

University staff health: associations between body composition, physical fitness, and quality of life

Saúde de servidores universitários: associações entre composição corporal, aptidão física e qualidade de vida

Matheus Amarante do Nascimento¹ , Ágatha Graça¹ , Higor Santos Fonseca¹ , Fábio Luiz Cheche Pina² , Daniel Vicentini de Oliveira¹ , and Wendell Arthur Lopes¹ 

¹Universidade Estadual de Maringá, Maringá, Paraná, Brasil; ²Universidade Estadual de Londrina, Londrina, Paraná, Brasil.

*Autor correspondente: d.vicentini@hotmail.com

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Abstract: This study analyzed body composition, functional capacity, and quality of life in 34 university staff members (18 women; 31.2 ± 16.6 years), comparing results by sex and age group, and correlating them with length of service. Assessments included BMI, body fat percentage, lean mass, handgrip strength, flexibility, standing long jump, and SF-36 domains, applying Mann-Whitney U, Kruskal-Wallis, and Spearman's correlation tests ($p < 0.05$). Men presented higher body weight ($p = 0.009$), height ($p = 0.001$), lean mass ($p < 0.001$), and vitality ($p = 0.035$). Age and length of service were associated with anthropometric measures. Length of service was positively correlated with vitality ($\rho = 0.55$; $p < 0.001$). These findings suggest associations between occupational characteristics and aspects of perceived health, supporting institutional health promotion strategies.

Keywords: Body composition; Functional capacity; Quality of life; Workers; Occupational health.

Resumo: Este estudo analisou composição corporal, capacidade funcional e qualidade de vida de 34 servidores universitários (18 mulheres; 31,2 ± 16,6 anos), comparando resultados por sexo e faixa etária, e correlacionando-os ao tempo de serviço. Foram avaliados IMC, percentual de gordura, massa magra, preensão manual, flexibilidade, salto horizontal e domínios do SF-36, aplicando Mann-Whitney U, Kruskal-Wallis e correlação de Spearman ($p < 0,05$). Homens apresentaram maior peso ($p = 0,009$), estatura ($p = 0,001$), massa magra ($p < 0,001$) e vitalidade ($p = 0,035$). A idade e o tempo de serviço estiveram associados a medidas antropométricas. O tempo de serviço apresentou correlação positiva com a vitalidade ($\rho = 0,55$; $p < 0,001$). Esses achados sugerem associações entre características ocupacionais e aspectos da saúde percebida, reforçando a importância de estratégias institucionais de promoção da saúde.

Palavras-chave: Composição corporal; Capacidade funcional; Qualidade de vida; Trabalhadores; Saúde do trabalhador.



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Introduction

The university environment, particularly among technical and academic staff, is characterized by a routine marked by prolonged periods of sitting, low physical demand, and high levels of mental stress. This combination has been associated with adverse health outcomes such as overweight, musculoskeletal disorders, and impaired quality of life^{1,2}. Studies indicate that office workers may spend up to 82% of their workday in sedentary behavior, significantly increasing the risk for cardiovascular disease, type 2 diabetes, obesity, and premature mortality³.

Body composition is one of the main indicators of both functional and metabolic health. With aging, increased visceral adiposity and reduced muscle

mass may coexist. When accompanied by impaired muscle function, these changes are associated with functional limitations and difficulties in performing daily activities⁴. Simple assessments such as body mass index (BMI) and body fat percentage, when combined with physical tests of strength and flexibility, can help identify individuals at higher risk and guide targeted prevention strategies⁵.

Functional capacity, in turn, refers to an individual's ability to perform daily tasks autonomously and effectively. Evidence shows that variables such as handgrip strength, flexibility, and horizontal jump performance are directly associated with functional performance, especially in adults and older individuals^{6,7}. The progressive loss of functional capacity, when not detected early, may lead to dependence, increased work leave, and overall

deterioration in quality of life. Another critical aspect within the university context relates to psychosocial health. Work-related quality of life—including perceptions of pain, vitality, mental health, and social relationships—can be deeply affected by both occupational and physical factors. National studies have identified high levels of stress, anxiety, and depressive symptoms among public servants, particularly those with longer tenure and exposure to intense cognitive and emotional demands⁸.

