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A BRIEF HISTORY OF THE EUROPEAN ANTHROPOLOGICAL ASSOCIATION (EAA)

WITH SPECIAL THANKS TO ANITA SUJOLDZIC, PAVAO RUDAN, CHARLES SUSANNE,
THE EAA BOARD AND PAST PRESIDENTS

C. G. Nicholas Mascie-Taylor

Past EAA President and Honorary Member
University of Cambridge, UK

This presentation describes the historical origins of the EAA starting in 1968 to its formal foundation in Zagreb on October 7th, 1976. It provides information on the known 155 founding members and the initial administrative structure and organisation. The contributions of key people in running and furthering the aims and objectives of the EAA over the last 50 years are acknowledged.

A total of 24 congresses have been held (including this one) in 15 countries and 18 different locations; 4 in Croatia, 3 each in Denmark and Hungary and 2 each in Greece and Poland. There have been 14 EAA Presidents from 12 countries, of whom 4 have been women. The maximum term a President can serve is now 4 years. The EAA has elected 17 Honorary members, from 9 countries, 4 from UK, 3 from Hungary and 2 each from Belgium, Czechoslovakia and France.

The current EAA administrative structure is described. Successful EAA activities over the last 50 years are detailed including the newsletter, student prizes, colloquia, summer schools, the EAA website, biennial books, the focus on early career researchers, the very popular webinar programme and finally the EAA 50th anniversary book comprising 37 chapters written by 63 EAA members from 17 countries. We have much to celebrate!

INVITED LECTURES

LIFE AND DEATH IN ROMAN PANNONIA: RECONSTRUCTING DIVERSITY THROUGH MULTIPROXY ANALYSES

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This presentation introduces the conceptual framework and initial results of the speaker's five-year Momentum (Lendület) Bioarchaeology Research Project funded by the Hungarian Academy of Sciences. Launched in late 2023, the project investigates local and immigrant populations inhabiting the northeastern part of Transdanubia, within the Roman province of Pannonia, between the 1st and 4th centuries CE. By integrating archaeological evidence, burial data, physical anthropology, isotope analyses, and archaeogenetics, the project applies a multiproxy bioarchaeological approach to reconstruct mobility, biological relationships, lifestyle, social organization, and mortuary practices. This framework expands the study of Pannonia beyond the archaeological and epigraphic sources on which research has traditionally relied.

The archaeogenetic component comprises approximately 200 newly generated ancient genomes, complemented by pre-publication genome-wide data from Sarmatian-associated individuals buried east of the Danube in the region of present-day Pest County. Genome-wide analyses reveal densely interconnected communities and a pronounced temporal shift east of the Danube. Earlier individuals show close genetic affinities with Central European populations, whereas individuals dating to the 5th century exhibit substantial ancestry related to East Eurasian and Near Eastern/Caucasus populations. In contrast, Late Roman individuals excavated west of the Danube display high genetic diversity, limited close biological relatedness within and between cemeteries, and evidence of admixture with populations originating beyond the Roman frontier.

Together, these findings highlight the complex and dynamic demographic history of the Pannonian frontier zone.

Keywords: Pannonia; Roman period; Sarmatians; Bioarchaeology; Ancient DNA; Population genetics; Identity-by-descent.

THE CONTRIBUTION OF COHORT STUDIES IN BIOLOGICAL ANTHROPOLOGY, MEDICINE, EPIDEMIOLOGY AND SOCIAL SCIENCES

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The presentation begins with a brief overview of possible study designs of which cohort studies is one type of observational study.

Part I describes how a cohort study design was used to measure the impact of a 10-year project to move (“graduate”) 1 million Bangladeshis out of extreme poverty. The project involved different income generating activities (e.g. providing cattle, crop cultivation, small businesses and handicraft production) and worked with 29 non-government organisations across Bangladesh in both urban and rural settings. 11 surveys were carried out (7 annual) on the same 1700 households between 2010-2016 measuring income, expenditure, productive assets, morbidity, nutritional status, food security, food diversity and gender empowerment. Using a Repeated Measures Anova, significant within-subject improvements in all domains were found while male-headed households were more successful than female-headed households. Overall, 1,160,000 people were lifted out of extreme poverty. A second example of a cohort design with repeated measures was a Chilean study which revealed feeding fortified cow’s milk to young babies, rather than breastfeeding, led to increased overweight and obesity.

Part II briefly describes the history of cohort studies and the pros and cons of this study design. Three celebrated studies, the Framingham (USA) heart study which commenced in 1948, the Japan Atomic Bomb Survivor cohort (1950) and the British Doctors 1951 study on smoking and lung cancer all revealed the benefits to health of a cohort design.

Part III reviews an on-going Cambridge University led adult Bangladeshi cohort study examining non-communicable diseases in urban, slum and rural settings. It shows high prevalence at baseline of hypertension (23%) and type II diabetes (16%) with a further 8% undiagnosed. Only 25% of hypertensives are diagnosed, treated and controlled. 29% of slum residents are depressed compared with 15% and 8% in urban and slum, respectively. Multimorbidity (more than 2 conditions) increases with age and is greatest in the wealthiest quintile.

Part IV discusses birth cohorts, some large country cohorts, cohort consortia and opportunities and challenges to international collaboration in cohort studies.

Keywords: Cohort studies; Public health; Health inequalities; Epidemiology.

FROM MUMMIES TO PATHOGENS: PALEOGENETICS AND ANCIENT HUMAN REMAINS

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The application of next-generation sequencing (NGS) to ancient human remains has revolutionized the study of past populations by enabling the recovery of ancient human and microbial DNA. Paleogenetic analyses of mummies and archaeological skeletons provide unique insights into human history while transforming our understanding of the origins, evolution, and spread of infectious diseases. By identifying ancient pathogens and reconstructing their genomes, ancient DNA has become an indispensable tool for investigating the health, evolution, and disease burden of past populations.

One of the earliest and best-known applications of palaeogenetics is the investigation of the Tyrolean Iceman, Otzi. Using metagenomic diagnostics and targeted genome capture, we identified the gastric pathogen *Helicobacter pylori* and reconstructed its complete genome. Comparative genomic analyses revealed a virulent strain belonging to a predominantly Asian ancestral lineage, providing new insights into the evolutionary history and dispersal of *H. pylori* in Europe. Naturally mummified human remains from Vac, Hungary, have proven to be an exceptional source for the molecular detection of ancient pathogens. The reconstruction of complete *Mycobacterium tuberculosis* genomes from these mummies has greatly advanced our understanding of the long-term evolution, diversity, and adaptation of the tuberculosis pathogen while demonstrating the enormous potential of ancient DNA for investigating historical infectious diseases. Our investigations of mummies from Pharaonic Egypt combine morphological, radiological, and molecular methods to reconstruct health and disease in ancient populations. High-resolution computed tomography together with ancient DNA analyses has enabled the identification of infectious diseases, vascular pathologies, and genetic predispositions. A notable example is the detection of ancient *Plasmodium falciparum* DNA in Tutankhamun, providing direct molecular evidence for malaria tropica in ancient Egypt.

Together, these examples demonstrate how palaeogenetics has transformed the study of ancient human remains by enabling the direct detection of pathogens and providing unique insights into the long-term co-evolution of humans and infectious diseases.

Keywords: Ancient DNA; Paleogenetics; Mummies; Ancient pathogens; Paleopathology.

DRAGUTIN GORJANOVIC KRAMBERGER, KRAPINA AND VINDIJA SITES AND THEIR ROLE IN NEANDERTHAL RESEARCH

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The two Croatian sites that have yielded Neanderthal skeletal remains – Krapina (Husnjakov brijeg) and Vindija Cave – have played a pivotal role in the study of human evolution and the development of modern palaeoanthropology as a scientific discipline. Excavations at Husnjakov brijeg in Krapina, conducted by Dragutin Gorjanovic-Kramberger between 1899 and 1905, produced one of the largest Neanderthal skeletal collections, representing individuals of various ages and both sexes. This exceptional assemblage provides unique insights into the population variation of Neanderthals living approximately 130,000 years ago. Numerous stone tools and faunal remains recovered from the site have also contributed to our understanding of Neanderthal behaviour. Gorjanovic-Kramberger's pioneering studies provided crucial evidence at a time when the age, taxonomy and phylogenetic status of Neanderthals were intensely debated.

Excavations at Vindija Cave, led by Mirko Malez, uncovered fragmentary remains of late Neanderthals dated to approximately 45 ka, when the first anatomically modern humans had already reached Europe. Certain morphological features of the Vindija Neanderthals have been interpreted by some researchers as evidence of either biological continuity or admixture with incoming modern humans. Archaeological finds from the site have also stimulated debate regarding cultural interactions between these populations. In 2010, DNA extracted directly from Vindija Neanderthal bones yielded the first draft sequence of the Neanderthal nuclear genome, demonstrating that Neanderthals contributed genetically to present-day human populations. This landmark discovery transformed our understanding of human evolution and helped establish the field of palaeogenomics.

Keywords: Neanderthals; Modern human origins; Palaeogenomics; Palaeoanthropology; Croatia.

SYDEL SILVERMAN'S UNIFIED ANTHROPOLOGY

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Every year, when teaching the history of cultural anthropology, I tell my students that American anthropology is traditionally divided into four subfields: cultural anthropology, biological (or physical) anthropology, archaeology and linguistic anthropology. And, of course, when discussing the American historical particularist tradition in my course Theories and Methods in Anthropology, Franz Boas invariably emerges as a scholar who worked across all four fields. Does this mean that we can meaningfully speak of the unity of anthropology? Or is such unity merely an illusion produced by a powerful disciplinary narrative, masking what are in fact irreconcilable differences among the four subfields? Was the fragmentation of anthropology merely a consequence of the publication and misinterpretation of Thomas Kuhn's *The Structure of Scientific Revolutions* (1962)? Or do the seemingly endless debates among the subfields reflect a more fundamental tension arising from the incompatible epistemological commitments of the natural sciences and the humanities?

In 1999, in Cabo San Lucas, Mexico, Sydel Silverman (1933–2019) attempted to foster dialogue among scholars representing the four subfields of anthropology. This meeting, titled *Anthropology at the End of the Century*, brought together leading anthropologists to reflect on the state of the discipline at the turn of the millennium. Silverman, who served as President of the Wenner-Gren Foundation for Anthropological Research from 1987 to 1999, regarded the symposium as the culmination of a broader effort to reassess anthropology's past and future. The conference addressed both the development of twentieth-century anthropology and the challenges facing the discipline in the twenty-first century. One of Silverman's central ambitions was to strengthen the idea of anthropology as an integrated discipline. Why did she consider this goal so important? And to what extent does this vision remain relevant today?

Keywords: Interdisciplinarity; Anthropological paradigms; Sydel Silverman.

SHIFTING MENSTRUAL PATTERNS AND RISING PREMENSTRUAL SYMPTOMS OVER THE PAST DECADES (1998–2025) AMONG YOUNG LITHUANIAN WOMEN

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Research increasingly suggests that menstrual cycle characteristics are associated with long-term physical (cardiovascular disease, metabolic disorders, breast cancer) and mental health. Early or late menarche, irregular cycles, changes in cycle length, menstrual bleeding may be associated with reproductive lifespan and biological aging. Recent studies also raise the question of whether the increasing incidence of PMS reflects a true increase or improved detection. There is a lack of research examining the characteristics of the menstrual cycle, its trends, and biopsychosocial factors.

The aim of this study was to analyse changes in timing of menstruation, cycle length, bleeding length and premenstrual (PMS) symptoms over the past 20–30 years in young Lithuanian women.

For this purpose, the menstrual cycle characteristics of young (16–25 years old) Lithuanian women were analysed using studies from 1998–2002 (N=1405), 2010–2014 (N=1447), and 2021–2025 (N=1385).

The mean age at menarche decreased from 13.22 years (1998–2002) to 12.38 years (2021–2025). The duration of the menstrual cycle increased (from 27.8 to 28.4 days, $p<0.05$), as did the frequency of menstrual bleeding (from 4.0 to 4.78 days, $p<0.01$) and the prevalence of irregular cycles (from 24% to 35%, $p<0.05$). As for the different PMS symptoms, their prevalence increased several-fold (on average from 24% to 89%). In 2025, almost all women (99%) experienced at least one PMS symptom in the premenstrual week or during the menstrual phase (97%), but as many as 88% of women also experienced a PMS attributed symptom in the middle of the cycle. The most common symptoms were fatigue, stress, and breast tenderness. More common premenstrual symptoms were associated with longer menstrual cycles and bleeding, sexual activity, increased use of social media, and dissatisfaction with one's body image.

Keywords: Menstrual cycle; Premenstrual syndrome; Changes and trends; Biopsychosocial factors.

ORAL PRESENTATIONS

DEGRADATION PROCESSES OF HAIR IN AQUATIC AND SOIL CONDITIONS

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Background: Background: Hair is a biological substrate that can yield valuable insights in both archaeology and forensic science. While prior research has predominantly addressed post-mortem alterations, this study concentrates on hair forcibly removed during life (ante-mortem). The primary objective was to characterize patterns of hair degradation in aquatic and soil environments.

Material and methods: Approximately 20 hairs were collected from each of 109 volunteers by ante-mortem extraction, following approval from a bioethics committee. Samples were obtained from adult women and men and included a range of hair colours, namely blond, grey and dark. The collected hairs were then placed in two types of soils and two types of water to simulate different depositional environments. Over a six-month period, hair roots were systematically observed under a microscope and documented through photographic records. Based on these observations, a degradation scale was developed, with particular emphasis on morphological changes within the brush-like structure of the hair root.

Results: Findings indicate that in aquatic settings, progressive structural alterations of the root region may serve as a useful indicator for estimating the post-mortem interval (PMI). In contrast, degradation processes in soil are largely influenced by the activity of keratin-degrading (keratinolytic) and keratin-associated (keratinophilic) fungi. The growth and metabolic processes of these microorganisms were shown to be highly influenced by temperature, making it a key determinant of both the speed and degree of hair decomposition.

Conclusion: This study highlights distinct pathways and influencing factors of hair degradation across different depositional contexts. The proposed scale offers a potential tool for forensic applications, particularly in refining PMI estimation in water environments and understanding biologically mediated decomposition in soil.

Keywords: Post-mortem interval; Hair degradation scale; Brush-like hair root; Dermatophytes; Aquatic and soil environment.

DECODING FACIAL SOFT TISSUE THICKNESS IN THE POLISH POPULATION USING MULTIPLANAR RECONSTRUCTION

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Background: Forensic facial reconstruction (FFR) is an important tool in human identification, and its accuracy depends on the use of appropriate facial soft tissue thickness (FSTT) values. Contemporary FSTT data for Central European populations, including Poles, is scarce. The application of generalized values derived from ethnically heterogeneous groups may introduce errors and reduce the reliability of facial approximations.

Objective: The aim of this study was to establish a comprehensive database of FSTT values for the adult Polish population. By providing contemporary, population-specific reference data, this study seeks to improve the accuracy and reliability of forensic facial reconstructions in Central Europe.

Materials and methods: FSTT measurements were obtained from computed tomography (CT) scans of healthy adult Polish individuals (n = 100), stratified by sex, age (18–85 years), and body mass index (BMI). Measurements were performed at standardized craniofacial landmarks, including 12 midline and 19 bilateral points, using specialized DICOM viewer software.

Results: Significant sexual dimorphism was observed at most landmarks, with males exhibiting greater soft tissue thickness than females, particularly in the mandibular and midfacial regions. Notable differences were found between the Polish sample and commonly used international reference datasets, indicating population-specific facial morphology. Additionally, associations were identified between soft tissue thickness and age and/or BMI at selected landmarks. Although BMI was a significant predictor of FSTT, the interaction between sex and BMI was not statistically significant ($p > 0.05$), indicating that the observed sex differences are independent of BMI.

Conclusions: This study provides a rare and valuable dataset that addresses a significant gap in European forensic anthropology. Population-specific FSTT standards are indispensable for accurate facial approximations. This database will constitute a definitive reference for forensic identification in Poland and represents a significant step in the implementation of our project aimed at reconstructing facial appearance based on genetic and epigenetic data.

Keywords: Facial soft tissue thickness; Craniofacial landmarks; CT scans; Poland.

Acknowledgement / Funding Source: The study received funding from the National Science Centre, Poland, grant number 2024/53/B/NZ8/02535.

MULTIMODAL MORPHOLOGICAL DESCRIPTION OF A CENTRAL EUROPEAN POPULATION: THE A.D.A.P.T. SW PLATFORM AND FIDENTIS DATABASE

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Background: The Anthropological Database of Body Proportions (A.D.A.P.T.) project was established as a multimodal morphological database with the primary aim to describe the variability in the Central European population.

Materials and methods: The A.D.A.P.T. SW platform includes adults of both sexes across a broad age and BMI spectrum. Standardized anthropometric measurements are combined with high-resolution 3D body and facial scans, whole-body MRI data and demographic metadata. These allow analyses of body shape variability, proportionality, adiposity distribution and sex- and age-related differences. It is complemented by the FIDENTIS that represents a large-scale 3D facial database designed for the analysis of facial morphological variability in a Central European population (adults and sub-adults). Facial data are acquired using stereophotogrammetric systems.

A key methodological contribution of A.D.A.P.T. and FIDENTIS analytical approaches is utilized and demonstrated within a unified 3D analytical framework where longitudinal pre- and post-operative bariatric datasets from the Kardiovize project at Saint Anne University Hospital are analysed using surface analysis based on geometric morphometrics of dense 3D surfaces, enabling quantification of regional facial soft-tissue changes following major weight loss.

Results: Clinical applications submitted for funding include craniofacial and neck morphology in obstructive sleep apnea, and machine-learning-based prediction of insulin resistance from body composition and surface morphology. Longitudinal bariatric cohorts enable detailed assessment of coordinated facial-body morphological transformation following major weight loss, with quantification of regional soft-tissue redistribution and shape change. In ergonomics, the A.D.A.P.T. platform is used for clothing and protective equipment design, optimization of sizing systems and evaluation of body-shape compatibility in occupational and extreme-environment settings. In parallel, the FIDENTIS database is increasingly applied in ergonomic contexts focused on wearables and facially interface-dependent protective equipment.

Conclusions: Future development targets advanced clinical risk modelling, multimodal body composition analysis and predictive modelling of morphological change. The platforms support international collaboration in comparative anthropology, geometric morphometrics, biomedical anthropology and ergonomics, particularly in cross-population variability research and personalized morphological prediction systems.

Keywords: 3D human body modelling; Body surface and composition analysis.

CALCANEAL QUANTITATIVE ULTRASONOMETRY AS A FIELD-FRIENDLY TOOL FOR BONE QUALITY ASSESSMENT IN ITALIAN POSTMENOPAUSAL WOMEN: ASSOCIATIONS WITH BODY COMPOSITION AND MENOPAUSAL DURATION

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Background: In postmenopausal women, bone quality assessment is essential for identifying skeletal fragility risk. The calcaneal Bone Quality Index (BQI), assessed via quantitative ultrasound (QUS), represents a non-invasive, field-friendly alternative to dual-energy X-ray absorptiometry (DXA).

Objective: To investigate the associations between BQI, body composition, menopausal duration and functional variables in Italian postmenopausal women.

Subjects and methods: A cross-sectional study design – in which all measurements were taken at a single point in time – was conducted on 138 Italian postmenopausal women (mean age: 61.1±5.3 years; mean years since menopause (YSM): 10.5±6.1 years). BQI was assessed using calcaneal QUS (SONOST 3000). Body composition was assessed through bioelectrical impedance analysis (BIA 101, Akern), providing fat-free mass (FFM), fat mass (FM) and fat percentage (%F). Handgrip strength (HGS) was measured bilaterally using a dynamometer. Pearson correlations and two multiple linear regression models were performed using BQI as the dependent variable: a background model (age, YSM, BMI) and a body composition model (%F, FFM, HGS). A simple linear regression with YSM alone was also conducted.

Results: BQI showed significant negative correlations with age ($r=-0.30$, $p=0.0003$) and YSM ($r=-0.34$, $p<0.0001$), and positive correlations with BMI, FFM and FM ($r=0.18$ for all, $p=0.033$). No significant correlations emerged for %F and HGS. The body composition model was not statistically significant ($F=1.864$, $R^2=0.040$, $p=0.139$), whereas the background model was statistically significant ($F=7.133$, $R^2=0.138$, $p=0.0002$), with YSM as the strongest predictor ($p<0.0001$). In simple linear regression, YSM alone explained 12% of BQI variance ($R^2=0.120$, $p<0.0001$).

Conclusions: Menopausal duration is the primary determinant of calcaneal bone quality in postmenopausal women, independent of body composition. These findings support the use of calcaneal QUS as a field-friendly pre-screening tool for bone quality monitoring in non-clinical and large-scale epidemiological settings.

Keywords: Postmenopause; Calcaneal QUS; Bone health; Body composition; Ageing.

EARLY GUT MICROBIOTA DEVELOPMENT AND CATCH-UP WEIGHT GAIN IN FULL-TERM SMALL FOR GESTATIONAL AGE INFANTS IN THE FIRST YEAR OF LIFE

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Background: The gut microbiota undergoes dynamic changes during infancy, a period that coincides with intensive early growth and metabolic development.

Objective: This study aimed to assess gut microbiota colonization patterns in full-term small for gestational age (SGA) infants with catch-up weight gain during the first year of life.

Subjects and methods: The longitudinal cohort study included 19 full-term SGA infants and 46 full-term infants born appropriate for gestational age (AGA). Stool samples and body weight measurements were collected at several points throughout the first year of life. Gut microbiota composition was assessed using 16S rRNA gene sequencing. Microbial composition and diversity across developmental stages were evaluated using alpha diversity, beta diversity, and taxa abundance analyses. The relationship between the rate of weight gain and the pace of gut microbiota maturation was also examined.

Results: SGA infants demonstrated higher alpha diversity than AGA infants at most time points. In the SGA group, the Shannon index, reflecting gut microbiota maturation, was positively associated with the rate of body weight gain over time ($p=0.015$), whereas no such association was observed in AGA infants. Genera characteristic of SGA group included *Citrobacter*, *Staphylococcus*, *Blautia*, *Veillonella*, *Klebsiella* and *Clostridium XIVa*.

Conclusions: Overall, SGA infants exhibited a distinct gut microbiota profile with higher alpha diversity compared with AGA peers. In this group, a more mature microbiota was associated with faster weight gain and a greater abundance of short-chain fatty acid-producing and obesity-associated bacteria, suggesting that early microbial development may contribute to the risk of overweight and obesity later in life.

Keywords: Small for gestational age; Catch-up growth; Gut microbiota; Body mass.

Acknowledgement / Funding Source: Grant MINIATURA 4 (2020/04 /X /NZ7/00308) from the National Science Centre (NCN), Poland.

ASSOCIATION BETWEEN GUT MICROBIOTA COMPOSITION AND BODY HEIGHT IN CHILDREN BORN SMALL FOR GESTATIONAL AGE IN THE SECOND YEAR OF LIFE

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Background: Early-life gut microbiota development plays an important role in child growth and metabolic health. Children born small for gestational age (SGA) often show altered growth trajectories compared with those born appropriate for gestational age (AGA). However, the relationship between gut microbiota maturation and linear growth in these groups remains insufficiently understood.

Objective: The aim was to investigate the association between gut microbiota diversity and body height in SGA children in the 2nd year of life, compared with children born AGA.

Subjects and methods: Fecal samples were collected from 39 children (15 SGA and 24 AGA). DNA was isolated and the bacterial 16S rRNA gene was sequenced using Oxford Nanopore Technologies (MinION platform). Bioinformatic and statistical analyses were performed using MetaG pipeline, as well as MicrobiomeAnalyst and Python tools. Gut microbiota alpha diversity was estimated using the Shannon diversity index. Body height was standardized to height-for-age z-scores according to World Health Organization growth standards. Spearman correlation analysis was used to assess the relationship between height z-score and gut microbiota alpha diversity.

Results: No significant correlation between height z-score and gut microbiota alpha diversity was observed in the SGA group. In contrast, a significant positive correlation was found in the AGA group ($p < 0.05$). As alpha diversity is considered a marker of gut microbiota maturation, these results suggest that in AGA children linear growth occurs in parallel with microbiota succession. In SGA children, microbiota development appears to be uncoupled from linear growth.

Conclusions: A positive association between gut microbiota diversity and height was observed in AGA children but not in SGA children.

Keywords: Small for gestational age; Body height; Gut microbiota.

Acknowledgement / Funding Source: Grant MINIATURA 4 (2020/04 /X /NZ7/00308) from the National Science Centre (NCN), Poland.

BODY COMPOSITION CHARACTERISTICS AS THE MODERATORS OF PAIN THRESHOLDS CHANGES IN DIFFERENT THERMO-CLIMATIC CONDITIONS

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Background: Pain perception (PP) is a complex human trait shaped by biological characteristics and environmental conditions. From an anthropological perspective, variability in pain sensitivity reflects interactions between body build, physiological regulation and external stressors (e.g. hypoxia, thermal extremes). Body composition influences thermoregulation and metabolic processes and may therefore contribute to individual differences in sensory thresholds, pain thresholds and pain tolerance.

Objective: The aim was to assess whether body composition is associated in differences in PP under various environmental conditions.

Subjects and methods: The study included 45 individuals (62% men, mean age 27.96). Participants completed controlled laboratory sessions in a thermoclimatic chamber under baseline conditions, simulated altitude (4200 m asl), heat (+42 °C) and cold (-10 °C). Sensory thresholds, pain thresholds and tolerance were assessed using electrical stimuli. Body composition was assessed using bioimpedance. Analysis of covariance was used to examine the effects of environmental conditions and body characteristics on pain-related outcomes.

Results: Body build and composition characteristics associated with individual sensory, pain and tolerance thresholds. In hypoxic conditions, sensory thresholds were significantly associated with sex ($p<0.01$), body mass ($p<0.05$), and muscle mass ($p<0.05$). During cold exposure (-10°C), total body water percentage significantly related with sensory thresholds ($p<0.05$). Under elevated ambient temperature (+42°C), muscle mass ($p<0.05$) and BMI ($p<0.05$) were significant predictors of pain tolerance.

Conclusions: Body build and composition are associated with differences in PP under specific environmental conditions. Sensory thresholds were related with somatic characteristics in hypoxia and cold, while pain tolerance in heat was related to muscle mass and BMI. These findings highlight the importance of considering environmental context and body composition when examining human variability in pain responses.

Keywords: Body composition; Pain perception; Environmental conditions.

Acknowledgement / Funding Source: The study was approved by the Bioethics Committee of Regional Medical Association in Kraków (98/KBL/OIL/24, 16 October 2024).

LIMITS OF ADAPTATION. PAIN THRESHOLDS AND TOLERANCE IN ALPINISTS UNDER ENVIRONMENTAL STRESS – EXPLORATORY ANALYSIS

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Background: Human responses to pain and sensory stimuli are shaped by both biological constitution and long-term exposure to environmental stressors. Extreme environments such as high altitude, cold, heat and intensive physical effort represent strong selective and adaptive pressures. Alpinists constitute a unique group with repeated exposure to hypoxia, thermal stress and sustained physical load, which may influence sensory perception and pain regulation.

Objective: The aim was to examine differences in sensory threshold, pain threshold and pain tolerance between experienced alpinists and non-acclimatized controls across a range of experimentally induced environmental and physiological conditions.

Subjects and methods: The study included 10 alpinists and 35 control participants. Sensory, pain and tolerance thresholds were assessed under five conditions: baseline, simulated altitude (4000 m), heat (42°C), cold (-10°C) and physical exercise. Between-group differences were evaluated using Cohen's d effect sizes (95% bootstrap confidence intervals, 3000 resamples). Effect-size-based inference served as the primary analytical framework.

Results: Alpinists demonstrated consistently higher pain thresholds than controls, particularly at baseline, during heat exposure and following exercise, with large to very large effect sizes. In contrast, group differences in sensory thresholds were generally small and inconsistent across conditions. Notably, pain tolerance showed an opposite pattern: in heat and exercise conditions, controls exhibited substantially higher tolerance than alpinists, despite lower pain thresholds.

Conclusions: The findings indicate that long-term exposure to extreme environments is associated with distinct patterns of pain processing, characterized by elevated pain thresholds but reduced tolerance under prolonged stress. This highlights the complex interplay between biological adaptation, functional specialization and environmental experience, underlining the value of pain-related traits as anthropological markers of human variability and adaptation.

Keywords: Biological anthropology; Pain perception; Environmental stress; Physiological adaptation; Alpinists.

Acknowledgement / Funding Source: The study was approved by the Bioethics Committee of Regional Medical Association in Kraków (98/KBL/OIL/24, 16 October 2024).

ASSOCIATION BETWEEN ANTHROPOMETRIC MEASUREMENTS OF THE LOWER FACE AND OCULAR BIOMETRIC PARAMETERS IN CHILDREN

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Background: Facial anthropometry and ocular biometry are important for understanding craniofacial and ocular growth during childhood. While previous studies have examined the relationship between general body measurements and ocular biometry, the association between lower facial anthropometric dimensions and ocular biometric parameters remains insufficiently investigated.

Objective: To assess the relationship between anthropometric measurements of the lower face and ocular biometric parameters, particularly axial eye length, which is associated with myopia development.

Subjects and methods: The study included 112 school-aged children divided into four age groups. Anthropometric measurements were obtained using digital callipers and photogrammetric analysis, while ocular biometric parameters were measured with the IOLMaster 700.

Results: Several anthropometric and biometric parameters showed significant age-related changes. Male participants exhibited significantly greater lower facial height ($p=0.0074$) than females. They also had higher values of axial eye length, anterior chamber depth, and horizontal corneal diameter. Significant positive correlations were found between axial eye length and lower facial height, mandibular height, mouth height, facial width, facial height, and maxillary and mandibular depth. The strongest correlation was observed with lower facial height ($r=0.305$; $p=0.0011$). Anterior chamber depth was also positively correlated with lower facial height, mandibular height, and mouth height, with the highest correlation again observed for lower facial height ($r=0.287$; $p=0.0021$).

Conclusions: The findings provide reference data on facial and ocular growth and suggest a relationship between lower facial dimensions and ocular biometry. These results may contribute to improved monitoring of craniofacial and ocular development and support the early identification of children at risk of myopia.

Keywords: Anthropometry; Face; Eye biometry; Children; Myopia.

