SOMATIC CONSTITUTION OF FEMALE STUDENTS FROM SELECTED FACULTIES AT THE UNIVERSITY OF RZESZÓW

Dorota **KOPEĆ**

Faculty of Physical Education, University of Rzeszow, Poland

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- Somatic constitution,
- Morpho-physiological development,
- Body composition.

Abstract:

In today's society, the body constitution is of multidimensional relevance, ranging from health, taking care of the figure to physical activity, sports and scientific aspects. The aim of this study was to characterize the somatic constitution of female students from selected faculties at the University of Rzeszów (physical education, art education, and nursing). The study was conducted in June 2018. Based on anthropometric measurements (height and weight, waist, hip, thigh, shoulder and chest circumference), selected somatic indexes such as BMI, FMI, FFMI, BSA, BAI, WHR, WHtR were calculated. The body composition analysis - BMR, FAT (% and kg), FFM, TBW (% and kg), MM, and BM - was performed using Body Composition Analyzer MC-980 by Tanita. The conducted analysis showed the greatest intra-group diversity among female students of art education with regard to somatic features, i.e. body weight, arm, waist, hips and chest circumference in the position of maximum deep breath as well as somatic indexes, i.e. BMI, FMI, BAI, WHR, WHtR. The Fat Mass analysis confirmed the trends in this group. Those women feature the highest values of Fat Mass, BMR, FMI and BAI indexes. Physical education students are characterized by the highest values of arm, thigh, waist and chest circumference as well as the highest values of FFM, MM, and BM indexes. Nursing students distinguish themselves by low body mass, small hip, thighs, and waist circumference and the lowest value of the chest circumference. They feature the lowest somatic values of FAT, BMR and BSA. The widest range of chest mobility occurs in female physical education and art education students.

INTRODUCTION

The issue of somatic constitution has been the subject of many scientific studies. It is considered in terms of concern for health, physical condition and fitness. It refers to a healthy lifestyle, physical activity and promotion of a healthy diet. The research conducted in various age groups, differentiated in terms of sex, physical activity level and environmental diversity show a multitude of factors reflected in the analyzed topic.

Przednowek et al., characterize the constitution and composition of body in girls practicing contemporary dance [Przednowek et al. 2017]. Similar research was conducted by Pilewska on a group of highly trained male and female dancers [Pilewska et al. 2013a,b,c]. Wesołowska assessed the relationship between somatic constitution and hurdles - kind of

sport practiced by her respondents [Wesołowska 2006]. In 2008, scientists from Bydgoszcz carried out a research in order to determine the constitution and composition of the body of sprinters of various sports categories [Krakowiak et al. 2008]. Pietraszewska characterized the posture of persons working in uniformed services [Pietraszewska 2001]. The assessment of body composition of elderly women was carried out by Janiszewska et al. [Janiszewska et al. 2015]. The authors conducted an analysis of unfavorable disproportions in body composition in the context of coronary vascular diseases. Eksterowicz et al., studied morphological changes that occurred in physical education students during their stay at a summer sports camp [Eksterowicz et al. 2007].

University studies are the last stage of organized education preparing young people to taking up their life roles and starting their professional life [Mirek et al. 2008]. While discussing the issue of somatic constitution of Cracow students in the context of their physical activity, Mirek et al. emphasized the fact that there are not many studies concerning individual development indicators of adolescents [Mirek et al. 2008]. The same topic was taken up by Asienkiewicz and al., who dealt with the somatic and typological diversity of first-year students of the University of Zielona Góra [Asienkiewicz et al. 2014]. Moreover, they carried out comparative characteristics of first-year students studying physical education in many academic centers in Poland [Asienkiewicz 2010]. Asienkiewicz also conducted research on a group of young people studying at the PWSZ in Koszalin [Asienkiewicz 2013]. The assessment of students' body composition was also carried out by researchers from academic center in Warsaw. Kopiczko et al. undertook research on a group of physically active and inactive students from Warsaw. The aim of their research was to assess the distribution of adipose tissue in the context of relative body mass [Kopiczko, Bogucka 2018]. The research on the group of university students was also conducted by Rodziewicz-Gruhn et al. [Rodziewicz-Gruhn, Połacik 2014]. They characterized the level of selected somatic traits in the context of health and physical fitness assessment. Szafraniec undertook research of typological diversity of women - students of the Faculty of Biology and Agriculture at the University of Rzeszów. The research concerned the influence of social environment on somatic constitution and the impact of body constitution and social environment on the occurrence of the menarche [Szafraniec 2012]. Similar research was conducted by Wasiluk at the University of Physical Education in Warsaw [Wasiluk 2011]. Female students of physical education from ZWWF in Biała Podlaska were subjected to continuous research in order to characterize their physical development. The results of the research were included in the context of the size of students' place of residence. The Body Mass Index interpretation of students studying health education was the goal of research conducted by a team of scientists from the University of Physical Education in Krakow and the PWSZ in Nowy Sącz [Sterkowicz 2006]. The scientists referred to the subject of somatic constitution in the context of students' own assessment. Differences in BMI interpretation between men and women were confirmed. It was pointed out that FFMI and FMI should also be complementary indexes in the assessment of somatic constitution.

