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Editorial

Densitometry as a Diagnostic Technology. Cuba within the Global Map of Research on Osteoporosis and Body Composition

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Numerous studies and epidemiological surveys have estimated the incidence of hip fractures as a contemporary problem. Data from organizations such as the European Union Society of Geriatric Medicine (EUGMS) and the International Osteoporosis Foundation (IOF) indicate that the annual incidence of hip fractures among people aged 50 and over in Europe ranges from approximately 250 to more than 800 per 100,000 person-years [1-3].

Studies on bone mineral density (BMD) and body composition have undergone a profound methodological evolution since the second half of the 20th century. Early work relied on techniques such as hydrodensitometry and classical anthropometry, which offered indirect approximations of fat mass and lean mass.

The academic context in which these studies are framed is twofold. Firstly, the recent history of body composition and bone mineral density (BMD) measurement, with the introduction in 1987 of the dual-beam photon densitometer, began a new stage in its application for diagnostic purposes and great advances in image analysis, which have been characterized by a technological transition from hydrodensitometry to dual-energy X-ray absorptiometry (DEXA), considered by most authors as the gold standard in the diagnosis of osteoporosis and skeletal muscle mass [4].

These major advances in imaging led to a change in the international consensus for the diagnosis of bone fracture risk and the measurement of musculoskeletal mass in body composition over the last 40 years, with an interesting evolution of the recommendations of scientific organizations and societies in subsequent decades, for osteoporosis, sarcopenia and the typology of body fat distribution, as part of the most recent imaging studies of obesity. Second, the accumulated evidence from regions such as North America and Europe-with large national surveys (NHANES), cohort studies, and reference databases-has led to a recognized standardization that, while useful, remains insufficient or inadequate when applied without adjustment to populations with different ethnic compositions, demographic histories, and nutritional profiles [5-12].

From a methodological perspective, the adoption of dual-energy X-ray absorptiometry (DXA) as the gold standard for assessing bone mineral density (BMD) and body composition has brought decisive advantages-accuracy, the ability to perform measurements in different regions, and comparability-as well as well-known limitations: sensitivity to variations in body size, dependence on population-based reference data, and differences between equipment and manufacturers that require careful interpretation of the results (for example, variations between the GE Lunar and Hologic systems) [8-12].

Starting in the 1990s, an international consensus was established, marked by two key developments: the WHO Study Group and the European Osteoporosis Foundation [4]. These groups proposed the use of T- and Z-scores derived from DXA as diagnostic criteria for osteoporosis. However, these standards were limited to Caucasian populations and placed particular emphasis on postmenopausal women. It has been recognized that significant variations in bone geometry and fracture prevalence exist according to age, gender, and race [8-12].

Furthermore, clinical identification using T- and Z-scores-tools that have facilitated diagnostic interpretation-can lead to misclassification if the cut-off points are not validated in the target population. These methodological problems are exacerbated in contexts where public policies and clinical guidelines-along with limited technological resources-still depend on developing robust criteria better adapted to the local context of their populations.

Among the various available techniques, dual-energy X-ray absorptiometry (DEXA) is the standard procedure for estimating fracture risk by quantifying bone mineral density (BMD). The results are expressed as a T-score, or the number of standard deviations (SD) that the BMD value deviates from that of a young adult population (20-29 years). The World Health Organization (WHO) has established a bone mineral density (BMD) ≤ 2.5 T-score for osteoporosis [4,8-12].

Subsequently, the WHO specified that this value should correspond to a femoral neck measurement using the NHANES III study as a reference [12], which was later recognized in a European consensus [1,2]. The International Society for Clinical Densitometry (ISCD) considers that a diagnosis can be made when the T-score is below 2.5 in any of the following sites: lumbar spine, total hip, or femoral neck [1,12-15].

The accumulated evidence in Cuba, using recognized technology and published in various scientific and academic journals, Highlights the multifactorial nature of hip fracture risk, which includes age, sex, bone health, medications, lifestyle, and medical conditions [16-22].

The table 1 and figure 1 shows bone mineral density for the femoral neck in age groups of 50 years and older, after being adjusted to the equivalent measurement according to the Hologic technique, and with the t-score value obtained from an estimate made by a comparative analysis with the HANES III reference for young non-Hispanic women [12].

