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BARIATRIC SURGERY INDUCES POSITIVE CHANGES IN BODY COMPOSITION IN OLDER ADULTS

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ABSTRACT

The number of older adults have increased considerably in the last years, as well as the number of obese older adults is also on the rise. Aim: The aim of this study was to evaluate the changes in body composition of older adults after 3, 6, and 12 months of bariatric surgery. Materials and Methods: A historical cohort of 35 older adults (62.35±1.47 years) who underwent bariatric surgery took part in this study. Body composition was analyzed by bioelectrical impedance. Data regarding physical activity and diet profile were also analyzed. Results: There was a significant reduction in body weight and fat percentage after the surgery, and skeletal muscle mass showed stabilization 6 months after the surgery. Forty-eight percent of the participants adhered to a combination of aerobic and resistance training and to a higher protein intake after the surgery. Conclusion: We believe that our main finding was the maintenance of lean muscle mass despite the weight reduction after the surgery and that this was associated with the combination of resistance training and the increase in protein intake.

Key words: Older adults. Bariatric surgery. Body composition. Physical training.

RESUMO

Cirurgia bariátrica induz alterações positivas composição corporal em adultos idosos

O número de idosos aumentou consideravelmente nos últimos anos, assim como o número de idosos obesos também está aumentando. Objetivo: o objetivo deste estudo foi avaliar as alterações na composição corporal de idosos após 3, 6 e 12 meses de cirurgia bariátrica. Materiais e Métodos: Participou do estudo uma coorte histórica de 35 idosos (62,35 ± 1,47 anos) submetidos à cirurgia bariátrica. A composição corporal foi analisada por bioimpedância elétrica. Dados sobre atividade física e perfil alimentar também foram analisados. Resultados: Houve redução significativa do peso corporal e percentual de gordura após a cirurgia, e a massa muscular esquelética apresentou estabilização 6 meses após a cirurgia. Quarenta e oito por cento dos participantes aderiram a uma combinação de treinamento aeróbio e de resistência e a uma maior ingestão de proteínas após a cirurgia. Conclusão: Acreditamos que nosso principal achado foi a manutenção da massa muscular magra apesar da redução de peso após a cirurgia e que esta foi associada à combinação do treinamento resistido e ao aumento da ingestão proteica.

Palavras-chave: Idosos. Cirurgia bariátrica. Composição corporal. Treinamento físico.

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INTRODUCTION

Aging is characterized by decreased organ function and morphofunctional changes throughout the body (Reid, Fielding, 2012).

In developed countries, a patient is considered an older adult at 65 years old and in developing countries at 60 years old (WHO, 1995).

The number of older people is increasing significantly worldwide, IBGE data show that the Brazilian population is on an aging path, and by 2060, the percentage of people over 65 will rise from the current 9.2% to 25.5% (IBGE, 2018).

In addition to the increase in the number of older adults, the number of obese older adults is also on the rise. Some studies show that in the 60 to 69 age group, 42.5% of women and 38.1% of men are obese.

For those 70 to 79 years old, 31.9% of women and 28.9% of men have this condition. In Brazil, the prevalence of obese older people is 8.7% among men and 16.1% among women (IBGE, 2008, 2018).

Obesity is a complex and multifactorial problem. Weight may be affected by environmental conditions, genetic factors, and the combination of overeating and low energy expenditure (Zaveri et al., 2016).

There is an essential physiological association between aging and obesity. Aging is associated with an increase in abdominal white fat (Barzilai, Rennert, 2012) and fat deposition in skeletal muscle (Slawik, Vidal-Puig, 2006), which affect insulin sensitivity as well as muscle loss in older adults.

This infiltration of fat into muscle contributes to the loss of muscle mass and strength, defined as sarcopenia, a syndrome that commonly affects obese older adults.

It is estimated that sarcopenia begins at 40 years old, causing a loss of about 5% of muscle mass each decade, with a faster decline after the age of 65.

This process increases the risk of developing chronic diseases (diabetes, hypertension, dyslipidemia and sleep apnea), compromising autonomy and crucially decreasing functionality and quality of life (Alba et al., 2019; Vargas et al., 2013).

Accordingly, the clinical treatment of these patients is sought first.

However, due to aging and age-related changes in metabolism, conservative treatment is often insufficient. Among the alternatives to resolve this situation, there is the option of bariatric surgery, which is considered an effective treatment and shows sound weight reduction with improvement of comorbidities. Several studies have reported that laparoscopic bariatric surgery in older adults is safe and very effective in the remission and control of diseases associated with obesity, and it improves quality of life as well (Chouillard et al., 2018; Nassif et al., 2011; Sosa et al., 2004).

