

Review Article:

Inadequate Protein Intake Before and After Different Types of Bariatric Surgery: Systematic Review



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ABSTRACT

Background: Bariatric surgery is considered the most effective treatment for morbid obesity. Despite the successful weight loss after bariatric surgery, patients are susceptible to protein deficiency. Changes in food intake after surgery can cause some nutritional deficiencies. This study aimed to determine the status of protein profile in the patients before and after bariatric surgery.

Methods and Materials: This systematic search was performed in April 2021. Cochrane, PubMed, and Google Scholar databases were used for our literature search by searching the keywords of “body composition”, “fat-free mass”, “bariatric surgery”, “protein malnutrition”, and “protein intake”.

Results: Our studies showed that few studies had evaluated the protein status in candidates before surgery. Obesity surgery reduces muscle mass and serum protein, so evaluation of these factors is necessary. The bariatric surgery method exposes people to protein malnutrition and changes in body composition; therefore, more attention to their protein intake needs to be done.

Conclusion: Based on our results, dietary intake can affect the outcome of surgery. So, we recommended evaluating protein status and lean body mass before and after the bariatric surgery. Also, the effect of different types of protein supplementation to improve body composition can be assessed in further studies.

1. Introduction

Obesity is a complex, multifactorial, and preventable disease which have affected over a third of the world's population today, but it can be treated by diet, exercise, drugs, and surgery [1]. Bariatric surgery

is currently the most effective weight loss strategy for reducing comorbidity and mortality in patients with morbid obesity when other treatments of obesity are failed [2]. Roux-en-Y gastric bypass (RYGB) and Sleeve Gastrectomy (SG) are the most common procedures [3, 4].

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There is concern about bariatric surgery as a complex procedure. These procedures can create a higher malnourishment status in patients and cause protein deficiency [5]. Previous studies have shown that loss of Fat-Free Mass (FFM) after surgery is one of the important complications of bariatric surgery compared to other weight-loss interventions, but it can lead to weight regain due to a decrease in resting energy expenditure [6]. A systematic review has shown that RYGB has been associated with greater FFM loss than adjustable gastric banding [7]. Also, low serum albumin and prealbumin levels have been observed in more than one-third of patients in the first year after bariatric surgery [8]. According to current guidelines, an average daily protein intake of 1.5 g/kg of ideal body weight is recommended after bariatric surgery to minimize postsurgical FFM loss [9, 10].

We examined the literature regarding protein consumption before and after surgery in different types of bariatric surgery to determine the optimal amount of protein that should be taken to reduce the risk of complications.

2. Materials and Methods

The present systematic review was performed and reported following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [11].

Search strategy

The systematic search was performed in April 2021. Cochrane, PubMed, and Google Scholar databases were used for our literature search. The following search terms were used: “body composition” (MeSH, all fields) or “fat-free mass” (MeSH, all fields) and “bariatric surgery” (MeSH, all fields) and “protein malnutrition” (MeSH, all fields) or “protein intake” (MeSH, all fields) in English publications without date restrictions.

Study selection and content evaluation

The full-text evaluation was performed, and also references from relevant manuscripts were reviewed manually for additional manuscripts. Titles, abstracts, and full-text articles were reviewed to include in the study based on our eligibility criteria. Studies were included if they met the following criteria: 1) study patients in the age range of 18–70 years with a Body Mass Index (BMI) of over 40 kg/m² who underwent bariatric surgery such as RYGB or SG, 2) without getting daily protein supplementation or a high-protein diet for over one month (≥ 60 g/d), 3) body composition as outcome measurement de-

termined by either air displacement plethysmography, bioelectrical impedance analysis, dual-energy X-ray absorptiometry or magnetic resonance imaging, and 4) a follow-up of over 2 months.

Exclusion criteria were 1) inclusion of pregnant women, 2) protein supplementation or a high-protein diet combined without data about the effect of proteins only, and 3) no data about the primary outcome.

The following data were extracted from each study, and study quality was assessed. The quality of each study was judged based on the set criteria. Three reviewers judged the quality of the studies.

