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Male Body Composition and Some Methodological and Conceptualization Insights on Gender and Ancestral Origin

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Abstract

Introduction: The literature lacks sufficient examples exploring the influence of ethnicity and sex on body composition.

Objective: This study compares a healthy Cuban male population with young American, Mexican, and Austrian male populations concerning bone mass, body composition, and nutritional characteristics.

Materials and Methods: A cohort of 663 healthy Cuban men aged 20 to 60 years was surveyed in the City of Havana and select municipalities in the province of Pinar del Rio between 1998 and 2009. Ancestry classification included categories of European descent, mixed European-African descent, and African descent. Genotyping of Vitamin D receptor (VDR) alleles was conducted, amplifying the region associated with the vitamin D gene polymorphism from 100 ng of DNA. Lunar DEXA (Dual-Energy X-ray Absorptiometry) was used for bone density analysis at various sites, and comparative measurements included bone mineral concentration, lean mass, fat tissue, and adiposity ratios. Cross-calibration transformation to HOLOGIC equivalent values was performed, and the NHANES III non-Hispanic young man dataset was used for comparison.

Results: Indices of fat and muscle mass relative to height squared within the 10^{th} to 85^{th} percentiles align closely with the NHANES population normality reference (2009). Muscle mass index similarities exist up to 34.9 years among Europeans and mixed European-African Cuban men compared to Caucasians and African Americans in NHANES, with Afro-Cubans and Mexican men displaying slightly lower values.

Conclusion: This article comprehensively describes and compares bone mass, muscularity, and adiposity in young Caribbean males with "self-described" Caucasians, African Americans, and Mexican Americans. The findings provide valuable insights into the precision of characterizing young men's body composition through indicators such as ancestral origin determination, vitamin D receptor genotype, and DEXA-Lunar densitometry.

Keywords: *Ethnicity; Body Composition; Bone Mass; Nutritional Characteristics; Ancestry Classification; Vitamin D Receptor Genotype; Muscle Mass Index; Fat Mass Index; NHANES III; DEXA-Lunar Densitometry*

Introduction

It has been difficult to compare the prevalence of bone fractures and somebody composition indices in various regions of the world because studies differ in their techniques, sample selection criteria, as well as in the definitions used to classify ethnicity and diagnostic criteria without the risk of being considered "biologistic" in this approach to such a contemporary problem.

Geographical, climatic and historical factors have contributed to the patterns of human genetic variation observed in the world today. For example, population processes associated with colonization, periods of geographical isolation, socially reinforced inbreeding and natural selection. In general, however, the antiquity of our common ancestors and the continuous gene flow between human groups have limited genetic differentiation in our species.

Ethnicity, sex, and their influence on body composition have been taken into account by many authors, but there are not enough examples in the literature of this aspect and the manifestations that have characterized it as components to be studied in the pathophysiology of some diseases. However, labels such as "Hispanic", "black", "Mexican-American", "white", "Asian", "European" or "African" can have ambiguous or contradictory meanings among researchers, research subjects and the public. The use of such broad labels without careful definitions, made worse by the use of respondent "self-identification", can undermine scientific understanding and imply that distinctions are not precise between seemingly socially defined populations [1-3].

When finally feasible and actually available, individual genetic assessment of relevant genes is likely to be more useful than race in medical decision-making; in the meantime, ethnicity, or ancestry may provide useful information in some cases, as may other categories such as sex or age in biomedical contexts [1-4]. Caucasian women in the United States, for whom there is abundant and detailed information, appear to have an incidence twice as high as that reported in the Hispanic population, which includes immigrants from Mexico, Central and South America in some authors' criteria [5,6]. In this sense, the great heterogeneity and variation produced by the frequent miscegenation among these populations is recognized [7].

In the case of men, this situation is more complex due to the scarcity of research using population samples and inclusion criteria that rigorously take into account the absence of disease to analyse bone mass and body composition in young populations and that adequately define their ancestral origin [8-15].

