OBESITY AND BODY COMPOSITION DETERMINED BY BIOIMPEDANCE-METRY IN MOROCCAN ADULT POPULATION

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Abstract

Obesity emerges as a pressing public health issue in Morocco, exerting a substantial impact on the holistic well-being of the population. Recent estimations reveal a noteworthy prevalence of weight-related challenges and associated health risks among Moroccans. The objective of this study is to evaluate the prevalence of obesity and its implications on body composition among adult subjects in Morocco. This study is a descriptive cross-sectional survey. It was carried out on adults aged 29 to 66, including females and males. A total of 89 adults were recruited for this investigation, the have conducted anthropometric and bioimpedancemetry measurements. The results of our study showed highly significant associations (p<0.000) that were observed between anthropometric parameters (weight, height, and BMI) and impedance indices, primarily body fat and lean mass, with the exception of the association between height and body fat percentage (p≥0.266). However, no significant association was observed between phase angle and various anthropometric characteristics (p > 0.05). In conclusion, our study offers valuable insights into the body composition of the Moroccan adult population using bioimpedancemetry. The observed distinctions between genders and the relationships between anthropometric parameters and bio impedance indices underscore the significance of body composition assessment in elucidating health outcomes. When juxtaposed with comparable studies in Morocco and international literature, our findings enrich the existing knowledge base while identifying areas for further exploration.

Keywords: Physical Activity, Adolescents, Parental Influences, Social Support, Morocco.

1. INTRODUCTION

Obesity is a pressing public health concern in Morocco, with a substantial impact on the population's overall well-being. According to recent estimates, a significant portion of the Moroccan population faces issues related to weight and its associated health risks. Approximately 55.1% of the population is classified as overweight, and an alarming 21.7% falls under the category of obesity [1].

Recognizing the gravity of this health issue, the World Health Organization (WHO) emphasizes the urgency of intensifying efforts in prevention and diagnosis. It is worth noting that many cases of diabetes, a condition often linked to obesity, can be avoided with proper interventions. Moreover, there are effective measures for identifying and managing diabetes, thereby enabling individuals with the condition to lead long and healthy lives [2].

The Moroccan government deserves recognition for its proactive initiatives aimed at raising awareness about diabetes risks and promoting widespread screening. These

initiatives hold the potential to prevent new cases, enhance healthcare access for those affected, and ultimately save lives [3].

However, it's essential to acknowledge that comprehensive and nationally representative studies on these risk factors in Morocco are limited. The most recent data available dates back to 2000, when a study found that 13.2% of Moroccans aged 20 were obese, 33.6% had high blood pressure, 6.6% were diabetic, and 17.2% smoked tobacco [4]. Another study conducted by the Ministry of Health highlighted the significant health burden imposed by unhealthy dietary patterns, particularly those associated with the nutritional transition characterized by high fat, saturated fat, and sugar consumption [5].

Obesity, classified by the WHO as a risk factor for non-communicable diseases, presents a nationwide public health challenge affecting individuals across the age spectrum, from children to adults. Recent data from the 2011 National Population and Family Health Survey indicates that 12.5% of children under 5 years old are overweight, with 2.6% classified as obese. This prevalence has increased from 10.4% in 2003–2004. Among adolescents aged 13 to 15 years, the 2010 Moroccan School Student Health Survey reports a 14.6% prevalence of overweight and a 2.8% prevalence of obesity (Global School-based Student Health Survey, GSHS). Notably, morbid obesity, characterized by a BMI exceeding 30, affects approximately 3.6 million Moroccans, with women being disproportionately affected, accounting for nearly 27% of cases. In contrast, only 8% of the adult male population falls into the morbidly obese category. It is essential to emphasize that overweight and obesity, along with the non-communicable diseases associated with them, are largely preventable [6].

The primary objective of this study is to assess the prevalence of obesity and its impact on body composition in adult subjects within Morocco.

