ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 11, Issue, 10, pp. 50867-50870, October, 2021
https://doi.org/10.37118/ijdr.23196.10.2021

RESEARCH ARTICLE OPEN ACCESS

EVOLUTION OF WEIGHT LOSS AND CHANGES IN BODY COMPOSITION AFTER BARIATRIC SURGERY: IS AGING A DETERMINING FACTOR?

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ARTICLE INFO

Article History:
Received 16th July, 2021
Received in revised form
20th August, 2021
Accepted 17th September, 2021
Published online 23rd October, 2021

Key Words:
Bariatric surgery;
Electrical Bioimpedance;
Basal metabolic Rate;
Morbid Obesity.

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ABSTRACT

Introduction: The process of aging and morbid obesity (MO) of the population are global events that have direct outcomes in health systems organizations. Although there are no epidemiological data defined in MO in the most advanced age groups, the greatest impact is related to sarcopenia, progressive muscle loss and fat gain that comes with aging. Bariatric surgery is increasingly common in combating MO. However, after this intervention, it is not fully understood the changes in body composition and evolution of weight loss, as well as the influence of age in this context. **Objective:** to evaluate the evolution of anthropometric parameters through the electrical bioimpedance balance (BIA) in the pre- and post-operative period of bariatric surgery in young adults (>35 years) and older adults (>55 years). Methodology: Observational clinical study of retrospective cohort (2015 to 2018) analyzed by the examination results in the medical records. Patients were divided into two groups: G35= <35 years (under 35 years); G55= >55 years (over 55 years). The parameters analyzed by BIA were: age, weight, height, body mass index (BMI), bone mineral content (BMR), basal metabolic rate (BMR), visceral fat area (VFA), lean body mass (MCM), body fat mass (BFM). The data were analyzed in Graphpad Prism 6.01, being considered the statistical difference when $p > 0.05$. **Results:** After analysis of the medical records, 74 medical records were selected, being 77% women; 23% men. A decrease in body weight was observed in both groups, with statistical significance $p<0.05$, however G<35, lost 10 kg more, and a reduction in body fat was observed in G> 55 years of age, with statistical significance $p=0.004$. **Conclusion:** We concluded that the changes in body composition after bariatric surgery have age as a determining factor, with a substantial decrease in BMI, as well as benefits of greater loss of visceral fat area.

Citation: ***Adalgiza Mafra Moreno, Marco Orsini, Shirlei Lacerda, Renata Teixeira de Castro, Aluana Santana Carlos et al.*** "Evolution of weight loss and changes in body composition after bariatric surgery: is aging a determining factor?", *International Journal of Development Research*, 11, (10), 50867-50870.

INTRODUCTION

The increase in overweight and morbid obesity (MO) among the aging population is a warning, since high body mass index (BMI) values are associated with higher mortality rates in older adults than in younger adults (Han, 2013). Thus, aging and obesity are a priority in public health, since they are contributing factors to the emergence of chronic diseases, among them: type 2 diabetes mellitus, cardiovascular diseases, and several types of cancer. Besides the appearance of chronic non-communicable diseases (NCD), the aging and obesity process brings a series of physiological changes that reduce the mass, strength, and muscle function in several systems. Other aspects that change noticeably during the aging process is the reduction of physical activity; with this, they tend to gain weight progressively from 40, 50 years (Carmona-Maurici, 2020; Kautzky-Willer, 2019). Aging is defined according to the Pan American Health Organization (PAHO), as a global evolutionary process, characterized by the deterioration of a mature organism, so that with the passing of time it generates less capacity in face of the stress imposed by the environment in which it lives, thus increasing its possibility of death. According to recent studies, the elderly has been associated with a high prevalence of obesity, representing 2.5 million deaths (World