Aim

The aim of the research conducted at selected faculties of the University of Rzeszów was to characterize somatic constitution and composition of women's bodies.

Material and method

Material includes the results of anthropometric research carried out in June 2018 on a group of 105 first-year students of physical education (PE), art education (AE) and nursing

(N) at the University of Rzeszów. Anthropometric measurements of height and body mass, circumference of waist, hips, thighs, upper arm, and chest circumference in the position of maximum inspiration and expiration were carried out (Table 2). Using Body Composition Analyzer MC-980 by Tanita, body composition analysis was performed by setting the following parameters: FAT - fat content expressed in % and kg, FFM - fat-free tissue mass (kg), MM - muscle mass (kg), TBW - total water content in the body (% and kg), BM - bone mass (kg), BMR - basal metabolic rate (kcal) (Table 3). The conducted measurements were the basis for calculation of anthropometric indexes BMI, FMI, FFMI, BSA, BAI, WHR, and WHtR (Table 4). The classification in Table 1 applies exclusively to women.

Table 1. Somatic indexes [Fus et al. 2015]

Index	Classification	Formula
BMI	17 - 18.49 - underweight 18.5 - 24.99 - normal value 25 - 29.99 - overweight 30 - 34.99 – 1st stage of obesity 35 - 39.99 – 2nd stage of obesity over 40 – extreme obesity	BMI=body mass/body height^2
FFMI	In the case of women, the upper limit is already 22, and the range from 15 to 16 is classified as normal.	FFMI = FFM / (height * height) + 6,3 x (1,8 - height)
BSA	Average value 1,6m^2	
BAI (Body Adiposity Index)	Age bracket 20 – 39: < 21% underweight 21-33% normal weight > 33-39% overweight > 39% obesity	
WHR	Android obesity on WHR>0,8	WHR=waist circumference/waist circumference
	Gynoid obesity on WHR<0,8	
WHtR	<35 malnutrition 35-42 underweight 42-46 light underweight 46-49 normal body mass 49-54 overweight 54-58 serious overweight >58 obesity	WHtR=(waist circumference/ height)x100

Research results

From the conducted research it follows that N students are characterized by a much lower body weight (57.0 kg) in comparison to a group of AE and PE students (61.0 kg). The largest intra-group differences with regard to the examined parameter were observed among girls studying AE (24%). The same situation was noted when measuring the waist circumference. N students feature the lowest value (93.9 cm), while PE and AE students

demonstrate definitely higher values (96.9 cm). In this case, the largest intra-group differences were also determined at the faculty of AE (Table 3).

Another phenomenon was observed in the case of body height measurement, where similar values feature the AE (164.1 cm) and N students (164.9 cm), while PE students are significantly higher (168.2 cm). The measurement results of this somatic feature showed statistical significance, as well as measurements of arm circumference. In this case, the highest value was again noted among the PE students (28.5 cm), while in the other two groups the values are similar - 25.8 cm for women studying AE and 25.3 cm for N students. A higher value of variation coefficient was noted in the group of AE students (16%); at the same time a correlation between the examined parameter and the field of study was observed.

The results of thigh circumference measurements in the examined fields of study do not show significant differences. However, the highest result belongs to women studying PE (56.7 cm); intermediate result (55.2 cm) was noted among women from the faculty of AE, and the lowest result (54.0 cm) was noted among N students.