DYNAMICS OF FACIAL PROPORTIONS DURING ADOLESCENCE AND COMPARISON OF FACIAL INDICES CALCULATED USING DIRECT ANTHROPOMETRY AND PHOTOGRAPHS

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Background: Adolescence is a period of rapid facial growth. Facial proportions change significantly during puberty. Studies investigating facial proportions during adolescence are scarce. One method of analysis is the calculation of facial indices. Faces can be analysed using different methods. Studies comparing different approaches for facial analysis are controversial.

Objective: The aim of this study was to assess the dynamics of facial proportions during adolescence and compare indicators calculated using direct anthropometry and photographs.

Subjects and methods: Study included 1376 adolescents from 10 to 20 years of age. Their faces were measured directly and photographed in frontal plane. Craniofacial landmarks were obtained, facial parameters were measured, 34 facial indices were calculated. Their dynamics were analysed using direct anthropometry method.

Results: The facial index gradually increased in both sexes, while the interpupillary distance relative to facial height decreased ($p < 0.05$). The zygomandibular index and the nasal width relative to facial height remained stable in both sexes ($p > 0.05$). The indices in girls did not change as rapidly as those in boys. The indices involving eye parameters and morphological facial height, and those involving eye parameters and bigonial width, were higher in girls ($p < 0.05$). The ratio of eye parameters relative to morphological facial height and labial fissure width did not differ between the two methods ($p > 0.05$). All indices involving bizygomatic width differed between the two methods ($p < 0.05$).

Conclusions: The faces have become relatively longer than wider. Cheeks and jaw grew horizontally evenly. Nose grew vertically at a similar rate faces got longer in both sexes. Boys' faces were relatively longer and their jaws were wider. Indices, that agreed with the two methods, mostly included vertical parameters, eye dimensions, and labial fissure width. Indices involving cheeks width showed the least agreement between the two methods.

Keywords: Anthropometry; Facial indices; Facial photographs.

THE SOCIO-CULTURAL EXPOSOME AS A REGULATOR OF HUMAN GROWTH

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Background: Humans are social. The social environment is strongly associated with body height. Recent evidence emphasizes the role of social signalling in the regulation of human growth.

Objective: To disentangle the influence of physical living conditions such as wealth, health, nutrition, and education from influences that are transmitted among group members. We analysed the impact of the group assuming a theoretical “transgenerational growth potential” based on 14 mill.

Subjects: German conscripts born between 1865 to 1975.

Results: The transgenerational mean height is 173cm (SD+9.8 cm). Between the late 19th and the late 20th centuries the mean male height increased from 165.8 cm (SD±6.5 cm) to 180.1 (SD+7 cm). The skewness of the height distribution was always close to zero. Height was significantly associated with living conditions, but the association disappeared when linking characteristics of the within population distribution of height with the disparity of living conditions and economic inequality. Mean height of the social community is a strong attractor of individual height and reduces the transgenerational growth potential by more than 50%.

Conclusions: Based on the SEPE concept we describe the effect of the exposome on body height through a socio-endocrine signalling cascade. This cascade “translates” social conditions - including an individual’s emotional perception of its position within the group - into hypothalamic neuropeptides. These signals trigger endocrine responses affecting stress, sexual characteristics, and body height. In turn, these outcomes serve as socially relevant signals to be perceived by other group members. This feedback loop has been evolutionarily conserved in vertebrates for more than 400 million years.

Keywords: Body height; Socio-endocrine signalling; Secular trend; Community.

SOCIOECONOMIC FACTORS INFLUENCING AGE AT MENARCHE IN WOMEN BORN FROM 1985 TO 1991

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Background: The late 20th and early 21st centuries were a period of significant social and economic transformation in Poland. This makes research on this period extremely important for a better understanding of the impact of socio-economic factors on human biological development.

Objective: This research aimed to evaluate socioeconomic differences in the age at menarche among young women born between 1985 and 1991.

Subjects and methods: The study was cross-sectional and conducted in 2010 among 1,884 females aged 19–24 years. Age at menarche of participants and their mothers was obtained retrospectively. Socioeconomic factors included: mothers' and fathers' education levels, the urbanization level of respondents' place of residence, and the number of siblings. One-way ANOVA and stepwise regression were used.

Results: One-way ANOVAs for each socioeconomic variable showed a significant effect on age at menarche (place of residence – $F=10,693$, $p<0.001$; number of siblings – $F=6,337$, $p<0.01$; mother's education level – $F=192,931$, $p<0.001$; father's education level – $F=152,611$, $p<0.001$). Subsequently, a stepwise regression analysis was performed, including participants' age, their mothers' age at menarche, and socioeconomic variables. The model showed that the most important variable was father's education level ($\beta=-0.260$, $p<0.001$), followed by maternal menarcheal age ($\beta=0.160$, $p<0.001$), and mother's education level ($\beta=-0.201$, $p<0.001$); only the number of siblings was not significant (model's adjusted $R^2=0.25$).

Conclusion: Socioeconomic variables significantly influenced age at menarche among females born between 1985 and 1991, on par with the genetic component, namely, the mother's age at menarche. This underscores the importance of the analysed factors, especially in a period of numerous economic changes.

Keywords: Socioeconomic factors; Age at menarche; Sexual maturation.

LOCAL COMMUNITIES AS ASPIRED PLACES: CONCERNS OF SOCIAL ENVIRONMENT AND PSYCHOLOGICAL WELLBEING AMONG EASTERN INDONESIAN STUDENTS IN JAVA

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Background: Owing to persistent inequalities in access to higher education across Indonesia, many students from the eastern regions should leave their respective home villages and go to Java in the western part of the country to pursue higher studies. While existing literature has largely examined the sociopolitical dynamics shaping their experiences of educational mobility within the country, far less attention has been devoted to their future aspirations.

Objective: This study therefore investigates how students from eastern Indonesia envision their participation in the labour market in the country and the motivations underlying their choices.

Subjects and methods: It focuses on students from regions commonly positioned at the political, economic, and social margins of the nation, such as East Nusa Tenggara, North Maluku, Maluku, and Papua, through a seven-month ethnographic fieldwork conducted in Yogyakarta, one of Indonesia's foremost centres of higher education in Java, between July 2025 and January 2026.

Results: The findings suggest that, throughout their educational mobility journeys, these students construct a form of 'collective imagination' around the idea of returning to their home villages, not out of disillusionment, but out of a deep sense of self-care, commitment, and dedication. Their aspirations foreground concerns related to both the social environment and psychological wellbeing by emphasising three key dimensions of human ecology, which are environment, behaviour, and biology. Within their local communities in their home villages, the students perceived to have a balanced set of aspirations, connecting between familiarity of sociocultural ties and characteristics and a willingness to contribute to their home villages later as returning graduates.

Conclusion: This orientation is likely to create more favourable psychological wellbeing and overall mental health. In this regard, their understanding and imaginary of future participation in the nation reflects a preference for pursuing more biocultural gains through working in their home villages, despite various challenges, rather than prioritising merely economic ones.

Keywords: Educational mobility; Future aspirations; Human ecology; Social environment; Psychological wellbeing.

Acknowledgement / Funding Source: Katholischer Akademischer Ausländer-Dienst (KAAD) Germany.

SOCIOECONOMIC STATUS AS A DETERMINANT OF ADIPOSIITY IN CHILDREN IN THE MORAVIAN-SILESIA REGION: FINDINGS FROM A PRELIMINARY STUDY WITHIN THE REFRESH PROJECT

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Background: Adequate body weight is considered one of the indicators of an individual's health. Body fat ratio must be monitored to assess body weight adequacy, particularly for the prediction and diagnosis of overweight and obesity. As the literature documents, the amount of body fat among children of early school age is influenced by sex and their families' economic status, suggesting an association between increased childhood obesity and economic disadvantage.

Objective: The aim of this study was to examine whether children from households experiencing persistent financial hardship exhibit higher adiposity levels than their peers from economically stable families.

Methods: This prospective study included 532 children aged 10–11 years (girls: $n=250$, age 10.6 ± 0.7 years; boys: $n=282$, age 10.7 ± 0.8 years). Children were divided into three socio-economic groups and by sex: G1M boys ($n=166$) and G1F girls ($n=145$) from economically stable families; G2M boys ($n=67$) and G2F girls ($n=56$) for whom socio-economic status (SES) could not be identified; and G3M boys ($n=49$) and G3F girls ($n=49$) from financially disadvantaged families. Body composition (BC) parameters – body mass (BM), body fat (BF), and visceral fat (VF) – were measured using BIA. Family SES was assessed through a questionnaire for parents.

Results: Significant differences in BMI, BF, and VF were found only between the groups G1M and G3M, boys in G1M showing lower values than those in G3M (BMI: G1M= 17.8 ± 3.1 , G3M= 19.3 ± 4.4 ; BF kg: G1M= 8.0 ± 5.2 , G3M= 10.7 ± 8.2 ; BF%: G1M= 19.6 ± 8.2 , G3M= 23.5 ± 11.0 ; VF cm^2 : G1M= 34.0 ± 28.9 , G3M= 49.3 ± 44.7).

Conclusion: A potential association between increased adiposity and family financial difficulties was observed only in boys.

Keywords: Body mass index; Body fat; Visceral fat; Family financial distress; Preadolescent children.

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THE MARRIAGE CALENDAR: A STRUCTURED STATISTICAL ANALYSIS OF NUPTIALITY SEASONALITY AMONG THE EVANGELICAL REFORMED POPULATION IN 19TH-CENTURY ZELOW (CENTRAL POLAND)

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Background: Zelow is a multicultural settlement with an interesting and complicated history.

Objective: The aim of this study is to characterize 19th-century Zelow in terms of seasonality and changes in marriages over time, and to examine the socioeconomic and cultural factors that could have influenced the seasonality patterns.

Subjects and methods: The study analysed 1,946 marriage records from the Evangelical Reformed parish in Zelow (1821–1900). A generalized additive model with a zero-inflated Poisson distribution was applied to examine long-term trends in marriage frequency, seasonal patterns, the influence of occupational categories, the interactions of these factors.

Results: Nuptial frequency rose steadily until the mid-1800s and again after 1870, with a temporary drop around 1850 likely linked to the cholera epidemic. Marriages were most common early in the year and in November. The interaction between long-term trends and within-year seasonality showed that annual marriage patterns shifted over the century, with a major turning point around 1860. Before this date, the strongest peaks occurred in February and November, while the most pronounced decline consistently appeared in the weeks preceding Easter. Marriage patterns differed markedly by occupational group. Jobs were classified as seasonal (mainly agricultural) and non-seasonal (crafts and trades). While seasonal occupations initially dominated among grooms, they were gradually replaced by non-seasonal professions by mid-century, leading to an overall balance between the two groups by the late 1800s. Seasonal workers tended to marry in the first half of the year, whereas non-seasonal grooms were more common in the second half.

Conclusion: Overall, marriage seasonality in nineteenth-century Zelow reflected shifting socio-economic and cultural conditions within a community transitioning from a rural settlement to an increasingly industrialized environment.

Keywords: Seasonality; 19th century; Marriages; GLM; Zero inflated Poisson.

Acknowledgement / Funding Source: MB received partial support from the research programme “Epicentres of Civilization – Intelligent Households, Technology and Society” within the Strategy AV21 of the Czech Academy of Sciences.

IMPROVED SOCIAL INTEGRATION SHAPES FEMALE BODY COMPOSITION IN TURKISH MIGRANTS: BIOCULTURAL EVIDENCE FROM GERMANY AND THE NETHERLANDS

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Background: Turkish migrants in Western Europe exhibit higher adiposity than both host-country populations and non-migrant Turks, yet the role of host-country institutional environments remains poorly understood. European nations differ substantially in their integration policy frameworks – Germany pursues an integration-oriented approach encouraging participation in host institutions, while the Netherlands has historically emphasised multicultural policies preserving ethnic community structures. These contrasting regimes may create divergent biocultural environments with measurable consequences for somatic adaptation.

Objective: To examine whether contrasting integration policy regimes independently shape body composition in Turkish adult migrants, with particular attention to sex-specific biocultural responses.

Subjects and methods: Cross-sectional study of 478 Turkish adults (aged 20–65 years) across Türkiye (n=278), Germany (n=75), and the Netherlands (n=125). Standardised anthropometry assessed BMI, arm fat area (AFA), arm muscle area (AMA), fat percentage, fat-free mass, and frame index. Statistical analyses included one-way ANCOVA, multiple and hierarchical regression, principal component regression, and St. Nicholas House Analysis (SNHA) – a graph-theoretical method for detecting multivariate association structures – applied separately to six sex-by-country subgroups.

Results: Both Germany and the Netherlands independently predicted elevated AFA relative to Türkiye in regression models ($\beta=0.061-0.073$, $p<0.05$). Country of residence explained an independent increment in AFA variance in females ($\Delta R^2=0.025$, $p=0.017$), with Germany additionally predicting higher AMA ($\beta=0.128$, $p=0.031$) after full covariate adjustment. A country/integration policy dimension accounted for 12.0% of predictor variance and significantly predicted both outcomes ($p<0.001$). In males, cross-country differences were largely explained by age. SNHA networks revealed that the structural coupling between body composition, education, and income was systematically reorganised across migration contexts, with sex-specific patterns particularly pronounced in female subgroups.

Conclusions: Host country integration policy constitutes an independent biocultural force shaping female migrants' somatic profiles. These findings underscore the need for sex-responsive, structurally informed public health approaches to migrant well-being.

Keywords: Migrant health; Integration policy; Body composition; Biocultural adaptation; Anthropometry.

UNEARTHING MORTALITY CRISES, UNDERSTANDING PAST SOCIETIES: THE BIOARCHAEOLOGY OF HISTORICAL MASS GRAVES

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Background: I began researching the archaeology and anthropology of mass graves in 1994 with the first excavation and interdisciplinary study of a plague burial site from the outbreak in Marseille in 1722. Since then, I have had the opportunity to study other sites associated with historical plague epidemics (both medieval and modern), as well as two mass graves resulting from the Napoleonic retreat from Russia in December 1812 (in Vilnius and Königsberg). The Battle of Mohacs (1526) resulted in mass graves, offering insights into large-scale mortality during this historical event.

Objective: This paper aims to evaluate the scientific contributions of excavating historical mass graves to the field of anthropology, focusing particularly on the reconstruction of biological, environmental and cultural responses to crisis situations.

Subjects and methods: This study takes a comparative and interdisciplinary approach, combining bioarchaeology, palaeogenetics and archival research. Selected case studies include historical mass graves related to plague epidemics and conflict, enabling cross-contextual analysis of mortality patterns and funerary practices.

Results: These investigations reveal distinct yet overlapping signatures of crisis. The plague mass graves provide insights into plague paleoepidemiology and the organisation of emergency burials in response to an infectious mortality crisis. The Napoleonic mass graves highlight the physiological impacts of starvation, cold exposure and infectious diseases during a period of military collapse. The Mohacs site offers evidence of perimortem trauma and battlefield burial management. Burial practices across all contexts reflect urgency, resource constraints and social attitudes towards the deceased.

Conclusions: The excavation of historical mass graves can significantly enhance our understanding of past mortality crises, as it allows us to integrate biological data with cultural and historical frameworks. The study of these contexts also raises ethical considerations and informs modern debates on mass fatality management. Mass graves created during historical epidemics and conflicts crises constitute exceptional biological archives for biological anthropology and bioarchaeology, which are crucial for better understanding past human societies.

Keywords: Mass graves; Bioarchaeology; Plague epidemics; Napoleonic wars; Paleomicrobiology.

THE MOHACS NATIONAL MEMORIAL MASS GRAVES: YEARS OF STRUGGLE FOR THE RESEARCHERS OF THE UNIVERSITY OF SZEGED

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Objective: To present the progress, challenges, and preliminary anthropological results of the multidisciplinary investigation of the Mohacs mass graves.

Subjects and methods: As the Mohacs National Memorial Mass Grave 3 excavation could not be completed in 2020, additional field campaigns were conducted in 2021 and 2022, the latter involving an international team. Following excavation, the skeletal remains were transferred to the University of Szeged for detailed osteological analysis. In 2024, Mass Grave 4 was also excavated and is currently under investigation. The primary aim of the osteological analysis is the re-association of fragmented remains to reconstruct individual skeletons, determine the demographic composition of the graves, and identify perimortem traumatic lesions and palaeopathological lesions

Results: The investigations have established a comprehensive multidisciplinary research framework combining archaeology, field and laboratory anthropology, paleopathology, forensic osteology, archaeogenetics, and isotope analyses. Osteological examinations are progressing, providing new evidence on the demographic characteristics of the buried individuals and the nature of their traumatic injuries, while supporting the reconstruction of the events surrounding the mass burials.

Conclusions: The Mohacs mass grave project represents one of the largest and most challenging anthropological investigations ever undertaken in Hungary. Despite numerous logistical and scientific challenges, the ongoing research is yielding important new insights into the victims of the Battle of Mohacs while providing the basis for their respectful identification and eventual reburial.

Keywords: Battle of Mohacs; Mass graves; Osteological analysis; Paleopathology.

Acknowledgement / Funding Source: The Authors would like to acknowledge the contributions of the directors and other staff members of the Janus Pannonius Museum (Pecs, Hungary) and the Duna-Drava National Park (Pecs, Hungary). This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

TWO MASS GRAVE SITES OF WAR PRISONERS: ENIGMAS OF “GREY ZONE“ ARCHAEOLOGY AND ANTHROPOLOGY

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Background: During 2020, remains of 1927 individuals from two mass grave sites were exhumed. Archival and archaeological data indicated these were remains of Red Army prisoners of war (POW) who died in Nazi camps.

Objective: The study objective was to examine the remains on site before their scheduled reburial that same year.

Results: Analysis revealed differences: in Zokniai site, only 30.9% of individuals had POW ID tags, and 3.4% had Red Army ID capsules; 61.2% possessed some artifacts, mainly equipment and personal items. Age range was from 15 to 50+ years, the remains contained a number of former traumas and diseases, and at least 19.5 percent of skulls had gunshot wounds (shots into the occipital area). In Armalenai site, 69.7% of individuals had POW ID tags, and only 0.3% Red Army ID capsules. Only 33% possessed some items, mainly buttons. Age range mostly 18–30 years, fewer traces of traumas and diseases, no gunshot lesions. At both sites, scapular traumas with healing signs were documented; causality remains unclear.

Conclusions: Summing up the available data, it is concluded that POW inhumed in Zokniai were transferred for a short period in the first months of the war: no stationary camp (location unknown); a low number of POW ID tags; more personal items; possible time: second half of 1941 – beginning of 1942. It was noted that individuals were often of older age, had more early pathologies (officers?); gunshot lesions – cause of death in part of those POWs. The Armalenai, on the contrary, had a stationary camp with preserved location; more than half of POWs had ID tags, but few equipment and personal items and no obvious cause of death, though the regular number of bodies per pit suggests that it may have been exhaustion and infectious diseases (e.g. typhus); probable burial period: autumn 1942 – spring 1943.

Keywords: Forensic anthropology; Mass graves; WW2.

MULTIPLE/MASS BURIALS FROM THE LATE BRONZE AGE AND THE EARLY IRON AGE OF THE CARPATHIAN BASIN – A COMPARATIVE STUDY

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Background: The Gava culture dominated the Eastern Carpathian Basin (12–9th c. BCE) is characterised by a homogeneous material culture, settlement with a high density of archaeological finds and distinctive Hajduboszormeny-style metallurgy. Despite its prominence, cemeteries associated with the culture are largely unknown. In the 9–8th centuries BCE, the appearance of steppe-related Mezocsat culture introduced significant changes, including rare inhumation burials concentrated at key transport hubs. Recently discovered Early Iron Age mass burials provide new insights into this transitional period.

Objective: The research focuses on the Late Bronze Age – Early Iron Age transition (9–8th c. BCE), a period marked by numerous settlements but few known cemeteries, through the bioarchaeological analysis of 3 archaeological sites (Pusztataskony-Ledence, Hodmezovasarhely-Kopanacs XI, and Tiszabo-Galamb-dulo).

Methods: Osteological analyses were conducted on human skeletal remains from the 3 sites, including the assessment of preservation, minimum number of individuals (MNI), age at death and sex estimation, and the examination of pathological and traumatic lesions.

Results: The skeletal remains are generally well preserved, showing limited taphonomic alteration and high anatomical completeness. The reconstructed demographic profiles indicate that subadults are represented in proportions consistent with expected prehistoric mortality patterns, unlike many contemporary cemetery populations where children are underrepresented. The preservation of the remains enables detailed investigation of stress markers, trauma and infectious lesions that may reflect the living conditions and mortality patterns of these communities.

Conclusion: The main question regarding these complex funerary structures is interpretation: do they represent the consequences of an epidemic, a massacre or a specific mortuary ritual?

Keywords: Carpathian Basin; Mass burials; Paleopathology; Bioarchaeology; Prehistory.

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**INTEGRATING GEOINFORMATICS AND
ANTHROPOLOGICAL TECHNIQUES FOR THE RESOLUTION
OF COMPLEX COMMINGLED SKELETAL ASSEMBLAGES.
THE MASS GRAVE 3 AT THE MOHACS NATIONAL
MEMORIAL SITE**

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Background: This study outlines a methodology for the excavation and anthropological examination of partially commingled human remains from Mass grave 3 (MG3), associated with the 1526 Battle of Mohacs.

Objective: The identity and circumstances of the demise of the individuals found in MG3 are the 2 main scientific questions. These can be answered after rearranging the disarticulated remains.

Materials and methods: The presented methodology aims to facilitate the documentation, classification, sorting and rearrangements of partially commingled remains so that the number of individualized skeletons in the assemblage – where only one-third of the material was originally recovered as relatively complete skeletons – can be increased.

Results: The geoinformatics software QGIS 3.20.2, was used to record the position of the different skeletal elements within the grave. Moreover, a new anatomical coding system proved effective in differentiating skeletons based on their level of completeness. Additionally, a set of osteometric formulae proposed by Anastopoulou and colleagues, and Byrd and collaborators were tested and modified before using them to narrow down the number of potential matches for each element. Lastly, an organized system that integrates the already mentioned tools and others like visual pair-matching or articulation is proposed.

Conclusion: Results after applying this new methodology show that the original number of relatively complete skeletons could be increased by 50% after applying this new methodology, suggesting that the presented method can be utilized in any other plural burial.

Keywords: Mohacs battle; Osteometric sorting; Commingled skeletal remains; GIS; Biological anthropology.

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METHODOLOGICAL INSIGHTS INTO THE ESTIMATION OF THE MINIMUM NUMBER OF INDIVIDUALS FROM UPPER LIMB BONES IN THE 16TH-CENTURY CE MASS GRAVE 3 AT THE MOHACS NATIONAL MEMORIAL SITE

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Background: Estimating the minimum number of individuals (MNI) is a key challenge in the analysis of commingled burials. Although landmark- and zonation-based methods are widely used, their effectiveness depends on skeletal preservation and requires ongoing evaluation. Our team at the University of Szeged is investigating mass grave 3 (MGN3) at the Mohacs National Memorial Site, associated with the Battle of Mohacs (1526). The grave contains the partially commingled remains of approximately 300 individuals, including skeletons, isolated bones, and thousands of fragments, offering a unique opportunity to assess MNI estimation methods in a complex assemblage.

Objective: As part of a broader research project, our objective is to provide a methodological basis for MNI determination as accurately as possible. To achieve this the landmark- and zonation-based methods were applied simultaneously and systematically to the upper limb bones of various skeletal units, including complete skeletons and isolated bone fragments from MGN3.

Results: Our results demonstrate that both methods perform well when applied to compact and relatively small skeletal elements. However, bones more susceptible to fragmentation proved considerably more problematic, necessitating modifications to the existing scoring systems. Specifically, additional landmarks were introduced, and the original zonation system was adapted. The scapula provides a representative example. Several hundred scapular fragments were examined, revealing fracture patterns that frequently left identifiable and sided fragments unscorable using the original zonation scheme. To address this limitation, the zonation system was modified accordingly, substantially increasing the number of scorable elements and improving MNI estimation.

Conclusion: Although MNI estimation is a key component of mass grave analysis, the state of skeletal preservation strongly influences method performance. Our findings demonstrate that adapting and refining standard MNI methods is essential for maximizing their applicability and accuracy in highly fragmented assemblages.

Keywords: Mohacs battle; Commingled skeletal remains; Minimum number of individuals; Biological anthropology.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

ESTIMATING THE MINIMUM NUMBER OF INDIVIDUALS IN THE 16TH-CENTURY CE MASS GRAVE 3 AT THE MOHACS NATIONAL MEMORIAL SITE – METHODOLOGICAL CHALLENGES AND PROPOSED MODIFICATIONS FOR THE ANALYSIS OF LOWER LIMB BONES

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Background: Mass grave analysis presents major challenges, particularly in identifying skeletal elements and estimating the minimum number of individuals (MNI) in commingled assemblages. While landmark- and zonation-based methods are widely used, their performance varies with fragmentation and preservation. We are investigating mass grave 3 (MGN3) at the Mohacs National Memorial Site, linked to the Battle of Mohacs (1526). The grave contains the partially commingled remains of approximately 300 individuals, including articulated skeletons, isolated bones, and thousands of fragments, providing an exceptional case study for evaluating MNI estimation methods under different preservation conditions.

Objective: Our research aims to assess the applicability of landmark- and zonation-based methods to lower limb bones and to establish a methodological framework for MNI estimation. Both methods were applied systematically to complete skeletons, isolated elements, and fragmented lower limb bones recovered from MGN3.

Results: Preliminary results showed no significant difference between the numbers of identified small and large lower limb elements, supporting the interpretation of MGN3 as a primary burial. However, identification and scoring success varied considerably with bone preservation and fragmentation. The hip bone, for example, was almost always fragmented to some degree. These observations prompted proposed modifications.

Conclusions: Our findings highlight the importance of adapting standard MNI estimation methods to the preservation characteristics of individual assemblages. Such refinements improve both the applicability and the accuracy of MNI estimation, thereby enhancing the anthropological investigation of large, partially commingled burial contexts.

Keywords: Mohacs battle; Commingled skeletal remains; Minimum number of individuals; Biological anthropology.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

PRELIMINARY RESULTS OF THE ANALYSIS TARGETING PERIMORTEM CUT MARKS FROM THE MASS GRAVE 3 CONNECTED TO THE BATTLE OF MOHACS, 1526 CE

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Background: This year the 29th of August is the 500th anniversary of one of the most decisive battles of Late Medieval Europe. Five mass graves are known to be directly connected to the Battle of Mohács from the Ottoman expansion era. The pits contain human remains belonging to members of the defeated army of the Kingdom of Hungary. Between August of 2020 and October of 2022, mass grave 3 was completely excavated in three seasons revealing high number of perimortem cut marks on the remains.

Objective: According to our theory, the buried individuals may have been executed rather than falling in the battlefield or having been slaughtered in the attacked camp site. To test the execution hypothesis, we have created a sample of 35 individuals with different excavation dates and good preservation of most major body parts, representing the entire extent of the grave.

Results: Several perimortem cut marks were observed and recorded according to their location on the skeleton. More than 85% of all perimortem cut marks affect the skulls and the cervical vertebrae, and 80% of lesions are in the posterior regions. Our opinion is that most of the individuals were executed by decapitation or at least targeted cuts to the occipito-cervical region. Relatively few early modern battlefield mass graves are known and analysed applying modern standards; our examinations provide unique opportunity for detailed insight into the events of an early modern battle.

Conclusion: Currently, approximately 10% of the bioarchaeological material is examined. In the next few years, comprehensive anthropological and forensic investigation will be carried out, yielding more detailed results and well-established conclusions concerning one of the most important events of the history of Hungary.

Keywords: Perimortem cut marks; Paleopathology; Execution; Decapitation; Battle of Mohacs.

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EXAMINATION OF PERIMORTEM INJURIES TO THE POSTCRANIAL SKELETON IN THE HUMAN BONE MATERIAL FROM MASS GRAVE 3 ASSOCIATED WITH THE BATTLE OF MOHACS (AUGUST 29, 1526 CE)

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Background: The mass graves linked to the Battle of Mohacs (1526) are located at the Mohacs National Memorial Site in southern Hungary. Historical sources suggest that around 2,000 prisoners were executed after the battle and buried in these graves. After excavations in 1960 and 1976, mass grave 3 was re-excavated between 2020 and 2022, enabling detailed archaeological and anthropological analyses.

Objective: To conduct an osteoarchaeological analysis of the human remains from mass grave 3, focusing on perimortem trauma observable on the postcranial skeleton, and to expand the previously limited dataset to refine the interpretation of injury patterns within the assemblage.

Materials and methods: The analysis includes skeletal remains of 161 individuals recovered from mass grave no. 3. After excavation, the bones were systematically examined using macroscopic osteological methods.

Results: Perimortem trauma was identified in 100 individuals, including 190 cut marks, 13 stab wounds, and 43 fractures. The larger sample provides a more complete picture of injury patterns and reveals greater trauma diversity than previously recognized. Postcranial injuries were less common than cranial and cervical trauma. While historical evidence supports an attempted escape scenario, the exact circumstances of these injuries – combat, captivity, escape, or execution – remain uncertain.

Conclusion: The Mohács mass graves are rare in Europe and offer exceptional archaeological and anthropological insight into both the battle and its aftermath.

Keywords: Bioarchaeology; Paleopathology; Sharp force injury; Execution.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

EXECUTION-INDICATIVE SHARP-FORCE INJURIES IN MOHACS MASS GRAVE 3 – FORENSIC MEDICAL ASPECTS

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Background: One of the five known mass graves associated with the Battle of Mohacs preserves the remains of approximately 370 individuals. Preliminary forensic observations suggested that many of the fatal injuries were more consistent with execution than battlefield combat.

Objective: To identify patterns of perimortem trauma and evaluate the hypothesis of mass execution.

Materials and methods: A representative sample of 45 individuals was selected from the mass grave using expert selection. Potentially fatal injuries and the immediate causes of death were assessed using conventional forensic anthropological methods complemented by modern medical imaging techniques.

Results: In nearly two-thirds of the examined individuals, death resulted from a sword strike delivered from behind to the occipital region adjacent to the spine and the C1–C3 vertebrae, causing spinal cord injury. Approximately one-third died from injuries to the major cervical vessels caused by frontally inflicted sword blows to the face and neck. Multiple repeated strikes and a non-random distribution of non-fatal injuries were also documented.

Conclusions: The observed injury patterns strongly support the hypothesis that these individuals were killed in a mass execution rather than in battlefield combat, with no primary intention of decapitation.

