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Posture of adolescent male handball players compared to non-athletes

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Posture of adolescent male handball players compared to non-athletes

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A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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abstract

Background The aim of the present study was to assess the posture and somatic parameters in adolescent male handball players compared to non-athletes and determine whether a relationship exists between the posture and the volume of training and/or its frequency.

Material/Methods Sixty-eight adolescent male handball players and sixty-nine non-athletes aged 15–18 were examined. The posture was evaluated by the moiré method.

Results Handball players exhibited smaller and less frequent asymmetries compared to the non-athletes. Statistically significant differences were found in the position of shoulder blades ($p < 0.05$) and pelvic alignment in the frontal ($p < 0.001$) and transverse ($p < 0.05$) planes. The spinal shape in the sagittal plane did not differentiate the training subjects from non-athletes. The study also revealed weak correlations between the training period and a deviation of the spinous processes ($r = 0.25$), a symmetry of the shoulder blades ($r = 0.25$), and an inclination angle of the thoracolumbar segment ($r = -0.26$). No correlations were observed between the training frequency and posture parameters.

Conclusions It can be concluded that despite the predominance of asymmetric elements, handball training does not negatively affect the posture in the frontal and transverse planes.

Key words postural defects, asymmetries, moiré technique, athletes, handball training

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INTRODUCTION

Sports practice shapes the character of a young person, improves physical fitness and considerably affects the physical development and posture. The positive impact of physical activity on all aspects of health and fitness in children and adolescents has been demonstrated in previous studies [1, 2, 3]. The study of Vicente-Rodríguez et al. [4] revealed that physical activity in the form of handball practice not only enhanced physical fitness of the young female subjects, but also increased bone mass and improved bone density [4].

Unfortunately, training loads, which are specific to a given sport, may put strain on passive and active elements of the spine, leading to the development of postural asymmetries and affecting the shape of anteroposterior (AP) spinal curvatures. Intensive exercises causing spinal strain from the earliest years may increase the risk of developing musculoskeletal disorders and affect the process of growth [5, 6]. Moreover, participation in sports activities is related to the risk of injuries. Asymmetric tilt and shift patterns in the shoulder girdle cause muscle imbalance and weakness, thus increasing the risk of shoulder injuries [7]. According to the studies from Scandinavia, sports injuries account for 10–19% of all severe injuries, and teenagers who play football, basketball and handball are especially prone to these injuries [8].

Handball is a team game, in which asymmetric elements of play prevail. Handball players make passes and throw the ball into the goal with one, dominant upper limb. It is estimated that, in a season, each player performs about 48,000 throws, during which the ball reaches the speed of up to 130 km/h [9]. Such heavy, one-sided overload may lead to chronic shoulder pain and instability [9] but also cause asymmetries of the shoulder girdle and affect the posture.

The posture of athletes has been the focus of interest of many researchers [10–19]. Most of them point out that sports training tends to affect posture of athletes [13, 14, 15, 20, 21, 22, 23, 24]. Some authors claim that many sports, especially those of an asymmetric nature, may contribute to the development of static disorders of the vertebral column, postural asymmetry, as well as disbalances in muscle mass among the training individuals [16, 22, 25, 26]. Many researchers have demonstrated that asymmetry, defined as the difference between the right and the left sides of the body, does exist in sport [7, 22, 27, 28, 29, 30]. It is important to quickly recognize the signs of this phenomenon and try to eliminate it, if necessary. Previous studies have also shown positive effects of sports training on the body posture in terms of its symmetry [20, 31, 32].

Due to considerable training loads, there is definitely a need for posture monitoring in athletes of all ages [33], and especially in children and adolescents.

The aim of the present study was to assess the posture of adolescent male handball players compared to non-athletes and to determine any possible relationships between the posture, training experience and/or training frequency.

MATERIAL AND METHODS

SUBJECTS

The study group included 68 adolescent male handball players (H), aged 15–18 years ($\bar{x}$ = 16.2 ±0.86). The length of the training experience and the frequency of trainings to a large extent depended on the age and varied from 3 to 9 years ($\bar{x}$ = 4.68) and 3 to 7 times a week ($\bar{x}$ = 5.05), respectively. The control group (C) consisted of 69 male teenagers at a similar age ($\bar{x}$ = 16.4 ±0.91) who had not been engaged in any regular physical activities apart from the obligatory 45-minute physical education classes, 4 times a week. The athletes and control participants were divided into 3 age groups: 15-year-olds, 16-year-olds and 17- and 18-year-olds. Seven handball players (approx. 10%) and 6 non-athletes (9%) were left-handed.

