MORPHOBIOMECHANICAL PECULIARITIES OF FOOTBALL PLAYERS AGED 11–13 YEARS

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Summary

Background. Modern sports practice, numerous scientific studies show that the world sports peaks can be conquered only by especially talented athletes who, firstly, have a pronounced natural inclination to achievements in a particular sport, and secondly, who managed to implement them in long-term improvement process. **Materials and Methods**. The number of respondents involved in the observational experiment stage was n = 130 players of 11–13 years old. The paper used professional scientific and methodological literature reviews, pedagogical observation; anthropometry, adolescent's posture analysis was performed using "Torso" program, mathematical statistics methods. **Results.** The videometry results, which are confirmed by an orthopedist, established the dynamics of functional state deterioration of musculoskeletal system. The study that examined the body length parameters in young players with different posture types, determined that among athletes aged 11–12 years, the highest body length values were in players with scoliotic posture and round back. In athletes aged 12–13 years, the highest average body weight values were typical for players with round back posture type and the lowest for flat back players. **Conclusions**. Characteristic posture features of the studied contingent have been established: normal posture was observed in 50% of football players aged 11–12, and 42.85% of football players aged 12–13. The most

common functional musculoskeletal system disorder in young athletes is scoliotic posture, which is found in 26.66% of 11–12 year old players and 28.57% of 12–13 year old players. The second in the number of detected functional musculoskeletal system disorders in young football players is a round back observed in 16.67% of 11–12 year olds and 17.15% in 12–13 year old athletes. The data obtained indicate that the problem of functional musculoskeletal system disorders in young athletes is more acute than ever.

Key words: football, young athletes, morpho biomechanical features, functional musculoskeletal system disorders.

INTRODUCTION

Based on professional scientific and methodological literature analysis and generalization, practical experience of Ukrainian [16, 17] and foreign scientists [12] it is established that modern sport trends determine the long-term systematic process of higher skills improvement, dictate the need to its gradual formation improvement including football.

Football is one of the most popular sports, which has many supporters for its dynamism, the thrill of rival teams struggle, ease of ball possession by players when performing tricks in difficult game situations [10].

According to the scientific community [2, 3, 9], the educational and training process intensification inherent in modern children's and youth sports, aimed at high sports results achieving, leads to increased stress on the child's body and can cause metabolic, morphofunctional disorders, prenosological conditions and diseases in young athletes.

Nowadays the problem of prevention, early detection and correction of musculoskeletal system disorders of young athletes is becoming increasingly important [1, 5, 18].

In the course of scientific literature reviewing, despite the fact that the problem of musculoskeletal disorders in young athletes is widely highlighted in scientific and methodological literature, it was found that percentage of functional musculoskeletal system (MSS) disorders in young athletes today remains high [4, 6, 13].

The study of growth and development peculiarities of children and adolescents in changing socio-economic conditions is one of the key problems of preventive physical rehabilitation at the present stage [8, 9, 11, 13, 14].

The analysis of scientific knowledge array served as a basis for statement that currently the development of scientifically health preserving programs at the stage of preliminary basic training of young football players with functional musculoskeletal system disorders has not received proper theoretical comprehension in scientific discourse [7, 15, 19].

The paper was performed according to research work plan of SHEI "Vasyl Stefanyk Precarpathian National University" for 2015–2020 on "Theoretical and methodological foundations of differentiated physical education in preschools, schools and out-of-school institutions and universities" (state registration number 0116U003890).

MATERIALS AND METHODS

The number of respondents involved in the observational experiment stage was n = 130 players aged 11–13 years. The scientific and methodological literature analysis was carried out to form a theoretical basis, current trends in the study of health preserving programs at the stage of preliminary basic training of young football players with functional musculoskeletal system disorders; empirical level of research: pedagogical observation; anthropometry, that is the study of subjects on the basis of standard equipment and the generally accepted and unified methods of V.V. Bunak in E.G. Martirosov modification, photography and analysis of male posture were performed using "Torso" program identifying three angular characteristics of biogeometric posture where α_1 is the head inclination angle formed by vertical and line connecting the spinous process of the seventh cervical vertebra C_7 and MC of the head; α_2 is the angle formed by horizontal and line connecting the most prominent point of frontal bone and chin; α_3 is the angle of torso inclination formed by the vertical and the line connecting the spinous process of the seventh cervical vertebra (C_7) – the most prominent part of the spine at the cervical - thoracic junction - and the spinous process of the fifth lumbar vertebra (L_5) – the most lordically deepened label of transverse lordosis (somatic coordinate system center) (V.O. Kashuba, 2003). The experimental data were processed using traditional mathematical statistics methods, which allow to operate with such statistical indicators as arithmetic mean (x), standard error (m). Determining the statistical significance of obtained research results required nonparametric Mann-Whitney test.