Keywords: Decapitation; Cervical spine trauma; Mass grave; Sharp-force injuries; Execution.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

BIOARCHAEOLOGICAL PROFILING AND DIGITAL FACIAL RECONSTRUCTION OF INDIVIDUAL NO. 95 FROM MOHACS MASS GRAVE 3

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Background: Bioarchaeological investigations aim to reconstruct the biological profiles of past populations through the systematic analysis of human skeletal remains. Facial reconstruction is a specialized approach that complements these analyses by providing visual representations of historical individuals.

Objective: To present the comprehensive biological and facial reconstruction of individual No. 95, recovered from a mass grave associated with the 1526 Battle of Mohacs.

Materials and methods: The study combined bioarchaeological and archaeogenetic analyses with a digital facial reconstruction based on the Manchester method. Historical depictions of 16th-century European mercenaries guided the reconstruction of hairstyle, beard, and clothing.

Results: Individual No. 95 was a young adult male (25+ ys) with an estimated stature of 170–180 cm and a dental crossbite. A second skeletal unit (individual No. 60) may belong to the same person, although preservation prevented confirmation. Musculoskeletal markers indicate regular physical labour. At least 4–5 sharp-force injuries were identified on the head and neck, a facial reconstruction was created using osteological, genetic and archaeological evidence.

Conclusions: The integration of bioarchaeological, archaeogenetic, and digital facial reconstruction methods provides a detailed biological and visual reconstruction of an individual connected with the Battle of Mohacs. This interdisciplinary approach enhances our understanding of the lives and deaths of those buried in the Mohacs mass graves and demonstrates the value of combining scientific analyses with historical evidence.

Keywords: Battle of Mohacs; Mass grave; Biological reconstruction; Digital facial reconstruction.

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PRELIMINARY RESULTS OF THE PALEOPATHOLOGICAL ANALYSIS OF THE HUMAN SKELETAL REMAINS FROM MASS GRAVE 4 AT THE MOHACS NATIONAL MEMORIAL SITE (1526 CE), HUNGARY

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Background: The Battle of Mohacs in 1526 was one of the most decisive events in Central European history. The osteological material recovered from the five mass graves located at the Mohacs National Memorial Site is associated with this historical event. Between 2020 and 2024, two of these mass graves were excavated to gain insight into the individuals buried within them.

Objective: The aim of the present study is to provide a preliminary report on the investigation results of the osteological material originating from mass grave 4.

Materials and Methods: The study material consists of commingled and incomplete human skeletal remains recovered from mass grave 4, which were archaeologically attributed to 237 individuals during the excavation process. Standard methods routinely applied in physical anthropology were used for the demographic and palaeopathological analyses.

Results: As a first step, incomplete skeletal remains recovered under different inventory numbers during the excavation, but potentially belonging to the same individual, were reassociated. As a result, the number of individuals was reduced to 184. Demographic data indicate that most individuals buried in mass grave 4 were young adult males.

Preliminary palaeopathological observations revealed the presence of infectious (e.g., tuberculosis), degenerative, and inflammatory lesions, among others. Detailed differential diagnostic analyses are currently in progress. Minor developmental anomalies were observed at high frequency, while major and rare developmental anomalies were also identified, including tuberculum/processus paracondylaris and ponticulus posticus.

Conclusions: Our findings provide insight into the demographic composition and health status of the individuals who fought in the Battle of Mohacs and may also contribute to the identification of potential biological relationships among the buried individuals.

Keywords: Human mass grave; Mohacs; 1526; Paleopathology; Developmental disorders.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

PRELIMINARY RESULTS OF THE PALEOPATHOLOGICAL ANALYSIS OF THE HUMAN SKELETAL REMAINS FROM MASS GRAVE 4 AT THE MOHACS NATIONAL MEMORIAL SITE (1526 CE), HUNGARY

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Background: At the Battle of Mohacs (1526 CE), the Christian army was defeated by an Ottoman force nearly three times its size. Historical sources indicate that during the battle, captives were taken, and about 2 thousand captives were executed two days later.

Objective: To better understand the fate of these victims, we examined patterns of perimortem trauma in the skeletons of the mass grave IV (237 individuals) at the Mohacs National Memorial (Satorhely, Hungary), one of the five known mass graves associated with the battle.

Materials and methods: The human remains were generally poorly preserved, and most skeletons were incomplete. Despite these limitations, the material was analysed using standard macroscopic methods by a team of osteologists and forensic practitioners.

Results: Our results indicate that sharp force perimortem trauma most frequently affected the left side of the body, particularly the parietal bones, the mandible, and the ulna. The highest number of perimortem cut marks recorded on a single individual was 18. The repeated, often parallel nature of many injuries makes them unlikely to have been sustained in interpersonal combat, as such wounds would have required a high degree of precision. In addition, the angles of several lesions suggest that the victims were in a vulnerable or defenceless position when the blows were delivered.

Conclusions: This project is unique not only in Hungary but also in Europe because of the size and archaeological context of the Mohacs mass graves, as well as the complexity of their investigation. The main limitations of the study were the poor state of preservation, misalignment of skeletal parts due to natural decomposition processes, and the limited amount of directly comparable material. Future research aims to continue the analyses and provide a comprehensive demographic, palaeopathological, and forensic anthropological assessment of the individuals buried in the grave.

Keywords: Paleopathology; Perimortem trauma; Execution; Sharp force injuries.

Acknowledgement / Funding Source: This study was carried out within the framework of the Mohacs 500 project, with the support of the Ministry of Agriculture and the Hungarian Government (government decree nos. 1159/2023., IV. 27. and 1288/2024., IX. 19.).

3D IMAGING OF MASS GRAVES IN HISTORICAL CONFLICTS: ENHANCING DIAGNOSTIC AND ANALYTICAL POTENTIAL IN BIOANTHROPOLOGY

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Background: Background Mass graves, particularly those associated with historical conflicts, represent complex archaeological and anthropological contexts in which preservation issues, ethical constraints, and limited accessibility often hinder analysis. In such contexts, traditional macroscopic approaches are frequently insufficient to fully characterize skeletal lesions, especially when remains are fragmented, fragile or inaccessible. Recent advances in three-dimensional (3D) imaging, including CT and micro-CT scanning, provide new opportunities to overcome these limitations through non-destructive investigation, high-resolution internal analysis, and digital preservation.

Objective: This study explores the contribution of 3D imaging to the analysis of human remains from mass graves, with a particular focus on its impact on preservation, accessibility, and the retrospective diagnosis of pathological processes.

Subjects and methods: The research is based on assemblages from two historical mass graves: Mohacs (Hungary, 1526) and the Napoleonic retreat from Russia (1812). Skeletal elements were digitized using high-resolution CT and micro-CT imaging. Virtual models were analysed to assess bone preservation, identify pathological alterations, and reconstruct trauma patterns. Digital datasets also enabled the virtual manipulation of fragile or inaccessible specimens, as well as the production of 3D-printed replicas for further study.

Results: 3D imaging significantly enhances the analysis of fragile and restricted-access materials by enabling detailed observation without physical handling. Virtual reconstructions improve the identification of pathological lesions and trauma patterns that are difficult to detect macroscopically. This approach also facilitates the reconstruction of pathological processes, including infectious and traumatic conditions, through the analysis of internal bone structures. Furthermore, digital archiving ensures the long-term preservation and reproducibility of observations.

Conclusions: 3D imaging constitutes a major methodological advance in bioarchaeology. It not only preserves vulnerable material and improves accessibility but also provides substantial added value for retrospective diagnosis and the reconstruction of pathological processes. These technologies contribute to a more comprehensive understanding of past populations while addressing ethical and conservation constraints.

Keywords: 3D imaging; Mass graves; Paleopathology; Trauma analysis; CT scanning.

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GROWTH IN TIMES OF POLITICAL EUPHORIA, EARLY DEMOCRACY AND HOPE FOR FREEDOM

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Background: Improvements in living conditions correlate with substantial long-term trends in height, e.g. of 15 cm/100 years in Japanese males, 21 cm/150 years in Dutch males, and 14 cm/110 years in German males. Recent evidence suggests strong effects of the political background on these trends.

Subjects and methods: Height of more than 14 million men of the German Armed Forces born 1865–1975 was correlated with indicators of economic prosperity, nutrition, health, and income inequality. Coherence analysis was applied to control for time trends in the multiple associations between these indicators.

Results: Mean height of young adult men increased by 0.45 mm/year (before 1916), by 2.15 mm/year (1916–1933), by 1.87 mm/year in the early Federal Republic of Germany (FRG) until 1973, and by 1.45 mm/year in the late FRG. The most substantial height increases in height were associated with declining income inequality during periods of political upheaval, early democratization, and liberation, and during the socially turbulent transition after the mid-1970s from a “national German” to a “modern European” society.

Conclusion: The non-linear pattern of secular height increments in Germany since the late 19th century suggests that democratization, political euphoria and liberation, hope for a better life, and illusions of equity, freedom, justice, and the expectation of social advancement entail competitive growth, strategic growth adjustments and finally, long-term and substantial secular trends in height.

Keywords: Secular trend; Democracy; Freedom; Coherence analysis.

PRENATAL SUNLIGHT IN THE SECOND TRIMESTER PREDICTS TIMING OF MENARCHE IN POLISH WOMEN BORN BETWEEN 1985–1991

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Background: Seasonal variation in prenatal environmental conditions has been linked to developmental and health outcomes. Maternal sunlight exposure during pregnancy may influence foetal growth and reproductive maturation through vitamin D-related pathways. Age at menarche is an important marker of timing and a predictor of later metabolic and cardiovascular health. Despite evidence supporting programming of reproductive development, the association between sunshine exposure and age at menarche remains insufficiently investigated.

Objective: To examine the relationship between maternal sunshine exposure during pregnancy and age at menarche in daughters, while accounting for season of birth, birthweight, and socioeconomic characteristics.

Subjects and methods: The study included 1,635 Polish female university students aged 19–25 years. Age at menarche was retrospectively reported. Prenatal sunshine exposure was estimated using national meteorological data on average monthly sunshine duration in Poland and calculated separately for each trimester of pregnancy. Generalized linear models assessed associations between trimester-specific sunshine exposure, season of birth, and age at menarche, with progressive adjustment for birthweight, parental education, urbanization level, number of siblings, and birth order. Sequential multiple regression analyses evaluated independent trimester effects.

Results: The mean age at menarche was 12.70 ± 1.17 years. In unadjusted analyses, summer and autumn birth were associated with earlier menarche; however, these associations were fully attenuated after adjusting for prenatal sunshine exposure. Higher maternal sunshine exposure during the second trimester was consistently and robustly associated with earlier menarche across all models (e.g. for the final model $\beta = -0.145$, 95% CI: $-0.21 - -0.08$; adj. $R^2 = 0.256$).

Conclusions: Prenatal maternal sunshine exposure, particularly during the second trimester of pregnancy, is a significant predictor of age at menarche independent of season of birth. These findings strongly support the role of gestational sunlight exposure - likely reflecting maternal vitamin D status, in the developmental programming of female pubertal timing.

Keywords: Early-life environmental exposures; Season of birth; Vitamin D; Perinatal epidemiology; DOHaD framework; Age at menarche.

VASOMOTOR MENOPAUSAL SYMPTOMS AND ADIPONECTIN LEVELS AMONG WOMEN WITH DIFFERENT MENOPAUSAL STATUS

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Background: Vasomotor menopausal symptoms (VMS), including hot flushes (HFs) and night sweats (NS), are among the most common and burdensome menopausal complaints, negatively affecting women's quality of life and functioning during the menopausal transition. VMS have been associated with higher levels of cardiovascular disease (CVD) risk indicators; however, the mechanisms underlying these relationships remain unclear. Adiponectin is the most abundant anti-inflammatory adipokine in the human body and exerts beneficial physiological effects. Higher adiponectin levels are associated with a reduced risk of CVD. The occurrence of VMS may be related to lower adiponectin levels, but studies addressing this issue are scarce and the findings remain inconsistent.

Objective: To examine the associations between adiponectin levels and the frequency and severity of vasomotor symptoms, taking selected covariates into account.

Subjects and methods: The frequency and severity of VMS were assessed using a questionnaire in 139 women in the peri- (n=70) and postmenopausal stages (n=69). Basic anthropometric measurements were performed, and serum levels of adiponectin, sex hormones, and cardiovascular disease risk indicators were determined. Statistical analyses were conducted using the general linear model (GLM) and ordinal logistic regression models in Statistica and SPSS software.

Results: More frequent and more severe HFs were observed among postmenopausal women. Perimenopausal women exhibited higher adiponectin levels regardless of HF and NS severity (p<0.001) and frequency (p<0.001). These associations remained significant after adjustment for age, educational level, body mass index, waist circumference, HOMA-IR, and estradiol levels.

Conclusions: The present findings may contribute to a better understanding of the relationships between adipokines, obesity, and vasomotor symptoms in women with different menopausal status.

Keywords: Vasomotor symptoms; Hot flushes; Night sweats; Menopausal status; Adiponectin.

Acknowledgement / Funding Source: Internal grant from the University of Wrocław (grant no. BPIDUB.4610.185.2022), entitled "In Search of the Determinants of Reproductive Ageing – Multidisciplinary Research in Women Aged 40–65 Years."

SELF-PERCEIVED STRESS ASSOCIATED WITH THE SEVERITY OF MENOPAUSAL SYMPTOMS ACROSS MENOPAUSAL TRANSITION

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Background: Menopausal symptoms affect approximately 60–80% of women during the menopausal transition. For many, these symptoms substantially reduce quality of life due to their impact on sleep, mood, and stress levels. This issue is particularly important, as a large proportion of perimenopausal women experience chronic stress and exhibit increased sensitivity to psychological stress resulting from fluctuations in estradiol levels.

Objective: The study aimed to assess the relationship between self-perceived psychological stress and menopausal symptoms in peri- and postmenopausal women.

Subjects and methods: Data from 390 women aged 40–65 years (mean age 51.3 ± 6.00) were analysed. Participants completed an anonymous questionnaire covering demographic, health-related, and lifestyle information. Perceived stress was measured using the Perceived Stress Scale 10 (PSS 10), while the severity of menopausal symptoms was assessed with the Menopause Specific Quality of Life Questionnaire (MENQoL). Basic anthropometric measurements and body composition analysis using the BIA method were also conducted.

Results: Overall, women reported moderate stress levels, with perimenopausal women showing significantly higher stress. After adjusting for additional variables – age, place of residence, education, income, occupation status, physical activity, smoking, body mass index, fat mass (FM) or fat mass-to-fat free mass ratio (FM/FFM) – higher FM/FFM was strongly associated with higher stress levels in perimenopausal women; this relationship did not occur in postmenopausal women. PSS 10 scores positively correlated with total MENQoL scores ($r=0.36$, $p<0.001$). Perimenopausal women reported more severe symptoms in the psychosocial, physical, and sexual domains, whereas postmenopausal women had significantly higher scores in the vasomotor domain. Analyses across individual MENQoL domains showed that in both peri- and postmenopausal groups, higher PSS 10 scores were associated with higher symptom severity in all domains except the sexual one.

Conclusions: The study confirms that the severity of menopausal symptoms is associated with perceived stress, with perimenopausal women being particularly vulnerable to elevated psychological stress levels.

Keywords: Menopausal symptoms; MENQoL; Perceived stress; Menopausal status.

SEX DIFFERENCES IN PHYSICAL FITNESS AND BODY COMPOSITION CHANGES AFTER 4-WEEK PHYSICAL TRAINING IN STUDENTS

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Background: An essential element of soldiers' efficiency and readiness to carry out tasks is their physical fitness, which is closely dependent on their body mass and composition, which in turn determine the proper functioning of the body.

Subjects and methods: The aim of this study was to examine changes in physical fitness and body composition of students after a 4-week physical training. The study involved women (N=45) and men (N=45). Body composition measurement and selected physical fitness tests (PushUps, shuttle run 10x10m) were conducted before and after the 4-week military training period.

Results and Conclusions: Changes in physical fitness tests were shown in both men and women. However, in the case of body composition, significant changes in response to a 4-week training were noticed only in women in BFM ($t=9,6$; $p<0,001$), SMM ($t=10,0$; $p<0,001$) and BF% ($t=10,7$; $p<0,001$). This study showed dimorphic variation in body composition and physical fitness changes in response to specific physical training.

Keywords: Physical fitness; Body composition; Physical training; Sexual dimorphism.

THE IMPACT OF FAMILY PATTERNS ON CHILDREN'S PHYSICAL ACTIVITY

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Background: Physical inactivity is a leading risk factor for death from non-communicable diseases. People who are not active enough have a 20–30% higher risk of death than those who are active. Regular physical activity is associated with improved physical fitness, cardiometabolic health, bone health, cognitive outcomes, mental health, and reduced body fat in children and adolescents. People's lives are becoming increasingly sedentary due to motorized transport and increased use of screens for work, study and leisure. Evidence shows that a higher amount of sedentary lifestyle is associated with the following adverse health outcomes: increased obesity in children and adolescents, poorer cardiometabolic health, fitness and behavioural/prosocial behaviour, and reduced sleep time.

Objective: In our study, we present the effect of family pattern on children's physical activity. We raised the following questions: Does increased screen time cause a decrease in physical activity? Does parental BMI influence children's physical activity? Also: Is family activity pattern related to children's physical activity?

Subjects and methods: In 2025, we surveyed the physical status of 121 6–11-year-old schoolchildren in Budapest. We had a questionnaire about their and their family's health status and free time activities. Body composition was examined by In Body 720 body composition analyser.

Results: Based on our results, in the studied population, physical activity was primarily determined by participation in organized sports and the mothers' physical activity level. It showed a smaller correlation with screen time, mainly during weekdays, while we found no significant correlation with parents' BMI values.

Conclusion: Our conclusion is that an active family environment results higher activity in children. Children's physical activity is primarily determined by participation in organized sports and the parents' sports pattern, while everyday screen use shows a moderate negative correlation with the number of active days.

Keywords: BMI; Blood pressure; Fitness score; Central fat.

NEUROMUSCULAR PERFORMANCE PROFILES IN HANDBALL PLAYERS: COMBINED ISOMETRIC MID-THIGH PULL – COUNTERMOVEMENT JUMP ASSESSMENT AND BODY COMPOSITION CHARACTERISTICS

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Background: Handball requires repeated high-intensity actions, rapid changes of direction, jumping, and high levels of strength and power. The isometric mid-thigh pull (IMTP) assesses maximal force production, while the countermovement jump (CMJ) evaluates explosive performance. Although both tests are widely used, little is known about the neuromuscular performance profiles emerging from their combined interpretation. This study aimed to identify distinct IMTP-CMJ performance profiles in handball players and examine their associations with age category and playing position.

Subjects and methods: Elite male and female handball players aged 13–25 years (n=432) from youth and senior categories completed IMTP and CMJ testing on a force platform. Relative IMTP peak force (N/kg) and relative CMJ peak power (W/kg) were studied by using z-score analysis. The distribution of the resulting profiles was then compared across age categories and playing positions.

Results: Only a weak relationship was found between relative IMTP force and CMJ power, indicating that greater isometric strength did not necessarily correspond to superior dynamic performance. Three distinct profiles were identified: (1) low relative strength and power; (2) strength-dominant (high relative strength with comparatively lower dynamic performance); and (3) power-dominant (moderate relative strength with high dynamic performance). Profile distribution differed across age groups and playing positions. Strength-dominant athletes were less frequent among younger players, while some positions showed a lower prevalence of power-dominant characteristics.

Conclusions: Combined IMTP and CMJ assessment identifies distinct neuromuscular profiles in handball players, demonstrating that maximal isometric strength and explosive performance represent complementary aspects of athletic ability. A profile-based approach may improve individualized strength and power training and optimize load management, particularly in youth athletes. Future studies incorporating surface electromyography (sEMG) may further clarify the neuromuscular mechanisms underlying these performance profiles.

Keywords: Handball; Isometric mid-thigh pull; Countermovement jump; Neuromuscular profiling; Body composition; DEXA.

BIOIMPEDANCE-DERIVED PHASE ANGLE AS AN ADDITIONAL PREDICTOR OF TREADMILL SPIROERGOMETRIC PERFORMANCE IN YOUNG ELITE ATHLETES

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Background: Understanding the relationship between athletes' structural characteristics and functional performance requires assessment of both body composition and internal physiological status. Bioimpedance analysis provides parameters related to tissue bioelectrical properties, including phase angle. Evidence on the relevance of phase angle in spiroergometric assessments of young elite athletes remains limited.

Objective: This ongoing study examines whether bioimpedance-derived phase angle provides additional explanatory value for time to exhaustion and allometrically scaled VO₂ peak beyond age, body height, and DEXA-derived skeletal muscle proportion.

Subjects and methods: Preliminary analyses included 94 female and 130 male elite handball players aged 13–25 years. Female recruitment is ongoing, while male data collection is complete. Participants completed a stepwise incremental treadmill protocol to maximal voluntary exhaustion. VO₂ peak was calculated from a 30-second moving average of breath-by-breath data and allometrically scaled to body mass. Bioimpedance was assessed using an InBody 770 device. Phase angle was the main explanatory bioimpedance variable; device-generated resistance and reactance Z-scores were retained for potential vector-based bioimpedance interpretation. Skeletal muscle proportion was assessed by DXA. Sex-stratified multiple regression models examined the explanatory value of skeletal muscle proportion and phase angle beyond age and body height.

Results: Preliminary sex-stratified regression analyses suggested that DEXA-derived skeletal muscle proportion accounted for additional variance in time to exhaustion and allometrically scaled VO₂ peak compared with models containing age and body height only. Phase angle showed a small but significant additional contribution, mainly for time to exhaustion. The overall pattern was similar in both sexes, despite limited explanatory value of the age- and height-only models in males.

Conclusions: Bioimpedance-derived phase angle may provide complementary information for interpreting treadmill spiroergometric performance in young elite athletes, especially time to exhaustion.

Keywords: Bioimpedance-derived phase angle; Spiroergometry; DEXA; Sport diagnostics; Youth handball.

MULTIMODAL ASSESSMENT OF BODY STRUCTURE IN YOUNG ELITE HANDBALL PLAYERS USING DEXA, 3D BODY SCANNING AND ANTHROPOMETRY

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Background: Accurate body composition assessment is essential in elite sports for athlete monitoring and performance optimization. Dual-energy X-ray absorptiometry (DEXA) is considered a reference method, however, its routine application is limited by cost, time requirements and the need for specialized equipment. Three-dimensional (3D) body scanning has emerged as a rapid, non-invasive and radiation-free alternative but its validity in adolescent elite athletes remains underinvestigated.

Objective: This study aimed to compare body structure parameters measured by DEXA, 3D body scanning and traditional anthropometry in young elite handball players, and to assess the potential of 3D body scanning as a tool for body structure evaluation in elite sports.

Subjects and methods: A total of 144 adolescent elite handball players participated in the study. Body composition was assessed using DEXA and a 3D body scanner using a standardized protocol. DEXA-derived variables included regional total mass and lean soft tissue mass of the upper limbs, lower limbs and trunk. The 3D scanner provided segmental body volumes and circumferential measurements. Dominant and non-dominant limbs were analysed separately. Pearson correlation analyses and linear regression models were used to evaluate relationships between measurements obtained by the methods.

Results: Very strong correlations were found between 3D-derived segmental volumes and DEXA-derived regional total mass values ($r = 0.936\text{--}0.983$). Strong associations were also observed between segmental volumes and lean soft tissue mass ($r = 0.836\text{--}0.952$). Significant correlations were identified between conventional anthropometric circumferences and corresponding 3D-derived measurements ($r = 0.855\text{--}0.942$).

Conclusions: As a rapid, non-invasive, radiation-free method, 3D body scanning may represent a practical tool for routine athlete monitoring and large-scale field assessments in elite youth sports.

Keywords: Body composition; DEXA; 3D body scanner; Handball; Adolescent athletes.

PHYSICAL EXERCISE TRAINING AND MENOPAUSE: EFFECTS ON BODY COMPOSITION AND QUALITY OF LIFE

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Background: Menopause, defined as the cessation of menstruation for a continuous period of 12 months, marks a significant transition in a woman's life, typically occurring around age 51, characterised by physical and psychological changes that can negatively affect overall health and quality of life.

Objective: This longitudinal study is designed as a non-randomized controlled trial to investigate the effects of a 12-week supervised physical exercise program on body composition, body image perception, and quality of life in a sample of Italian menopausal women.

Subjects and methods: Thirty-seven postmenopausal women were assigned to either an exercise intervention group (n=22), which performed two 60-minute sessions weekly of a combined exercises training, or a non-exercising control group (n=15). Anthropometric data (stature, weight, circumferences, skinfold thicknesses), bioelectrical impedance analysis, and air displacement plethysmography were collected. Body image perception and quality of life were assessed using Thompson & Gray's silhouettes and the MENQOL questionnaire, respectively. The handgrip strength test and the treadmill stress test were performed to assess upper limb muscular strength and aerobic capacity, respectively. Differences between pre-and post- data were assessed by the t-test for dependent samples.

Results: Compared with the control group, the intervention group showed a mild reduction in body fat mass, along with a significant decrease in biceps (p=0.01) and suprailiac (p=0.04) skinfold thickness. Additionally, significant improvements were observed in bioelectrical impedance parameters, with increased reactance (p=0.04) and phase angle (p=0.01), in handgrip strength (right: p<0.01; left: p=0.02), and peak oxygen consumption (p<0.01). Moreover, significant reductions were observed in menopause-related symptoms, particularly in psychosocial (e.g., dissatisfaction with personal life: p=0.01), physical (e.g., back and neck pain: p<0.01), and sexual (e.g., avoidance of intimacy: p<0.01) domains.

Conclusions: A combined exercises training program can significantly improve in body composition, muscle strength, aerobic capacity, and multiple domains of well-being in postmenopausal women. Due to the limited sample size, further studies with larger cohorts are essential to confirm these preliminary results.

Keywords: Menopause; Physical exercise; Quality of life; Body composition.

CALCANEAL QUANTITATIVE ULTRASONOMETRY AS A FIELD-FRIENDLY TOOL FOR BONE QUALITY ASSESSMENT IN ITALIAN POSTMENOPAUSAL WOMEN: ASSOCIATIONS WITH BODY COMPOSITION AND MENOPAUSAL DURATION

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Background: In postmenopausal women, bone quality assessment is essential for identifying skeletal fragility risk. The calcaneal bone quality index (BQI), assessed via quantitative ultrasound (QUS), represents a non-invasive, field-friendly alternative to dual-energy X-ray absorptiometry (DXA).

Objective: To investigate the associations between BQI, body composition, menopausal duration and functional variables in Italian postmenopausal women.

Subjects and methods: A cross-sectional study design – in which all measurements were taken at a single point in time – was conducted on 138 Italian postmenopausal women (mean age: 61.1±5.3 years; mean years since menopause (YSM): 10.5±6.1 years). BQI was assessed using calcaneal QUS (SONOST 3000). Body composition was assessed through bioelectrical impedance analysis (BIA 101, Akern), providing fat-free mass (FFM), fat mass (FM) and fat percentage (%F). Handgrip strength (HGS) was measured bilaterally using a dynamometer. Pearson correlations and two multiple linear regression models were performed using BQI as the dependent variable: a background model (age, YSM, BMI) and a body composition model (%F, FFM, HGS). A simple linear regression with YSM alone was also conducted.

Results: BQI showed significant negative correlations with age ($r=-0.30$, $p=0.0003$) and YSM ($r=-0.34$, $p<0.0001$), and positive correlations with BMI, FFM and FM ($r=0.18$ for all, $p=0.033$). No significant correlations emerged for %F and HGS. The body composition model was not statistically significant ($F=1.864$, $R^2=0.040$, $p=0.139$), whereas the background model was statistically significant ($F=7.133$, $R^2=0.138$, $p=0.0002$), with YSM as the strongest predictor ($p<0.0001$). In simple linear regression, YSM alone explained 12% of BQI variance ($R^2=0.120$, $p<0.0001$).

Conclusions: Menopausal duration is the primary determinant of calcaneal bone quality in postmenopausal women, independent of body composition. These findings support the use of calcaneal QUS as a field-friendly pre-screening tool for bone quality monitoring in non-clinical and large-scale epidemiological settings.

Keywords: Postmenopause; Calcaneal QUS; Bone health; Body composition; Ageing.

STRESS, SPIRIT AND SHAPE: UNPACKING ADOLESCENT HEALTH IN ZAGREB HIGH SCHOOLS

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Background: Adolescence is a critical period when stress may affect nutritional status and body composition. Spirituality, defined as meaningful connections with oneself, others, nature, and something beyond the self that promote purpose, joy, and inner peace, may support coping with stress and healthier lifestyles. However, its relationship with stress and nutritional status remains unclear.

Objective: To examine the associations of perceived stress and spiritual health with anthropometric indicators (BMI and body fat percentage) among adolescents, while assessing the influence of sex, age, and socioeconomic status on these relationships.

Subjects and methods: This cross-sectional study included 500 adolescents from Zagreb, Croatia. Perceived stress, spiritual health, and nutritional status/body composition were assessed using the PSS-10, Spiritual Health Scale, anthropometry, and bioelectrical impedance analysis.

Results: Adolescents reported moderate perceived stress levels (mean=17.16, SD=6.08). BMI categories were: underweight (7.3%), normal weight (78.6%), overweight (11.7%), and obesity (2.4%); median body fat percentage was 19.72%. Girls showed higher stress than boys (19.66 ± 5.63 vs. 14.58 ± 5.44 , $p < 0.001$). Spiritual health was moderate (median=23.00) and not significantly correlated with stress ($r = -0.044$, $p = 0.388$), with weak associations emerging after adjustment for sex and age, but not for socioeconomic status. Stress was not associated with BMI ($r = -0.032$, $p = 0.475$), neither after adjustment for covariates, but was positively associated with body fat percentage ($r = 0.326$, $p < 0.001$), independent of age and socioeconomic status but not sex. Spiritual health was negatively associated with BMI ($r = -0.208$, $p < 0.001$) and body fat percentage ($r = -0.129$, $p = 0.004$). These associations remained significant in adjusted analyses.

Conclusions: Stress, spiritual health, and nutritional status appear to be mildly interconnected components of adolescent health. Promoting psychosocial well-being may support healthier nutritional outcomes, highlighting the need for further longitudinal and intervention research.

