

Evaluation of Bone Mineral Density in a Moroccan Population of Obese Patients

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Abstract: Obesity and osteoporosis are two major public health problems worldwide, given their significant morbidity and mortality. Obesity has long been considered as a protective factor against osteoporosis, however other studies suggest that excess fat cannot be beneficial for bone. Despite the lack of consensus on the effects of fats on bone, a number of mechanisms have been proposed to explain the contradictions observed. The aim of our study is to evaluate the bone mineral density in obese subjects followed at Mohammed VI university hospital of Marrakech.

Keywords: obesity – body mass index – osteoporosis – bone mineral density.

INTRODUCTION

Obesity is defined, according to the World Health Organization (WHO), as a BMI greater than or equal to 30. It represents a global health problem whose prevalence more than doubled between 1980 and 2014, currently affecting nearly 13% of the world's population with a slight female predominance [1]. Osteoporosis is another major public health problem, characterized by fragility of the skeleton as well as excessive susceptibility to fracture following minimal trauma.

Data in the literature regarding the relationship between body composition and bone mass remains conflicting. The objective of our study was to evaluate the bone mineral density (BMD) in obese subjects followed in our department.

METHODS

This is a cross-sectional descriptive study conducted in obese adult patients hospitalized for the treatment of obesity in the endocrinology department of the Mohammed VI University Hospital of Marrakech.

Patients weighing no more than 120 kg were measured for bone mineral density in the lumbar spine and femur using dual-energy X-ray absorptiometry. Osteoporosis was defined according to the WHO criteria. Weight, height and waist circumference were recorded simultaneously, and the body mass index (BMI) was calculated.

RESULTS

We counted 34 patients, the average age of our patients was 40 years with extremes between 21 and 69 years, we noted a female predominance with 31 women and 3 men, the average BMI was 44 kg / m² with extremes ranging from 35 to 57 kg / m², obesity was morbid in 68% and severe in the rest of the cases, the average waist circumference in our patients was 120 cm, being pathological in all patients, 4% were diabetic and 14.2% had hypertension, 20% of our patients were menopausal. At the osteodensitometry, only one patient

had osteopenia with a Tscore at the spine of -1.2. The rest of our patients, 97%, had a normal bone mineral density with an average spine T score of 0.65 and a femoral score of 1.39.

DISCUSSION

To date, studies of the relationship between body composition and bone mass have found contradictory results [2-9], in part because the results vary according to the samples studied and the measurements used.

BMI is commonly used as a clinical marker to assess fracture risk, which is even higher when BMI is low [10]. It is also an effective measure for identifying the mechanical impact of a heavier load on the skeleton [6], but it is not ideal for characterizing body fat or fat distribution [2].

In our study, obesity is associated with a normal bone mineral density even in postmenopausal obese women, as is the case in most studies using BMI as an indicator of adiposity and who found that obesity is a protective factor against osteoporosis. In a recent American study [9], it was shown that any increase in

BMI by 10 units, which corresponds to the change from a normal BMI to the obese BMI category, is accompanied by an increase in bone mineral density (BMD) of 0.08 g / cm², this would be the equivalent of moving from an osteoporotic BMD level to a normal BMD level, knowing that this relationship does not differ by age, sex or race. A Moroccan study published in 2006 in healthy women aged 65 and over confirmed the protective effect of a high BMI on BMD, this was explained by the adipocytes that play the role of a substitute ovary which would produce aromatizing estrogens from androstenedione secreted by the adrenal cortex after menopause [11].

The protective effect of total body fat on BMD has been questioned with studies [12,13] showing a lack of association or a negative association after adjustment for weight, this is the case of one study who examined bone mineral density and body composition in 1209 black, Hispanic and white men. Weight, BMI, waist circumference, and body fat were associated with BMD only up to certain thresholds, while lean mass had more consistent associations, which led to the conclusion that the protective effect of increased weight in maintaining bone mass was most likely due to the influence of lean tissue, so maintenance of lean mass is the most promising strategy to maintain bone health [12].

Subsequently, other studies evaluated the relationship between regional adiposity and BMD, and the results were inconsistent for central obesity [14, 15]. Several measurements of body composition may be useful in understanding how obesity relates to bone mass and explain these inconsistent findings in the literature. For example, some studies have found a positive association between BMI and bone mass and a negative relationship between body fat and bone mass [2]. These results indicate two divergent aspects of obesity on bone mass, on one hand the positive impact of a heavier weight load and, on the other hand, the negative aspect associated with body fat.

Other studies have shown that body fat composition can also be important in understanding potential impacts on BMD. For example, visceral fat is associated with higher levels of pro-inflammatory cytokines that promote bone resorption and osteoporosis, while subcutaneous fat is associated with higher levels of protein and hormones (estrogen, adiponectin, leptin) that protect against osteoporosis [16, 17].

A recent review of the literature [18] presented a summary of the different mechanisms by which body fat may influence bone composition (Table 1).

Table-1: Mechanisms by which obesity influences bone status

Positive influence: increase of BMD	Negative influence: decrease of BMD
Mechanical load	Pro-inflammatory cytokines: IL 6, TNF
Converting estrogens to androgens	Vitamin D deficiency
Increase in free sex hormones	Leptin?
Secretion of indulin and amylin	Adiponectin?
Increase in GLP 2	
Leptin?	
Adiponectin?	

