Quality of life and its relationship with different anthropometric indicators in adults with obesity

Qualidade de vida e sua relação com diferentes indicadores antropométricos em adultos com obesidade

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Abtract

Introduction: Obesity compromises the quality of life. However, few studies have investigated the influence of different anthropometric indicators on the quality of life of this population. **Objective:** We aimed to correlate the physical and mental components of quality of life and verify its association with different anthropometric indicators in adults with obesity. **Methods:** A cross-sectional study was conducted in adults with obesity [body mass index (BMI) ≥ 30 kg/m²]. The quality of life was investigated using the SF-36 questionnaire, with scores ranging from 0 (worst-case scenario) to 100 (best scenario for the outcome). The anthropometric indicators used were BMI, waist circumference, waist/height ratio (WHR), and lean and fat body mass. For analysis, Spearman's correlation and crude and adjusted linear regression for sociodemographic variables were used. **Results:** A total of 75 subjects ($n_{females}$ = 47; μ_{age} = 34.8 ± 7.1 years) were included, and their means of the physical and mental components were 64.5 ± 15.9 and 50.8 ± 21.3 points, respectively. The social functioning domain presented a strong positive correlation (r = 0.760) with the mental health domain, and eight moderate correlations (0.400 ≤ r ≥ 0.699) were found between the different domains of the questionnaire. The functional capacity domain and the physical component presented a moderate negative correlation with the WHR (r = -0.402 and r = -0.407, respectively). After adjustment, the WHR was inversely associated with the physical component (β = -1.197; p = 0.002). **Conclusion:** In adults with obesity, important correlations were observed between the physical and mental components of quality of life, and the waist/height ratio was the only anthropometric indicator correlated and associated with the physical component of the outcome.

Keywords: Abdominal fat. Body fat distribution. Cross-sectional studies. Mental health.

Resumo

Introdução: *A obesidade compromete a qualidade de vida física e mental em função do excesso de peso corporal. Entretanto poucos estudos se propuseram a compreender a influência dos diferentes indicadores antropométricos na qualidade de vida dessa população.* ***Objetivo:*** *Correlacionar os componentes físico e mental da qualidade de vida e verificar a sua associação com diferentes indicadores antropométricos em adultos com obesidade.* ***Métodos:*** *Realizou-se um estudo transversal com adultos com obesidade (índice de massa corporal [IMC] ≥ 30kg/m²). A qualidade de vida foi investigada pelo questionário SF-36, com amplitude de escores de zero (pior cenário) a 100 (melhor cenário para o desfecho). Os indicadores antropométricos foram: IMC, perímetro de cintura, razão cintura/estatura (RCE), massa corporal magra e gorda. Na estatística, empregou-se correlação de Spearman e regressão linear bruta e ajustada para variáveis sociodemográficas.* ***Resultados:*** *Nos 75 sujeitos ($n_{mulheres}$ = 47; μ_{idade} = 34,8 ± 7,1 anos), o componente físico apresentou média de 64,5 ± 15,9 pontos e mental de 50,8 ± 21,3 pontos. O domínio de aspecto social apresentou forte correlação positiva (r = 0,760) com o domínio da saúde mental e foram encontradas oito correlações moderadas (0,400 ≤ r ≥ 0,699) entre os distintos domínios do questionário. O domínio capacidade funcional e o componente físico apresentaram moderada correlação negativa com a RCE (r = -0,402 e r = -0,407, respectivamente). Na análise ajustada, a RCE apresentou uma associação inversa com o componente físico (β = -1,197; p = 0,002).* ***Conclusão:*** *Em adultos com obesidade, observou-se importantes correlações entre os componentes físico e mental da qualidade de vida e a razão cintura/estatura foi o único indicador antropométrico correlacionado e associado ao componente físico do desfecho.*

Palavras-chave: *Gordura abdominal. Distribuição da gordura corporal. Estudos transversais. Saúde mental.*