Based somatic parameters of the studied groups are presented in Table 2.

PROCEDURES

The study was approved by the Bioethics Committee for Scientific Research at the Jerzy Kukuczka Academy of Physical Education in Katowice, Poland. Prior to the study, all participants filled in specially devised questionnaires. Written consent was obtained from all parents, who had also completed a questionnaire to provide information on their children’s dominant hand, training experience, and other forms of physical activity, participation in Physical Education classes, locomotor organ pathologies or other obstacles to physical activity. A separate questionnaire was devised for the handball players and non-athletes. Information concerning the frequency of training sessions and players’ attendance was also obtained from handball coaches.

The inclusion criteria were: 1) parental consent to participate in the study, 2) minimum three years of handball training, without any pauses (handball players) or non-engagement in any sports or other physical activities on a regular basis (the control group), 3) participation in mandatory physical education classes, 4) age 15–18 years.

Candidates were excluded from the study in case of incomplete application forms, motor organs pathologies, lack of written consent from their parents or non-submission of the questionnaire. All subjects were evaluated in the morning or early afternoon, before training or physical exercise class.

METHODS

Body height (BH) and body weight (BW) were measured with medical scales and a height meter (with an accuracy of 0.1 kg and 5 mm, respectively). The body max index (BMI) was calculated based on body height and body weight measurements.

The posture was assessed using a specialised apparatus which utilizes the Shadow moiré technique. This method is recommended as a measurement tool in physical therapy; it is a non-invasive, inexpensive and easily available screening test. The moiré method provides a 3-dimensional picture of the back and allows an analysis of over 50 parameters describing the posture with an accuracy of 1 mm and 1° [16, 17, 25, 32, 34, 35]. In the present study, the MORA System was used, manufactured by CQ Elektronik System, Poland.

Prior to the recording, the following structures were marked on the body: spinous processes (C_7–S_1), posterior superior iliac spines, and inferior angles of the shoulder blades. The examined person was instructed to adopt a habitual posture. Each subject stood barefoot, at a certain distance and with his back to the camera, which recorded the posture for about 5 seconds. Quick examination eliminated the risk of postural muscle fatigue.

In the frontal and transverse planes, the analysis included:
- the torso lateral inclination angle, defined by the deflection of the C_7–S_1 line from the vertical axis inserting the S_1 vertebra in the frontal plane (TLA) [o];
- the maximum deviation of the spinous processes from the C_7–S_1 line (DSP) [mm];
- the pelvic position in the frontal plane defined by the value of its lateral inclination (PL) and the pelvic position in the transverse plane defined by the value of its torsion (PT), [mm];
- symmetry of the shoulders (inclination angle of the shoulder line) (IS) [mm];
- symmetry of the shoulder blades: height difference of the inferior angles of scapulae inclination, frontal plane (HSB); in protrusion, transverse plane (PSB) and the difference in the distance of scapulae inferior angles from the spine (SSB) [mm];
- the outline of the trunk and hips (“waist triangles”) as determined by the HWT and WWT indices; the HWT parameter specifies the height difference of the waist triangles and is calculated in the vertical axis [mm] while the WWT parameter specifies the width difference of the waist triangles and is calculated in the horizontal axis [mm].

The values of all the above parameters are shown as absolute values, and deviations are given from the normal value of 0, regardless of their direction (right-left, front-back deviations).

In order to calculate the total value of all the deviations from symmetry in the frontal and transverse planes (i.e., the 0 value), a synthetic index of postural symmetry (SIPS) was devised reflecting the position of individual posture components (Table 1) [17, 32]. While assessing the alignment of the shoulder blades (HSB, PSB, SSB) and waist triangles (HWT, WWT), maximum 3 points were assigned to the greatest deviation from symmetry, without summing up the points for individual deflections.

Table 1. The criteria for assigning point values to the various postural elements of the body based on the synthetic index of postural symmetry (SIPS)

Calculated parameters	Number of points for the deflections mentioned below						
	< 1	1-2	2.01-3	3.01-5	5.01-10	10.01-15	>15
TLA	0	1	2	3			
DSP	0			1	2	3	4
PL	0				1	2	3
PT	0				1	2	3
IS	0				1	2	3
HSB* PSB* SSB*	0				1	2	3
HWT** WWT**	0				1	2	3

*, ** – parameters for the placement of which there are maximum 3 points for the highest-assessed index

Deviations to which 1 point was assigned were considered minor asymmetries, moderate asymmetries were given 2 points, whereas considerable asymmetries – 3 points. In the case of spinous processes deviation, apart from the above mentioned score, 4 points were assigned to a deviation of over 15 mm, which is a serious asymmetry capable of compromising the body balance and indicating lateral curvatures of the spine (scoliosis).

