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The correlations between body posture parameters and the somatic type of male and female pupils playing selected musical instruments

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Abstract

Introduction

The literature review has shown that the issue is discussed sporadically and authors more often focus on the correlations of body mass with the feet architecture than the relationships between postural parameters and the somatic type.

Material, methods and research tools. 393 students from randomly selected music schools were qualified for the study. The values of body weight and height were assessed using an electronic medical scale and body posture parameters by means of the photogrammetric method.

Summary.

The most frequent correlations of the somatic type and body posture parameters of the musicians involved in the study were observed with the parameters of the frontal plane, less with the parameters of transverse plane and sporadically with sagittal parameters. No significant correlations were reported between the somatic type of male and female pupils of

classes I-VI and the non-normative parameters of body posture. Among female pupils of the slender physique type in classes I-V, significant correlations were observed with the frontal parameters, less with the sagittal parameters and no correlations with the transverse parameters. Interestingly, moderately significant relationships with a similar frequency distribution were observed in class VI and in slender girls. Among stout male pupils from class II, the most frequent significant correlations were with sagittal parameters, less with frontal parameters, and from class IV with pupils of slender and moderate physique with frontal parameters, less with sagittal parameters and no correlations with the transverse parameters. As regards male students of stout physique from class III, significant correlations were observed with frontal parameters and less significant ones with transverse parameters. Pupils of slender and stout physique from class I turned out to have insignificant relationships with frontal and sagittal parameters. Among boys of medium and stout physique from class 5 as well as slender and stout from class 6, correlations between the somatic type and postural parameters were sporadic.

Key words: body posture, somatic type

Introduction

The literature review has shown that the issue concerning correlations of body posture parameters with the somatic type is rarely discussed [1]. Research studies concentrate more on the studies of correlations of body weight and height with the foot architecture than on postural parameters with the somatic type. Studies on the group of nursery children are conducted on a sporadic basis although this is a significant stage of posturogenesis. This period precedes the beginning of the new stage – the school time. This period of life is characterized by changes of body height and proportions, angular and linear sizes of physiological parameters of spinal curvatures which are the factors determining the quality of body posture [2]. The studies conducted by Walaszek et al. [3] showed that body height significantly correlated with postural parameters in twenty-one female students aged 12-14 and playing the Western concert flute.

The purpose of the study was to demonstrate significant correlations of the postural parameters with the somatic type of male and female pupils playing selected musical instruments.

Material, methods and research tools

393 individuals were recruited from randomly selected music schools. All the students who had been students of a music school for at least one year were allocated for the study. All subjects were divided into classes depending on the leading instrument and within a class depending on gender, age and the period of playing an instrument. Accordion students accounted for class I, Western concert flute students – class II, grand piano students – class III, guitar students – class IV, violin students – class V, and cello students – class VI. Eventually, 190 girls (K) and 203 boys (M) were qualified for the statistical analysis. The average age of girls was 14.25 years and the experience of playing an instrument was 7.25 years. In the group of boys, the figures were 14.44 and 7.40 respectively. The most girls practiced playing the grand piano (44 subjects) and the fewest girls played the Western concert flute (21 subjects). As for boys, the largest number of them practiced playing the guitar (42 people) whereas the Western concert flute was the least played instrument (23 subjects). Violin female students had the longest experience of playing the instrument (10.2 years) while those who played the flute demonstrated the shortest period (4.6 years). Among boys, these were respectively: the violin (10.2 years) and the Western concert flute (11.94 years).

The studies were conducted in the period from 10 September 2016 to 20 December 2016 by a team of six under the guidance of the author.

The measurement of body posture, weight and height was carried out using in each of the selected schools, Table 1. The measurement of body mass and height was conducted by means of an electronic medical scale, with accuracy of 1g and 1 mm.

The values of sagittal, frontal and transverse parameters describing body posture were determined by means of the computer set using the phenomenon of mora projection, in accordance with the assumed rules [4]. The coding of body posture parameters considered three prescriptive ranges (range I and III suboptimal and range II optimal) developed by Mrozkowiak [4]. The somatic type was diagnosed based on Rohrer's index, in line with Wank's classification for men and Kolasa's for women.

