DESCRIPTION FOR THE GENERAL PUBLIC

Osteoporosis is currently the most frequently diagnosed systemic metabolic disease of the skeleton, characterised by reduced density of the bones and by weakening of the micro-architecture of bone tissue, which, in effect, is connected with increased susceptibility to fractures. An effect of the demographic changes that are taking place in European populations will be a significant increase in the frequency of osteoporosis in both women and men. By the year 2025, the number of Europeans with osteoporotic changes will have reached 33.9 million, which means an increase by 23% in comparison with the year 2010, when the number was 27.5 million. The risk factors for accelerated bone mass density (BMD) loss of the skeleton include primarily: sex and age (the rate of bone mass loss is significantly accelerated in women after menopause because of changes in the hormone economy), the low value of peak bone mass, and, in the case of women, also a late age of menarche, low values of the weight-height proportion, irregular nutrition, diet poor in calcium and in vitamin D, low physical activity, alcohol consumption, and tobacco smoking. Most of the environmental risk factors for osteoporosis present in contemporary human populations also influenced accelerated bone mass loss in historical populations, although this impact could be smaller and could generate different dynamics of the changes and a different direction of the dimorphic differences. What could also be different is the genetic susceptibility of historical populations to osteoporosis. The most frequently analysed gene polymorphisms linked with disorders of bone mass density of the skeleton include polymorphisms of: the vitamin D receptor gene (*VDR*), the oestrogen receptor gene (*ER*), the type I collagen receptor gene (*COLIA)* and the LDL-receptor-related protein 5 (*LRP-5*). The increasing frequency of osteoporotic changes diagnosed in contemporary human populations, not only in women at postmenopausal age (which would reasonably have been expected considering the aging societies), but also among young women and among men, has caused an increased interest in osteoporotic changes also in historical populations. Researchers attempt to understand the dynamics of the process in terms of the temporal changes by joining the mainstream of research in the area of evolutionary medicine. Analyses confirm the fact that osteoporotic disorders were an affliction of human populations in the past, increasing from the Neolithic along with the transition from the hunter-gatherer economy to agriculture and breeding economy. The results of the studies are, however, inconsistent. Some of them indicate a significant bone mass loss only in women at postmenopausal age. In other studies, researchers suggest a pattern of the process different from contemporary populations, indicating no explicit sexual dimorphism and no bone mass density loss of the skeleton linked with age, or even a reduction of bone density of the skeleton in young women at perireproductive age. The authors of most of the cited studies on BMD stress in their publications that there is still a lack of comprehensive research carried out from a chronological perspective in one geographical area, research connecting an analysis of bone mass loss assessed using the DEXA method and analysis of trabecular bone architecture (TBA) of the vertebrae, research additionally preceded by an estimation of diagenetic changes and supplemented with a macroscopic assessment of the frequency of osteoporotic fractures and an identification of potential genetic differences within gene polymorphisms connected with osteoporosis.

The scientific aim of the project is to fill this gap and to determine the pattern of variability in bone mass loss and to assess the frequency of osteoporotic fractures in adult men and women representing four chronologically varied human populations living in the same area – Kuyavia (the north-central part of Poland) during the Neolithic (4600-4000 BC), the early Middle Ages (11^{th}-13^{th} century AD), the Middle Ages (12^{th}-16^{th} century AD) and in modern times (16^{th}-19^{th} century AD) with an evaluation of genetic susceptibility to osteoporosis. It will allow an identification of the changes and the dynamics of the process of bone mass density loss of the skeleton with age over 6 thousand years.

The examination of human skeletons from the past will make it possible to reconstruct and to understand the way that has led human populations to the present state, where a significant part of the population of the developed countries is affected by osteoporotic changes, and to join in prognoses of changes of this phenomenon in the future. It will also make it possible to answer the question whether the current prevalence of osteoporosis is only a side effect of civilisational changes of human populations, e.g. prolonged life expectancy and changes in the physical activity, or also a consequence of changes in the genetic structure, e.g. resulting from the disappearance of the effect of natural selection. Knowledge about how the genetic and the environmental factors have been shaping the processes of bone mass loss and of bone mass density loss is of practical significance for the planning of methods of treatment and prevention of osteoporosis in the future.