The ethnological analysis of the populations of Cuba, Puerto Rico, Dominican Republic and Venezuela constitutes one of the variables that allow us to establish links between these territories and form the hypothesis of a Spanish Caribbean: In all of them, we can observe the presence or traces of three ethnic groups that make up the populations of the same countries, although the intensity varies according to how each of them projects or influences the formation of particular ethno-consciousnesses. These are the Aborigines, the Europeans, and the Africans. The Cuban, Caribbean, and Central American populations are the product of miscegenation between the ancestors of Spanish colonialists and black African slaves, mainly from the coasts of West Africa and to a lesser extent, Chinese and native aboriginals [1,4-6].

Our men, according to these criteria, have a lower risk of fracture at the anatomical sites assessed than the Rochester population [11-16] and are slightly above the Canadian men [17]. The changes in men according to age, highlighting the highly significant decreases according to ANOVA ($p < 0.000$) in Ward's triangle density (-30%) and in femoral neck density (-20%), according to height ratios throughout the life cycle. The Havana man aged 50 - 59 years had a femoral neck fracture risk of 2.6%, but this rises to 12.1% in the case of Ward's triangle, according to the Hispanic reference of the DEXA Lunar computer programme [18-24].

In our research, the genotype of the vitamin D receptor (VDR) alleles marker present in genetic equilibrium, according to the Hardy-Weinberg principle, and its frequencies do not differ from those reported by others authors. The allelic frequencies were B = 0.361 and b = 0.639 and the genotypic frequencies were bb = 0.395, Bb = 0.488 and BB = 0.117. When analysing differences in bone density in the population under 40 years of age, according to the type of vitamin D receptor gene, it was observed that eight percent of the 121 genetic studies performed in the subsample showed polymorphism of the vitamin D receptor gene (BB), and that these subjects had decreased lumbar vertebrae density when compared to age-matched individuals [20,21].

Another interesting of this Havana population's analysis interesting fact was that the highest frequency of polymorphism of the vitamin D receptor gene was observed in those identified with the ancestral classification of Europoids (67%) and to a lesser extent (33%) in the Europoid-Negroids, or colloquially known as "mulattos" [20,21].

Another problem that has limited the interpretation and ability to compare bone density in different groups of healthy populations has been the different accuracy characteristics of the densitometry equipment used.

Hologic is one of two major DXA manufacturers, the other being GE Healthcare (Madison, WI; Lunar Prodigy and iDXA models), which have been validated with 4-compartment models. Although both manufacturers use fan-beam DXA technology, GE-Healthcare uses narrow-angle DXA, while Hologic uses wide-angle fan-beam instrumentation. In addition, body composition results may vary between devices due to possible differences in calibration standards and the specific algorithms used to calculate the composition measurements that each manufacturer has designed [25-33].

Until 2009, reference data for DXA body composition had been proprietary and specific to each brand's system. However, in 2009, the National Health and Nutrition Examination (NHANES) published data representative of the US population. Both the Hologic and GE systems have NHANES data integrated into their software to generate Z-scores for various measures of adiposity and lean mass [25,26,31-33].

Objective of the Study

This article presents as objective for the first time a body composition percentile distribution and a comparative analysis, taking into account these recommendations, of a healthy Cuban male population studied with DEXA-Lunar technology and compared with young American, Mexican, and Austrian male populations on recent studies related to bone mass loss, body composition, and nutritional characteristics among different populations. The passage discusses various factors such as age, gender, ethnicity, and their potential impact on bone health, muscle mass, and adiposity [34-38].

Materials and Methods

Subjects

The healthy target population used in this investigation consisted of 663 men between the ages of 20 and 60 years, in a population selected with previously published inclusion criteria [18-24] obtained during the years 1998 to 2009 obtained through a survey carried out in study centres, universities, and workplaces in the City of Havana and some municipalities in the eastern most part of the province of Pinar del Rio and where the limit established for the body mass index of 18.5 to 34.9 kg/m^2 was considered as part of the exclusion criteria. Table 1 presents the distribution in percentiles of the young healthy population according to inclusion criteria between 20 and 39.9 years of age, considered as reference population for bone mass density according to anatomical sites, lean mass and body fat [19-22].