Table 1. The list of recorded body posture parameters

No.	Symbol	Parameters		
		Unit	Name	Description
Sagittal plane				
1	Alfa	degrees	Inclination of lumbo-sacral region	
2	Beta	degree	Inclination of thoracolumbar region	
3	Gamma	degree	Inclination of upper thoracic region	
4	Delta	degree	Sum of the values of partial angles	Delta = Alpha + Beta + Gamma
5	DCK	mm	Total length of the spine	Distance between C_7 and S_1, measured in vertical axis
6	KPT	degree	Angle of trunk extension	Defined as a deviation of the C_7-S_1 line from vertical position (backwards)
7	KPT -	degree	Angle of body bent	Defined as a deviation of the C_7-S_1 line from vertical position (forwards)
8	DKP	mm	Thoracic kyphosis length	Distance between LL and C_7
9	KKP	degrees	Thoracic kyphosis angle	KKP = 180 – (Beta+Gamma)
10	RKP	mm	Thoracic kyphosis height	Distance between points C_7 and PL
11	GKP	mm	Thoracic kyphosis depth	Distance measured horizontally between the vertical lines passing through points PL and KP
12	DLL	mm	Lumbar lordosis length	Distance measured between points S_1 and KP
13	KLL	degree	Angle of lumbar lordosis	KLL = 180 – (Alpa + Beta)
14	RLL	mm	Lumbar lordosis height	Distance between points S_1 and PL
15	GLL -	mm	Lumbar lordosis depth	Distance measured horizontally between the vertical lines passing through points PL and LL
Frontal plane				
16	KNT -	degree	Angle of body bent to the side	Defined as deviation of the C_7-S_1 line from the vertical axis to the left
17	KNT	degree		Defined as deviation of the C_7-S_1 line from the vertical axis to the right
18	LBW -	mm	Right shoulder up	Distance measured vertically between horizontal lines passing through points B2 and B4
19	LBW	mm	Left shoulder higher	
20	KLB	degree	Shoulder line angle, right shoulder up	Angle between the horizontal line and the straight line passing through points B_2 and B_4
21	KLB –	degree	Shoulder line angle, left shoulder up	
22	LŁW	mm	Left scapula up	Distance measured vertically between horizontal lines passing through points Ł1 and Łp
23	LŁW	mm	Right scapula up	
24	UL	degree	Angle of scapula line, right scapula up	Angle between the horizontal line and the straight line passing through points Ł1 and Łp
25	UL -	degree	Angle of scapula line, left scapula up	
26	OL	mm	Lower angle of left scapula more distant	Difference of the distance of lower angles of the scapula from the line of spinous processes measured horizontally along the lines passing through points Ł1 and Łp
27	OL -	mm	Lower angle of right scapula more distant	
28	TT –	mm	Left waist triangle up	Difference of the distance measured vertically between points T_1 and T_2, T_3 and T_4.
29	TT –	mm	Right waist triangle up	

30	TS	mm	Left waist triangle wider	Difference of the distance measured horizontally between straight lines passing through points T_1 and T_2, T_3 and T_4
31	TS -	mm	Right waist triangle wider	
32	KNM	degree	Pelvis tilt, right ilium up	Angle between the horizontal line and the straight line passing through points M1 and Mp
33	KNM -	degree	Pelvis tilt, left ilium up	
34	UK	mm	Maximum inclination of the spinous process to the right	Maximal deviation of the spinous process from the line from S_1. The distance is measured in horizontal line.
35	UK -	mm	Maximum inclination of the spinous process to the left.	
36	NK	_	Number of the vertebra maximally distanced to the left or to the right	Number of the vertebra most distanced to the left or to the right in the asymmetric line of the spinous process, counting as 1 the first cervical vertebra (C1). If the arithmetic mean takes the value e.g. from 12.0 to 12.5, it is Th_5, if from 12.6 to 12.9 it is Th_6.
37	NK	_	Number of the vertebra maximally distanced to the right	
Transverse plane				
38	ŁB -	mm	Lower angle of the right scapula more convex	Difference of the distance of lower scapula angles from the surface of the back
39	ŁB	mm	Lower angle of the scapula more convex	
40	UB –	degree	Angle of projection line of lower scapula angles, the left one more convex	Difference in the angles $UB_1 – UB_2$. Angle UB_2 between: the line passing through point Łl and at the same time perpendicular to the camera axis and the straight line passing through points Łl and Łp. Angle UB_1 between the line passing through point Łp and perpendicular to the camera axis and the straight line passing through points Łp and Łl.
41	UB	degree	Angle of projection line of lower scapula angles, the right one more convex	
42	KSM	degree	Pelvis rotated to the right	Angle between the line passing through point M1 and perpendicular to the camera axis and the straight line passing through points M1 and MP
43	KSM -	degree	Pelvis rotated to the left	Angle between the line passing through point Mp and perpendicular to the camera axis and the straight line passing through points Ml and MP
44	Mc	Kg	Body weight	Measurements were conducted on the medical scales with an accuracy of 0.5 cm and 100 g.
45	Wc	cm	Body height	

