Segundo puesto

Área Salud y Bienestar

Anthropometry and Body Composition in University Students: Implications for the Prevention of Chronic Non-Communicable Diseases

Antropometría y composición corporal en estudiantes universitarios: implicancias para la prevención de enfermedades crónicas no transmisibles

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Resumen

La etapa universitaria constituye un período crítico para el establecimiento de hábitos alimenticios que pueden influir en el riesgo de padecer enfermedades crónicas en la edad adulta. El impacto de estos patrones alimenticios en los indicadores antropométricos y la composición corporal de la población universitaria sigue estando poco documentado y muestra resultados dispares. Por lo tanto, el objetivo de este estudio fue evaluar las medidas antropométricas y la composición corporal según el sexo en estudiantes universitarios como indicadores relevantes para la prevención de enfermedades crónicas no transmisibles.

Se evaluó a estudiantes universitarios (n = 47) de entre 18 y 22 años. Se clasificaron por sexo: mujeres (n = 38) y hombres (n = 9). Las mediciones incluyeron peso, altura, las circunferencias y los pliegues cutáneos, así como parámetros indirectos, índice de masa corporal, porcentaje de grasa corporal y relación cintura-cadera. El análisis estadístico se realizó mediante prueba t de Student (p < 0,05).

Se observaron diferencias entre los sexos: los hombres presentaron circunferencias corporales mayores y una relación cintura-cadera más alta, mientras que las mujeres mostraron porcentajes más altos de masa grasa y mayores pliegues cutáneos.

En conclusión, se encontraron diferencias significas según el sexo, lo que refleja una distribución de la grasa más centralizada en los hombres, mientras que las mujeres mostraron una mayor adiposidad subcutánea y un mayor porcentaje de masa grasa. Estos hallazgos refuerzan la importancia de considerar estas diferencias con enfoque preventivo sobre el desarrollo de enfermedades crónicas no transmisibles.

Abstract

The university stage is a critical period for establishing eating habits that can influence the risk of chronic diseases in adulthood. The impact of these eating patterns on anthropometric indicators and body composition in the university population remains poorly documented and shows mixed results. Therefore, the objective of this study was to evaluate anthropometric measurements and body composition according to sex in university students as relevant indicators for the prevention of chronic non-communicable diseases.

University students (n = 47) between the ages of 18 and 22 were evaluated. They were classified by sex: women (n = 38) and men (n = 9). Measurements included weight, height, circumferences, and skinfolds, as well as indirect parameters, body mass index, body fat percentage, and waist-to-hip ratio. Statistical analysis was performed using Student's t-test (p < 0.05).

Differences were observed between the sexes: men had larger body circumferences and a higher waist-to-hip ratio, while women had higher percentages of fat mass and larger skinfolds.

In conclusion, significant differences were found according to sex, reflecting a more centralized distribution of fat in men, while women showed greater subcutaneous adiposity and a higher percentage of fat mass. These findings reinforce the importance of considering these differences with a preventive approach to the development of chronic non-communicable diseases.

Introduction

The university stage represents a critical window for the establishment of dietary habits and nutritional status that may persist into adulthood and influence the risk of chronic diseases. University students gain greater autonomy over their food choices, along with changes in physical activity, sleep patterns, and academic demands, making them a key group for the prevention of nutritional imbalances and alterations in body composition (Younes *et al.*, 2025). Recent studies have documented an increase in the consumption of ultra-processed foods and unbalanced dietary patterns among university students, which promotes metabolic disturbances, overweight, obesity, and future complications in adulthood that impact nutritional status and body composition in the medium and long term (Martínez-Rodríguez *et al.*, 2023; Brown *et al.*, 2024; Paola *et al.*, 2022; Ilić *et al.*, 2024; Musijowska & Kwilosz, 2024; Suárez González *et al.*, 2025). Thus, poorer dietary quality has been associated with higher body fat percentage, greater visceral fat, and lower muscle mass (Hariyanto *et al.*, 2025).

Moreover, it is important to highlight influencing factors such as the transition into university life. There is evidence that lifestyle changes upon entering university are associated with weight gain and increases in body fat, and that these changes differ between men and women. A longitudinal study found that during the first university year, men gained significantly more fat mass, weight, and waist circumference than women, while both groups showed a decline in dietary quality (Beaudry *et al.*, 2019). In this context, biological factors, for example, hormonal differences between sexes, behavioral factors such as meal frequency, snack intake, and physical activity, as well as sociocultural aspects including lifestyle habits, family practices, and social pressure, interact differently in men and women. These interactions may lead to variations in lean mass, fat mass, and the distribution of central adipose tissue, thereby altering cardiometabolic risk (Alotaibi *et al.*, 2023).