Despite growing scientific production on occupational health, few studies have simultaneously examined body composition, functional capacity, and psychosocial dimensions of quality of life, particularly in the context of Brazilian public universities. This gap limits the development of intersectoral health promotion programs, such as structured workplace physical activity initiatives or preventive physiotherapy interventions⁹.

Therefore, this study aimed to analyze body composition, functional capacity, and quality of life indicators among public university staff. Specifically, it sought to: (a) describe the anthropometric and functional profile of participants; (b) compare these indicators by sex and age group; and (c) investigate potential associations between body composition and psychosocial domains of quality of life. We hypothesized that staff with higher body fat percentage and lower functional capacity would present worse scores in mental health, pain, and vitality domains.

Materials and Methods

Study design and participants

This is a cross-sectional, quantitative study conducted in 2017 with staff from a public higher education institution in southern Brazil. The sample was composed of 34 university employees from a local university of Paraná State, selected by convenience. Eligibility criteria were: (1) an active employment status with the institution; (2) voluntary consent to participate; and (3) availability to attend the scheduled assessments. Individuals with incomplete or inconsistent data were excluded from the final analysis. The study was approved by the Research Ethics Committee (approval No. 2.569.751) before data collection began.

Procedures and instruments

All assessments were conducted by the same trained evaluator following standardized protocols. Data

collection was performed under controlled conditions to ensure consistency across participants.

Sociodemographic and occupational data:

Sociodemographic and occupational variables included self-reported sex (male or female), chronological age (in full years), and length of service at the institution (in months), calculated based on the time elapsed since the participant's official employment start date. These variables were collected using a standardized form and used to characterize the sample, as well as to explore potential associations with physical and psychosocial outcomes. Age and service time were treated as continuous variables in statistical analyses and, when relevant, stratified into categorical groups for subgroup comparisons.

Anthropometry: Body mass was assessed using a calibrated electronic scale (Omron, Model HBF-214, Illinois, USA), with participants barefoot and dressed in light workout attire, and recorded to the nearest 0.1 kg. Height was obtained using a wall-mounted stadiometer (E120A – Tonelli), also without shoes, and recorded to the nearest 0.1 cm. Body mass index (BMI) was then determined by dividing body mass (kg) by height squared (m^2)¹⁰.

Body composition: Body composition assessment was conducted using single-frequency bioelectrical impedance analysis (BIA), employing a Biodynamics model 310e device (Biodynamics Corporation, Seattle, WA, USA). The equipment was calibrated daily, following the manufacturer's specifications, to ensure measurement accuracy. All assessments were performed by the same trained examiner, and conducted between 6:00 a.m. and 9:00 a.m. to minimize circadian variation. Participants received detailed pre-assessment instructions: to void the bladder approximately 30 min before the procedure; to abstain from eating or drinking within 4 hours prior; to avoid intense physical activity for at least 24 h; to refrain from consuming alcohol and caffeine for a minimum of 48 h; and to suspend the use of diuretics for at least 7 days before the test.

Before measurements, any metal objects were removed, and participants were positioned supine on a non-conductive surface, aligned along the longitudinal axis of the table. The legs were positioned at a 45° abduction angle from the midline, with the arms pronated. After cleaning the skin with alcohol, four electrodes were placed—two on the right hand and two on the right foot—according to standardized BIA procedures. Participants remained in the supine position for 10 min prior to data

acquisition. The device estimated fat-free mass (FFM), body fat (kg), and % body fat¹¹.

Handgrip muscle strength: Upper-body muscle strength was assessed using the isometric handgrip test performed with a dynamometer (TKK 5401 GRIP-D; Smedley, Takei, Tokyo, Japan). Participants stood with the dominant arm extended alongside the body and held the dynamometer in the dominant hand. At a signal from the examiner, the participant applied maximal handgrip force until the dynamometer registered the final value. The evaluation was repeated three times, with a one-minute interval between measurements, with the highest score considered as the final result of the test¹².

