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Original Article

Study on Determining Body Composition Using the Tanita Device in Individuals Aged 20 to 30 Years

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Abstract

The aim of the present study is to analyze the body composition of individuals aged between 20 and 30 years, using the TANITA device, based on the bioelectrical impedance analysis (BIA) method. A total of 40 participants were included (20 men and 20 women), divided into two groups according to their level of physical activity: active and sedentary. The evaluation focused on parameters such as body weight, body mass index (BMI), muscle mass, fat mass, body water percentage, bone mass, basal metabolic rate, and metabolic age. The results highlighted significant differences between men and women, particularly regarding muscle mass and fat percentage. Active individuals presented a more balanced body composition, higher muscle mass, and lower fat percentage and BMI, compared to sedentary subjects, who showed increased fat mass and decreased body water percentage.

1. Introduction

Body composition represents more than just a simple distribution of body weight; it is a complex expression of health status, metabolic risk, and physiological adaptation to lifestyle. In an era in which obesity and related chronic diseases are reaching epidemic proportions, an accurate understanding of the ratio between fat mass and lean mass becomes essential. The assessment of these components, performed through modern methods such as bioelectrical impedance analysis (BIA) or dual-energy X-ray absorptiometry (DXA), provides valuable data not only for

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clinical practice but also for public health interventions. In this context, investigations into the validity and applicability of these methods contribute decisively to the foundation of personalized interventions and to the effective monitoring of individual health status.

According to research conducted by (John S. Kelly and John Metcalfe (2012), the TANITA BC418MA device provides a reliable, non-invasive, and accessible method for assessing body composition, suitable for adults as well as for children and obese individuals. Although sex-related differences are observed, they do not affect the clinical relevance of the instrument.

Along the same lines, (Samouda and Langlet, 2022) emphasize that bioelectrical impedance analysis (BIA) is a practical and widely accessible method, easy to use not only by non-specialized medical staff but also by the general public. Franco-Villoria et al. emphasize that BIA results become reliable when validated formulas are used, as automatically generated values can vary significantly (2016). In clinical practice, Qadah et al. highlight the importance of body composition analysis, especially in patients with obesity, where BIA methods require additional validation for overweight youth (2024). This idea is also supported by Thajer et al., who draw attention to the risk of underestimating actual body fat when using instruments with low sensitivity (2021).

Regarding the use of the body mass index (BMI), research conducted by Okorodudu et al. highlights its limitations: although it has high specificity, its sensitivity is low, which can lead to significant omissions of excess adiposity cases, particularly in children (2010).

Nevertheless, Rudnev et al. mention that BMI continues to be widely used due to its simplicity and rapid applicability in population studies (2020). Additionally, Ayvaz and Çimen state that, although rudimentary, this method remains the most accessible for clinical and statistical use (2011). However, for an accurate assessment of body composition, more precise methods are required.

Thus, Minderico et al. emphasize the importance of precise measurements in monitoring weight-loss interventions; noting that although techniques such as DXA offer high accuracy; their high costs and limited accessibility favor the frequent use of BIA, anthropometry, and BMI (2008). Supporting BIA, researchers Kutáč and Gajda confirm that the TANITA BC418MA device provides adequate accuracy for clinical use, provided that measurement protocols are strictly followed (2011).

From a theoretical perspective, Sîrbu et al. state that the assessment of obesity risk requires knowledge of the proportion of adipose tissue, as body weight alone is not a sufficient indicator (2005). In this regard, Gurău (2002) and Crăciun & Tache (2006) define body composition as the ratio between lean mass and adipose tissue mass, where lean mass, including water, proteins, and minerals, should account for approximately 89% of total body weight.

From an educational perspective, Kochman et al. highlighted, in a comparative study, significant differences between first- and fifth-year physiotherapy students regarding physical condition and body composition (2022). The results suggest the influence of academic training and lifestyle on physical condition. From the author's perspective (Silișteanu, 2022), the benefits of regular physical activity help counteract the negative effects of a sedentary lifestyle, especially in older adults, by reducing body fat and supporting physical, metabolic, and mental health. Given the increasing incidence of obesity, adopting accessible and reliable methods for assessing body composition, such as BIA, becomes essential. When combined with physical and nutritional interventions, these assessments can significantly contribute to prevention and clinical rehabilitation strategies.

