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The Intersection of Obesity and Skeletal Health: Insights from Post-COVID-19 Indian Population

Introduction

Obesity, is defined as a medical condition in which an individual has an excessive amount of body fat, often measured by a person's body mass index (BMI), and is a global health concern. BMI categorizes adults as normal (BMI 15.5–24.9), overweight (BMI ≥ 25), or obese (BMI ≥ 30). Various risk factors contribute to osteoporosis and fractures. Recent research suggests that skeleton functions as an endocrine organ that influences lipid and insulin metabolism, with an inverse relationship between insulin resistance and bone density [1, 2]. COVID-19 has led to long-term health consequences, but its effects on skeletal health remain underexplored.

Materials and methods

A prospective comparative study was conducted with 47 participants meeting inclusion criteria (Suppl. Tab. 1). The primary objective was to investigate bone mineral density (BMD) and its determinants in a group of patients who visited the Department of Endocrinology at the National Institute of Medical Sciences. The study aims to analyze various factors related to BMD, including anthropometric measurements, dietary patterns, and laboratory investigations. After enrolling the patients, their vitals (BP, pulse) were checked, and the following investigations such as complete blood count (CBC), serum calcium, serum potassium, CRP, X-Ray (D-L Spine), and BMD. The Anthropometry core elements such as height, weight, waist circumference, hip circumference, and WHR of the patients were measured. In strict accordance with established ethical guidelines, the research project commenced only after obtaining formal ethical approval from the Ethics Committee. Furthermore, a meticulous process of informed consent documentation was rigorously undertaken using a comprehensive written consent form. Anthropometric measurements, lab tests, and bone density assessments were performed. Data were analyzed using statistical methods, including correlation analysis and logistic regression. The statistical analysis were done using the software IBM Statistical Package for Social Sciences SPSS V28.

Results

Gender was negatively associated with hemoglobin levels and positively associated with waist–hip ratio (WHR) and certain BMD parameters. Age showed a positive association with hemoglobin levels and a negative association with ultradistal radius bone mineral content (BMC). Smoking habits were observed in 32% of patients. BMI was negatively correlated with hemoglobin levels and positively correlated with certain BMD parameters.

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Table 1. Regression Coefficient Expression Difference in Change in BMD Showing an Association between DXA Scan and BMI in Obese Categories

DXA VS. BMI	Spearman correlation p-value
Total left femur BMD	0.511 (0.000)
Total left femur T score	0.440 (0.002)
Left forearm radius T score	0.368 (0.011)
Left forearm radius Z score	0.368 (0.011)
Total BMC	0.299 (0.041)

BMC — bone mineral content; BMD — bone mineral density; BMI — body mass index

Obesity appears to have a protective effect on skeletal health due to increased bone density associated with higher body weight. However, the relationship between obesity and skeletal health is complex, with some studies suggesting that increased fat mass may not be beneficial for skeletal mass [3]. Gender-based differences in the obesity paradox and BMD remain debated, but waist circumference and femoral neck BMD have been inversely correlated. Femoral sites show stronger correlations between obesity and BMD compared to lumbar spine sites, likely due to higher cortical skeletal content.

Discussion

Our study explored the obesity paradox in relation to BMD among post-COVID Indian individuals using DEX scans, patient lab data, and anthropometric measurements. We found that obesity offers significant protection against osteoporosis, osteopenia, and low skeletal mass in COVID-19 patients. Despite differences in lab results, BMI, L1 Z Score, and BMI, we did not discover any correlation between gender, age, smoking, or tobacco use and the COVID-19-induced obesity paradox (Tab. 1).

Contrary to previous beliefs, increased fat mass was linked to smaller bone size, as demonstrated by Taes et al. [3]. Our study also suggested that greater body weight, associated with obesity, contributes to higher bone density. While some studies have debated the relationship between gender, menopausal status, and BMD in the context of the obesity paradox, our findings did not reveal substantial differences. Waist circumference and femoral neck BMD were inversely correlated (Suppl. Fig. 1) [4]. After adjusting for age and BMI, we found a positive relationship between obesity (fat mass), a negative relationship for non-obese (lean mass), and a neutral relationship between the two. Notably, femoral sites showed a stronger correlation between obesity and BMD than lumbar spine sites, likely due to the higher proportion of cortical bone in the femoral locations [5].

In conclusion, the impact of obesity on skeletal health is complex. COVID-19 has accelerated bone density loss in post-COVID patients, particularly in the femur, raising concerns about osteoporosis risk. This study sheds light on the complex interplay between obesity, COVID-19, and skeletal health, emphasizing the need for continued investigation and intervention strategies to mitigate bone density loss in susceptible populations.

Article information

Supplementary materials

The Supplementary materials for this article can be found at https://journals.viamedica.pl/clinical_diabetology/article/view/97294#supplementaryFiles

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Conflict of interest

The authors declare that there is no conflict of interest.

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