The aim of this study was to evaluate the changes in body composition and the relation with protein intake and exercising in obese older adults undergoing bariatric surgery at a center for morbid obesity and metabolic syndrome from the preoperative period up to 12 months postoperatively.

MATERIALS AND METHODS

The present study was conducted using a historical cohort design and included 35 older adults (aged ≥60 years).

There were 28 women and 7 men who underwent bariatric surgery by the Roux-en-Y gastric bypass technique, using laparotomic access (conventional open) and laparoscopic access (closed), from 2010 to 2018.

All surgeries were performed by the same professional team of the Center for Obesity and Metabolic Syndrome at a South Brazilian hospital.

All older adults subjected to bariatric surgery between 2010 to 2018 were included in this study, and the study was approved by the local research ethics committee, under the protocol number 638,534.

Clinical, functional, physical, nutritional, and physiotherapeutic data were obtained through the participants' medical records, aiming to have the specific information of each patient care area, according to the service care flow chart.

There was also a physical therapy consultation on two occasions. There was a preoperative consultation aimed at assessing the respiratory and motor systems, as well as providing familiarization of the breathing exercise protocol and emphasizing the overall movement.

The postoperative consultation was aimed at addressing the importance of physical activity as well as indicating the most appropriate type of exercise for each patient, such as resistance training or, in the case of patients with injuries, physical therapy.

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Resistance training is any exercise that causes the muscles to contract against an external resistance with the expectation of increases in strength, tone, mass, and/or endurance.

The body composition variables analyzed were: body mass index (BMI), fat mass, weight, fat percentage and skeletal muscle mass, measured by bioelectrical impedance (In Body 770®), using simultaneous multi-frequency direct segmentation.

The electrical current intensity of the bioelectrical impedance device was 80 µA, and a frequency of 50/60 kHz was used. The older adults underwent the body composition evaluation preoperatively and postoperatively 3, 6, and 12 months after surgery, according to the protocol of the Center for Obesity and Metabolic Syndrome of PUCRS.

Percentage of excess weight loss (%EWL) was calculated using the formula: [(initial weight − follow-up weight)/(initial weight − ideal weight)] × 100. The percentage of total weight loss (%TWL) was calculated by the formula: [(initial weight - follow-up weight)/initial weight] × 100.

In the preoperative period and postoperative period, i.e., 3, 6, and 12 months after surgery, physical activity profile was analyzed by evaluating the level and type of activity performed, and protein intake by the patients was determined.

Statistical analysis was performed using one-way ANOVA for repeated measures with a Tukey post-test. The significance level used in all tests was 5%. Statistical treatment was performed using GraphPad Prism version 6.0. Results are presented as mean±standard deviation.

The study was approved by the PUCRS' Research Ethics Committee, under the protocol number 638,534.

RESULTS

Thirty-five older adults were included in the study, where 32 surgeries were with laparoscopy (closed), and three with laparotomy (open).

The patients had a mean age of 62.35±1.47 years, and 80% were women and 20% men. One of the main findings of the present study was the substantial reduction in patients' excess weight.

Preoperative weight was 45.42±16.48 kg for all individuals. %EWL was significantly decreased by 45.77±2.65% at 3 months, by 62.44±3.27% at 6 months and by 78.83±4.06% at 12 months after surgery ($p < 0.05$) (Figure 1A). %TWL was also significantly reduced at all times, at 3 month by 17.11±0.44%, at 6 months by 25.57±0.71% and at 12 months by 29.99±1.08% ($p < 0.05$) (Figure 1B).

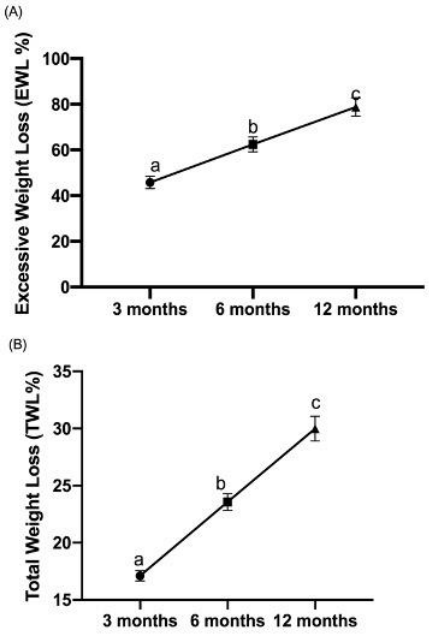

Figure 1 - Excess weight loss (%EWL) (A) and total weight loss (%TWL) (A) in obese older adults at 3, 6 and 12 months after bariatric surgery. Different letters indicate statistically significant difference ($p<0.05$).

