

Abstract of the dissertation

Author's name & surname: Agata Bisiecka

Title of the dissertation: The presence of Wormian bones of the human skull (WBs) as an indicator of developmental instability

Field of study: natural sciences

Discipline: biological sciences

Date of abstract's preparation: 12.09.2023

Keywords: anthropometry; non-metric features; accessory bones; Wormian bones; physiological stress

Introduction: Wormian bones of the human skull (WBs) are the irregular structures occurring as an effect of formation of the additional ossification centers within non-mineralized mesenchymal tissue. Their etiology has not been fully explained so far; the interaction of genetic and environmental factors is assumed. The absence of WBs or their small number in an individual is a typical phenomenon usually not associated with pathological conditions. However, there are medical criteria for treating them as an indicator of possible pathology. The presence of WBs is perceived as an evidence of uneven growth of the skull and brain, and the mechanism of their formation is explained as a developmental compensation of the skull bones. Between them an additional ossification center occur, accelerating ossification and enlarging its area to maintain the consistency of the braincase. There are also other skeletal signs of developmental disturbances in individual – so-called determinants of physiological stress: *cribra orbitalia* and linear enamel hypoplasia (LEH), among others. Since WBs often accompany conditions that limit an individual's ability to function in the environment, it was assumed that their occurrence could be interpreted as another determinant of physiological stress.

Aim of the study: To assess the possibility of interpreting the presence of WBs in the human skull as an indicator of developmental instability suitable for anthropological, bioarchaeological and related research on historical and contemporary populations as another skeletal determinant of physiological stress. This goal was achieved by assessing the relationships between the occurrence, number and size of WBs with gender, basic measurements of cranial chords and arches, the presence of other cranial non-metric traits and physiological stress determinants, as well as with calculated body height.

Material and methods: The study involved 317 adult individuals from the Ostrów Lednicki and Bokštro gatve 6 and Subačiaus gatve 7 skeletal series. Anthropometric techniques (including photometric analysis of the WBs surface and measurements of the postcranial skeleton), cranioscopic techniques (including assessment of the presence of cranial non-metric traits and *cribra orbitalia*), odontological (including assessment of the LEH) have been used. Statistical analyzes were performed in Statistica 13.5 software, and selected analyzes were performed in the R environment (R Studio).

Results: WBs occurred in the Ostrów Lednicki series with a frequency of 86.7% (♂) and 70% (♀), and 75.6% and 60.9% in the Lithuanian series, respectively. In males from both series, the WBs were more numerous, and in males from Ostrów Lednicki they were larger than in females. Significant differences in skull measurements due to the presence of WBs were observed in the Ostrów Lednicki (♂: *eu-eu, co-co*; ♀: *mst-mst*), Bokštro gatve 6 (♂: *n-b, n-ba, ol-sta*; ♀: *fol-fol*), Subačiaus gatve 7 (♀: *pr-ba*). The number of WBs correlated with the measurements: Ostrów Lednicki (♂: *eu-eu, co-co, mf-ek*; ♀: horizontal circumference, arch *n-o*, arch *b-l*), Bokštro gatve 6 (♂: *ol-sta*; ♀: *fol-fol*), Subačiaus gatve 7 (♂: *l-o*, arch *l-o*; ♀: *n-pr, pr-ba, zy-zy*). The WBs size category was associated with the value of the measurements: Ostrów Lednicki (♂: *eu-eu, mf-ek*; ♀: *n-b, b-l*, horizontal circumference, sagittal arches, *zy-zy*), Bokštro gatve 6 (♂: *n-b, n-ba, ol-sta*; ♀: *fol-fol*), Subačiaus gatve 7 (♂: *ba-o*; ♀: *n-pr, pr-ba, zy-zy*). The value of the cranial index differed significantly among males from Ostrów Lednicki with present or absent WBs. It also correlated with WBs number differed between groups specified according to their size. *Cribra orbitalia* in the Ostrów Lednicki series were observed more often in males with an 'increased' and 'high' number of WBs. LEH occurred more frequently in individuals with WBs. WBs were also more numerous in females with linear enamel hypoplasia.

Conclusions: There are gender differences in the occurrence, number and size of WBs, indicating a predominance of these phenomena in males. WBs are related with some skull dimensions, especially those associated with its width, but have no effect on the other non-metric traits. Their relationship with *cribra orbitalia* and LEH has been preliminary confirmed, although this issue requires further research. However, they are not related to the body height.

Significance of the research: The role of WBs as an indirect determinant of physiological stress useful in analysis of skeletal remains has been preliminarily confirmed. Their critical thresholds were defined: number above 10 and size above 2 cm in at least one of the

dimensions. WBs meeting these criteria should be treated as an indication for in-depth diagnostics of the individual. Moreover, the discussion showed significant methodological differences in the approach to the suture bones. The results of this dissertation support the development of anthropology, biomechanics, biomedicine and related sciences.