2. Materials and Methods

The aim of this study is to analyze the body composition of a sample of individuals aged 20 to 30 years, using the TANITA device, based on the bioelectrical impedance analysis (BIA) method. The study seeks to evaluate relevant body composition parameters (muscle mass, fat mass, body water percentage, bone mass, and body mass index), as well as to identify significant differences according to sex and level of physical activity.

Research Objectives: Determination of body composition (weight, BMI, muscle mass, fat mass, bone mass, body water percentage, BMR, metabolic age) in individuals aged 20–30 years, using the TANITA device. Comparison of body composition differences between men and women. Analysis of the influence of physical activity level (active vs. sedentary) on body composition. Evaluation of changes in body composition after intervention (physical activity program). Correlation of body composition parameters with each other (e.g., muscle mass, bone mass, fat mass, body water percentage, BMI, weight, etc.).

Inclusion Criteria: Age of participants between 20 and 30 years. Sex: both men and women. Health status: clinically healthy individuals, without diagnosed metabolic or cardiovascular conditions. Availability to comply with the testing protocol (no food or drink 2–3 hours prior, no intense physical effort 12 hours prior, etc.). Written informed consent from participants for study participation through signature.

Research Hypotheses:

- Are there significant differences between men and women regarding body composition (particularly muscle mass and fat percentage)?

- Do physically active individuals exhibit a more balanced body composition (higher muscle mass, lower fat percentage) compared to sedentary individuals?

- Does the determination of body composition using the bioelectrical impedance method provide an accurate and relevant assessment of health status and physical fitness level?

Research Steps:

1. Stage I – Subject Selection: 40 participants (20 men and 20 women), aged 20–30 years, divided into two categories: active and sedentary.

2. Test Preparation: Participants were instructed to: avoid food and drink for at least 3 hours prior to testing; refrain from intense physical activity for 12 hours prior; avoid alcohol and caffeine on the day of testing.

3. Actual Testing: Each participant was weighed and analyzed while standing

barefoot, according to the TANITA device instructions.

Research Methods: The analysis of the specialized literature involved studying and reviewing current scientific literature related to body composition, assessment methods (particularly bioelectrical impedance), the TANITA device, as well as the relationships between body composition, health, and physical activity. The observation method was used during the testing process to monitor participants' behavior, how they followed instructions, and their reactions during the assessment.

The testing method was conducted using the TANITA device, which utilizes bioelectrical impedance analysis (BIA) to determine body composition. This device provides a wide range of parameters: weight, BMI, body fat percentage, muscle mass, bone mass, body water percentage, basal metabolic rate, and metabolic age.

The mathematical-statistical method was used for processing and interpreting the data obtained from the tests, employing descriptive and comparative statistical methods. The indicators used were: Arithmetic Mean ($\bar{x}$) – to determine the average values of each parameter within the analyzed groups. Standard Deviation (σ) – to assess how dispersed the values are relative to the group mean. Coefficient of Variation (CV %) – expresses the homogeneity or heterogeneity of the data, based on the percentage dispersion relative to the mean. Graphical Method.

Research Subjects: The study was conducted on a sample of 40 subjects (20 men and 20 women), aged between 20 and 30 years, at the Reflexo TOX SRL Rădăuți physiotherapy clinic. Participants were randomly selected but divided into two groups according to their level of physical activity: Group A – active individuals (engaging in regular physical activities at least 3 times per week); Group B – sedentary individuals (low or no physical activity). All participants were informed about the purpose of the study and provided written consent. Body composition analysis was performed using the TANITA device, which provides the following parameters: total body weight, body mass index (BMI), body fat percentage, muscle mass, body water percentage, bone mass, basal metabolic rate (BMR), and metabolic age. All subjects were measured in the morning, on an empty stomach, under standardized conditions to minimize errors.

Description of the Experimental Process: Participants were instructed to avoid food and drink 2–3 hours prior to testing. All metal objects (jewelry, watches) were removed. Measurements were taken barefoot, in a relaxed standing position, following the TANITA device instructions. Individual data were recorded manually and later entered into a file for statistical analysis. Comparisons were made between sexes and between active and sedentary groups.

3. Results and Discussions

Results and Discussions present the changes in body composition, highlighting the effects of physical activity and sedentary behavior on weight, muscle, fat, bone mass, and hydration, and interpret the physiological and health implications.