Health Organization, 2005; Horvath, 2014). According to the World Health Organization (WHO), it is estimated that by 2025 global obesity will reach 18% in men and will exceed 21% in women, while the most severe forms (BMI> 40 kg / m2, grade III) will exceed 6% in men and 9% in women. In addition, 16% of women and 9% of men over 65 are obese with a profile for therapeutic interventions. The frequency of obesity increases with age up to 64 years for men and up to 54 years for women, the percentage of obese individuals (IMC≥30kg/m2) in the population 25 to 34 years was 19.3% and 55 to 64 years 24.3% (Silveira, 2020; Organização Mundial de Saúde, 2020). The increase of obesity cases requires effective treatment and prevention strategies. Among the treatments for obesity, we can mention the changes in lifestyle (restrictive diets and avoid sedentariness with stimuli in physical activities), use of medicines (appetite suppressants) and in some specific cases bariatric surgery (Han, 2013). Bariatric surgery (BS) has shown more effective results for weight loss when compared to other non-invasive methods and has shown clinical relevance for the maintenance of long-term results (Bray, 2016; Chung, 2016). A recent published study showed that patients with BMI>40 Kg/m2 who presented comorbidities, BS was considered the most useful treatment method to rehabilitate obese patients, leading to a substantial reduction in BMI and an improvement in clinical outcomes observed twelve months after surgery (Wolfe, 2016). Although the clinical benefits of BS in the young adult are already well discussed in the literature, it is still not fully understood about the changes in the composition and evolution of weight loss in the population after the fifth decade of life. Therefore, the objective of this study is to compare the parameters of body composition in pre- and postoperative of patients undergoing BS in different age groups.

MATERIALS AND METHODS

Type of study

A clinical, observational, longitudinal, retrospective cohort study, following the criteria established by Strengthening the Reporting of Observational Studies in Epidemiology (STROBE),[12] in outpatients submitted to Bariatric Surgery at the specialized clinic in the city of Rio de Janeiro-Brazil.

Ethical Aspects

This study was conducted in accordance with the principles established in Resolution 466/12 of the National Health Council. As it guides this research and guarantees the maintenance of secrecy, confidentiality, and privacy of the data of the research subjects. The study protocol was approved by the Universidad Iguaçu-UNIG's ethics committee under CAAE 13926719.5.0000.8044.

Sample Selection

The sample was selected by the electronic database of the Clinical Nova Meta located in RJ in the period from 2015 to 2018, following the diagnostic criteria for indication of CB. The following inclusion criteria were used to select the medical records: patients who underwent CB, assessed by the bioimpedance balance in preoperative and at 15 and 45 days after surgery. As exclusion criteria we have: patients without minimum follow-up of two consultations after surgery (15 days and 45 days) and without evaluation by BIA, presence of pacemaker and clinical signs of edema.

Evaluation of body measurements and anthropometric indexes by electrical bioimpedance (BIA)

The analysis criteria of the database with verification of the BIA examination, was performed by two researchers. The measurements used in this study were: weight (Kg) and height (cm) to obtain the body mass index (BMI). The InBody 520® model, with specific software, was used to evaluate the body composition using the tetrapolar bioimpedance method. This bioimpedance model acts by means of a low frequency and high voltage alternating current (800 and 50 kHz) to provide the body parameters. Through bioelectrical impedance it was possible to obtain the following data: bone mineral content (BMO), visceral fat area (VFA), lean body mass (LBM) and body fat mass (BFM). At the moment of the evaluation by bioelectric impedance the patient had to follow the following protocol for a more reliable result: wear light clothes, without metals and without adornments, do not ingest coffee and caffeinated drinks in the last 24 hours. The evaluation was performed in the morning, with the patient fasting for up to 4 hours and was oriented to urinate before the exam. The patient remained in orthostatic position for adequate body distribution; he was guided to remove accessories, cell phones and shoes, to avoid measurement errors; he was helped to climb the scale with bare feet, head aligned to the body, looking forward and keeping the knees together. Following this protocol, he was read by evaluating the body composition through a low amplitude and high frequency electric current that passes through the person's whole body. At the end, the patient was helped to get off the scale, put on his shoes and return to his initial position.

Statistical analysis

The data were presented as mean ± standard error of the mean. The normal distribution of the values found was analyzed through the Kolmogorov-Smirnov test. The results of the groups were compared using the Student t-test for independent data. The nonparametric Mann-Whitney test was applied to the results that did not follow the normal distribution. The significance in all tests will be established at the p 0.05 level. Such statistical analyses were performed by GraphPad Prism version 6.01 for Windows (GraphPad Software, Inc., USA).