Abdominal muscle endurance: Abdominal endurance was evaluated using the 1-Minute Sit-Up Test. Participants lay in a supine position with knees flexed at approximately 90 degrees and feet flat on the floor, held in place by an evaluator or fixed object. Arms were crossed over the chest, and the movement consisted of lifting the upper torso until the elbows touched the thighs, followed by a controlled return to the starting position. The total number of correctly performed repetitions within 60 s was recorded. Only complete and properly executed sit-ups were counted, based on standardized testing criteria for form and range of motion¹³.

Flexibility: A sit-and-reach flexibility box (WCS, Brazil) was used to assess low back and hip joint flexibility¹³. Each participant sat with legs fully extended and soles of the feet placed flat against the flexibility box. With arms evenly stretched, palms down, the participant reached forward without jerking to push the sliding marker as far as possible along the scale with the fingertips. The position of maximum trunk flexion was held for approximately two seconds. The test was repeated three times. The highest score in cm was documented and used for data analysis.

Quality of Life: Health-related quality of life was assessed using the 36-Item Short Form Health Survey (SF-36), a validated multidimensional questionnaire composed of eight domains: functional capacity, physical role limitations, pain, general health, vitality, social functioning, emotional role limitations, and mental health¹⁴. Each domain score ranges from 0 to 100, with higher scores indicating better perceived health. Participants completed the Brazilian Portuguese version, adapted and validated by Ciconelli et al.¹⁵, under supervision to ensure clarity and adherence to standard administration procedures. Scoring followed the instrument's

guidelines, and domain scores were analyzed individually, as no total score is generated. Emphasis was placed on domains commonly linked to occupational health, such as vitality and mental health, given their relevance to psychosocial well-being.

Standing long jump: Lower-limb explosive performance was assessed using the standing long jump test. Participants stood behind a marked take-off line with their feet approximately shoulder-width apart and were instructed to jump forward as far as possible, taking off and landing with both feet. Two attempts were performed. Jump distance was measured in centimeters from the take-off line to the back of the heel nearest to that line upon landing, and the greatest distance was used for analysis. An additional attempt was allowed if the participant fell backward or touched the floor with another part of the body. The procedure followed the protocol described by Marin-Jimenez et al.¹⁶

Data analysis

Data were analyzed using Python software (pandas, scipy, seaborn, and matplotlib libraries) and JAMOVI version 2.3.28. The normality of the data was assessed using the Shapiro-Wilk test. As most variables did not present normal distribution, non-parametric tests were applied. Continuous variables were described as mean and standard deviation. Comparisons between sexes were performed using the Mann-Whitney U test, and differences among age groups (<30 years, 30–49 years, and ≥50 years) were evaluated using the Kruskal-Wallis test. Associations between variables were examined using Spearman's correlation coefficient (ρ). The significance level was set at 5% ($p < 0.05$).

Results

A total of 34 university staff members participated in this study, comprising 18 women and 16 men, with a mean age of 31.2 ± 16.6 years. Descriptive statistics for anthropometric, functional, and psychosocial variables, stratified by sex, are shown in Table 1. Statistically significant sex differences were observed in body mass ($p = 0.009$), height ($p = 0.0007$), fat-free mass ($p = 0.0001$), handgrip strength ($p < 0.0001$), standing long jump distance ($p < 0.0001$), vitality ($p = 0.035$), and social functioning ($p = 0.042$), with higher values among men for all seven variables. No statistically significant sex differences were observed for the remaining variables presented in Table 1. Among the SF-36 domains, men had higher scores for vitality ($p = 0.035$) and social functioning ($p = 0.042$).

Table 1 – Descriptive statistics and comparison by sex (Mann-Whitney U test).