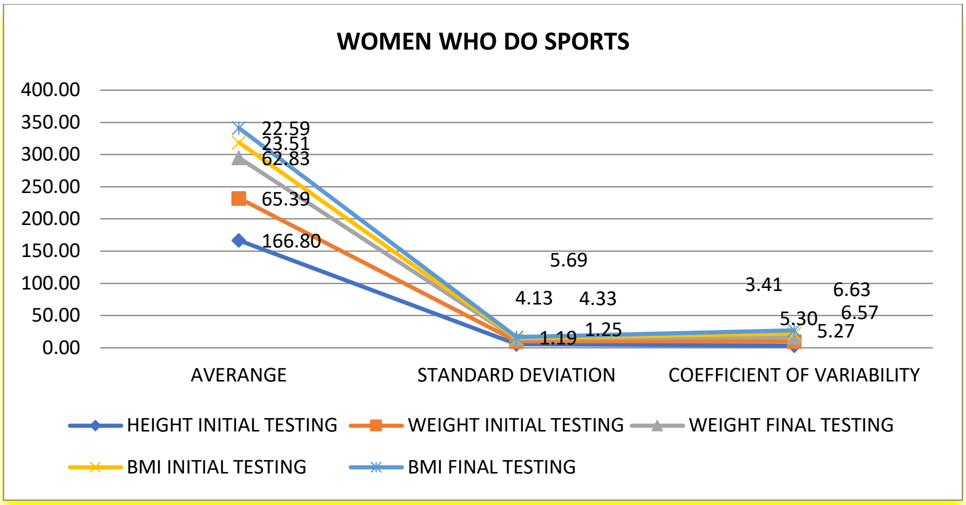

Figure 1. *Evolution of participants weight and BMI*

The mean initial weight was 65.39 kg, placing the subjects in the normal or slightly overweight range, depending on height. The standard deviation was 4.33 kg, suggesting moderate variation among subjects. The coefficient of variation was 6.63%, confirming slight heterogeneity within the group at the beginning of the intervention.

The mean final weight was 62.83 kg, indicating an average decrease of 2.56 kg compared to the initial measurement. The standard deviation was 4.13 kg, showing slightly less dispersion compared to the initial testing. The coefficient of variation was 6.57%, almost identical to the initial value, suggesting that the variation in weight remained constant, but with a lower mean. The average decrease was 2.56 kg, with a standard deviation of only 0.20 kg, indicating a consistent and homogeneous change across the entire group. The coefficient of variation for the difference was 0.05, extremely low, confirming an almost perfect uniformity of the results.

The mean BMI value was 23.51, placing the subjects within the normal weight range according to WHO classification (18.5–24.9). The standard deviation was 1.25, indicating relatively low variation among individuals. The coefficient of variation was 5.30%, suggesting that the group is moderately homogeneous in terms of body mass distribution relative to height. The mean BMI decreased to 22.59, keeping the group within the same normal weight range, but closer to the lower limit.

The standard deviation was 1.19, slightly lower than in the initial testing. The coefficient of variation was 5.27%, almost identical to the initial value, indicating good stability of the distribution. The mean difference was 0.92 BMI units, confirming a significant reduction in body mass relative to height. The standard deviation is very small, only 0.06 and the coefficient of variation is 0.03, reflecting a similar response to the intervention among all participants. The weight loss of 2.56 kg and the BMI reduction of 0.92 units are clear evidence of the effectiveness of the applied intervention. The low values of standard deviations and coefficients of variation indicate a high uniformity of response to the intervention. The group was relatively homogeneous both in initial structure (height, weight, BMI) and in response to the intervention, suggesting that the methodology used was effective and reproducible.