The ancestry classification is used by some Latin American and Cuban authors for Europoids, mestizos (European-Negroids) and Negroids [4,5], that consider the anthropometric examination based on the width of the nose, the height of the orbit, the presence of prognathism of the upper jaw and the prostio-basio diameter. All patients were asked for their consent to participate in the study [20]. The project was approved by the Ethics Committee of the sponsoring institution [21].

DXA measurements

Double photon beam x-ray densitometry measurements were performed using the Lunar DEXA Lunar x-ray bone densitometer DPX-IQ, version 4.6 b: lumbar vertebrae (anterior-posterior), femoral neck, Ward's triangle, trochanter and total body. Comparative analysis of bone density (gm/cm^2), decline (%), relative ratios according to height on the day of measurement, bone mineral concentration, lean

Mean and Standard Deviation		BMI kg/m²	Height (cm)	Weight kg	Lumbar g/cm²	Femur neck g/cm²	Ward g/cm²	Trochanter g/cm²	Score t L	Score t f	FM kg	FM index kg/m²	Lean mass kg	Lean mass index kg/m²
		23.9	171.8	73.4	1.227	1.159	1.065	.959	-.096	.717	15.91	4.16	57.3	18.8
		3.6	7.3	12.7	.14	.15	.17	.13	1.16	1.22	10.24	2.2	8.9	1.8
Percentile	3	17.8	157.9	53.96	1.011	.880	.746	.739	-1.90	-1.65	3.61	1.37	39.5	15.9
	5	19.2	158.2	55.00	1.015	.901	.760	.760	-1.80	-1.31	4.36	1.70	40.4	16.1
	10	19.5	163.0	59.00	1.060	.983	.852	.798	-1.40	-.80	7.00	2.0	45.7	16.7
	25	21.5	167.0	65.00	1.136	1.065	.944	.857	-.80	-.03	10.4	2.91	52.0	17.15
	50	23.8	171.0	73.00	1.204	1.143	1.050	.953	-.30	.65	13.4	3.72	55.9	18.5
	75	24.9	176.3	80.00	1.319	1.276	1.182	1.052	.65	1.70	20.0	5.86	60.5	19.62
	85	26.3	180.2	86.50	1.317	1.298	1.238	1.115	.70	1.70	27.6	6.27	64.9	19.96
	90	27.1	181.0	90.00	1.418	1.359	1.282	1.137	1.50	2.20	25.5	8.8	76.3	20.65
	95	27.5	183.7	96.00	1.487	1.404	1.352	1.197	2.0	2.71	48.1	9.00	81.6	22.7
	97	31.0	186.0	105.0	1.513	1.461	1.437	1.211	2.26	3.12	55.2	9.07	82.3	23.9

Table 1: *Body composition percentile distribution on healthy men from 20 to 39.9, as reference values. Havana, Cuba. n 492 [21].*

mass (kg), fat tissue (kg) and adiposity ratios as Fat Mass Index (kg/m^2), Body fat percentage (%) according to age, ancestral affinity and body mass index.

For comparative analysis with other at-risk populations, data were obtained by cross-calibration transformation to the HOLOGIC equivalent value and by comparative analysis with the NHANES III non-Hispanic young man [25-27,29-34]. We normalized both fat and lean mass by height^2, just like BMI, which is simply weight divided by height^2. Studies have shown that lean mass and weight scale with height to approximately the power of two, establishing an analytic framework for height-scaled indices [30,39,43].

Study of the genotype of the alleles of vitamin D receptors

The genotype of the vitamin D receptor (VDR) alleles was carried out in the Molecular Genetics Laboratories of the Hermanos Ameijeiras Hospital, from 100 ng of DNA by amplification of the region containing the polymorphism associated with the vitamin D gene, using the vitamin D gene, by means of the polymerase chain reaction in a thermocycler and according to Morrison's recommendations [40]. Genotypes were determined for the RFLP system associated with the vitamin D receptor gene were determined. The system was characterized by PCR amplification of 900 base pairs and its digestion with the endonuclease Bsm I, which has or has not a single cleavage site [20,21,40].