The analysis of the sagittal plane included:
- the torso forward inclination angle, defined by the deflection of the C_7–S_1 line from the vertical axis inserting the S1 vertebra in the sagittal plane (TFA) [°];
- angular disposition of the upper thoracic curve – angle ∝ [o],
- angular disposition of the thoracolumbar curve – angle β [o],
- angular disposition of the lumbosacral curve – angle γ [o],

STATISTICAL ANALYSIS

The results are presented as means and standard deviations ($\bar{x}$ ±SD). Posture and anthropometric parameters of the handball players and non-athletes were compared using the independent samples t-test or U Mann-Whitney test (for non-normal distribution) at a 5% level of significance. The normality of distributions was verified by the Chi-square test. Pearson's r correlation coefficient (linear correlation coefficient) between the length of the training period, the frequency of trainings and posture parameters was also calculated. The correlation coefficient was significant at $p \leq 0.05$. Intergroup analysis of posture parameters of the handball players was performed using ANOVA Kruskal-Wallis test at a 5% level of significance. All calculations were done with the "STATISTICA" version 10 software (StatSoft Inc. USA).

RESULTS

Body height in the 17–18-year-old group and body height and weight in general were greater in the handball players compared to non-athletes (Table 2).

A comparison of spinal curvatures in the sagittal plane did not reveal differences between the handball players and non-athletes (Table 2).

Table 2. Average values (±SD) of anthropometric parameters and postural indices in sagittal plane among handball players (H) and the non-athletes (N)

Age group	15-year-olds		16-year-olds		17-18-years-olds		All groups	
Parameters	H (n = 18)	N (n = 18)	H (n = 29)	N (n = 25)	H (n = 21)	C (n = 26)	H (n = 68)	N (n = 69)
BH [cm]	175.11 ±10.5	170.28 ±7.14	179.34 ±6.69	177.1 ±5.84	182.29 ±5.68*	178 ±5.23	179.1 ±7.98**	175.66 ±6.74
BW [kg]	62.85 ±13.39	56.48 ±9.09	66.91 ±6.78	63.74 ±6.94	73.61 ±7.92	68.87 ±9.92	67.91 ±10.05*	63.94 ±9.88
BMI [kg/m²]	20.3 ±2.73	19.41 ±1.99	20.81 ±1.87	20.34 ±2.25	22.13 ±1.9	21.71 ±2.81	21.08 ±2.23	20.65 ±2.57
TFA [°]	1.92 ±1.8	2.27 ±1.68	1.87 ±1.36	2.09 ±1.4	1.52 ±0.99	1.77 ±1.36	1.77 ±1.38	2.02 ±1.45
∝ angle [°]	16.12 ±6.11	14.36 ±3.65	15.46 ±5.14	16.04 ±3.71	16.36 ±3.78	15.82 ±3.03	15.91 ±4.74	15.52 ±3.48
β angle [°]	14.75 ±2.71	13.37 ±2.58	13.36 ±2.8	13.94 ±2.66	12.24 ±1.94	11.65 ±303	13.38 ±2.68	12.93 ±2.93
γ angle [°]	10.58 ±6.11	12.75 ±5.65	9.72 ±5.08	10.26 ±4.07	9.62 ±4.45	10.72 ±5.18	9.92 ±13	11.08 ±4.97

Legend: TFA – torso forward inclination angle; *significantly ($p < 0.05$) different from the non-athletes, **significantly ($p < 0.01$) different from the non-athletes, ***significantly ($p < 0.001$) different from the non-athletes.

Posture assessment with respect to potential asymmetries in the frontal and transverse planes indicated more frequent and greater asymmetries in the non-athletes. Those asymmetries concerned pelvic alignment in the frontal and transverse planes (PL, PT), the width of waist triangles (WWT), and the position of the shoulder blades in the transverse plane (PSB). Furthermore, lower indices of postural symmetry (SIPS) were noted in the handball players compared to non-athletes (Tab. 3).