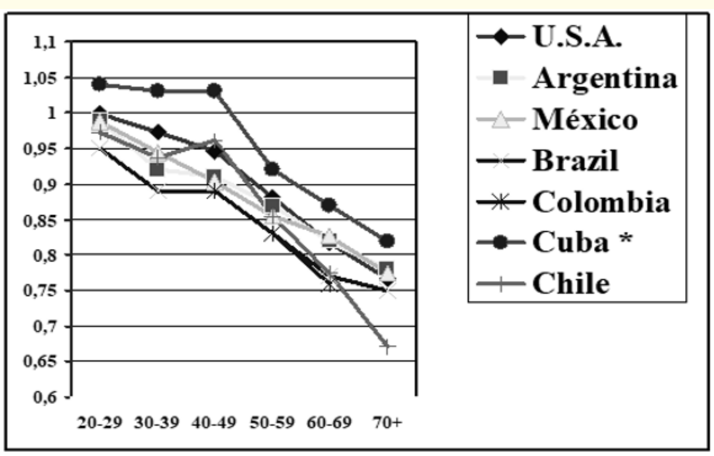

Figure 1: *Female BMD by DXA, Lunar in Latin America. Comparison with North American population* [10-12,16-24].*

Bone 1997,21: 369. Source: Chile´s values (Norland) were converted by 0,026 factor.

Cuba	Age	n	Mean g/cm^2	Standard dev.	T score mean*
	Women				
	50-59	171	0,744	0,121	-0,950
	60-69	117	0,684	0,111	-1,450
	70-79	36	0,597	0,082	-2,171
	80+	17	0,629	0,092	-1,908
	Men				
	50-59	158	0,774	0,117	-0,700
	60-69	60	0,782	0,128	-0,635
	70-79	26	0,707	0,080	-1,257
	80+	5	0,636	0,024	-1,852
Chile	**Women**				
	50-59	77	0,729	0,099	-1,072
	60-69	236	0,684	0,086	-1,454
	70-79	135	0,635	0,068	-1,861
	80+	15	0,584	0,091	-2,284
Mexico	50-59	1534	0,715	0,101	-1,191
	60-69	853	0,673	0,101	-1,539
	70-79	384	0,630	0,092	-1,901
	80+	87	0,576	0,109	-2,347
Brazil	**Women**				
	50-59	138	0,686	0,076	-1,434
	60-69	61	0,636	0,084	-1,852
	70-79	433	0,638	0,099	-1,832
	80+	-	-	-	-
	Men				
	50-59	122	0,777	0,117	-0,675
	60-69	106	0,763	0,126	-0,793
	70-79	154	0,726	0,111	-1,103
	80+	-	-	-	-
Spain	**Women**				
	50-59	232	0,740	0,094	-0,983
	60-69	466	0,717	0,118	-1,179
	70-79	770	0,606	0,103	-2,096
	Men				
	50-59	190	0,824	0,117	-0,283
	60-69	394	0,845	0,148	-0,111
	70-79	465	0,710	0,124	-1,234

Table 1: *Comparative analysis* with some authors of studies on femoral neck density in Ibero-American populations [10-12,16-24].*

Data were obtained by transformation to the equivalent HOLOGIC score and comparative analysis with the NHANES III non-Hispanic young women. Cauley JA, Thompson DE, et al. Risk of mortality following clinical fractures. Osteoporos Int 2000; 11: 556-61 [10].

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***According to standard deviation for the Safety limit * and risk in the healthy Cuban reference population.*

***The risk limit according to the t score (< 2.5 standard deviation) is 0.708 g/cm^2 for women and 0.875 g/cm^2 for men.*

The risk limit for the Cuban population, according to the t-score (< 2.5 standard deviations) for women (0.708 g/cm^2) and for men (0.875 g/cm^2), is based on the reference for a young, healthy population aged 20 to 29 years obtained using dual-beam X-ray densitometry technology with a DPX-IQ Lunar X-ray DEXA scanner, version 4.6b [16-22].

It is noteworthy that, according to the t-score obtained, a comparable decline is observed for women aged 80 years and older in Chile, Mexico, and Spain. In Cuba, however, this difference begins at age 70 [12,16-25].

All of this established an essential comparative framework for evaluating the relevance and originality of subsequent studies in Caribbean and Latin American populations, where Cuban studies have emerged in the last 15 years.

Conclusion

- The clinical importance of BMD lies in its role as a constitutive marker of bone fragility and a predictor of fracture risk; its population importance lies in the impact of osteoporotic fractures on morbidity, mortality, and healthcare costs; and its anthropological relevance lies in how biological variation-genetic, ethnic, and phenotypic-combines with nutritional, environmental, and sociocultural factors to shape the bone phenotype throughout life. For its part, body composition (fat mass, lean mass, total body water) is a direct determinant of metabolic health in the obesity process, as a mediator of the relationship between adipose and bone tissue [13-22].
- The study of bone mineral density (BMD) and body composition is currently a contemporary and universal problem, of high priority in the field of core knowledge for preventive medicine, nutritional epidemiology, and biomedical anthropology [1-3,12-14,23,24,25].

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