Source: author's own research

Test results

Legend for Table 2, 3.

Very significant correlation – red, (***)

Moderately significant correlation – blue, (**)

Insignificant correlation – green, (*)

No correlation – white

The statistical analysis of the results achieved in tests was intended to investigate the correlations of body posture parameters with the somatic type of male and female pupils playing selected musical instruments.

Table 2. Significance of correlations of body posture parameters and Rohrer's index of male and female pupils of music schools (n) 393

Sagittal plane			Frontal plane			Transverse plane		
Parameter	K	M	Parameter	K	M	Parameter	K	M
DCK	0,02904 *	0,1807	KNT	0,2573	0,00441 **	KSM	0,2681	0,3045
Alfa	0,4646	0,6672	KNT–	0,01992 *	0,3072	KSM–	0,4041	0,00335 **
Beta	0,4339	0,04253 *	KLB	0,04921 *	0,00916 **	ŁB	0,3305	0,4586
Gamma	0,2719	0,6827	KLB–	0,188	0,00316 **	ŁB–	0,04378 *	0,00566 **
KPT	0,2369	0,0596	UL	0,04921 *	0,00228 **	UB	0,00329 **	0,4564
KPT–	0,6356	0,07009	UL–	0,1315	0,00619 **	UB–	0,00462 **	0,4374
DKP	0,5574	0,1046	OL	0,307	0,00042 ***			
KKP	0,6752	0,1982	OL–	0,0299 *	0,0374 *			
RKP	0,06992	0,2361	TT	0,8585	0,2681			
GKP	0,3952	0,07683	TT–	$2{,}2*10^{-16}$ ***	0,2674			
DLL	0,7626	0,01988 *	TS	0,5608	0,1887			
KLL	0,9617	0,06927	TS–	0,09082	0,9336			
RLL	0,4359	0,05323	KNM	0,6491	0,1156			
GLL	0,6812	0,3459	KNM–	0,169	0,2111			

Source: author's own research

An insignificant correlation between the total spinal length (DCK) in the sagittal plane was observed among girls. With regard to boys, this correlation was reported in relations to the inclination of thoracolumbar region (Beta) and lumbar lordosis length (DLL). A very significant correlation was noticed among girls, in the frontal plane between the somatic type and the asymmetry of waist triangles height with the left waist triangle up (TT-). Insignificant correlations were observed among girls between the angle of body bent to the left side (KNT-), the shoulder line angle with the right shoulder up (KLB), the angle of scapula line with the right scapula up (UL), the asymmetry of the distance between lower angles and the spinous process with the left lower angle more distant (OL-). A very significant correlation was reported among boys, between the asymmetry of the distance of lower angles of the scapula from the line of spinous processes with the right lower angle more distant (OL). A moderately

significant correlation existed between the angle of body bent to the right side (KNT-), the shoulder line angle with the right (KLB) or left (KLB-) shoulder up, the angle of scapula line with the right lower (UL) or left (UL-) angle up. An insignificant correlation was observed only between the asymmetry of the distance of lower angles of the scapula from the line of spinous processes with the left lower angle being more distant (OL). With regard to girls, a moderately significant correlation was in the sagittal plane between the somatic type and the angle of the projection line of lower scapula angles with the left (UB-) or right (UB) more convex, and an insignificant correlation was reported between the asymmetry of the projection of lower scapula angles with the right scapula more convex (ŁB-). Moderately significant correlations were reported among boys between the angle of pelvic rotation to the right (KSM) and the asymmetry of the projection of lower scapula angles with the right angle being more convex (ŁB-), Table 2.

A further statistical analysis was intended to demonstrate correlations of the silhouette type with postural parameters from range I, II and II considering three prescriptive ranges appropriate for the player of a musical instrument. This required coding of the values of these parameters in line with the previously accepted rule.

