THE INFLUENCE OF HANDBALL SPECIAL TRAINING ON SPINAL SHAPE

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The program of studies on the effect of physical training of sports on body position and on the formation of spine curves in particular, covers also the examination of handball players with varying degree of ability.

The studies performed so far in Poland on the handball players from the national cadre, revealed marked predomination of thoracic kyphosis over lumbar lordosis /Zeyland-Malawka [5]/. Our previous investigations [2] concerning the spinal shape in judo sportsmen allowed the conclusion that the decrease of lumbar lordosis and the increase of thoracic kyphosis, as a statistically significant change, appear not earlier than after 10 years of physical training. Moreover, similar tendency in teenagers, aged 15-20 years, was reported by Kamburowski and Nowakowski [1] who analyzed the effect of age upon the spinal shape changes. In the light of the above findings, it seemed to be of interest to test wheather handball special training may influence the posture of the players with varying degree of abilities. Taking the opportunity of examining the players from the IIIrd, IInd and Ist league, the spine curves as well as selected parameters characterizing their posture, were subjected to measurements.

MATERIALS AND METHODS

The examined group included handball players in the age from 19 to 29 years and the mate of the mean period of practice: 12 years in the Ist league players n=11, 9.5 years - IInd league players n=12 and 5.1 years - IIIrd league players n=11. The total number 34 players were examined. Detailed characteristics of their body position in the mean values is given in Tab. 1.

The spine curves were registered by means of an electronic spherosomatograph, designed and made at The Technical University of Wroclaw [4]. This device registers on the paper or projects on the screen the spine curvatures in the frontal and sagittal plane, with the error not exceeding 3%. At the same time the coordinates of the particular spinal curves are transmitted to the computer memory. Appropriate programs calculate within a few seconds the particular indices characterizing the spine segments and curves. Analysis of the spine curves was performed by the Radius Method with Intersection point elaborated by Wielki [3]. With the use of 10 indices this method describes in detail the spinal shape /Fig.1/.

The results obtained, statistically analyzed, are presented in Tab. 1 which includes the mean values and standard deviations of ten indices introduced by Wielki [3] as well as ten additional indices.

These are:

1. Dorso-Lumbar Index /DLI/. Relation of the size of the dorsal cord to the lumbar cord, multiplied by 100.
2. Curve Relation Index /CRI/. Relation betwen the height $/h_1/$ of the dorsal curve to the height $/h_2/$ of the lumbar curve, multiplied by 100.

/1/ DLI = /AC : CB/ x 100
/2/ CRI = /h_1 : h_2/ x 100
/3/ RSI = /h_1 + h_2/ : /AC + CB/ x 100
/4/ II = /BI : AI/ x 100

/5/ DTI = /AF : FC/ x 100
/6/ DCI = /h_1 : AC/ x 100
/7/ RDC = /h_1 : s_2/ : $2h_1$

/8/ LTI = /CG : GB/ x 100
/9/ LCI = /h_2 : CB/ x 100
/10/ RLC = /h_2 + s_2/ : $2h_2$

Figure 1: Profile of the anatomical spinal curve indexes.

3. Relation Summation Index /RSI/. Relation of the sum of heights /h_1 + h_2/ to the sum of the 2 cord /AC+CB/, multiplied by 100.
4. Inclination Index /II/. Relation between the measurements of the horizontal passing through the lower point B to the vertical passing through the upper point A. Thus, BI to AI, multiplied by 100.
5. Dorsal Index /DI/. Indicates the position of the top of the curvature /D/ of the dorsal curves. If more than 100, the top is below the height /h_1/ of the curve.
6. Dorsal Curve Index /DCI/. Relation between the height of the dorsal curve /h_1/ to its cord /AC/, multiplied by 100.
7. Radius Dorsal Curve /RDC/. Size of the radius of the circle closest to the curve of the dorsal spine. It is the sum of the square of the height /h_1/ of the dorsal curve and the square of half the cord /s_1/ divided by 2 (h_1).
8. Lumbar Index /LI/. Indicates the position of the top /E/ of the lumbar parts of the radius. If more than 100, the top is below the height /h_2/ of the curve.
9. Lumbar Curve Index /LCI/ . Relation between the height of the lumbar curve /h_2/ to its cord /CB/ multiplied by 100.
10. Radius Lumbar Curve /RLC/. Radius of the circle closest to the curve of the lumbar spine. It is the sum of the square of the height /h_2/ of the lumbar curve and the square of half the cord /S_2/, divided by $2h_2$.
11. Height of thoracic kyphosis /h_1/.
12. Height of lumbar lordosis /h_2/.
13. Length of spine /TL/.
14. Height of body /BH/.
15. Angle of pelvic inclination.
16. Force of dorsal muscles.
17. Chest circumference.
18. Chest amplitude.
19. Lung vital capacity.
20. Body weight.