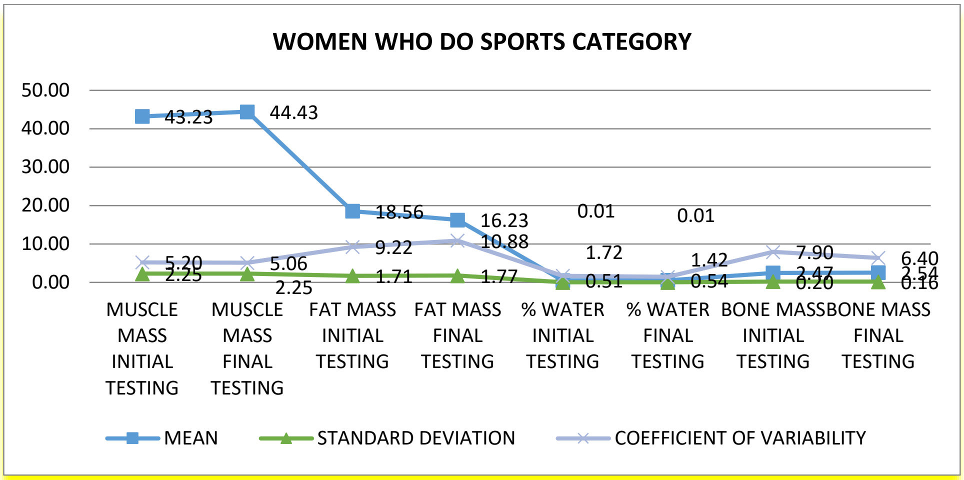

Figure 2. *Changes in muscle mass, fat mass, body water, and bone mass*

At the initial testing, the mean muscle mass was 43.23 kg, with a standard deviation of 2.25 kg and a coefficient of variation of 5.20%, indicating moderate variation among participants. At the final testing, the mean muscle mass increased to 44.43 kg, maintaining the same standard deviation of 2.25 kg, while the coefficient of variation slightly decreased to 5.06%, suggesting a slight increase in group homogeneity. The mean difference in muscle mass between the two tests was 1.2 kg, a clear and physiologically significant increase. The fact that the standard deviation of the difference is 0.00 kg suggests that all participants experienced the same progress, indicating an extremely uniform response to the intervention, possibly as a result of a well-structured exercise program (e.g., resistance or strength training).

The mean initial fat mass was 18.56 kg, with a standard deviation of 1.71 kg and a coefficient of variation of 9.22%. After the experimental program, the mean fat mass decreased to 16.23 kg, registering a mean difference of -2.33 kg, indicating a significant reduction in adipose tissue. Interestingly, the standard deviation slightly increased to 1.77 kg, and the coefficient of variation rose to 10.88%, indicating a slight increase in variation among participants regarding fat mass reduction. Nevertheless, the negative difference is clear and significant. These data suggest that the program had an overall positive impact, although the rate of fat mass reduction was likely influenced by individual factors (metabolism, adherence to diet, etc.).

Body water percentage clearly increased following the experimental program. At initial testing, the mean value was 0.51, equivalent to 51.00%, and at the final assessment, it reached 0.54 or 54.00%. The mean increase was 2.71%, a significant value reflecting improved body hydration, usually correlated with increased muscle mass and decreased fat mass. Standard deviations remained very low at 0.01 for both tests, and the coefficient of variation decreased from 1.72% to 1.42%, indicating that participants became more homogeneous in terms of this parameter. Interestingly, the variability of the body water percentage difference is -29.87%, reflecting a drastic reduction in variation among participants, with all showing relatively similar improvements.

At the initial testing, the mean bone mass was 2.47 kg, with a standard deviation of 0.20 kg and a coefficient of variation of 7.90%. At the final testing, bone mass slightly increased to 2.54 kg, registering a mean difference of 0.07 kg. This increase is modest but biologically relevant, especially if the training program included impact exercises (e.g., weight training, jumping and running).

The standard deviation decreased from 0.20 kg to 0.16 kg, and the coefficient of variation dropped to 6.40%, indicating reduced dispersion of values at the final testing. The small but positive difference and the decrease in variability show a common and beneficial trend regarding the maintenance and improvement of bone mass.

The results indicate significant improvements in participants' body composition following the applied program: Muscle mass increased by an average of +1.2 kg, representing a uniform and clearly positive evolution. Fat mass decreased by -2.33 kg, confirming the effectiveness of the intervention in reducing adipose tissue. Body water percentage increased by +2.71%, reflecting better hydration and a healthier body composition. Bone mass slightly increased by 0.07 kg, with reduced variability.