In the case of waist circumference measurements, the highest value of variation coefficient was recorded for AE students (19%). The average value of the examined parameter was 68.8 cm. The lowest result (66.4 cm) was achieved by female N students, while the highest value (73.5 cm) was obtained by PE women. In addition, the obtained results were statistically significant (Table 2).

The largest chest circumference at the time of maximum inspiration was achieved by women studying PE (80.7 cm). The smallest chest circumference at the maximum inspiration feature female N students (74.9 cm). The intermediate result belongs to AE students (78.3 cm); here, the largest intra-group differences were also observed (14%). In addition, the obtained results were statistically significant (Table 2). The results obtained from measurement of chest circumference at the maximum exhalation are arranged in analogy to the measurements of the circumference at the maximum inspiration. The highest measurement result (73.7 cm) belongs again to female PE students, the lowest one (70.2 cm) to N students, and the intermediate result (72.8 cm) also features women studying AE. The value of variation coefficient for this somatic trait is at the same level (16%) in the case of AE and PE students, while at the N faculty it is lower by a half (8%). The obtained results show statistical significance. Differences recorded between the phase of inspiration and exhalation indicate that PE students feature the greatest chest mobility (d = 7 cm), the AE students take the second place with the result of d = 5.5 cm and the lowest chest mobility occurs among the N students (d = 4.7 cm).

Table 2. Somatic traits

Somatic traits	AE				N				PE				p
	x	sd	V	Me	x	sd	V	Me	x	sd	V	Me	
Age	19,7	1,2	6	19,0	19,4	2,7	14	19,0	19,2	2,1	11	19,0	0,1657
Body mass	61,0	14,7	24	56,2	57,0	9,1	16	55,5	61,0	9,5	16	59,1	0,2022
Body height	164,1	5,5	3	163,5	164,9	5,9	4	164,0	168,2	5,5	3	168,0	**0,0121***
Arm circumference	25,8	4,0	16	25,0	25,3	2,7	11	25,0	28,5	3,1	11	28,0	**0,0001*****
Chest circumference, inspiration	78,3	10,8	14	77,0	74,9	6,1	8	76,0	80,7	5,5	7	80,0	**0,0001*****
Chest circumference, expiration	72,8	11,3	16	71,0	70,2	5,5	8	70,0	73,7	12,0	16	74,8	**0,0026****
Waist circumference	68,8	13,3	19	66,5	66,4	6,3	9	67,0	73,5	7,0	10	72,0	**0,0001*****
Hip circumference	96,9	11,2	12	95,0	93,9	6,2	7	94,0	96,9	7,0	7	95,5	0,2119
Thigh circumference	55,2	6,0	11	54,5	54,0	5,4	10	53,0	56,7	6,5	11	55,5	0,1370

Table 3. Body composition

Body composition	AE				N				PE				p
	x	sd	V	Me	x	sd	V	Me	x	sd	V	Me	
Fat %	24,3	8,0	33	23,4	22,0	5,9	27	21,4	21,6	6,3	29	21,0	0,6482
Fat Mass	15,4	9,9	64	13,4	12,9	5,4	41	11,8	13,7	5,9	43	12,5	0,7063
FFM	44,0	4,5	10	43,1	44,1	4,9	11	43,5	47,3	4,1	9	47,0	**0,0011****
MM	41,8	4,3	10	40,9	41,8	4,7	11	41,3	44,9	3,9	9	44,6	**0,0011****
TBW kg	31,7	3,2	10	31,5	31,6	3,1	10	31,2	32,6	2,6	8	31,9	0,1168
TBW%	54,6	5,9	11	55,8	55,5	5,6	10	56,0	54,1	4,8	9	54,7	0,2910
BM	2,2	0,2	9	2,2	2,2	0,2	11	2,2	2,4	0,2	9	2,4	**0,0004*****
BMR	5768	637	11	5611	5745	587	10	5661	5970	855	14	6025	0,0146*

