

# Mineral density of skeletal bones in persons participating in northern complex sports

UDC 796.034.2:612.75



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Received by the editorial office on 15.02.2024

## Abstract

**Objective of the study** was to evaluate the mineral density of bone tissue of skeletal segments in young men involved in northern all-around events.

**Methods and structure of the study.** Bone mineral density was studied in 24 young men aged 19-23 years, place of birth and place of permanent residence - Khanty-Mansi Autonomous Okrug-Yugra. The experimental group (EG) (n=12) included young men involved in the national sport - northern all-around (average age: 22,1±0,7 years), experience in sports 6-8 years. The control group (CG) (n=12) included young men who do not regularly engage in physical education and sports (average age 21,8±0,8 years). Using dual-energy X-ray absorptiometry, the mineral density of the bones of the skeleton and its segments, as well as the total content of minerals in them, was determined.

**Results and conclusions.** The total mineral content and total mineral density of skeletal bones did not reveal statistically significant differences between the control and experimental groups. In the EG subjects there was a statistically significant (p<0,05) increase in the mineral density of the bones of the pelvis, spine and lower extremity bones, respectively, by an average of 5,7%, 5,4% and 6,6%. Statistically significant (at p<0,05) increased values of the level of mineral density and the level of mineralization of the proximal femur and lumbar vertebrae (L1-L5) were found in the subjects of the experimental group relative to the control group. It is recorded that in young men involved in northern all-around, an area of increased mineral density of skeletal bones is formed within the boundaries of the lumbar spine - the pelvic girdle - the proximal femur. In young men involved in northern all-around, in contrast to those who do not regularly engage in sports, an increase in bone mineral density is observed in certain segments and zones of the skeleton, forming a special support zone.

**Keywords:** bone mineral density, skeletal segments, northern all-around, boys.

**Introduction.** The development of national sports is an important area of physical culture and sports development in the country, as it carries not only an element of physical culture, health and sports orientation, but also an important social and ethnocultural function [5, 7, 8]. In the northern regions of the Russian Federation, northern all-around events have become widespread among national sports [2, 9]. Many researchers see the prospects for developing this sport specifically for solving the problems of preserving the health of residents of the northern regions, not only as a culturally and evolutionarily established practice of preserving and maintaining the physical fitness of

the indigenous population, but also as a practice that can be transmitted and ensure the maintenance of health of newcomers [3, 4]. The existing research in this area mainly concerns individual aspects of sports training of athletes in this sport [1, 6, 10]. At the same time, it is obvious that the existing lack of research in terms of studying the characteristics of the development and formation of physiological changes when practicing this sport definitely hinders its development not only as a sport, but also as an element of physical culture.

**Objective of the study** was to evaluate the mineral density of bone tissue of skeletal segments in young men involved in northern all-around events.

**Methods and structure of the study.** Bone mineral density was studied in 24 young men aged 19-23 years, place of birth Khanty-Mansiysk Autonomous Okrug-Yugra, place of permanent residence Khanty-Mansiysk Autonomous Okrug-Yugra. The experimental group (n=12) included young men involved in a national sport – northern all-around (mean age: 22,1±0,7 years). The control group (control group, n=12) included young men who do not regularly engage in physical education and/or sports (mean age 21,8±0,8 years). Bone mineral density of the skeleton and its segments (BMD, g/cm<sup>2</sup>), as well as the total mineral content (TMC, kg) were estimated using dual-energy X-ray absorptiometry on an X-ray bone densitometer from Lunar Prodigy GE Medical Systems. The study was conducted at the District Clinical Hospital (Khanty-Mansiysk). The results in the tables are presented as median, 1-3 quartiles (Me, Q1-Q3). The procedure for statistical evaluation of the significance of differences in indicators between groups was carried out using the Mann-Whitney t-test. The minimum significance level (p) was taken to be 0,05.

**Results and conclusions.** The results of the study showed that the total mineral content (TMC) and bone mineral density (BMD) of the skeletal bones as a whole did not show statistically significant differences between the subjects of the main group and the comparison group (Table 1). An insignificant increase in total mineral density was found in the subjects of the main group.