Variable	Female	Male	p-value
Age (years)	29.1 ± 15.0	33.6 ± 18.5	0.308
Length of service (months)	106.7 ± 155.4	104.9 ± 171.1	0.754
Body mass (kg)	68.4 ± 12.8	85.7 ± 23.9	0.009*
Height (m)	1.64 ± 0.1	1.75 ± 0.1	< 0.001*
BMI (kg/m ²)	25.7 ± 5.0	27.9 ± 6.7	0.298
% body fat	26.5 ± 7.5	23.5 ± 7.3	0.259
Body fat (kg)	19.2 ± 8.4	21.5 ± 13.1	0.870
FFM (kg)	49.1 ± 7.0	64.3 ± 11.8	< 0.001*
Flexibility (cm)	22.5 ± 9.2	23.0 ± 10.6	0.875
Abdominal muscle endurance (reps)	20.2 ± 8.6	27.27 ± 12.9	0.105
Handgrip muscle strength (kgf)	28.3 ± 5.0	40.6 ± 6.3	< 0.001*
Lower limb power (m)	1.21 ± 0.3	1.77 ± 0.4	< 0.001*
Functional capacity	86.1 ± 13.9	85.3 ± 17.8	0.886
Role limitations due to physical health	84.9 ± 19.4	77.1 ± 24.0	0.356
Pain	68.7 ± 23.7	78.1 ± 17.2	0.422
General health perception	61.4 ± 16.9	58.3 ± 20.0	0.508
Vitality	50.0 ± 17.0	65.0 ± 19.6	0.035*
Social functioning	76.2 ± 11.3	85.2 ± 10.5	0.042*
Role limitations due to emotional problems	70.5 ± 38.1	72.0 ± 35.5	0.985
Mental health	61.5 ± 16.8	68.1 ± 16.0	0.243

BMI = body mass index, FFM = fat-free mass. * = $p < 0.05$.

No statistically significant sex differences were observed in the other SF-36 domains (Table 1). These distributions are also illustrated in Figure 1, with an asterisk indicating the variable in which a statistically significant difference was found.

Table 2 displays the descriptive statistics stratified by age group (<30 years, 30–49 years, and ≥50 years). Participants aged 50 or older tended to have higher body fat percentages, greater body mass, and elevated BMI values. Kruskal–Wallis tests indicated statistically significant differences across age groups in length of service, body mass, BMI, body fat percentage, body fat mass, fat-free mass, flexibility, abdominal muscle endurance, handgrip strength, and all eight SF-36 domains (all $p < 0.05$). No statistically significant differences were observed for height ($p = 0.776$) or standing long jump distance ($p = 0.302$), as shown in Table 2.

The results of Spearman's correlation analyses are presented in Table 3. A strong positive correlation was found between BMI and % body fat ($\rho = 0.80$, $p < 0.001$). A moderate-to-strong association was also observed between age and length of service ($\rho = 0.78$, $p < 0.001$). Furthermore, length of service was positively correlated with vitality ($\rho = 0.55$, $p < 0.001$), and negatively associated with height ($\rho = -0.43$, $p = 0.020$). Other weak correlations, such as between % body fat and

functional capacity ($\rho = -0.27$), or between BMI and mental health ($\rho = -0.02$), were not statistically significant.

Discussion

This study aimed to analyze body composition, functional capacity, and quality of life among public university employees, comparing values by sex and age group and exploring associations among key health indicators. The findings indicate a high prevalence of excess body weight, sex-related differences in body composition, and age-related changes in anthropometric and functional variables, highlighting the relevance of monitoring health indicators in occupational populations and reinforcing the need for institutional health promotion strategies.

Regarding body composition, both male and female participants presented mean BMI values classified as overweight according to WHO standards¹. This finding is consistent with national epidemiological data showing a high prevalence of overweight and obesity among Brazilian workers, including public employees, a pattern often associated with sedentary occupational routines and reduced levels of physical activity¹⁷. Although women presented slightly higher mean values of body fat percentage, the difference was not statisti-