3. Results

Study selection

In total, 467 articles were identified in three electronic databases. After removing duplicates, 171 articles remained, including review articles, research articles, editorials, mini-reviews, and short communications. After the screening of titles and abstracts, 23 potentially relevant articles were selected for full-text reading. In the end, 9 studies met the inclusion criteria and were considered eligible for this systematic review. They were written by Dagan et al. [5], Parrott et al. [9], Romeijn et al. [10], Guillet et al. [12], Moizé et al. [13], Nicoletti et al. [14], Katsanos et al. [15], Mohapatra et al. [16], and Novais et al. [17]. The study selection process and content evaluation are shown in Figure 1.

4. Discussion

Bariatric surgery is the most effective weight loss therapy in patients with morbid obesity [16]. Unfortunately, malnutrition and micronutrient deficiencies are common after most bariatric procedures, and thus, preoperative and postoperative nutritional assessment and corrections are advised [12, 16]. Restricted food intake after bariatric surgery can be an important factor both in the long-term control of body weight and in the onset of nutritional deficiencies. Protein deficiency intakes are reported in patients with morbid obesity so that post-bariatric protein requirements must be defined explicitly with validated methods [17].

For most patients, unplanned protein intake following bariatric surgery does not cover protein requirements, so specific dietary with protein recommendations must be adapted in obese patients after bariatric surgery [12]. Proteins/amino acids, unlike other macronutrients, are not stored in the body. After bariatric surgery, optimal

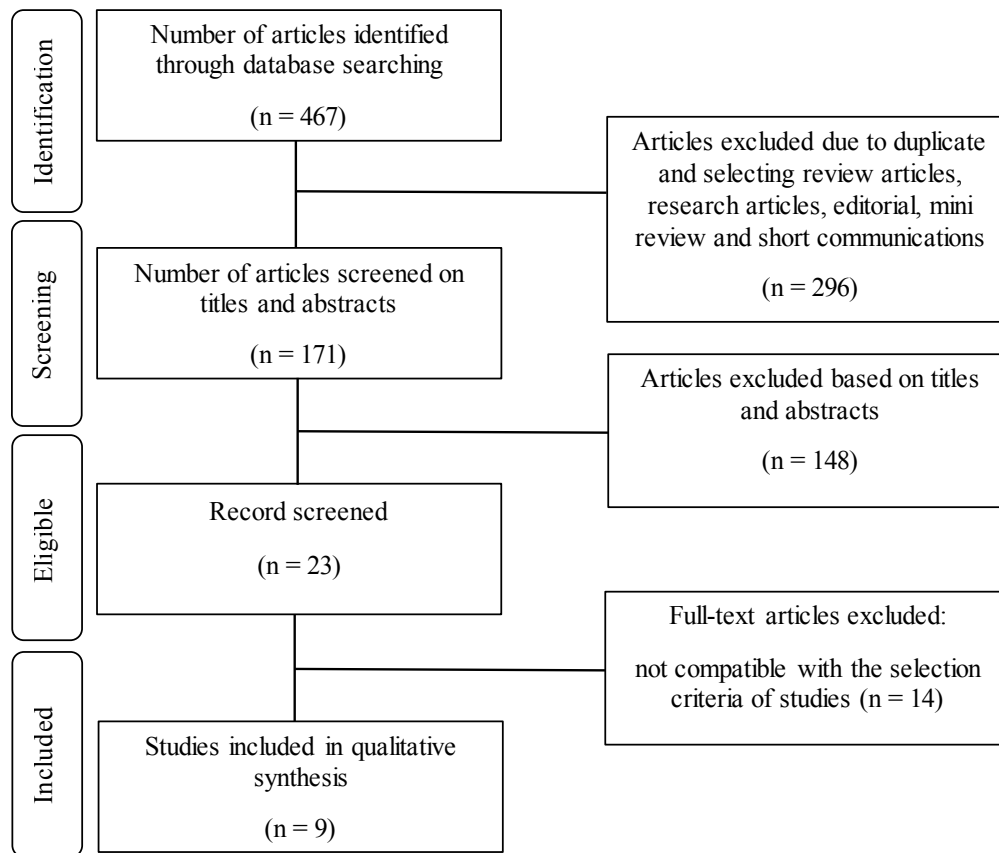


Figure 1. Diagram of study selection and content evaluation



dietary protein intake will be decreased [15]. The study supports the currently recommended protein intake goal of more than 60 g/d as an efficient strategy for better preservation of FFM post-LSG¹ [5].