Table 3. Correlations of the somatic type and values of body posture parameters appropriate for a player of a given musical instrument (n) 393

Gender	K						M					
Parameter	Instruments						Instruments					
	Accordion	Western flute	Grand piano	Guitar	Violin	Cello	Accordion	Western flute	Grand piano	Guitar	Violin	Cello
Sagittal plane												
DCK							0.01948 *	0.00187 **	0.0126 *			
Alpha		Op;0 ***						Op; 0.0052 **			Op; 0.1988	Op; 0.5404
Beta	Op[1];0 ***	Op;0 ***	Op;0 ***			Op; 0.0087 **		Op; 0.0052 **				Op; 0.5404
Gamma			0.01691					Op;0.0052 **				Op; 0.5404
KPT								Op; 0.0052 **		Op; 0.0004 ***	Op; 0.1988	Op; 0.5404
DKP			Op;0 ***				Op;0.0267 *				0.02583 *	
KKP		Op;0 ***								0.004442 **		
RKP		Op;0 ***				Op; 0.0087 **	0.006334 **	Op; 0.0052 **			Op; 0.1988	Op; 0.5404
GKP		Op;0 ***					Op;0.0267 *	Op; 0.0052 **		Op; 0.0004 ***		Op; 0.5404
DLL								Op; 0.0052 **	0.00094 ***		Op; 0.1988	Op; 0.5404
KLL						Op; 0.0087 **						0.02278 *
RLL								Op; 0.0052 **		Op; 0.0004 ***	Op; 0.1988	Op; 0.5404
GLL	Op;0 ***	Op;0 ***		Op;0 ***		Op; 0.0087 **		Op; 0.0052 **				Op; 0.5404
Frontal plane												
KNT	Op;0 ***	Op;0 ***					Op;0.0267 *	Op; 0.0052 **	Op; 0.0188 *			
KNT–				Op;0 ***	Op;0 ***	Op; 0.0087 **				Op; 0.0004 ***		Op; 0.5404
KLB				Op;0 ***	Op;0 ***	Op; 0.0087 **				Op; 0.0004 ***		Op; 0.5404
KLB–	0.002441			0.0438	Op;0 ***		Op;0.0267 *					Op; 0.5404
UL				Op;0 ***		Op; 0.0087 **				Op; 0.0004 ***		
UL–	Op;0 ***			0.0438				Op; 0.0052 **				

OL	Op;0 ***							Op; 0.0052 **	Op; 0.0188 *			
OL–				Op;0 ***	Op;0 ***	Op; 0.0087 **				Op; 0.0004 ***		
TT	Op;0 ***	Op;0 ***		Op;0 ***	Op;0 ***	Op; 0.0087 **		Op;0.0052 **	Op; 0.0188 *	Op; 0.0004 ***		Op; 0.5404
TT–	Op;0 ***	Op;0.747	Op;0	Op;0 ***	Op;0 ***	Op; 0.0087 **	Op;0.0267 *	Op; 0.0052 **	Op; 0.0188 *	Op; 0.0004 ***		Op; 0.5404
TS				Op;0 ***	Op;0 ***	Op; 0.0087 **		Op; 0.0052 **		Op; 0.0004 ***		Op; 0.5404
TS–	Op;0 ***	Op;0 ***	Op;0				Op;0.0267 *	Op; 0.0052 **	Op; 0.0188 *	Op; 0.0004 ***		Op; 0.5404
KNM				0.0438 *				Op; 0.0052 **	Op; 0.0188 *			
KNM–				Op;0 ***		Op; 0.0087 **			Op; 0.0188 *	Op; 0.0004 ***		Op; 0.5404
UK				Op;0 ***		Op; 0.0087 **				Op; 0.0004 ***		Op; 0.5404
UK–				0.0438 *				Op;0.0052 **	Op; 0.0188 *			
Transverse plane												
KSM			Op;0	Op;0 ***		Op; 0.0087 **			Op; 0.0188 *	Op; 0.0004 ***		Op; 0.5404
KSM–	0 ***				0.006055 **				0.01403 *			
ŁB	0 ***			0.0438 *					0.03374 *			
ŁB–					Op;0 ***					Op; 0.0004 ***		Op; 0.5404
UB				0.0438 *	0.003492 **							Op; 0.5404
UB–	0 ***			Op;0 ***					Op;0.0188 *	Op; 0.0004 ***		