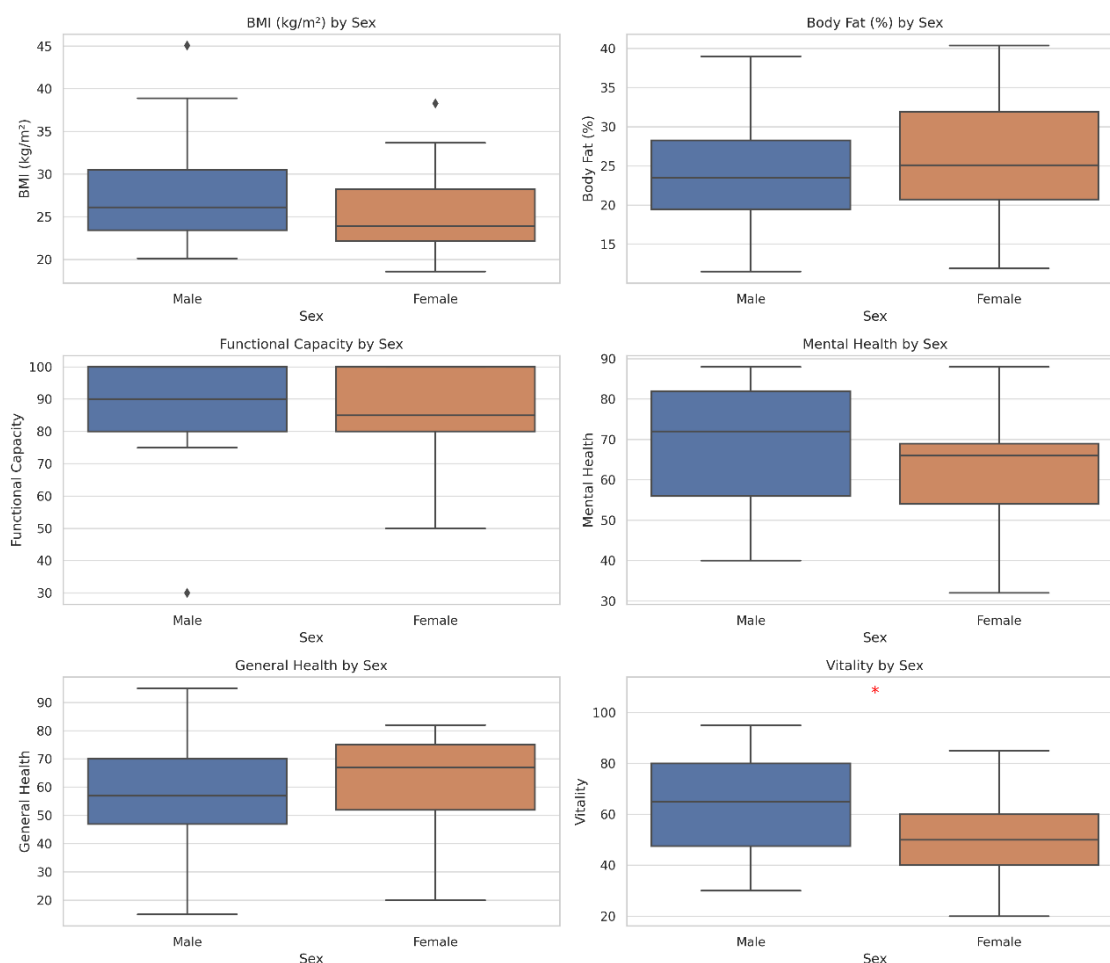


Figure 1 – Sex-based differences in body composition, functional capacity, and quality of life indicators.

Table 2 – Comparison between age groups (mean $\pm$ SD and Kruskal-Wallis test).