Introduction

Obesity, with its multifactorial and complex etiology,[1,2] is among the main chronic non-communicable diseases (NCDs) that cause problems in the quality of life, which is a construct linked to the individual's perception of well-being over a set of socio-environmental and personal parameters.[3] Evidence in the epidemiological scenario has pointed to alarming estimates of obesity, reaching 13% of the world's population and 18.9% of the Brazilian population,[4,5] constituting a threat to public health.[6] There is also evidence that the presence of this disease increases a family's expenses by 15% to 195% for medications, consultations, tests, hospitalizations, and treatment.[7] Data from the Brazilian Institute of Geography and Statistics (IBGE) show that in the public health scenario, more than 487 million is being spent annually on hospitalizations and outpatient procedures directly related to obesity in the Brazilian population.[8]

At the population level, obesity is diagnosed by a body mass index (BMI) ≥ 30 kg/m². In several studies, BMI has been used to observe declines in the quality of life due to excess body weight,[9-12] however, other anthropometric indicators can accurately provide the degree of risk to health, especially those linked to central adiposity.[9] Electrical bioimpedance, for example, is a widely used body assessment method in people with obesity, as it portrays the amount of lean mass and adipose tissue alone since they have different health implications.[13]

Obesity directly reduces the quality of life.[14] This is due to mechanical stress on the joints, increasing energy expenditure when performing activities of daily living, leading to demotivation and causing pain in the lower back and knees.[13] Excess body fat can also generate prejudice and social isolation, and cause feelings of inferiority and disturbances of greater complexity.[11,15] In obesity, a worsening of the psychological state is observed, with an increase in stressful factors and a risk of severe diseases such as anxiety, depression, and psychoticism, increasing financial expenses with the disease and directly impacting the mental health of obese people.[15,16] Therefore, the use of different anthropometric indicators to measure adipose tissue provides a better understanding of the damage caused to the quality of life of this population. However, few studies have been conducted to understand how different anthropometric indicators can infer the quality of life of people with obesity.[17,18]

This is a broad public health problem; thus, understanding the relationship between quality of life and obesity and its indicators makes it possible to have an in-depth view of the perceptions of people with obesity. In addition, in a population of obese persons, improving the patients' perception of quality of life is one of the primary objectives. Different referrals can be planned by health professionals from the diagnosis of the disease; hence, it is essential to know the relationships between

different anthropometric indicators and the quality of life.[17,19] Thus, the present study aimed to correlate the physical and mental components of quality of life and verify its association with different anthropometric indicators in adults with obesity.

Methods

This was a cross-sectional design based on baseline data from a randomized clinical trial. For this study, only the subjects' initial data were used without forming groups by randomization. All methodological procedures used in this research were previously published and are available for consultation.[20] The target population was adults diagnosed with obesity, with BMI ≥ 30 kg/m², of both sexes, and aged between 20 years and 50 years. The eligibility criteria were as follows: BMI of 30–39.9 kg/m²; aged 20–50 years; not performing physical exercises two or more times a week in the last three months; not being a smoker and not an excess alcohol consumer (≥ 7 weekly doses for women and ≥ 14 weekly doses for men); not having a chronic disease or osteomioarticular pathology; not using medications to control and/or treat obesity; and not having undergone any surgical procedure for weight reduction. The sample was of the non-probabilistic type because it was not guaranteed that all subjects of the target population had the same condition of entry into the study. The study was disseminated in the local media (radio, newspapers, internet) and social groups (distribution of pamphlets and placing of posters) around the Universidade Federal de Santa Catarina (UFSC). Interested parties made initial contact through telephone calls, emails, or in person, with prior registration of the main identification information and compliance with the eligibility criteria.