Table 1. *Correlations between anthropometric parameters and body composition*

	HEIGHT INITIAL	WEIGHT INITIAL	WEIGHT FINAL	BMI INITIAL	BMI FINAL	MUSCLE MASS INITIAL	MUSCLE MASS FINAL	FAT MASS INITIAL	FAT MASS FINAL	% WATER INITIAL	% WATER FINAL	BONE MASS INITIAL	BONE MASS FINAL
HEIGHT INITIAL	1												
WEIGHT INITIAL	0.63	1											
WEIGHT FINAL	0.63	0.99	1.00										
BMI INITIAL	-0.43	0.42	0.41	1.00									
BMI FINAL	-0.44	0.41	0.42	0.99	1.00								
MUSCLE MASS INITIAL	0.61	0.99	0.97	0.43	0.41	1.00							
MUSCLE MASS FINAL	0.60	0.99	0.98	0.45	0.42	1.00	1.00						
FAT MASS INITIAL	0.61	0.99	0.98	0.44	0.42	0.98	0.98	1.00					
FAT MASS FINAL	0.60	0.97	0.95	0.44	0.40	0.98	0.98	0.99	1.00				
% WATER INITIAL	-0.46	-0.92	-0.90	-0.54	-0.52	-0.90	-0.89	-0.94	-0.94	1.00			
% WATER FINAL	-0.48	-0.86	-0.90	-0.44	-0.48	-0.83	-0.82	-0.88	-0.84	0.91	1.00		
BONE MASS INITIAL	0.60	0.89	0.93	0.33	0.38	0.87	0.88	0.87	0.81	-0.77	-0.90	1.00	
BONE MASS FINAL	0.61	0.87	0.91	0.29	0.33	0.87	0.87	0.86	0.81	-0.74	-0.87	0.98	1

The low values of standard deviations and coefficients of variation for most parameters indicate homogeneous results, reflecting a predictable and effective impact of the applied program.

Height shows moderate positive correlations with body weight (r = 0.63), muscle mass (r = 0.60–0.61), and fat mass (r = 0.60–0.61). These correlations suggest that taller individuals tend to have both more muscle mass and more fat, which is physiologically normal, as greater stature implies increased body volume. In contrast, the correlation between height and BMI is negative, r = –0.43 at initial testing and –0.44 at final testing, confirming that at the same weight, taller individuals have a lower body mass index.

Body weight is closely related to muscle mass and fat mass: muscle mass: r = 0.99 (both initial and final); fat mass: r = 0.99 (initial) and r = 0.95 (final). These near-perfect correlations indicate that variations in weight are mainly due to changes in muscle mass and fat mass. Strong correlations also persist between initial and final weight, r = 0.99, showing that individuals who started at a certain weight remained in the same relative range at the end of the program. The correlation between initial and final BMI is extremely high, r = 0.99, indicating high stability of this indicator within the group. Additionally, BMI is moderately correlated with weight, r = 0.42–0.41, which is expected since BMI is calculated based on weight and height. However, height plays a compensatory role, which is why this correlation is not perfect. Muscle mass shows extremely high correlations both with body weight, r = 0.99, and between its own initial and final values, r = 1.00. This indicates proportional and consistent muscle gain in all participants, without major individual variations. Furthermore, muscle mass is strongly correlated with bone mass (r = 0.87–0.88), suggesting that individuals with a stronger bone structure generally develop greater muscle mass as well.

Correlations between fat mass and weight are nearly perfect (r = 0.99 initial, r = 0.95 final), indicating that fat is a significant component of total body weight. In addition, there is a strong inverse correlation between fat mass and body water percentage: Initial: r = –0.94; Final: r = –0.84.

These values reflect that, as fat decreases, the body water percentage increases, a physiologically normal relationship, since muscle tissue is much better hydrated than adipose tissue. Body water percentage is negatively correlated with both weight (r = –0.92 initial, r = –0.86 final) and fat mass, as previously mentioned. The moderate-to-high correlations indicate that participants with leaner body composition (less fat, more muscle mass) have a higher percentage of body water. The relationships are stable between the two testing points, confirming the effectiveness of the experimental program in improving overall hydration. Bone mass shows good correlations with: Total weight: r = 0.89 initial, r = 0.91 final; Muscle mass: r = 0.87–0.88; Fat mass: r = 0.87.

These correlations indicate that individuals with higher total body mass (regardless of the proportion of muscle vs. fat) also have higher bone density. The positive relationship with muscle mass is logical, given that an active musculoskeletal system stimulates bone density.