Keywords: Adolescents; Perceived stress; Spirituality; Nutritional status; BiCePs_Nutrition.

Acknowledgement / Funding Source: This research is part of the Institute for Anthropological Research project IA-INT-2024BiCePs_Nutrition (funded by The European Union's National Recovery and Resilience Plan (NPOO) for Croatia.

GEOMETRIC VARIABILITY OF THE LUMBAR SPINE FROM MEDIEVAL TO MODERN TIMES

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Background: Low back pain is a global epidemic, affecting over 600 million people worldwide. The condition has been tentatively linked to reduced physical activity in modern sedentary societies, yet the morphological basis of this relationship remains underexplored.

Objective: This study compared the three-dimensional shape of the lumbar vertebrae in historical and contemporary populations to assess whether reduced biomechanical loads on the spine – associated with a decrease in physical activity over time, as commonly reported in the literature – resulted in morphological changes in this most loaded area of the spine.

Subjects and methods: The shape of the fourth lumbar vertebra (L4) of adult individuals was analysed using 3D geometric morphometrics. The contemporary sample (N=100) consists of anonymized CT scans from the Medical University of Wroclaw, Poland, and the historical sample (N=92) originates from a Polish medieval cemetery in Cedynia, dated between 10th to 14th centuries AD. Both cohorts were age-matched to control for age-related bone loss. Landmark-based shape analysis was performed using generalized Procrustes analysis and Principal Component Analysis in the geomorph R package.

Results: Preliminary results reveal significant morphological differences between the two populations. Marked sexual dimorphism is present in the medieval population, demonstrating greater variability in vertebral shape between male and female skeletons compared to the contemporary cohort. Medieval lumbar vertebrae exhibit shorter and less massive transverse processes, while their inferior articular processes are more defined than those of modern vertebrae. A reduced vertebral body diameter is clearly visible in contemporary individuals relative to their medieval counterparts, suggesting gracilization of the lumbar spine under reduced mechanical loading regimes.

Conclusions: The observed shape changes indicate functional adaptation of the lumbar spine to declining physical activity levels over centuries. These findings provide an evolutionary perspective on spinal morphology and may enhance our understanding of low back pain aetiology in modern populations.

Keywords: Lumbar spine; Geometric morphometrics; Low back pain.

Acknowledgement / Funding Source: Adam Mickiewicz University – ID-UB grant no. 190 for “Doctoral research and international training and workshops”.

INDOOR MICROBIOME DIVERSITY AMONG ASTHMATIC AND HEALTHY CHILDREN – HIDDEN LIFE IN BED DUST

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Background: Indoor dust is an important reservoir of bacterial and fungal communities that may influence children's respiratory health.

Objective: The aim of this research was to compare microbiome diversity and abundance in bed dust samples from children with asthma and healthy children and to explore associations with household and environmental factors.

Subjects and methods: Bed dust samples from 150 children (69 with asthma, 81 controls) were analyzed using 16S rRNA and ITS sequencing. Microbial diversity and community composition were assessed and related to asthma status, socioeconomic factors, household characteristics, pet ownership, cleaning practices, and ventilation.

Results: Asthma status was not significantly associated with bacterial or fungal beta or alpha diversity, although a trend was observed for bacterial beta diversity between asthmatic and healthy children ($p = 0.065$). In contrast, several household and environmental variables were significantly associated with microbiome composition. For the bacterial microbiome, beta diversity was significantly associated with gender, parental education, household income, number of children and siblings, rural or urban living environment, pets' ownership, ventilation, dusting and cleaning practices. Alpha diversity was associated with gender, parental education and pets ownership. In addition to the finding that living environment and cleaning was significantly associated with fungal beta diversity, having cat showed strong associations with both bacterial and fungal alpha diversity measures (all p values < 0.05).

Conclusion: Bed dust microbiome diversity did not differ significantly between children with asthma and healthy controls, but household environment, pet exposure and cleaning practices were strongly associated with household microbiome, suggesting that environmental factors may influence indoor microbiome, relevant to childhood respiratory health.

Keywords: Dust microbiome; Bacterial and fungal communities; Asthma; Respiratory health; Illumina sequencing.

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OVERLAP AND HIDDEN ADIPOSITY IN ADOLESCENTS ACROSS BMI-DEFINED WEIGHT CATEGORIES

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Background: Standard BMI screenings often overlook adolescents with hidden health problems due to high body fat despite a normal BMI or very low body fat levels.

Objective: This study aimed to analyse adiposity in adolescents across BMI-defined weight categories: underweight (UNW), normal weight healthy (NWH) normal weight obese (NWO) and overweight or obese (OVOB), focusing on distributional variability, overlap, and sex differences.

Subjects and methods: Data were collected from 5,740 Polish adolescents (49.6% male) aged 10–18 years from the ADOPOLNOR project. Body composition was measured using bioelectrical impedance analysis to determine fat mass percentage (FMP), fat mass index (FMI), and fat-to-muscle mass ratio (FMR). Density plots were used to visualise the distributions of these indicators and overlap coefficients (OVL) were calculated to measure the similarity between adjacent groups and capture heterogeneity within BMI categories.

Results: Median values of all adiposity indicators increased from UNW to OVOB in both sexes ($p < 0.001$), with higher values in females, particularly in the NWO group (effect size $r \geq 0.65$). Substantial within-category variability was observed, consistent for both sexes. Overlap analyses revealed little similarity between NWO and NWH ($OVL \leq 0.24$), indicating clear separation despite similar BMI, but substantial similarity between NWO and OVOB ($OVL \geq 0.62$), demonstrating similar adiposity despite different BMI. Two adiposity clusters emerged: UNW/NWH (lower adiposity) and NWO/OVOB (higher adiposity), independent of BMI. Classification confirmed high adiposity in all NWO and most OVOB adolescents, while UNW and NWH were mostly average or low. A small proportion of underweight adolescents also showed high adiposity (5.3% males, 0.5% females).

Conclusions: BMI reflects general adiposity trends but does not capture variability within categories. Overlap between BMI groups suggests that BMI alone can misclassify adolescents, supporting the use of direct body composition assessment alongside BMI.

Keywords: Adolescents; BMI; Adiposity indicators; Adiposity heterogeneity.

BONE LOSS IN ADULTS EXPOSED A WEAK TERATOGENIC STRESS

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Background: We hypothesized that some developmental toxicants (teratogens) given at a sub-threshold teratogenic dose can detrimentally affect bone health in adults. We also examined whether such teratogenic exposure depends on the embryonic genome.

Materials and methods: ICR mice as well as 57Bl/6J (C57) and C3H/HeJ (C3H) mice exhibiting a low (C57) and high (C3H) bone mass phenotype were exposed to a single injection of 5-aza-2-deoxycytidine (5-AZA) at a sub-threshold teratogenic dose (0.15mg/kg) on day 10 of gestation. Offspring were obtained and their femur was evaluated by micro-computed tomography (micro-CT). The activity of caspase 3 and miRNA expression (~380 miRNAs) were tested in embryonic hind limb buds collected 24 and 48 h after 5-AZA injection. Primary cultures of femoral stromal/osteoblastic cells and osteoclast precursor cells were used to test the expression of RANKL and OPG as well as the level of osteoclast formation by TRAP staining.

Results: Micro-CT revealed that femora of ICR 5-month-old male offspring exposed to 5-AZA had trabecular microarchitecture indicative of bone loss. In hind limb buds of embryos altered expression of some microRNAs demonstrated as regulators of key osteoblastogenic genes has been observed. Furthermore, the increased expression of RANKL in femoral stromal/osteoblastic cells of offspring of 5-AZA-treated females has been found. Finally, loss of bone quality was registered in C3H offspring but not in their C57 counterparts.

Conclusions: This study implies that: 1) low-dose exposure to a teratogen can induce bone loss in adult offspring and 2) offspring inherently exhibiting a low bone mass phenotype may be more resistance to an antenatal stress-induced bone loss than those inherently exhibiting a high bone mass phenotype.

Keywords: Low-dose teratogen exposure; Bone loss; Stress.

BIO-MEDICAL ANTHROPOLOGICAL PERSPECTIVE ON URBAN-RURAL AND SOCIOECONOMIC DISPARITIES IN EASTERN CROATIA

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Background: Cardiovascular diseases (CVDs) remain the leading cause of death in Croatia, accounting for 37% of all deaths, with a standardized mortality rate of 572.8/100,000, substantially exceeding the EU average of 367.6/100,000. The Osijek-Baranja region in eastern Croatia, characterized by both continental climate and significant urban-rural gradients, presents a particularly high burden of modifiable CVD risk factors. Bio-medical anthropological approaches offer a critical lens for examining how biological vulnerability intersects with socioeconomic, environmental, and lifestyle determinants of cardiovascular health at the population level.

Objective: To analyse the prevalence and distribution of cardiovascular risk factors, including hypertension, dyslipidaemia, obesity, and physical inactivity, across urban and rural populations in eastern Croatia, and to assess associations with socioeconomic deprivation indicators and anthropometric measurements.

Subjects and methods: A cross-sectional study was conducted in the Osijek-Baranja County, encompassing adult participants registered with general practice offices in both urban and rural settings. Anthropometric assessments (body mass index, waist circumference, waist-hip ratio) were performed alongside clinical measurements (blood pressure, fasting lipid profiles). Socioeconomic data were collected through structured questionnaires. Data were analysed using multivariate logistic regression to identify independent predictors of elevated cardiovascular risk.

Results: Rural participants demonstrated a significantly higher prevalence of arterial hypertension, increased BMI, elevated waist circumference and waist-hip ratio, and elevated LDL cholesterol compared to urban counterparts. Urban participants showed significantly greater rates of insufficient physical activity. Overall, more than 75% of participants exhibited at least two major modifiable cardiovascular risk factors, consistent with regional epidemiological patterns documented across continental Croatia.

Conclusions: The findings highlight the persistence of high cardiovascular risk factor burden in eastern Croatia, with pronounced urban-rural disparities mediated by both biological and socioeconomic factors. A targeted, community-based public health strategy, integrating bio-medical anthropological profiling into cardiovascular prevention programmes, is urgently needed for this high-risk region. These results underscore the value of integrating anthropometric and population-level biological data into cardiovascular health interventions.

Keywords: Cardiovascular risk factors; Bio-medical anthropology; Urban-rural disparities; Croatia; Population health.

MULTISYSTEM MORBIDITY IN PRETERM SURVIVORS: ASSOCIATIONS WITH BIRTHWEIGHT-FOR-GESTATIONAL- AGE STATUS FROM BIRTH TO ADOLESCENCE

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Background: Preterm birth is associated with increased long-term morbidity, yet health outcomes are often analysed within separate organ systems. Less is known about how disease burden and co-occurring morbidity patterns differ according to birthweight-for-gestational-age status from birth to adolescence.

Objective: To assess disease burden, International Classification of Diseases, 10th Revision (ICD-10) disease chapter involvement, and morbidity co-occurrence patterns in preterm children according to small-, appropriate-, and large-for-gestational-age (SGA, AGA, and LGA) status.

Subjects and methods: A retrospective longitudinal study included 420 preterm children followed until adolescence (202 boys, 218 girls; born in 2000–2015). First-time diagnoses from medical records (n=1,818) were classified by ICD-10. Children were categorised as SGA, AGA, or LGA. Outcomes were analysed using Poisson and negative binomial regression.

Results: The primary disease burden was concentrated from birth to preschool age. Compared with SGA children, AGA and LGA children had significantly lower incidence rates of separate diseases (IRR 0.825, p=0.004; IRR 0.709, p=0.003) and affected ICD-10 chapters (IRR 0.812, p=0.008; IRR 0.692, p=0.009). Five or more diseases were recorded in 55% of SGA, 39% of AGA, and 25% of LGA children, while five or more ICD-10 disease chapters were affected in 44%, 28%, and 18%, respectively. Differences were significant between SGA and both AGA and LGA groups (p<0.05), but not between AGA and LGA (p=0.365). UpSet analysis showed unique morbidity profiles in 89.1% of SGA, 37.8% of AGA, and 92.9% of LGA children.

Conclusions: SGA status in preterm children was associated with greater long-term disease burden and broader ICD-10 disease chapter involvement. Morbidity profiles were highly heterogeneous, indicating that preterm health outcomes should be evaluated as multisystem and individualised rather than organ-specific outcomes alone.

Keywords: Preterm birth; Birthweight-for-gestational-age; SGA; Long-term morbidity; ICD-10.

GROWTH AND NUTRITIONAL STATUS IN CHILDREN WITH RECURRENT ABDOMINAL PAIN AND ITS RELATION TO EATING BEHAVIOURS

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Background: Paediatric feeding difficulties may adversely affect growth, nutritional status, and psychosocial functioning. In children with recurrent abdominal pain, gastrointestinal symptoms may contribute to maladaptive eating behaviours; however, data linking feeding-related behaviours with nutritional status in this population remain limited.

Objective: To investigate relationships between body height and nutritional status with eating behaviours in paediatric patients with recurrent abdominal pain.

Subjects and methods: This cross-sectional study included 138 paediatric patients (62 boys, 76 girls; mean age 11.4±3.62 years) undergoing diagnostic work-up for recurrent abdominal pain in paediatric gastroenterology clinic. Dependent variables were z-scores for height, BMI, mid-upper arm circumference (MUAC), mid-upper arm muscle circumference (MUAMC), and the sum of three skinfold thicknesses (triceps, subscapular, abdominal). Independent variables included age, sex, pain aetiology, symptom duration, breastfeeding duration, and Child Eating Behaviour Questionnaire domains. Multivariable linear regression models included variables significantly associated with anthropometric indicators in univariable analyses, with age and sex retained as confounders.

Results: Underweight was common, affecting 27.5% of patients. Eating behaviours varied with age: younger children presented higher food fussiness, satiety responsiveness, and slowness of eating (SE). Among feeding-related behaviours, SE was the most consistent correlate of poorer nutritional status, showing inverse associations in univariable analyses with height, BMI, MUAC, MUAMC, and skinfold sum. Pain aetiology was not associated with growth or nutritional indicators, whereas symptom duration ≥12 months was associated with lower MUAC and lower skinfold sum. In multivariable analyses, SE remained independently associated with lower height, BMI, and MUAMC, while together with symptom duration, contributed significantly to the explanation of variance in MUAC (10.06%, $p<0.001$) and skinfold sum (9.71%, $p<0.01$).

Conclusions: These findings suggest that recurrent abdominal pain may negatively influence growth and nutritional status through feeding-related difficulties, manifested by slowness of eating, particularly when gastrointestinal symptoms are prolonged.

Keywords: Growth; Nutritional status; Gastrointestinal disorders; Eating behaviour; Paediatrics.

EMBODIMENT AND THE TASTE FOR LIFE: EXISTENTIAL STRATEGIES IN HOME ENTERAL NUTRITION

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Background: Eating is a fundamental human practice through which people relate to themselves, others and the world. In contexts of illness, however, eating may become mediated by biomedical technologies that profoundly transform bodily experience and social life.

Objective: This paper examines the embodied experience of eating among adults undergoing home enteral nutrition therapy (HENT), drawing on interviews with patients and family caregivers to explore how feeding through a tube is lived, negotiated and incorporated into everyday life.

Subjects and methods: The study involved 10 adults with oesophageal cancer undergoing home enteral nutrition therapy and their family caregivers in southern Brazil. Data from semi-structured interviews and field observations were analysed using interpretive thematic analysis informed by phenomenology, embodiment, and the anthropology of the body. The study examines eating not only as a physiological process but also as a sensory, moral, and relational practice through which individuals create meaning and maintain social connections.

Results: Interpretive thematic analysis generated four interconnected themes that illuminate how patients and caregivers negotiate bodily disruption, identity and care through everyday feeding practices. Findings reveal that HENT is experienced through a dynamic interplay of suffering, adaptation and resistance. Participants mobilize existential strategies such as religiosity, hope, humour, compassion and shared caregiving practices to preserve a sense of continuity and maintain what many described as a “taste for life.” At the same time, the feeding tube may be experienced as a threat to identity, autonomy and bodily integrity, generating feelings of loss, guilt, repugnance and refusal. These experiences expose tensions between biomedical norms and the lived realities of illness, highlighting the moral and affective dimensions of technological care.

Conclusion: By foregrounding eating as an embodied and intercorporeal experience, the paper contributes to anthropological debates on health, illness and care. It argues that Home Enteral Nutrition is not simply a nutritional technology but a social and existential practice through which bodies, identities and relationships are continually reconfigured.

Keywords: Embodiment; Medical anthropology; Intercorporeality; Care; Home enteral nutrition.

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BALANCING IMMUNE PROTECTION AND EMOTION REGULATION: EVIDENCE FOR EARLY-LIFE TRADE-OFF IN BREASTFED INFANTS

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Background: Infant temperament changes during the first year of life, reflecting developmental changes in brain structure and function. Brain development is shaped by the immune system, which in infants is influenced by bioactive components present in breast milk.

Objective: This study examined the association between immunoactive factors in breast milk and the development of infant temperament during the first year of life.

Subjects and methods: The study included a sample of 112 mothers and their exclusively breastfed infants from Wroclaw (Poland) participating in the Mums Milk Plus. Concentrations of S-IgA, IgM, IgG, and lactoferrin were analysed in milk samples collected at 5 m using an ELISA method. Temperament traits were assessed using the Infant Behaviour Questionnaire at 5 and 12 m of life. Statistical analysis was conducted using linear mixed models.

Results: The infant temperamental trait Orienting/Regulation was associated with IgG ($\beta=0.28$, $p=0.042$) and IgM ($\beta=0.18$, $p=0.002$) levels at 5 and 12 months. Maternal depression, infant sex, and infant age did not confound these associations.

Conclusion: These findings may indicate that maternal immunological investment through breast milk is linked to infant neurobehavioral development, pointing to a potential developmental trade-off between immune support and the maturation of regulatory functions.

Keywords: Breastmilk; Immunoglobulins; Temperament; Emotion regulation.

Acknowledgement / Funding Source: The study was funded by the Polish National Science Centre (grant no. 2015/17/B/NZ8/02436; PI: Anna Ziomkiewicz) and the Wroclaw Medical University, Poland (grant No. SUBZ.A410.24.017 and grant No. SUBZ.A411.25.094; PI: Magdalena Orczyk-Pawilowicz).

SHIFTING HORIZONS: SOCIOECONOMIC ADAPTATION AND FAMILY RECONFIGURATION AMONG SYRIAN AND IRAQI REFUGEES IN IRELAND

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Background: Forced displacement and resettlement profoundly reshape the socioeconomic lives of refugee families. For Syrian and Iraqi households arriving in Ireland, the encounter with new institutional systems, welfare structures, and cultural expectations generates both challenges and opportunities. Understanding how families navigate these transitions is essential for interpreting broader population-level dynamics under conditions of forced mobility.

Objective: This study aims to examine how resettlement in Ireland transforms the socioeconomic organisation, kinship roles, and everyday practices of Syrian and Iraqi refugee families. It explores how displacement, asylum processes, and integration policies intersect with family life, how households negotiate the tensions between continuity and change.

Subjects and methods: The study uses a qualitative, anthropological approach to examine the experiences of Syrian and Iraqi refugee families in Ireland. Drawing on ethnographic fieldwork, interviews, participant observation, home visits, and autoethnographic reflection, it explores how families navigate resettlement, daily challenges, support services, and adaptation processes within the Irish context.

Results: Findings indicate that resettlement produces both constraints and new forms of agency. Gendered divisions of labour shift as women increasingly enter education and employment, while men navigate altered social positions due to labour-market barriers and linguistic dependency. Intergenerational roles are reconfigured as children act as cultural and linguistic brokers, mediating interactions with schools, healthcare, and welfare systems. Structural factors – such as housing precarity, bureaucratic regimes, and limited employment opportunities – shape daily life, yet families respond with context-specific strategies that maintain cultural coherence, dignity, and reciprocity.

Conclusions: Syrian and Iraqi refugee families in Ireland are not passive recipients of integration frameworks but active agents who creatively negotiate new socioeconomic realities. Their adaptive practices illuminate how displacement reconfigures family life and contributes to wider anthropological understandings of resilience, population dynamics, and the moral economies of care in contexts of forced migration.

Keywords: Forced migration; Socioeconomic adaptation; Family reconfiguration; Gender and generational dynamics; Refugee integration (Ireland).

Acknowledgement / Funding Source: Queen's University Belfast.

VALIDATION OF CANDIDATE SNPS AND CPGS FOR HUMAN FACE PREDICTION

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Background: Human facial genetics remains challenging due to the complexity of facial morphology, its highly polygenic basis, and the combined influence of genetics, environment, age, and lifestyle on facial appearance.

Objective: To develop predictors of human facial appearance that could aid facial reconstruction in forensic anthropology and predict facial appearance using DNA-based methods alone.

Subjects and methods: Data from ~800 individuals, including Illumina GSA genotypes, EPIC methylation profiles, metadata, and 3D facial scans, were analyzed. Candidate facial SNPs were evaluated using MeshMonk with facial segmentation and landmark-based phenotyping. Associations were tested between 747 DNA variants and facial traits in 658 individuals. In addition, BMI-predictive CpG sites were validated, and a compact BMI prediction model was developed using Elastic Net regression on methylation data from 624 individuals.

Results: Using global-to-local segmentation approach we found 29 SNPs to be significantly associated with 22 segments of the faces. The facial landmarking approach identified 27 candidate SNPs to be significantly associated with 60 facial distances. Elastic Net regression yielded 30 CpG BMI predictors. In the validation set, the model achieved a mean absolute error of 2.9 kg/m². The current results represent a step forward in our research on facial prediction.

Keywords: Human face morphology; BMI; Phenotyping; DNA-based prediction.

Acknowledgement / Funding Source: The data used in this study were collected previously as part of a project funded by NCBR (project no. DOB-BIO10/06/01/2019). The study received funding from the National Science Centre, Poland, grant number 2024/53/B/NZ8/02535.

AT THE CROSSROADS OF CONTINENTS: ANCIENT DNA INSIGHTS INTO THE MATERNAL AND PATERNAL POPULATION HISTORY OF CROATIA

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Background: South-Eastern Europe, and Croatia in particular, has served as a genetic crossroads between the Near East and Europe since prehistoric times, shaped by numerous and recurrent migration events. Mitochondrial DNA (mtDNA) and Y-chromosomal markers are especially valuable in this context due to their uniparental inheritance and limited recombination. Their analysis in ancient genomes provides an exceptional framework for tracing migration processes and demographic changes through time.

Objective: The aim of this study was to investigate patterns and trends in Croatian maternal and paternal genetic landscapes from the Neolithic, Bronze, and Iron Ages through Antiquity and the medieval period to the modern era.

Subjects and methods: A database comprising 304 published ancient genomes from Croatia was compiled. The ISOGG Y-DNA Haplogroup Tree 2019–2020 and mtDNA Tree Build 17 (PhyloTree) were used to determine Y-chromosomal and mitochondrial haplogroups, respectively.

Results: The Croatian mtDNA profile indicates strong continuity of major maternal lineages (H, U, T, J, and K), reflecting enduring Mesolithic ancestry and early Neolithic farming expansions, with only minor changes over time. In contrast, Y-chromosomal data show substantial paternal turnover, shifting from early farmer- and hunter-gatherer-associated haplogroups (G2a, J2b) to a more diverse historic population influenced by R1a, I1, J1a, E1b, and N1a. Compared with historic populations, modern Croatians exhibit a marked increase in I2a, now the dominant paternal lineage.

Keywords: mtDNA; Y chromosome; Ancient DNA; Croatian (pre)history.

Acknowledgement / Funding Source: This research was funded by the project “Applied Bioanthropology in the Study of ancient and contemporary populations in the Republic of Croatia – IA-INT-2024-BioAntroPoP” (Luka Bockor), Institute for Anthropological Research and European Union, NextGenerationEU, Individual scientific career development.

RESILIENT FUTURES USING INTERDISCIPLINARY RESEARCH GUIDED BY LOCAL INDIGENOUS KNOWLEDGE

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Background: For thousands of years, the Murray–Darling River – one of the largest river systems in Australia – sustained large populations through periods of environmental change. Prior to European settlement, it was among the most densely populated regions on the continent. Today, the river system is highly regulated and ecologically vulnerable, with climate volatility, biodiversity loss, and water governance challenges threatening the resilience of wetland and floodplain ecosystems.

Objective: This paper examines long-term human–environment interactions in the Murray–Darling Basin to identify how interdisciplinary research, informed by Indigenous knowledge, can contribute to future sustainability and conservation.

Subjects and methods: This study integrates palaeoecology, archaeology, and anthropology. It draws on natural history collections, ecological datasets and the Indo-Pacific Palaeoecology Database (IPPD) to reconstruct environmental change. Archaeological analyses from sites such as Kow Swamp and Coobool Creek examine changes in body size and social organisation across climatic transitions. This data is combined with community-driven research in partnership with the Yorta Yorta Aboriginal Nation, incorporating First Nations ontologies through collaborative methodologies.

Results: Findings show significant environmental and social transformations since the late Glacial into the Holocene. Biodiversity shifts are evident in ecological datasets, while archaeological evidence indicates changes in human morphology and group relations. Integrating Indigenous knowledge with scientific data reveals relational practices that sustain ecosystems and highlights culturally grounded strategies for resilience.

Conclusions: Interdisciplinary, community-driven approaches are essential for understanding deep human–environment histories. By centring First Nations knowledge and ontologies alongside scientific data, the study demonstrates how co-produced knowledge can inform more effective and culturally appropriate conservation strategies. Such approaches are critical for supporting the restoration and long-term sustainability of the Murray–Darling River system.

Keywords: Indigenous knowledge; Wetlands; Ancient ancestors; Conservation.

HUMAN REMAINS IN ANTHROPOLOGY: LEGACY, CHALLENGES AND PERSPECTIVES

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Background: The term human remains encompasses a broad range of materials, including skeletons, mummified individuals, biological samples, digital reproductions, and objects containing human traces. These materials are essential for evolutionary, bioarchaeological, and forensic research, providing valuable insights into past populations, health, mobility, and biological diversity. Many collections derive from archaeological excavations, exhumations, scientific expeditions, exchanges, and donations. However, their acquisition histories, particularly in non-European contexts, are often linked to colonial, Eurocentric, and racialised scientific practices. Beyond their scientific value, human remains hold symbolic, cultural, and emotional significance, contributing to identity formation and collective memory.

Objective: To explore the ethical, cultural, and scientific challenges surrounding the management, classification, ownership, restitution, and heritage value of human remains within contemporary frameworks of cultural heritage and social responsibility.

Subjects and methods: This study adopts a critical interdisciplinary perspective informed by anthropology, bioarchaeology, heritage studies, and museum ethics. Particular attention is given to the impact of colonial legacies on university and scientific collections. The project “Colonial Legacies of Universities: Materialities and New Collaborations” provides the conceptual framework for examining these issues and promoting dialogue among researchers, institutions, and stakeholders.

Results: Human remains emerge as hybrid entities situated between scientific specimens, cultural heritage, and ancestral remains. This status generates debates regarding ownership, restitution, access, and stewardship. Current heritage approaches increasingly emphasize participation, transparency, and collaboration with descendant and stakeholder communities.

Conclusions: The study and management of human remains require ongoing ethical reflection and socially responsible scientific practice. Transparent dialogue and inclusive collaboration are essential for developing equitable and sustainable approaches to the stewardship of human remains and their associated heritage.

Keywords: Human remains; Collections; Anthropology; Cultural heritage; Colonial legacy; Ethics.

Acknowledgement / Funding Source: Project “Colonial Legacies of Universities: Materialities and New Collaborations” (2025–2029; HE - Proposal No. 101177706).

MORPHOLOGICAL VARIABILITY OF THE CRANIOVERTEBRAL JUNCTION IN A HISTORICAL ITALIAN SKELETAL COLLECTION: INSIGHTS FROM THE ROMA SERIES

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Background: The craniovertebral junction (CVJ) is a complex region that balances mobility, stability, and protection of vital neurovascular structures. This study synthesizes findings from investigations of the historical ROMA skeletal series (Museum of Anthropology “Giuseppe Sergi,” Sapienza University of Rome), examining variation in the foramen magnum, occipital condyles, atlas occipitalisation, and proatlas-related anomalies.

Materials and methods: The analyses were performed on adult human crania dating from the 17–19th centuries. Standard anthropological methods were used for sex and age assessment. Macroscopic and morphometric examinations included measurements of the foramen magnum and occipital condyles, assessment of bilateral asymmetry, evaluation of hypoglossal canal morphology, and identification of rare craniovertebral anomalies such as atlanto-occipital fusion, precondylar tubercles, and third occipital condyles.

Results: The craniovertebral region displayed marked morphological variation. The foramen magnum showed diverse size and shape, while occipital condyles exhibited weak sexual dimorphism and mainly developmental asymmetry. Rare anomalies included atlas occipitalisation, precondylar tubercles, and third occipital condyles, supporting the developmental role of the proatlas in craniovertebral morphology.

Conclusions: The ROMA skeletal series provides valuable evidence of craniovertebral variation in a historical European population. These findings enhance understanding of cranial base development and underscore the value of museum collections for documenting human skeletal diversity, with important implications for radiological and surgical practice.

Keywords: Craniovertebral junction; Occipitalization of the atlas; Third occipital condyle; Precondylar tubercle; Asymmetry.

Acknowledgement / Funding Source: We are grateful to Prof. Giovanni Destro-Bisol for kindly facilitating access to the skeletal collections curated at the Museum of Anthropology “Giuseppe Sergi”; to Leonardo Torresi and Giorgia Gallo Cassarino for their valuable assistance and support during the meticulous cataloguing of the material and Elisabetta Aloisi Masella for her help in collecting data.

TOWARDS A FRAMEWORK FOR THE INCREMENTAL OPTIMIZATION OF AN AGE-AT-DEATH ASSESSMENT USING THE MACROSCOPIC EXAMINATION OF THE AURICULAR SURFACE OF THE ILIUM

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Background: A macroscopic assessment of morphological changes to the auricular surface of the ilium is one of the most widely used methods for determining age-at-death in osteoarchaeology. A few variants that have been developed so far have received a mixed response, with questions being raised about their accuracy and the too narrow age-at-death intervals. While most methods propose a visual assessment of the entire auricular surface at once, the method developed by Buckberry and Chamberlain, published in 2002, is the only one that proposes scoring each morphological component separately. This approach has the potential for further refinement.