Table 4. Somatic indexes

Somatic indexes	AE				N				PE				p
	x	sd	V	Me	x	sd	V	Me	x	sd	V	Me	
BMI	22,1	5,3	24	21,1	20,9	2,8	14	20,3	21,6	3,0	14	20,9	0,6047
FMI	5,8	3,7	65	4,7	4,7	1,9	40	4,5	4,8	2,0	41	4,3	0,6737
FFMI	16,4	1,8	11	16,4	16,2	1,2	8	16,1	16,7	1,2	7	16,5	0,1264
BSA	1,7	0,2	10	1,6	1,6	0,1	8	1,6	1,7	0,1	8	1,7	0,0584
BAI	28,2	5,9	21	27,1	26,3	2,9	11	25,6	26,4	3,2	12	26,3	0,5726
WHR	0,71	0,07	9	0,71	0,71	0,05	7	0,71	0,76	0,04	5	0,76	**0,0001*****
WHtR waist height	42	0,08	20	0,41	40	0,03	9	0,40	44	0,04	10	0,43	**0,0002*****

The analysis of body composition showed that the highest FM value was noted among female AE students (15.4 kg), which is 24.3% of body weight (Table 3). The group of female PE students was characterized by fat tissue at the level of 21.6% (13.7 kg). However, the smallest FM values were observed among N students (12.9 kg), which is 22% of body weight. The most intra-group differences in the scope of the examined parameter featured the AE students (64%).

In the case of FFM, it is noted that the highest value is recorded among women studying PE (47.3 kg). In other groups, the results are at similar levels - 44.0 kg among AE women and 44.1 kg among N students. Additionally, the results showed statistical significance (Table 3). Similar phenomenon occurs in the case of MM. Here, the highest result belongs also to PE women and amounts to 44.9 kg; in other groups the result is identical (41.8 kg). As stated above, the results show statistical significance between the researched parameter and the field of study. The results of BM measurement are analogous. The values of this parameter are at the level of 2.4 kg among PE students, and among AE and N students they are at the level of 2.2 kg. In this case statistical significance was also noted.

The TBW is at a similar level in the examined groups of women and amounts to 31.7 kg in the AE group, which accounts for 54.6% of body weight, 31.6 kg, or 55.5% of body weight in N group and in PE group 32.6 kg that is 54.1% of body weight. The obtained results are within the norm. In the case of BMR, the situation is different. The lowest BMR value was noted among N students (5,745 kcal), while the highest value was obtained by PE

students (5970 kcal). In this research group, the largest intra-group differences were also noted (14%). The obtained results are statistically significant.

Regardless of the research group, the BMI results are at a similar level and classify the examined girls in the group of persons with normal body mass. In addition, the highest value of the variation coefficient within the range of researched parameter (24%) was recorded at the faculty of AE. At the same time, the conducted analysis showed that the FMI value is at a similar level in the N (4.7) and PE (4.8) groups. The highest value of this parameter (5.8) was recorded among AE students. Here, the highest value of variation coefficient (65%) is also observed, which proves the greatest intra-group differentiation in the scope of the examined parameter. In the case of FFMI, no significant differences were observed. The obtained results include 16.2 for female N students, 16 for female AE students, and 16.7 for female PE students.

The BSA analysis indicates that the examined parameter assumes similar values in the AE and PE groups (1.7 m^2). A slightly lower result was recorded in the N group (1.6 m^2). All measurements are within average values for this index. The BAI index assumes the highest value among women studying AE (28.2%). In this field of study, a significantly higher variation coefficient is also observed, which proves the greatest intra-group differences in the scope of the described index. In other groups of women, body fat is at a similar level of 26.3% among N students and 26.4% among PE students. In all groups, the body fat index remains normal (Table 4).

The conducted research showed that the value of WHR index classifies the research group to persons with gynoid obesity (Table 4). This phenomenon is observed regardless of the field of study. The value of the WHtR index is 44 for women studying PE - suggesting a slight underweight, 42 for women studying AE and 40 for female N students stating underweight. The largest intra-group differences within the range of this parameter were noted in the group of AE students (20%). At the same time, there a correlation between the researched parameter and the field of study was noted.

Discussion

This study focuses on somatic constitution of young women studying at three different university faculties. The analysis of obtained results showed that the lowest values in terms of body weight feature women studying nursing. Students of art and physical education are characterized by higher, balanced weight values.

Janiszewska observed a similar phenomenon while conducting research on a group of students studying nursing, physical education and physiotherapy [Janiszewska et al. 2015]. Results of that research are reflected in the study of Asienkiewicz, who researched somatic traits on a group of female students from PWSZ in Koszalin [Asienkiewicz 2013].