Source: author's own research

Legend

Op; pv[1] – individuals only from the optimal range; pv, in this case there is verified a hypothesis that the likelihood of "the occurrence of the normal silhouette" is the same for each silhouette type (range classification according to Rohrer's index);

Among female students playing the accordion, no correlation was observed between the physique type and suboptimal body posture (prescriptive range I and III). A very significant correlation was reported, in turn, between the posture type and the following vales of optimal posture parameters (prescriptive range II): the inclination of thoracolumbar region, depth of lumbar lordosis, angle of trunk bent to the right, angle of scapula line with the left scapula up, asymmetry of the distance between lower scapula angles and the spinous process line with the left angle being more distant, asymmetry of the height of waist triangles with the left or right triangle up, asymmetry of the width of waist triangles with the right triangle wider, angle of pelvis tilt to the left, angle of the projection line of lower scapula angles with the left angle more convex, Table 3.

With regard to female pupils playing the Western concert flute, no correlation was reported between the physique type and suboptimal body posture (prescriptive range I and III). Yet, a very significant correlation was noticed between the body posture type and the following values of optimal posture parameters (prescriptive range II): the inclination of lumbosacral and thoracolumbar region, the angle, height and depth of thoracic kyphosis, the depth of lumbar lordosis, the angle of trunk bent to the right, the asymmetry of the height of waist triangles with the left triangle up, the asymmetry of the width of waist triangles with the right triangle being wider, Table 3.

No correlation was reported among female players of the grand piano between the physique type and suboptimal body posture (prescriptive range I and III). However, a very significant correlation was observed between the body posture type and the following parameters of optimal posture (prescriptive range II): the inclination of the thoracolumbar region and the length of thoracic kyphosis, Table 3.

No correlation was shown between the physique type and suboptimal body posture (prescriptive range I and III) among female guitar players. However, a very significant correlation was reported between the posture type and the following parameters of optimal posture (prescriptive range II): the depth of lumbar lordosis, the angle of trunk bent to the left, the angle of the shoulders line with the right shoulder up, the angle of the line of lower scapula angles with the right scapula up, the asymmetry of the distance between lower scapula angles and the spinous process with the right angle being more distant, the asymmetry of the height of waist triangles with the left or right triangle up, the asymmetry of the width of waist triangles with the left one being wider, the angle of the pelvis inclination to the right, asymmetric line of the spinous process with the right side being convex, the angle of the pelvis tilt to the right, the angle of the projection line of lower scapula angles with the left one

more convex. An insignificant correlation was observed between the pelvic inclinations to the left and the asymmetric line of the spinous process with the left side being convex, Table 3.

Among female pupils playing the violin, no correlation was observed between the physique type and suboptimal body posture ((prescriptive range I and III). However, very significant correlations were reported between the body posture type and the following optimal posture parameters (prescriptive range II): the angle of body trunk bent to the left, the angle of the shoulders line with the right or left shoulder up, the angle of the line of lower scapula angles with the right scapula up, the asymmetry of the distance between lower scapula angles and the spinous process with the right angle being more distant, the asymmetry of the height of waist triangles with the left or right triangle up, the asymmetry of the width of waist triangles with the left one being wider, the asymmetric projection of lower scapula angles with the right being more convex. A moderately significant correlation was demonstrated between the angle of pelvic tilt to the left, the angle of the projection line of lower scapula angles with the right one more convex, Table 3.

No correlation of the physique type with suboptimal body posture (prescriptive range I and III) was observed among female cello players. Yet, a moderately significant correlation was displayed between the posture type and the following parameters of optimal posture (prescriptive range II): the angle of the inclination of the thoracolumbar spine, the height of thoracic kyphosis, the angle and depth of lumbar lordosis, the angle of trunk bent to the left, the angle of the shoulders line with the right one up, the asymmetry of the height of lower scapula angles with the right one up, the asymmetry of the height of waist triangles with the right or left one up, asymmetry of the width of waist triangles with the left one wider, the angle of pelvic inclination to the right, asymmetric line of the spinous process with the right side being projection, the angle of the pelvic tilt to the right, Table 3.