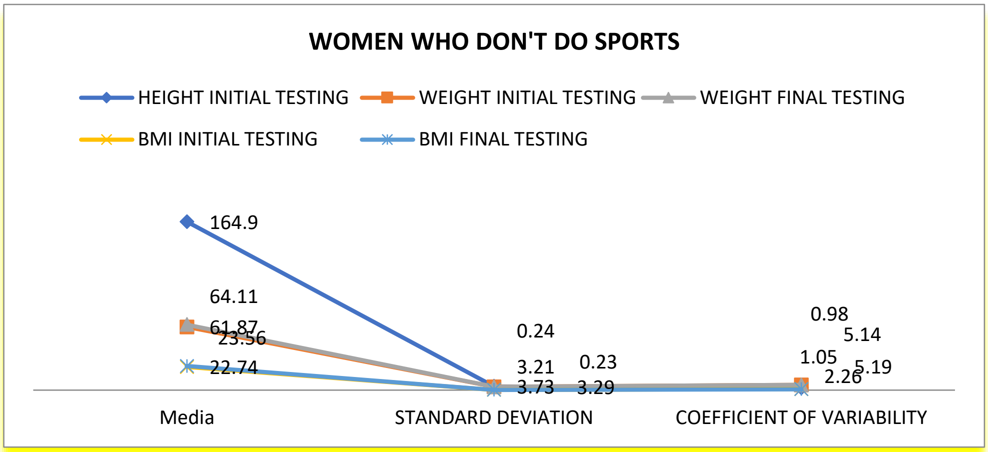

Figure 3. *Body composition changes in sedentary women*

The women in this group exhibit an average height within the normal range, close to the national average. The very low coefficient of variation of 2.26% indicates a homogeneous group in terms of stature, with minimal individual variations. This aspect is important since height is a fundamental factor in BMI calculation. An average weight increase of approximately 2.24 kg is observed between the beginning and end of the testing period. Although the variation is not extremely large, it is significant in the context of physical inactivity. The group remains relatively homogeneous, with coefficients of variation around 5%, suggesting that the weight gain trend is uniformly distributed among participants. The increase in BMI from 22.74 to 23.56 indicates a subtle but consistent shift toward the upper limit of the normal range of 18.5 to 24.9. Considering that the values are close to the overweight threshold of 25, there is a real risk of transitioning to overweight if the trend continues. Very low coefficients of variation, below 1.1%, confirm that this pattern of weight gain is common within the group, without extremes.

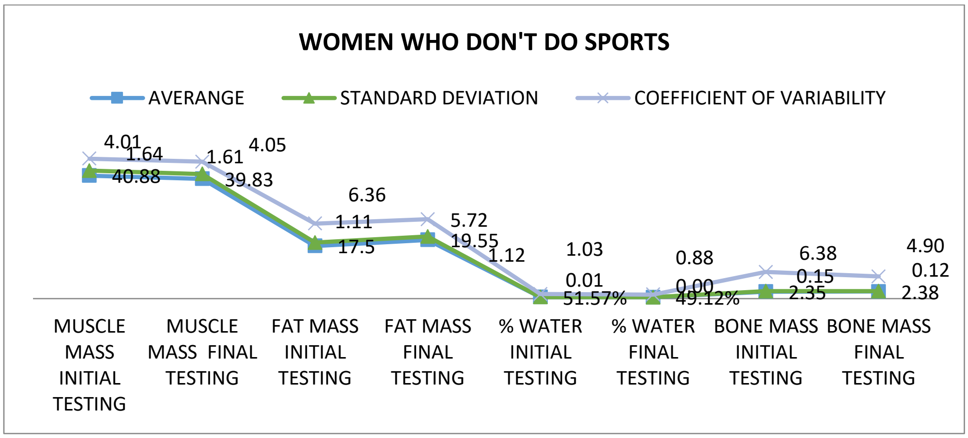

Figure 4. *Sedentary lifestyle on body composition in adult women*

A significant decrease in muscle mass is observed, indicating a loss of lean tissue, likely in favor of fat accumulation. This phenomenon is common in cases of physical inactivity and a slowed metabolism. The reduction in muscle mass leads to a decrease in basal metabolic rate, reduced muscle tone, and an increased risk of postural imbalances and sarcopenia (in the long term).