RESULTS

The results of the investigation are illustrated in Table 1. From the comparison it follows that the players from the *IIIrd and the IInd league differ from those of the* Ist league in the following indices: DLI, CRI, LCI as well as the height of lumbar curve /h_2/. It is evident that in the Ist league players the base of the thoracic kyphosis is elongated in comparison with the shortened lumbar lordosis. Increased CRI value may be accounted for the decreased height of lumbar lordosis. Likewise, LCI decreased due to the decreased height of lumbar lordosis. Likewise, LCI decreased due to the decreased height of lumbar lordosis /h_2/.

Of the other parameters decisive of the posture the differences in body height, chest circumference, angle of pelvic inclination, lung vital capacity and body weight, reached statistical significance in the players grouped in the IIIrd and Ist leagues and in the IInd and Ist league, no differences in the spine shape and the posture parameters, developed. The only exception concerned the length of spine which decreased in the IInd league players as compared to the IIIrd league players.

To analyze the tendency of changes in the players from the particular leagues, a special list was made /Tab. 2/. It appeared that in the IIIrd league players, Type A - Normal was predominating /81.8%/ while Type B-Lordotic was encountered only in 18.2 %. The same type structure was confirmed in the students examined. As for the league II, the frequency of occurrence of Type A - Normal was lower /58.3%/. On the other hand, in the Ist league, Type A Normal was encountered only in 45.5 %, Type B - Lordotic - in none of the cases and Type C - Kyphotic in as many as 54.5 %.

DISCUSSION AND CONCLUSIONS

The results obtained evidence that the handball training influences the spine shape of the players. It appeared that both the period of practice as well as the physical abilities of the players /sports level/ increase the height of the thoracic curve /kyphosis/ and markedly decrease the height of the lumbar curve /lordosis/. These changes, beside flattening of the intervertebra discs, may result in shortening of the spine length. In terms of population study, it manifested itself by decreased frequency of occurence of type A /Normal/ and increased frequency of type C /Kyphotic/.

It is still to be evaluated, however, what are the other aspects of the changes observed. This will require more thorough investigations on the effect of the spinal shape changes in the light of biomechanics, circulation, ventilation and pain.

TABLE 1
List of parameters characterizing the spine curves and body position of the handball players

League Parameters	III		II		I		The level of statistically significant		
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	III-II	II-I	III-I
1 DLI	194.82	46.89	207.23	59.02	292.00	83.40		0.05	0.01
2 CRI	363.27	151.50	336.10	219.00	935.00	606.45		0.01	0.001
3 RSI	9.96	3.20	10.44	1.33	11.22	2.51			
4 II	8.87	1.82	7.80	3.11	7.65	2.97			
5 DI	87.45	15.51	83.70	14.43	89.78	13.62			
6 DCI	12.55	1.25	11.57	1.29	13.30	3.01			
7 RDC /mm/	389.09	48.23	408.00	80.98	420.33	110.96			
8 LI	98.36	18.81	86.76	22.73	102.56	49.84			
9 LCI	7.55	1.94	8.24	2.51	4.53	2.52		0.01	0.01
10 RLC /mm/	354.91	93.93	321.00	119.32	385.56	116.47			
11 h_1 /mm/	45.81	6.87	40.61	5.97	52.40	13.49		0.05	
12 h_2 /mm/	15.00	6.21	15.17	5.87	7.78	4.04		0.01	0.01
13 TL /mm/	360.91	19.38	334.10	24.64	337.73	10.64	0.05		0.05
14 BH /cm/	181.93	6.23	184.21	4.92	189.55	3.25		0.01	0.001
15 Angle of the pelvic inclination /deg./	32.73	3.19	31.63	2.23	29.73	1.86			
16. Tension of dorsal musc. /kG/	148.54	19.69	150.00	18.20	163.64	17.07			
17 Chest circumf. /cm/	96.73	3.31	97.81	3.35	101.64	3.14		0.05	0.01
18 Chest amplitude /cm/	8.73	1.36	10.45	3.79	8.73	3.41			
19 Lung vital capacity /ml/	5850.03	650.00	5830.00	464.87	6527.24	327.78		0.01	0.01
20 Body weight /kg/	76.81	8.82	79.91	6.40	88.27	5.08		0.05	0.01

TABLE 2
Frequency of occurrence of the posture types in the players from the particular sport leagues.

Type League	B		A		C	
	N	%	N	%	N	%
III	2	18.2	9	81.8	-	-
II	3	25.0	7	58.3	2	16.7
I	-	-	5	45.5	6	54.5

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