Statistical analysis and processing

The results are presented in means and distribution measures: standard deviation and percentile distributions. Analysis of variance (ANOVA) and Student's t test for the mean of independent samples are applied to determine the differences of the study variables, according to age and origin according to ancestral classification, relating them to the critical limits of the World Organization of Health [44,45] and with the peak values of density in the young Cuban population, as well as with the means and medians of the Cuban population between 20 and 39 years of age [19,21], the reference population of the DEXA software and NHANES data are also considered [28,29,32-34].

Asian origin's men were not included in the comparative analysis, because there were a few of them, and they were entirely mixed race (Mongoloid-European). Those variables of the total compartment and by regions of fat and lean mass with bimodal behaviour in their distribution were transformed to their logarithm for multivariate statistical analysis. The Safety Margin Limits were considered for the body mass index, total body, and body composition compartments for 70, 80, and 85% of the population, based on the 5^{th}, 75^{th}, 85^{th}, and 90^{th} percentile cut-offs for this population [19,21,23]. All statistical analyses were performed by the SPSS/PC system version 26.0, Chicago, Illinois.

Results and Discussion

Recent studies on the difference attributed to biological sex, as another risk factor, agree in affirming that it does not differ according to this aspect, although it does present particularities. During the life cycle, the loss of bone mass in women is predominantly of trabecular bone mass, while in the case of men this decrease begins early in the third decade due to changes attributed to the insulin-like growth factor regulation system. Significant cortical bone loss in men is described after the age of 50 years and accelerates after the age of 70 years, in association with the decrease in testosterone and oestrogen [11-15].

The preservation of the number of trabeculae in men may help us to understand their lower frequency of fractures. For the purpose of a more specific diagnosis, the use of the t-score has been tried, but this still does not resolve some contradictory elements. When analysing the cut-off sites for hip femoral neck density in men aged 50 years and older from the National Health and Nutrition Survey of the United States of America, a relative fracture risk frequency of 6% is described, with 47% osteopenia [8,11,12,14,16,33,34].

When the percentile distribution of young Cuban men is considered (Table 1), it is verified that the values for fat and muscle mass/height^2 indices of their population between the 10^{th} and 85^{th} percentiles are very similar and are located in the cut-off points described as a reference guide for the limit of normality by Kelly., *et al*. [34] in their NHANES population in 2009.

When a comparative analysis is made (Table 2), to the indicators of height, body mass index and the relative indices of fat and skeletal muscle mass according to height^2, it can be seen that young Cubans men, despite being shorter than the young Austrian population, are comparable in the amount of lean mass and the ratios of skeletal muscle mass to fat. A different pattern of body composition was observed in the young Mexicans workers [35] with lower height and lean masses and higher adiposity indices than the Austrian [38] and Cuban populations [21].

In the Cuban population over 40 years of age, an average increase in adiposity is observed, but it remains within the limits considered for the body fat index by Kelly and collaborators [34], who register overweight in fat mass index/m^2, from 6.1 kg/m^2, and light obesity within limits of 9.1 - 12 kg/m^2. This body fat index was above 7.6 to 8 kg/m^2 for Austrian and Mexican populations over 40 years of age [35,36,38].

If we were to consider how close the nutritional characterization of our sample was to the Cuban male population from studies carried out in 2010 to 2011, we can review the data from III National Survey of Risk Factors in Cuba, which identifies the prevalence of nutritional status through BMI by age [42]. The reference study records the group aged 15 to 24 years with the highest frequency of individuals classified with chronic energy deficiency (15% of adolescents with a chronic energy deficiency of light grade I), which was interpreted by its authors as changes due to puberty and which decrease with increasing age, although it increases slightly again in older people.

Our study's inclusion criteria established limits for the body mass index of 18.5 to 34.9 kg/m^2, which can be verified in the percentile distribution of this healthy population from 20 to 39.9 years old, with a median height of 171 cm and an average of 171.8 ± 7.3 (Table 1), very similar to the results of the population survey [42]. During the recruitment of cases for this research, young pre-university students,