Fat Mass has an initial mean value of 17.5 kg and a final mean value of 19.55 kg, with an increase of 2.05 kg. The coefficient of variation is 6.36% → 5.72%. There is a clear increase in fat mass, indicating adipose tissue accumulation in the absence of caloric expenditure through physical activity. Although the coefficient of variation is relatively low, the tendency to gain weight is present in most participants. This type of change is typical for a sedentary lifestyle and may contribute to increased metabolic risk, hormonal imbalances, and impaired cardiovascular health. The initial mean body water percentage is 51.57%, and the final mean is 49.12%, with a decrease of -2.45%.

The coefficient of variation is 1.03% → 0.88%, and the body water percentage has significantly decreased, reflecting a reduction in muscle mass and an increase in fat, since muscles contain approximately 70–75% water, while fat contains only about 10–15%. The decrease in body water may indicate mild dehydration, a compositional imbalance (higher fat-to-muscle ratio), and a reduction in the body's metabolic capacity. The initial mean bone mass is 2.35 kg, and the final mean value is 2.38 kg, showing a slight increase of 0.03 kg. The coefficient of variation is 6.38% → 4.90%. Bone mass remained nearly constant, with a slight increase. In general, a sedentary lifestyle does not stimulate bone formation, but proper nutrition can help maintain values within normal limits. However, in the absence of movement and impact exercises that stimulate osteogenesis, bone mass may gradually decrease over the long term, especially after the age of 35–40 years.

Table 2. *Correlations between anthropometric parameters and body composition in sedentary women*

	HEIGHT INITIAL	*WEIGHT INITIAL*	*WEIGHT FINAL*	*BMI INITIAL*	*BMI FINAL*	*MUSCLE MASS INITIAL*	*MUSCLE MASS FINAL*	*FAT MASS INITIAL*	*FAT MASS FINAL*	*% WATER INITIAL*	*% WATER FINAL*	*BONE MASS INITIAL*	*BONE MASS FINAL*
HEIGHT INITIAL	1												
WEIGHT INITIAL	0.98	1.00											
FINAL	0.99	1.00	1.00										
BMI INITIAL	0.58	0.71	0.70	1.00									
BMI FINAL	0.57	0.70	0.70	0.97	1.00								
MUSCLE MASS INITIAL	0.97	0.98	0.98	0.66	0.68	1.00							
MUSCLE MASS FINAL	0.97	0.98	0.98	0.66	0.66	0.99	1.00						
FAT MASS INITIAL	0.99	0.97	0.97	0.55	0.54	0.96	0.97	1.00					
FAT MASS FINAL	0.99	0.98	0.98	0.57	0.56	0.97	0.97	0.99	1.00				
% WATER INITIAL	-0.83	-0.79	-0.78	-0.32	-0.28	-0.82	-0.85	-0.86	-0.86	1.00			
FINAL	-0.95	-0.96	-0.95	-0.63	-0.61	-0.96	-0.96	-0.95	-0.95	0.89	1.00		
BONE MASS INITIAL	0.97	0.99	0.99	0.69	0.68	0.97	0.97	0.96	0.97	-0.83	-0.97	1.00	
BONE MASS FINAL	0.92	0.96	0.96	0.80	0.79	0.95	0.94	0.90	0.92	-0.75	-0.95	0.97	1

Sedentary women show a clear tendency for body composition deterioration over time: a decrease in muscle mass of 1.05 kg, an increase in fat mass of 2.05 kg, and a decrease in body water percentage of 2.45%. Despite maintaining bone mass, the lack of physical exercise promotes an imbalance between lean mass and fat mass. These changes may affect posture, energy levels, and overall metabolic risk (diabetes, hypertension, dyslipidemia).

Height is strongly correlated with all body mass indicators, which is logical since taller individuals automatically tend to have greater masses (muscle, bone, fat), even under sedentary conditions.

Correlations between weight, BMI, and body composition

There is a perfect correlation of 1.00 between initial and final weight, indicating stability of value distribution within the group. There is a strong correlation of 0.7 between BMI and weight, confirming that weight is the primary determinant of BMI.

The correlation between weight and muscle mass/fat mass is 0.98, indicating that weight is distributed between both muscle mass and fat mass. Weight gain in sedentary women is strongly associated with fat mass accumulation, but also partly with muscle mass, which may be passive and non-functional in the absence of exercise.