RESULTS

When examining football players aged 11–12 (n = 60), according to the videometry results, which is confirmed by the testimony of an orthopedist, we found that 50.00% (n = 30)

of athletes do not have violations of MSS, posture disorders in the frontal plane are observed in 26.66% (n = 16), flat back – 6.67% (n = 4), round back – 16.67% (n = 10). Interesting information was obtained during the survey of football players aged 12–13 (n = 70): we found a tendency to reduce the number of young football players with normal posture – 42.85% (n = 30), as well as increase the number of athletes with posture disorders – scoliotic posture was detected 28.57% (n = 20) of football players, round back – 17.14% (n = 12), flat back – 11.43% (n = 8) (Table 1).

Table 1. Posture peculiarities in 11–13 year old football players (n = 130), %

Football players, years	Posture			
	normal	round back	flat back	scoliotic
11-12 (n = 60)	50.00	16.67	6.67	26.66
12-13 (n = 70)	42.85	17.15	11.43	28.57

The obtained data state that 12–13 years age period is potentially dangerous in the MSS formation of young football players.

In study process, involving body length parameters in young football players with different posture types, there was determined that among 11–12 year old athletes the greatest body length values were in football players with scoliotic posture and round back (average 153,0 ± 1.3 cm) (Table 2).

Table 2. Body length indicators of young football players with different posture types ($\bar{x} \pm m_{\bar{x}}$), cm

Posture	Age, years	
	11–12 (n = 60)	12–13 (n = 70)
Normal	152.71±1.42	160.37±1.33
Round back	153.05±1.30	159.67±1.54
Flat back	151.82±1.26	159.63±1.41
Scoliotic	153.06±1.24	159.65±1.39

Notes: feature changes are not statistically significant (p> 0.05) in the data of given players groups aged 11–12 and 12–13 concerning normal posture (based on non-parametric Mann-Whitney test)

At the same time, the largest body length values of surveyed athletes aged 12–13 years have football players with normal posture (160.37 ± 1.33) cm and with a round back (159.67 ± 1.54) cm.

Studies of the average body weight values in football players aged 11–12 years showed that the highest values have athletes with flat back – (38.75 ± 0.73) kg and the lowest values have football players with scoliotic posture – (39.44 ± 1.09) kg. In athletes aged 12–13 years the highest average body weight values were characteristic for football players with a round back type (43.58 ± 1.38) kg, and the lowest values for football players with a flat back (42.00 ± 1.22) kg (Table 3).

Table 3. Body weight indicators of young football players with different posture types ($\bar{x} \pm m_{\bar{x}}$), kg

Posture	Age, years	
	11–12 (n = 60)	12–13 (n = 70)
Normal	39.53±0.94	43.13±1.09
Round back	39.50±0.85	43.58±1.38
Flat back	38.75±0.73	42.00±1.22*
Scoliotic	39.44±1.09	43.16±1.58

Notes: * – the difference is statistically significant (p < 0.05) within the group of football players 12–13 years old concerning normal posture (based on non-parametric Mann-Whitney test)

The results of fundamental invistigations study with common research problems [10, 11, 15] allowed us to conclude that any studied angular index change is accompanied by changes in position of the head in space. Modern research [10, 15] shows that angle decrease, formed by the vertical and the line connecting the spinous process of the vertebrae C_{VII} and MC of the head (α_1) indicates an muscles overload of the posterior part of the cervical spine at cervical - thoracic junction.

In 11–12 years old football players the angle formed by vertical and line, connecting the spinous process of the vertebrae C_{VII} and the MC of the head (α_1), had the greatest value in athletes with round (36.8 ± 0.6°) and flat (36.5 ± 0.5°) back. Footballers with scoliotic posture had the lowest average values of this indicator (31.0 ± 0.71°) (Table 4).

Table 4. Characteristics of the angle formed by the vertical and line, connecting the spinous process of the vertebrae C_{VII} and CM of the head (α_1), in young football players ($\bar{x} \pm m_{\bar{x}}$), °

Posture	Age, years	
	11–12 (n = 60)	12–13 (n = 70)
Normal	39.21±0.69	32.20±0.59
Round back	36.80±0.60*	36.91±0.52*
Flat back	36.50±0.50	36.25±0.43*
Scoliotic	31.01±0.71	31.38±0.70*

Notes: * – the difference is statistically significant ($p < 0.05$) within the group of football players 12–13 years old concerning normal posture (based on non-parametric Mann-Whitney test)

Recorded facts show that in football players aged 12–13, the angle formed by vertical and line, connecting the spinous process of the vertebrae C_{VII} and the MC of the head (α_1), had the greatest value in athletes with round back posture type (31.38 ± 0.70 °), and the lowest average values of this indicator are characteristic for football players with scoliotic posture type.