	n	Age (yr) (year)	Height (cm) X ± SD	BMI (kg/m²) X ± SD	FM % X ± SD	FMI (kg/m²) X ± SD	LM (kg) X ± SD	LMI (kg/m²) X ± SD
Havana, Cuba 2010 [19,21]	363	20 -29.9	170.9 ± 6.3	23.7 ± 3.2	18.1 ± 4.8	4.78 ± 2.5	56.2 ± 11.8	18.6 ± 1.51
	129	30-39.9	171.5 ± 7.0	23.9 ± 3.3	18.9 ± 8.1	5.01 ± 2.5	56.2 ± 8.9	18.4 ± 2.5
	94	40-49.9	175,09 ± 5.13	26.55 ± 3.9	16.68 ± 8.7	6.65 ± 4.5	54.4 ± 5.13	17.2 ± 1.2
	158	50-59.9	171.04 ± 7.0	25.42 ± 3.8	19.08 ± 9.4	4.57 ± 2.9	52.08 ± 8.2	17.49 ± 2.76
Mexico 2016 [35]	370	20-29.9	170.5 ± 6.9	25.7 ± 4.1	-	6.2 (5.9- 6.5)	50.2 ± 6.3	17.3 ± 1.8
	548	30-39.9	168.9 ± 6.7	26.8 ± 3.8	-	7.1 (6.8 -7.4)	50.4 ± 6.9	17.7 ± 2.0
	583	40-49.9	168.9 ± 6.7	27.4 ± 4.0	-	7.6 (7.4 -7.8)	50.4 ± 6.9	17.7 ± 2.1
	397	50-59.9	167.7 ± 6.6	27.5 ± 3.6	-	7.7 (7.4- 8.0)	50.2 ± 6.1	17.6 ± 1.8
The Austrian LEAD cohort 2020 [38]	1233	18-29.9	178.6 ± 7.1	24.2 ± 3.8	24.8 ± 7.4	6.0 ± 2.7	55.2 ± 7.2	17.3 ± 1.9
	885	30-39.9	178.8 ± 6.9	25.9 ± 4.0	27.7 ± 6.9	7.1 ± 2.8	56.9 ± 6.9	17.8 ± 1.9
	830	40-49.9	179.2 ± 6.9	27.0 ± 4.2	29.8 ± 6.5	8.0 ± 2.9	58.1 ± 7.0	18.1 ± 1.8
	839	50-59.9	178.1 ± 6.7	27.8 ± 4.1	31.3 ± 6.2	8.6 ± 2.8	57.8 ± 6.7	18.2 ± 1.8

Table 2: *Reference values for body composition parameters in men according to Lunar DEXA densitometry.*

universities and neighbouring workers of the City of Havana, between 18 and 24 years of age, were examined and the frequency of cases below the third percentile of BMI was only 1.5% and 1.5% above the 97th percentile.

Our men's adiposity indicator's fat mass index per square of height, (kg/m^2) and the lean mass composition moves within expected limits according to the criteria used by Kelly [34] and is maintained from 20 to 39.9 years of age.

The low sensitivity of the indicator body mass index (BMI) was verified, which has previously been criticized by others [30,39,41,43]. Students and workers at the University of Wisconsin-Milwaukee [37] over 30 years of age have an adiposity index of more than 6 kg/m^2, when compared to young Cubans of those ages, according to their median and average figures. Increased body fat pattern is most evident between the ages of 40 and 60 (Table 2 and 3).

The double photon beam densitometry technique, DXA, although performed accurately, has several recognized limitations: low precision in estimating truncal fat and muscle due to the inability to separate intra-abdominal organs; overestimation/underestimation of the

	n	Body fat percentage (%) Mean and Standard Deviation. Percentile.					Fat Mass Index (Kg/M ^{2}) Mean and Standard Deviation. Percentile.			
		Age (yr)	X ± SD	10th	50th	90th	X ± SD	10th	50th	90th
Havana, Cuba, 2010 [21]	369	20 - 29.9	15.8 ± 6.4	7.22	15.1	25.5	3.65 ± 1.2	1.6	3.6	5.41
	129	30 - 39.9	18.9 ± 8.09	7.4	18.4	31.3	5.01 ± 2.5	2.0	4.5	8.8
	94	40 - 49.9	25.8 ± 13.5	8.9	22.6	48.2	6.7 ± 1.4	2.1	5.52	14.4
	158	50 - 59.9	19.1 ± 19.4	5.6	18.9	29.5	4.6 ± 2.9	2.9	4.06	8.89
Ball State University and University of Wisconsin-Milwaukee, 2017 [37]	384	20 - 29.9	21.1 ± 8.3	11.0	20.2	31.8	5.6 ± 3.0	2.3	5.0	10.7
	104	30 - 39.9	26.3 ± 10.6	11.2	26.4	39.9	7.3 ± 3.9	2.7	6.8	12.4
	145	40 - 49.9	29.1 ± 8.6	15.8	30.1	41.0	8.3 ± 3.7	3.6	8.0	14.6
	214	50 - 59.9	30.9 ± 7.9	20.0	31.4	40.8	8.9 ± 3.4	4.7	8.7	13.4

