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Research Article

The Effect of a Backpack Weight Carried on the Right or Left Shoulder and at the Heteronymous Hip and the Correlations with the Physical Activity of 7-Year-Old Children of Both Sexes

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Abstract

Introduction: Periodically, at the turn of August and September, the problem of overloading children with too heavy school backpacks is rising.

Material and Method: Body posture studies were carried out in a group of 65 students aged 7 years, using the moiré projection method in 4 positions: 1st- in habitual posture, 2nd-in posture after 10 minutes of load, 3rd-in posture one minute after removing the load, 4th-in posture two minutes after removing the load. Physical fitness was measured with the modified Sekita test.

Results: The values of body posture features were analyzed to determine the significance of differences between consecutive measurements and their relationship with the values of physical fitness features.

Conclusions:

Carrying a 4-kg backpack obliquely on the right or left shoulder and at the heteronymous hip also negatively affects the biomechanical body statics of a 7-year-old child. Therefore, this way of carrying a backpack should not be recommended to 7-year-old students.

Physical fitness is more important in the restitution of the value of posture features in the frontal plane than in the sagittal and transversal planes. The relationships of its individual elements are more common among boys than girls, and their frequency is similar for each sex and in each way of carrying. The most significant values showing a relationship with body posture features among boys are speed and strength, whereas among girls they are strength and agility.

The value of restitution of any of the analyzed features of body posture was not complete after the first and second minute from the load release, which may indicate low overall efficiency, immature corrective, and compensatory processes and too much weight of the school supplies carried.

Keywords: Children's Health, Moire topography, Physical fitness, Postural asymmetry factor

Introduction

Human posturogenesis is very prone to epigenetic factors between the ages of 1 and 7 [1]. Other studies suggest that this period lasts at least until the age of 8-9 [2]. The results of Mrozkowiak's research edge the upper limit to 9-10 years of age [3]. According to *Cupryś Walicka et al.* [4] the postural and creative processes of children aged 6-7 are harmonious without any basically clear biological factors that would increase the percentage of defective postures. However, the authors keep claiming that negative changes can be found in the period of "school shock", which includes incompatibility of the desks and chairs' dimensions, distance from the blackboard, improper sitting position and carrying of school supplies [4]. The results of the studies by Mrozkowiak and Żukrowska confirm the role of the school chair in posturogenesis [5,6]. The subject literature on the impact of the school backpack on the student's body posture is quite rich. However, there are few reports of changes in the value of posture features under the load of school supplies. The early works of Romanowska [7] and Mrozkowiak [8] slightly outlined the problem. The statements of doctors and physiotherapists go along with recommendations of the Chief Sanitary Inspector, who emphasizes that any student should not carry a heavy schoolbag. The load of the schoolbag that should be evenly spread on the back of the student should not exceed 10-15% of the body weight. The spokesman reminds us that the student's schoolbag should have an appropriate structure. It must have a stiff back support touching the back and equal, wide harness with adjustable length to the child's height. It is advisable to fasten the chest at the front as it stabilizes the backpack. However, the use of school bags on wheels is not recommended as pulling them requires the involvement of one hand and causes postural disturbances.

The author's interest in the issues stems from the persistently high percentage of static disorders in the body posture of students from the oldest preschool group and grades 1-3 of primary school, the constantly proclaimed opinion about the negative impact of the way of carrying school supplies on body posture, and the lack of clear recommendations and contraindications against the negative way of carrying the schoolbag. The aim of the research was to show which way of carrying school supplies is more friendly to the body posture of a 7-year-old student, obliquely on the left shoulder and right hip, or on the right shoulder and left hip, and the relationship with the features of physical fitness.

Research Material

The study involved children from randomly selected kindergartens in the West Pomeranian and Greater Poland voivodeships. Body posture defects and disturbances were not a criterion that excluded participation in the research programme. The division of the respondents into those from rural and urban environments was abandoned since this feature would never determine the homogeneity of the group and the cultural and economic blurring boundary of both environments. The respondent was qualified to the programme according to the following scheme: if the respondent was 6years, 6months and 1day old and under 7years, he was included in the 7-year-old age group. This allowed to use the previously developed normative ranges appropriate for this age and sex category, diagnosing the quality of the body posture from the test day [3]. In total, 65 students participated in the programme, of which 53.84% (35 people) there were girls and 46.15% boys (30 people).

Overall Physical Fitness

The Wroclaw Physical Fitness Test for 3-7-year-old children was used to diagnose physical fitness [9]. According to the author, the test is of a high degree of reliability and is adequate in terms of discriminatory ability and degree of difficulty [10]. The proposed test, which significantly increased the motivation to exercise in the presence of parents, consists of four tests implemented as a part of the Sports Day: agility (pendulous run over 4x5m with carrying blocks), power (standing long jump), speed (running at 25m), and force (a 1kg ball both-hands-throw from the head). The author modified the test by a fifth attempt-endurance. Starting position-high starting stance. Movement-run over 300m. The running time from the start to finish was assessed and converted into points depending on the result and gender. If the child did not finish the race, they got score "0". The run took place on a recreational path with a hardened surface, remaining all safety rules [11]. Visualization [12].

Body Posture

The applied method using the projection moiré phenomenon determines the value of several dozen features describing the body posture. It makes it possible to determine the influence of various methods of carrying a bag with school supplies on body posture, restitution of the value of features after removing the load, and the importance of physical fitness in disorders and restitution of the value of the diagnosed features.

A custom-designed diagnostic frame was provided to ballast the body posture (utility model no. W.125734) (photo 2,3). The presence of an assistant during the examination was dictated by the need of minimizing the time from the load removal to the second registration of the value of the posture features. Every effort has been made to ensure that the custom-designed loaded frame was individually adapted to the type of child's body structure. The adopted 10minute load time was the average time to walk from the place of residence given in the questionnaire completed by the parents [13]. However, the load was determined by averaging the weight of school supplies to 4kg carried by first-class children from a randomly selected primary school. Selected features of body posture were measured in 8 positions, four for each way of carrying. The first position-habitual position (Picture 1). Second position-posture after 10minutes of asymmetric loading on the back (in the last 5 seconds) (Picture 2). Third position-posture one minute after the load removal (Picture 1). Fourth position-posture two minutes after the load removal (Picture 1). On the first day, included all children were under the measurements in 1st, 2nd, 3^{rd,} and 4th position with a diagonal load from the left shoulder to the right hip, and on the next day-all children in 1st, 2nd, 3rd and 4th in position from the right shoulder to the left hip. The load was supposed to imitate the way of wearing school supplies. The subject could move freely. This was in line with the previous results of Mrozkowiak's research, which showed that after this time, the values of posture features could be at the starting point [8].

Picture 1: Presentation of habitual posture.

Picture 2: Presentation of posture with oblique loading on the right shoulder and at the left hip.

It could be assumed that it was appropriate and relatively constant for each student when diagnosing the habitual posture on the first day of the research programme. However, to maintain the reliability of the research, it was assumed that any inconsistency with the value of the features from the first stage of the measurements may affect the final test result. Therefore, before pulling the load destined by the procedure, the features of the habitual posture were always determined as a reference for the subsequent dynamic changes of the diagnosed features. The height and weight of the children as well as the weight of the carried school supplies were measured with a medical balance before the first day of the tests.

The measurement site for the value of selected features of the body posture consists of a computer and a card, a programme, a monitor and a printer, a projection-receiving device with a camera for measuring selected parameters of the pelvis-spine syndrome. The place of the subject and the camera were oriented spatially in accordance with the levels on the camera and in relation to the line of the child's toes. It is possible to obtain a spatial image thanks to the projection of lines on the child's back with strictly defined parameters, which falling on the body are distorted depending on the configuration of its surface. Thanks to the use of the lens, the image of the examined person is taken by a special optical system with a camera, and then transferred to the computer monitor. Line image distortions recorded in the computer memory are processed by a numerical algorithm into a contour map of the tested surface. The obtained image of the back surface enables a multi-layered interpretation of the body posture. It is possible to determine the size of the angular and linear features describing the pelvis and physiological curvatures in the sagittal and transversal planes apart from the assessment of the torso asymmetry in the frontal plane [14]. The simultaneous measurement of all the real values of the spatial location of individual body sections is the most important aspect in this method.

The following test procedure was developed to minimize the risk of making mistakes in the measurements of selected posture features [3,15,16]

a) Habitual posture of the subject against the background of a white, lightly illuminated sheet: free, unforced posture, with feet slightly apart, knee and hip joints in extension, arms hanging along the body and eyes looking straight ahead, with the back to the camera at 2.5meters, toes at a perpendicular line to the camera axis.

b) Marking points on the back skin of the examined: the top of the spinous process of the last cervical vertebra (C_7), the spinous process being the top of the thoracic kyphosis (KP), the spinous process being the top of the lumbar lordosis (LL), the transition place from thoracic kyphosis to lumbar lordosis (PL), the lower angles of the scapulae (Łl and Łp), the posterior upper iliac spines (Ml and Mp), and the S1 vertebra. A white necklace was put on the subject's neck to clearly mark the B1 and B3 points. Long hair up to reveal C_7 point.

c) The digital image of the back was recorded in the computer memory in each of the tested positions from the middle phase of free exhalation after entering the necessary data about the examined person (name and surname, year of birth, weight and body height, comments about the condition of the knees and heels, chest, past injuries, surgical procedures, diseases of the musculoskeletal system, gait, etc.).

d) Processing of the recorded images takes place without the participation of the subject.

e) The value of the features describing the body posture spatially are printed after saving the mathematical characteristics of the photos in the computer memory (Figure 1).

Subject of Research

Picture 3: Presentation of posture with oblique loading on the left shoulder and at the right hip.

The Wrocław fitness test allowed to measure the strength, power, speed, and agility of preschool children. The author modified Sekita's test for a test of endurance. Definitions of the tested physical and complex motor skills are generally available in the literature [10]. The applied method, which uses the phenomenon of the projection moire, defines several dozen features describing the body posture. For statistical analysis, 36 angular and linear features of the spine, pelvis and torso in the frontal plane as well as body weight and height were selected. It was guided by the need of the most reliable and spatially complete look at the child's body posture, which allowed to fully identify the measured discriminants (Table 1) (Figures 2-4) (Picture 3,4).

MAGMAR Olsztyn
Mirosław Mrozkowiak
Phone number: 602 529 652
COMPUTERIZED EXAMINATION OF THE BODY POSTURE

Name: Height: 119 cm, Year of birth: 1993
Data: 1SP1MK\0CIOLL00, Date of examination: 2000-12-02, Printout: 2001-01-23
Medical intelligence: Comments:

Global parametres
Length of the spine: DCK 346.6 [mm] meaning 29.1% of height
Tilt angles [deg.]: ALFA 10.1, BETA 15.2, GAMMA 13.9 In total: 39,2 [deg.]
Torso tilt angle: KPT 6.3 [deg.] Compensation rate: 3.8 [deg.]