Objective: Current considerations aim to re-evaluate the composite score, which could be adjusted to better reflect the data.

Subjects and methods: In the case of the original scoring procedure, there are five separate traits. Two of these are scored using a five-grade scale, while the remaining traits are scored using a three-grade system. However, this approach, which is dictated by the feasibility and ease of macroscopic identification of particular stages, does not reflect the relative numerical importance of traits when they contribute to the composite score, which is their sum. The simplest solution is to apply different combinations of weights to the whole dataset incrementally and look for improvements in the correlation between age-at-death and the composite score. The proposed procedure was tested using data provided by the original authors and published alongside their paper.

Results and conclusion: Incremental optimization proved to be very computationally intensive; therefore, test runs were performed using a limited weight range, spanning 0–2 with a step of 0.1. Although the resulting weights suggest the need to widen the range, the procedure has improved the overall Spearman's correlation, raising it from 0.624 to 0.651. Once the weights have been determined, the composite score groups should be adjusted.

Keywords: Age-at-death assessment; Osteoarchaeology; Macroscopic evaluation.

NEW DATA ON THE MORPHOLOGICAL TRAITS OF NEANDERTHAL TEETH FROM THE STAJNIA CAVE (POLAND)

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Background: Neanderthal fossils are rare, and in Poland they have been found at only two sites: Ciemna Cave and Stajnia Cave. At Stajnia Cave, nine Neanderthal teeth associated with Micoquian artefacts and dated to ~120,000–92,500 years ago were discovered. Although their morphology and taxonomic status have been confirmed, the internal morphological variation of Neanderthal teeth remains poorly understood.

Objective: The main aim of our study is to present new detailed data on the traits of the Neanderthal teeth from the Stajnia Cave including their internal morphology.

Materials and methods: The six of nine teeth whose characteristics of the internal morphology have not been described (including three permanent molars; 1 deciduous upper molar, 1 permanent upper incisor and 1 lower premolar) were scanned using a micro-computed tomography scanner and their 3D models were. The non-metric features observed on the surface of the enamel-dentine junction of these teeth were diagnosed and described. For molars with good state of the crown preservation, enamel thickness data were obtained. The analysed non-metric and metric traits of the examined teeth were compared with that known for the analogous types of teeth belonging to other Neanderthals and *Homo sapiens* (Palaeolithic and recent).

Results: The obtained data concerning examined specimens expand our knowledge on the morphological variability of Neanderthal teeth. Considering the dating of the examined teeth (marine isotopic stage 5), the described traits are particularly important for considering the phylogenetic significance of dental features within the Neanderthal evolutionary lineage.

Keywords: Neanderthals; Pleistocene; Teeth; Hominins; Morphology.

AT THE EDGE OF EUROPE: LATE PLEISTOCENE HOMININ SETTLEMENT AND WORKSHOP ACTIVITY AT INKAYA CAVE, NORTHWESTERN ANATOLIA

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Background: The Balkan–Anatolian corridor is a key but understudied route of Late Pleistocene hominin dispersal. Inkaya Cave (Çanakkale, Türkiye), discovered in 2016, provides the first stratified and radiometrically dated occupation sequence from northwestern Anatolia, spanning approximately 86,000–22,000 years BP.

Objective: This study presents the preliminary findings of systematic excavations at Inkaya Cave, examining lithic technological organization, spatial site-use patterns, and the broader implications for Late Middle to Early Upper Palaeolithic hominin mobility across the Balkan-Anatolian corridor.

Subjects and methods: Excavations conducted between 2017 and 2025 exposed a stratified cultural deposit approximately 340 cm thick, yielding 17,925 lithic artifacts. Technological classifications followed Inizan et al. (1999) and Kuhn et al. (2009); typological attributions were based on Bordes (1961).

Results: The assemblage is dominated by flakes (70.45%), with a notable blade component (18.44%) indicative of a Late Middle/Early Upper Palaeolithic transitional industry. Side scrapers are the most common retouched tools and increasing Levallois elements support a Mousterian attribution. A lithic workshop was active between ~65,000 and 40,000 BP, while abundant local raw materials favoured a pragmatic flake-based technology.

Conclusions: Chronological, technological, and biogeographic evidence suggests an association with *Homo neanderthalensis*. Inkaya Cave, situated along the Balkan-Anatolian corridor, appears to have been a key Late Pleistocene hominin activity center, providing important insights into Neanderthal mobility and adaptation at Europe's southeastern edge.

Keywords: Late Middle Palaeolithic; Mousterian; Inkaya Cave; Northwestern Anatolia; Neanderthal; Lithic workshop; Balkan-Anatolian corridor.

Acknowledgement / Funding Source: This research is supported by the Ministry of Culture and Tourism, the Rectorate of Ankara University, the Governorship of Çanakkale, Truva Bakir Mining, and T-Design Engineering Company.

HUNTER-GATHERERS WOLF INTERACTIONS INCREASED IN THE FRANCO-CANTABRIAN GLACIAL REFUGEE DURING THE LGM BEFORE DOG DOMESTICATION

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Background: Hunter-gatherers in the Late Palaeolithic developed several cultural and technical innovations, among which dog domestication outstands. The complex process of wolf-dog domestication seems to have been developed in several sub-regions of Eurasia. Among these regions, the Franco-Cantabrian Fringe (FCF) in Western Europe outstands for having some of the oldest morphometrically and genetically identified dog remains. On this basis, the Magdalenian hunter-gatherers have been proposed to have played a role in dog domestication and its expansion through Europe more than 17,000 years ago. Human-wolf interactions are a prerequisite for dog domestication to occur.

Objective: Thus, with the aim of studying the FCF as a putative locus of domestication, we studied the archaeological register in search of human-wolf interactions.

Subjects and methods: We recorded all prehistoric wolf and dog occurrences in the Cantabrian Provinces in Northern Spain, both in the bibliography and in the archaeological deposit centres, from the Mousterian to the pre-Roman period. Additionally, we compared this data with data from other mammals, mainly hunted/consumed animals, in the same archaeological sites. Moreover, we studied the anthropic marks of a sub-sample of wolves and dogs representing all the main cultural periods.

Results: Our results show a sharp increase of wolf remains in human-inhabited caves during the Last Glacial Maximum (LGM) in the Solutrean and Magdalenian cultural periods, a parallel increase of mammals consumed by hunter-gatherers, and a marginal exploitation of wolf resources (e.g. food, teeth pendants) by hunter-gatherers.

Conclusion: Results are compatible with an increase in human and wolf cave co-habitation during the LGM, facilitating wolf-human interactions. Demographic and climatic factors may explain these dynamics, which predate dog domestication in the region. In conclusion, FCF human-wolf dynamics are compatible with dog domestication during the Magdalenian in a period that was the culmination of Western European hunter-gatherers culture.

Keywords: Magdalenian; Solutrean; Hunter-Gatherers; Domestication; Wolf.

MOBILITY PATTERNS IN THE LOMBARD-PERIOD COMMUNITIES OF VICENNE AND MORRIONE (CAMPOCHIARO, ITALY; 7TH C. CE)

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Background: The cemeteries of Vicenne and Morrione (7th c. CE; Campochiaro, Molise) represent a key Lombard-period funerary complex in southern Italy. Their archaeological record, particularly contextual horse-horseman burials with riding equipment, indicates strong links with Pannonian Avar contexts and suggests a non-local origin of this group. Lombard chronicler Paul the Deacon reports the arrival, in the 7th century, of a group of foreigners from Eastern Europe in this region, likely providing a precise historical reference to this archaeological context.

Objective: This study investigates mobility patterns within these communities and tests whether isotopic evidence supports the hypothesis of a non-local origin of the community.

Materials and methods: Mobility was investigated through strontium isotope ($^{87}\text{Sr}/^{86}\text{Sr}$) analysis of early-forming dental enamel, primarily first molars. The sample comprises 61 individuals (31 Vicenne; 30 Morrione), including 13 horsemen. The local isotopic baseline was established using five modern plant samples collected within 2 km of the sites.

Results: The baseline defines a narrow, low-radiogenic range (0.70804–0.70851), whereas human enamel values range from 0.70822 to 0.72347. Results show that 44% of the individuals fall within or close to the local range. No significant sex-based differences in local/non-local status are observed between the two cemeteries. With one exception, all non-local individuals are adults, while local individuals are predominantly subadults and young adults (20–35 years). All horsemen are non-local, except for one adolescent individual, and display marked isotopic variability.

Conclusions: These results indicate a substantial non-local component, with a considerable number of high-radiogenic strontium values unusual for the region and, in some cases, the Italian peninsula, supporting the archaeological and historical evidence that the group was of foreign origin. The predominance of young individuals among locals supports the numismatic evidence for a short-term use of the cemeteries (~50 years). Future analyses will test different hypotheses concerning the possible origin(s) of this group.

Keywords: Pannonian Avars; Horsemen; Strontium isotopes; Human mobility.

BEYOND OSTEOLOGY: MULTI-OMIC ANALYSIS OF A COMPLEX EARLY MEDIEVAL BURIAL FROM LETONICE, CZECH REPUBLIC

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Background: A complex burial deposited in a storage pit and dated to the 9th–10th centuries CE was re-examined using biomolecular archaeological approaches, integrating ancient DNA, palaeoproteomics, and previous palaeopathological analyses. The burial contained two adult women and two children, accompanied by animal remains and artefacts, with limited contextual information regarding the circumstances of deposition.

Objective: The study aimed to apply multi-omic analysis of dental calculus and enamel proteomics to refine biological sex estimation and to provide insights into diet, health, and lived experience.

Materials and methods: The assemblage included two adult females (37–46 years) and two subadults (~7 and 12 years old). Skeletal indicators of stress or pathology, such as cribra orbitalia and enamel hypoplasia, were observed. Sex was estimated using amelogenin peptides from dental enamel, and dental calculus was analysed for ancient DNA and proteins.

Results: Proteomic analysis identified dietary proteins consistent with consumption of legumes (e.g. *Pisum sativum* and other Fabaeae), *Cucumis sativus*, dairy, and wheat. Both proteomic and genetic data provided low-confidence signals potentially attributable to *Beta vulgaris*. Microbial proteins associated with oral pathogens were also detected. All individuals were identified as female, consistent with osteological assessment of the adults and enabling sex determination of the subadults. Dietary evidence suggests the consumption of plant-based and dairy resources typical of Early Medieval Central Europe, potentially including processed cereal- and legume-based foods.

Conclusions: This study demonstrates the value of integrating biomolecular and osteological approaches in reconstructing aspects of diet, health, and identity in archaeologically ambiguous burial contexts, contributing to a more nuanced understanding of past human lifeways.

Keywords: Biomolecular anthropology; Diet; Palaeoproteomics; Metabarcoding; Early Middle Ages.

Acknowledgement / Funding Source: We acknowledge CEITEC Proteomics Core Facility of CIISB, Instruct-CZ Centre, supported by MEYS CR (LM2023042, CZ.02.01.01/00/23_015/0008175, e-INFRA CZ (ID:90254)).

THE FRAGILE LIVES OF SARMATIAN CHILDREN: EARLY-LIFE STRESS AND MORTALITY IN PAST COMMUNITIES OF THE GREAT HUNGARIAN PLAIN

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Background: Studying past childhood health and disease remains a vital and highly informative, but still challenging and underrepresented, area of archaeological research. While over the past 20 years there has been a significant increase in the study of children and childhood in archaeology and bioarchaeology, less attention has been paid to children from the Barbaricum.

Objective: By integrating palaeoproteomic techniques with bioarchaeological approaches, this study redirects attention from the Roman Empire to the often-overlooked ‘barbarians’ beyond its borders to examine sex-based differences in childhood health east of the Roman limes.

Subjects and methods: 137 nonadult individuals (≤ 20 years-old) from 18 archaeological sites on the Great Hungarian Plain have been selected for macroscopic documentation of oral pathologies and childhood stress indicators, identified based on well-established criteria and scored as present or absent. Working with archaeological skeletal remains of pre-pubertal individuals makes osteological sex estimations based on morphological techniques very unreliable and problematic; therefore, we applied a streamlined mass-spectrometry workflow for sex identification, targeting amelogenin peptides from dental enamel using a minimally destructive acid-etching method and high-resolution LC–MS/MS with a parallel reaction monitoring assay.

Results and conclusions: Preliminary results show that these individuals had a high incidence of stress episodes during early life: boys and girls were similarly affected. Most affected individuals experienced multiple stress episodes during childhood, with as high as 7 or 8 for some. The fact that some children had linear enamel hypoplasia occurring even in utero and during the first year of life (both girls and boys), points to the fact that their mothers were under serious physiological stress. These episodes were severe enough to affect the foetus or the baby, confirming that in the past, as today, children (along with infants and pregnant women) carry most frequently the burden of malnutrition, infection, disease, and often death.

Keywords: Bioarchaeology; Palaeoproteomics; Amelogenin; Linear enamel hypoplasia; Roman Period.

Acknowledgement / Funding Source: This research is funded by the European Commission under the program HORIZON-MSCA-2023-PF-01 (101155225) awarded to C.I.T.

SOCIAL STATUS AND BODY ARE SIGNIFICANTLY RELATED AMONG MALES BUT NOT AMONG FEMALES IN AN EARLY MEDIEVAL AVAR POPULATION

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Background: Adult body height reflects the growth process during the subadult phase of life and varies not only between biological sexes and populations, but also in a diachronic pattern and between different social groups within a population.

Objectives: This study investigates the association between estimated body height and social status among early medieval Avars. A significant positive association between body height and social status was hypothesized.

Subjects and methods: A total of 348 skeletons (182 males, 166 females) from the Avar times burial ground Vienna Csokorgasse were included in the present study. This is 46% of the 755 burials and about 79% of the individuals older than 20 years excavated there. Only adult individuals from undisturbed or unrobbed graves were included in the sample. Body height was reconstructed based on the long bones. Social status was determined by a new classification scheme, developed for this study based on grave goods and burial characteristics.

Results: In males, body height increases significantly from low to very high social status, while the coefficient of variation declined from low to very high social status. Males of very high social status were on average 6.5 cm taller than males of low status. In contrast, no significant differences in body height between different social strata could be observed in their female counterparts. The difference between the tallest and shortest body heights is only 0.9 mm.

Conclusions: The significance of body height as an indicator of social status is only evident in the biological male sex. This could be related to social inequality between the sexes in this Avar sample. Further research is needed to better understand the significance of gender roles among the Avars.

Keywords: Early medieval Avars; Sex differences; Body height; Social status.

Acknowledgement / Funding Source: Hochschuljubiläumsfond grant number: H448297/2023.

REGIONAL CONNECTIVITY AMONG AVAR PERIOD POPULATIONS - A NETWORK ANALYSIS USING CRANIOMETRIC TRAITS

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Background: Network-based approaches allow population-level biological-distance data to be examined beyond conventional pairwise comparison, capturing how individual sites are embedded within a broader web of relationships. Applied to the Avar period Carpathian Basin, such approaches can reveal whether geographic regions differ systematically in how strongly and how broadly their constituent sites are connected within the wider network.

Objective: To construct a pruned craniometric biological-distance network of Avar period sites in the Carpathian Basin, and to evaluate whether geographically defined regions correspond to distinct connectivity profiles, independently identified community structure, and node-level structural roles.

Subjects and methods: Twelve craniometric variables were recorded for 1,716 individuals from 49 Avar period sites in the Carpathian Basin, grouped into four larger geographic regions (Transdanubia, Danube Tisza Interfluvium North and South, Transisza). A population-level biological-distance matrix was computed and pruned into a network. Node-level metrics were calculated for each site. Regional differences in these metrics were assessed via Kruskal-Wallis tests. Node-level structural roles were additionally classified using data-driven percentile thresholds and compared against regional membership using the Adjusted Rand Index.

Results: Regions differed significantly in several network metrics, revealing distinct connectivity profiles, although substantial within-region variability was also observed, indicating that regional membership alone does not fully determine the network position of a site. Community structure identified showed only weak-to-moderate correspondence with geographic regions, suggesting that regional boundaries only partially capture the underlying pattern of biological similarity.

Conclusion: The results indicate that regional averages alone do not adequately capture individual site behaviour, supporting the value of pursuing finer-scale, sub-regional analyses in future work. Geographic regions alone do not fully account for population structure and connectivity patterns in this network, plausibly reflecting mobility or shared earlier population history.

Keywords: Biological distance; Network analysis; Avar Period.

Acknowledgement / Funding Source: The research was supported by the National Research, Development and Innovation Office (PD 146612).

ANTHROPOLOGICAL INSIGHTS INTO A PLAGUE-ERA BURIAL SITE FROM EUROPE'S FIRST PERMANENT LAZARET

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Background: The second plague pandemic spread throughout Europe between the fourteenth to eighteenth centuries and caused high mortality. As trade was instrumental in its spread, plague was prevalent in port cities such as Venice (Italy). Aiming to reduce transmission, Venetian health officials established Lazzaretto Vecchio in 1423 as the first permanent isolation hospital for individuals showing signs of infectious disease, including plague and leprosy. Over the following two centuries, thousands of people are believed to have died and been interred on the island.

Objective: Salvage excavations undertaken during building works in 2004-2005 uncovered 109 fossae (communal graves) across the island. This study focuses on establishing a demographic profile of Europe's first permanent lazaret.

Materials and methods: Fossa 6 was selected to be representative of the Lazzaretto Vecchio population, as it contained well-preserved skeletal remains of 53 discrete individuals. The grave likely dates to either the 1575–1577 or 1630-1631 plague outbreak. Using biological anthropological methods, an osteobiographical profile was created for each individual.

Results: Of the 53 individuals, 36% were estimated to be female, 32% were estimated to be male, and 32% were estimated to be subadults (sex assessment not attempted). The most represented age at death was between 3–12 years and 35–50 years, each accounting for 26.4% of the sample. Young adults (20–35 years) accounted for 20.7% of the sample. A range of pathological conditions was observed, including degenerative bone disease and possible treponemal infection. A higher proportion of females is consistent with other Italian plague assemblages. Age at death distributions resembled those of previously studied European plague assemblages except for individuals aged 13–19 years old being less frequent in the present sample (5.7%).

Conclusions: The isolated setting of the hospital at Lazzaretto Vecchio provides unique insights into early disease control interventions and the health status of the interred individuals.

Keywords: Plague; Second plague pandemic; Osteobiography; Catastrophic burials; Lazzaretto; Venice (Italy).

THE OLDEST KNOWN CASE OF A MANDIBULAR CONDYLAR PROCESS FRACTURE

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Background: Mandibular neck fractures account for a substantial proportion of mandibular injuries in modern populations, but evidence for such trauma in archaeological contexts is extremely limited. Their rarity reflects both diagnostic challenges and high mortality historically associated with post-traumatic infections. Only few healed condylar injuries are known from historical (Roman and medieval) periods, making Neolithic cases exceptional.

Objective: The aim is to characterize the morphology and healing of the oldest known isolated low-neck fracture of the mandibular condylar process and to contextualize its implications for survival and community care.

Subjects and methods: The individual BK4_79, a 30-35-year-old female, represents the Lengyel culture from the area of today's Brzesc Kujawski (north-central Poland). Macroscopic examination was combined with radiographic imaging (Scan eXam One) and cone-beam CT (Carestream CS 9600). Trabecular architecture was analysed using MaZda 4.6. Regions of interest were taken from the fracture zone and normal trabecular bone of the condylar head. Texture parameters – entropy, difference entropy, and long-run emphasis – were used to calculate the Bone Index. Differences between sites were tested using one-way ANOVA ($p < 0.05$).

Results: The right mandibular condylar process exhibited an antero-medial displacement consistent with lateral pterygoid traction, along with a characteristic annular periosteal reaction around the neck. Radiographic analysis showed overlapping fragments, cortical continuity, and complete bony union without pseudarthrosis. The Bone Index was significantly lower in the fracture region (0.91 ± 0.04) than in the reference condylar head (0.94 ± 0.03), indicating increased corticalisation associated with remodelling. Asymmetric molar wear on the right side reflects long-term occlusal imbalance caused by shortening of the ramus.

Conclusions: The successful healing of the fracture indicates a closed, isolated injury that allowed full consolidation, and shows that the woman survived for years after the trauma. These findings highlight biological resilience and suggest social support within Neolithic communities.

Keywords: Condylar fracture; Mandible; Paleopathology; Neolithic; Poland.

UPDATED APPROACH TO THE OLD TOPIC – INVESTIGATION OF ENTHESEAL CHANGES IN TWO ARCHAEOLOGICAL KUYAVIAN POPULATIONS USING METHODOLOGY BASED ON CURRENT MEDICAL KNOWLEDGE

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Background: In previous decades enthesal changes were frequently used to reconstruct activity patterns in past populations. Criticism of these studies primarily focused on insufficient knowledge about the aetiology of these changes and the lack of appropriate methodology for their description. Further interest in this topic resulted in the development of more detailed scoring systems. However, usefulness of these systems for the study of archaeological skeletons has rarely been tested.

Objective: The aim of this study is to analyse enthesal changes in the upper limb in two strongly culturally and chronologically differentiated populations using methodology based on up-to-date medical knowledge.

Materials and methods: The sample includes two series of adult skeletons from two closely located archaeological sites in Kuyavia (North-Central Poland): Neolithic (41 males, 37 females) and Medieval (43 males, 48 females). Villotte's scoring system (2006) was used to define the expression of five fibrocartilaginous insertion sites on the humerus and radius. Multivariable logistic regression was conducted to assess influence of historical period, age and sex on probability of occurrence of enthesal changes.

Results: Results indicate that more advanced age significantly increases probability of occurrence of changes at all analysed entheses. There is also a quite consistent pattern in the differences between populations: in four of the five studied sites, the probability of occurrence of enthesal changes is higher in the medieval series (one of these differences was statistically significant at $p=0.0096$ and the other was close to significance at $p=0.0505$). The results suggest a generally higher level of physical activity in the Middle Ages. Although enthesal changes are not absolute markers of physical strain, such analyses can still provide valuable information about activity in historical populations, provided that relevant methodologies are applied and results are interpreted cautiously.

Keywords: Fibrocartilaginous entheses; Enthesal changes; Markers of activity; Multivariable study.

HEALTH AND LIFESTYLE IN THE NABATAEAN KINGDOM: A PALEOPATHOLOGICAL ANALYSIS OF PRIMARY BURIALS FROM HEGRA, SAUDI ARABIA (100 BCE–200 CE)

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Background: Hegra (Mada'in Salih) was the second largest city in the Nabataean Kingdom, inhabited from around 100 BCE–200 CE. More than 100 monumental tombs remain at Hegra as conserved evidence of the ancient civilisation. Excavations of Nabataean tombs have typically revealed commingled and fragmented skeletal remains resulting from reuse and looting, which hinders the exploration of individual experiences of health and disease.

Objective: This study analyses a unique collection of 38 discrete skeletons from primary Nabataean burials.

Material and methods: These form part of a larger commingled assemblage which was excavated from four Hegra tombs between 2008 and 2019. By comparing demographic profiles and pathology prevalence rates, with the broader archaeological and ethnographic context of the region, the present study aims to facilitate a deeper understanding of the health status of the Nabataean people.

Results: Nine skeletal and six dental indicators of trauma, habitual activity, and generalised stress were systematically recorded. Skeletal age and sex were estimated following standard anthropological methods. The sample comprises 2 foetal skeletons (<0), 2 infants (0–3 years), 5 children (4–12 years), 4 adolescents (13–20 years), 10 adults (21–50 years), 5 mature adults (50+ years), and 10 non-specific adults. Sex distributions of the skeletally mature individuals include eight males, six females, and one of ambiguous sex. Preliminary results indicate a relatively high crude prevalence of degenerative joint disease (39.5%), antemortem tooth loss (21.1%), and Schmorl's nodes (21.1%). Periosteal reactions were present in three adults (7.9%) and antemortem fractures in five (13.2%).

Conclusion: These findings are consistent with other Nabataean sites where skeletal remains were found to exhibit relatively good health, with only some evidence of terrain-related falls. When interpreted relative to the cultural and environmental context of Hegra, this study will be important for supplementing a larger paleopathology study with a more nuanced understanding of individual lived experiences at Hegra.

Keywords: Paleopathology; Biological anthropology; Health; Nabataeans; Hegra.

Acknowledgement / Funding Source: This project is funded by the Royal Commission for AlUla (RCU).

A COMPLEX CASE OF CRANIOFACIAL DEFECT WITH PROSTHETIC MANAGEMENT AND CO-OCCURRING SELLAR ENLARGEMENT IN 18TH-CENTURY CRACOW, POLAND

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Background: The co-occurrence of craniofacial defects and endocrine-related skeletal alterations in archaeological individuals is extremely rare, offering unique opportunities to explore health, medical care, lived experience in past populations. Cleft palate is an uncommon finding and only exceptionally accompanied by prosthetic intervention. Morphological changes of sella turcica, which may reflect pituitary pathology, remain underreported.

Objective: This study presents a complex case of an adult male from 18th-century Cracow, integrating osteological, radiological, and material evidence to provide a comprehensive reconstruction of pathological conditions and their functional implications.

Subjects and methods: The individual analysed in this study derives from crypts in the Church of St Francis of Assisi in Cracow. Sex and age-at-death were estimated using standard anthropological methods. Detailed macroscopic examination of the skull was complemented by high-resolution computed tomography (CT). The palatal prosthesis was analysed in terms of its morphology and elemental composition. The sella turcica was assessed morphometrically according to clinical radiological standards and compared with modern reference data.

Results: The individual exhibited a large defect of the hard palate consistent with an isolated bilateral cleft, associated with a well-preserved, custom-made obturator composed of a metal plate and a textile component. CT imaging additionally revealed marked enlargement of the ST with erosive remodelling of the dorsum sellae, indicative of long-standing pressure-related changes. These findings point to the coexistence of a craniofacial developmental defect and a probable pituitary macroadenoma.

Conclusions: This case represents a rare co-occurrence of multiple pathological conditions in an archaeological individual. The presence of a sophisticated palatal prosthesis indicates adaptation to functional impairment and access to specialized care, highlighting the value of integrating osteological, radiological, and material evidence to reconstruct past health and lived experiences.

Keywords: Cleft palate; Palatal obturator prosthesis; Pituitary macroadenoma; Crypts; 18th-century Cracow.

Acknowledgement / Funding Source: The research was conducted as part of an interdisciplinary project funded by the National Science Centre under the OPUS 12 call (registration number: 2016/23/B/HS3/01910).

BODY REMAINS OF GREGOR JOHANN MENDEL, FOUNDER OF GENETICS. RESULTS OF ANTHROPOGENETIC RESEARCH – FROM FIELD TO WHOLE GENOME

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Objective: To commemorate the 200th anniversary of the birth of Gregor Johann Mendel (July 20, 1822 – January 6, 1884), anthropogenetic research was conducted in 2022 on the skeletal remains of the founder of genetics and abbot of the Augustinian Monastery in Brno.

Subjects and methods: This field research was preceded by an examination of items from Mendel's estate at the Augustinian Abbey on Mendel Square in Brno. The necessary permits for conducting field research at the crypt of the Augustinian Order were secured.

The excavation of Mendel's tomb at the Central Cemetery in Brno took place from June 14 to June 30, 2021. Strict anti-contamination measures were implemented to ensure that samples could be collected immediately from the discovered bones for genetic analysis.

During field research, skeletal remains of five monks were discovered and recovered, including a coffin containing the remains of Gregor Johann Mendel. These remains were then transferred to the Laboratory of Biological and Molecular Anthropology at Masaryk University, where they were identified and subjected to anthropological and genetic analysis. Notably, Mendel's body was found to be partially mummified; remnants of brain tissue, parts of saponified fat tissue from the abdomen, and fingernails were also present.

Conclusions: GJM's skeletal remains were identified through archaeological and anthropological analysis, as well as by isolating mitochondrial DNA from both the skeleton and a hair found in his book at the abbey. His mitochondrial haplogroup was determined to be H1C1. Sequencing of his nuclear genome revealed 99.1% of the sequence, providing information about his genetic variants associated with his physical traits and predispositions to certain diseases. For example, the analysis of his nuclear genome identified that he had blood type 0, was Rh-positive, was not lactase-deficient, and had a Y-chromosome haplogroup classified as R1a. In terms of physical characteristics, he had blue eyes, brown hair, and fair skin, along with a tendency towards baldness. More characteristics will be presented in the poster.

Keywords: Gregor Johann Mendel; Physical anthropology; Palaeogenetics.

POSTER PRESENTATIONS

ANALYSIS OF DISTANTIA CRISTARUM AND DISTANTIA SPINARUM IN LATVIAN FEMALE RESIDENTS FROM DIFFERENT REGIONS BASED ON 1930S DATA

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Background: Distantia spinarum and distantia cristarum are external pelvic measurements used in obstetrics. Historically, external pelvimetry was used as a screening tool because very small external pelvic measurements may suggest a generally small pelvis.

Objectives: This study aims to analyse distantia cristarum and distantia spinarum using data collected in the 1930s from individuals across different regions of Latvia. The findings provide a reference for comparison with contemporary populations and improve our understanding of anthropometric changes over time.

Materials and methods: Anthropological expeditions led by J. Primanis were conducted in Piebalga (1936), Jurmala of Vidzeme (1937), and the Zemgale district (1939). These included measurements of distantia cristarum (DC) and distantia spinarum (DS) measured in centimetres. The median and interquartile range (IQR) described non-normally distributed variables.

Results: The study included 3,801 adult females. The median DS for females was 26.0 cm in Zemgale and 25.0 cm in Jurmala of Vidzeme and 26.5 cm in Piebalga. The median DC for females was 29.5 cm in Zemgale, and 28.5 cm in Jurmala of Vidzeme and 30.0 cm in Piebalga, respectively. The Kruskal-Wallis test showed statistically significant differences in distributions of DC and DS between the regions ($p < 0.001$). Pairwise comparisons found significant differences between Jurmala of Vidzeme and Zemgale ($p < 0.001$) and between Jurmala of Vidzeme and Piebalga ($p < 0.001$) in both measurements, while there were significant differences of DS also between Zemgale and Piebalga ($p = 0.006$); there were not significant differences of DC between these two regions ($p > 0.999$).

Conclusions: The distantia cristarum and distantia spinarum reveals significant differences in body structure among Latvian female residents across regions during the 1930s. The results indicate a different set of factors (genetic, environmental, etc.) that determine the development of the skeleton, including the pelvic bones, in different regions of Latvia in the 1930s.