Table 3: *Body fat and its proportions in men according to age in two populations (Measured by DEXA Lunar total bodies).*

degree of sarcopenia or the presence of obesity based on the amount of fat and muscle interpolated from arms and legs and low precision in the presence of oedema and hydration status not controlled during the measurement [26,27,46-48].

Of course, the application of this tool with a careful protocol in a healthy population that meets the inclusion criteria, must be protected from these sources of bias and provide us with an acceptable measurement of body composition. Table 4 shows the cut-off points by anatomical sites, which allow a regional diagnosis of the distribution of fat and lean mass.

When this table is analysed, it can be seen how the 5th and 85th percentiles stand out as Safety Margins to identify excess adipose tissue both in the total body and by anatomical regions and that surprisingly they have a similar and harmonious distribution with the percentiles for the Index Body Mass [21].

Recent research and broaden ethnic categories. Importance of the ancestral origin of this population

The classification criteria used in our research for ancestral origin have been previously published [20], the ethnic origin (europoid, europoid-negroid and negroid) of fathers and maternal and paternal grandparents was specified and how the interviewee declared them.

Markers	Mean and Standard Deviation	Percentile						
		3	5*	50	75	85*	90	95
Height, cm	171.8 ± 7.3	157.9	158.2	171.0	178.0	180.2	181.0	183.7
BMI, $kg.m^{-2}$	23.9 ± 3.6	17.8	19.2	23.8	24.9	26.3	27.1	27.5
FM index, (kg/m^2)	4.16 ± 2.2	1.37	1.70	3.72	5.86	6.27	8.8	9.0
Body fat, %	19.1 ± 7.8	6.99	7.7	19.9	24.2	26.9	28.9	31.9
Leg fat, %	16.1 ± 6.4	6.3	6.4	16.2	20.9	23.9	26.3	27.3
Trunk fat, %	18.5 ± 7.5	6,6	7.3	18,4	24.6	26.9	28.8	31.5
Arm fat, %	19.8 ± 10.2	6.2	6.3	19.1	28.9	32.3	35.1	36.8
Lean mass, Kg	55.2 ± 8.8	36.5	40.5	55.9	60.8	64.9	76.31	81.7
Skeletal Muscle Mass Index, kg/m^2	18.8 ± 1.8	15.9	16.1	18.5	19.6	20.1	21.4	22.7
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Table 4: *Safety Margin* and Risk cut-off sites. Body composition by anatomical region. Healthy Male population aged 20-39.9. Cuba 1998-2009.*

The results were compared with the study of the frequency of genotype polymorphism of the receptor alleles of vitamin D [20], where a high association was found for europoids and mulattoes with changes in the density of the lumbar vertebrae, neck of the femur and other anatomical sites.

In the case of Afro-Cubans (Negroids), the frequency of cases was low and did not allow us to demonstrate significant associations. If we consider that the male population of this study comes from the City of Havana and some nearby municipalities in the province of Pinar del Rio, it should be necessary to analyse the background of the findings with the use of autosomal polymorphisms and paternal and maternal inheritance, which allowed Marcheco and collaborators to carry out a detailed analysis of the ethnic mix in Cuba in 2014 [6]: they observed that the mean proportions of Europeans, Africans, and Native Americans in their sample were 72% (SD: 622.61), 20% (SD: 622.66), and 8% (SD: 66.86), respectively. However, the amount of European ancestry tends to be higher in the western provinces of Cuba than in the eastern provinces [1,5,6].