Thoracic kyphosis
D.LL_C7 DKP 309.9 [mm] (89.4%) KKP angle 150.9 [deg.]
D.PL_C7 RKP 195.7 [mm] (56.5%) GKP depth 32.7 [mm] (WKP 0.167)

Lumbar lordosis
D.S1_KP DLL 271.2 [mm] (78.2%) KLL angle 154.7 [deg.]
D.S1_PL RLL 150.9 [mm] (43.5%) GLL depth -30.8 [mm] (WLL -0.204)

Frontal plane
Torso tilt angle KNT 1.4 [deg.]
Left shoulder higher about 8.2 [mm] Angle of shoulder blades line KLB -1.7 [deg.]
Left shoulder blade higher about 6.1 [mm] (-2.4 deg.) (UL), closer about 20.6 [mm] (-8.0 deg.) (UB)
The difference of the distance of shoulder blades from the spine OL: 2.4 [mm] (1.7%)
Left waist triangle higher about -46.2 [mm] (TT), wider about -14.7 [mm] (TS)
The pelvis: tilt angle KNM 1.5 [deg.], turn angle KSM -6.4 [deg.]
Shoulder's asymmetry rate regarding KK WBS = -10.5 (-3.8%), regarding C7 WBC = 6.3 (2.3%)
Shoulder- pelvis asymmetry rate vertical WBK = 10.2 (1.9%) horizontal WBX = -10.5 (-5.3%)
Maximum deviation of 1. spinous process from C7_S1 UK 11.1 [mm] at Th6 level

DESCRIPTION

The manufacturer of the measuring device of Computerized Examination Of the Body Posture, feet,...:
CQ Electronic System, M.E. Artur Swierc, Na Niskich Lakach street, 19/2, Wroclaw, phone numer: 0601 794162

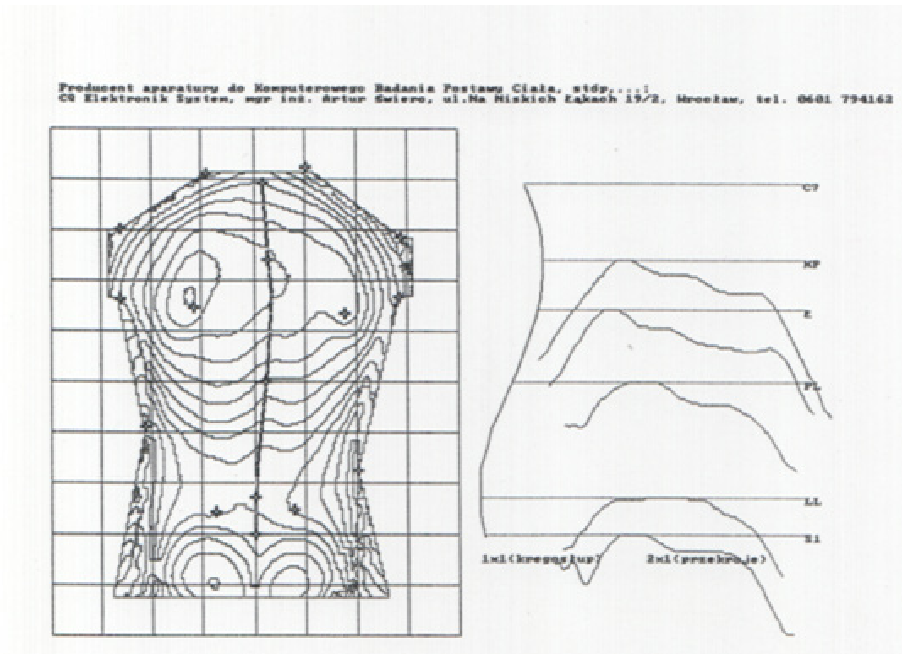


Figure 1: An example of a record sheet of measurements of the posture features of the spine-pelvis syndrome.

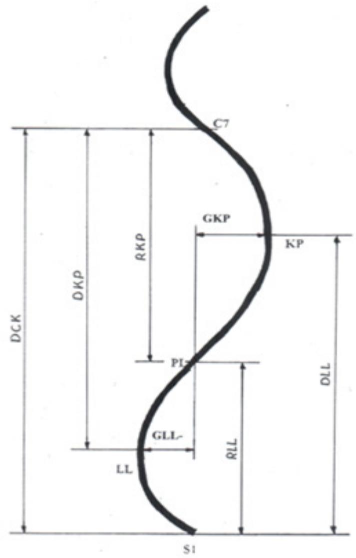


Figure 2: Selected linear features of the spine in the sagittal plane.

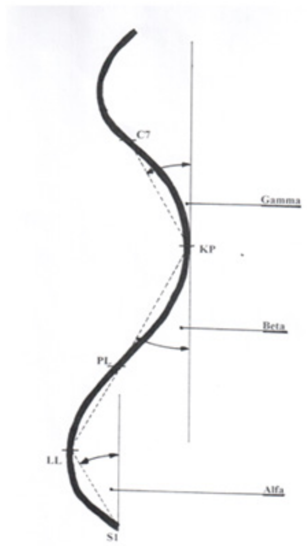
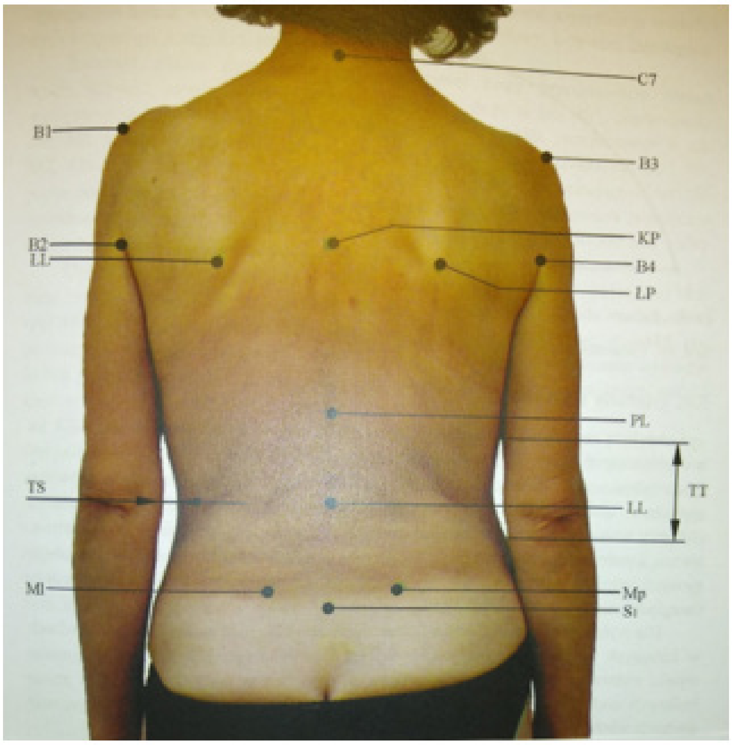


Figure 3: Selected angular features of the spine in the sagittal plane.

Figure 4: The pelvis tilt in the transversal plane.



Picture 4: Location and markings of the torso points in the frontal plane.

Table 1: The list of registered body and morphological features.

No	Symbol	Parametres		
		Label	Name	Description
Sagittal plane				
1	Alfa	degrees	The inclination of limbosacral segment	
2	Beta	degrees	The inclination of thoracolumbar segment	
3	Gamma	degrees	The inclination of upper thoracic segment	
4	Delta	degrees	The total of angles value	Delta = Alfa+ Beta+ Gamma
5	KPT	degrees	Torso extension angle	It is determined by the inclination of C_7-S_1 line from the vertical (backwards)
6	KPT -	degrees	Torso bend angle	It is determined by the inclination of C_7-S_1 line from the vertical (forwards)
7	DKP	mm	The length of thoracic kyphosois	The distance between LL a C_7 points
8	KKP	degrees	The angle of thoracic kyphosois	KKP = 180-(Beta+Gamma)
9	RKP	mm	The height of thoracic kyphosois	The distance between C_7 a PL points
10	GKP	mm	The depth of thoracic kyphosois	The distance measured horizontally between vertical lines crossing PL and KP points
11	DLL	mm	The length of lumbar lordosis	The distance between S_1 a KP points
12	KLL	degrees	The angle of lumbar lordosis	KLL = 180-(Alfa + Beta)
13	RLL	mm	The height of lumbar lordosis	The distance between S_1 a PL points

14	GLL -	mm	The depth of lumbar lordosis	The distance measured horizontally between vertical lines crossing PL and LL points
Frontal plane				
15	KNT -	degrees	The angle of the torso bend to the side	It is determined by the deviation of the C_7-S_1 line from the vertical to the left.
16	KNT	degrees		It is determined by the deviation of the C_7-S_1 line from the vertical to the right.
17	KLB	degrees	The angle of shoulders, when the right one is higher	The angle between the horizontal line and the straight line through B_2 and B_4 points
18	KLB –	degrees	The angle of shoulders, when the left one is higher	PLBW=LBW-PBW
19	UL	degrees	The angle of shoulder blades, when the right one is higher	The angle between the horizontal line and the straight line through Ł1and Łp points
20	UL -	degrees	The angle of shoulder blades, when the left one is higher	
21	OL	mm	The more distant lower angle of the left shoulder blade	The difference in the distance of the lower angles of the shoulder blades from the line of the spinous processes of the spine, measured horizontally by straight lines passing through the Łl and Łp points
22	OL -	mm	The more distant lower angle of the right shoulder blade	
23	TT	mm	The left waist triangle is higher	The difference of the distance measured vertically between T_1 and T_2 and T_3 and T_4.
24	TT –	mm	The right waist triangle is higher	PLTT = LTT-PTT
25	TS	mm	The left waist triangle is wider	The difference of the distance measured horizontally between T_1 and T_2 and T_3 and T_4.
26	TS -	mm	The right waist triangle is wider	
27	KNM	degrees	Pelvic tilt angle, the right ala of ilium is higher	The angle between the horizontal line and the straight line through M1and Mp points
28	KNM -	degrees	Pelvic tilt angle, the left ala of ilium is higher	
29	UK	mm	The maximum deviation of the spinous process of the vertebra to the right	The greatest deviation of the spinous process from the vertical deriving from S_1. The distance is measured along the horizontal axis.
30	UK -	mm	The maximum deviation of the spinous process of the vertebra to the left	
31	No of the vertebrae	–	The number of the vertebrae deviating as far as possible to the left or right	Number of the vertebrae most deviating to the left or right in the asymmetric line of the spinous process, counting as 1, first cervical vertebra (C1). If the arithmetic mean is, for example, from 12.0 to 12.5 it is Th5, if from 12.6 to 12.9 it is Th6.
Płaszczyzna Poprzeczna				
32	UB –	degrees	The angle of convex line of lower shoulder blades, where the left is more convex	The angle difference of UB_1 - UB_2. The UB_2 angle between a line crossing the Łl point and being simultaneously perpendicular to the camera axis and the straight-line crossing Łl and Łp points. The UB1 angle is between the line crossing the Łp point and being simultaneously perpendicular to the camera axis and the straight-line crossing Łp and Łl points.
33	UB	degrees	The angle of convex line of lower shoulder blades, where the right is more convex	PLLB = LLB - PLB
34	KSM	degrees	Pelvic tilt to the right	The angle between a line crossing M1 point and being simultaneously perpendicular to the camera axis and a straight-line crossing M1 and MP points
35	KSM -	stopnie	Pelvic tilt to the left	The angle between a line crossing Mp point and being simultaneously perpendicular to the camera axis and a straight-line crossing M1 and MP points
36	DCK	mm	Total length of the spine	The distance between C_7 and S_1 points measured vertically.
Morphological features				
37	Mc	kg	Body weight	The height and weight were measured on an electronic medical balance
38	Wc	cm	Body height	

Source*: Own research

Table 2: The significance of differences in the value of body posture features between 1st and 2nd, 1st and 3rd, 1st and 4th, 2nd and 3rd, and 3rd and 4th measurement in oblique loading on the left shoulder and at the right hip among boys.