Keywords: Distantia cristarum; Distantia spinarum; Historical data.

BODY, MEDIA OR ACTIVITY: WHAT SHAPES CONTEMPORARY BODY IMAGE?

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Background: Despite the growing number of studies on body image, few have simultaneously examined anthropometric parameters, psychological factors, and the influence of social media within a single integrative framework. Existing research rarely captures the complex interplay between biological, psychological, and socio-cultural determinants of body perception. This gap highlights the need for interdisciplinary approaches that provide a more comprehensive understanding of body image as a multidimensional construct.

Objective: To investigate the relationships between physical activity, social media exposure, and subjective body image, integrating anthropometric and psychometric data.

Subjects and methods: The study involved healthy individuals aged 18–30 years. Exclusion criteria included pregnancy, breastfeeding, diagnosed eating disorders, metabolic or chronic diseases, use of medications affecting body weight or appetite (except hormonal contraception), and current body composition modification. After providing informed consent, participants completed a sociodemographic questionnaire and a set of standardized psychometric instruments: the Body-Esteem Scale for Adolescents and Adults, the Multidimensional Body-Self Relations Questionnaire, the International Physical Activity Questionnaire, and the Sociocultural Attitudes Towards Appearance Questionnaire. Subsequently, anthropometric measurements were conducted, including body composition (via bioelectrical impedance analysis), body height, skinfold thickness, and body circumferences. All measurements were performed by trained anthropologists under standardized conditions ensuring privacy, comfort, and participant autonomy.

Results: The study is currently ongoing. The required minimum sample size is 138. To date, 61 participants have been enrolled (41 women, 20 men). Results will be presented at the conference.

Conclusions: This project is expected to provide novel insights into how physical activity and social media exposure interact with biological factors to shape body image. Understanding these relationships is crucial, as body image disturbances are significant risk factors for reduced psychological well-being, disordered eating, and low self-esteem. The findings may contribute to the development of more effective, interdisciplinary prevention and intervention strategies.

Keywords: Body image; Self-esteem; Physical activity; Social media.

ASSOCIATION BETWEEN INHALANT ALLERGIES AND BONE MASS IN YOUNG ADULTS ASSESSED BY RADIAL QUANTITATIVE ULTRASOUND

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Background: Allergic diseases may affect skeletal health through chronic inflammation and immune-mediated mechanisms. However, evidence in young adults remains limited.

Objective: The aim of this study was to examine the association between inhalant allergy and bone mass in men and women aged 18–30 years.

Subjects and methods: The study included 649 young adults (256 men and 393 women). Bone mass was assessed using quantitative ultrasound (Sunlight MiniOmni) of the left radius (a non-dominant site, minimising the influence of mechanical loading), with the Z-score used as the outcome measure. Participants were classified into three groups: inhalant allergy (IA; mites, pollen, grasses, and mould), other allergy (OA; food and animal allergies), and no allergy (NA). Analyses were conducted separately for men and women using two regression models: a base model (Model 1) including covariates (BMI, history of wrist fracture, vitamin D and calcium supplementation), and a lifestyle model (Model 2) including smoking, alcohol consumption, and physical activity.

Results: Regression analyses revealed sex-specific differences. In men, IA was significantly negatively associated with Z-score in both models (Model 1: $\beta=-0.331$, $p=0.011$; Model 2: $\beta=-0.357$, $p=0.006$), indicating reduced bone mass. In women, IA was positively associated with Z-score in Model 1 ($\beta=0.214$, $p=0.039$) and Model 2 ($\beta=0.221$, $p=0.037$), indicating higher bone mass.

Conclusions: Inhalant allergy was associated with bone mass in a sex-specific manner, with less favourable bone health in men but not in women. The divergent pattern observed between sexes may reflect differences in hormonal and immune-mediated mechanisms, potentially involving the bone-protective role of oestrogen in women and greater susceptibility to inflammation-driven bone resorption in men; further research is needed. Allergic diseases may therefore be an important factor in anthropological research on skeletal health and biological variability.

Keywords: Z-score; Skeletal health; Sex differences; Lifestyle factors.

Acknowledgement / Funding Source: This study was supported by grants UK/1017/2025 and KEGA 046UK-4/2023.

ACUTE HYPOBARIC HYPOXIA INDUCES COORDINATED DNA METHYLATION ALTERATIONS AND IMMUNE CELL REDISTRIBUTION IN LOWLANDERS

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Background: Acute hypobaric hypoxia rapidly affects oxygen transport, endocrine regulation, and immune function. However, how short-term hypoxic stress links immune cell redistribution with changes in blood DNA methylation remains unclear.

Objectives: We aimed to characterize coordinated immune and DNA methylation responses to acute hypobaric hypoxia in lowlanders and to distinguish methylation changes caused by altered blood cell composition from potentially cell-intrinsic responses.

Subjects and methods: 18 healthy lowlanders were exposed to simulated altitude (3,500 m) for 75 minutes. Blood samples collected before and after exposure underwent genome-wide DNA methylation analysis using Illumina EPIC arrays. Differential methylation, functional enrichment, and immune cell deconvolution analyses were performed, and EPIC v1 and v2 datasets were integrated to identify methylation changes independent of blood cell composition.

Results: Acute hypobaric hypoxia induced widespread blood DNA methylation changes, particularly in immune-related pathways. Most signals reflected shifts in immune cell composition, with increased neutrophils and decreased lymphocytes. After adjustment, only a few hypoxia-associated loci remained, including an enhancer region of ECE1, a gene involved in vascular responses to hypoxia.

Conclusions: Even brief hypobaric hypoxia induces coordinated immune redistribution and detectable changes in blood DNA methylation. These findings highlight the importance of accounting for blood cell composition and support DNA methylation as a sensitive molecular indicator of acute hypoxic stress.

Keywords: Acute hypobaric hypoxia; Epigenetics; Cell composition deconvolution; DNA methylome; Remodelling; Innate-adaptive immune axis.

Acknowledgement / Funding Source: Our study was partly supported by grants from SPRING-GX and by JSPS KAKENHI (Grant number: 23K27259).

SOME ANTHROPOLOGICAL CHARACTERISTICS OF THE SOUTHERN SINAI BEDOUINS

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Background: The study of the unique endogamous Southern Sinai Bedouin population involves an integrated approach that considers various anthropological characteristics.

Objective: To analyse unique population data on lateral asymmetry of functional features, taste sensitivity to phenylthiocarbamide, and pigmentation among Bedouins.

Subjects and methods: Laterality traits (handedness, hand clasping, arm folding, dominant eye) were studied in 1,061 men and 172 women. PTC sensitivity data obtained by the classic serial dilution method were studied in healthy male Bedouins from different tribes (n=317). Spectrophotometric skin measurements were collected using an EEL spectrometer in 135 South Sinai Bedouins (men).

Results: The proportion of left-handed Bedouin men was 6.62%, while the proportion of left-handed women was 5.11%, that is generally lower than in other human populations. Significant gender differences in eye dominance were observed; motor tests showed a tendency toward a lower percentage of left-handedness in women. Significant intertribal differences in sensitivity to phenylthiocarbamide were found in Bedouin communities: a high frequency of the T allele was recorded in most tribes, while a relatively low level was found in the Gebelia tribe. Skin pigmentation in Bedouins was darker than in other Arab populations; skin reflectance showed no significant intertribal differences at a wavelength of 685 nm.

Conclusions: The specific features of lateralization trait distribution in Bedouins are due to both cultural characteristics and gene drift in small groups. Intertribal differences in the frequency of PTC genes can be explained by genetic drift or endogamy, but further research is needed to determine which factor is more significant. The relatively dark pigmentation of the skin of Sinai Bedouins is explained by the fact of intermarriage with the Sudanese. A unique group of Bedouin tribes is characterized by a specific combination of anthropological characteristics.

Keywords: Southern Sinai Bedouins; Laterality; Sensitivity to phenylthiocarbamide; Pigmentation; Spectrophotometry.

UNEQUAL INVESTMENT: PARENTAL RESOURCE ALLOCATION BETWEEN ILL AND HEALTHY SIBLINGS – PRELIMINARY RESULTS

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Background: From an evolutionary perspective, parental investment involves allocating limited parental resources among offspring to maximize reproductive success. A child's illness poses a substantial challenge to family functioning and may alter parental investment strategies; however, empirical findings in this area remain inconsistent. Moreover, healthy siblings of ill children are often overlooked both in research and in everyday parental practice.

Objective: The present study aimed to examine patterns of parental investment in families raising an ill child compared to families with exclusively healthy offspring, from an evolutionary–psychological perspective.

Subjects and methods: The study included 126 Polish families: 63 families raising both an ill and a healthy child and 63 families raising exclusively healthy offspring. Mothers completed an original questionnaire used to construct indices of emotional, financial, and total parental investment, as well as to assess the family's socioeconomic status.

Results: In families raising both an ill and a healthy child, the ill child received significantly higher emotional ($Z=2.43$, $p<0.05$), financial ($Z=2.88$, $p<0.001$), and total parental investment ($Z=3.45$, $p<0.001$) than the healthy sibling, indicating a reallocation of parental resources toward the offspring with greater needs. As the ill child's age increased, maternal emotional investment ($R=-0.32$, $p<0.05$) as well as parents' total emotional investment ($R=-0.26$, $p<0.05$) declined, leading to a reduction in investment disparities between siblings over time. Additionally, healthy children in families with an ill child received significantly lower financial investment ($Z=-2.36$, $p<0.05$) than their peers from families raising only healthy children.

Conclusion: Overall, the results suggest that an ill child reshapes parental investment strategies in line with evolutionary models of adaptive resource allocation, often to the relative disadvantage of healthy siblings.

Keywords: Parental investment; Ill offspring; Healthy children; Family.

EVALUATION INDEX FOR EXPANSION PATTERN OF CENTER OF PRESSURE USING CENTER OF PRESSURE DIAGRAM IN JAPANESE CHILDREN

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Background: Our previous research showed that standing postural stability develops until age 8 in Japanese girls and age 9 in Japanese boys. We have drawn up the assessment method for the standing posture of Japanese children (4 to 11 years old). However, we have not discussed how it can be clearly that parents and teachers can understand their assessment of COP in school settings.

Objective: This study examined whether the expansion patterns of centre of pressure (COP) using COP diagrams can be used as a simple evaluation index for static balance in the subjects.

Subjects and methods: The subjects were 178 (86 boys and 92 girls) students aged 5 to 11. The data collection instrument was the Gravicorder GS-7 (ANIMA corporation, Tokyo, Japan). The subjects instructed to stand upright with the centre of the sole of their foot aligned with the reference point on the examination table, whilst fixing their gaze on a fixed point two metres ahead at eye level during measurement. When subjects posture had stabilized, the subjects measured to take thirty seconds for each condition (eyes open and eyes closed). The expansion patterns of the COP classified into four types: 1) centre, 2) front and rear, 3) right and left and 4) random.

Results and conclusions: The average measurement values of LNG per Env. Area under both conditions for boys and girls in the centre type were higher than other types. This indicated the expansion patterns of the COP could evaluate the measurement values of COP in the same way as previous research. The evaluation of the COP patterns reflected the measurement values of LNG per Env. Area. Limitations exist with the reliability of the relationship between the expansion patterns of COP and the measurement values of COP.

Keywords: Centre of pressure; Expansion patterns of COP; COP diagrams; Japanese children.

THE INFLUENCE OF MATERNAL AGE ON NEONATAL OUTCOMES AND BIRTH WEIGHT

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Background: Maternal age has a significant impact on prenatal growth and development and being a great importance for neonatal outcomes and newborn sizes.

Objective: The study aims to evaluate how maternal age influences neonatal outcomes.

Subjects and methods: Data of 2740 livebirth singleton neonates born in 2010 (653) and 2020 (2087), as well as data on their mothers, were collected from the birth registry of the Obstetrics and Gynaecology Hospital “St. Sofia”, Sofia. According to maternal age the women were divided into seven age groups: under 20 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, 40–44 years, 45 years and older. According to birth weight the newborns were defined as low birth weight (<2500) and normal birth weight (≥2500). The collected data were analysed by SPSS 16.0. Z-score transformation was applied to birth weight as Z-score was calculated for sex. The significant differences were assessed by the t-test of Student and one-way ANOVA analyses and significance level was set at $p \leq 0.05$.

Results: The maternal mean age and the number of women giving birth over the age of 30 have increased over the years. In 2010, the highest percentage of mothers (31.7%) fall into the age group 25–29 years, followed by mothers aged 30–34 years (28.6%). Among mothers who gave birth in 2020, the highest percentage (29.4%) fall into the 30–34 age group, followed by mothers aged 25–29 (27.1%). The percentage of mothers over 39 years of age is the lowest. Maternal age has a significant impact on the birth weight ($p=0.001$). The highest percentage of babies with low birth weight occurs in mothers under 20 and over 40 years. The newborns, whose mothers were under 20 years of age had mean birth weight of 3102.49 ± 459.82 in 2010 and 2996.70 ± 480.69 in 2020. The highest mean birth weight is observed in maternal age group 35–39 years in 2010 and over 40 years in 2020.

Conclusions: Maternal age affects the pregnancy outcome. Adolescent and older mothers are at risk of giving birth to babies with lower birth weight.

Keywords: Newborn; Maternal age; Births; Birth weight.

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UNCOVERING THE GENETIC PLEIOTROPY BETWEEN OBESITY AND HYPERTENSION IN ROMA POPULATION

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Background: Obesity and hypertension disproportionately affect Roma people. Although shared genetic determinants are assumed to influence both blood pressure (BP) and adiposity related phenotypes, their contribution to these two sets of phenotypes in Roma population remains poorly understood.

Objective: This study aims to estimate the shared genetic influence between adiposity and BP traits in a high-risk population like the Roma and to assess the effect of previously obesity associated genetic variants on BP phenotypes.

Subjects and methods: A total of 354 individuals from 50 extended Roma pedigrees residing in the Basque Country (Spain) were evaluated for seven anthropometric traits (weight, BMI, waist circumference, WHR and three components of the anthropometric somatotype) and four BP-related phenotypes (systolic and diastolic BPs, mean arterial pressure and pulse pressure). Genetic correlations between adiposity and BP traits were estimated using a variance components framework in the SOLAR program. Additionally, 24 variants previously associated with obesity were tested for association with BP phenotypes to identify potential drivers of pleiotropy in this population using R software.

Results: Among Roma adults, 52% were obese and 12% hypertensive; notably, 87% of hypertensive individuals were also obese. Waist circumference was genetically correlated with systolic BP (41%) and mean arterial pressure (42%), whereas no significant genetic correlations were observed for diastolic BP. Variants in the FTO gene were associated with increased diastolic BP, while rs1137101 (LEPR gene) showed a negative association with systolic BP.

Conclusion: The studied Roma population exhibits a high prevalence of obesity, frequently co-occurring with hypertension. However, evidence for pleiotropic effects between these conditions is limited and primarily centred in the genetic correlation between BP phenotypes and central adiposity. Shared environmental factors appear to play a greater role than pleiotropy in the covariation of these two conditions.

Keywords: Roma population; Obesity; Hypertension; Pleiotropy; Genetic variant.

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DIGITAL NATIVES: SOCIAL MEDIA, PHYSICAL ACTIVITY AND BMI IN ZAGREB ADOLESCENTS

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Background: Today's adolescents are immersed in a digital environment, with social networks central to their lives for entertainment, communication and getting information. Being online enables adolescents to share their daily experiences, opinions, emotions, attitudes and express their identity. Still, the displacement hypothesis suggests that time spent on media reduces the time available for other, offline activities (e.g., physical activity), leading to potential negative impact on health.

Objective: To determine which social networks adolescents use most often, how often and what is their main motivation for using these networks. Furthermore, to examine whether the frequency of using social networks is the same among respondents who practice physical activity 3 or more times a week compared to respondents who are not so physically active. Also, to determine whether the body mass index differs between respondents who use the internet at all or very rarely and those who use it more frequently.

Subjects and methods: This research, part of the Institute for Anthropological Research project IA-INT-2024-BiCePs_Nutrition, surveyed 500 high school students in Zagreb, Croatia, who voluntarily participated. The students independently filled out a questionnaire on demography, physical activity, frequency and motivation for using social networks. The data was analysed using SPSS software.

Results: Analyses have shown that Instagram and TikTok are used more often than Facebook and/or X. For communication, students most often use Snapchat and WhatsApp. Most students access these networks several times a day. The students self-assessed that the use of social networks has an influence on their thoughts, feelings and self-perception. The association between social media time and physical activity level was generally weak, just as with BMI.

Conclusion: To conclude, the prevalence of social media use among adolescents in Croatia is high, just as in general in the world. Still, this bad habit has not yet affected their physical activity level that much, nor their BMI.

Keywords: Adolescents; Social media; Physical activity; Body mass index; BiCePs_Nutrition.

Acknowledgements / Funding source: This research is part of the Institute for Anthropological Research project IA-INT-2024-BiCePs_Nutrition (funded by The European Union's National Recovery and Resilience Plan (NPOO) for Croatia. We would like to thank the students and their parents for their participation, and the teachers for their valuable support in facilitating this study.

EXERCISE-INDUCED MODULATION OF BODY COMPOSITION, ADIPONECTIN-ASPROSIN BALANCE AND LIPID AND CARBOHYDRATE METABOLISM IN MEN WITH METABOLIC SYNDROME: A RANDOMIZED CONTROLLED TRIAL

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Background: Adiponectin has anti-inflammatory and insulin-sensitizing effects, whereas asprosin stimulates appetite and promotes insulin resistance. However, the relationships among adiponectin, asprosin, physical activity, and metabolic syndrome (MetS) remain poorly understood.

Objective: This study aimed to evaluate the effects of two 12-week exercise interventions (aerobic training, combined aerobic-resistance training) on body composition, adiponectin and asprosin concentrations, and metabolic parameters in men with MetS.

Subjects and methods: Sixty-two men with MetS (age 36.6±6.9 years; BMI 33.6±4.4 kg/m²) were randomly assigned to: aerobic training (EG1, n=21), combined aerobic-resistance training (EG2, n=21), or a non-intervention control group (CG, n=20). Body composition and biochemical markers (adiponectin, asprosin, triglycerides, fasting glucose, insulin) were assessed at baseline, weeks 6 and 12, and 4 weeks post-intervention. Intervention effects were analysed using linear mixed models with post hoc tests and effect sizes.

Results: EG1 showed a significant increase in the adiponectin/asprosin ratio (p=0.02, ES=0.73), along with improvements in body composition and lipid accumulation product (p<0.01, ES=2.28). EG2 improved body composition and insulin resistance (p<0.01, ES=1.19), while the control group showed a decline in the adiponectin/asprosin ratio (p<0.01, ES=1.54). Aerobic training primarily enhanced adipokine balance and lipid metabolism, whereas combined aerobic-resistance training improved carbohydrate metabolism in men with MetS, likely through reductions in visceral adiposity.

Keywords: Body fat; Fat free mass; Insulin resistance.

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ASSOCIATIONS BETWEEN SMOKING, ALCOHOL CONSUMPTION AND BONE QUALITY IN YOUNG ADULTS

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Background: The effects of smoking and alcohol consumption on bone health in older adults are well established, nonetheless their influence on bone quality in young adults remains limited.

Objective: This study aimed to examine the relationship between bone quality, alcohol consumption, and smoking, considering the influence of physical activity (PA) and body composition.

Subjects and methods: The sample included 1001 Slovak men and women aged 18–30 years (mean age 22±2.35 years). Bone quality was assessed using a quantitative ultrasound device (Sunlight MiniOmni™), which provided Z-score values. Body composition variables, including skeletal muscle mass (SMM, kg) and percent body fat (PBF, %), were measured with a bioimpedance analyser (InBody 770). Lifestyle behaviours such as alcohol consumption, smoking habits and PA were collected using the WHO STEPS 2014 questionnaire.

Results: Regression analysis revealed that the duration of alcohol consumption favourably impacted bone quality Z-scores ($\beta = 0.172$, $p < 0.001$), whereas the number of cigarettes smoked was negatively associated with ($\beta = -0.113$, $p = 0.042$). The SNHA results confirmed the positive association with alcohol ($r = 0.19$), while for smoking ($r = 0.23$) inconsistent results were observed, suggesting an apparently positive effect likely mediated by the relationship with alcohol consumption.

Conclusion: These findings indicate that lifestyle risk factors such as smoking and alcohol use are associated with bone tissue quality in young adults; however, the mixed evidence observed in this, and previous studies highlights the need for further research to clarify the biological and behavioural mechanisms involved.

Keywords: Bone quality; Smoking; Alcohol consumption.

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THE RELATIONSHIP BETWEEN BMI AND BLOOD PRESSURE IN CHILDREN AGED 6–11 YEARS

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Background: Based on the results of several international studies on the relationship between nutritional status, body composition and blood pressure in childhood and adolescence, it can be said that there is a clear relationship between BMI and blood pressure even in childhood: higher BMI values are usually associated with higher blood pressure, and prehypertension and hypertension are more common among overweight or obese children. This is also important because childhood blood pressure readings often predict the risk of cardiovascular problems later in adulthood.

Objective: In our study, we were looking for answers to the following questions: do Fitness Score and fitness status affect blood pressure? How does BMI, body composition, especially body fat, affect blood pressure? Is hydration level related to fitness?

It is assumed that abdominal obesity has a particularly strong connection with elevated blood pressure, it matters where excess fat accumulates in the body.

Subjects and methods: In 2025, we surveyed the physical status of 121 6–11-year-old schoolchildren in Budapest. Body composition was examined by In Body 720 body composition analyser, and blood pressure by Omron M1 Compact monitor.

Results: The Fitness Score is primarily influenced by body composition. Blood pressure is primarily compositional and not fitness-dependent. Blood pressure is a matter of body composition. Blood pressure is related to body size and central fat deposits. Central fat is more important than total body fat percentage. Hydration is a fitness factor.

Conclusion: Overall, in the prevention of childhood hypertension, taking into account body composition and especially abdominal fat accumulation can help us recognizing risks in time and intervene more effectively. It is worth checking BMI and blood pressure regularly in childhood, especially in the case of overweight, but in addition to BMI, it is also advisable to measure the proportion of body fat and abdominal obesity.

Keywords: BMI; Blood pressure; Fitness score; Central fat.

STANDARDIZED LANDMARK-BASED METHODOLOGY FOR MAXILLARY ANALYSIS IN PATIENTS WITH CLEFT CONDITIONS

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Background: Craniofacial development in early ontogenesis is characterized by considerable morphological variability. Cleft conditions represent altered developmental pathways of palatal structures and provide a unique model for studying variation in craniofacial morphology beyond typical development. Modern digital approaches using 3D scanning and specialized software enable detailed evaluation of these structural differences.

Objective: The aim of this study was to assess morphological variability of the isolated cleft palate in infants using a standardized landmark-based morphometric methodology and to evaluate whether this approach is feasible and reliable for clinical and research use.

Subjects and methods: The study included 72 children aged 8–18 months with isolated cleft palate treated at University Hospital Brno. Morphometric analysis was performed using CleftMeter and standardized Seckel landmarks (I, C, Q, T). All measurements were independently obtained by three evaluators, and inter-rater reliability was assessed for the Q–Q', T–T', and C–C' palatal widths.

Results: Inter-rater reliability was evaluated using the Intraclass Correlation Coefficient (ICC) for each dimension separately. A two-way random-effects model with absolute agreement was applied (ICC(2,1)). All dimensions showed excellent agreement: T–T' (ICC=0.97), C–C' (ICC=0.95), and Q–Q' (ICC=0.96), with near-perfect reliability for averaged ratings (ICC=0.98–0.99).

Conclusions: This study demonstrates that a standardized landmark-based morphometric approach using CleftMeter is both feasible and highly reliable for the assessment of isolated cleft palate in infants. Excellent inter-rater agreement across all evaluated parameters confirms the robustness and reproducibility of the proposed methodology.

Keywords: Craniofacial variability; Palatal morphology; Seckel landmarks.

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LONG-TERM CHANGES IN SOMATIC GROWTH AND NUTRITIONAL STATUS AMONG CHILDREN AND ADOLESCENTS FROM EASTERN POLAND (1986–2021)

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Background: Long-term changes in children and adolescents' somatic development are sensitive indicators of population health and socioeconomic conditions. In recent decades, the double burden of malnutrition, including both excessive and insufficient body mass, has become increasingly evident.

Objective: This study aimed to assess secular changes in body height, body mass, BMI, and nutritional status among children and adolescents from Eastern Poland between 1986 and 2021, with consideration of sex differences.

Subjects and methods: The study included 27,997 individuals (13,172 boys and 14,825 girls) aged 8, 13 and 17 years, examined at five time points (1986, 1996, 2006, 2016 and 2021). Anthropometric measurements were performed using standardized procedures. BMI was calculated as body mass (kg) divided by height squared (m²), and nutritional status was classified using international cut-off points. Temporal changes were analyzed using Welch's ANOVA with Games–Howell post hoc tests, and effect sizes were estimated using Hedges' g. Differences in BMI categories were assessed using the chi-square test.

Results: A clear secular trend was observed. The greatest increases in height and body mass occurred in 13-year-olds (boys: +10.62 cm and +12.54 kg; girls: +7.40 cm and +8.42 kg). Overweight and obesity prevalence increased across all age groups, particularly among younger children (up to +19.89% in girls and +21.70% in boys). Underweight decreased in younger groups but increased among older girls. These changes were most pronounced in 2016–2021.

Conclusions: The findings confirm the presence of clear secular trends in the somatic development of children and adolescents from Eastern Poland. The observed changes are consistent with long-term population-level influences that may have affected growth and development over time. Variation in the direction and magnitude of these changes across age and sex groups highlights the complexity of developmental processes in the studied population.

Keywords: Secular trends; Somatic development; BMI; Children and adolescents; Nutritional status.

MATERNAL OVERWEIGHT AND OBESITY AND THEIR IMPACT ON PREGNANCY OUTCOME

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Background: The presence of overweight and obesity during pregnancy is a prerequisite for a high risk of adverse consequences for both the mother and the foetus. These maternal conditions can lead to long-term health complications in postnatal ontogenesis of the offspring, which creates a potential health risks in the next generations.

Objective: The aim was to assess the impact of maternal overweight and obesity on the pregnancy outcome (mode of delivery, gestational age and birth weight status).

Subjects and methods: Data on 373 mothers and their newborns, collected from the 2010 birth registry of the First Obstetrics and Gynaecology Hospital “St. Sofia”, Sofia were analysed. The included data refer to live-born children from singleton pregnancies. Nutritional status was assessed by the BMI, overweight was defined as a BMI of 25–29.9 kg/m² and obesity as a BMI ≥30. Comparisons were performed using a Chi-square and Fisher exact test, differences were considered statistically significant at $p \leq 0,05$ (SPSS 16.0).

Results: Overweight occurred in 47,0% of investigated women and 31,0% of them were obese. Maternal overweight and obesity showed statistically significant association with weight status of the newborn ($p=0.039$). The rate of newborns with weight ≥ 4000 g was 2.3% and 6.2% in overweight and obese mothers respectively. Nearly 40,0% of all births were performed by Caesarean section with higher but not significant prevalence in overweight and obese mothers. The highest percentage (5.8%) of newborns who was born before 37 gestational week was found for overweight mothers, but the association is not statistically significant. Overweight and obesity in pregnancy could be related to high birth weight and also could increase the risk of preterm birth.

Conclusion: The association with the mode of delivery remains unclear because of the high rate of elective Caesarean deliveries in Bulgaria regardless of maternal nutritional status.

Keywords: Maternal overweight; Maternal obesity; Birth weight; Gestational age; Mode of delivery.

Acknowledgements / Funding source: National Science Fund of Bulgaria, Grant No. KII-06-H51/7 from 11.11.2021.

SUBALTERN CARE SYSTEMS AND THE POLITICS OF HEALTH KNOWLEDGE: COLLABORATIVE DECOLONIAL AUTOETHNOGRAPHIC PERSPECTIVES FROM SOUTHERN BRAZIL

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Background: This paper examines subaltern care systems as spaces of knowledge production, healing practices, and resistance to the epistemic dominance of biomedicine. Drawing on medical anthropology, decolonial studies, and the concept of subaltern systems developed by Dimas Floriani, it explores how community-based practices of care persist, adapt, and acquire legitimacy within contemporary contexts shaped by biomedical rationality.

Subjects and methods: The study uses a collaborative decolonial autoethnographic approach drawing on the long-term experiences of two researchers involved in women's circles, healing practices, Indigenous-inspired ceremonies, and community care networks in Southern Brazil. Data included ethnographic records, field diaries, reflexive dialogues, and embodied knowledge from sustained participation. Through collaborative analysis, personal experiences were situated within broader social, political, and epistemic contexts.

Results: The analysis identified three interconnected patterns across both trajectories. First, subaltern care practices are learned and transmitted through embodied participation, relationality, and collective experience rather than institutional authority alone. Second, these practices generate alternative understandings of body, illness, wellbeing, and personhood that coexist with, negotiate, and at times challenge biomedical rationalities. Third, participants continuously negotiate legitimacy, recognition, and authority while inhabiting and moving across multiple therapeutic worlds, revealing how different forms of life sustain, contest, and transform the politics of health knowledge.

Conclusion: These findings highlight subaltern care systems as complex networks of knowledge, rituals, and social relations rather than residual traditions. They show how struggles for epistemic justice are enacted through everyday practices of care, healing, and community support, where alternative forms of knowledge are collectively produced and shared. The study contributes to debates on medical pluralism, decoloniality, and therapeutic diversity, while demonstrating the value of collaborative autoethnography for examining health knowledge from lived experience.

Keywords: Medical anthropology; Subaltern care systems; Decolonial health studies; Medical pluralism; Epistemic justice.

Acknowledgement / Funding Source: PROAP/UFPR Fundacao Araucaria.

LONGITUDINAL GROWTH PATTERN OF HUNGARIAN CHILDREN WITH ACHONDROPLASIA: THE EVALUATION OF TREATMENT-RELATED GROWTH CHANGES

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Background: Achondroplasia is characterized by a distinctive growth pattern involving disproportionate short stature, limb shortening, macrocephaly and altered growth velocities throughout childhood.

Objective: The project aims to examine the impact of vosoritide (VOXZOGO®) treatment on growth patterns in children with achondroplasia and to assess the applicability of the European achondroplasia-specific growth references to a Hungarian achondroplasia cohort.