Variable	<30 years	30–49 years	≥ 50 years	p-value
Age (years)	20.7 $\pm$ 2.5	46.0 $\pm$ 3.45	57.38 $\pm$ 1.49	< 0.001*
Length of service (months)	11.0 $\pm$ 4.8	222.0 $\pm$ 1.56	313.88 $\pm$ 2.98	< 0.001*
Body mass (kg)	76.5 $\pm$ 3.93	86.75 $\pm$ 2.17	71.9 $\pm$ 1.14	< 0.001*
Height (m)	1.71 $\pm$ 3.39	1.72 $\pm$ 2.47	1.63 $\pm$ 4.64	0.776
BMI (kg/m ²)	26.1 $\pm$ 1.62	29.63 $\pm$ 2.82	27.26 $\pm$ 2.04	0.040*
% Body fat	23.61 $\pm$ 1.62	31.15 $\pm$ 4.14	27.12 $\pm$ 3.65	< 0.001*
Body fat (kg)	19.18 $\pm$ 1.23	26.95 $\pm$ 1.8	21.05 $\pm$ 2.25	< 0.001*
FFM (kg)	57.31 $\pm$ 4.46	59.8 $\pm$ 3.06	51.27 $\pm$ 3.08	< 0.001*
Flexibility (cm)	23.13 $\pm$ 3.4	19.5 $\pm$ 3.37	22.5 $\pm$ 3.19	0.013*
Abdominal endurance (reps)	25.17 $\pm$ 3.83	18.5 $\pm$ 1.19	18.38 $\pm$ 1.74	< 0.001*
Handgrip strength (kgf)	34.55 $\pm$ 1.08	33.1 $\pm$ 3.43	31.55 $\pm$ 4.88	0.007*
Lower limb power (m)	1.51 $\pm$ 4.88	1.33 $\pm$ 1.68	1.33 $\pm$ 4.1	0.302
Functional capacity	87.39 $\pm$ 4.33	85.0 $\pm$ 1.26	81.88 $\pm$ 4.76	< 0.001*
Role limitations (physical)	82.48 $\pm$ 1.85	81.0 $\pm$ 4.8	78.75 $\pm$ 4.58	0.010*
Pain	68.39 $\pm$ 1.73	85.0 $\pm$ 4.86	80.6 $\pm$ 3.39	< 0.001*
General health	56.91 $\pm$ 1.73	62.5 $\pm$ 4.23	69.75 $\pm$ 4.69	< 0.001*
Vitality	49.35 $\pm$ 2.22	72.5 $\pm$ 2.22	75.62 $\pm$ 1.35	< 0.001*
Social functioning	81.7 $\pm$ 3.1	78.5 $\pm$ 1.39	76.5 $\pm$ 1.78	< 0.001*
Role limitations (emotional)	72.7 $\pm$ 2.73	46.5 $\pm$ 3.74	69.4 $\pm$ 1.18	< 0.001*
Mental health	63.5 $\pm$ 2.16	66.0 $\pm$ 2.76	65.8 $\pm$ 2.3	0.025*

BMI = body mass index. FFM = fat-free mass. Reps = repetitions. * = $p < 0.05$.

Table 3 – Spearman correlation coefficients between selected variables.

Variables	ρ	p-value
BMI $\times$ % Body Fat	0.80	< 0.001*
Age $\times$ Length of Service	0.78	< 0.001*
Length of Service $\times$ Vitality	0.55	< 0.001*
Length of Service $\times$ Height	-0.43	0.020*
% Body Fat $\times$ Functional Capacity	-0.27	> 0.05
BMI $\times$ Mental Health	-0.02	> 0.05

BMI = body mass index; ρ = Spearman's rank correlation coefficient. * $p < 0.05$.

cally significant, suggesting that both sexes may be exposed to similar lifestyle and work-related factors that contribute to increased adiposity. The strong positive correlation observed between BMI and body fat percentage ($\rho = 0.80$; $p < 0.001$) reinforces the usefulness of BMI as a screening indicator in population studies, despite its known limitations in accurately estimating body composition¹⁸.

Statistically significant differences between sexes were observed in body mass, height, fat-free mass, handgrip strength, standing long jump distance, and the SF-36 vitality and social functioning scores, with higher values among men (Table 1). These results are consistent with previous evidence showing that hormonal and physiological differences influence lean mass development, skeletal structure, and body dimensions¹⁹. Such differences support the recommendation that occupational health studies should consider sex-specific analyses, since risk classification and functional interpretation may vary between men and women.