Few studies have evaluated the protein status of the candidate patients before surgery [5]. Obesity surgery reduces muscle mass and serum protein, so evaluation of these factors is necessary [12]. Also, obese patients after bariatric surgery show altered intake of macronutrient and micronutrient levels and nutrients deficiency [15]. The amino acid profile changes after RYGB prove that total protein and albumin levels may not be good indicators of protein profile after the surgery [14]. Ingesting essential amino acids has the primary role in regulating muscle protein synthesis and can potentially improve the loss of muscle protein after gastric bypass [15].

Dagan et al. [5] evaluated the association between daily protein intake and relative FFM loss at 6 and 12 months after SG surgery in a prospective cohort study. The study participants included 77 patients (45 women) at 6 months and 68 patients at 12 months. Their Mean±SD age was 42.7±9.4 years, and their mean preoperative body mass

index was 42.2±4.8 kg/m². Their results indicated that protein intake of more than 60 g/d is a strong protective factor (Odds ratio=0.29, 95% confidence interval: 0.09–0.96; P=0.043) [5].

Guillet et al. [12] assessed Average Protein Requirement (APR) in obese subjects before, 3 months, and 12 months after SG or Roux-en-Y gastric bypass using the validated method of nitrogen balance. They did a prospective longitudinal study conducted in 21 patients with morbid obesity Mean±SD BMI: 43.9±1.4 kg/m². They demonstrated a temporal change in protein requirement after bariatric surgery, whatever the type of surgery [12].

Moizé et al. [13] evaluated the relationship between protein intake and Lean Tissue Mass (LTM) loss following bariatric surgery. They did an observational study on 25 patients who underwent gastric bypass and 25 patients who underwent SG. A protein intake of more than 60 g/d was associated with lower LTM loss at 4 and 12 months (P=0.30 and P=0.013, respectively) [13].

In another study [14], the protein and amino acid nutritional status of obese adults before and after bariatric surgery was evaluated. Thirty obese women (who under-

went Roux-en-Y gastric) participated in this study. Anthropometric and bioimpedance data (body composition analysis), food and protein intake, albumin, total serum protein, and plasma amino acids levels were assessed before the surgery and then 3, 6, and 12 months after the surgical procedure. The amino acid profile showed concentrations of most amino acids increased 3 months after surgery, but concentrations of some amino acids such as glutamic acid, serine, arginine, alanine, methionine, valine, phenylalanine, isoleucine, and tyrosine decreased. After the 12-month follow-up, the total protein and albumin concentrations decreased [14].

Loss of skeletal muscle (constitutes the largest protein/amino acid pool in the body) in patients who have undergone gastric bypass is a consistent observation and has important implications in health and disease. A balance between the rates of muscle protein synthesis and breakdown sustains a given level of muscle protein. So a reduced rate of protein synthesis is implicated in the loss of muscle after gastric bypass [15].

This study is the first review that evaluates protein status before and after bariatric surgery. All eligible articles were recruited through a comprehensive search of databases. However, there are still some limitations that should be taken into account. The exact level of serum protein, as well as protein intake, should be analyzed and reported. Also, the small number of included studies and participants might influence the overall effect size dimension. The included studies were not performed in developed countries.

5. Conclusion

Overall, low preoperative and postoperative protein intake is a modifiable risk factor and leads to FFM loss after SG. Based on our results, dietary intake can affect the outcome of surgery. So, we recommended evaluating protein status and lean body mass before and following the bariatric surgery. Also, the effect of different types of protein supplementation to improve body composition can be assessed in further studies.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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