2. MATERIALS AND METHODS

2.1 Study Design and Participant Selection

This study is a descriptive cross-sectional survey. The study protocol was approved by the Ethical Committee and Biomedical Research of the Faculty of Medicine and Pharmacy, Rabat and written informed consent was obtained from each parent recruited. Participants were, randomly, recruited from primary and secondary schools located in Rabat and its regions.

2.2 Population and sampling

The study was carried out on a total of 89 adults aged 29 to 66, including females and males. The adults recruited in the present cohort represent the parents involved in our previous study, which focused on adolescent-parent couples to assess obesity and physical activity in these couples.

This study exclusively enrolled individuals classified as healthy, while those exhibiting symptoms indicative of diseases necessitating limitations on physical activity were intentionally excluded.

2.3 Anthropometric Data

For each participant, we asked for information about age, sex, medical history, medication, and the level of knowledge about good physical activity practices using a specific questionnaire and interviews. The have benefited from anthropometric and

bioimpedancemetry measurements Participants were subject to anthropometric measurements. These measurements were performed according to standard procedures.

Measurements were taken in the morning during a clinic visit by trained operators. The body weight of participating subjects, dressed in light suits, was measured with a mechanical scale (150 ± 0.1 kg, Seca 750, Germany). Standing height was taken barefoot using a stadiometer (200 ± 0.1 cm, Seca 217, Germany). BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m2).

2.4 Body composition by bio-impedancemetry

Participants were also subject to Bioelectrical impedance measurement, (or BIA) is a simple and non-invasive measurement. Very low-voltage electrical currents, harmless and painless, pass through the body between two electrodes.

Bioelectrical impedance is now widely used in the medical field to determine the quantity of water, body fat, and muscle in the body [7].

2.5 Impedance metere

The impedance meter used for this study is of the latest generation for the analysis of body composition (%, muscle, fat, water, etc.), which provides immediate review. The new BIODY XPERT ZM is a professional mobile impedance meter that is wireless (with electrodes), while remaining lighter and as compact as possible and maintaining a high level of reliability.

BIODY XPERT ZM uses high technology to meet the expectations of health professionals. Wireless and weighing less than 300g, it connects via Bluetooth to a data interpretation platform based on intelligent algorithms. BIODY XPERT ZM can be used anywhere the Internet is connected. Associated with a regularly updated server, it automatically benefits from advances in scientific research and studies on body composition [8].

2.6 Statistical Analysis

Statistical analyses were executed using IBM SPSS Statistics version 21.0. Descriptive statistics, involving the computation of means for individual variables, were applied for comprehensive characterization. The study encompassed a thorough assessment of interrelationships among Body Bio impedance Indices. Correlation coefficients (r), computed through the Pearson chi-square test, were employed to examine the associations between anthropometric and body-composition variables. The presentation of findings includes the concise representation of mean±SD (standard deviation). Significance levels were determined using the ANOVA test for meticulous statistical inference. Statistical significance, was set at p<0.05.

3. RESULTS

3.1. Participants and descriptive data

Table 1 presents the age and anthropometric characteristics of the study population according to gender. The average age of the participants is 48.00±7.21 years, with a statistically significant difference between men and women. Regarding anthropometric parameters, significant differences were observed (p<0.000), primarily for height and BMI.

Table 1: Age and Anthropometric Characteristics of the Study Population

	Total (n=89)		Women (n=59)		Men (n=30)		p-value
	Mean±Sradard Deviation	Median	Mean±Sradard Deviation	Median	Mean±Sradard Deviation	Median	
Age (ans)	48,00±7,21	47,36	45,75±6,65	45,74	52,41±6,24	52,97	0,000
Weight (kg)	77,58±12,91	78,00	77,24±13,82	78,40	78,25±11,06	76,50	0,730
Height (cm)	164,69±8,31	164,10	160,46±5,65	160,30	173,02±6,14	172,25	0,000
BMI (Kg/m^2)	28,63±4,58	28,54	29,93±4,76	29,69	26,06±2,82	26,03	0,000
Waist Circumference (cm)	96,12±11,43	97,00	95,75±12,82	96,50	96,80±8,42	97,50	0,687
Hip Circumference (cm)	107,52±14,84	107,00	109,45±17,66	109,00	103,92±5,72	104,00	0,099

P-values determined using the ANOVA test

Results are presented as mean±SD

3.2. Body Bio impedance Indices

The body impedance indices are depicted in Table 2. In general, statistically significant differences were observed (p<0.000) between females and males for the various variables under investigation. The mean PhA value in the examined population was 7.16±0.69 (males: 7.57±0.58; females: 6.955±0.65).