Mirek et al. [Mirek et al. 2008], analyzing the weight component of students from Kraków universities, observed that among female students, the highest weight feature women with intensive physical activity. In addition, he stated that in the examined groups the highest height distinguishes women majoring in sports.

Students of physical education at the University of Rzeszów obtained the highest results of waist, arm and thigh circumference. Different results were obtained by Kopiczko et al. [Kopiczko, Bogucka 2018]. Comparing the results of waist circumference measurement between physical education and humanistic faculty students, she noticed that in physically active students both the waist and waist circumference are lower. Within the three researched groups of the University of Rzeszów, the lowest waist circumference is characterized by female students of nursing. It differs slightly from the waist circumference of the older group of dancers practicing contemporary dance [Przednowek et al. 2017]. Among the considered

groups of women, the highest values of variation coefficient in the field of somatic constitution concerning the height, arm, waist, hip and chest circumference in position of maximum inhalation and exhalation feature the art education students.

Women dealing with movement are characterized by the largest range of chest mobility. This is confirmed by results of research on a group of female physical education students carried out by Asienkiewicz [Asienkiewicz 2013]. Immediately after them, at the second place are art education students, whose result includes increased chest activity during their voice emission classes, choral classes and playing on wind instruments. The lowest chest mobility was observed in nurses.

The Body Fat Mass among students examined by Mirek et al. [Mirek et al. 2008] is the lowest among women with high physical activity (13.5 kg). Among students of physical education, it is expressed by similar values (13.7 kg). In Janiszewska's study [Janiszewska et al. 2015], the FM result of female students, including physical education students, is comparable to the motor inactive group of art education students.

In terms of body composition, the highest values of FFm, MM, TBW and BM are noted among women whose educational profile includes sports activities. The highest BMR metabolic rate was also observed in this group. The obtained data may suggest a sports model of the female body. The Fat Mass index falls within the norm in the three examined groups, while the highest values of fat mass characterize the art education students; in this group the highest BMI and BAI values as well as the highest variation coefficients in the range of researched parameters are also observed. The TBW index is within the norm, which for women amounts to 45-60%. The BMI results of all three groups are correct and within the norm, with the lowest BMI index featuring students of nursing. It is similar to students of the University of Physical Education in Warsaw researched by Kopiczko et al. [Kopiczko, Bogucka 2018], while the result of women studying art education is similar to the results of physically inactive women analyzed by the researcher.

The BMI index in women from the faculty of physical education at the Rzeszów University is at the medium level in the studied groups. It correlates with the result obtained by Asienkiewicz [Asienkiewicz 2013; Asienkiewicz et al. 2014], and Rodziewicz-Gruhn et al.[Rodziewicz-Gruhn, Połacik 2014] in the same groups of women.

The average value of BSA body surface area index (1.6 m^2 in women) is represented by the nursing faculty students, while the other two groups noted increased values (1.7 m^2). The Body Adiposity Index (BAI) shows the normal weight in all groups in the range of 21-33%. The WHR index (waist / hips) indicates gluteal-femoral obesity with the highest value in the group of women studying physical education. Janiszewska obtained the same results [Janiszewska et al. 2015]. Przednowek et al. [Przednowek et al. 2017], while characterizing the body constitution of girls practicing contemporary dance, noted that the WHR index is higher in the group of girls aged 14-15 years and lower in the group of older girls (16-17 years). Referring to those results, the WHR index in examined female students shows even lower values in all researched groups, i.e. it decreases with age. Kopiczko et al. [Kopiczko, Bogucka 2018] observed the fact that the gynoid type of fat tissue distribution is more common among physically active students, and among the inactive ones, android type prevails; however, this study does not confirm this. The WHtR index is maintained within the norm with a high variation coefficient indicated in the group students studying art education.

Conclusions

1. Female students of art education feature the highest FM, BMR, FMI and BAI values.
2. Female students of physical education are characterized by the highest values of arm, thighs, waist and chest circumference. Their body height is also the greatest of all

female groups. In their bodies, the highest values of FFM, MM and BM were observed
3. In young women, the value of WHR index decreases with age.
4. The largest range of chest mobility feature female students of physical education.

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