After that, all subjects were assessed for eligibility criteria; the only criterion adopted for exclusion was not answering the questionnaire. Participants who met the eligibility criteria received an email containing the link to a questionnaire built on the Question Pro® platform, containing sociodemographic and quality of life information, with the freedom to respond alone at a comfortable time and place, without the presence or influence of researchers. Quality of life was assessed using the questionnaire SF-36[21], made of 36 questions on the quality of life, under two components: physical and mental. Each component was subdivided into four domains: the physical component represented by role-physical, physical functioning, body pain, general health and the mental component by role-emotional, social functioning, mental health, and vitality. Each of the eight domains was individually interpreted on a scale from zero (worst case) to 100 points (best case for quality of life).

After completing the online questionnaires, the participants were guided to anthropometric assessments, performed two days a week, during the day. The anthropometric indicators evaluated were BMI, fat mass, lean mass, waist circumference, and waist/height ratio. A compact stadiometer was used to measure the height, and a metal measuring tape was used to measure the perimeter, both with a 0.1 cm scale (Sanny®). The anatomical reference for the waist circumference measurement was the midpoint between the last rib and the iliac crest. Body mass, lean mass, and fat mass data were obtained by electrical bioimpedance (Model InBody 770 - Ottoboni®). For the test, participants were asked to use light clothing; remove metallic objects; suspend medications and diuretic drinks 24 hours before the test; avoid the consumption of food and drinks four hours before the test; not perform exercises 24 hours before the test; not consume alcohol 24 hours before the test; and not be in the menstrual period.[22] The test was carried out in a controlled environment, with a temperature between 20 and 25 °C, with the participants in an orthostatic position on the platform.[22] All measurements were performed on the same day by trained evaluators.

As adjustment variables, the sociodemographic characteristics of the sample were employed: sex (male, female), marital status (with partner, without partner), ethnicity (white, others), age (in full years), and education (in full years). Data analysis comprised descriptive statistics, using absolute and relative frequencies, mean, and standard deviation. The normality of the data distribution was verified using the Kolmogorov–Smirnov test. Due to the variability of each domain's data, Spearman's correlation was used to investigate the relationship between the different quality of life domains and anthropometric indicators, classifying the correlation values as weak (0 ≤ r ≥ 0.399), moderate (0.400 ≤ r ≥ 0.699), or strong (0.700 ≤ r ≥ 1.000).[23]

Linear regression analysis was used to create prediction models between dependent variables (physical and mental components) and anthropometric

measures in a crude and adjusted way. The adjusted analysis comprised two levels: sociodemographic variables (sex, marital status, ethnicity, age, and education) and body composition variables (BMI, fat mass, lean mass, waist circumference, and waist/height ratio). The waist/height ratio values were multiplied by 100 to facilitate the interpretation of β values. The backward selection strategy and critical p-value of ≤ 0.20 were used for confusion control. P-values ≤ 0.05 were considered statistically significant.

The research was approved by the Human Research Ethics Committee of UFSC under the number 2.448.674. All participants were duly informed about the procedures and signed the free and informed consent form. The methodological procedures used in this research were previously published.[20]

Results

The study was conducted with 515 volunteers. Of these, 83 adults with obesity met the eligibility criteria for participation in the study. The leading causes of non-inclusion were the degree of obesity (other than I or II), the practice of physical activity (more than twice a week), and the presence of other diseases (diabetes mellitus TII, hypertension, and depression). Of the 83 eligible volunteers, eight were excluded for not responding to the quality of life questionnaire. Thus, the final sample corresponded to 75 subjects considered in the inferential analyses. Sociodemographic characteristics, anthropometric indicators, and quality of life are shown in Table 1.

Table 2 shows the values of correlation between the domains of quality of life among adults with obesity. Only the social functioning domain with mental health showed a strong correlation (r = 0.760). Eight correlations with moderate strengths were found: role-physical × role-emotional = 0.544; physical functioning × body pain = 0.497; general health × social functioning = 0.514; general health × mental health = 0.554; general health × vitality = 0.546; role-emotional × social functioning = 0.504; role-emotional × mental health = 0.546; mental health × vitality = 0.671. No negative correlation was found.

