Research on the effects of weight reduction on gut microbiota diversity in post-bariatric patients

Heloí Bruna Ribeiro de Melo

Anderson Barbosa Baptista

ABSTRACT

Obesity has been studied as a worldwide epidemic in constant growth in recent decades. Bariatric surgery, in its various modalities, offers better life prospects for these patients. Basically these surgeries reduce the capacity of the gastric volume, controlling the food intake and consequently the weight reduction. Good habits can arise after weight loss, such as physical activity practices and balanced diet. This new lifestyle, and the remission of possible comorbidities associated with obesity, can alter the gut microbiota. The symbiotic relationship between these bacteria residing in the Gastrointestinal Tract (GIT), offer several benefits to man, such as: protection against infections, blocking colonization of pathogenic bacteria, pH control, enzymatic activities, absorption of nutrients such as ions and action in the production of some vitamins.

Keywords: Gut microbiota, Bariatric surgery, Bacterial resistance.

1 INTRODUCTION

Obesity has been studied as a worldwide epidemic in constant growth in recent decades. Bariatric surgery, in its various modalities, offers better life prospects for these patients. Basically these surgeries reduce the capacity of the gastric volume, controlling the food intake and consequently the weight reduction. Good habits can arise after weight loss, such as physical activity practices and balanced diet. This new lifestyle, and the remission of possible comorbidities associated with obesity, can alter the gut microbiota. The symbiotic relationship between these bacteria residing in the Gastrointestinal Tract (GIT), offer several benefits to man, such as: protection against infections, blocking colonization of pathogenic bacteria, pH control, enzymatic activities, absorption of nutrients such as ions and action in the production of some vitamins. When dysbiosis occurs, that is, the imbalance of this ecological relationship, problems for the health of the host may arise. Thus, it is necessary to understand how these relationships are influenced by weight reduction. From this understanding, it is possible to discuss new post-surgical care protocols with patients who seek this treatment for weight reduction. Based on this context presented above, the objective of this study is to elucidate the alterations of the intestinal microbiota of patients who have undergone weight reduction through bariatric surgery.

2 MATERIALS AND METHODS

This is an integrative literature review in the period between 2009 and 2023. The databases Elsevier, Periódicos da CAPES, PubMed and Springer were used. Descriptors used: "bariatric surgery", "weight reduction", "gastrointestinal microbiota", "*bariatric surgery*", *"weight loss"*, *"gastrointestinal microbiome"*. Inclusion criteria: human studies, case studies and systematic review articles of literature published in Portuguese and English. Exclusion criteria: animal studies, dissertation work, monographs and course completion.

3 RESULTS AND DISCUSSION

From the definition of the databases and the selected descriptors, 102 articles were found. After applying the inclusion and exclusion criteria, 17 studies were considered for analysis. A single study showed disadvantages in microbiota changes. The other 16 studies presented the advantages and positive points of these alterations of the colonization of bacteria in the TGI.

Obesity has been linked to a higher risk of cardiovascular disease, low-grade inflammation, as well as several chronic diseases, such as type 2 diabetes and high blood pressure. Bariatric surgery arises in this context, as an option for weight reduction and consequently the improvement of these comorbidities. Consider that the bacterial population, in addition to being altered in obese individuals (dysbiosis), has the potential to influence the pathogenesis of obesity (MARTINS; et. al, 2018). Gentile *et. al* (2022) point out that weight reduction and improvement in the imbalance of the TGI microbiota can promote the reversibility of these comorbidities, increasing life expectancy.

Obesity is associated with changes in the composition of the gut microbiota and decline in the diversity and genetic richness of the microbiota. Phyla of gut bacteria, such as *Bacteroidetes* and *Firmicutes*, showed the greatest changes in obese people compared to lean controls. The obese patient has an intestinal microbiota with distinct characteristics, such as low richness of microbial genes and compositional and functional changes. (EJTAHED *et. al* 2016; ZHANG *et. al* 2009; QUEVRAIN *et. al* 2016).

Weight reduction as a possibility of rescuing the composition and functionality of these microorganisms. According to him, bariatric surgery is linked to beneficial results in reducing weight and improving metabolic functions (DAMMS-MACHADO, *et al* 2015; OSLAND, *et al* 2017; DEBÉDAD, *et al* 2019; WANG Z, *et al* 2011).