Numerous studies [10, 15] establish that in right angle α_2 setting, formed by horizontal and line connecting the most prominent point of frontal bone and chin, a significant role is played by numerous small muscles system, which weakening leads to angle increasing. View angle maintenance, including cervical spine support, is facilitated by gluteal muscles, overloading which changes the angle, formed by the horizontal and the line connecting the most prominent point of frontal bone and chin [10, 15].

It should be noted that average values characteristics of the angle, formed by horizontal and line connecting the most prominent point of frontal bone and chin (α_2), allows us to determine that in 11–12 years old players with no posture disorders the average value of this angle is equal to (84.10 ± 0.68 °), and for football players aged 12–13 (84.20 ± 0.52 °) (Table 5).

Table 5. Characteristics of the angle, formed by horizontal and line connecting the most prominent point of frontal bone and chin ($α_2$), in young football players ($\overline{x} \pm m_{\overline{x}}$), °

Posture	Age, years	
	11–12 (n = 60)	12–13 (n = 70)
Normal	84.10±0.68	84.20±0.52
Round back	75.50±0.50*	76.80±1.11*
Flat back	79.25±0.43*	79.50±0.50*
Scoliotic	78.00±0.94*	78.25±0.90*

Notes: * – the difference is statistically significant (p <0.05) within the group of football players 11–12 and 12–13 years old concerning normal posture (based on non-parametric Mann-Whitney test)

It is established that in scoliotic posture the average values of this indicator are the smallest, that is in football players aged 11–12 (78.00 ± 0.94 °), in athletes of 12–13 years – (78.25 ± 0.90 °).

Measurements show that in flat back football players 11–12 years this indicator is equal to (79.25 ± 0.43 °), in athletes 12–13 years – (79.50 ± 0.50 °).

The obtained factual data show that the value of the angle $α_3$, formed by the vertical and the line connecting the spinous processes of the vertebrae C_{VII} and L_5, has the lowest indicator values (1.25 ± 0.43 °) in 11–12 years old athletes with a flat back, and at the same time this indicator value in football players with a normal posture is equal on the average (2.50 ± 0.56 °) (table 6).

Critical consideration of the obtained experimental data indicates the fact that in a round back this indicator in 11–12 years old footballers is equal to (3.50 ± 0.50°).

In football players aged 12–13 with normal posture this indicator is on average (2.27 ± 0.43 °).

Table 6. Characteristics of the angle, formed by the vertical and the line connecting the spinous processes of the vertebrae C_{VII} and L_V (α_3), in young football players ($\overline{x} \pm m_{\overline{x}}$), °

Posture	Age, years	
	11–12 (n = 60)	12–13 (n = 70)
Normal	2.50±0.56	2.27±0.43
Round back	3.50±0.50	3.50±0.48*
Flat back	1.25±0.43	1.50±0.50*
Scoliotic	3.44±0.50	3.56±0.49

Notes: * – the difference is statistically significant (p <0.05) within the group of football players 11–12 and 12–13 years old concerning normal posture (based on non-parametric Mann-Whitney test)

In postural disorders, the indicator average values decrease to (1.50 ± 0.50 °) in flat back and increase to (3.56 ± 0.49 °) and (3.50 ± 0.48 °) in scoliotic posture and round back accordingly.

CONCLUSIONS

The characteristic posture features of the studied contingent are established. The results of videometry, which were confirmed by orthopedist, revealed that correct posture is characteristic for 50% of football players aged 11–12, and 42.85% of football players aged 12–13. The most common functional musculoskeletal system disorder in young athletes is scoliotic posture, which is found in 26.66% of players aged 11–12 years and 28.57% of players aged 12–13 years. The second in the number of detected functional musculoskeletal system disorders in young football players is a round back observed in 16.67% of 11–12 years old and 17.14% in 12–13 year old athletes. The data obtained indicate that the problem of functional musculoskeletal system disorders in young athletes is more acute than ever. At the present stage, the state of posture as a highly dynamic system is determined by its inherent indicators: human body parts mutual location, gravity center position, physiological spine curves expression, form of chest, abdomen, legs, body goniometry. The analysis of scientific knowledge array served as a basis for statement that the most informative posture characteristics are provided with the angle angle formed by vertical and line connecting the

spinous process of the seventh cervical vertebra C_7 and CM of the head (α_1); the angle formed by horizontal and line connecting the most prominent point of frontal bone and chin (α_2); the angle (α_3) formed by the vertical and the line connecting the spinous processes of the vertebrae C_{VII} and L_5. The studies aimed at correcting of foot supporting-spring properties violations of young football players with different skills during the competitive period within the game season are prospective.

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