Subjects and methods: The longitudinal study was initiated in October 2025. To date, 20 Hungarian children with achondroplasia, aged 2–13 years, have been enrolled at the Department of Paediatrics, Semmelweis University, Budapest, Hungary. Anthropometric assessments are conducted at baseline and repeated at 3-month intervals throughout the follow-up period. Measurements include body weight, body height/length, sitting height, arm span, lengths of the upper and lower limb segments, trunk and limb circumferences and breadths, as well as head dimensions. The observed growth patterns are evaluated relative to the growth channels defined by the European achondroplasia-specific reference standards.

Results: In this pilot study, analyses focused on body weight, body height/length, body mass index and head circumference. The preliminary findings demonstrate the applicability of the European achondroplasia-specific reference standards for monitoring individual growth trajectories. At this preliminary stage, the analyses focus on determining whether the observed growth patterns remained within or deviated from the growth channels of the achondroplasia-specific references.

Conclusion: Our newly developed anthropometric protocol provides a standardized framework for the longitudinal assessment of growth in children with achondroplasia and includes an extensive set of body and head measurements that enable detailed monitoring of body proportions and cranial growth throughout childhood. Extended follow-up will be required to clarify the influence of vosoritide treatment on the overall growth patterns of children with achondroplasia.

Keywords: Achondroplasia; Dwarfism; Somatic growth; Body proportions; Vosoritide (VOXZOGO®) treatment.

SUBMAXIMAL OXYGEN DEFICIT DURING INCREMENTAL TREADMILL EXERCISE IN ELITE YOUTH FEMALE HANDBALL PLAYERS

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Background: Laboratory-based assessment of cardiorespiratory function is a widely applied method in sports science. Most performance evaluations focus on oxygen uptake parameters. Despite the well-established concept of oxygen deficit introduced by Hill in the 1920s, relatively few studies have examined its behaviour during submaximal exercise, with limited exploration of deficit dynamics.

Objective: To analyse oxygen deficit during graded exercise in young female handball players and examine its relationship with morphological and physiological characteristics.

Subjects and methods: Forty-two female handball players (15.4±1.3 years) performed a quasi-ramp treadmill spiroergometry test. Oxygen deficit was estimated using the American College of Sports Medicine (ACSM) algorithm, restricted to exercise segments below the anaerobic threshold. Body composition was assessed by Dual Energy X-ray Absorptiometry (DEXA). Cluster and principal component analyses were applied to identify athlete profiles.

Results: Cluster and principal component analyses revealed two distinct athlete profiles with statistically significant differences in both morphological and physiological traits. Cluster 2 showed significantly higher relative VO₂ peak (51.43±3.70 vs. 45.70±2.87 mL·kg⁻¹·min⁻¹; p<0.001; Cohen's d=1.76), yet also exhibited a greater oxygen deficit per kilogram (39.03±16.71 vs. 32.56±14.33 mL·kg⁻¹; p=0.018; d=0.80). Cluster 1 had higher absolute body mass (69.67±8.13 vs. 59.66±6.81 kg; p<0.001), skeletal muscle mass (p<0.001), and fat mass (p<0.001), indicating that body composition strongly influenced oxygen deficit values. The observed differences in oxygen deficit profiles suggest a strong influence of genetic predispositions, particularly in cardiovascular and muscular oxygen utilization capacity. Age also emerged as a critical factor in determining the potential for adaptation.

Conclusions: Oxygen deficit during submaximal exercise appears to be a multifactorial phenomenon shaped by structural and physiological traits. While certain influencing factors can be modified through training, others especially those of genetic origin pose inherent limitations. Early development of cardiorespiratory capacity may offer the most effective strategy for long-term optimization.

Keywords: Handball; Oxygen deficit; Spiroergometry; Body composition.

STRESS AND SEX HORMONE CHANGES OF YOUNG ELITE HANDBALL PLAYERS IN RELATION TO THEIR MOOD PROFILES

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Background: Excessive training-induced stress in athletes is theorised to cause maladaptation in athletes, when there is an imbalance in training and recovery, which can later lead to overtraining syndrome (OTS). OTS detection is prominently based on the change of testosterone and cortisol levels due to maximal exertion, alongside mood profiling.

Objective: To study the relationship between mood profile, stress state, endocrine status and response to physical exertion in youth handball players. The analysis is part of a large study to develop a new screening method for overtraining status in athletes.

Subjects and methods: 584 elite Hungarian handball players (14–35 ys) were examined in the Sport Sciences and Diagnostic Research Centre of the Hungarian Handball Federation between 2023 and 2025. Saliva samples were collected in resting state and after vital maximum exertion to measure the concentration of testosterone and cortisol, and 17- β -oestradiol hormone levels. Hormone levels were estimated by ELISA method. Subjective stress state of the athletes was surveyed via Profile of Mood States questionnaire.

Results: The athlete references of resting levels of sex hormones, as well as the change in the ratio of sex hormone and cortisol hormone levels were constructed for athletes. Sex hormone levels showed deviations from the non-athlete references in both sexes: the resting testosterone level of male athletes was higher, while 17- β -oestradiol level of female athletes was lower than non-athletes' level in their age-groups. Physical exertion caused all three hormone levels to change significantly in both sexes. The testosterone/cortisol ratio change showed relation to the mood profile of the athletes.

Conclusions: New indices based on sex hormone and cortisol levels are under construction for the screening of overtraining in athletes. Our further aim is to study fatigue, inflammatory and immune biomarkers beside the studied hormone levels to analyse their relations with injury risk in elite athletes.

Keywords: Endocrine state; Overtraining; Stress state; Mood profile; Handball.

FACTORS INFLUENCING BONE HEALTH: THE ROLE OF LONG-TERM PHYSICAL ACTIVITY AND NUTRITION IN ELITE FEMALE MASTERS ATHLETES

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Background: Regular physical activity positively influences bone mineral density (BMD), helping to prevent osteopenia and osteoporosis. Alongside exercise, nutrition, particularly dairy intake and other bone-supporting foods play a key role in skeletal health through its impact on mineralization processes. However, interactions between long-term sport participation, dietary patterns, body composition, and biological factors in older female athletes remain insufficiently understood.

Objective: To assess relationship between long-term participation in various athletics disciplines, dietary habits, body composition, biological factors and BMD in elite female master athletes.

Subjects and methods: The study included 199 females in the Masters category aged 57.6 ± 11.2 years. The study sample was ethnically homogeneous (European ancestry). Bone parameters of the forearm were assessed using DXA at two measurement sites: distal and proximal. Body composition was analysed using bioelectrical impedance analysis. Usual dietary intake was evaluated through an interview using a semi-quantitative food frequency questionnaire, identifying four dietary patterns.

Results: Long-term sports participation in masters age promoted maintenance of adequate bone mineralization and may influence dietary choices. Extended athletic training, particularly strength and throwing events, showed a beneficial effect on skeletal health and reduced osteoporosis risk after the age of 40. BMD was significantly associated with dietary patterns, especially diets rich in dairy products, vegetables, fish, poultry, nuts, and legumes, along with body composition indicators.

Conclusions: Physical activity in master-aged women supports bone health and may interact with nutritional behaviours. Long-term training, especially strength-based and throwing disciplines, contributes to improved skeletal outcomes and may reduce osteoporosis risk after midlife. Dietary patterns rich in nutrient-dense foods are important determinants of BMD. The findings highlight the need for individualized training and nutrition strategies and further research on biological interactions affecting bone health in ageing female athletes.

Keywords: Aging; Bone health; Skeletal health; Risk of osteoporosis; Biological factors; Sports anthropology.

Acknowledgement / Funding Source: The research was conducted as part of the International Track and Field Masters Athletes Cohort Study Project. The research was funded as part of UPB Research Project No. 14: “Factors Determining Bone Mineral Status in Recreational and Professional Athletes of Different Age Groups,” conducted at the Józef Piłsudski University of Physical Education in Warsaw, Poland.

INTERLEUKIN RESPONSE TO COMBINED AEROBIC – RESISTANCE TRAINING AND DIETARY INTERVENTION IN MEN WITH ABDOMINAL OBESITY

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Background: Chronic low-grade inflammation links abdominal obesity with insulin resistance, adverse body composition and cardiometabolic risk. Among inflammatory mediators, IL-6 and IL-8 may reflect obesity-related inflammation and the response to lifestyle intervention.

Objective: To evaluate the effects of a 6-week aerobic-resistance training program, with or without dietary intervention, on interleukins, insulin sensitivity, cardiometabolic indices and body composition in men with abdominal obesity.

Subjects and methods: Forty-four men with abdominal obesity (waist circumference: 110.2±8.8 cm; BMI: 32.0±3.8 kg/m²) were randomized to a control group (CG, n=12), exercise group (EG, n=16), or exercise-plus-diet group (EDG, n=16). Outcomes were assessed at baseline and after 6 weeks and included IL-6, IL-8, CRI I, CRI II, BF/BM, FFM/BM, and ABD/BM. Group, time, and interaction effects were analysed using mixed ANOVA with post hoc testing, and effect size was expressed as partial eta squared (η^2).

Results: The strongest anti-inflammatory effect was observed for IL-6. Its concentration decreased from 8.72±5.51 to 4.56±4.21 pg/mL in EDG (–47.7%, $p<0.01$) and from 8.83±6.44 to 6.17±6.17 pg/mL in EG (–30.1%, $p=0.02$), whereas no significant change was found in CG. Significant effects for IL-6 were confirmed for group ($p=0.01$; $\eta^2=0.18$), time ($p=0.01$; $\eta^2=0.03$) and group-by-time interaction ($p=0.03$; $\eta^2=0.03$). IL-8 showed no significant changes despite a numerical decrease in both intervention groups. The most favourable accompanying changes were observed in EDG, including lower BF/BM ($p<0.01$; $\eta^2=0.03$), lower ABD/BM ($p<0.01$; $\eta^2=0.04$) and higher FFM/BM ($p<0.01$; $\eta^2=0.02$). CRI I also decreased in EDG ($p=0.01$), whereas CRI II decreased over time and interaction ($p=0.01$), with the greatest reduction in EDG.

Conclusions: Combined exercise and dietary intervention produced the most favourable inflammatory and metabolic response, reflected by a marked reduction in IL-6. These findings support combined lifestyle treatment over exercise alone for improving inflammatory status in men with abdominal obesity.

Keywords: Adipokines; Abdominal obesity; Diet; Physical activity; Inflammatory markers; Insulin resistance.

FOOTPRINT MORPHOMETRY IN STATURE ESTIMATION OF SUBADULTS: ANTHROPOLOGICAL AND FORENSIC IMPLICATIONS

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Background: Footprint morphometry offers a promising approach for biological profiling in forensic anthropology, in situations where podiatric traces are more likely to be recovered than skeletal or genetic evidence. Studies exist on young adults and older populations till date, but research specifically on juvenile (or subadult) populations remains limited.

Objectives: This study is a preliminary attempt to investigate how static footprint dimensions relate to stature in Slovak subadults and evaluates their applicability for stature estimation models that can be relevant to human growth research in anthropological domains and Central European forensic caseworks.

Subjects and methods: A cross-sectional sample of 110 healthy Slovak adolescents (58 females, 52 males; 10–18 years) was collected using a recently validated non-colouring cream method to obtain bilateral static footprints and stature. Seven footprint variables were measured (toe lengths FPT1–FPT5, ball breadth FPBB, heel breadth FPHB).

Results: All footprint variables showed significant positive correlations with stature ($r=0.366-0.894$, $p<0.001$), with toe lengths exhibiting consistently stronger associations than breadth measurements in both sexes. Linear regression models yielded high coefficients of determination, particularly among males (R^2 up to 0.906), whereas females showed slightly lower but robust predictive power (R^2 up to 0.782). Multiple regression models that combined length and breadth variables with age further enhanced accuracy, reaching $R^2=0.910$ in males and $R^2=0.809$ in females.

Conclusion: The study contributes to a baseline or preliminary data for a Central European subadult reference, underscoring the anthropological importance of growth-related variations in foot form and the forensic value of footprint evidence in the identification of juvenile individuals encountered in crime scenes and mass disaster scenarios.

Keywords: Forensic anthropology; Biological estimation; Footprints; Stature prediction; Subadults.

Acknowledgement / Funding Source: The study is a part of anthropometric research project on the Slovak population, and the research was approved by an Ethics Committee of Comenius University in Bratislava, Slovakia (under project number ECH19004).

THE RELATIONSHIP BETWEEN BIOLOGICAL MATURITY AND ASYMMETRIES IN BIOMECHANICAL PARAMETERS AMONG YOUTH HANDBALL PLAYERS

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Background: Rapid growth and changes in body proportions during puberty may cause a transient decline in motor coordination and increase injury risk. Force parameters measured during the landing phase of countermovement jumps (CMJ) may serve as sensitive biomechanical indicators of neuromuscular control. Trunk muscle strength and stabilizing capacity are essential for coordinated segmental movement.

Objective: This study aims to examine how biological maturity status and trunk strength jointly influence landing force mechanics during vertical jumping. It also investigates how landing asymmetries change over time in more mature athletes in relation to the optimization of movement coordination.

Subjects and methods: The analysis included data from 407 male and female youth handball players aged 14–17 years. Biological maturation was categorized by peak height velocity status in boys and age at menarche in girls. Vertical jumps were recorded using a Vald ForceDecks force platform at 1000 Hz. The analysis focused on biomechanically relevant asymmetry parameters during the landing phase. Trunk muscle strength was measured using a BioniX isokinetic trunk dynamometer in rotation, flexion–extension, and lateral flexion at an angular velocity of 30°/s, based on mean work values. Data processing is currently ongoing.

Results: We hypothesize that peak force asymmetry during the CMJ landing phase may temporarily increase around peak height velocity and menarche, particularly in athletes with lower trunk strength. This asymmetry is expected to decrease in later stages of biological maturation.

Conclusions: The study is expected to clarify changes in adolescent movement of coordination and to support the importance of technical retraining of sport-specific movements in youth handball players.

Keywords: Biomechanics; Biological maturation; Bone age; Peak height velocity; Trunk strength; CMJ; Asymmetry.

ULTRASOUND-BASED SKELETAL AGE AND ITS ASSOCIATION WITH PHYSICAL PERFORMANCE IN SLOVAK YOUTH ICE HOCKEY PLAYERS: A PRELIMINARY STUDY

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Background: Biological maturation is an important factor influencing physical performance in youth athletes. Differences between chronological and skeletal age may contribute to variability in strength, speed, and overall athletic performance. Assessing skeletal age using non-invasive methods may provide valuable insights for sports practice.

Objective: This preliminary study aimed to evaluate differences between chronological and skeletal age and examine the relationship between skeletal age and physical performance in youth ice hockey players.

Subjects and methods: A total of 48 male youth ice hockey players were assessed. Chronological age ranged from 8.23 to 12.47 years (mean 9.86 ± 0.95 years). Skeletal age was determined using the BAUSport ultrasound device and players were classified as early, on-time, or late maturers. Physical performance was evaluated using a 20 m sprint test (0–10 m, 10–20 m, 0–20 m), a 2 kg medicine ball throw, and an agility test (5–0–5). Correlation analysis and non-parametric Kruskal–Wallis tests with post hoc comparisons were used.

Results: The distribution of maturation timing showed that 46% of players were early maturers, 50% on-time, and 4% late maturers. A strong positive correlation was found between skeletal age and upper limb strength ($r=0.696$, $p<0.001$). No significant correlations were observed between skeletal age and sprint performance. Significant differences between maturation groups were found for the medicine ball throw ($p=0.022$), with early maturers outperforming on-time peers ($p=0.036$). No significant differences were observed for sprint or agility performance.

Conclusions: Skeletal age appears to significantly influence upper limb strength but not speed or agility in youth ice hockey players. Early maturers demonstrate performance advantages, which may contribute to selection bias. These findings highlight the importance of considering skeletal age in talent identification and may provide practical guidance for coaches in optimizing training and athlete evaluation.

Keywords: Skeletal age; Ultrasound assessment; Youth athletes; Ice hockey; Physical performance.

CRANIAL SEXUAL DIMORPHISM IN TWO CONTEMPORARY EUROPEAN POPULATIONS: CONSISTENT PATTERNS AND IMPLICATIONS FOR SEX ESTIMATION

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Background: Sex estimation is a fundamental task in forensic anthropology and bioarchaeology. However, the expression of sexual dimorphism varies according to population specificity, secular trends, and biological as well as environmental factors. For this reason, it is necessary to validate existing methods and to develop new ones.

Objective: To assess cranial sexual dimorphism in two European populations and compare patterns in cranial measurements, morphology, and indices between groups.

Materials and methods: The material consisted of two series of macerated adult skulls with documented sex and age at death: 68 from a modern Portuguese population (36 females, 32 males) and 84 from a twentieth-century Greek population (38 females, 46 males). For each skull, 27 standard cranial measurements were taken, cranial indices were calculated, and morphological traits known to exhibit sexual dimorphism were evaluated. Sex differences in nonmetric traits were assessed using logistic regression, whereas metric traits were evaluated by means of discriminant function analysis.

Results: No significant differences were found in the magnitude of sexual dimorphism between the two populations. In both groups, cranial dimensions showed greater sex differentiation than cranial indices, with the strongest dimorphism observed in the mid-craniofacial region. Among the descriptive traits, glabellar shape, zygomatic arch prominence, mandibular body height, and the size of the mandibular condylar process displayed the highest degree of sexual dimorphism. Significant correlations between metric and nonmetric traits were also observed. Regardless of biological sex, larger skulls tended to exhibit more pronounced masculinized features, whereas smaller skulls showed more feminized characteristics. Anthropological sex estimation methods demonstrated 100% agreement with documented sex in males, while 6 females (8.11%) were misclassified.

Conclusions: Cranial traits show consistent sexual dimorphism across populations. Combining metric and morphological data improves accuracy and reduces error, supporting improved sex estimation methods in forensic anthropology for modern European samples.

Keywords: Sexual dimorphism; Skull; Metric traits; Non-metric traits; Contemporary population.

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PILOT STUDY ON LEVEL 3 FINGERPRINT FEATURES FOR THEIR USE IN FORENSIC IDENTIFICATION

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Background: Dermatoglyphs are formed early during prenatal development and, due to their individuality and permanence, are commonly used for identification. When fingertips touch a surface, sweat distributed along the ridges is transferred, producing a latent fingerprint. To use this latent fingerprint for identification purposes, each country establishes a well-defined minimum number of level 2 features (or minutiae). Latent fingerprints obtained from crime scenes usually has poor quality, resulting in an insufficient number of minutiae; therefore, the fingerprint must be discarded. To increase the likelihood that a partial latent fingerprint can be used, level 3 features – which include detailed ridge attributes – have been proposed to enhance identification. However, these features remain poorly studied and are less commonly employed in fingerprint identification.

Objective: To conduct a pilot study to identify level 3 features and assess their frequencies in the index finger and thumb.

Subjects and methods: The study sample consisted of 100 fingerprints from 50 adult men; only the fingerprints of the index finger and thumb of the right hand, with at least three quality records available over time, were analysed using conventional observational methods. The anonymous sample was obtained from the autonomous police of the Basque Country (Ertzaintza). Six level 3 features were considered, and the frequencies of these features were calculated for each finger.

Results: The most frequently observed level 3 feature on the analysed fingers was “ridge protrusion”, followed by “hook”. In general, more level 3 features were found in the thumb than in the index finger.

Conclusion: These preliminary results suggest that “ridge protrusion” may be a good candidate for use as a third-level feature in identification.

Keywords: Fingerprints; Level 3 features; Ridge; Dermatoglyphics; Personal identification.

Acknowledgement / Funding Source: This study is carried out within the ZiForKrim collaborative space (research line Lophoscopic identification). ZiForKrim is jointly promoted by the ZTF-FCT at the University of the Basque Country (EHU) and Ertzaintza’s Scientific Police Unit. The financial support comes from the Basque Government, through the Basque Academy of Police and Emergencies (AVPE).

MORE THAN JUST A PROFILE: THE RISE OF EPIGENETICS IN MODERN FORENSICS

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Background: Recent advances in molecular biology have expanded the scope of forensic science far beyond traditional DNA profiling methods such as short tandem repeat analysis. One of the most important developments is the use of epigenetic biomarkers – particularly DNA methylation – which provides information that complements and extends classic genetic identification. DNA methylation refers to the addition of methyl groups to cytosine residues at CpG sites, and these patterns vary with age, lifestyle or tissue type making them highly informative in forensic contexts.

A major application is the identification of body fluids using tissue specific methylation signatures. These markers can also assist in interpreting mixed biological samples, which are often challenging for standard genetic approaches. DNA methylation analysis further enables the differentiation of monozygotic twins, who share identical DNA sequences but may exhibit distinct epigenetic profiles. Methylation based methods can also be used to determine biological sex from forensic traces.

Another key use is the estimation of epigenetic age, allowing investigators to infer an individual's age from biological material. Methylation patterns may also provide insights into lifestyle factors, phenotypic traits, biogeographical ancestry, and certain health conditions. Additionally, methylation signatures help determine tissue origin and sample age, offering valuable contextual information.

An increasingly important application is sample authentication, where methylation patterns help detect fabricated, contaminated, or altered biological evidence, thereby supporting the integrity of forensic analyses.

DNA methylation analysis is also applicable to ancient DNA. It enables estimation of age at death, reconstruction of past lifestyles, and investigation of evolutionary processes. By comparing methylation profiles across populations, researchers can identify adaptive traits and gain deeper insight into human evolutionary history.

Objective: The aim of this study is to provide a comprehensive review of contemporary applications of DNA methylation in forensic science, including identification, age estimation, tissue origin analysis and its emerging use in ancient DNA research.

Keywords: DNAmAge; Epigenetics; Methylations.

ARE FACIAL INDICATORS GOOD MARKERS OF SEXUAL DIMORPHIC DIFFERENCES?

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Background: Facial indices are commonly used to assess facial masculinization and feminization and are thought to reflect sexually selected traits linked to physiological, behavioural, and psychological characteristics. However, evidence for consistent sex differences remains inconclusive.

Objective: To examine sexual dimorphism in facial indices commonly used to quantify facial masculinization and feminization in a contemporary Polish population.

Materials and methods: The study included 3D facial scans of 459 women and 400 men aged 20–79 years. Using 43 anatomical landmarks, 95 linear measurements and ten facial proportion indices – including the nasal index, fWHR, facial index, and cheekbone prominence – were calculated from Vectra 3D images.

Results: Significant nominal sex differences were observed for the nasal, mouth, and total facial indices ($p < 0.001$); for fWHR and the lower fWHR ($p < 0.01$); and for cheekbone prominence ($p < 0.05$). Higher mean values in women were found for the lower facial height to total facial height ratio, upper facial index, cheekbone prominence, lower fWHR, and mouth width index. Despite these statistically significant differences, the distributions of index values in women and men largely overlapped. Dimorphism indices for facial proportions were consistently small, ranging from 0.07 for the lower facial height to total facial height ratio to 0.56 for the mouth width index, with relatively minor percentage differences between female and male means (0.41–17.59%).

Conclusions: These findings suggest that reliance on single proportional indicators may be insufficient for assessing facial masculinization or feminization, and that future research should focus on multivariate, multi feature approaches.

Keywords: Vectra 3D imaging system; Facial morphology; Facial masculinization/feminization.

Acknowledgement / Funding Source: Data was collected in Project No. DOB-BIO10/06/01/2019, financed by National Centre for Research and Development within framework of call 10/2019 related to scientific research and studies for National Defense and Security.

THE CONTRIBUTION OF ANCIENT GENOMES TO THE VARIATION OF BROWN FAT THERMOGENESIS IN THE MODERN JAPANESE

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Background: Brown adipose tissue (BAT) plays a role in non-shivering thermogenesis, yet its activity varies significantly among individuals and across seasons. We previously reported that BAT thermogenesis is lower and more seasonally plastic in Japanese individuals compared with continental East Asians.

Objective: Given the unique genetic ancestry of the Japanese, we hypothesized that genome variation inherited from the Jomon people, prehistoric hunter-gatherers living in the Japanese archipelago 16,000 – 2,350 years before present, contributes to the diversity of BAT activity in modern Japanese people.

Subjects and methods: We analysed genome-wide data from 416 healthy Japanese adults with BAT activity measured by FDG-PET/CT. After genotyping, imputation, and quality control, PCA was used to assess genetic similarity with East Asian populations, and ADMIXTURE analysis estimated Jomon ancestry using ancient Japanese genomes.

Results: As a result, PCA clearly distinguished modern Japanese individuals from continental populations and showed that BAT activity in our participants decreased with increasing genetic distance from continental East Asians ($p=0.036$, $\beta=-0.108$). ADMIXTURE analysis showed that Jomon ancestry was prevalent only among Japanese individuals and was strongly correlated with their PCA scores. Interestingly, individuals with higher Jomon ancestry showed significantly lower BAT activity ($p=0.018$, $\beta=-0.124$). Our findings suggest that this trait may have been an adaptation to the hunter-gatherer lifestyle and warmer climate of the Jomon period, providing an advantage against starvation by minimizing thermogenic energy expenditure.

Keywords: Cold adaptation; Brown adipose tissues; Ancient Japanese genomes; Physiological adaptation.

Acknowledgement / Funding Source: JSPS KAKENHI Grant Numbers JP21H02571, JP24K02106 and JP23KJ0705.

AN ADAPTIVE VARIANT OF SLC25A11 ENHANCES BROWN ADIPOSE TISSUE ACTIVITY IN HUMANS

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Background: Brown adipose tissue (BAT) counteracts obesity primarily by enhancing energy expenditure. Although substantial individual variation in BAT activity suggests the involvement of genetic factors, reports on specific genetic variants remain limited.

Objective: To identify genetic determinants of human BAT activity by integrating adipose tissue eQTL data and natural selection metrics for genes differentially expressed between BAT and WAT.

Methods: In this study, we screened 119 genes previously identified as differentially expressed between BAT and white adipose tissue (WAT) by Perdikari et al., integrating expression quantitative trait loci (eQTL) data in adult adipose tissue with natural selection intensity metrics.

Results: Consequently, we identified SLC25A11, a component of the malateaspartate shuttle (MAS), as a novel BAT-associated molecule. Genetic variants in SLC25A11 were significantly associated with high BAT activity in 444 adults who underwent PET-CT imaging following cold exposure. A consistent trend was also observed via infrared thermography in an independent adult cohort. In silico mining revealed that these genetic variants upregulate SLC25A11 expression in adipose tissue and correlate with a reduced risk of obesity and type 2 diabetes. Furthermore, evolutionary analysis using modern and ancient human genomic diversity panels demonstrated that this genetic variant, linked to high BAT activity, rapidly spread through ancient European populations via positive natural selection during the Last Glacial Maximum to Heinrich Event 1. Notably, it was revealed that this positive natural selection ceased to operate after Heinrich Event 1.

Conclusion: These findings underscore the critical role of the MAS in regulating BAT thermogenesis and support the hypothesis that environmental adaptations experienced by ancestral populations have shaped obesity susceptibility in modern humans.

Keywords: Cold adaptation; Brown adipose tissues; SLC25A11; Positive natural selection.

Acknowledgement / Funding Source: JSPS KAKENHI Grant Numbers JP21H02571, JP24K02106 and JP23KJ0705.

HOW TO STAND OUT: ARTIFICIAL SKULL DEFORMITIES IN VARIOUS POPULATIONS – A SYSTEMATIC REVIEW

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Background: The consequences of artificial cranial modification extend beyond aesthetic and social dimensions, encompassing significant biological effects. Intentional cranial deformation leads to measurable alterations in cranial morphology and vascular architecture.

Objective: The aim of the present study was to evaluate structural and morphological changes resulting from altered cranial growth patterns, as well as their potential impact on the proper functioning of the organism.

Subjects and methods: A systematic search of three databases (PubMed, Web of Science, Cochrane) identified 1,335 articles, of which 52 were included after screening and eligibility assessment. The included studies comprised anthropometric analyses, 3D morphometry, radiological examinations, and qualitative descriptions. Data were analysed qualitatively by identifying recurring patterns of structural and morphological changes within the neurocranium and viscerocranium, depending on the type of deformation.

Results: Tabular cranial deformation, in its various subtypes, predominated among the observed forms. Most studies reported the presence of structural changes in the cranial bones associated with prolonged mechanical pressure were identified. These differences included bone thinning as well as localized reductions in bone density. Within the venous system, modifications in vascular trajectory and vessel thinning were observed. The deformations primarily involved redirection of neurocranial growth and compensator adaptation of the craniofacial complex. Despite these morphological alterations, no functional disturbances were identified in most cases.

Conclusions: Artificial deformations influenced the shape of the cranial vault. However, regardless of their type, intracranial volume remained unchanged. The observed changes indicate the presence of adaptive mechanisms of a morphological nature as a response to prolonged pressure. Differences in the structure of the craniofacial suggest interrelationship between its development and altered growth of the cranium. Despite pronounced modifications in bone and vascular structures, the majority of studies do not report functionally significant impairments.

Keywords: Artificial cranial deformation; Ancient populations; Human skull.

THICK BONES, ANCIENT LIVES: CRANIAL VAULT THICKNESS IN THE ETRUSCAN NECROPOLIS OF SPINA

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Background: Despite growing interest in skeletal robusticity, cranial vault thickness remains an underexplored trait in bioarchaeological studies. Its aetiology is multifactorial, involving ontogenetic processes, nutritional status, and possible pathological conditions.

Objective: This ongoing study focuses on the analysis of cranial vault thickness (CVT) in a sample of 30 adults from the Etruscan necropolis of Spina (Italy, 6–5th century BCE). Following the identification of a tendency toward cranial hyperostosis in the adult individuals of Spina, apparently unrelated to sex or skeletal robustness, this study aims to assess a possible connection between the thickening of the cranial bones and some observed alterations of the inner and outer surface.

Materials and methods: For this purpose we adapted and applied a methodology of analysis based on the division of the cranial surface into 4 areas and 16 smaller anatomic units: for each unit, we assessed the state of preservation and we measured the maximum and minimum thickness and the thickness at predetermined landmarks; then, we took into account the presence and severity of alterations (such as porotic lesions, abnormal blood vessels impressions, abnormally pronounced digital impressions and others).

Results: The comparison of our preliminary results with previously published studies confirms higher values of CVT for the Spina sample; this thickening seems to be more significant in the parietal bones, with some individuals presenting with areas of the vault up to 5 mm thicker than the cut-off. While the absence of significant porotic lesions rules out the possibility of porotic hyperostosis, the high incidence of encephalic vascular anomalies, including evidence of diploic veins impressions, and abnormal periosteal appositions, might relate to cases of high intracranial pressure and the subsequent activation of thermoregulating systems in the encephalon.