Table 3. Average values (±SD) of postural indices in frontal and transverse planes among handball players (H) and the non-athletes (N)

Age group	15-year-olds		16-year-olds		17–18-years-olds		All groups	
Parameters	H (n = 18)	N (n = 18)	H (n = 29)	N (n = 25)	H (n = 21)	C (n = 26)	H (n = 68)	N (n = 69)
TLA[°]	1.34 ±0.85	1.03 ±0.66	1.03 ±0.71	1.03 ±0.77	1.08 ±0.75	0.95 ±0.81	1.13 ±0.76	1 ±0.75
DSP [mm]	5.48 ±2.43	4.87 ±2.86	5.4 ±4.16	4.65 ±3.37	4.61 ±3.07	6.01 ±3.39	5.18 ±3.52	5.22 ±3.27
PL [mm]	2.41 ±1.39***	7.93 ±5.83	2.46 ±2.73***	9.82 ±4.83	2.21 ±1.8	3.76 ±4.03	2.37 ±2.14***	7.23 ±5.97
PT [mm]	7.25 ±5.01	7.93 ±5.83	6.51 ±4.82*	10.34 ±6.03	8.25 ±6.29	10.1 ±6.13	7.24 ±5.33*	9.62 ±6.02
IS [mm]	9.55 ±9.38	7.02 ±4.38	7.53 ±5.56	7.32 ±5.42	6.74 ±6.45	9.68 ±6.8	7.82 ±6.99	8.13 ±5.8
HSB [mm]	10.28 ±8.31	9.71 ±8.49	7.11 ±4.33	10.35 ±9.69	7.41 ±6.82	8.7 ±7.57	8.04 ±6.41	9.56 ±8.53
SSB [mm]	9.09 ±6.49	5.73 ±5.06	7.02 ±5.58	5.86 ±5.79	11.63 ±6.3	11.81 ±10.4	8.99 ±6.29	8.07 ±8.16
PSB [mm]	14.7 ±10.89	18.38 ±9.55	13.48 ±8.43*	19.08 ±9.1	15 ±10.21	19.07 ±11.59	14.27 ±9.56**	19.91 ±11.46
HWT [mm]	10.57 ±7.88	13.17 ±8.37	9.32 ±6.72	7.55 ±6.59	9.11 ±7.22	14.2 ±10.65	9.59 ±7.11	11.67 ±9.42
WWT [mm]	10.28 ±8	7.4 ±5.84	10.15 ±6.39	10.54 ±7.41	8.32 ±5.9**	16.92 ±12.51	9.62 ±6.59	12.27 ±10.3
SIPS [pts]	10.11 ±1.97	10.78 ±3.43	9.21 ±2.64**	11.48 ±3.55	9.42 ±2.99*	11.46 ±2.37	9.51 ±2.59***	11.29 ±3.09

Legend: TLA – torso lateral inclination angle, DSP – maximum deflection of the spinous process from the C7–S1 line, PL – pelvic lateral inclination in the frontal plane, PT – pelvic torsion, HWT – height symmetry of the waist triangles, WWT – width symmetry of the waist triangles, HSB – height symmetry of the shoulder blades, PSB – depth symmetry of the shoulder blades in the transversal plane, SSB – symmetry of the shoulder blades from the spine, IS – symmetry of the shoulders, SIPS – synthetic index of postural symmetry, TFA – torso forward inclination angle; *significantly ($p < 0.05$) different from the non-athletes, **significantly ($p < 0.01$) different from the non-athletes, ***significantly ($p < 0.001$) different from the non-athletes.

Correlation analysis for the handball players (n = 68) revealed the following: the total length of the training period was weakly correlated with the DSP index (r = 0.25), the SSB index (r = 0.25) and angle β (r = -0.26). No correlations were observed between the frequency of trainings and postural parameters.

Intragroup analysis of the posture parameters of handball players confirmed the difference in SSB indices between the age groups ($p < 0.05$) and angle β ($p < 0.01$).

The frequency of particular asymmetries was generally greater in the non-training individuals (Figs. 1, 2). However, spinous process deviation was more frequently observed in handball players than in the non-training group. Spinous processes deviations exceeding 15 mm were seen both in the handball players and non-athletes (3% of the study population). Pelvic alignment in the frontal plane (PL) was within the normal range (94%). Athletes exhibited minor asymmetries (6%) while some moderate (17%) or considerable (9%) asymmetries were noted in the non-training individuals. Moderate or considerable asymmetries in the pelvic position in the transverse plane (PT) were also more frequent in the non-athletes (42%) than in handball players (29%) (Fig. 1). Considerable asymmetries in shoulder blades position were more frequently noted in the non-athletes (68%) than in handball players (59%). Considerable asymmetries in the alignment of waist triangles were seen in 31% of the handball players and in 49% of the non-training subjects, whereas considerable asymmetries in the position of the shoulders occurred in 12% of the handball players and 10% of non-athletes (Fig. 2).

