

BONES MINERALIZATION STATUS OF SOLDIERS DOING MILITARY SERVICE IN DIFFERENT TYPES OF POLISH ARMY UNITS

STAN MINERALIZACJI KOŚCI ŻOŁNIERZY PEŁNIĄCYCH SŁUŻBĘ W RÓŻNYCH TYPACH JEDNOSTEK WOJSKA POLSKIEGO

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Authors' contribution

Wkład autorów:

- A. Study design/planning
zaplanowanie badań
- B. Data collection/entry
zebranie danych
- C. Data analysis/statistics
dane – analiza i statystyki
- D. Data interpretation
interpretacja danych
- E. Preparation of manuscript
przygotowanie artykułu
- F. Literature analysis/search
wyszukiwanie i analiza literatury
- G. Funds collection
zebranie funduszy

Summary

Background. For proper construction and functioning of human skeletal system a very important thing is adequate supply of calcium, which content in daily rations, in addition to genetics, degree of physical activity and level of sex steroids, is an essential factor influencing on bone mass. Aim of the work: the aim of the work was to assess mineral status of regular soldiers doing military service in different types of Polish military units.

Material and methods. An assessment of bones calcification and protein-energy nutritional status of 1913 men, soldiers doing military service in different types of Polish military units, was made. Body height and body mass were determined by standard methods using a scales and a height-meter. Bone mineral density was measured by DEXA densitometry on forearm bone of non-prevailing arm, using the EXA 3000 apparatus.

Results. Results of densitometry showed that 1594 soldiers, that is 83.3% of subjects had standard bone calcification. Bone mineralization characteristic of osteopenia was found among 304 people, that is 15.9% of examined, while 15 subjects (0.8%) revealed changes characteristic of osteoporosis.

Conclusions.

1. Bone mineral density of 16.7% of examined soldiers serving in different types of military units indicates presence of abnormalities in bone calcification with varying degrees of severity.

2. It is advisable to take among soldiers an extensive health promotion regarding dietary health education aimed at nutritional prevention of bone mineralization disorders can cause fractures and early elimination soldiers from service.

Keywords: mineral nutritional status, bone calcification, soldiers

Streszczenie

Wstęp. Dla prawidłowej budowy i funkcjonowania układu kostnego człowieka bardzo ważną rzeczą jest odpowiednia podaż wapnia, którego zawartość w całodziennej racji pokarmowej, obok uwarunkowań genetycznych, stopnia aktywności fizycznej i poziomu hormonów płciowych, stanowi zasadniczy czynnik wpływający na wartość masy kostnej w organizmie. Celem pracy była ocena stanu odżywienia mineralnego żołnierzy pełniących zawodową służbę wojskową w różnych typach jednostek wojskowych Wojska Polskiego.

Materiał i metoda. Dokonano oceny stanu uwapnienia kości oraz odżywienia białkowo-energetycznego 1913 mężczyzn, żołnierzy, pełniących służbę w różnych typach jednostek wojskowych. Wysokość i masę ciała określano standardowymi metodami przy użyciu wagi i wzrostomierza. Gęstość mineralną kości mierzono metodą densytometryczną DEXA, na kości przedramienia ręki niedominującej, przy użyciu aparatu EXA 3000.

Wyniki. Wyniki badań densytometrycznych wykazały, że 1594 żołnierzy, czyli 83,3% badanych miało uwapnienie kości w normie. Mineralizację kości charakterystyczną dla osteopenii stwierdzono u 304 osób, czyli u 15,9% badanych, podczas gdy u 15 badanych (0,8%) wykazano zmiany charakterystyczne dla osteoporozy.

Wnioski. Stan gęstości mineralnej kości 16,7% badanych żołnierzy pełniących służbę w różnych typach jednostek wojskowych wskazuje na występowanie zaburzeń w ich uwapnieniu o różnym stopniu nasilenia. Celowym jest podjęcie, wśród żołnierzy, szeroko zakrojonej promocji zdrowia w zakresie żywieniowej oświaty zdrowotnej, mającej na celu żywieniową profilaktykę zaburzeń mineralizacji kości.

Słowa kluczowe: stan odżywienia mineralnego, uwapnienie kości, żołnierze

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Background

More than 70% of our skeleton is made of bone tissue i.e. compounds of calcium, phosphorus and magnesium. Bone mineralisation is a dynamic process in which at the same time two processes take place: resorption and osteogenesis. While resorption is a destructive process and consists in destruction of bone tissue, osteogenesis is related with bone tissue mineralisation. Both processes are equally efficient. Therefore imbalance of bone remodeling with predominance of its destruction is cause of osteoporosis and increase of bone fragility. Maximum skeleton mass, known as the peak bone mass, human body gain between 25 and 35 years old. After the age of 40 slow, about 0.3% per year, loss of calcium from bones is observed, which causes a progressive loss of bone mass [1]. Therefore, in osteoporosis prophylaxis it is very important to achieve maximum peak bone mass, which is a major prognostic factor of osteopenia or osteoporosis occurrence risk, and thus possibility of fractures in later periods of life [2]. For proper construction and functioning of human skeletal system a very important thing is adequate supply of calcium, which content in daily rations, in addition to genetics, degree of physical activity and level of sex steroids, is an essential factor influencing on bone mass. Epidemiological studies, conducted in many centers in Poland, indicate existence of numerous irregularities in nutrition manner of Polish population, including shortages of calcium in the diet. Long-lasting, negative calcium balance results in skeletal mineralization disorders manifested as development of osteopenia, and/or osteoporosis [3,4]. Analysis of distributions of daily calcium intake from the diet indicates that 73.5% of food rations of Polish males and 86.9% females is characterized by too low content of this element [5]. Therefore, it is very important to keep positive calcium balance, which will determine advantage of osteogenesis over resorption processes, in nutrition, especially, young people.