Table 2: Body Bio impedance Indices

	Total (n=89)		Women (n=59)		Men (n=30)		p-value
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	
Body Fat Mass (kg)	25,66±10,34	22,85	28,79±9,94	30,57	19,42±8,16	18,32	0,000
Lean Body Mass (kg)	52,49±10,10	50,51	48,94±9,06	48,30	59,47±8,31	58,55	0,000
Total Body Water	36,26±5,86	35,33	33,26±4,08	33,35	42,25±4,01	42,25	0,000
Extra cellular Body Water	14,79±3,99	14,61	14,04±1,82	13,88	16,29±1,78	16,48	0,000
Intra cellular Body Water	21,46±3,99	20,42	19,22±2,46	18,90	25,92±2,38	25,78	0,000
Phase Angle at 50khz (°)	7,16±0, ,69	7,10	6,955±0,65	7,05	7,57±0,58	7,70	0.000

P-values determined using the ANOVA test

3.3. Correlation between anthropometric and body-composition variables

Table 3 compiles the results of the correlation test (Pearson coefficient). Indeed, highly significant associations (p<0.000) were observed between anthropometric parameters (weight, height, and BMI) and impedance indices, primarily body fat and lean mass, with the exception of the association between height and body fat percentage (p≥0.266). However, no significant association was observed between phase angle and various anthropometric characteristics (p > 0.05).

Table 3: Pearson correlation coefficients (r) between anthropometric and body-composition variables

			Anthropometric parameters		
			Weight	BMI	Height
Body Impedance Indices	**BF**	*r* de Pearson	0,758	0,872	-0,121
		p-value	0,000	0,000	0,266
	LM	*r* de Pearson	0,573	0,168	0,703
		p-value	0,000	0,116	0,000
	PhA 50khz	*r* de Pearson	0,142	0,045	0,205
		p-value	0,190	0,678	0,057

BF: Body Fat

LM: Lean Mass

PhA 50 kHz: Phase Angle at 50 kHz

4. DISCUSSION

Our study aims to determine the prevalence of obesity and its impact on body composition in adult subjects in Morocco.

Our investigation centered on assessing the body composition of Moroccan adults aged 29 to 66 years using bioimpedancemetry. Our findings revealed significant differences in anthropometric characteristics between men and women, including height and BMI. The total BMI mean value was 28.63 ± 4.58 kg/m².

Before delving into the findings, it is imperative to acknowledge both the strengths and limitations of our research. Strengths include the clear study design of our study, which is a well-defined cross-sectional survey that provides a snapshot of body composition in a specific age group within the Moroccan population. This design is suitable for assessing differences and associations within a defined group. Also, the study included both males and females, which allows for a comprehensive analysis of gender differences in body composition.

However, it is important to acknowledge some limitations of our study. Firstly, the cross-sectional nature of our research restricts our ability to establish causal relationships. Secondly, our study focused solely on a Moroccan adult population, limiting the generalizability of our findings to other ethnicities or geographical regions. Future research involving larger, more diverse samples from different regions would provide a more comprehensive understanding of body composition variations.