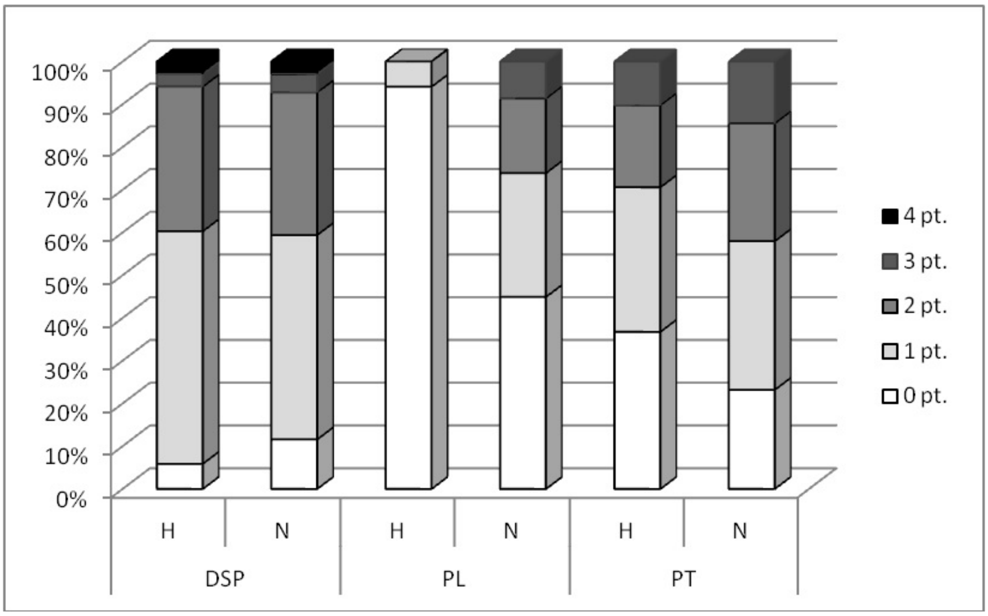

Fig. 1. The frequency of spinous processes deviations (DSP) and pelvic asymmetries in the frontal (PL) and transverse plane (PT) in the handball players (H) and non-athletes (N)

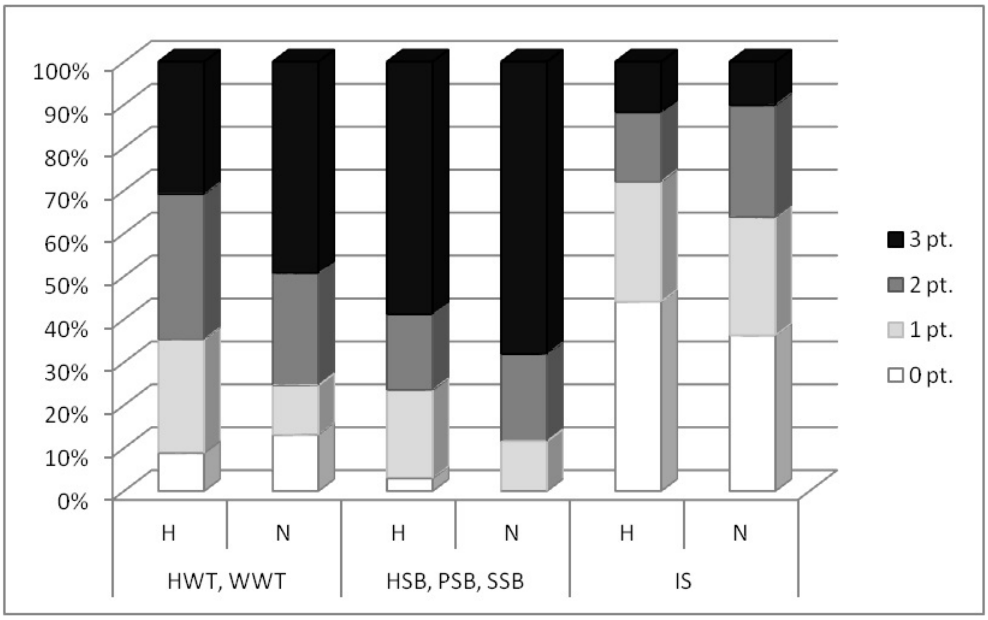

Fig. 2. The frequency of particular asymmetries in waist triangles (HWT, WWT), shoulder blades (HSB, PSB, SSB) and shoulders (IS) in the handball players (H) and non-athletes (N)