In connection with professionalization of the Polish Army and individual feeding system of soldiers, it is not possible to monitor supply of calcium from food, and therefore it seems necessary to conduct random surveys on bone mineralization, the more that such tests are not part of routine physical examinations that are obligatory in the Polish Army.

The aim of the work was to assess mineral status of regular soldiers doing military service in different types of military units.

Material and methods.

An assessment of bones calcification and protein-energy nutritional status of 1913 men, soldiers doing military service in different types of Polish military units, was made.

Body height and body mass were determined by standard methods using a scales and a height-meter. Bone mineral density was measured by DEXA densitometry on forearm bone of non-prevailing arm, using the EXA 3000 apparatus. Bone calcification was evaluated based on the T-score value, in which average value and standard deviation in a group of young adults, regardless of age, were assumed as reference values. As a norm the T score value up to -1 was accepted. It means that value of bone mineral density is not lower than one standard deviation below average value. The T-score value between -1 and -2.5 is characteristic for osteopenia, while the value below -2.5 for osteoporosis [6].

Results

Average age of examined soldiers amounted to 31.6 ± 3.73 (26.4 - 37.2). Average body mass and body height amounted to 83.9 ± 3.7 kg (74.4 - 89.6 kg) and 177.9 ± 2.1 cm (174.2 cm - 181.4 cm) respectively. (table 1)

Table 1. Basic parameters characterizing examined groups of Polish Army

Type of military service	Age of subjects [years]	Body height [cm]	Body mass [kg]
Pilots	37.2±6.4	177.6±5.2	86.6±10.8
Board technicians	31.9±1.8	177.1±6.7	87.2±12.7
Medical aircraft crew			
doctors	35.8±2.9	180.6±6.8	89.6±14.7
paramedics	35.7±5.4	176.3±5.2	84.3±10.4
Parachutists	33.6±5.8	175.3±4.2	74.4±8.6
Navy sailors	29.0±5.2	176.3±5.7	82.4±11.8
Armoured warfare	29.9±5.4	177.7±5.7	86.0±11.1

Chemical troops	27.2±3.9	177.6±6.2	80.9±11.5
GROM - special operations forces unit	30.0±3.4	179.5±6.6	85.8±10.0
Soldiers going to ISAF in Afghanistan	27.2±3.9	177.6±6.2	80.9±11.5
Representative Battalion	30.4±5.1	180.7±4.3	85.4±10.2
Representative Cavalry Regiment	26.5±4.0	179.8±5.8	80.4±10.4

Results of densitometry showed that 1594 soldiers, that is 83.3% of subjects had standard bone calcification. Bone mineralization characteristic of osteopenia was found among 304 people, that is 15.9% of examined, while 15 subjects (0.8%) revealed changes characteristic of osteoporosis (table 2).

Table 2. Bone calcification of examined soldiers (%) [7,8,9,10,11,12]

Type of military service	Standards bone calcification T score ≥ -1	Osteopenia 1 <T score $\geq -2,5$	Osteoporosis T score < -2,5
Pilots	87.6	12.4	-
Board technicians	84.5	15.5	-
Medical aircraft crew			
doctors	86.6	6.7	6.7
paramedics	85.7	14.3	-
Parachutists	98.0	2.0	-
Navy sailors	76.5	22.7	0.8
Armoured warfare	88.6	9.6	1.8
Chemical troops	92.6	7.4	-
GROM - special operations forces unit	90.9	9.1	-
Soldiers going to ISAF in Afghanistan	81.6	17.4	1.0
Representative Battalion	85.3	13.7	1.0
Representative Cavalry Regiment	75.0	20.8	4.2

Discussion

The best bone mineralization was found among parachutists and soldiers serving in a special unit "GROM" which is most likely a result of a special selection of men to serve in this type of unit. It seems that changes characteristics of osteopenia found among over 20% of examined soldiers serving in the Representative Cavalry Regiment result from too low calcium supply with the diet during adolescence period, because average age of the subjects didn't exceed 26 years. Changes in calcification of skeleton characteristic of osteoporosis were found in a small percentage of subjects. They were found mainly among medical aircraft crews.

Abnormalities in calcification of skeleton occur also among soldiers of other armies. Examination of skeletal system of British soldiers, participants of the Gulf War, revealed significant reduction of osteogenesis, what authors associated with exposure to potentially harmful conditions of service [13]. This suggestion is confirmed by results of tests carried out among Polish soldiers returning from a mission in Afghanistan, which also showed abnormalities in mineralization of bones [9]. Results of carried out in 2006 tests of 2329 US soldiers, men and women doing 12 months service in Iraq, revealed 5252 cases of fractures or dislocations. Similar examinations of 375 men and 138 women during basic training in the Israeli artillery has revealed occurrence of fractures of femoral bone and tibia much more common among women. As result of carried out studies modification of military training programs according to sex was recommended [14].

Conclusions

1. Bone mineral density of 16.7% of examined soldiers serving in different types of military units indicates presence of abnormalities in bone calcification with varying degrees of severity which can cause fractures and early elimination soldiers from service.
2. It is advisable to take among Polish soldiers an extensive health promotion regarding dietary health education aimed at nutritional prevention of bone mineralization disorders.

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