Table 3 shows correlations between anthropometric indicators and domains of quality of life in adults with obesity. It was observed that only physical functioning (r = -0.402) and physical component (r = -0.407) showed a moderate and negative correlation with the waist/height ratio.

Tables 4 and 5 show the associations between anthropometric indicators and the physical and mental components of quality of life, respectively. After adjusting for sociodemographic variables, only the waist/height ratio showed an inverse association with the physical component. In this relation, the increase of 0.01 of the waist/height ratio unit decreased the physical component by 1.2 points (β = -1.197; p = 0.002). In the mental component, there was no association between the different anthropometric indicators in the adjusted analysis. No discrepant values (VIF >10) were found in the multicollinearity analysis between the variables maintained in the model.[24]

Table 1 - Sociodemographic characteristics, anthropometric and quality of life of adults with obesity (n = 75)

Variables	**n (%)**
Sex (female)	47 (62.7)
Marital status (with partner)	50 (66.7)
Ethnicity (white)	58 (77.3)
Obesity grade 1 (30 - 34,9 kg/m²)	56 (74.7)
	$\bar{x}$ ± SD
Age (in full years)	34.8 ± 7.1
Education (in full years)	15.7 ± 2.8
Anthropometric indicators	
BMI (kg/m²)	33.5 ± 2.8
Fat mass (kg)	38.7 ± 8.0
Lean mass (kg)	55.1 ± 12.1
Waist circumference (cm)	109.1 ± 10.0
Waist/height ratio	0.64 ± 0.0
Physical Component	64.5 ± 15.9
Role-Physical	71.0 ± 34.1
Physical functioning	76.0 ± 18.6
Body pain	64.1 ± 19.8
General health	47.0 ± 18.4
Mental Component	50.8 ± 21.3
Role-Emotional	43.6 ± 40.3
Social Functioning	60.3 ± 23.8
Mental health	58.7 ± 21.0
Vitality	40.4 ± 18.4

Note: n = absolute frequency; % = relative frequency; $\bar{x}$ = mean; SD = standard deviation.

Table 2 - Correlation between the domains of quality of life of adults with obesity (n = 75)

	Physical Component				**Mental Component**			
	Role-Physical	Physical functioning	Body pain	General health	Role-Emotional	Social Functioning	Mental health	Vitality
Physical Component								
Role-Physical	1.000	-	-	-	-	-	-	-
Physical functioning	0.323	1.000	-	-	-	-	-	-
Body pain	0.214	0.497[a]	1.000	-	-	-	-	-
General health	0.269	0.369	0.355	1.000	-	-	-	-
Mental Component								
Role-Emotional	0.544[a]	0.206	0.081	0.206	1.000	-	-	-
Social Functioning	0.236	0.353	0.310	0.514[a]	0.504[a]	1.000	-	-
Mental health	0.331	0.378	0.324	0.554[a]	0.546[a]	0.760[b]	1.000	-
Vitality	0.195	0.289	0.319	0.546[a]	0.361	0.610[a]	0.671[a]	1.000

Note: Values resulting from the use of Spearman correlation (r); [a] moderate correlation (0.400 ≤ r ≥ 0.699); [b] strong correlation (r ≥ 0.700).

Table 3 - Correlation between anthropometric measures and the components and domains of quality of life of adults with obesity (n = 75)

	Anthropometric indicators				
	BMI	Fat mass	Lean mass	Waist circumference	Waist/height ratio
Physical Component	-0.367	-0.267	-0.128	-0.331	-0.407[a]
Role-Physical	-0.219	-0.131	-0.129	-0.216	-0.165
Physical functioning	-0.328	-0.297	-0.055	-0.294	-0.402[a]
Body pain	-0.248	-0.177	-0.017	-0.181	-0.361
General health	-0.315	-0.239	-0.180	-0.266	-0.269
Mental Component	-0.122	-0.126	-0.086	-0.123	-0.110
Role-Emotional	-0.078	-0.103	-0.103	-0.119	-0.052
Social Functioning	-0.104	-0.147	-0.032	-0.077	-0.120
Mental health	-0.221	-0.197	-0.087	-0.193	-0.231
Vitality	-0.122	-0.095	-0.078	-0.079	-0.051

Note: BMI = body mass index. Values resulting from the use of Spearman correlation (r); [a] moderate correlation (0.400 ≤ r ≥ 0.699).