If Marcheco's research similarity is considered, it could be accepted that the sample of young men was not representative of Afro-Cubans, nor of Asians, simply because of a problem of sample size. However, when comparing our results with data from the Kelly population, comparable in criteria of age, health condition, technical rigour and applicability of both Hologic and DEXA technologies, using GE Healthcare Lunar and Hologic DXA systems as previously defined in material and methods [25-28], it could be understood that the results

are not enough to demonstrate differences in the results of body composition associated with the ancestral origin of all ethnic groups; but they do describe with some rigour the behaviour of their composition variables and bone density in the groups of the Cuban Europoid and the mulatto [20,21] (Table 5).

Ages	Lean Mass Index/height m2 (kg/m2)						
	Europoid [21]	Mulatto [21]	Afro-Cubans [21]	Caucasian [34]	African-Americans [34]	Mexican-American [34]	Mexican workers [36]
20	18.2 ± 1.1	17.5 ± 1.0	21.8 ± 1.4	18.9 ± 2.5	19.5 ± 2.9	18.7 ± 2.2	16.6 ± 1.5
25	19.3 ± 1.2	19.9 ± 1.8	17.9 ± 3.4	19.3 ± 2.5	19.9 ± 3.0	19.4 ± 3.0	17.38 ± 1.8
30	18.6 ± 0.7	18.1 ± 1.9	17.7 ± 0.7	19.6 ± 2.5	20.3 ± 3.0	19.8 ± 2.2	17.54 ± 1.6
35	16.3 ± 0.7	18.8 ± 3.2	15.5 ± 1.1	19.8 ± 2.5	20.5 ± 2.9	20.2 ± 2.3	17.62 ± 1.8
40	16.5 ± 2.1	17.2 ± 3.1	17,7 ± 1,3	20.0 ± 2.56	20.6 ± 2.9	20.3 ± 2.3	18 ± 1.9
Fat Mass Index/height m^2 (kg/m^2)							
20	5.4 ± 1.2	3.9 ± 1.9	-	5.95 ± 2.59	4.8 ± 2.49	5.89 ± 2.16	
25	3.5 ± 1.3	3.5 ± 0.6	3.16 ± 0.6	6.37 ± 2.69	5.59 ± 2.81	6.80 ± 2.44	
30	5.2 ± 2.4	5.5 ± 2.3	5.9 ± 3.3	6.78 ± 2.77	6.17 ± 3.02	7.45 ± 2.6	
35	3.4 ± 2.2	4.3 ± 2.7	3.2 ± 1.8	7.19 ± 2.8	6.56 ± 3.1	7.84 ± 2.67	
40	9.1 ± 2.3	4.7 ± 2.1	5.0 ± 2.3	7.57 ± 2.89	6.81 ± 3.14	8.06 ± 2.67	

Table 5: *Body composition in Cuban and North American men according to densitometry. Analysis according to ethnicity, DEXA Lunar and Hologic QDR 4500.*

The muscle mass index is similar up to 34.9 years of age among Europeans and mulattos in Cuba compared to Caucasians and African Americans in the NHANES study [34], but this indicator tends to be lower for Afro-Cubans and Mexican men living in Mexico studied by Clark., *et al*. [35,36]. Araújo´s study also shows an overwhelming influence of income versus race/ethnicity on rates of bone loss among men. This is in contrast to baseline (cross-sectional) differences, where racial/ethnic differences dominated SES differences [8,9].

The increase according to age of the adiposity indicator in the Mexican-American in the NHanes study [34] is similar to that registered in the native population of Mexico by Clark., *et al*. [35].

Errors attributable to inaccuracies and technological requirements in densitometry

Various expert groups recommend the use of dual-energy X-ray absorptiometry (DXA) to assess lean mass as an estimate of all non-fat/non-bone tissue, fat mass, and bone mineral content. In fact, its use is suggested to calculate the appendicular lean mass index (IMMA = IMMA/height^2) to define sarcopenia or low muscle mass using a defined cut-off point of < 5.5 kg/m^2 in women and an IMMA < 7.0 kg/m^2 [32,33,39,41,46-48].