Another study showed that during an academic exam period, students experienced a significant increase in fat mass and a reduction in muscle mass, accompanied by a decrease in physical activity and a worsening of dietary habits (Mudarra-García *et al.*, 2025). An additional major period in recent years was the COVID-19 pandemic, which intensified these trends in many contexts. Lockdown periods resulted in reduced physical activity and a deterioration in dietary quality among students, with detectable consequences for body composition (Olfert *et al.*, 2022).

Dietary patterns and physical activity levels interact with diet type (vegetarian vs. omnivorous) and body composition, with variations observed according to sex (Lombardo, 2024). The adoption of alternative dietary patterns, such as vegetarian diets, has gained relevance among young people, motivated by ethical, environmental, or health-related concerns. However, the impact of these dietary patterns on anthropometric indicators and body composition in university populations remains poorly documented, especially in comparison with omnivorous diets. Recent studies show heterogeneous findings: while some research suggests similar fat and lean mass values in vegetarians compared to omnivores (Almurdi *et al.*, 2022), other studies indicate that well-structured plant-based diets may support favorable body composition (Jakše *et al.*, 2025). Furthermore, dietary diversity understood as the number of different food groups consumed emerges as a factor potentially linked to better nutritional status and body composition, although evidence among young populations is limited and shows mixed results (Bylinowska *et al.*, 2024).

However, most studies focus on global indices such as body mass index (BMI) or waist circumference rather than skinfolds, body fat percentage, or muscle mass, and with little differentiation by sex or diet type. For this reason, the objective of the present study was to evaluate anthropometric and body composition measurements according to sex in university students as relevant indicators for the prevention of chronic non-communicable diseases.

Materials and Methods

Study Design

This study was conducted in the province of Mendoza, Argentina, between August 2024 and October 2025. The epidemiological study design was observational, descriptive, and cross-sectional. The study employed a non-probabilistic convenience sampling strategy with voluntary participation, based on nutritional interviews in which body composition was assessed. All volunteers who participated in the study signed written informed consent in accordance with the protocol approved by the Ethics Committee of Universidad Juan Agustín Maza (Mendoza, Argentina).

Population

The sample consisted of individuals (n = 47) of both sexes aged 18 to 22 years, with stable body weight (± 3 kg over three months) and without recently diagnosed endocrine and/or metabolic disorders. Volunteers were excluded if they were undergoing pharmacological treatment capable of altering body composition or metabolism; had a high habitual intake of alcoholic beverages; had known malignant neoplasms; presented obesity treated with surgery; were pregnant or breastfeeding; had participated in clinical trials or nutritional interventions for weight control within the past three months; or failed to complete all required measurements or questionnaires. In the case of women, measurements were taken during the follicular phase of the menstrual cycle (days 5–10) in order to minimize variability associated with hormonal changes and water retention.

Anthropometric Measurements

Body composition was assessed through anthropometric measurements conducted according to the standardized protocols of the International Society for the Advancement of Kinanthropometry (ISAK) and carried out by a nutritionist with previous experience in body composition assessment. The intra-evaluator technical measurement error (TEM) was calculated beforehand in an initial pilot subgroup, obtaining values of less than 5 % for skinfolds and less than 1 % for circumferences, which indicated adequate accuracy

and repeatability of the measurements. The evaluations were performed in the morning (8:00 – 11:00 a.m.), after a minimum fast of 8 hours. Participants were required to refrain from intense physical exercise for 24 hours prior to the assessment, avoid alcohol and caffeine consumption for 12 hours prior to the assessment, and maintain adequate hydration without excessive fluid intake immediately prior to measurement. Measurements were taken with participants wearing light clothing and no shoes.

