analysis are applied, which are used to test statistically significant differences among examinees.

## 7.1 The survey of the basic parameters of morphological characteristics of all examinees

By surveying the charts (1-3), which give the results of the central and dispersive parameters of morphological characteristics of the overall samples of students, who are divided into two groups: Nis (28) and Pristine (34), we get the impression that the results of all the students, when their morphological characteristics are concerned, are rather homogeneous and that there are no results that basically disagree with possible and expected values.

**Chart 1.** *The central and dispersive parameters of morphological characteristics of examinees: Nis (28) and Pristine (34).*

	srd.vrd.		std.dev.		min		max		coefficient		interv.pov.			
	NIŠ	PRIŠ	NIŠ	P	NIŠ	PRIŠ	NIŠ	PRI	NI	P	NIŠ	PRIŠ	NIŠ	P
VIS	167.	170.3	6.63	7.01	156.	158.	180.	185.	3	4.12	164.	167.	169.	1
M	59.4	58.56	5.65	6.60	48.0	42.0	69.0	69.0	9	11.2	57.2	56.2	61.6	6
L	59.2	60.24	2.65	2.43	54.5	55.5	63.7	66.2	4	4.03	58.1	59.4	60.2	6
K	355.	343.2	29.8	31.1	305.	262.	413.	405.	8	9.07	343.	332.	366.	3
B	21.2	20.15	1.93	1.67	18.2	16.4	25.5	23.8	9	8.27	20.4	19.5	21.9	2
D	2.13	2.02	.19	.17	1.83	1.64	2.55	2.39	8	8.28	2.05	1.96	2.20	2

According to the results from the chart one, it can be said that the values of all the characteristics are within relatively possible limits, when both groups of examinees are taken into consideration.

**Chart 2.** *The parameters that show the deviation from normal distribution of morphological characteristics of examinees: Nis (N-28) and Pristine (N-34).*

	median		Skewness		Kurtosis	
	NIŠ	PRIŠ	NIŠ	PRIŠ	NIŠ	PRIŠ
VIST	165.50	170.00	.42	.08	-.77	-.61
M AST	58.50	60.00	-.16	-.43	-.68	-.42
L ITM	59.25	60.00	-.07	.35	-.90	-.07
K IOU	353.66	344.33	.08	-.33	-.89	-.09
B MIN	21.06	20.34	.69	-.10	-.09	-.21
D VCI	2.11	2.03	.55	-.09	-.34	-.21

Kurtosis's negative values (the curve is smashed) can be seen in the test (LITM) when the examinees from Nis are examined. Whereas, according to Skewness and

Kurtosis's parameters, the significant deviation from normal distribution cannot be seen, when the students from Pristine are examined.

**Chart 3.** *The test of normal distribution (Kolmogorov-Smirnov) of morphological characteristics of examinees Nis (N=28) and Pristine (N=34).*

	max D		lambda		p	
	NIŠ	PRIŠ	NIŠ	PRIŠ	NIŠ	PRIŠ
VIST	.150	.075	.792	.436	.557	.991
MAST	.030	.068	.160	.395	1.000	.998
LITM	.049	.056	.259	.324	1.000	1.000
KIOU	.071	.042	.374	.243	.999	1.000
BMIN	.082	.055	.435	.320	.992	1.000
DVCI	.089	.037	.473	.218	.979	1.000



When morphological characteristics are concerned (chart 3), the distribution of examinees' characteristics, of both groups, is mainly within the limits of normal distribution.

## 7.2 The results of difference analysis of morphological characteristics of physical education female students, considering two groups of students (from Nis and Pristine)

The differences among morphological characteristics of physical education female students, considering the two groups of students (from Nis and Pristine), were determined by using the multi-variant analysis of variable (MANOVA) and the mono-variant analysis of variable (ANOVA).

**Chart 4.** *The importance of morphological characteristics difference of all physical education female students.*

	n	F	p
MANOVA	6	1.394	.234

According to the fact of MANOVA analysis (chart 4) that  $p=.234$ , there are no reasons not to accept the H1 hypothesis. It means that there are no differences among examinees of both groups when their morphological characteristics, divided into six traits, are concerned.

**Chart 5.** *The importance of morphological characteristics difference of all physical education female students.*

ANOVA	F	p
VIST	3.027	.087*
MAST	.328	.569
LITM	2.538	.116
KIOU	2.415	.125
BMIN	5.605	.021*
DVCI	5.809	.019*

By analysing ANOVA (chart 5), the statistically important difference among some examinees is noticed. The difference appears according to the morphological difference of

the whole sample: for body height (VIST)  $p=.087$ , body mass index- (BMIN)  $p=.021$  and Devenport- Cup's index-body mass index (DVCI)  $p=.019$ .

**Chart 6.** *The importance of morphological characteristics difference of the examinees of both samples*

t-test	Group	Group	Mean values		t	p
VIST	NIS	PRIŠ	167.28	170.32	1.740	.087
BMIN	NIS	PRIŠ	21.235	20.154	2.367	.021
DVCI	NIS	PRIŠ	2.125	2.016	2.410	.019

According to the given results (chart 6), it is obvious that there is the statistically significant difference among the examinees. The difference is obvious among three of six variables of researched space.

Body height is measured in cm, and according to the results from chart 6, we can notice that the students from Pristine are taller than the students from Nis (170.324 and 167.286)

When both indexes for body mass (BMIN and DVCI) are concerned, it is evident that the female students from Pristine achieved poorer results (20.154 and 2.016).

**Chart 7.** *The importance of morphological characteristics difference of the examinees of both samples.*

	n	F	p
Discriminative NA	6	1.369	.244

According to the fact (chart 7) that  $p=.244$  for six synthesized traits of the examinees' morphological characteristics, by using the discriminative analysis, it is evident that we can accept the H2 hypothesis. It means that there is no significant difference and no clearly defined limit between any groups of the examinees.

**Chart 8.** *The discrimination coefficient of the examinees' morphological characteristics of the whole sample*

	<i>discrimination coefficient</i>
VIST	.006
MAST	.018
LITM	.003
KIOU	.010
BMIN	.008

DVCI	.000
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By analysing the discrimination coefficient, it is obvious that the discrimination among different examinees is negligible, considering all the traits of the researched area.

## 8 Conclusion

According to the researches made so far, when morphological characteristics are taken into consideration, the characteristics of two groups of the examinees can be logically formulated. The researches included the sample of 62 students and the use of MANOVA method, the discriminative ANOVA method, t-test, as well as the discrimination coefficient and the grade of average values.

According to the fact that  $p > .1$ , by using MANOVA analysis and the discriminative analysis (.234 .244) for some or all of the six traits, we can say that there is not a difference between the two groups of samples, because the H1 hypothesis is accepted. It means that, between the two groups of the examinees (from Nis and Pristine); there is not the significant difference, not even in the limited area of morphological characteristics (by neglecting the traits where the differences are minimal). The further analysis in this area, according to the researched classification, is not necessary, because, if there are differences, they are minimal and insignificant. Nevertheless, those differences point out that they should be researched by some other approach and methods.

## 9 References

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## **10 Contact**

Assoc. Prof. Jadranka Kocic, Ph.D.

Faculty of Physical Education, University of Pristina – Leposavic

Dositeja Obradovica, 38218 Leposavic, Serbia (Kosovo)

Email: mala@sbb.rs