There is much controversy about the best way to represent sarcopenia. The reason for the controversy is that measures of muscle mass alone do not usually predict functional strength and health in adults and the evolution of these criteria has been very active in the last 10 years; but still only precise this with great specificity type of diagnosis in the elderly [27,32,33,46-48].

The most relevant advantages of DXA are not only the use of a series of cut-off points to define the presence of sarcopenia, but also the relatively low radiation exposure (approximately 0.001 mSv, less than a standard chest X-ray). Also, DXA is cheaper compared to a standard CT scan and is technically easy to perform. Densitometry (DEXA), even when performed accurately, has several limitations: low accuracy in estimating truncal fat and muscle due to the inability to separate intra-abdominal organs; overestimation/underestimation of the degree of sarcopenia or the presence of obesity based on the amount of fat and muscle interpolated from arms and legs and low precision in the presence of oedema. Messina., *et al*. [46] found that in 485 DXA examination reports, 93% had at least one error, most of which were related to data analysis n = 441 (79%), followed by patient positioning n = 66 (12%) and demographics/artefacts'. Among the disadvantages, DEXA is not the optimal modality to estimate visceral fat, which is metabolically more active than subcutaneous fat, and it is not accurate enough to estimate thoracic and paraspinal muscles. Compared to CT and MRI, DXA cannot estimate muscle quality in terms of fat infiltration [25-29].

How to interpret male's changes body composition and its impact on the global burden of disease?

In the GBD 2010 study, low bone mineral density was taken into account, for the first time, in estimates of the global health burden. Given the complexity of measuring osteoporosis per se, low BMD was selected as a risk factor, given its relationship with osteoporotic fractures and its relative ease of measurement with DXA techniques as an exposure variable for risk assessment with fractures due to osteoporosis, the reliability of the data and the availability of epidemiological data [22].

For all load estimates, men showed higher values than women. One reason was the higher incidence of fractures in men than in women. Indeed, in the NHANES [34], different cohorts have shown significant variations in their age- and sex-adjusted BMD levels based on their ethnicity: Instead, these authors found that composite indices measuring hip geometry and other parameters, rather than low BMD alone, they were responsible for a large interethnic variation in fracture risks [8,9,19,21,49,50]. In the present study, for example, estimates of BMD levels in the population of the Caribbean region, despite being a low-income region, were higher in both men and women compared to most of the countries, high income countries [19,21-24,50,51].

This work is the first study carried out to date to measure the loss of global health that would be theoretically avoidable in the absence of a low BMD in the world population, considering BMD as a continuous variable and using a unique methodology that allows comparing estimates between genders, age groups and regions of the world and analysing trends over time [24,51].

In a very recent analysis of the global burden that the association of excess body weight, measured by a simple marker and considered to be insensitive for measuring adiposity in the evaluation of body composition, means for the health system, it has been verified that deaths and the dalys attributable to high BMI findings showed that, globally, from 1990 to 2017, they have more than doubled in both sexes. The marked increase in the number of deaths and days globally attributable to a high BMI can be explained in part by taking into account the ageing and growth of the population. In addition, overall deaths and ADLs attributable to high BMI found that high BMI was higher in women than in men ≥ 70 years, but lower in women than in men < 70 years. The reason for this phenomenon is not fully understood [52].

Conclusion

Despite the multiple advances of the last 35 years in the compatibility and adequacy of technologies, both imaging and genetic and metabolic markers, which allow a more precise knowledge of human body composition, this problem of science remains uncertain, both

in its causal relationship with factors associated with its behaviour due to the biological gender itself, and its relationship with lifestyle and various risk factors.

This article describes and compares the bone mass or muscularity and adiposity of a young Caribbean population with other "self-described" populations such as Caucasians, African Americans, and Mexican Americans. Their results bring us closer to a greater precision of the body composition of the young man through indicators of easy application and availability, such as the characterization of ancestral origin and the DEXA densitometry; but they still leave some uncertainty in the relationships of the body distribution of muscle mass and tissue grade, when a diagnosis of loss or excess is sought, in order to be able to relate them to changes due to activity or to the decline of the life cycle after 40 years. Thus, this article remains open-ended, which aims to encourage other researchers to continue this type of study.

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