DISCUSSION

The study demonstrated that, despite a considerable amount of asymmetric elements in the discussed sport discipline (e.g. a throw to the goal, passes, etc.), the handball players exhibited smaller deviations in body symmetry compared to non-training participants. Also, the assessed asymmetries were noted less frequently than in the non-athletes. It should be emphasized though that some of the handball players also exhibited substantial posture asymmetries as well as considerable (over 15 mm) spinous process deviations. Furthermore, the study revealed that the length of the period of handball practice was correlated

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with the DSP, SSB parameters and the angle of inclination of the thoracolumbar segment (β). These correlations suggest that with longer training periods spinous processes deviations and asymmetry in shoulder blades alignment in relation to the spine tend to increase while the angle of inclination of the thoracolumbar segment decreases.

Comparative studies on the posture of athletes practicing various sports often reveal differences in the posture of the study groups compared to non-training control participants. Barczyk et al. [16] assessed the posture in table tennis players by the Moiré method and observed frequent occurrence of asymmetries in the frontal and transverse planes, in particular shoulder blades and waist triangles asymmetry. This was accounted for by one-sided very intensive work of the trunk muscles, which might have a negative effect since it favours the development of asymmetries. On the other hand, the study on the posture of football players and the non-training controls showed that athletes often had normal pelvic alignment in the frontal plane and symmetric waist triangles whereas some abnormalities were observed in the pelvic alignment in the transverse plane and in the protrusion of shoulder blades [32]. A comparison of football players' posture with their peer group yielded results which are slightly different from those obtained in the present analysis. The fact of better pelvic alignment in the frontal plane in football players and handball players as compared to their non-training counterparts is definitely worth mentioning. However, another study on football players reported lateral deviations of the spine (i.e. scoliosis) in as many as 29% of the subjects [26]. Still another study carried out on athletes [25] demonstrated some minor differences of the posture in the frontal and transverse planes when compared to the non-athletes. The authors concluded that 14-year-old athletes were more often characterised by asymmetric waist triangles than non-training controls, whereas no differences were seen between the respective groups of the 15-year-olds and 16-year-olds [25].

The above mentioned results do not explicitly confirm the positive or negative impact of sports training on the symmetry of posture in the frontal or transverse planes. There is no apparent trend towards posture symmetry or asymmetry resulting from high levels of physical activity in children and adolescents. It should be noted that asymmetric spine movements associated with sports or everyday routines always performed in the same direction are detrimental and can cause postural defects [35]. Abnormalities most frequently observed in the present study were moderate or considerable asymmetries in the position of the shoulder blades and waist triangles. Since these asymmetries were predominantly noted in the non-athletes, their occurrence might most probably be accounted for by certain everyday activities (e.g. sitting, standing, carrying) being always performed in the same manner. This results in increased work load on certain muscle groups and increased tension to the ligaments of these muscles, which can cause a dynamic asymmetry associated with the difference in muscle strength or joint mobility on the right and left side of the body [35]. Such imbalance may lead to asymmetric alignment of various body structures, and, consequently, posture asymmetries. In non-training individuals, postural muscles may also be considerably weaker than in athletes, which also influences posture quality.

The results of this study revealed frequent asymmetries in the pelvic alignment in the transverse plane. This postural defect had been mentioned in several previous studies indicating that pelvic asymmetry is a very common phenomenon that also affects healthy people and need not to be associated with serious dysfunctions [27, 36, 37, 38]. Literature specifies two types of pelvic asymmetries, i.e., asymmetry related to typical everyday activities and habitual asymmetry, resistant to corrective interventions and often accompanied by the symptoms of pathological asymmetry in the pelvic position [36]. In the present study on healthy individuals, including those who practice sports, asymmetries related to typical activities were relatively common, which, according to Gnat et al. [36], may result from mechanical strain on the pelvis.

