CHARACTERISTIC OF BODY POSTURE OF THE PARTICIPANTS OF THE EUROPEAN JUNIOR VOLLEYBALL CHAMPIONSHIPS.

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EXAMINATION AIMS.

The aim of the examinations was to determine the changes of spinal curvature in volleyball players, who participated in the European Junior Volleyball Championships in Poznan, under the influence of external axial load of the body.

METHODS.

The examinations were conducted with non-invading method with the use of Posturometer-S (Fig. 1). Spinal curvatures were recorded in the sagital, frontal and transversal planes making use of the slider passing over spinous processes from the 7th cervical vertebra (C7) to the 5th lumbar vertebra.

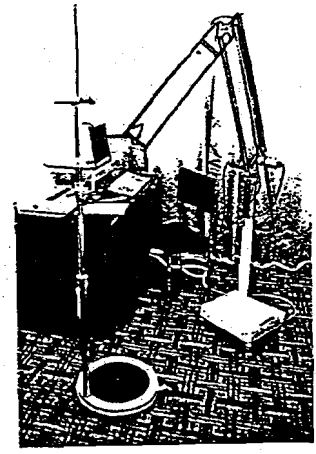

Fig.1. Posturometer S.

Each of the tested individuals held the load of 20 - 60 kg in both hands hanging down along the body axis, Four diagrams of spinal curvatures were made for each of the tested competitor: first - without the load, second with the load of 10 kg per each upper extremity, third with the load of 20 kg per each upper extremity and fourth with the load of 30 kg per each extremity. During the measurements the competitors stood on the apparatus stabiliser in the free pose with the head in Frankfurt position, with the heels on one line, the straight knees and the feet astride to ensure body stability. Besides each individual was subjected the measurements of body height and mass.

The obtained results of spinal curvatures were analysed with the modified indexes according to Wielki:

1. index of thoracic kyphosis $WKP = (WG / h1) * 100 \%$
2. index of lumbar lordosis $WLL = (WD / h2) * 100 \%$

The indexes were modified for the purpose of software programme (in order to avoid division by zero), because zero value was frequently calculated when the depth of lumbar lordosis was determined.

A type of body construction of all the tested individuals was additionally determined making use of the simplified Rohrer's index: $WR = \text{mass} / (\text{height} \wedge 3)$

ANALYSIS OF THE RESULTS.

90 competitors, the participants of the European Junior Championships for Volleyball, aged 17 - 19 years old, were tested in Poznan in 1992. The participants came from 8 countries including 12 from France, 11 - Germany, 12 - Czech Republic, 13 - Poland. 12 - Spain. 12 - Commonwealth of Independent States and 6 from Italy.

In general the characteristic of the tested group was homogeneous with regard to body construction. **Rohrer's** index - Fig. 2 - ranges from 8.12 * 10-6 **kg/cm3** to 13.74 * 10-6 **kg/cm3**.

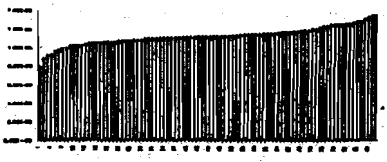

Fig.2. Rohrer's index.

The changes in the shape of spinal curvatures were found out the basis of the analysed indexes WKP and WLL in the tested competitors. Significant changes were noticed in the competitors who were given the load of 60 kg. Smaller loads do not bring about significant changes of thoracic kyphosis and lumbar lordosis indexes. Different directions of spinal curvatures were observed - Fig. 3. The increase of thoracic kyphosis was noticed in 41 competitors, it was smaller for 42 cases whereas the value did **not change** in the case of 7 competitors. However the lumbar lordosis index increased its value in 35 competitors, it was smaller for 50 individuals and for 5 of them the values did not undergo any changes.

	increase	decrease	constant
WKP 60	41	42	7
WLL 60	35	50	5

Fig.3. Direction of changes of spinal curvatures at the load of 60 kg.

Fig. 4 presents the directions of spinal curvature changes for individual representations. On the basis of the changes of spinal curvatures brought about by load, it was possible to determine the direction of postural muscle operation.

	ITA			FRA			NL			POL			ESP		
	increase	decrease	constant	increase	decrease	constant	increase	decrease	constant	increase	decrease	constant	increase	decrease	constant
WKP 60	4	2	0	5	7	0	3	6	2	5	7	1	10	1	0
WLL 60	2	4	0	5	7	0	3	8	0	6	6	1	6	5	0

	GER			TCH			CIS		
	increase	decrease	constant	increase	decrease	constant	increase	decrease	constant
WKP 60	3	5	3	7	3	2	5	6	1
WLL 60	2	8	1	5	4	3	6	6	0

Fig.4. Direction of changes of spinal curvatures at the load of 60 kg for individual representations.

When the thoracic kyphosis index increases or does not change its value, the reaction of dorsal muscles to the load is correct. Such results of regular reaction of dorsal muscles was found in the competitors from Spain and the Czech Republic whereas the results were relatively worse in Polish and French competitors (see Fig. 4).

Shallowing of lumbar lordosis, that is the decrease of lumbar lordosis index value or maintaining it on the same level, speaks for a good abdominal musculature. These qualities are revealed by German and Dutch sportsmen and those from the Commonwealth of Independent States (Fig. 4).

The analysis of the dependence between the change of spinal curvature and competitors' body mass and height showed a very low correlation degree. The correlation index values are presented on Fig. 5.

Fig. 5.

	WKP	WKP 20	WKP 40	WKP 60	WLL	WLL 20	WLL 40	WLL 60
HEIGHT	-0.029	4.054	4.041	-0.093	0.062	-0.171	-0244	-0.11
WEIGHT	-0.063	-0.048	0.055	0.042	4.05	4.181	-0.197	-0.159

Fig.5. Correlation factors between the change of spinal curvature and body height and mass.

At a low dependence between thoracic kyphosis and lumbar lordosis indexes and the body mass, it can be observed that the correlation factor tends to increase at the increase of the load.

CONCLUSIONS.

On the basis of the conducted examinations and analysis of the collected material the following conclusions were made:

1. At the homogeneity of the group with regard to the type of body construction some significant changes of the spinal curvatures were noticed at the external load of 60 kg.

2. No significant correlation between the body height, mass and the thoracic kyphosis index (WKP) and the lumbar lordosis index (WLL) were observed.

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