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BMI before surgery was 42.85±6.71 kg/m^2) decreased at 3 months to 35.22±5.39 kg/m^2, at 6 months to 33.24±6.27 kg/m^2 and at 12 months to 30.19±5.96 kg/m^2 ($p<0.05$) (Figure 2).

The patients showed a preoperative fat percentage of 48.29± 9.66%, and a reduction was observed after 3 months (44.93±8.33%), after 6 months (41.25±8.27%) and after 12 months (35.16±11.09%), which was significant at the last two times ($p <0.05$) (Figure 3).

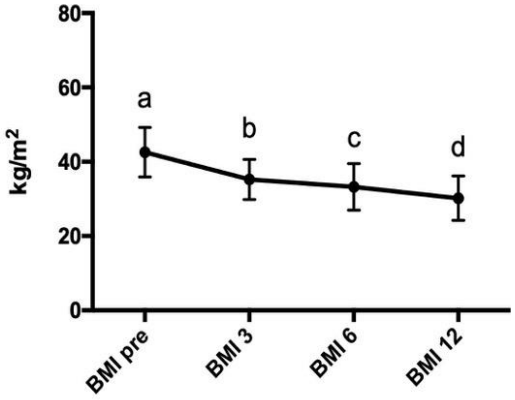

Figure 2 - Body mass index (kg/m^2) in obese older adults at 3, 6 and 12 months after bariatric surgery. Different letters indicate statistically significant difference ($p<0.05$).

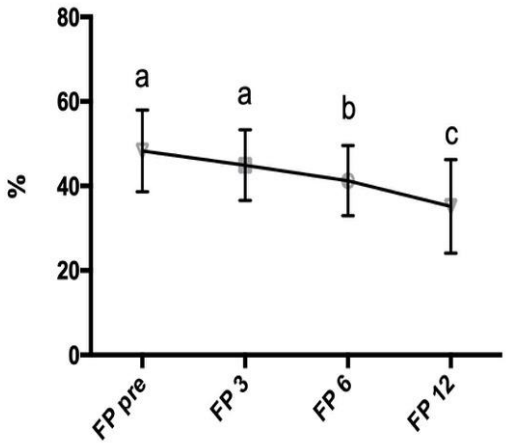

Figure 3 - Fat percentage (%) in obese older adults at 3, 6 and 12 months after bariatric surgery. Different letters indicate statistically significant difference ($p<0.05$).

Figure 4 shows the changes in patient fat mass after surgery. The preoperative value was 54.65±13.56 kg, and at 3 months, a significant reduction to 41.53±11.48 kg was observed. The same was observed after 6 months (34.45± 11.01 kg) and 12 months (27.70±11.50 kg) ($p <0.05$).

One of the most representative results of the present study can be seen in figure 5. Skeletal muscle mass, which was 34.01±15.27 kg before surgery, decreased only at 3 months after surgery (27.24±5.66kg) ($p<0.05$). However, this parameter was maintained after six months at 27.02±5.8 kg and remained stable after 12 months at 26.55±5.83kg, showing no significant difference from 3 months ($p> 0.05$).

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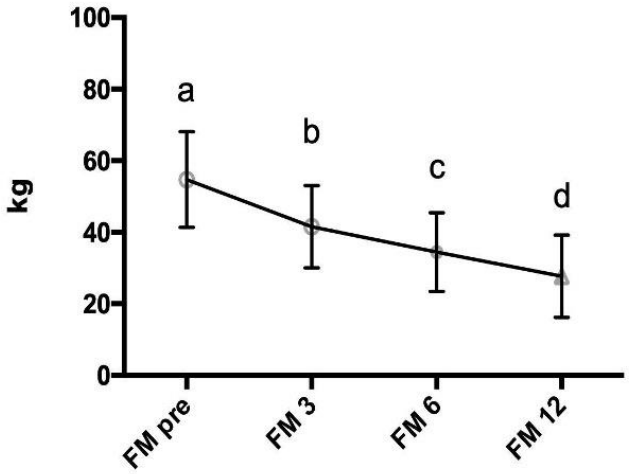

Figure 4 - Fat mass (kg) in obese older adults at 3, 6 and 12 months after bariatric surgery. Different letters indicate statistically significant difference (p<0.05).