Our findings revealed significant differences in anthropometric characteristics between men and women, including height and BMI. The total BMI mean value was 28.63 ± 4.58 kg/m². These results are consistent with previous studies conducted in Morocco. Indeed, a recent study conducted in the Kenitra region on adults aged 18 years and older also showed a significant difference in BMI by gender, with a total BMI average of 24.86 ± 4.22 kg/m²[9]. Another study involving only Moroccan women aged 20 to 80 showed an average total BMI of 29.3±5.04kg/m²[10]. There are usually variations between men and women. These women tend to have a higher percentage of fat mass than men, which can influence their BMI. It is also important to note that differences in BMI between women and men can vary across populations and geographic regions. Studies have shown that women tend to have a slightly higher BMI than men, on average. However, it is essential to consider other factors such as age, physical

activity, genetics, and eating habits to obtain a more accurate assessment of health and body weight. According to a study published in The Lancet in 2016, which analyzed data from more than 112 million individuals in 200 countries, women generally have a higher BMI than men. The study found that the average BMI of women was 24.5, while that of men was 24.2[11]. Another old study, published in the journal PLOS ONE in 2015, also showed that women tended to have a slightly higher BMI than men. The study analyzed data from nearly 5,000 adults and found that the average BMI of women was 27.6, while that of men was 26.7 [12].

However, other international studies showed significant differences in BMI between men and women. Indeed, a study published in BMC Public Health in 2019 analyzed data from over 20,000 adults and concluded that there were no significant differences in BMI between men and women [13]. The Same study revealed that the impact of obesity on the health-related quality of life (HRQOL) in adults showed gender-specific differences, emphasizing the importance of crafting effective weight control programs tailored to each gender. The counterintuitive phenomenon of "obesity-HRQOL" was confirmed in adult males. Additional research, employing diverse measures, is essential to explore the mechanisms underlying the gender-specific prevalence of obesity [13].

When comparing our results with international studies on body composition using bioimpedancemetry, several similarities and differences emerged. In a study conducted among a sample of Polish young adults, similar significant gender differences were observed for weight, height, and BMI, supporting our findings [14]. This has been previously demonstrated by Gallagher, D., et al., who analyzed data from over 1,600 adults and found that women had significantly higher body fat percentages than men across all age groups[15], while Janssen et al. found that men had significantly higher fat-free mass values than women[16]. However, it is important to note that the mean age of their study population differed from ours, which may have influenced the results.

Contrastingly, another study showed gender disparities were noted in BMI, fitness score, percent body fat, and various body composition parameters, in summary, there is a notable prevalence of obesity, percent body fat (%BF), and inadequate fitness levels in the Saudi population, with substantial variations between genders [17].These differences may also stem from variations in sample characteristics, study design, or population-specific factors. There is a correlation between anthrompetric parameters and body composition in the adult population. Our study recorded highly significant associations (p<0.000) between the anthropometric parameters (weight, height, and BMI) and the impedance-metry indices. In this context, research conducted among patients from the Department of Clinical Nutrition in France concluded that body composition values were very close for patients with a BMI between 16 and 18 [18-20].

Our study adds to the growing body of knowledge on body composition, particularly in the Moroccan context.

- The identified associations between anthropometric parameters (weight, height, and BMI) and bio impedance indices underscore the importance of body composition assessment in understanding the health status of the Moroccan adult population.

- Importantly, the identification of significant associations between anthropometric parameters and bio impedance indices in our study emphasizes the importance of body composition assessment in understanding the health status of the Moroccan adult population.

- These findings contribute to the existing body of knowledge on body composition in both national and international contexts.

f) Unanswered Questions and Future Research

It's vital to acknowledge the limitations of our study, including its cross-sectional nature and the focus on a specific population. Future research endeavors should adopt longitudinal designs to explore causal relationships and involve more diverse samples encompassing various ethnicities and geographical regions. Such studies will contribute to a more comprehensive understanding of body composition variations.

5. CONCLUSION

In conclusion, our study provides valuable insights into the body composition of a Moroccan adult population using bio impedance-metry. The observed differences between genders and the associations between anthropometric parameters and bio impedance indices highlight the relevance of body composition assessment in understanding health outcomes. When compared to similar studies in Morocco and international literature, our findings contribute to the existing knowledge base while identifying areas for further exploration. Future research should continue to investigate body composition in diverse populations to promote better health outcomes worldwide.

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