No	Variables	Measure-ment	Wilcoxon's Test							
		1	2	3	4					
		Me	Me	Me	Me	1/2	1/3	1/4	2/3	3/4
1	DCK	314,05	294,30	299,60	311,45	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
2	Alfa	8,45	13,75	11,20	9,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
3	Beta	9,75	12,85	11,55	10,45	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
4	Gamma	11,20	18,00	15,80	13,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
5	Delta	29,65	45,00	37,60	33,85	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
6	KPT-	4,15	7,95	5,70	4,90	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
7	KPT	4,75	2,05	2,60	3,90	0,005**	0,005**	0,005**	0,005**	0,005**
8	DKP	279,00	266,95	272,10	275,15	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
9	KKP	159,00	149,05	152,65	155,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
10	RKP	185,30	175,10	181,05	183,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
11	GKP	19,95	32,85	25,55	22,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
12	DLL	247,00	243,30	245,35	246,55	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
13	KLL	161,95	153,35	157,25	159,90	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
14	RLL	135,60	132,15	133,70	135,00	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
15	GLL	24,45	27,70	25,95	24,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
16	KNT-	1,40	8,40	4,10	2,05	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
17	KNT	2,35	0,50	1,15	1,90	0,050	0,176	0,248	0,025*	0,063
18	KLB-	1,90	0,90	1,40	1,60	0,012*	0,011*	0,011*	0,012*	0,011*
19	KLB	1,05	8,00	5,00	1,95	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
20	UL-	4,15	1,00	1,90	3,40	0,011*	0,011*	0,018*	0,042*	0,012*
21	UL	1,95	7,60	4,85	2,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
22	UB-	3,30	1,00	1,95	2,80	0,012*	0,012*	0,011*	0,028*	0,011*
23	UB	4,00	7,40	5,15	4,40	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
24	OL-	8,10	10,15	9,20	8,45	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
25	OL	4,30	1,10	2,10	3,35	0,012*	0,012*	0,012*	0,018*	0,012*
26	TT-	4,80	1,85	2,70	4,00	0,012*	0,011*	0,011*	0,012*	0,011*
27	TT	8,30	14,30	11,00	9,30	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
28	TS-	5,10	13,65	10,35	6,50	0,012*	0,012*	0,012*	0,012*	0,012*
29	TS	8,35	2,10	4,10	6,85	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
30	KNM-	7,50	11,30	9,70	8,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
31	KNM	3,40	1,10	1,80	3,10	0,008**	0,008**	0,007**	0,008**	0,011*
32	KSM-	2,45	0,75	1,65	2,10	0,011*	0,011*	0,011*	0,017*	0,011*
33	KSM	5,50	11,30	8,60	6,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
34	UK-	1,50	0,75	0,95	1,15	0,012*	0,012*	0,011*	0,018*	0,011*
35	UK	6,95	10,95	9,15	7,85	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**

Source*: Own research

The Following Research Questions Arise from the Aim of the Research

a) Which of the analyzed ways of carrying the weight of school supplies disturbs less the statics of body posture?

b) Which way of carrying the weight of school supplies is more related to physical fitness?

c) Which way of carrying the weight of school supplies by is the restitution of the value of the posture features full?

Our Own Research Results and the Analysis of the Available Literature Suggest That

a) Both ways of carrying the weight of school supplies significantly disturbs the statics of body posture.

b) Physical fitness is of greater importance in the restitution of the value of body posture features in the frontal plane than in the sagittal and the transversal plane in both analyzed ways of carrying. The relationships of its individual elements are more common among boys than girls. Among boys, the most common abilities correlating with is speed and strength, and among girls it is strength and agility.

c) Restitution of the value of posture features after carrying the weight of school supplies both ways is incomplete.

Statistical Methods

It was assumed that the standard deviation is a measure of differentiation. The higher it is in relation to the mean, the greater the variation of results is in each group. There was no reference to it in the description of the results, but in analytical practice its application was treated as a concomitant measure of the arithmetic mean. In the used analysis, the reference to SD was abandoned. These were only given in the introductory tables (where M was also given) as a formality. SD was a concomitant measure of M. It was also assumed that the value of SD in the performed studies was not interpreted in any way, especially if the analysis was based on non-parametric tests and median (Me), but not the mean (M). Therefore, SD and M were finally removed in the initial analyzes to concentrate the tables and leave there only necessary issues for the research. Standard deviation is a concomitant measure of the arithmetic mean and therefore it is not valid to put it next to the median.

The analysis of the study results was performed using the IBM SPSS Statistics 26 programme. At the initial stage, the Shapiro-Wilk and Kołmogorow-Smirnow tests were used to ensure if the distributions of the analyzed variables were consistent with the normal distribution. For most of the variables, there were statistically significant deviations from the normal distribution at the level of $p<0.05$. Therefore, it was decided to use tests and non-parametric coefficients in the statistical analysis. The Wilcoxon rank test was used to determine whether there was a statistically significant difference (change) between two measurements (in the same group) of the quotient variable whose distribution was significantly different from the normal one. The following symbols were used in the tables: M-Arithmetic Mean, Me-Median, SD-Standard Deviation, Z-Wilcoxon test statistic, "p"-significance of the Wilcoxon test. The level of significance was set at $p<0.05$, marked as*, and additionally, the significance level $p<0.01$, marked as**. Thus, if $p<0.05$ or $p<0.01$, then the difference between the measurements was statistically significant. The Spearman's rho correlation coefficient was used to determine whether there were statistically significant correlations between the variables measured at the quotient level, which distribution significantly differed from the normal one. The level of statistical significance was set at $p<0.05$, marked as*, and additionally, the level of significance $p<0.01$, marked as**. Thus, if $p<0.05$ or $p<0.01$, then the correlation between the variables was statistically significant. If the correlation was statistically significant at the level of $p<0.05$, then the correlation coefficient rho should be interpreted. It could take values from -1 to+1. The more distant it was from 0, and the closer it was to -1 or+1, so the correlation was stronger. Negative values meant that as the value of one variable increased, the value of the other variable decreased. On the other hand, positive values indicated that as the value of one variable increased, the value of the other variable increased, too. In the individual tables of correlation, only the variables were considered (in the rows), which at least one statistically significant result was recorded for.

Individual values of posture features are expressed in different sizes and ranges, so it is not possible to calculate the average difference for all these variables between the two measurements. An analysis performed in such a way would distort the results and make the variables, in which the quantities are higher of greater importance, and the variables, in which the quantities were lower of less importance. Therefore, the correlation between the averaged difference in the value of features between the measurements and physical fitness was made separately for girls and boys, using absolute values, i.e., the calculations did not use exact numerical values concerning the differences, but the ratio of the difference to the initial value. This approach makes the variables not to be overrepresented or underrepresented in the average result.

The comparison of 1st with 2nd measurements in carrying the bag on the left shoulder and right hip or the right shoulder and left hip, separately for boys and girls, was aimed at showing significant changes in the way of carrying school supplies in the analyzed values of posture features. The analysis included a comparison of the value of posture features between 1st and 3rd, 1st and 4th, 2nd and 3rd and 3rd and 4th with the measurement of the school bag carried on left shoulder and right hip or right shoulder and left hip, separately for girls and boys. This was to show the restitution (full or incomplete) of changes in the analyzed posture features in the adopted way of carrying school supplies and showing which of both ways of carrying school supplies causes fewer significant changes in body posture features, thus it can be recommended. To concentrate the results of the analysis as much as possible, the tables include only the medians, and the significance of the Wilcoxon test results.

Obtained Results

In total, the research carried out in a group of 65 people of both sexes allowed to register 10010 values of features describing body posture in habitual posture and dynamic positions, body weight and height, and physical fitness. An average body weight was as follows: among girls 24.46kg, body height 123.87, and among boys: 24.56kg and 123cm, respectively. All children had a slender body type according to the Rohrer Weight and Growth Index [17]. Information was also obtained through a survey conducted among 65 parents of children reported to the research project [13]. The analysis of the results of the applied Wrocław fitness test and the endurance diagnostic trial showed that the tested group of children represented a sufficient level of physical fitness, assuming grading: insufficient, sufficient, good, very good. This level was significantly lower than the values obtained in the measurements of other authors from 2006, 1996, 1972 and 1967 [18-20]. The phenomenon of sexual dimorphism in the studied group of 7-year-olds of both sexes was not confirmed.

When analyzing the changes in the value of the features among boys, in oblique carrying on the left shoulder and at the right hip, the Wilcoxon rank test showed a statistically significant difference between the 2nd and the 1st measurement in all analyzed variables, except for the torso asymmetry in the frontal plane (KNT+), where no statistically significant changes appeared. Significant changes between the 3rd and 1st, 2nd and 3rd and 3rd and 4th measurements were also shown in almost all analyzed variables. The exceptions are the differences between the 1st and 3rd, and 3rd and 4th measurement in the case of torso asymmetry in the frontal plane (KNT+), which are not statistically significant (Table 2). However, there was a statistically significant difference in all the analyzed variables in carrying on the right shoulder and on the left hip. In carrying on the right shoulder and left hip, a statistically significant difference was found between 3rd and 1st, 2nd and 3rd and 3rd and 4th in all analyzed variables, except for the difference between the 1st and the 4th measurement in the case of torso asymmetry in the frontal plane (KNM+), which is not statistically significant (Table 3).

Table 3: The significance of differences in the value of body posture features between 1st and 2nd, 1st and 3rd, 1st and 4th, 2nd and 3rd, and 3rd and 4th measurement in oblique loading on the right shoulder and at the left hip among boys.

No	Variables	Measurement				Wilcoxon's Test				
		1	2	3	4					
		Me	Me	Me	Me	1/2	1/3	1/4	1/3	1/4
1	DCK	314,05	294,30	300,70	309,90	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
2	Alfa	8,45	13,20	11,20	9,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
3	Beta	9,75	12,65	11,60	9,80	<0,001**	<0,001**	0,089	<0,001**	<0,001**
4	Gamma	11,20	17,25	14,45	12,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
5	Delta	29,65	43,30	36,45	32,25	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
6	KPT-	4,15	7,20	6,10	4,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
7	KPT	4,75	1,80	2,65	4,05	0,005**	0,005**	0,005**	0,005**	0,005**
8	DKP	279,00	266,15	272,25	277,15	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
9	KKP	159,00	150,25	153,75	157,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
10	RKP	185,30	175,05	182,95	184,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
11	GKP	19,95	31,45	25,65	21,65	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
12	DLL	247,00	241,30	245,25	246,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
13	KLL	161,95	154,25	157,40	160,35	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
14	RLL	135,60	130,55	132,10	133,95	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
15	GLL	24,45	27,20	25,95	25,05	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
16	KNT-	1,40	0,45	0,65	1,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
17	KNT	2,35	5,85	4,60	3,15	0,012*	0,012*	0,011*	0,012*	0,012*
18	KLB-	1,90	5,60	4,80	3,10	0,012*	0,012*	0,012*	0,012*	0,012*
19	KLB	1,05	0,35	0,55	0,90	<0,001**	<0,001**	<0,001**	0,002**	<0,001**
20	UL-	4,15	6,20	5,00	4,50	0,012*	0,012*	0,012*	0,011*	0,012*
21	UL	1,95	0,80	1,25	1,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
22	UB-	3,30	5,35	4,45	4,00	0,012*	0,012*	0,011*	0,012*	0,012*

23	UB	3,65	1,75	2,75	3,25	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
24	OL-	8,10	4,70	6,00	7,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
25	OL	4,30	6,05	4,90	4,70	0,012*	0,012*	0,011*	0,012*	0,012*
26	TT-	4,80	10,10	7,60	5,45	0,012*	0,011*	0,012*	0,011*	0,012*
27	TT	8,30	3,90	5,35	7,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
28	TS-	5,10	9,15	7,70	6,05	0,011*	0,012*	0,012*	0,012*	0,012*
29	TS	8,35	3,85	5,60	6,50	<0,00**	<0,001**	<0,001**	<0,001**	<0,001**
30	KNM-	7,50	2,10	3,80	5,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
31	KNM	3,40	9,70	6,70	4,30	0,008**	0,008**	0,109	0,008**	0,008**
32	KSM-	2,45	8,60	6,45	3,65	0,012*	0,012*	0,012*	0,012*	0,012*
33	KSM	5,50	2,60	3,70	4,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
34	UK-	1,50	7,60	5,65	3,20	0,012*	0,012*	0,012*	0,012*	0,012*
35	UK	6,95	2,30	4,40	5,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**

Source*: Own research

Considering the differences of values among girls considering both ways of carrying, a statistically significant difference was shown between 2nd and 1st, 3rd and 1st, 2nd and 3rd and 3rd and 4th measurement for all analyzed variables (Table 4,5).