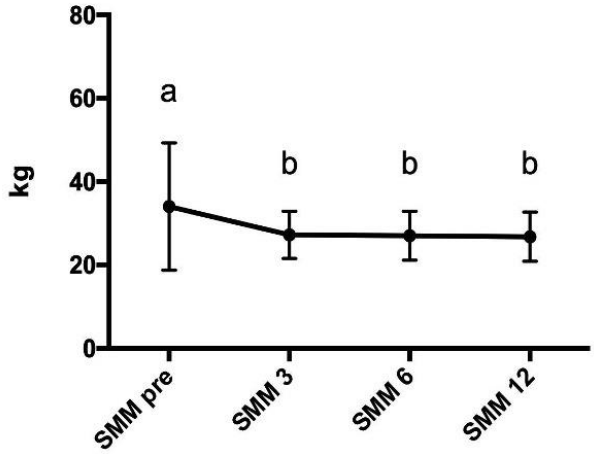

Figure 5 - Skeletal muscle mass (kg) in obese older adults at 3, 6 and 12 months after bariatric surgery. Different letters indicate statistically significant difference (p<0.05).

It was observed that 92.9% of the sample did not engage in physical activity of any kind in the preoperative period. Three months after bariatric surgery, 50% of patients adhered to the resistance training indicated, while in the following six months, adherence dropped to 33.3% in resistance training and other activities.

After 12 months, 22.2% of patients reported doing resistance training, and 48% did a combination of two or more exercises. At this point, walking showed a higher percentage compared to other activities, with adherence levels of 25, 18.5 and 7.4% for respectively 3, 6 and 12 months after surgery (Table 1).

Protein intake in the older adults undergoing gastric bypass was determined in the preoperative period and 3, 6, and 12 months after surgery, and we found that at 3 months, there was an increase in patients consuming protein supplement, milk and eggs. However, we observed that at 6 months after surgery, protein supplementation declined, and that egg consumption increased at this time and decreased somewhat by 12 months. Meanwhile, milk consumption, which was low preoperatively, increased from 3 months onwards, reaching 97% consumption at the end of follow-up (Table 1).

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Table 1 - Physical activity and protein intake profile 3, 6 and 12 months after bariatric surgery.

Variable	Pre (%)	3 months (%)	6 months (%)	12 months (%)
Physical activity				
YES	7.1	68.6	91.4	82.9
NO	92.9	31.4	8.6	17.1
Exercise				
Resistance training	ND	50	33.3	22.2
Walking	ND	25	18.5	7.4
Pilates	ND	8.3	7.4	14.8
Water activities	ND	NA	7.4	7.4
Combined training	ND	16.7	33.3	48.1
Milk consumption				
YES	77.15	97.15	91.43	97.15
NO	22.85	2.85	8.57	2.85
Egg consumption				
YES	11.42	42.85	31.43	31.43
NO	87.57	57.15	68.57	68.57
Meat consumption				
YES	88.57	100	97.15	94.28
NO	11.42	0	2.85	5.71
Supplementation				
YES	0	77.14	62.85	60
NO	100	22.85	37.14	40

Legend: ND: not determined

DISCUSSION

Crisp et al., (2018) compared the results of three types of bariatric techniques in older adults over 70 years of age during an 18-month follow-up. The authors found that Roux-en-Y gastric bypass by video laparoscopy proved to be the safest for this population, even knowing its limitations regarding the decreased absorption of some vitamins.

During a 12-month follow-up Bouchard et al., (2009), investigated the impact of sarcopenia, obesity and physical capacity as well on older adults through objective measures of physical function and body composition after bariatric surgery. After analyzing 904 patients, the authors reported significant improvement in sitting and standing and the one-leg stand test. Overall physical capacity revealed that sarcopenic and non-sarcopenic obese individuals were similar.

In another study, 100 older adult patients who underwent Roux-en-Y gastric bypass surgery and did resistance exercise (Nassif et al., 2011), were evaluated preoperatively and followed up (30 days and 3 and 6 months postoperatively); they had decreased lean muscle mass from 30 days to 3 months, which was maintained in the subsequent period. This maintenance of lean muscle mass was also found in our study as of 3 months postoperatively, which could be explained by the continuous decrease in fat infiltration into muscle after an initial loss of lean muscle mass.