Body weight, fat mass, and lean mass were obtained using a bioelectrical impedance scale (capacity 150 kg, precision 100 g; OMRON, model HBF-514C, Buenos Aires, Argentina), allowing for the evaluation of body composition. Height was measured using a portable stadiometer (MEDNIB brand, measurement range 1–210 cm, precision 0.5 cm). Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Skinfolds thicknesses (triceps, biceps, suprailiac, and subscapular) were measured using a skinfold caliper (Calsize brand; precision 0.5 mm, opening up to 85 mm). Waist and hip circumferences were measured with a flexible anthropometric tape (Calibres Argentinos brand, Rosario, Argentina; scale 10 mm, error 1 mm). All measurements were performed in triplicate, and the mean value was used for analysis. Based on the collected anthropometric data, body composition was evaluated exclusively using the parameters obtained from the bioelectrical impedance scale (fat mass and lean mass). This approach was adopted given its reported agreement with indirect estimations of body fat derived from skinfold-based equations, such as the Durnin and Womersley method (Durnin & Womersley, 1974; Capone *et al.*, 2025). Additionally, the waist-to-hip ratio (WHR) was calculated as an indicator of body fat distribution.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 31.0 for macOS© (IBM©, New York, USA). For descriptive statistics, arithmetic means were used as a measure of central tendency and standard deviation as a measure of dispersion. For inferential statistics, the normality of the variables was assessed using the Shapiro-Wilk test, and the homogeneity of variances was evaluated using Levene's test. Depending on the fulfillment of these assumptions, Student's t-tests for independent samples were applied; when equality of variances was not assumed, Welch's correction was used. The significance level was set at $p < 0.05$.

Results

The sample consisted of 47 individuals. Participants were classified according to sex as women (n = 38) and men (n = 9), and according to diet type as omnivorous (n = 35) and vegetarian/ovolactovegetarian (n = 12). In the overall sample, mean body weight was 66.4 ± 18.3 kg, average height was 1.61 ± 0.10 m, and BMI was 24.9 ± 6.2 kg/m^2, values that fall within the healthy weight range according to WHO criteria, although close to the upper limit of that range.

Table 1 shows the anthropometric and body composition differences between women and men. Men had higher values for indicators associated with peripheral body volume (arm, calf, and neck circumferences), indicating greater structural robustness. Similarly, the WHR was higher among men, indicating a greater tendency toward central adiposity. In contrast, women showed higher values for skinfold and fat mass percentage, reflecting greater subcutaneous adiposity.

Table 1. Descriptive statistics and anthropometric comparisons according to sex

Variable	Female	Male	p-value
Weight (kg)	64.1 ± 19.5	76.8 ± 8.6	-
Height (m)	1.6 ± 0.05	1.77 ± 0.09	-
BMI (kg/m^2)	25.0 ± 7.1	24.4 ± 2.7	> 0.05
Arm circumference (cm)	28.8 ± 5.6	31.4 ± 2.6	0.047
Calf circumference (cm)	35.8 ± 4.1	38.4 ± 2.2	0.013
Neck circumference (cm)	32.3 ± 3.8	36.4 ± 1,5	< 0.001
WHR	0.76 ± 0.07	0.81 ± 0.04	0.011
Fat Mass (%)	36.5 ± 9.05	21.9 ± 4.7	0.003
Lean Mass (%)	25.9 ± 3.09	38.9 ± 2.6	> 0.05
Triceps Fold (mm)	19.4 ± 7.8	11.8 ± 3.6	< 0.001
Bicipital Fold (mm)	9.7 ± 5.5	5.6 ± 1.9	< 0.001
Subscapular Fold (mm)	16.5 ± 7.9	12.2 ± 2.5	0.008
Suprailiac Fold (mm)	18.4 ± 8.5	15.2 ± 7.3	> 0.05

The t-test for independent samples was used. Significance level p<0.05. Values are expressed as mean ± SD.

Although the suprailiac skinfold thickness and lean mass percentage (p > 0.05) did not show statistically significant differences between the sexes, the overall pattern of greater adiposity in the female group was consistent. This behavior is consistent with the typical sex-related distribution of body tissues. It should be noted that BMI values were similar between the two sexes, despite clear differences in the distribution and composition of body fat.

In addition, anthropometric and body composition variables were compared between different dietary patterns (omnivorous vs. vegetarian/ovo-lacto-vegetarian) using analysis of variance (ANOVA), with no statistically significant differences (p > 0.05) observed between the groups (data not shown). However, at a descriptive level, vegetarian and ovo-lacto-vegetarian individuals showed slightly lower values in skinfold thickness and waist circumference and tended to have a higher percentage of fat mass and lower lean mass. However, the data do not allow definitive relationships to be established, so these results should be further investigated in future research.