Table 4: The significance of differences in the value of body posture features between 1st and 2nd, 1st and 3rd, 1st and 4th, 2nd and 3rd, and 3rd and 4th measurement in oblique loading on the left shoulder and at the right hip among girls.

No	Variables	Measurement				Wilcoxon's Test				
		1	2	3	4					
		Me	Me	Me	Me	1/2	1/3	1/4	2/3	3/4
1	DCK	294,10	280,50	287,45	292,35	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
2	Alfa	8,90	14,50	12,05	10,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
3	Beta	11,20	14,30	13,15	11,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
4	Gamma	11,25	18,20	15,80	14,00	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
5	Delta	31,00	46,70	40,95	35,25	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
6	KPT-	4,10	8,10	5,30	4,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
7	KPT	4,20	2,20	2,80	3,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
8	DKP	276,25	264,85	268,90	273,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
9	KKP	157,70	147,75	150,65	154,55	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
10	RKP	176,90	166,60	171,45	175,35	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
11	GKP	20,45	33,70	25,85	22,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
12	DLL	248,15	244,05	245,70	247,55	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
13	KLL	159,90	150,50	154,50	157,75	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
14	RLL	129,15	124,70	127,35	128,40	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
15	GLL	23,40	27,35	25,10	23,90	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
16	KNT-	0,40	8,60	4,30	1,60	0,001**	0,001**	0,001**	0,001**	0,001**
17	KNT	0,80	0,30	0,50	0,70	0,003**	0,007**	0,007**	0,003**	0,025*
18	KLB-	1,40	0,60	1,00	1,10	0,003**	0,003**	0,007**	0,011*	0,003**
19	KLB	1,50	8,30	4,50	2,10	0,001**	0,001**	0,001**	0,001**	0,001**
20	UL-	2,80	0,70	1,10	2,10	<0,001**	<0,001**	0,001**	<0,001**	<0,001**
21	UL	3,20	7,60	4,20	3,40	0,001**	0,001**	0,002**	0,001**	0,001**
22	UB-	2,70	0,90	1,30	2,10	<0,001**	<0,001**	<0,001**	0,001**	<0,001**

23	UB	2,80	7,30	5,50	3,50	0,001**	0,001**	0,001**	0,001**	0,001**
24	OL-	7,60	11,30	9,60	8,40	0,001**	0,001**	0,001**	0,001**	0,001**
25	OL	4,30	1,10	2,50	3,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
26	TT-	4,70	1,70	3,10	4,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
27	TT	4,80	12,50	10,30	6,20	0,001**	0,001**	0,001**	0,001**	0,001**
28	TS-	4,90	14,10	10,40	6,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
29	TS	5,10	2,10	3,70	4,80	0,001**	0,001**	0,001**	0,001**	0,001**
30	KNM-	2,70	11,40	8,70	4,10	0,001**	0,001**	0,001**	0,001**	0,001**
31	KNM	2,90	1,00	1,10	2,30	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
32	KSM-	2,90	0,80	1,40	2,60	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
33	KSM	4,10	10,40	7,90	5,80	0,001**	0,001**	0,001**	0,001**	0,001**
34	UK-	3,10	1,10	1,90	2,90	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
35	UK	3,70	10,20	7,20	4,20	0,001**	0,001**	0,001**	0,001**	0,001**

Source*: Own research

No	Variables	Measurement				Wilcoxon's Test				
		1	2	3	4					
		Me	Me	Me	Me	1/2	1/3	1/4	2/3	3/4
1	DCK	294,10	280,90	286,50	290,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
2	Alfa	8,90	13,75	11,65	10,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
3	Beta	11,20	13,65	12,20	10,95	<0,001**	<0,001**	0,865	<0,001**	<0,001**
4	Gamma	11,25	17,40	15,40	13,15	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
5	Delta	31,00	44,70	39,40	34,15	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
6	KPT-	4,10	7,50	6,30	4,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
7	KPT	4,20	2,00	2,80	3,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
8	DKP	276,25	263,55	268,15	275,15	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
9	KKP	157,70	148,80	152,70	155,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
10	RKP	176,90	166,15	172,40	175,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
11	GKP	20,45	31,70	24,60	22,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
12	DLL	248,15	244,00	244,30	248,00	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
13	KLL	159,90	152,45	155,40	159,25	<0,001**	<0,001**	0,002**	<0,001**	<0,001**
14	RLL	129,15	123,55	126,85	127,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
15	GLL	23,40	26,50	25,05	24,30	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
16	KNT-	0,40	0,10	0,20	0,30	0,001**	0,001**	0,001**	0,005**	0,001**
17	KNT	0,80	5,40	4,10	1,70	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
18	KLB-	1,40	4,80	3,70	2,30	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
19	KLB	1,50	0,30	1,00	1,30	0,002**	0,001**	0,004**	0,005**	0,002**
20	UL-	2,80	5,60	4,30	3,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
21	UL	3,20	1,50	2,30	2,90	0,001**	0,001**	0,001**	0,001**	0,001**
22	UB-	2,70	5,60	4,30	3,10	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
23	UB	2,80	1,60	2,10	2,70	0,001**	0,001**	0,001**	0,001**	0,001**
24	OL-	7,60	3,10	4,90	6,70	0,001**	0,001**	0,001**	0,001**	0,001**
25	OL	4,30	6,10	5,30	4,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
26	TT-	4,70	10,50	7,80	5,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
27	TT	4,80	2,80	3,70	4,50	0,001**	0,001**	0,001**	0,001**	0,001**

28	TS-	4,90	8,90	7,40	5,80	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
29	TS	5,10	1,50	3,70	4,70	0,001**	0,001**	0,001**	0,001**	0,001**
30	KNM-	2,70	1,20	1,90	2,40	0,001**	0,001**	0,001**	0,001**	0,001**
31	KNM	2,90	8,70	6,50	4,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
32	KSM-	2,90	8,90	6,50	4,20	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
33	KSM	4,10	2,10	3,20	4,00	0,001**	0,001**	0,001**	0,001**	0,001**
34	UK-	3,10	8,70	6,80	4,50	<0,001**	<0,001**	<0,001**	<0,001**	<0,001**
35	UK	3,70	1,40	2,70	3,40	0,001**	0,001**	0,001**	0,001**	0,001**

Source*: Own research

Note*: Legend: The significance of differences in the size of body posture features between 1st and 2nd, 1st and 3rd, 1st and 4th, 2nd and 3rd, and 3rd and 4th measurement in oblique loading on the right shoulder and at the left hip among girls.

Analyzing the relationship between the tested trials of physical fitness and the differences in the value of features between the 2nd and 3rd measurement in carrying school supplies obliquely on the left shoulder and at the right hip by boys, it turned out that the greater the endurance, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), and the larger of torso (KNT+), the height of the shoulders (KLB-), the shoulder blades (UL-) and the distance of the lower angles from the processes line of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes vertebrae of the spine (UK-) and pelvis (KSM-). The grater the speed, the smaller the differences in the size of the angle of the lumbosacral section (Alpha), the angle of lumbar kyphosis (KLL) and the asymmetries of the trunk (KNT+), shoulders (KLB-), shoulder blades (UL-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-) and the pelvis, and the greater convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-). The greater the strength, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but larger of torso (KNT+), shoulders (KLB-), shoulder blades (UL-), the distance of angles of lower shoulder blades from the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-) and the pelvis in the frontal plane (KNM+) and transversal (KSM-) plane.

The greater the force, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but larger of torso (KNT+), height of the shoulders (KLB-), the blades (UL-), the distance of the angles of the lower shoulder blades from the line the spinal processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the agility, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but larger of torso (KNT+), height of the shoulders (KLB-), shoulder blades (UL-), the distance of the angles of the lower shoulder blades from the line the spinal processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), the pelvis in the frontal (KNM+) and transversal (KSM-) planes. The greater the overall efficiency, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but greater of torso (KNT+), the height of the shoulders (KLB-), the height of the shoulder blades (UL-), the distance of the angles of the lower shoulder blades from the line the spinal processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-) and the pelvis in the frontal (KNM+) and transversal (KSM-) planes.

Considering the differences between the 3rd and 4th measurement, it turned out that the greater the endurance, the smaller the asymmetries of the torso (KNT+), the height of the shoulder blades (UL-), the width of the waist triangles (TS-), the convexity of the angles of the lower blades in the transversal plane (UB-), but greater the height of shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the symmetry of the line of the spinous processes vertebrae of the spine (UK-) and the pelvis (KSM-). The greater the speed, the smaller the asymmetries in the height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the lines of the spinous processes of the spine (UK-) and pelvis (KSM-), but greater differences in the value of the angle (KLL) and height (RLL) of lumbar lordosis, torso asymmetry (KNT+), height of the shoulder blades (UL-), height (TT+) and width (TS-) of the waist triangles , the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-).

The greater the strength, the smaller the asymmetry of the torso (KNT+), the height of the shoulder blades (UL-), the width of the waist triangles (TS-), the convexity of the angles of the lower shoulder blades, where the lower angle of the left one is more convex (UB-) or the right one (UB+), but greater height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), the pelvis in the frontal (KNM+) and transversal (KSM-) planes. The greater the force, the smaller the asymmetries of the torso in the sagittal (KPT-) and frontal (KNT+) planes, the height of the shoulder blades (UL-), the width of the waist triangles (TS-), the convexity of the angles of the lower shoulder blades (UB-), but greater in the height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-) and the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the agility, the smaller the asymmetries of the torso (KNT+), the height of the shoulder blades (UL), the width of the waist triangles (TS-), the convexity of the angles of the lower shoulder blades (UB-), but the greater the height of the shoulders (KLB-), the distance of the angles of the lower blades from the lines of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal (KSM-) planes. The greater the overall efficiency, the smaller the asymmetries of the torso (KNT+), the height of the shoulder blades (UL), the width of the waist triangles (TS-), convexity of the angles of the lower blades in the transversal plane (UB-), but greater in the height of the shoulders (KLB-), distance of the angles of the lower shoulder blades from the line of spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM-) and transversal (KSM-) planes. By examining the differences between the 1st and 2nd measurement, it turned out that the greater the endurance, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but greater in the asymmetry of the torso (KNT+), the height of the shoulders (KLB-) , the shoulder blades (UL-), the distance of the lower angles of the shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-) and the pelvis (KSM-). The greater the speed, the smaller the asymmetries of the trunk (KNT+), the height of the shoulders (KLB-), the shoulder blades (UL-), the distance of the angles of the lower shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-), pelvis (KSM-), but greater convexities of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-).

