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THE CORRELATION OF OBESITY AND FGF-23/A-KLOTHO SYSTEM PARAMETERS WITH BONE MINERAL DENSITY AND MINERAL METABOLISM IN WOMEN WITH CLIMACTERIC SYNDROME

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Background. The climacteric period is a physiological process in the female body accompanied by neuroendocrine and metabolic alterations, during which bone tissue remodeling and mineral metabolism may undergo significant changes. Particularly, when climacteric syndrome co-occurs with obesity, the impact of metabolic disorders on the state of bone tissue becomes a matter of distinct scientific interest.

The normal functioning of bone tissue is intrinsically linked to calcium and phosphorus metabolism. In these processes, the FGF-23 and α-Klotho system represents one of the crucial regulatory mechanisms. While FGF-23 is involved in the regulation of phosphorus homeostasis, α-Klotho acts as an essential co-receptor for FGF-23 signaling, thereby mediating its biological effects.

In recent years, considerable attention has been focused on the relationship between FGF-23 and α-Klotho levels and bone mineral density. Some studies have noted that in postmenopausal women, α-Klotho levels show a positive correlation with bone mineral density, whereas FGF-23, in certain instances, demonstrates a negative correlation. Nonetheless, the specific characteristics of these relationships in women concurrently presenting with both climacteric syndrome and obesity remain insufficiently investigated.

From this perspective, evaluating the FGF-23/α-Klotho system in conjunction with mineral metabolism and bone mineral density parameters will enable a deeper understanding of the pathogenetic mechanisms underlying bone metabolism disorders in women with climacteric syndrome and obesity.

Research Objective. To evaluate the correlation between FGF-23/α-Klotho system parameters and bone-mineral metabolism disorders in women presenting with climacteric syndrome and obesity, and to determine their significance for early diagnosis.

Methods.

1. General Clinical and Anamestic Examination

- **Anthropometric parameters:** WHtR (Waist-to-Height Ratio) and VAI (Visceral Adiposity Index).
- Determination of blood pressure and heart rate (HR).
- Evaluation of the age at menopause, its duration, and the duration of climacteric symptoms.
- Assessment of the clinical severity of climacteric syndrome using the MRS (Menopause Rating Scale).

2. Laboratory and Biochemical Methods

- FGF-23 and α-Klotho system.
- Mineral metabolism (Ca, P, Mg, PTH, 25(OH)D, alkaline phosphatase).
- Renal function (creatinine, urea, eGFR).
- Metabolic parameters (fasting glucose, insulin, HOMA-IR, lipid profile).

3. Instrumental Method

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Bone mineral density will be determined using dual-energy X-ray absorptiometry (DXA). The following anatomical regions will be evaluated:

- Lumbar spine
- Femoral neck
- Total hip area

4. Statistical Methods

- **Descriptive statistics:** M ± SD, Me [Q1; Q3], n (%).
- **Intergroup comparison:** Student's t-test / Mann–Whitney U-test; ANOVA / Kruskal–Wallis test.
- **Qualitative data analysis:** χ^2 (Chi-squared) test or Fisher's exact test.
- **Correlation analysis:** Pearson or Spearman coefficients.
- Multivariate regression analysis.
- **ROC analysis:** Determination of AUC, sensitivity, specificity, and optimal cut-off values.
- **Criterion for statistical significance:** $p < 0.05$.

Expected Scientific Significance

- The relationship between FGF-23/α-Klotho parameters and bone mineral density, as well as calcium-phosphorus metabolism in women with climacteric syndrome and obesity will be established.
- The correlation of FGF-23/α-Klotho parameters with abdominal-visceral adiposity, insulin resistance, and lipid metabolism will be evaluated.
- The diagnostic value of bone-mineral metabolism disorders based on FGF-23/α-Klotho will be assessed, and an algorithm for their early detection will be developed.

Conclusion. The co-occurrence of climacteric syndrome and obesity requires a comprehensive study of the state of bone-mineral metabolism. Identifying the interactions of the FGF-23/α-Klotho system with calcium-phosphorus metabolism and bone mineral density stands as a promising scientific direction for uncovering the pathogenetic features of bone metabolism disorders in this cohort of women.

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