Coimbra *et. al* (2022) consider that the recovery of the composition of the TGI microbiota is a factor associated with metabolic improvements and even success in maintaining lost weight. He and his collaborators report that the type of surgical technique may influence the time of this recovery of the TGI microbiota. Gastric *bypass* consists of the reduction of the stomach and diversion of intestinal transit.

Already the *Sleeve technique, the* surgical manipulation happens only in the reduction of the size of the stomach, maintaining the anatomical and functional characteristics of the intestine. According to them, patients who underwent *gastric bypass* had a higher proportion of growth of *Actinobacteria*, which help protect against pathogenic bacteria, as well as contribute to food digestion and maintenance of the intestinal barrier. In the recovery of *Bacteroidetes that* helps in the modulation of the immune system and *Firmicutes*, bacteria that help in metabolism, both techniques showed similar results.

Lee *et. al*, (2019) also present differences of these changes according to the surgical technique. The relative abundance of *Faecalibacterium prausnitzii*, which improves the intestinal barrier and has inflammatory properties, was higher in patients undergoing *gastric bypass.*

Cavalcanti *et. al* (2021) add that it is likely that the greatest success of the *bypass* technique is because the proteobacteria are less translocated into the blood, and remain in larger quantities in the gut. After gastric *bypass*, the intestinal pH is also modified, inducing the oxidation potential in the intestine and probably affecting the facultative anaerobic phyla.

Pajecki *et. al* (2019) observed that in addition to the surgical technique, the amount of reduced weight can also influence changes in the TGI microbiota. According to him, when observing post-bariatric patients for 15 months, 55.9% had considerable weight loss. All of them had population reduction of *Proteobacteria*, microorganisms associated with malabsorption of nutrients and diarrhea. But people who had little weight reduction did not show significant increases in *Firmicutes* and *Bacteriodetes.*

Costa *et. al*, (2021), elaborated their study with emphasis on the negative effect of microbiota modifications, adding that the remission of comorbidities with weight loss and gastroplasty can cause food intolerance. Anatomical reorganization and reduction of hydrochloric acid can reduce microbial diversity, favoring the overgrowth of resistant bacteria. This dysbiosis causes fragility in the intestinal mucosa, reducing this barrier against infections. Also according to the quantitative cross-sectional study, with 32 post-bariatric patients, 43% reported, through the application of a questionnaire, some type of food intolerance, with episodes of vomiting and diarrhea.

This permeability of the intestinal mucosa in the obese may also have benefits for the patient. Their findings state that the variations occurred over 1 year, to a greater or lesser degree, according to the type of surgical technique. This permeability caused the reduction of bacteria of the Phylum *Proteobacteriae*, which consequently caused the increase of *A. muciniphila, a* bacterium that promotes the reduction of adiposity, decrease in the synthesis of fatty acids, in addition to improving glucose tolerance (DAO, et al., 2019; TREMAROLI, 2015;)

No comparative studies were observed between people who lost weight through surgery and people who had weight reduction only by low-calorie diets. In addition, all studies, whether randomized, clinical

or systematic reviews, used a period of 3 to 15 months between surgical procedures and data collection. In this case, no studies with post-bariatric patients for long periods of time were mentioned.

4 FINAL CONSIDERATIONS

In all the studies analyzed, it was presented the difficulty of the researchers to reach a consensus on the mechanisms of changes in the bacterial population as weight reduction occurs. In this sense, findings related only to the consequences of weight reduction on the TGI microbiota were presented. The researchers emphasize that they emphasize that bariatric surgery should be the last method for weight control, in addition, individual efforts are required to obtain positive results with surgery. The studies are still recent, non-standardized and inconclusive on this subject. No comparative studies were found between groups that reduced weight through bariatric surgery and groups that underwent only low-calorie diets. It was evidenced that this theme is complex and relevant for the adequate management of these post-operative patients. Based on more conclusive studies on the subject, it will be possible to adapt care protocols for obese patients. For this, all future tests must be standardized in order to be reproduced on a larger scale, for the purpose of scientific proof.

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