The greater the strength, the smaller the differences in the length of the thoracic kyphosis (DKP), the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but the greater the differences in the height of the thoracic kyphosis (RKP), and the asymmetries of the torso (KNT+), height of the shoulders (KLB-), shoulder blades (UL-), the distance of the lower angles of the shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal plane (KSM-). The greater the force, the smaller the asymmetries of the torso (KPT-), the convexities of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but the greater the asymmetries of the torso (KNT+), the height of the shoulders (KLB-), and the shoulder blades (UL-) , the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), the pelvis in the transversal plane (KSM-). The greater the agility, the smaller the differences in the length of the thoracic kyphosis (DKP), the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but the greater of the torso (KNT+), the height of the shoulders (KLB-), and the shoulder blades (UL-), the distance of the angles of the lower shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal (KSM-) plane. The greater the overall fitness, the smaller the differences in the length of the thoracic kyphosis (DKP), the asymmetries of the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-), but the greater of the torso (KNT+), the height of the shoulders (KLB-), and the shoulder blades (UL) -), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-) the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal (KSM-) plane (Table 6).

Analyzing the differences between the 1st and 3rd measurement, it turned out that the greater the endurance, the smaller the asymmetries of the torso (KNT+), the height of shoulders (KLB+), shoulder blades (UL-), width of the waist triangles (TS-), convexity of the angles of the lower shoulder blades (UB -), but greater distances of the lower angles of the shoulder blades of the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-), and pelvic asymmetries (KSM-). The grater the speed, the smaller the asymmetries in the height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-), pelvis (KSM-) but the greater of the torso (KNT+), height of the shoulder blades (UL-), width of the waist triangles (TS-), and convexity of the angles of the lower shoulder blades (UB-). The greater the strength, the smaller the asymmetries of the torso (KNT+), the height of the shoulders (KLB+), shoulder blades (UL-), width of the waist triangles (TS-), convexity of the angles of the lower shoulder blades, where the lower right angle is more convex (UB+) or the left one (UB-), but greater distances from the angles of the lower blades from the line of the spinous processes (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-). The greater the force, the smaller the asymmetries of the torso (KNT+), the height of the shoulders (KLB+), the shoulder blades (UL-), the width of the waist triangles (TS-), the convexity of the angles of the lower shoulder blades (UB-), but the greater distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the agility, the smaller the differences in the depth of thoracic kyphosis, GKP, torso asymmetries (KNT+), the height of the shoulders (KLB+), shoulder blades (UL-), the width of waist triangles (TS-), convexity of the angles of the lower shoulder blades (UB-), but the greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height of the waist triangles (TT-), the pelvis (KNM+), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-).

Table 6: Correlations between physical fitness and restitution between 2nd and 3rd, 3rd and 4th and 1st and 2nd measurement of the value of posture features in left shoulder - right hip carrying mode among boys.

Varia-bles	The Difference Between 2nd and 3rd Measurement						The Difference Between 3rd and 4th Measurement						The Difference Between 1st and 2nd Measurement					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Alfa	-0,31	-0,55*	-0,12	0,31	-0,29	-0,22	0,25	0,41	-0,12	-0,28	-0,03	0,00	-0,35	-0,30	0,23	0,29	-0,13	0,03
KPT-	-0,01	-0,08	0,38	0,06	0,34	0,27	0,03	0,07	-0,10	-0,78*	-0,11	-0,09	-0,03	0,19	-0,06	-0,72*	-0,41	-0,22
DKP	-0,15	-0,28	-0,41	0,10	-0,38	-0,39	0,38	0,45	0,22	-0,34	0,25	0,25	-0,39	-0,33	-0,64**	-0,19	-0,56*	-0,70**
RKP	0,04	0,26	0,39	-0,42	0,36	0,32	0,10	0,17	0,37	0,38	-0,12	0,27	0,22	0,25	0,52*	0,10	0,09	0,47
KLL	-0,28	-0,52*	0,00	0,43	-0,19	-0,11	0,34	0,53*	0,36	-0,16	0,36	0,41	-0,29	-0,27	0,31	0,34	-0,05	0,13
RLL	0,16	-0,06	-0,09	-0,02	0,12	0,01	0,38	0,55*	0,08	-0,03	0,15	0,25	0,29	0,22	0,11	0,13	0,22	0,22
KNT	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
KLB-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
UL-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
UB-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB	0,26	0,18	0,11	0,10	0,04	0,20	-0,41	-0,30	-0,57*	-0,20	-0,20	-0,49	-0,16	-0,24	-0,55	-0,08	-0,30	-0,45
OL	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT	0,04	-0,10	-0,10	-0,45	0,07	-0,19	0,70**	0,60*	-0,14	-0,33	-0,09	0,05	0,68*	0,48	0,09	-0,45	0,15	0,17
TS-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
KNM	0,50	0,00	1,00**	0,00	1,00**	1,00**	0,50	0,00	1,00**	0,00	1,00**	1,00**	0,50	0,00	1,00**	0,00	1,00**	1,00**
KSM-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
UK-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force, ZW-Agility, OG-Overall Fitness.

The greater the overall fitness, the smaller the asymmetries of the torso (KNT+), height of the shoulders (KLB+), shoulder blades (UL-), width of the waist triangles (TS-), convexity of the angles of the lower shoulder blades (UB-), but the greater the distance of the angles of the lower shoulder blades from the line the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal (KSM-) plane. Taking into account the differences between the 1st and 4th measurement, it was shown that the greater the endurance, the smaller the asymmetries in the height of the shoulder blades (UL-), the height (TT) and the width (TS-) of the waist triangles, the convexity of the angles of the lower shoulder blades (UB-), but greater height of shoulders (KLB-), the distance of the lower angles of the shoulder blades from the line of the spinous processes of the spine (OL+), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-). The greater the speed, the smaller the asymmetries of shoulders height (KLB-), the distance of the lower angles from the line of the spinous processes of the spine (OL+), the line of the spinous processes of the spine (UK), the pelvis (KSM-), but greater the height of the shoulder blades (UL-), (TT-) the height and width (TS-) of the waist triangles, and the convexity of the angles of the lower shoulder blades (UB).The greater the strength, the smaller the differences in the length of the thoracic kyphosis (DKP), the asymmetry of the shoulder blades (UL-), the height (TT-) and width (TS-) of the waist triangles, the convexity of the angles of the lower shoulder blades (UB-), but the greater height of the shoulders (KLB-) , the distance of the lower angles from the line of the spinous processes of the spine (OL+), the line of the spinous processes (UK), and the pelvis (KSM-). The greater the force, the smaller the differences in the depth of lumbar lordosis (GLL), the height (TT-) and width (TS-) of the waist triangles, the height of the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), but the greater the height of the shoulders (KLB) -), the distance of the lower angles from the line of the spinous processes of the spine (OL+), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-). The greater the agility, the smaller the asymmetries in the height of the shoulder blades (UL-), height (TT-) and width (TS-) of the waist triangles (UB-), but greater the height of the shoulders (KLB-), the distance of the lower angles from the line of the spinous processes of the spine (OL+), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-). The greater the overall fitness, the smaller the differences in the length of the thoracic kyphosis (DKP), the height of the shoulder blades (UL-), the height (TT-) and width (TS-) of the waist triangles (TS-), the convexity of the angles of the lower shoulder blades (UB-), but greater the height of the shoulders (KLB-), the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-) (Table 7).

Table 7: Correlations between physical fitness and restitution between 1st and 3rd and 1st and 4th measurement of the value of posture features in left shoulder - right hip carrying mode among boys.

Variables	The Difference Between 1st and 3rd Measurement						The Difference Between 1st and 4th Measurement					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
DKP	0,12	0,14	-0,17	-0,29	-0,05	-0,10	-0,33	-0,50	-0,63*	-0,07	-0,45	-0,62*
GKP	0,17	0,23	-0,35	0,12	-0,55*	-0,19	-0,01	0,10	-0,13	0,37	-0,38	-0,02
GLL	0,27	0,31	-0,17	-0,42	-0,30	-0,18	0,16	0,20	-0,25	-0,56*	-0,06	-0,23
KNT	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	0,24	0,21	0,19	0,20	0,127	0,26
KLB-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
KLB	-0,58*	-0,21	0,01	0,37	0,07	-0,07	-0,27	0,05	0,05	0,29	0,05	0,03
UL-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB	-0,37	-0,25	-0,60*	-0,31	-0,24	-0,54	-0,23	-0,23	-0,57*	-0,43	-0,25	-0,52
OL	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
TT	0,66*	0,54	0,15	-0,25	0,04	0,23	0,45	0,39	0,64*	0,23	0,22	0,55
TS-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
KNM-	0,16	-0,02	-0,20	0,05	-0,10	-0,08	-0,28	-0,58*	-0,54	0,19	-0,45	-0,51
KNM	0,50	0,00	1,00**	0,00	1,00**	1,00**	0,87	-0,50	0,87	0,50	0,87	0,87
KSM-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
UK-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force, ZW-Agility, OG-Overall Fitness.

Following the differences between the 2nd and 3rd measurement in the oblique carrying on the right shoulder and left hip, it was observed that the greater the endurance, the smaller the asymmetries in the height of the shoulder blades (UL-), height (TT) and width of the waist triangles, where the left one is wider (TS) or the right one (TS-), convexity of the angles of the lower shoulder blades (UB-), but greater asymmetry of the torso (KNT+), shoulders height (KLB-), the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-). The greater the speed, the smaller the differences in the size of the inclination angle of the lumbosacral spine (Alpha), angle of lumbar kyphosis (KLL), torso asymmetry (KNT+), shoulders height (KLB-), and the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), the pelvis (KSM-), but greater height of the shoulder blades (UL-), the height (TT-) and width (TS-) of the waist triangles, and the convexity of the angles of the lower shoulder blades (UB-). The greater the strength, the smaller the differences in the length of the lumbar lordosis (DLL), the height of the shoulder blades (UL-), the height (TT-) and width (TS-) of the waist triangles, the convexity of the angles of the lower shoulder blades (UB-), but greater of the torso (KNT+) , shoulder height (KLB-), the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis in the frontal (KNM+) and transversal (KSM-) plane. The greater the force, the smaller the asymmetries of the torso (KPT-), the height of the shoulder blades (UL-), the height (TT-) and width (TS-) of the waist triangles (UB-), but greater of the torso (KNT+), shoulders height (KLB-), the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the agility, the smaller the asymmetries in the height of the shoulder blades (UL-), height (TT-) and width (TS-) of the waist triangles, the convexity of the angles of the lower shoulder blades (UB-), but greater of the torso (KNT+), shoulders height (KLB-) , the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-).

The greater the overall efficiency, the smaller the asymmetries in the height of the shoulder blades (UL-), height (TT-) and width (TS-) of the waist triangles, the convexity of the angles of the lower shoulder blades (UB-), but greater of the torso (KNT+), the height of the shoulders (KLB-)), the distance of the lower angles from the line of the spinous processes of the vertebrae of the spine (OL+), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). By examining the differences between the 3rd and 4th measurement, it turned out that the greater the endurance, the smaller the asymmetries of the torso (KNT+), shoulders height (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-), the pelvis (KSM-), but greater of widths (TS-) of the waist triangles, and the convexity of the angles of the lower shoulder blades (UB-). The greater the speed, the smaller the asymmetries of the width (TS-) of the waist triangles, the line of the spinous processes of the vertebrae of the spine (UK), the convexity of the angles of the lower shoulder blades (UB-), but greater of the torso (KNT+), the height of the shoulders (KLB-), the distance of the lower angles of the shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the strength, the smaller the asymmetries of the torso (KNT+), shoulders height (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-),and pelvis (KSM-), but greater in the following variables: convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-). The greater the force, the smaller the asymmetries of the torso (KNT+), shoulders height (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-), but greater differences in the height of the lumbar lordosis (RLL), the convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-). The greater the agility, the smaller the asymmetries of the torso (KNT+), shoulders height (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-), but greater convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-).