RESULTS

Data from 170 medical records of patients undergoing BS over a period of 3 years (2015 to 2018) were analyzed, of which 96 were excluded because they did not meet the inclusion criteria. Then, 74 patients were included in the study who were divided into groups under 35 and over 55 years old. Regarding gender, it was observed that most of the patients were female, 81.6% in the group under 35 years and 64% in the group over 55 years. At the moment before the surgery, similarity was observed with respect to most anthropometric indicators evaluated, showing that the groups are comparable despite the different ages, however, the group of patients over 55 years old presented a greater area of visceral fat (+37.2%, p= 0.0031) when compared to patients under 35 years old (table 1).

Indicators / Groups	Group -35 (n = 49)	Group +55 (n = 25)	Value P
Age	29,7 ± 0,5	62,0 ± 1,3	<0,0001
Height	1,67 ± 0,01	1,65 ± 0,01	0,4859
Weight	121,2 ± 2,7	112,2 ± 3,4	0,0520
BMI	43,6 ± 1,0	41,0 ± 0,9	0,1969
BMC	3,3 ± 0,1	3,1 ± 0,1	0,2964
VFA	185,1 ± 11,8	254,0 ± 21,4	0,0031
BFM	52,3 ± 2,7	55,6 ± 2,0	0,8394
MME	32,77 ± 1,5	31,2 ± 1,2	0,7528

The variables are presented in mean ± standard error of the mean. BMI = body mass index. BMC = Bone Mineral Content. VFA = visceral fat area. BFM = Body Fat Mass. MME = Skeletal Muscle Mass. P values less than 0.5 represent statistical difference between groups (t test or Mann-Whitney test).

As the main objective of the study is to evaluate how is the behavior regarding the modifications of anthropometric indicators observed by electrical bioimpedance, it was performed the calculation of the variation of these indicators between the previous moment and the moment after 45 days of surgery. It is observed that the group under 35 years of age has a higher weight loss (+33.2%, p=0.17) and a lower BMI (+27%, p=0.03) when compared to the group of patients over 55 years of age. However, the group of patients older than 55 years had a greater loss of visceral fat area (VFA) (+66.7%, p=0.004) when compared to younger patients (Figure 1 and Figure 2).

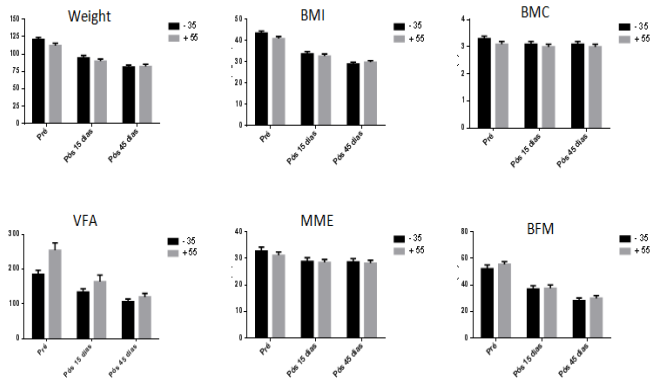

Figure 1. Evolution of anthropometric indicators after 15 and 45 days of bariatric surgery in groups under 35 (-35) and over 55 (+55). The variables are presented in mean ± standard error of the mean. BMI = body mass index. BMC = Bone Mineral Content. VFA = Visceral fat area. BFM = Body Fat Mass. MME = Skeletal Muscle Mass