No correlation of the physique type with suboptimal body posture (prescriptive range I and III) was demonstrated among students playing the accordion. Moderately significant correlations were, however, noticed between the body posture type and the parameter of optimal posture (prescriptive range II): the height of thoracic kyphosis. Insignificant correlations were noticed with: the total length of the spine, length and depth of thoracic kyphosis, the angle of trunk bent to the right, the angle of the shoulders line with the left one up, asymmetry of height and width of waist triangles with the right one up and wider, Table 3.

No correlations were observed between the physique type and the suboptimal body posture (prescriptive range I and III) among male pupils playing the Western cello flute. A moderately significant correlation was noticed between the physique type and the following parameters of

optimal body posture (prescriptive range II): the total length of the spine, the inclination angle of the lumbosacral spine, thoracolumbar and upper thoracic spine, the angle of body trunk bent, the height and depth of thoracic kyphosis, the length, height and depth of lumbar lordosis, the angle of body trunk bent to the right, the angle of scapula line with the left one up, asymmetry of the distance between lower scapula angles and the spinous process line with the left scapula more distant, the asymmetry of the height and width of waist triangles with the left or the right one being up and wider, the angle of pelvic inclination to the left, the asymmetric line of the spinous process with the left side being convex, Table 3.

No correlation of the physique type with the suboptimal body posture (prescriptive range I and III) was reported among male pupils playing the grand piano. Yet, a very significant correlation was noticed between the physique type and the following parameter of optimal body posture (prescriptive range II): the length of lumbar lordosis. Insignificant correlations were observed with the following parameters: the total length of the spine, the inclination angle of the body trunk to the right, the asymmetry of the distance of between lower scapula angles and the spinous process line with the left scapula more distant, the asymmetry of the height of waist triangles with the left or right one up, the asymmetry of the width of waist triangles with the right one wider, the inclination of scapula to the left or to the right, the asymmetric line of the spinous process with the left side projection, the angle of pelvic tilt to the right or left, the asymmetry of projection of lower scapula angles with the left or right one being more convex, the angle of the projection line of lower scapula angles with the left scapula more convex, Table 3.

No correlation of the physique type with the suboptimal body posture (prescriptive range I and III) was displayed among male guitar players. However, very significant correlations were observed between the physique type and the following parameters of the optimal body posture (prescriptive range II): the angle of body trunk bent, depth of thoracic kyphosis, height of lumbar lordosis, the angle of trunk bent to the left, the angle of the shoulders line with the right one up, the angle of the line of lower scapula angles with the right one up, the asymmetry of the distance between lower scapula angles and the line of the spinous process with the right scapula more distant, the asymmetry of the height and width of waist triangles with the left or right one being up and wider, the angle of the pelvis inclination to the right, the asymmetry of the spinous process line with the right-sided projection, the angle of the pelvic tilt to the left, the projection asymmetry of lower scapula angles with the right one more convex, the angle of the line of lower scapula angles with the left scapula more convex, Table 3.

No correlations were noticed between the physique type and the suboptimal body posture (prescriptive range I and III) among male violin players. Yet, an insignificant correlation was demonstrated between the body posture type and the following parameters of optimal posture (prescriptive range II): the length of thoracic kyphosis for boys playing the violin and the angle of lumbar lordosis for cello players, Table 3.

Summary

The most frequent correlations of the somatic type and body posture parameters of the musicians involved in the study were observed with the parameters of the frontal plane, less with the parameters of transverse plane and sporadically with sagittal parameters. No significant correlations were reported between the somatic type of male and female pupils of classes I-VI and the non-normative parameters of body posture. Among female pupils of the slender physique type in classes I-V, significant correlations were observed with the frontal parameters, less with the sagittal parameters and no correlations with the transverse parameters. Interestingly, moderately significant relationships with a similar frequency distribution were observed in class VI and in slender girls. Among stout male pupils from class II, the most frequent significant correlations were with sagittal parameters, less with frontal parameters, and from class IV with pupils of slender and moderate physique with frontal parameters, less with sagittal parameters and no correlations with the transverse parameters. As regards male students of stout physique from class III, significant correlations were observed with frontal parameters and less significant ones with transverse parameters. Pupils of slender and stout physique from class I turned out to have insignificant relationships with frontal and sagittal parameters. Among boys of medium and stout physique from class 5 as well as slender and stout from class 6, correlations between the somatic type and postural parameters were sporadic.

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