The greater the overall fitness, the smaller the asymmetry of the torso (KNT+), shoulders height (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the spine (OL+) and the height of the waist triangles (TS-), the line of the spinous processes of the vertebrae of the spine (UK-)), and pelvis (KSM-) but greater in the variables: convexity of the angles of the lower shoulder blades (UB-) and the width of the waist triangles (TS-). Taking into account the differences between the 1st and 2nd measurement, it turned out that the greater the endurance, the smaller the asymmetry of the torso (KNT+), the height of the shoulders (KLB-), the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-). The greater the speed, the smaller the asymmetry in the distance of the angles of the lower blades from the line of the spinous processes of the vertebrae of the spine (OL+), the width of the waist triangles where the right (TS-) or left one is wider (TS+), and the line of the spinous processes of the vertebrae of the spine (UK+), but greater of the torso (KNT+), shoulders height (KLB-), shoulder blades (UL-), the line of the spinous processes of the vertebrae of the spine (UK-), height of the waist triangles (TT-), the convexity of the angles of the lower shoulder blades (UB-), and pelvis (KSM-).

The greater the strength, the smaller the differences in the length of thoracic kyphosis (DKP) and lumbar lordosis (DLL), smaller asymmetry of the torso (KNT+), height of the shoulders (KLB-), shoulder blades (UL-), the convexity of the lower angles of the shoulder blades where the lower left angle is more convex (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the spine (UK-), and the pelvis (KSM-), but greater convexity of the angles of the lower shoulder blades, where the lower right angle is more convex (UB+), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-). The greater the force, the smaller the asymmetry of the torso in the sagittal (KPT-) and frontal (KNT+) plane, shoulders height (KLB-), shoulder blades (UL-), and the convexity of the angles of the lower shoulder blades, where the lower left angle is more convex (UB-), height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-), but greater convexity of the angles of the lower shoulder blades, where the right lower angle is more convex (UB+), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and wide waist triangles (TS-). The greater the agility, the smaller the differences in the length of the thoracic kyphosis (DKP), the asymmetry of the torso (KNT+), the height of the shoulders (KLB-), the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades, where the lower left angle is more convex (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-) and the pelvis (KSM-), but greater convexity of the angles of the lower shoulder blades, where the right lower angle is more convex (UB+), the distance of the angles of the lower blades from the line of the spinous processes vertebrae of the spine (OL+) and width of the waist triangles (TS-). The greater the overall fitness, the smaller the differences in the length of thoracic kyphosis (DKP), trunk (KNT+), shoulders height (KLB-), shoulder blades (UL-), and the convexity of the angles of the lower shoulder blades, where the lower left angle is more convex (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-) and the pelvis (KSM-), but greater convexity of the angles of the lower shoulder blades, where the right lower angle is more convex (UB+), the distance of the angles of the lower blades from the line of the spinous processes vertebrae of the spine (OL+) and width of the waist triangles (TS-) (Table 8).

Table 8: Correlations between physical fitness and restitution between 2nd and 3rd, 3rd and 4th and 1st and 2nd measurement of the value of posture features in right shoulder - left hip carrying mode among boys.

Variables	The Difference Between 2nd and 3rd Measurement						The Difference Between 3rd and 4th Measurement						The Difference Between 1st and 2nd Measurement					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Alfa	-0,34	-0,62*	0,01	0,26	-0,14	-0,11	-0,01	0,31	0,30	0,07	0,08	0,19	-0,45	-0,41	0,22	0,24	-0,03	0,01
KPT-	-0,11	-0,33	-0,16	-0,82**	-0,11	-0,34	-0,22	0,08	-0,02	-0,51	-0,42	-0,18	-0,23	-0,14	-0,31	-0,83**	-0,49	-0,45
DKP	-0,15	-0,12	-0,04	0,30	-0,26	-0,08	0,12	0,26	-0,06	-0,22	-0,20	0,00	-0,34	-0,28	-0,66**	-0,26	-0,62*	-0,72**
DLL	0,08	0,08	-0,53*	-0,11	-0,37	-0,30	-0,44	-0,24	0,06	0,44	0,10	-0,04	-0,17	-0,15	-0,69**	-0,03	-0,48	-0,50
KLL	-0,41	-0,60*	0,18	0,36	0,15	0,08	0,19	0,25	0,48	-0,05	0,37	0,38	-0,48	-0,48	0,24	0,40	0,02	0,06
RLL	0,52*	0,36	-0,09	-0,39	0,19	0,02	0,19	0,11	0,01	0,60*	-0,02	0,23	0,26	0,28	-0,10	0,10	0,10	0,06
KNT	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
KLB-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UL-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	0,12	0,11	0,13	0,14	0,11	0,13	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB	0,20	0,11	0,55	0,14	0,16	0,38	-0,25	-0,16	0,42	0,00	0,30	0,20	-0,01	-0,02	0,56*	0,06	0,31	0,37
OL-	0,12	0,03	0,34	0,04	0,22	0,23	0,10	-0,10	0,64*	0,38	0,43	0,55	0,04	-0,12	0,34	0,11	0,24	0,24
OL+	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
TT	-0,11	-0,43	-0,46	-0,10	-0,38	-0,44	-0,21	-0,58*	-0,35	-0,23	-0,03	-0,34	-0,20	-0,57*	-0,31	-0,22	-0,03	-0,33
TS-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TS	-0,60*	-0,55*	-0,13	0,12	-0,12	-0,21	0,08	0,05	0,15	0,16	-0,14	0,03	-0,54	-0,69**	0,05	0,42	-0,12	-0,11
KNM	0,50	0,00	1,00**	0,00	1,00**	1,00**	0,50	-0,87	-0,50	0,87	-0,50	-0,50	-0,50	0,87	0,50	-0,87	0,50	0,50
KSM-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UK-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UK	0,06	-0,32	-0,16	-0,06	-0,32	-0,24	-0,44	-0,62*	-0,22	0,14	-0,14	-0,34	-0,34	-0,56*	-0,14	-0,05	0,06	-0,23

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed SI-Strength, MO-Force, ZW-Agility, OG-Overall Fitness.

By examining the differences between the 1st and 3rd measurement, it turned out that the greater the endurance, the smaller the asymmetries of the torso (KNT+), shoulders height (KLB-), shoulder blades (UL-), convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT -), the line of the spinous processes of the vertebrae of the spine (UK-), the pelvis in the frontal (KNM+) and transversal (KSM-) plane, but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-). The grater the speed, the smaller the asymmetries of the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-), but greater of the torso (KNT+), height of the shoulders (KLB-) and shoulder blades (UL-), the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the spine to the left (UK-) or right (UK), and the pelvis (KSM-). The greater the strength, the smaller the asymmetries of the torso (KNT+), the height of the shoulders (KLB-) and the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-).The greater the force, the smaller the asymmetries of the torso (KNT+), shoulders (KLB-) and shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-). The greater the agility, the smaller the asymmetries of the torso (KNT+), the height of the shoulders (KLB-) and shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the lines of the spinous processes of the vertebrae of the spine (UK-), and pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-). The greater the overall fitness, the smaller the asymmetries of the torso (KNT+), height of the shoulders (KLB-) and shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the height of the waist triangles (TT-), the line of the spinous processes of the vertebrae of the spine (UK -), and pelvis (KSM-), but greater distances between the angles of the lower shoulder blades and the line of the spinous processes of the vertebrae of the spine (OL+) and the width of the waist triangles (TS-).

Considering the differences between the 1st and the 4th measurement, it was found that the greater the endurance, the smaller the differences in the angle of inclination of the thoracolumbar spine (Beta), the asymmetries of the height of the shoulders (KLB-) and the shoulder blades(UL-), the convexity of the lower angles of the shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine (UK-) and the pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the height (TT-) and width of the waist triangles (TS-). The greater the speed, the smaller the differences in the angle of inclination of the thoracolumbar spine (Beta), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height (TT-) and width of the waist triangles (TS-), but greater the height of the shoulders (KLB-) and shoulder blades (UL-), convexity of the angles of the lower shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-). The greater the strength, the smaller the differences in the angle of inclination of the thoracic-lumbar spine (Beta), the height of the shoulders (KLB-) and shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-), but greater distances of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), the height (TT-) and width of the waist triangles (TS-), and the pelvis (KNM+). The greater the force, the smaller the asymmetries in the height of the shoulders (KLB-) and the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-), but greater the distance of the lower angles of the shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), height (TT-) and width of the waist triangles (TS-). The greater the agility, the smaller the differences in the angle of inclination of the thoracic-lumbar spine (Beta), height of the shoulders (KLB-) and shoulder blades (UL-), convexity of the angles of the lower shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine to the left (UK-), and pelvis (KSM-),but greater distances between the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), height (TT-) and width of the waist triangles (TS-), and pelvis (KNM+).The greater the overall fitness, the smaller the asymmetries in the height of the shoulders (KLB-) and the shoulder blades (UL-), the convexity of the angles of the lower shoulder blades (UB-), the line of the spinous processes of the vertebrae of the spine (UK-), and the pelvis (KSM-), but greater the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+), height (TT-) and width of the waist triangles (TS-), and pelvis (KNM+) (Table 9).

Table 9: Correlations between physical fitness and restitution between 1st and 3rd and 1st and 4th measurement of the value of posture features in right shoulder - left hip carrying mode among boys.

Variables	The Difference Between 1st and 3rd Measurement						The Difference Between 1st and 4th Measurement					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Beta	0,44	0,32	-0,11	-0,07	-0,18	0,00	-0,55*	-0,57*	-0,63*	-0,28	-0,80**	-0,83**
KNT	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	0,15	0,19	0,11	0,12	0,14	0,13
KLB-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UL-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UB-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
OL	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
TT	-0,25	-0,60*	-0,29	-0,17	0,01	-0,32	-0,19	-0,52	-0,17	-0,22	0,11	-0,22
TS-	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**	1,00**	-1,00**	1,00**	1,00**	1,00**	1,00**
KNM	-1,00**	0,87	-0,50	-0,87	-0,50	-0,50	0,50	0,00	1,00**	0,00	1,00**	1,00**
KSM-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UK-	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**	-1,00**	1,00**	-1,00**	-1,00**	-1,00**	-1,00**
UK	-0,49	-0,59*	-0,09	0,15	0,08	-0,19	-0,39	-0,40	0,24	-0,11	0,50	0,13

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force, ZW-Agility, OG-Overall Fitness.

Considering the girls and the differences between the 2nd and 3rd measurement in the oblique carrying school supplies by girls on the left shoulder and at the right hip, it turned out that the greater the endurance, the smaller the asymmetries of the convexity of the angles of the lower shoulder blades (UB-), but the greater the height of the shoulders (KLB-). The greater the strength, the greater the asymmetries in the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the line of the spinous processes of the vertebrae of the spine (UK-).