Negative correlations are observed with body water percentage: Initial % body water vs. weight, fat, muscle, BMI: between −0.75 and −0.96; Final % body water compared with final fat mass: −0.95

These significant negative correlations show that as body fat increases, hydration levels decrease, because muscles have high water content while adipose tissue is poorly hydrated. Sedentary behavior leads to a reduction in total body water, reflecting decreased muscle mass and increased fat mass.

Regarding the correlation of bone mass, there is a strong positive correlation with: Muscle mass: +0.95–0.97; Weight: +0.96–0.99; Height: +0.97.

Bone mass is directly correlated with overall body size and muscle mass. Although bone mass does not vary much, it remains proportional to the other components. Sedentary women in the sample show very strong correlations between height, weight, muscle mass, and bone mass. Increased body weight is associated with both fat mass gain and imbalances. Body water percentage is inversely proportional to adipose tissue accumulation, confirming a decline in body quality in the absence of physical activity.

Discussions

The results obtained in the analyzed studies indicate that BIA-type devices, such as those in the Tanita range, can provide an acceptable estimate of body composition, but with some limitations depending on the population and clinical context. In the research conducted by Jebb et al., the Tanita analyzer, based on bioelectrical impedance, demonstrated a mean deviation of only 0.8 kg compared to the four-compartment model, being comparable with methods such as tetrapolar impedance and skinfold measurement (2000). Although the precision was lower than that of “gold standard” methods (e.g., DXA), the accuracy obtained was considered clinically acceptable. The proposed prediction equation, which includes factors such as sex, age, and logarithmic transformations of body parameters, showed reasonable standard deviations between sexes (4.8% in men, 3.3% in women). In another study, Parker et al. observed that the Tanita DC-430U model significantly underestimated body fat percentage (%BF) compared to DXA, by approximately 8 percentage points (2023). However, the device correctly classified children according to body fat levels. Absolute agreement between methods was moderate (r = 0.53), and repeated measurements demonstrated increased precision when performed on different days. According to data published by Davar, in a sample of 283 students, women showed significantly higher values of total body fat and visceral fat (2015). A significant correlation was identified between %BF, waist-to-hip ratio (WHR), and skinfolds, suggesting the need for sex-specific interventions, particularly for female students.

Additionally, Turkay's study highlighted that fat mass and BMI influence metabolic age, whereas higher body density reduces it (2020). After 12 weeks of regular physical exercise, significant improvements in body composition parameters were observed, demonstrating the role of physical activity in reducing metabolic risks. In the study conducted by Leahy et al., BIA underestimated total body fat, especially in individuals with a body fat percentage >25%, and segmental analysis revealed sex differences: the trunk was overestimated in men and underestimated in women (2012). Nevertheless, mean deviations (approximately 4%) suggest that BIA can be used as a viable alternative to DXA in young and healthy populations, with caution in individuals with excess body weight. The contribution of the research conducted by Silișteanu and Antonescu highlights the effectiveness of a combined diet and physiotherapy program, with patients who followed both interventions achieving better results than those who neglected nutrition (2016). Additionally, a higher dropout rate from exercise programs was observed among women, emphasizing the need for personalized motivational interventions. Overall, the data support the usefulness of the BIA analyzer as an accessible evaluation tool, but underline the need for ongoing validation, especially in populations with specific physiological or clinical characteristics (children, obese individuals, elderly). Tailoring physical and nutritional interventions based on body composition assessment can enhance the effectiveness of obesity prevention and treatment strategies.

4. Conclusions

Body composition analysis using the bioelectrical impedance method (BIA) with the TANITA device provides a comprehensive and relevant view of health status and physical fitness levels in young adults. Significant sex differences were identified: men exhibited higher muscle and bone mass, while women had a higher percentage of body fat. Physically active individuals demonstrated a more balanced body composition, characterized by increased muscle mass, reduced fat mass and better hydration compared to sedentary individuals.

The experimental program led to reductions in body weight and BMI, associated with a significant decrease in fat mass and an increase in muscle mass.

The results confirm that maintaining a regular level of physical activity has a direct positive impact on body composition and, consequently, on overall health.

Strong correlations between indicators (weight–muscle mass, weight–fat mass, muscle mass–bone mass) highlight the interdependence of body components and the relevance of using the BIA method in studies of this type.

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