**Table 1.** Indicators of total skeletal mineralization in subjects of the compared groups, Me (Q1-Q3)

Subject group	TMC, kg	BMD, g/cm <sup>2</sup>
Nordic all-around (n=12)	3,01 (2,93-3,12)	1,23 (1,19-1,27)
Comparison group (n=12)	3,03 (2,89-3,14)	1,22 (1,18-1,23)

However, the study of bone mineral density by skeletal segments revealed reliable intergroup differences (Table 2). Thus, in the subjects of the EG relative to the control group, a statistically significant (at p<0,05) increase in the mineral density of the pelvic bones, spine and lower limb bones was observed, respectively, on average 5,7%, 5,4% and 6,6% higher relative to the CG.

Further assessment of mineralization of individual zones of the femur and lumbar vertebrae (L1-L5) also revealed statistically significant

**Table 2.** Mineral density (BMD, g/cm<sup>2</sup>) of different skeletal segments in subjects of the compared groups, Me (Q1-Q3)

Skeletal segment	Nordic all-around (n=12)	Comparison group (n=12)
Scull	1,76 (1,70-1,85)	1,84 (1,77-1,88)
Torso	0,98 (0,96-1,03)	0,99 (0,94-1,02)
Upper limbs	0,98 (0,92-1,01)	0,98 (0,93-1,00)
Lower limbs	1,45 (1,42-1,51)*	1,36 (1,33-1,42)
Pelvis	1,30 (1,26-1,32)*	1,23 (1,18-1,25)
Spine	1,18 (1,15-1,20)*	1,12 (1,09-1,15)

Note: \* - differences between groups are significant at a significance level of p<0,05.

increased values of both the level of mineral density and the level of mineralization of these segments in subjects of the experimental group relative to the control group in all studied zones (Table 3). The maximum differences in mineral density were noted for the L1 vertebra – in the EG it was higher relative to the comparison group by an average of 11,8% (p<0,05).

**Table 3.** Bone mineral density (BMD, g/cm<sup>2</sup>) and total mineral content (TMC, g) in the proximal femur and lumbar vertebrae (L1-L4) in subjects of the comparison groups, Me (Q1-Q3)

Skeletal segment zone	Indicator	Nordic all-around (n=12)	Comparison group (n=12)
Proximal femur	TMC	44,8 (42,5-45,9)*	41,4 (39,8-42,2)
	BMD	1,26 (1,23-1,32)*	1,18 (1,16-1,23)
Vertebra - L1	TMC	17,1 (16,6-17,9)*	13,7 (13,1-14,9)
	BMD	1,23 (1,20-1,29)*	1,10 (1,08-1,16)
Vertebra - L2	TMC	20,2 (18,8-21,9)*	16,9 (15,8-17,5)
	BMD	1,30 (1,25-1,33)*	1,21 (1,18-1,23)
Vertebra - L3	TMC	22,3 (20,8-24,1)*	19,4 (18,3-19,9)
	BMD	1,33 (1,28-1,35)*	1,25 (1,23-1,28)
Vertebra - L4	TMC	23,6 (22,3-25,2)*	20,2 (19,2-21,9)
	BMD	1,34 (1,30-1,36)*	1,24 (1,22-1,27)

Note: \* - differences between groups are significant at a significance level of p<0,05.

In young men involved in Nordic all-round sports, an area of increased mineral density of the skeletal bones is formed within the boundaries of the lumbar spine - pelvic girdle - proximal femur. In fact, in the absence of differences in mineral density in other segments, athletes of this type were observed to form a kind of «support» hypermineralized skeletal girdle, which is not observed for athletes of other sports in our previous studies.

**Conclusions.** It has been established that young men involved in northern all-around events have an increase in bone mineral density in individual



skeletal segments that form a special support zone. Elements of northern all-round events can be included in health programs to increase bone mineralization in support zones - the lumbar spine, pelvis and proximal femur, as it can be used in the future to prevent osteopenia, osteochondrosis, and fractures of these segments.

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