The greater the force, the smaller the asymmetries in the height of the shoulder blades (UL+), and the width of the waist triangles (TS+), but greater the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the line of the spinous processes of the vertebrae (UK-). The greater the agility, the greater the asymmetries in the height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the line of the spinous processes of the vertebrae (UK-). The greater the overall fitness, the greater the asymmetries in the height of the shoulders (KLB-), the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) and the line of the spinous processes of the vertebrae of the spine (UK-). By analyzing the differences between the 3rd and 4th measurement, it was shown that the greater the endurance, the greater the differences in the length of the thoracic kyphosis (DKP), the asymmetries in the height of the shoulders (KLB+) and shoulder blades (UL-) and the height of the waist triangles (TT+). The greater the strength, the greater the asymmetries in the height of the shoulders (KLB+) and shoulder blades (UL-). The greater the force the greater the asymmetries in the height of the shoulder blades (UL-) and the pelvis (KNM+). The greater the agility, the greater the asymmetry in the shoulder blades height (UL-). The greater the overall fitness, the greater the asymmetries in the height of the shoulders (KLB+) and shoulder blades (UL-). When examining the differences between 1st and 2nd measurement, it was found that the greater the endurance, the smaller the asymmetries of the convexity of the lower angles of the shoulder blades (UB-), and the greater the differences in height (RLL) and depth (GLL) of the lumbar lordosis. The greater the speed, the greater the height asymmetry of the waist triangles (TT+). The greater the strength, the greater the differences in the angle of inclination of the thoracic-lumbar spine (Beta), the asymmetries in the height of the shoulders (KLB+) and the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the force, the smaller the asymmetries in the width of the waist triangles (TS-) and the greater of the height of the shoulder blades (UL-). The greater the agility, the greater asymmetries of the shoulder's height (KLB+). On the other hand, the greater the overall fitness, the greater the differences in the angle of inclination of the thoracic-lumbar spine (Beta), the asymmetries of the height of the shoulders (KLB+) and waist triangles (TT+) (Table 10).

Table 10: Correlations between physical fitness and restitution between 2nd and 3rd, 3rd and 4th and 1st and 2nd measurement of the value of posture features in t left shoulder - right hip carrying mode among girls.

Variab-les	The Difference Between 2nd and 3rd						The Difference Between 3rd and 4th						The Difference Between 1st and 2nd					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Beta	0,08	0,24	0,02	-0,16	0,39	0,11	0,08	-0,17	0,09	0,56	-0,32	-0,03	0,44	0,32	0,76**	0,37	0,52	0,64*
DKP	-0,18	-0,12	-0,23	-0,07	-0,36	-0,21	0,59*	0,29	0,21	0,30	0,44	0,32	0,16	-0,15	0,16	0,11	-0,06	0,05
RLL	-0,07	0,33	-0,32	-0,16	-0,19	-0,23	0,39	0,08	0,19	0,09	0,27	0,36	0,64*	0,20	0,13	0,34	0,27	0,39
GLL	0,00	0,22	0,13	0,02	0,39	0,19	0,53	0,13	0,10	0,12	0,04	0,21	0,66*	0,27	0,33	0,20	0,31	0,52
KLB-	0,89*	0,67	0,82	0,63	0,89*	0,89*	0,15	0,36	0,65	0,34	0,41	0,41	0,00	0,60	0,32	-0,11	0,10	0,10
KLB	0,10	-0,02	0,28	-0,70	0,32	0,09	0,80*	0,70	0,77*	0,17	0,72	0,92**	0,54	0,70	0,88**	-0,57	0,84*	0,82*
UL-	0,41	-0,46	0,46	0,80	0,56	0,56	0,90*	0,30	0,95*	0,89*	1,00**	1,00**	0,50	-0,30	0,63	0,89*	0,70	0,70
UL+	0,11	0,29	0,54	-0,87*	0,49	0,34	0,03	0,41	-0,13	0,06	-0,35	-0,07	0,63	0,52	0,30	-0,09	0,09	0,36
UB-	-0,90*	-0,20	-0,58	-0,67	-0,80	-0,80	-0,82	-0,05	-0,41	-0,57	-0,67	-0,67	-0,90*	-0,20	-0,58	-0,67	-0,80	-0,80
OL	0,70	0,10	0,95*	0,89*	0,90*	0,90*	0,20	0,40	0,74	0,45	0,50	0,50	0,50	0,30	0,95*	0,78	0,80	0,80
TT	-0,72	-0,25	-0,51	-0,50	-0,35	-0,68	0,79*	0,64	0,70	0,19	0,49	0,85*	0,50	0,97**	0,74	-0,17	0,63	0,79*
TS-	0,21	0,82	0,11	-0,34	0,05	0,05	-0,20	0,10	-0,79	-0,78	-0,60	-0,60	-0,30	0,50	-0,63	-0,89*	-0,60	-0,60
TS	-0,36	-0,14	0,21	-0,84*	0,22	-0,07	-0,56	-0,08	-0,15	-0,25	-0,20	-0,31	-0,63	-0,05	0,17	-0,51	0,20	-0,07
KNM	0,67	0,05	0,65	0,57	0,67	0,67	0,40	-0,30	0,79	0,89*	0,70	0,70	0,30	-0,40	0,58	0,67	0,50	0,50
UK-	0,70	0,10	0,95*	0,89*	0,90*	0,90*	-0,60	-0,80	-0,74	-0,45	-0,70	-0,70	0,40	0,20	0,32	0,11	0,30	0,30

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force, ZW –Agility, OG-Overall Fitness.

While examining the differences between the 1st and 3rd measurement, it turned out that the greater the endurance, the greater the asymmetries of the height of the waist triangles (TT+). The greater the speed, the greater the differences in the angle of thoracic kyphosis (KKP). The greater the strength, the greater the asymmetries of the torso (KPT-), shoulders height (KLB+) and the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the agility, the greater asymmetries of the shoulder's height (KLB+). The greater the overall fitness, the greater the asymmetries of shoulders height (KLB+) and waist triangles (TT+). Following the differences between the 1st and 4th measurement, it was found that the greater the endurance, the greater the differences in the height of the lumbar lordosis (RLL) and the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the speed, the smaller the pelvic asymmetry (KNM+) but greater the differences in the angle of inclination of the upper thoracic section of the spine (Gamma), the sum of angles of the piecemeal spine Delta (Alpha+ Beta+ Gamma), the thoracic kyphosis angle (KKP) and the asymmetries of the line of the spinous process of the vertebrae of the spine (UK-). The greater the strength, the greater the asymmetries in the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the force, the smaller the difference in length of lumbar lordosis (DLL), but greater height of lumbar lordosis (RLL) and the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the agility, the greater the asymmetries in the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+). The greater the overall efficiency, the greater the asymmetries in the distance of the angles of the lower shoulder blades from the line of the spinous processes of the vertebrae of the spine (OL+) (Table 11).

Analyzing the differences between the 2nd and 3rd measurement in the oblique carrying on the right shoulder and at the left hip, it turned out that the greater the endurance, the smaller the asymmetries of the height of the waist triangles (TT-). The greater the speed, the smaller asymmetries of the shoulder's height (KLB-). The greater the strength, the smaller asymmetries of the shoulder height (KLB+) but greater differences in the angle of inclination of the thoracic-sacral segment (Beta). The higher the force, the smaller the torso asymmetries in the sagittal (KPT+) and frontal (KNT-) plane and the width of the waist triangles (TS+), but the greater differences in the thoracic kyphosis angle (KKP).

The greater the agility and general fitness, the smaller the shoulder height asymmetry (KLB+). Considering the differences between the 3rd and 4th measurement, it turned out that the greater the strength, the smaller the differences in the angle of inclination of the upper thoracic segment (Gamma). The greater the force, the greater the differences in the height of thoracic kyphosis (RKP).

The greater the speed, the greater the torso asymmetries (KNT+). Considering the differences between the 1st and 2nd measurement, it was found that the greater the endurance, the greater the differences in the angle of thoracic kyphosis (KKP-) and pelvic asymmetries (KSM-). The greater the strength, the smaller the asymmetries in the height of the shoulders (KLB+), shoulder blades (UL-) and waist triangles (TT-). The greater the force, agility and overall efficiency, the smaller the asymmetries in the height of the shoulder blades (UL-) and waist triangles (TT-) (Table 12).

Table 11: Correlations between physical fitness and restitution between 1st and 3rd and 1st and 4th measurement of the value of posture features in left shoulder - right hip carrying mode among girls.

Variables	The Difference Between 1st and 3rd						The Difference Between 1st and 4th					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Gamma	-0,17	0,27	-0,34	-0,49	-0,18	-0,20	0,29	0,59*	0,20	-0,36	0,27	0,28
Delta	0,07	0,23	-0,12	-0,26	0,08	0,05	0,23	0,59*	0,29	-0,41	0,37	0,33
KPT-	0,82	0,53	0,89*	0,63	0,56	0,70	0,41	0,58	0,18	0,00	0,08	0,47
KKP	0,11	0,58*	0,07	-0,44	0,10	0,16	0,24	0,71**	0,23	-0,47	0,30	0,32
DLL	-0,07	0,11	0,17	-0,51	0,28	0,10	-0,29	0,02	-0,03	-0,66*	-0,06	-0,10
RLL	0,42	-0,01	0,21	0,23	0,26	0,37	0,76**	0,06	0,32	0,62*	0,29	0,54
KLB	0,65	0,73	0,86*	-0,17	0,83*	0,92**	-0,08	0,48	0,20	-0,44	0,28	0,16
OL	0,50	0,30	0,95*	0,78	0,80	0,80	0,90*	0,30	0,95*	0,89*	1,00**	1,00**
TT	0,85*	0,61	0,69	0,24	0,51	0,86*	-0,61	-0,65	-0,69	0,24	-0,45	-0,75
KNM	0,30	-0,40	0,58	0,67	0,50	0,50	0,00	-0,90*	0,05	0,45	0,10	0,10
UK-	0,30	0,50	0,11	-0,22	0,10	0,10	0,36	0,97**	0,22	-0,23	0,21	0,21

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force, ZW-Agility, OG-Overall Fitness.

Table 12: Correlations between physical fitness and restitution between 2nd and 3rd, 3rd and 4th and 1st and 2nd measurement of the value of posture features in right shoulder - left hip carrying mode among girls.

Variab-les	The Difference Between 2nd and 3rd						The Difference Between 3rd and 4th						The Difference Between 1st and 2nd					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Beta	0,41	0,24	0,64*	0,25	0,52	0,57	0,18	0,27	0,42	-0,02	0,37	0,43	0,30	0,13	0,46	0,32	0,19	0,45
Gamma	0,21	-0,21	0,11	0,72**	-0,11	0,12	-0,33	-0,34	-0,71**	-0,04	-0,43	-0,55	0,09	0,10	-0,30	0,01	-0,02	-0,13
KPT	-0,67	0,25	-0,29	-0,96**	-0,09	-0,32	0,00	-0,02	0,38	-0,15	0,29	0,18	-0,11	0,27	0,39	-0,49	0,33	0,18
KKP	0,44	0,05	0,44	0,65*	0,26	0,46	-0,21	-0,11	-0,31	-0,12	-0,06	-0,17	0,58*	0,19	0,45	0,48	0,33	0,57
RKP	-0,10	0,18	-0,31	-0,39	-0,20	-0,23	0,47	-0,44	0,25	0,73**	0,13	0,26	0,33	-0,06	0,05	0,27	0,05	0,13
KNT-	-0,25	0,18	0,51	-0,91**	0,51	0,23	-0,15	0,22	-0,15	0,15	0,00	-0,14	-0,34	0,40	0,35	-0,69	0,41	0,13
KNT	0,10	0,50	0,21	0,11	0,20	0,20	0,30	0,90*	0,11	-0,34	0,10	0,10	0,00	0,90*	-0,05	-0,45	-0,10	-0,10
KLB-	-0,40	-1,00**	-0,32	0,11	-0,30	-0,30	0,63	0,05	-0,03	0,06	0,26	0,26	0,30	-0,60	-0,16	0,22	0,10	0,10
KLB	-0,38	-0,59	-0,88**	0,39	-0,98**	-0,80*	0,06	-0,04	-0,66	0,44	-0,60	-0,49	-0,45	-0,56	-0,95**	0,31	-0,98**	-0,89**
UL-	0,36	-0,56	-0,05	0,34	0,21	0,21	-0,30	0,10	-0,63	-0,78	-0,60	-0,60	-0,70	-0,50	-0,95*	-0,78	-0,90*	-0,90*
TT-	-0,90*	-0,70	-0,53	-0,34	-0,70	-0,70	0,10	0,87	0,35	-0,06	0,21	0,21	-0,70	-0,10	-0,95*	-0,89*	-0,90*	-0,90*
TS	-0,07	0,44	0,30	-0,79*	0,25	0,11	-0,27	0,45	0,36	-0,48	0,25	0,29	-0,19	0,34	0,44	-0,89**	0,39	0,20
KSM-	0,10	-0,30	0,63	0,78	0,50	0,50	0,15	0,05	-0,49	-0,34	-0,21	-0,21	0,90*	0,20	0,58	0,67	0,80	0,80

Source*: Own research

Note*: Legend: WY-Endurance, SZ-Speed, SI-Strength MO-Force, ZW-Agility, OG-Overall Fitness.