Conclusion: Thus, the increase in CVT values might be part of the ensuing processes of bone remodelling, associated with instances of abnormal cranial stresses.

Keywords: Cranial vault thickness; Cranial alterations; Cranial hyperostosis; Data recording method.

DENTAL PROSTHESIS FROM THE AUGUSTINIAN TOMB: ADDITIONAL EVIDENCE FOR THE IDENTIFICATION OF GREGOR JOHANN MENDEL

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Background: In 2021, an archaeological–anthropological–genetic investigation of the Augustinian tomb at the Central Cemetery in Brno included the exhumation of skeletal remains of five members of the Augustinian Order. During this research, dental prostheses were discovered in the deepest coffin. The skeletal remains from this grave were subsequently identified as those of Gregor Johann Mendel using several independent methodological approaches.

Objective: The aim of this study was to provide additional evidence supporting the identification of Gregor Johann Mendel through a detailed material and technological analysis of the recovered dental prosthesis.

Subjects and methods: The dental prosthesis was subjected to a range of analytical methods, including X-ray imaging and scanning electron microscopy combined with energy-dispersive X-ray spectroscopy (SEM–EDX). These techniques enabled comprehensive characterisation of the prosthesis’s construction, elemental composition, and microstructural features. The obtained data were interpreted in relation to the historical development of restorative dentistry and known manufacturing technologies.

Results: The analyses revealed specific materials, construction principles, and microscopic characteristics consistent with historical dental prosthetic techniques. Comparison with documented advances in restorative dentistry allowed the prosthesis to be dated to the period between 1855 (1863) and 1926.

Conclusions: The documented dates of birth and death of the five Augustinians, including Gregor Johann Mendel (1822–1884), suggest that the dental prosthesis most likely belonged to Mendel, given its dating and evidence of prolonged use. This provides independent support for his identification and highlights the value of ancient dental restorations as dating and identification tools.

Keywords: Gregor Johann Mendel; Dental prosthesis; Identification; Augustinian tomb; SEM–EDX.

Acknowledgement / Funding Source: MUNI/R/1413/2024.

THE DEGREE OF DENTIN EXPOSURE AS A SIGNIFICANT CAUSE OF PULP STONE FORMATION IN HUMAN DENTITION

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Background: Pulp stones (PS) are calcified, hard structures most commonly found in the pulp chamber of permanent molars. The causes of these structures have not yet been fully understood. Among the hypothetical factors influencing their occurrence is the importance of mechanical stimuli induced by the dental wear process.

Objective: The main aim of this study was to test the mechanical stimulation hypothesis mentioned above.

Materials and methods: The study material consisted of permanent lower molars belonging to representatives of two human populations dating from the Middle Ages and the turn of the 19th/20th century. The presence of PS was diagnosed based on CT images of the examined teeth using RadiAnt DICOM Viewer software, and the degree of dentin exposure was determined using a 40-point scale. Due to the relatively small number of adequately preserved molars (n=169, M1–M3), statistical analyses were performed for all molars combined (without considering the division into population types and separately for each of the populations), and for both populations combined separately for three molar types. The original tooth wear scale was converted to a three-level scale.

The relationship between the frequency of PS and the degree of tooth wear for each type of analysis was analysed using Pearson chi-square tests ($p < 0.05$).

Results: The results indicated a statistically significant relationship between the occurrence of PS and the degree of dentin exposure in the case of the first two types of analyses (for all molars together: without division into populations (28.84; $p < 0.05$), with division into two populations (26.38; $p < 0.05$ and 10.17; $p < 0.05$, respectively). The finding of a positive relationship between these features (positive value of Kendall's tau-c) supports the hypothesis put forward. This relationship was not established for each of the molar types analysed separately (related to the small sample size of the subgroups).

Keywords: Pulp stones; Dental wear; Pulp chamber calcification.

BIOARCHAEOLOGICAL ANALYSIS OF SKELETAL REMAINS FROM EARLY MODERN PERIOD (RAD, SLOVAKIA)

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Background: The archaeological excavation was conducted within the current parish garden of the Roman Catholic rectory in the northeastern part of the village of Rad (Trebisov district, Slovakia), located in the southern part of the Eastern Slovak Lowland. A Minorite monastery stood at this site from 1637 to 1767. A total of sixteen individuals were exhumed, all dating back to the 16th–18th centuries.

Objective: The aim of the anthropological analysis was to establish the biological profile using appropriate anthropological methods and to document all pathological and non-pathological changes and skeletal varieties.

Subjects and Methods: The subject of the study was the relatively well-preserved skeletal remains of an adult individual designated as H6 (H from Slovak word hrob, which means grave and 6 as order of analysed remains from this site). Standard morphoscopic and morphometric methods were employed for sex and age estimation, and Sjøvold's method was used to estimate stature.

Results: Based on the analyses, the remains were identified as a male, aged 33 to 70 years. The presence of ossified thyroid cartilage suggests an age of over 45 years. Based on the maximum length of the left femur, stature was estimated at $170,385 \pm 3,48$ cm. Degenerative changes include pronounced osteoarthritis of both knee joints and massive osteophyte formation on the thoracic vertebral bodies (Th5–Th12). Chronic mechanical stress is indicated by enthesopathies observed bilaterally on the forearm bones in the areas of the tuberositas radii et ulnae, as well as the ossification of costal cartilages on five ribs. The presence of cribra orbitalia in both orbits and significant enamel hypoplasia on the canines suggests physiological and nutritional stress during ontogenesis.

Conclusions: The comprehensive findings indicate high physical workload and physiological stress during the growth period. The extent of degenerative changes correlates with the estimated advanced age (maturus/senilis). These results contribute to the knowledge of the demographic and health status of the Minorite monks in Eastern Slovakia during the Early Modern period.

Keywords: Anthropology; Rad village; Early Modern Period; Physical stress markers; Degenerative changes.

Acknowledgement / Funding Source: The work was supported by the KEGA project No. 039PU-4/2026.

BIOARCHAEOLOGICAL EVIDENCE OF RHIZARTRHROSIS IN INDIGENOUS POPULATIONS FROM GRAN CANARIA (CANARY ISLANDS, SPAIN)

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Background: Bioarchaeological studies have traditionally devoted limited attention to the palaeopathological analysis of hand bones, despite their considerable value for interpreting degenerative processes, biomechanical stress, and functional limitations in ancient populations. Within the Canary Islands, rhizartrhrosis has rarely been documented in archaeological contexts, and detailed descriptions based on dry bone analysis remain scarce.

Objective: This study aims to identify and describe cases of rhizartrhrosis in pre-Hispanic individuals from Gran Canaria (Canary Islands, Spain), assessing its bioarchaeological relevance and its implications for manual activity and functional impairment.

Subjects and methods: A macroscopic osteological analysis was conducted on hand remains recovered from several archaeological sites in Gran Canaria. Particular attention was paid to degenerative changes affecting the trapeziometacarpal joint between the trapezium and the first metacarpal, located at the base of the thumb. The degree of joint degeneration was evaluated through morphological observation and compared with established clinical classifications.

Results: The preliminary analysis identified at least ten individuals presenting unilateral or bilateral rhizartrhrosis with different degrees of severity consistent with the classification proposed by Richard Eaton and Lewis Littler, 1973. Observed alterations included joint surface degeneration, osteophyte formation, deformation of the articular surfaces, and advanced degenerative remodelling. Potential associated factors include ageing, repetitive manual activities involving intensive thumb use, biomechanical overload, and possible previous trauma.

Conclusions: Rhizartrhrosis represents one of the most significant degenerative pathologies affecting the hand within the osteoarchaeological record of Gran Canaria. Its study provides valuable information regarding manual dexterity, habitual activities, and functional limitations among the indigenous populations of the Canary Islands, highlighting the importance of incorporating hand paleopathology into future bioarchaeological research.

Keywords: Rhizartrhrosis; Bioarchaeology; Paleopathology; Canary Islands; Hand osteology.

Acknowledgement / Funding Source: This research was conducted within the framework of a predoctoral contract funded by the Canary Agency for Research, Innovation and Information Society (ACIISI) at the Universidad de La Laguna.

BIOARCHAEOLOGICAL RESEARCH OF EARLY IRON AGE PRE-SCYTHIAN BURIALS FROM HUNGARY

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Background: The transition between the Late Bronze Age (LBA) and the Early Iron Age (EIA) in the Carpathian Basin was marked by major cultural changes. During the 9th century BC, the Mezocsat group emerged in the Great Hungarian Plain, the adjacent northern foothills, and southwestern Slovakia. Known mainly from cemeteries, the absence of settlements suggests a mobile pastoral lifestyle. Their inhumation burials and grave goods indicate strong connections with the Caucasus, the Ponto-Caspian steppe, and the Northern Balkans.

Objective: This ongoing bioarchaeological study aims to investigate the mobility, biological relationships, subsistence strategies, and health status of the Mezocsat group, while assessing their affinities with preceding LBA and contemporary EIA populations of the Carpathian Basin.

Subjects and methods: The study examines the majority of available skeletal remains attributed to the Mezocsat group, most originating from northeastern Hungary. Standard anthropological methods were applied to assess biological characteristics, metric and morphological variation, pathological conditions, trauma, activity-related skeletal changes, and dietary patterns.

Results: Metric and morphological analyses indicate that the Mezocsat population formed a relatively homogeneous biological group. Skeletal trauma is uncommon and rarely associated with interpersonal violence, suggesting relatively peaceful living conditions. Regional variation in physiological stress markers may reflect episodes of nutritional stress or infectious disease. Advanced degenerative joint disease is generally absent; however, repetitive lumbar spine microtrauma in several individuals indicates specific habitual physical activities. Dietary evidence suggests a greater reliance on animal-derived foods, particularly meat and dairy products, than in other LBA and EIA populations of the Carpathian Basin.

Conclusions: The bioarchaeological evidence supports the interpretation of the Mezocsat group as a biologically homogeneous population with distinct lifestyle and subsistence patterns. Their skeletal characteristics provide important insights into mobility, health, and adaptation during the cultural transformations that accompanied the transition from the Late Bronze Age to the Early Iron Age.

Keywords: Early Iron Age; Pre-Scythian; Mezocsat group; Bioarchaeology.

Acknowledgement / Funding Source: This project is supported by the grant of Hungarian Research, Development and Innovation Office (project number: Advanced-152134).

RESULTS OF PALAEOPATHOLOGICAL EXAMINATION OF SKELETAL MATERIAL OF CATHOLIC CHURCH IN BODROGKERESZTUR, HUNGARY

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Background: In the village of Bodrogkeresztur, the condition of the medieval Roman Catholic church had deteriorated to such an extent that its restoration as a monument became inevitable. The restoration was preceded by an archaeological excavation in several stages between 2017 and 2021. Human skeletal remains were also excavated from both the interior of the church and the cemetery surrounding the church.

Objective: Our goal was a systematic bioarchaeological analysis of skeletal assemblages of Roman Catholic Church in Bodrogkeresztur, Hungary including basic demographic reconstruction and assessment of palaeopathological conditions and markers of physiological stress.

Subjects and methods: Anthropological examinations were carried out at University of Nyiregyhaza, Hungary. Skeletal remains of 341 individuals were identified. Most of the skeletons can be dated to the 15th-17th centuries. Age at death, sex estimation and assessment of the palaeopathological lesions were carried out following the Historical Anthropological Protocol generally used in Hungary detailed in the oral presentation.

Results: 245 (71.85%) adult and 96 (28.15%) juvenile individuals were identified of the total 341. In the adult group 65 males, 49 females were identified and there were 131 undetermined individuals. 60% of the subadult individuals died before 6 years of age. Palaeopathology: 166 observed lesions altogether. Lesions indicative of physical stress and inflammation were the most common. More traumatic cases of fractures on ribs, humeri and skulls were observed.

Conclusions: The graveyard and the church were probably used by one community over centuries. Lesions caused by physical stress, inflammation and oral cavity lesions were the most frequent alterations in this community. Genu hypervascularisation was the second most frequent lesion type. It might be in connection with some physical activity. More cases of traumatic lesions suggest that local conflicts and other historical events might resulted in violence over the centuries.

Keywords: Catholic church in Bodrogkeresztur; Palaeopathology; Anthropological examination.

THE BIOLOGICAL EXPRESSION OF SOCIAL HIERARCHY: CHILDHOOD STRESS IN AN EARLY STATE CONTEXT IN URARTIAN KINGDOM (9–7TH CENTURY BCE)

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Background: The emergence of social hierarchies during the early formation of states resulted in unequal exposure to environmental and physiological stress, particularly within urban settings. The Van Citadel, the capital of the Urartian Kingdom established in the 9th century BCE, alongside the adjacent Old Van City, presents a unique context. Despite their geographical proximity, these contexts represent distinct socio-political strata and urban inequality, the Citadel associated with elite or military groups whereas the Old City reflecting the civilian groups.

Objective: This study aimed to assess the impact of social stratification on childhood health by comparing skeletal stress markers between these two subpopulations.

Materials and methods: The sample comprises 70 juvenile individuals (Van Citadel n=47; Old Van City n=23). Skeletal stress markers, including porotic hyperostosis, cribra orbitalia, diploe thickening, periostitis, enamel hypoplasia (LEH, PEH), rickets, and spina bifida, were evaluated using macroscopic methods. Group differences were analysed using Fisher's exact tests, odds ratios (OR), and regression models controlling for age.

Results: Although no statistically significant differences were observed, effect size estimates revealed distinct stress profiles. Developmental stress, as indicated by linear enamel hypoplasia, was more prevalent in the Van Citadel (OR=2.50), whereas metabolic stress markers such as porotic hyperostosis and cribra orbitalia were relatively more frequent in the Old Van City. Infectious conditions were rare but slightly more prevalent in the Citadel.

Conclusions: These findings suggest that urban inequality in an early state society influenced the biological expression of stress rather than its overall prevalence. Children in the Old Van City experienced greater chronic nutritional stress, while those in the Citadel exhibited patterns consistent with episodic developmental disruption. By integrating bioarchaeological evidence with models of early state formation, this study demonstrates that social inequality was biologically embodied in distinct childhood stress pathways, affecting not the magnitude but the expression of physiological stress.

Keywords: Bioarchaeology; Social inequality; Childhood stress; Urartian Kingdom; Early state societies.

READING DISEASE IN BONE: BIOARCHAEOLOGICAL AND MOLECULAR PERSPECTIVES ON SKELETAL PATHOLOGY IN A HUMAN SKELETON FROM SIDE (TURKIYE)

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Background: Tuberculosis has profoundly shaped human history, but skeletal diagnosis alone is often limited by non-specific lesions and preservation issues. Biomolecular methods therefore provide valuable complementary evidence for detecting tuberculosis in archaeological human remains.

Objective: This study investigates pathological changes observed in a human skeleton excavated from the ancient city of Side (Antalya, Türkiye) and dated to the Byzantine period using an integrative bioarchaeological approach combining palaeopathological assessment and ancient DNA (aDNA) analysis.

Materials and methods: The individual exhibited vertebral porotic lesions and was buried outside the main necropolis, an unusual funerary context that may reflect disease-related social responses, marginalization, or concerns about contagion. DNA was extracted from skeletal remains using the QIAamp DNA Investigator Kit and the presence of amplifiable human DNA was verified by PCR and qPCR. Shotgun sequencing libraries were then prepared and sequenced on an Illumina platform. In parallel, 16S rRNA amplicon sequencing and SILVA-based taxonomic assignment were employed to screen for the presence of pathogen DNA.

Results: Both shotgun and 16S metagenomic analyses revealed sequences affiliated with the *Mycobacterium tuberculosis* complex. Post-mortem damage patterns confirmed the authenticity of the ancient DNA signal. By integrating osteological and molecular evidence, this study strengthens the diagnosis of tuberculosis and demonstrates the importance of interdisciplinary approaches in biological anthropology.

Conclusion: The findings contribute to a better understanding of the biological and social impacts of infectious diseases in past human populations and highlight the potential of ancient DNA research to refine palaeopathological interpretations within their archaeological context.

Keywords: Bioarchaeology; Paleopathology; Ancient DNA (aDNA); Tuberculosis; Infectious diseases.

STORY OF THE VILLA ESTATE: ANTHROPOLOGICAL AND PALEORADIOLOGICAL INVESTIGATION OF CSUCSHEGY- HARSANYLEJTO (3RD-4TH C. CE) FROM PANNONIA

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Background: Aquincum as the capital of Pannonia Inferior was once part of the Roman Empire. The human population here was a mixture of romanized autochthon tribes and immigrants from across the Empire. Besides the civic and military towns, multiple villa estates were discovered by archaeologists in this area. One example for the latter is Csucshegy-Harsanylejtő (3rd–4th centuries CE) where a grave group of 13 individuals were found directly next to the villa building, and another group of 16 burials were excavated ca. 200–300 meters away from remains of the building.

Objective: Our goal was to reveal the life histories and reconstruct lifestyle of the individuals.

Materials and methods: Age estimation and sex determination were carried out by internationally accepted methodologies from macromorphological approach. In order to facilitate the proper diagnosis of the macroscopically observed pathologies (which data were collected based on individual and element count approach) and to reveal hidden alterations, the skeletal material underwent radiological investigation as well.

Results: The grave groups show a distinct demographic picture since the individuals found around the building are mainly subadults. Despite the small number of individuals, many interesting pathological cases (e.g. artificial cranial modification, stress markers, traumatic alterations, possible metabolic disorder, or signs of infections) were found during the palaeopathological analysis indicating life histories marked by stress exposure, as well as environmental and health-related challenges.

Keywords: Aquincum; Villa estate; Anthropology; Paleopathology; Paleoradiology.

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A POSSIBLE CASE OF PRENATAL SCURVY IN A NEWBORN FROM THE EARLY MODERN KOSICE-BELANSKA CEMETERY: A CASE STUDY

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Background: The study presents skeletal remains of a subadult individual exhumed from the Kosice-Belanska cemetery, dated to the 18–20th century, in whom macroscopic changes typical of long-term vitamin C deficiency, known as scurvy, were identified.

Objective: The aim of the study was to identify and document morphological indicators of scurvy in this individual and to contribute to the reconstruction of health status and living conditions of a historical population in eastern Slovakia.

Materials and methods: The age of the subadult skeleton was assessed by using the method of Fazekas and Kosa, while pathological changes were evaluated according to Buikstra, Mann & Hunt, Ortner and Waldron. Metric data were obtained using a digital calliper and a measuring tape. Based on the estimated age of approximately 40 weeks of prenatal development and the burial in a separate grave, the individual was interpreted as a newborn who most likely died shortly after birth.

Results: Subperiosteal new bone formation and abnormal cortical porosity were identified, with these pathological changes being clearly visible in multiple parts of the skeleton, including the skull, long bones, scapulae and ribs. Since vitamin C deficiency disrupts collagen synthesis responsible for vascular integrity, areas where interactions between blood vessels and bone or muscle occur are prone to repeated ruptures of weakened vessels, leading to the formation of subperiosteal new bone. Abnormal cortical porosity, in turn, developed as a result of increased capillary formation in response to repeated microtrauma of weakened vessels in connective tissues.

Conclusion: The results suggest that the observed lesions are consistent with a fully developed stage of scurvy, indicating severe vitamin C deficiency already during prenatal development, when the mother is the sole source of nutrients for the foetus. Although scurvy was historically relatively widespread, its identification in archaeological material, particularly in prenatal and neonatal individuals, remains rare. The combination and distribution of skeletal lesions observed in this individual provide strong support for the diagnosis of prenatal scurvy and highlight the diagnostic value of macroscopic skeletal indicators for identifying maternal nutritional stress in past populations.

Keywords: Scurvy; Vitamin C deficiency; Human skeletal remains; Pathology; Eastern Slovakia.

Acknowledgement / Funding Source: The research was supported by the GAPU 4/2026 grant.

DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS IN A SKELETAL INDIVIDUAL: A CASE STUDY

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Background: Diffuse idiopathic skeletal hyperostosis (DISH), also known as Forestier's disease, is a non-inflammatory degenerative disease of the spine and peripheral tendon attachments, characterized by calcification and ossification. In the axial skeleton, it primarily affects the ligamentum longitudinale anterius, but also the ligamentum longitudinale posterius and ligamenta flava, leading to the fusion of adjacent vertebral bodies.

Objective: The aim of this study was to describe and analyse the presence of DISH in an individual, based on observed morphological changes in the skeletal remains.

Materials and methods: Skeletal remains exhumed from a defunct Minorite church in the Rad village (Eastern Slovakia), were analysed using classical anthropological methods with a focus on estimating age, sex, and ancestry (AncesTrees program), as well as identifying developmental anomalies and pathological changes. The diagnosis of DISH was based on the criteria defined by Resnick and Niwayama.

Results: According to historical and anthropological records, the individual belonged to the Order of Minorites who lived in the area between 1637 and 1767. The skeletal remains were identified as a male (~50 years) of probable Southwestern European origin, exhibiting the skeletal manifestations of DISH. The diagnosis was supported by flowing ossification along the anterolateral aspect of the cervical (C5–6) and thoracic (Th3–6) vertebrae with characteristic preservation of the intervertebral disc spaces. Some rib fragments showed ectopic ossification of the costal cartilages and pronounced enthesopathic remodelling. Additional degenerative changes included thickening of the C1 vertebra, osteophytes, ossification of the thyroid cartilage, and the presence of Schmorl's nodes. Cribra orbitalia and enamel hypoplasia were observed as indicators of long-term physiological stress.

Conclusion: This study confirmed the chronic stage of DISH in a male characterized by axial ankylosis with a probable impact on the individual's mobility. The findings contribute to the palaeopathological understanding of DISH manifestations in historical populations.

Keywords: Axial ankylosis; Enthesopathy; Forestier's disease; Paleopathology; Eastern Slovakia.

ELONGATED STYLOID PROCESSES IN INDIVIDUALS FROM EARLY MEDIEVAL CEMETERIES IN GIECZ (GREATER POLAND VOIVODESHIP, POLAND)

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Background: The styloid process (processus styloideus) is a part of the temporal bone located on its inferior surface. Its normal physiological length ranges from 20 to 30 mm. Elongation of the styloid process is a pathological condition rarely observed in archaeological material.

Objective: The aim of this study is to present cases of elongated styloid processes identified in individuals from two early medieval cemeteries in Giecz.

Materials and methods: The remains of four individuals (two males aged 40–50 and 45–55 years, and two females aged 35–45 years and approximately 40 years) were selected from the analyzed skeletal material with preserved styloid processes, focusing on cases with the greatest elongation. Styloid process length was measured using a calliper and classified according to Langlais' classification.

Results: Elongated styloid processes (50–66 mm) were identified in all individuals. In two cases, type I (elongation exceeding 30 mm) was diagnosed, while in the remaining two cases type II was observed, characterized by segmentation of the styloid process with the presence of a pseudoarticulation.

Conclusions: The obtained results may suggest the presence of Eagle syndrome in the analysed individuals. The aetiology of this condition remains unclear; however, a possible genetic background has been proposed. Planned genetic analyses may help verify the hypothesis of heritability of this trait and provide directions for further research.

Keywords: Styloid process elongation; Eagle syndrome; Paleopathology; Central Europe.

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TRANSFORMING SKELETAL DATA INTO VISUAL FORM: A DIGITAL FACIAL DEPICTION OF “ZUZU”, AN EARLY HOLOCENE INDIVIDUAL FROM BRAZIL

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Background: Digital technologies are changing how archaeologists and anthropologists work with and share data, making it possible to create detailed visualizations of people from the past. Among these, facial depiction based on skeletal remains are particularly powerful, but they also come with important challenges. Faces are easily read as “real” and can give a stronger sense of certainty than the underlying evidence actually supports.

Objective: This work presents a digital facial depiction of “Zuzu,” an early Holocene individual (~9,600 cal BP) from Toca dos Coqueiros, Serra da Capivara National Park, Brazil. Rather than reconstructing the individual's actual appearance, we use a transparent, documented workflow that demonstrates how skeletal data are translated into a visual facial model.

Materials and methods: The skull was digitized using structured-light scanning and processed through a series of steps that combine anatomical analysis, soft-tissue modelling based on comparative data, and carefully controlled visualization choices. Throughout the process, we rely on preserved craniofacial features wherever possible, while treating more uncertain aspects with restraint.

Results: The final image is presented in grayscale and avoids adding features such as skin tone, hair, or other individualized traits, making clear that it is a model rather than a portrait. By making each step of the process explicit, this study shows how facial depictions can serve as a way of communicating archaeological knowledge without overstating what we know. More broadly, it highlights the importance of transparency and caution when creating and sharing visual representations of past human lives.

Keywords: Facial depiction; Early Holocene; South America; Craniofacial morphology; 3D modelling.

Acknowledgement / Funding Source: This article is dedicated to the memory of Niede Guidon, whose pioneering work in Serra da Capivara profoundly transformed our understanding of early human occupation in South America and whose lifelong commitment to the protection of archaeological heritage and the creation of FUMDHAM made much of this research possible. We would like to thank Jim Chatters for generously sharing the images of Naia and Kennewick Man, André Strauss for providing the reconstruction of the Lapa do Santo individual, and the Museu Nacional of Brazil for granting access to the image of Luzia

BIOARCHAEOLOGICAL INSIGHTS INTO A RURAL MIEVEAL POPULATION FROM ST. MARGARETHEN IM BURGENLAND (AUSTRIA, 11–13TH CENTURIES CE)

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Background: Little is known about the demography and life courses of high medieval communities living at the Austro-Hungarian border during a period characterized by both political and climatic changes. In 2021 however, a rescue excavation in St. Margarethen im Burgenland (Austria) led to the discovery of a burial site comprising three stratigraphic layers dating from the 11th to the 13th centuries. A total of 124 individual burials oriented along a west-east axis and interred without grave goods (except for the lowest Layer 3) as well as a substantial number of scattered skeletal remains outside their primary funerary context were recovered.

Objective: This discovery offered the unique opportunity to investigate the biological identities and life trajectories of an unknown population.

Materials and methods: The biological profiles (age-at-death, sex, stature) of all individual burials from Layers 1 and 3 were studied using standard macroscopic methods. Life courses were further investigated by documenting metric and non-metric diversity, stress markers (linear enamel hypoplasia, porotic lesions, enthesal markers) and pathological changes (dental pathologies, fractures, infections, degenerative conditions), building on a previous study of Layer 2. From all commingled human remains a minimum number of individuals was determined, and macroscopic sex estimation was performed on preserved pelves.

Results: Both the age-at-death and sex distribution of individuals from primary burials accords with the expected pattern of natural mortality for a rural community. Multiple individuals exhibiting abnormal endocranial blood vessel impressions (44.0%), periosteal new bone formation (14.0%), traumatic (9.43%) and pronounced osteoarthritic changes (29.27%) indicate a generally poor health status. In addition, at least 5 cases of different congenital disorders were observed. Between stratigraphic layers metric differences in the robustness of long bones could be discerned. From the commingled assemblage, a minimum number of 63 subadult and 85 adult individuals was determined, revealing a noticeable absence of infants and a majority of studied pelves estimated to be male.

Conclusion: We propose that these findings are indicative of a rural, non-militarized community in which individual life courses were shaped by both social and environmental factors.

Keywords: Medieval cemetery; Osteobiography; Palaeopathology.

AUTOMATED PLACEMENT OF ANTHROPOMETRIC LANDMARKS: PRELIMINARY STUDY

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Background: Anthropometric analysis of cranial structures plays a crucial role in fields such as forensic science and biological anthropology. The precise identification and placement of anthropometric landmarks are essential for accurate measurements and comparative analyses. However, manual annotation is time-consuming and subject to variability. Therefore, the development of automated methods for landmark detection has become an important area of research, aiming to improve efficiency, reproducibility, and objectivity in cranial analysis.

Objective: The aim of the study was to verify the viability of a deep learning-based method for automatically placing anthropometric landmarks on 3D models of skulls.

Subjects and methods: The study was carried out on 30 skull models derived from computed tomography scans; All the skulls came from a mediaeval archaeological site. The landmark detection task was performed using three independent deep learning models. Each model was trained individually on the complete training set. The preselection criterion was based on the completeness of the subject. Each model used for training was manually labelled by a subject expert using Blender software.

Results and conclusions: The preliminary results indicate that the proposed approach enables the effective automatic placement of selected anthropometric landmarks on cranial models. Additionally, the algorithm showed potential for reducing processing time and minimizing user-dependent variability. Further analysis and validation on larger datasets are required to confirm the robustness and general applicability of the developed solution.

Keywords: Facial reconstruction; Soft tissue markers; Anthropometry.

ARCHAEOANTHROLOGICAL ANALYSIS OF A MULTIPLE SECONDARY BURIAL WITH SIGNS OF PERIMORTEM VIOLENCE AND POSTMORTEM CLEANING DURING THE LATE HOLOCENE IN LA PAMPA, ARGENTINA

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Background: The Médano Petroquímica site (La Pampa, Argentina) is a pre-Hispanic burial area located in a sand dune structure of aeolian origin, characterized by burials with a high density of inhumed individuals. Between 2006 and 2009, six burials were excavated, from which approximately 130 individuals were recovered. Six radiocarbon dates suggest that the site was used towards the end of the Late Holocene, between 1435 and 1635 AD.

Objective: We present the results of a funerary taphonomic analysis of the human skeletal remains from burial feature H6-3.

Materials and methods: The analysis focused on the observation of intentional anthropogenic marks and the presence of natural taphonomic signs that could affect and interfere with the assessment of cultural features.

Results: This secondary multiple burial contained the remains of 39 individuals, including adults and subadults. Insect traces, ochre, articulated and disarticulated bone segments, signs of perimortem violence, and postmortem cleaning marks were observed on some bones. Some individuals appear to have died violently, and most were exposed to the elements in a primary context to accelerate decomposition, as evidenced by the widespread signs of *Dermestes*. Subsequently, the individuals were likely moved to this multiple burial, with bodies in various stages of decomposition and degrees of natural disarticulation arranged together. Finally, many of them were covered with ochre, except for the perinatal remains, which must have been protected in textile containers. The archaeoanthrological analysis provides information on the formation process of the funerary deposit.

Keywords: Pampas hunter-gatherers; Late Holocene; Secondary burials; Differential decomposition.

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