Men had significantly higher handgrip strength and standing long jump distance than women (both $p < 0.0001$). Men also reported higher scores in the SF-36 vitality ($p = 0.035$) and social functioning ($p = 0.042$) domains. Among employed women, greater strain related to domestic work has been associated with lower SF-36 vitality and social functioning scores²⁰. This finding offers a possible context for our results; however, domestic responsibilities were not assessed in our study, so their contribution to the observed sex differences cannot be determined.

A longitudinal study has documented age-related changes in body composition and height²¹. In the present sample, however, mean body mass and BMI were highest in the 30–49-year group, whereas length of service was highest in the ≥ 50 -year group. Flexibility differed across age groups ($p = 0.013$), but did not decline progressively with age. Handgrip strength also differed across groups ($p = 0.007$), with the lowest mean in the ≥ 50 -year group. General health scores differed across groups ($p < 0.001$) and

were highest in the ≥ 50 -year group. These cross-sectional findings do not establish changes over time.

Correlation analyses also revealed relevant associations between occupational and health variables. In addition to the strong correlation between BMI and body fat percentage, a moderate positive association was observed between length of service and vitality ($\rho = 0.55$; $p < 0.001$). This finding may indicate that longer institutional experience is associated with greater psychological adaptation to the work environment, although this interpretation should be made with caution due to the cross-sectional design. A negative association between length of service and height ($\rho = -0.43$; $p = 0.020$) was also observed, which likely reflects the effect of age on stature rather than a direct occupational influence, since reductions in height are commonly reported with aging due to intervertebral disc compression and postural changes^{21,22}. Weak negative correlations between adiposity indicators and functional capacity were also observed, consistent with previous evidence suggesting that increased body fat may negatively affect physical performance and perceived health, even when statistical significance is not reached²³.

From a public health and institutional management perspective, these results reinforce the importance of implementing structured health promotion programs in university settings. Interventions including supervised physical activity, ergonomic guidance, postural education, and periodic health assessments have been recommended as effective strategies to prevent functional decline and improve quality of life among workers²⁴. Considering that universities employ individuals with heterogeneous ages and job functions, preventive actions should be adapted to different occupational profiles and life stages.

Some limitations of this study should be considered. The cross-sectional design does not allow causal inferences, and the relatively small

sample size limits the generalization of the results. In addition, the inclusion of employees from different sectors may have increased variability in physical and psychosocial characteristics. Nevertheless, the multidimensional evaluation used in this study, including anthropometric, functional, and quality-of-life measures, provides relevant preliminary data and may serve as a basis for future longitudinal and interventional studies involving occupational populations in the higher education context.

Conclusion

This study identified differences in body composition, physical performance, and selected dimensions of quality of life among university staff. Men showed higher handgrip strength, standing long jump performance, vitality, and social functioning scores than women. Differences across age groups varied by outcome, without a consistent pattern of decline with increasing age. Length of service was positively associated with vitality. These findings may inform workplace health promotion initiatives that consider both physical and perceived health.

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Declaration of Conflicting Interests

The authors declare no conflicts of interest.

Authors' contributions

Conceptualization, M.A.N., D.V.O., and W.A.L.; methodology, M.A.N., F.L.C.P., D.V.O., and W.A.L.; investigation, M.A.N., A.G., and H.S.F.; data curation, M.A.N., A.G., and H.S.F.; formal analysis, M.A.N. and F.L.C.P.; writing – original draft, M.A.N. and D.V.O.; writing – review & editing, M.A.N., A.G., H.S.F., F.L.C.P., D.V.O., and W.A.L.; supervision, D.V.O. and W.A.L.

Declaration of Responsibility

The opinions expressed in this manuscript are the sole responsibility of the authors and do not necessarily represent the official position of the affiliated institutions or funding agencies.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Statement on the Use of Artificial Intelligence

The authors used ChatGPT (OpenAI) to assist with English language editing, manuscript revision, and the identification of candidate references. The authors reviewed the AI-assisted content and take full responsibility for the accuracy and integrity of the final manuscript.

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Jonato Prestes

*Universidade Católica de Brasília***Section Editor**

Noriberto Barbosa da Silva

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