Table 4 - Association between anthropometric indicators and the physical component of quality of life in adults with obesity (n = 75)

Anthropometric indicators	β	B standardized	R^2 adjusted	p valor	VIF
BMI					
Crude Analysis	-1.848	-0.326	0.094	0.005*	1.000
Adjusted Analysis	0.431	0.075	0.172	0.704	3.039
Fat mass					
Crude Analysis	-0.521	-0.260	0.054	0.032*	1.000
Adjusted Analysis	-0.096	-0.048	0.158	0.856	5.381
Lean mass					
Crude Analysis	-0.114	-0.086	-0.008	0.488	1.000
Adjusted Analysis	-0.150	-0.112	0.183	0.321	1.019
Waist circumference					
Crude Analysis	-0.516	-0.319	0.088	0.008*	1.000
Adjusted Analysis	2.724	1.683	0.149	0.545	592.524
Waist/height ratio					
Crude Analysis	-1.220	-0.361	0.117	0.003*	1.000
Adjusted Analysis	-1.197	-0.354	0.183	0.002*	1.007

Note: Analysis adjusted for sociodemographic variables and other anthropometric indicators; VIF = variance inflation fator; *≤ 0.05.

Table 5 - Association between anthropometric indicators and the mental component of quality of life in adults with obesity (n = 75)

Anthropometric indicators	β	B standardized	R^2 adjusted	p valor	VIF
BMI					
Crude Analysis	-0.729	-0.096	-0.005	0.417	1.000
Adjusted Analysis	-0.592	-0.076	-0.010	0.654	1.857
Fat mass					
Crude Analysis	-0.381	-0.141	0.005	0.252	1.000
Adjusted Analysis	2.504	0.922	-0.039	0.523	130.977
Lean mass					
Crude Analysis	-0.152	-0.084	-0.008	0.495	1.000
Adjusted Analysis	0.466	0.258	-0.029	0.496	9.117
Waist circumference					
Crude Analysis	-0.292	-0.133	0.003	0.282	1.000
Adjusted Analysis	-0.292	-0.133	0.003	0.282	1.000
Waist/height ratio					
Crude Analysis	-3.703	-0.081	-0.009	0.514	1.000
Adjusted Analysis	6.232	0.137	-0.020	0.553	3.393

Note: Analysis adjusted for sociodemographic variables and other anthropometric indicators; VIF = variance inflation fator; *≤ 0.05.

Discussion

The present study aimed to correlate the physical and mental components of the quality of life and verify its association with different anthropometric indicators in adults with obesity. Among the main findings, we highlighted a strong positive correlation of social functioning with mental health and the confirmation of the waist/height ratio as the only correlated anthropometric indicator associated with the physical component, but not with the mental quality of life. This trend has been observed previously,[25] including in other domains of the quality of life of people with obesity.[18,19,26]

Among the related quality of life domains, the most significant correlation strength was found between social functioning and mental health, which belonged to the mental component group. The first was related to daily activities, sociability with the community, and social disturbances, while the second was linked to mental fatigue and, in more severe cases, psychological diseases.[27,28] Although the analysis and sample of this study did not allow causality between the variables, it is plausible that social activities interfere with mental health since different authors have observed an improvement in this domain with increased activity and social circle.[11,27,29] In addition, moderate correlations were found between domains of the different physical and mental components, which allow considering the complex relationship between the multiple constructs that encompass the quality of life. Therefore, we can demonstrate the relationship between body pain and physical functioning, associated with the amount of lean mass in this population.[13,30] The relationship between emotional and physical roles is intrinsically influenced by the distortion of body perception, acting on self-esteem, the dedication of tasks, and satisfaction with the body.[31-33] Knowledge of these relationships can help take actions that improve the quality of life according to this population's needs. In addition, as an example, we can highlight the correlations of general health, demonstrating that a good perception of health is associated with high scores of the mental component. Thus, we can emphasize that improving health perception should be one of the main objectives for obese people, which influences psychosocial aspects and increases adherence to healthy practices.[33,34]