The assessment of posture in the sagittal plane did not show any statistically significant differences between the handball players and non-athletes. Therefore, the results of the present study do not confirm the observations of other authors [11, 13, 14, 15, 17, 18, 21, 23, 32] who suggested that asymmetric sports training had an effect on the shape of AP curvatures of the spine. There also studies reporting that certain sports disciplines do not affect athletes' posture in the sagittal plane [39, 40]. However, the above cited authors did not investigate the posture of handball players.

LIMITATIONS OF THE STUDY

The non-training participants differed from the handball players with respect to body height and mass, but those differences were not noted between 15-year-old and 16-year-old participants.

CONCLUSIONS

The present study indicates that adolescent handball players had smaller and less frequent asymmetries in the frontal and transverse plane compared to non-athletes. The shape of anteroposterior spinal curvatures did not differentiate the athletes from the non-training participants.

Longer periods of handball practice seem to be associated with more frequent and greater deviations of the spinous processes, greater asymmetries in the position of the shoulder blades in relation to the spine and lower angular values of the inclination of the thoracolumbar segment. The frequency of trainings did not correlate with any of the parameters under investigation.

REFERENCES

[1] Boreham C, Riddoch C. The physical activity, fitness and health of children. J Sports Sci. 2001;19:915–929.

[2] Penedo FJ, Dahn JR. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. Curr Opin Psych. 2005;18(2):189–193.

[3] Tittlbach SA, Sygusch R, Brehm W, et al. Association between physical activity and health in German adolescents. Eur J Sport Sci. 2011;11(4):283–291.

[4] Vicente-Rodriguez G, Dorado C, Perez-Gomez J, Gonzalez-Henriquez JJ, Calbet JA. Enhanced bone mass and physical fitness in young female handball players. Bone 2004;35(5):1208–121.

[5] Caine D, Lindner K. Overuse injuries of growing bones: the young female gymnast at risk? Physician and Sportsmedicine 1985;12:51–64.

[6] Baranto A, Hellström M, Cederlund C, Nyman R, Sward L. Back pain and MRI changes in the thoraco-lumbar spine of top athletes in four different sports: a 15-year follow-up study. Knee Surg Sports Traumatol Arthrosc. 2009;17:1125–1134.

[7] Wang HK, Cochrane T. Mobility impairment, muscle imbalance, muscle weakness, scapular asymmetry and shoulder injury in elite volleyball athletes. J Sport Med Phys Fit. 2001;41:403–410.

[8] Olsen OE, Myklebust G, Engebretsen L, Holme I, Bahr R. Exercises to prevent lower limb injuries in youth sports: cluster randomized controlled trial. BMJ. 2005:330–449.

[9] Pieper HG. Humeral torsion in the throwing arm of handball players. Am J Sports Med. 1998;26:247–253.

[10] López-Miñarro PA, Muyor JM, Alacid F. Sagittal spinal and pelvic postures of highly-trained young canoeists. J Hum Kinet. 2011;29:41–48.

[11] Kums T, Ereline J, Gapeyeva H, Pääsuke M, Vain A. Spinal curvature and trunk muscle tone in rhythmic gymnasts and untrained girls. J Back Musculoskelet Rehabil. 2007;20(2–3):87–95.

[12] Muyor J, López-Miñarro P, Alacid F. Spinal posture of thoracic and lumbar spine and pelvic tilt in highly trained cyclists. J Sport Sci Med. 2011:355–361.

[13] Rajabi R, Doherty P, Goodarzi M, Hemayattalab R. Comparison of thoracic kyphosis in two groups of elite Greco-Roman and freestyle wrestlers and a group of non-athletic participants. Br J Sports Med. 2008;42:229–232.

[14] Uetake T, Ohsuki F, Tanaka H, Shindo M. The vertebral curvature of sportsmen. J Sports Sci. 1998:621–628.

[15] Förster R, Penka G, Bösl T, Schöffl V. Form and mobility of the thoracolumbar spine leading to postural adaptations in male high ability rock climbers. Int J Sports Med. 2009;30:53–59.

[16] Barczyk-Pawelec K, Bańkosz Z, Derlich M. Body postures and asymmetries in frontal and transverse planes in the trunk area in table tennis players. Biol Sport. 2012;29:129–134.

[17] Grabara M. A comparison of the posture between young female handball players and non-training peers. J Back Musculoskelet Rehabil. 2014;27(1):85–92.

[18] Wodecki P, Guigui P, Hanotel MC, Cardinne L, Deburge A. Sagittal alignment of the spine: comparison between soccer players and subjects without sports activities. Rev Chir Orthop Reparatrice Appar Mot. 2002;4:328–336.