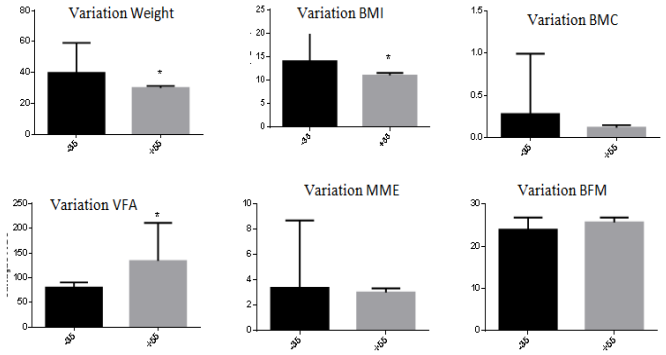

Figure 2. Variation of anthropometric indicators values before and after 45 days of surgery. The variables are presented in mean ± standard error of the mean. BMI = body mass index. BMC = Bone Mineral Content. VFA = visceral fat area. BFM = Body Fat Mass. MME = Skeletal Muscle Mass. The asterisk (*) represents significant difference between groups (t test or Mann-Whitney test, p<0.05)

DISCUSSION

This research investigated the body composition by electrical bioimpedance (BIA) in pre and post BS in two groups under 35 years and over 55 years. Although other studies have already investigated the effect of BS on aging, as far as we know, this is the first report that compares the effect of the evaluation of body composition by BIA technique with a protocol of 15 days before and 45 days after BS comparing different age groups. Our findings showed that changes in body composition occurred in both groups compared pre and post BS in both groups under 35 years and over 55 years. The sample studied showed a higher prevalence in women. According to data from the Brazilian Society of Bariatric and Metabolic Surgery (BSBMS), 75% of the procedures performed in Brazil in 2017 were in women[8]. Although there are changes in body composition in both sexes, in women the changes are associated with decreased estrogen levels caused by aging and menopause, among them the parameters of visceral fat and lean skeletal mass (Ley, 1992). Although our study did not stratify by sex the effect of BS, our findings indicate that the group over 55 may have been influenced by some of the variations in postoperative body composition ofBS due to the influence of the sample being greater in women. Therefore, our study presents new consistent evidence that the state of aging, chronological age and sex affect the outcome of CB. Ideally, the study conducted by Scozzari et al. presents that the scarcity of men in the samples performed with BS can obscure the sex-specific effects, so we stress that future studies should investigate the changes related to aging in women that may affect body composition and weight.

Some evidence points out thatmost patients lose significant weight linearly during the first year (Sjöström, 2011; Butner, 2010), corroborating with our post BS results. However, we present that the weight loss was higher in the group <35 years of age in relation to the group >55 years, which can be observed by some factors, in particular the metabolic rate, which seems to mediate the effects on both aging and sex. As discussed in the 4-year longitudinal study with women in perimenopause, Lovejoy et al. [17] found that although pre-aging was associated with decreased energy expenditure at rest, weight loss was 50% higher in women who became postmenopausal during the study. In addition, the decrease in fat rate was only seen in postmenopausal women. Corroborating with our data, which although not stratified by sex, the group >55 years of age showed a lower rate of visceral fat. Other studies suggest that there may be an effect of aging, perimenopause, and menopause on the decrease in visceral fat after BS, and it is important to consider a number of important variables that we were unable to include such as: functional status, level of physical activity, hormone replacement therapy (HRT) and surgical menopause. In addition, the types of surgical procedures that differ in effectiveness for weight loss should be considered (Butner, 2010; Toth, 2020; Henderson, 2008; Farahmand, 2012). Finally, we consider as a limitation and that it will be important in future studies to investigate the parameters of body composition evaluation with the stratification of women by age, to document the status of menopause, which would serve to discuss the effect of aging status and menopause in the outcome of BS. First, because about 5% of women enter natural menopause before 45 years of age and 5% enter menopause after 55 years of age (Gold, 2021; Sammel, 2009); Second, a substantial percentage of women aged <45 suffer surgical menopause (Henderson, 2008); Third, because estrogens seem to mediate the effects of reproductive axis function on weight regulation. Although our study has limitations, our evidence points out that age is a determining factor for the effects of body composition after BS, suggesting early multidisciplinary therapeutic strategies considering gender and the aging process (Hsu, 1998; Legenbauer, 2011; Ma, 2006).

CONCLUSIONS

This investigation allowed us to conclude that changes in body composition after bariatric surgery have age as a determining factor, with a substantial decrease in BMI, as well as benefits of greater loss of visceral fat area.

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