Among the anthropometric measures analyzed, the waist/height ratio was the only one that showed a correlation with the quality of life, reducing physical functioning and the physical component, which can directly impact health perception and the performance of moderate and vigorous activities, such as walking for a few blocks or climbing stairs. Sloan et al.[17] also observed this relationship and showed that an increase in the waist/height ratio is inversely associated with cardiorespiratory fitness, denoting a worsening of physical functioning. Furthermore, the increase in the waist/height ratio is associated with an increased risk of mortality from all causes, presenting results with greater precision than using only BMI or waist circumference, for example, warning about the risks of central fat.[9,18]

Additionally, the waist/height ratio was the only anthropometric indicator associated with the physical component in the regression analysis, even after adjusting for the other variables. In addition to the routine physical difficulties, an increase in abdominal fat may be associated with decreased gene expression related to increased muscle mass maintenance, increasing physical damage over time.[35] For these and other aspects, an accumulation of fat in the waist region is considered one of the most harmful health threats,[13,36] directly impacting the presence of several NCDs.[37] Therefore, avoiding the concentration of fat in the central region of the body can prevent reducing the quality of life. In addition, its increase brings greater health risks than the general increase in fat mass.[37,38]

Unlike the physical component, no relationship was observed between anthropometric indicators of obesity and the mental component of the quality of life. The mental component represents the psychological and social aspects strongly influenced by socio-environmental parameters, providing changes that are not always represented by anthropometric indicators.[2,39] Furthermore, in the meta-analysis proposed by Ul-Haq et al.[40], no differences were found in the impairment of the mental component between subjects with grade 1 (30≥ BMI <35) and grade 2 (35≥ BMI <40) obesity. Thus, it is reasonable to admit that possible implications of anthropometric measures on the mental component of quality of life could be more easily detected when comparing obese and eutrophic people than among the obese population.

Some limitations of this study were noted. The sample was predominantly white people; however, the quality of life was impaired by obesity regardless of this characteristic.[41] We did not assess socioeconomic

status, which is closely associated with the quality of life in all social strata. In addition, people with obesity grades I and II were evaluated, and we did not extrapolate the findings for populations with BMI > 40 kg/m² or < 30 kg/m².

Despite these limitations, the strengths of this study are highlighted. The individuals analyzed did not have other associated comorbidities, such as type II diabetes mellitus or hypertension. This provided more reliability to the results considering obesity as the main factor in impairing quality of life. Other positive points were the use of different anthropometric indicators other than the simple ones such as BMI and perimeter, which besides being accessible, had a low cost and did not need a specific environment, and more sophisticated ones such as electrical bioimpedance. In addition, we highlighted the use of five sociodemographic characteristics, avoiding possible confounders, since quality of life is affected by several socio-environmental and individual factors.

Conclusion

The results of this study suggest that the waist/height ratio is the anthropometric indicator with the greatest predictive strength for the physical component of the quality of life. Simultaneously, no relationship was observed between the mental component of the quality of life and different anthropometric indicators analyzed. Based on this information, health professionals can incorporate this anthropometric indicator in their practice, enabling a good understanding of patients' health sensation with obesity and, especially, estimating the improvement of the physical component. To provide more effective interventions that improve the quality of life of this population, other factors influencing the low quality of life should be investigated.

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Authors´ contributions

All authors contributed substantially to the design of this manuscript. WRT and LSL participated in the conceptualization, methodology, analysis and interpretation of data, writing of the article, and approval of the final version to be published. JB and GFDD contributed to the conceptualization, methodology, data interpretation, critical review of the article, and approval of the final version.

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