Considering the differences between the 1st and 3rd measurement, it turned out that the greater the endurance, the greater the difference in height of thoracic kyphosis (RKP). The greater the speed, the greater the difference in thoracic kyphosis angle (KKP). The greater the force, the greater the difference in height of the thoracic kyphosis (RKP) and the smaller the asymmetries in the height of the waist triangles (TT-). Considering the differences between the 1st and 4th measurement, it was observed that the greater the endurance, the smaller the asymmetries of the trunk (KNT+), the height of the shoulder blades (UL+), and the pelvis (KSM+) but the line of the spinous processes of the vertebrae of the spine (UK+). The greater the speed, the greater the difference in the sum of the piecemeal spine angles (Delta) and the height of thoracic kyphosis (RKP). The greater the strength, the smaller the asymmetries in the height of the shoulder blades (UL-) but greater of the torso (KPT+) and the convexity of the angles of the lower shoulder blades (UB-). The greater the force, the smaller the differences in the height of thoracic kyphosis (RKP) and the asymmetry in height of the shoulder blades (UL-). The greater the agility, the smaller the asymmetries of the torso (KNT+) and the height of the shoulder blades (UL-), but greater the convexity of the angles of the lower shoulder blades (UB-). The greater the overall efficiency, the smaller the asymmetries of the torso (KNT+) and the height of the shoulder blades (UL-), but the greater convexities of the angles of the lower shoulder blades (UB-) (Table 13).

Table 13: Correlations between physical fitness and restitution between 1st and 3rd and 1st and 4th measurement of the value of posture features in right shoulder - left hip carrying mode among girls.

Variables	The Difference Between 1st and 3rd						The Difference Between 1st and 4th					
	WY	SZ	SI	MO	ZW	OG	WY	SZ	SI	MO	ZW	OG
Delta	0,05	0,34	0,03	-0,36	0,29	0,14	0,21	0,63*	0,33	-0,46	0,41	0,30
KPT	0,02	0,24	0,58	-0,22	0,38	0,31	0,27	0,31	0,76*	0,04	0,49	0,50
KKP	0,15	0,66*	0,24	-0,42	0,29	0,32	0,03	0,46	0,16	-0,51	0,16	0,12
RKP	0,60*	-0,28	0,37	0,74**	0,21	0,39	-0,02	0,58*	-0,11	-0,62*	-0,11	-0,03
KNT	-0,10	0,80	-0,26	-0,67	-0,30	-0,30	-0,89*	-0,22	-0,82	-0,75	-0,89*	-0,89*
UL-	-0,72	-0,21	-0,81	-0,86	-0,87	-0,87	-0,82	-0,21	-0,97**	-0,92*	-0,97**	-0,97**
UL	-0,66	-0,33	0,02	-0,11	0,19	-0,11	-0,95**	-0,42	-0,41	-0,20	-0,38	-0,57
UB-	0,67	0,82	0,46	0,23	0,56	0,56	0,82	0,41	0,97**	0,86	0,97**	0,97**
TT-	-0,40	0,30	-0,79	-0,89*	-0,70	-0,70	-0,20	0,10	-0,79	-0,78	-0,60	-0,60
KSM	-0,64	-0,34	-0,54	-0,27	-0,40	-0,70	-0,86*	-0,45	-0,39	-0,50	-0,21	-0,63
UK	-0,63	-0,34	-0,08	-0,33	0,20	-0,27	-0,86*	-0,45	-0,39	-0,50	-0,21	-0,63

Source*: Own research

Legend: WY-Endurance, SZ-Speed, SI-Strength, MO-Force ZW-Agility, OG-Overall Fitness

Discussion

The subject literature is sparse. In fact, only Romanowska [7] and Mrozkowiak [8] attempted to describe the restitution of the value of the features after the student's body posture was loaded with an external load. Both authors in their investigations came to very similar conclusions. The influence of the six-kilogram symmetrical load on the upper limb girdle of 12-year-old girls showed insignificant changes in the values of selected posture features. There was also a visible complete restitution of the value of the diagnosed features two minutes after the load removal. The return to the starting values after the first minute was more intense. The authors concluded that among the studied students, symmetrically distributed load had a little effect on the spine-pelvic syndrome in the frontal plane, including right-sided scoliosis at the Th3 level. Other studies by Mrozkowiak on changes in the statics of body posture in the carrying the weight of school supplies by dragging a container with the left or right hand among students of both sexes showed significant changes in the value of the diagnosed posture features. This is evidenced by the significant differences of all features between the 1st and 2nd measurement. However, these changes were not related to gender.

The analysis also showed an incomplete restitution of the value of the features describing body posture. The return of the changed value of features after the first and second minute was incomplete. This is evidenced by the significant differences between the 1st and 2nd, 3rd and 4th measurement. The author attempted to show the relationship between physical fitness and the average significant differences in the value of features between 1st and 2nd, and 3rd and 4th measurement. Among boys, in the case of dragging a container with the right hand, the greatest relationship is shown by endurance and strength, and lower by speed. On the other hand, force and agility show no relation. Overall physical fitness has little to do with the differences in the value of the features. When dragging the container with the left hand, strength is most important, less force and agility, and the lest the speed. Overall physical fitness is related only to the asymmetrical line of the spinous process of the vertebrae of the spine (UK+). On the other hand, among girls, in the case of right-handed dragging, speed and force has the greatest relationship, and strength has less one. Endurance, agility, and overall physical fitness play no role. When dragging the container with the left hand, endurance and agility are of the most importance. Whereas speed, strength, force, and general physical fitness do not play a significant role [21].

New conditions for the functioning of children learning may contribute to the appearance or worsening of posture defects. Children limit their physical activity, but this is not the only influence on the shape of posturogenesis. Additonally, there are also external loads. An overloaded schoolbag may pose a threat to the proper shaping of body posture [22]. *Nowotny Czupryna, et al.* [23] found that the external load intensifies the asymmetry of the feet pressure on the ground. The authors believe that improper wearing of a schoolbag is not indifferent and may develop the already existing disorders [23]. The research of Dobosz and Sobota in a group of fourteen children aged 6-7 showed that wearing a backpack in the traditional way with a load value of 5% of body weight, the COP shifted backward, which, according to the authors, resulted in a strong compensatory reaction, leading to its forward displacement. The authors suggest that this trend occurs whenever the schoolbag is on the back at any load value, and the greater the load, the lower the compensation value [24]. Research by *Deng, et al.* [25] and *Zhang, et al.* [26] showed a significant relationship between pain in the neck and back and the occurrence of posture defects due to the excessive weight of the backpack. Neck and back pain occurred at a frequency of 41.1% and 32.8%, respectively. Wu's research has shown that asymmetrically transferred weight causes changes in body posture. Therefore, in order to reduce negative multiple system changes, the center of gravity of its mass should be as close to the center of the body as possible [27].

The research of *Hardie, et al.* showed that the change of the method of transferring the load from symmetrical to asymmetrical has the greatest impact on the quadratus muscles, and the least on the latissimus dorsi muscle [28]. According to Mrozkowiak's survey among parents of 7-year-old preschoolers, caregivers most often declare that they know their children's health. They believe that the first grader will wear a four-kilogram schoolbag on their back, learn traditionally (without a tablet) and spend about 2 hours improving their physical fitness. According to the author, the accepted lifestyle disagrees the development of physical fitness and the prevention of static posture disorders [13]. The statements quoted by *Bittman and Badtke* [29] and provided by Schild should be considered that the changes in the movement system of 5-7-year-old children depend primarily on the genetic determinants of the maturation of the musculo-nervous system. During this period, external factors, including physical activity, do not play a major role. It seems that the influence of external factors on the development of the locomotor system begins to increase with age and maturation of the muscular and nervous system around the age of 7-8.

The statistical analysis of the measurements of selected posture features clearly shows that none of the ways of carrying should be practiced by 7-year-old children. Both methods equally modulate body posture, both significantly disturb its habitual constancy. It should be assumed that the longer and more intensive the analyzed way of carrying, and the greater the weight of utensils, the greater the changes are. The age of the surveyed students is also important. The physical fitness presented by children as well as the relationships between its individual elements and the differences in the value of the posture features depend on the gender. Among boys, the distinguishing features of the tested fitness, which showed the most frequent relationships with the differences in the value of the posture features of the sagittal and transversal planes, were speed and strength, and in the frontal plane strength, agility, and general fitness. Among girls, endurance, strength, and agility, as well as general fitness, respectively. Among boys, differences in the value of posture features, which the physical fitness discriminants most often showed relationship with in the transversal plane were asymmetry of the left torsion pelvis (KSM-), asymmetry of the convexity of the angles of the lower shoulder blades, where the left angle was more convex (UB-), and in the frontal plane it was asymmetry of the height of the waist triangles, where the right one was higher (TT-), asymmetry of the pelvis with a left inclination (KNM). Among girls with a difference in the value of the sagittal features it was the angle (KKP) and height (RKP) of the thoracic kyphosis, and in the transversal plane was asymmetry of the convexity of the angles of the lower shoulder blades, where the right angle is more convex (UB-), and in the frontal one with asymmetry of the height of the shoulders, where the right one was higher (KLB+) and the shoulder blades height, where the right was higher (UL-).

Conclusions

a) Carrying a 4kg weight of school supplies obliquely on the right or left shoulder and at the heteronymous hip disturbs the biomechanical statics of the body of a 7-year-old child, which in the long run may cause mistakes and consequently, defects in body posture. Therefore, this way of carrying school supplies should not be recommended to 7-year-old students.

b) Physical fitness is of greater importance in the restitution of the value of the body posture features in the frontal plane rather than sagittal and transversal planes. The relationships of its individual elements are more common among boys than girls, with their incidence being similar within each gender and in each way of carrying. The most significant elements of fitness, showing a relationship with body posture features among boys are speed, strength, and among girl's strength and agility.

c) The restitution of the value of any of the analyzed features of body posture was not complete after the first and second minute after the load removal, which may indicate a low load general efficiency, immature correction, and compensation processes and too much weight of carried school supplies.

Acknowledgement

None.

Conflict of Interest

None.

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