[19] Grabara M. Sagittal spinal curvatures in adolescent male basketball players and non-training individuals — a two-year study. Sci Sport. 2016;31:e147-e153.

[20] Grabara M. Postural variables in girls practicing sport gymnastic. Biomed Hum Kinet. 2010;2:74–77.

[21] Muyor JM, López-Miñarro PA, Alacid F. A comparison of the thoracic spine in the sagittal plane between elite cyclists and nonathlete subjects. J Back Musculoskelet Rehabil. 2011;24(3):129–135.

[22] Varekova R, Vareka I, Janura M, Svoboda Z, Elfmark M. Evaluation of postural asymmetry and gross joint mobility in elite female volleyball athletes. J Hum Kinet. 2011;29:5–13.

[23] Wojtys EM, Ashton-Miller JA, Huston LJ, Moga PJ. The association between athletic training time and the sagittal curvature if the immature spine. Am J Sports Med. 2000;28:490–498.

[24] Rachbauer F, Sterzinger W, Eibl G. Radiographic abnormalities in the thoracolumbar spine of young elite skiers. Am J Sports Med. 2001;29(4):446–449.

[25] Grabara M, Hadzik A. The body posture in young athletes compared to their peers. Polish J Sport Med. 2009;25(2):115–124.

[26] Pietraszewska J, Pietraszewski B, Burdukiewicz A. Computer evaluation of the body posture of the young soccer players selected biomechanical parameters. Acta Bio-Optica Inform Med. 2009;15(4):352–355.

[27] Bussey M. Does the demand for asymmetric functional lower body postures in lateral sports relate to structural asymmetry of the pelvis? J Sci Med Sport. 2010;13:360–364.

[28] Oyama S, Myers JB, Wassinger CA, Ricci D, Lephart SM. Asymetric recting scapular posture in healthy overhead athletes. J Atlet Train. 2008;43(6):565–570.

[29] Krzykała M. Dual energy X-ray absorptiometry in morphological asymmetry assessment among field hockey players. J Hum Kinet. 2010;25:77–84.

[30] Dorado C, Sanches Moysi J, Vicente G, Serrano JA, Rodriguez LP, Calbet JAL. Bone mass, bone mineral density and muscle mass in professional golfers. J Sports Sci. 2002;20:591–597.

[31] Maćkowiak Z, Wiernicka M. Body posture in girls aged 13–18 involved in synchronized swimming. Polish J Sport Med. 2010;26(3):115–122.

[32] Grabara M. Analysis of body posture between young football players and their untrained peers. Hum Mov. 2012;13(2):120–126.

[33] Hennessey L, Watson AW. Flexibility and posture assessment in relation to hamstring injury. Br J Sports Med. 1993;27:243–246.

[34] Drzał-Grabiec J, Snela S. The influence of rural environment on body posture. Ann Agricult Environ Med. 2012;19(4):846–850.

[35] Grabara M. Comparison of posture among adolescent male volleyball players and non-athletes. Biol Sport. 2015;32(1):79–85.

[36] Zeylad-Malawka E, Prędkiewicz-Abacjew E. Symptoms of asymmetry in the posture of children and Young people – a threat to a fully efficient locomotor system and to health. Now Lek. 2006;75(4):394–398.

[37] Gnat R, Saulicz E, Biały M, Kłaptocz P. Does pelvic asymmetry always mean pathology? Analysis of mechanical factors leading to the asymmetry. J Hum Kinet. 2009;21:23–35.

[38] Gnat R, Saulicz E. Induced static asymmetry of the pelvis is associated with functional asymmetry of the lumbo-pelvo-hip complex. JOMPT. 2008;31(3):204–211.

[39] Grivas TB, Vasiliadis ES, Polyzois VD, Mouzakis V. Trunk asymmetry and handedness in 8245 school children. Develop Neurorehabil. 2006;9(3):259–266.

[40] Muyor JM, Sanchez-Sanchez E, Sanz-Rivas D, López-Miñarro PA. Sagittal spinal morphology in highly trained adolescent tennis players. J Sports Sci Med. 2013;12:588–593.

[41] López-Miñarro P, Alacid F, Rodriguez P. Comparison of sagittal spinal curvatures and hamstring muscle extensibility among young elite paddlers and non-athletes. Int Sport Med J. 2010;11(2):301–312.

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