It is well documented that resistance training during weight loss in older adults can significantly improve both body composition and physical capacity and can be used as a way to compensate for sarcopenia. Thus, we can attribute to the resistance training performed by the participants in our study, the maintenance of lean muscle mass that we observed.

We believe that the main finding of the present study was the maintenance of lean muscle mass at 6 months (27.02±5.88 kg) and 12 months (26.55±5.83 kg), with values not differing from that at 3 months ($p>0.05$). Maintenance of lean muscle mass result is one of the significant challenges after Roux-en-Y gastric bypass surgery, at any age but especially advanced age, where this can be considered extremely favorable.

Bariatric surgery can accelerate the process of muscle mass loss, which is already increased by age-related sarcopenia. This fact could be explained by the weight reduction caused by the procedure and the decline of macro- and micronutrient consumption, associated with the difficulties in nutrient absorption that this type of surgery imposes.

Also, it is known that resistance training increases the activation of satellite

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cells, decreasing fat infiltration into skeletal muscles, inducing angiogenesis and improving endothelial function (Alba et al., 2019).

This type of exercise stimulates protein synthesis and increases cross-sectional muscle area, number of myofibrils and strength, thereby improving the muscle quality of older adults.

According to the guidelines of the European Association for Obesity Studies, even if there are no reference values for weight loss, lean mass and fat mass defined for older adults undergoing bariatric surgery, the minimization of these losses would provide satisfactory results in these patients (Nassif et al., 2011).

Several studies have demonstrated the effectiveness of bariatric surgery in weight loss, and consequently, the reduction of fat percentage and fat mass in the older adult population (Alba et al., 2019; Nassif et al., 2011; Reid, Fielding, 2012; Slawik, Vidal-Puig, 2006).

It is known that muscle composition also depends on physical activity, so we evaluated physical activity profile and type of exercise in the preoperative period and 3, 6 and 12 months after surgery.

We found that before surgery, 92.9% of the older adults were sedentary and that after surgery, there was an increase in the number of those who were physically active.

There was an increase of around 50% in the number of patients who became physically active at 3 months, and at the end of 12 months, the number increased 48.9% more, where many patients did various types of exercises. These data corroborate findings in the literature, where it was observed that after 12 months of gastric bypass surgery, exercises with much better adherence were the combined type, i.e., involving more than one type of physical activity (Mathus-Vliegen et al., 2012), usually aerobic training associated with resistance training.

Another interesting finding in this study was the association between increased protein intake and maintenance of lean muscle mass, which occurred in the same period, i.e., as of 3 months.

Thus, there seemed to be a tendency for these factors to be associated, resulting in a decrease in fat percentage, which occurred mainly after three months of surgery. Similar data were obtained by Oppert et al., (2018), who reported that muscle strength loss after surgery could be overcome by combining resistance training with additional protein intake.

Obesity has been shown to be a critical health problem in people over 60, and bariatric surgery has proven to be an acceptable and effective tool in the treatment of adult obesity.

Perhaps the primary concern lies in the proper clinical approach and care management of the patients. Thus, since our study showed positive data related to the combination of a proper diet, training, and surgical approach for obese older adults, we reinforce the importance of a multidisciplinary team in the care of obese older adults who undergo bariatric surgery.

Our results suggest that the treatment of obesity in older adults through bariatric surgery is useful, especially with the Roux-en-Y gastric bypass technique. We demonstrated that this intervention produces a satisfactory weight loss (%EWL and %TWL) and reduction in BMI and fat percentage, with the maintenance of lean body mass, which we attribute to the early introduction of resistance training together with adequate protein intake.

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Availability of data and materials: The authors confirm that the data supporting the findings of this study are available within the article.

AUTHORS' CONTRIBUTIONS

Carolina Boeira Vargas had the conception of the idea of the study, have collected the data, analyzed the data, and wrote most of the paper,
Francine Picolli have wrote parts the paper,
Carina Rossoni have collected the data, analyzed the data, and wrote parts the paper,
Caroline Dani have analyzed the data, and wrote parts the paper,
Claudio Corá Mottin had the conception of the idea of the study, have supervised the study, and approved the article´s final version,
Ana Paula da Silva Machado have prepared the final manuscript, revised all documents and approved the article´s final version, and

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Rafael Reimann Baptista had the conception of the idea of the study, have analyzed parts of the data, wrote parts of the paper, have supervised the entire manuscript writing process and approved the article´s final version.

Conflict of interest and consent for publication: The authors declare not to have any kind of conflict of interest related to this work and gave the consent to publication.

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