It should be noted that, due to the imbalance in sample size between women and men, the relevant statistical adjustments were applied, as described in the statistical analysis section, in order to ensure the robustness of the estimates. However, this asymmetry in group size constitutes a methodological limitation of the study, as it may affect the statistical power of comparisons by sex and reduce the stability of estimates, especially in the smaller group (men). This limitation sets a guideline for future research.

Discussion

The findings of the present study reveal a clear pattern of sex-based differences in body composition, with greater body circumferences and a more central fat distribution in men, and higher subcutaneous adiposity in women. These results are consistent with international evidence and previous studies conducted in university populations, supporting the role of sex as a determinant of body composition (Musijowska & Kwilosz, 2024).

The higher body fat percentage observed in women, and the larger body circumferences and waist-to-hip ratio found in men likely reflect biological and metabolic differences between sexes, which may influence cardiometabolic risk in distinct ways (Ilić *et al.*, 2024; Kwilosz, 2025). In men, previous studies have reported greater weight and fat gain during the first year of university compared to women, which is consistent with the higher circumferences and central fat distribution observed in the present study. This finding is clinically relevant, as the accumulation of centrally distributed fat, reflected by an elevated waist-to-hip ratio, has been associated with increased future metabolic risk (Beaudry *et al.*, 2019).

Women exhibited a higher percentage of body fat and greater skinfold thicknesses, indicating a predominance of subcutaneous adiposity. This pattern is consistent with previous findings in university populations and reflects well-established sex-related differences in fat storage. Although subcutaneous fat is considered metabolically less detrimental than visceral fat, elevated levels remain clinically relevant and highlight the importance of early preventive strategies focused on body composition (Ilić *et al.*, 2024).

Importantly, these findings reinforce the limitations of body mass index as a sole indicator of nutritional status. Since fat distribution (subcutaneous versus central) and muscle mass have distinct implications for cardiometabolic risk, the use of additional anthropometric measures such as skinfolds, circumferences, and lean mass percentage provides a more comprehensive assessment of body composition and potential metabolic risk in young adults.

Regarding dietary patterns, no differences were observed according to diet type in the present study. Previous research examining vegetarian and non-vegetarian diets has reported heterogeneous effects on fat mass, muscle mass, and other anthropometric parameters, suggesting that the relationship between diet and body composition is influenced by multiple factors (Pinheiro *et al.*, 2024; Jedut *et al.*, 2023; Fontes *et al.*, 2022). In contrast, Almurdi *et al.* (2022) reported no significant differences in body composition between vegetarian and omnivorous female university students. Overall, the available evidence indicates that the impact of dietary patterns on body composition is variable and context-dependent (Spurti, 2023).

Within the Argentine university context, a high prevalence of cardiovascular risk factors associated with unhealthy lifestyle behaviors has been reported (Fredes *et al.*, 2018). In this sense, although psychosocial variables were not directly assessed in the present study, evidence suggests that better diet quality is associated with more favorable health profiles in university students, reinforcing the relevance of comprehensive preventive strategies in this population (Martinelli *et al.*, 2018).

From a preventive perspective, the present findings emphasize the need for health promotion strategies in the university environment that consider sex-specific differences in body composition. Interventions aimed at promoting physical activity and healthy dietary patterns from the early stages of university life may help prevent unfavorable changes in body composition and reduce future cardiometabolic risk.

Finally, the results should be interpreted with caution due to methodological limitations, most notably the imbalance in sex distribution commonly observed in studies of university populations. This imbalance can introduce biases in prevalence estimates and observed associations, as well as limit the detection of real differences between men and women (Merone *et al.*, 2022; Weber *et al.*, 2021). Therefore, future studies with more balanced samples disaggregated by sex are needed to improve the validity and applicability of findings related to body composition and metabolic risk.

Conclusions

Significant differences in body composition were identified according to gender among university students in Mendoza: men had greater body circumference and higher WHR, while women had a higher percentage of body fat and skinfold thickness. Although no statistically significant differences were found according to diet type, the findings are consistent with the literature reporting heterogeneous effects of plant-based diets on anthropometric and body composition indicators. Given this variability, the promotion of longitudinal studies to confirm and further investigate these associations is reinforced, in order to prevent the development of chronic non-communicable diseases in young populations.

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