CONCLUSION

Our study found that obesity is associated with normal bone mineral density even in postmenopausal obese women, suggesting a protective role for obesity against osteoporosis, which remains controversial. That said, this beneficial effect must always be weighed against its adverse effects, particularly cardiovascular and metabolic.

REFERENCES

1. Obésité et surpoids. Available from <http://www.who.int/mediacentre/factsheets/fs311/fr>
2. Zhao LJ, Liu YJ, Liu PY, Hamilton J, Recker RR, Deng HW. Relationship of obesity with osteoporosis. *The Journal of Clinical Endocrinology & Metabolism*. 2007 May 1;92(5):1640-6.
3. Núñez NP, Carpenter CL, Perkins SN, Berrigan D, Jaque SV, Ingles SA, Bernstein L, Forman MR, Barrett JC, Hursting SD. Extreme obesity reduces

bone mineral density: complementary evidence from mice and women. *Obesity*. 2007 Aug;15(8):1980-7.

4. Lin H, Luo Q, He C, Yang L, He H, Wu Y, Lan Q, Xie W, Xiong E. On correlation between body mass index and lumbar spine average bone mineral density: a study in male patients with osteopenia and those with osteoporosis. *Sheng wu yi xue gong cheng xue za zhi= Journal of biomedical engineering= Shengwu yixue gongchengxue zazhi*. 2010 Feb;27(1):138-41.
5. Greco EA, Fornari R, Rossi F, Santemma V, Prossomariti G, Annoscia C, Aversa A, Brama M, Marini M, Donini LM, Spera G. Is obesity protective for osteoporosis? Evaluation of bone mineral density in individuals with high body mass index. *International journal of clinical practice*. 2010 May;64(6):817-20.
6. Beck TJ, Petit MA, Wu G, LeBoff MS, Cauley JA, Chen Z. Does obesity really make the femur

- stronger? BMD, geometry, and fracture incidence in the women's health initiative-observational study. *Journal of Bone and Mineral Research*. 2009 Aug;24(8):1369-79.
7. Albala CE, Yanez M, Devoto EN, Sostin CE, Zeballos LO, Santos JL. Obesity as a protective factor for postmenopausal osteoporosis. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*. 1996 Nov;20(11):1027-32.
 8. Asomaning K, Bertone-Johnson ER, Nasca PC, Hooven F, Pekow PS. The association between body mass index and osteoporosis in patients referred for a bone mineral density examination. *Journal of Women's Health*. 2006 Nov 1;15(9):1028-34.
 9. Lloyd JT, Alley DE, Hawkes WG, Hochberg MC, Waldstein SR, Orwig DL. Body mass index is positively associated with bone mineral density in US older adults. *Archives of osteoporosis*. 2014 Dec 1;9(1):175.
 10. Compston J, Cooper A, Cooper C, Francis R, Kanis JA, Marsh D, McCloskey EV, Reid DM, Selby P, Wilkins M, National Osteoporosis Guideline Group. Guidelines for the diagnosis and management of osteoporosis in postmenopausal women and men from the age of 50 years in the UK. *Maturitas*. 2009;62(2):105-108
 11. Achemlal L, Guerboub A, Mounach A, Nouijai A, Ghazi M, Bezza A, Tazi M, El Maghraoui A. L'obésité est un facteur protecteur de l'ostéoporose chez les femmes âgées Marocaines normales. *Revue du rhumatisme*. 2006;73:1154
 12. Travison TG, Araujo AB, Esche GR, McKinlay JB. The relationship between body composition and bone mineral content: threshold effects in a racially and ethnically diverse group of men. *Osteoporos Int*. 2008;19(1):29-38.
 13. Janicka A, Wren TA, Sanchez MM, Dorey F, Kim PS, Mittelman SD, Gilsanz V. Fat mass is not beneficial to bone in adolescents and young adults. *The Journal of Clinical Endocrinology & Metabolism*. 2007 Jan 1;92(1):143-7.
 14. Von Muhlen D, Safii S, Jassal SK, Svartberg J, Barrett-Connor E. Associations between the metabolic syndrome and bone health in older men and women: the Rancho Bernardo Study. *Osteoporosis international*. 2007 Oct 1;18(10):1337-44.
 15. Choi HS, Kim KJ, Kim KM, Hur NW, Rhee Y, Han DS, Lee EJ, Lim SK. Relationship between visceral adiposity and bone mineral density in Korean adults. *Calcified tissue international*. 2010 Sep 1;87(3):218-25.
 16. Blaak E. Gender differences in fat metabolism. *Curr Opin Clin Nutr Metab Care*. 2001;4(6):499-502
 17. Sheu Y, Cauley JA. The role of bone marrow and visceral fat on bone metabolism. *Current osteoporosis reports*. 2011 Jun 1;9(2):67-75.
 18. Gonnelli S, Caffarelli C, Nuti R. Obesity and fracture risk. *Clin Cases Miner Bone Metab*. 2014;11(1):9-14.