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Review Article

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Effects of Bariatric Surgery on the Consumption of Sweets and Fatty Foods by Patients in their Pre and Postoperative Period

Efeitos da Cirurgia Bariátrica no Consumo de Doces e Alimentos Gordurosos por Pacientes em seu Período Pré e Pós-Operatório

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Abstract
INTRODUCTION: Patients undergoing bariatric surgery (CB) report changes in their eating behaviors that may arise from behavioral, anatomical, and neuroendocrine causes resulting from the impact of the surgery. However, there is no consensus in the scientific literature on the impacts of BC on eating behaviors specifically associated with the consumption of high-calorie foods. OBJECTIVE: To analyze the scientific production that discusses the association between consumption of foods with high energy density by patients and their respective periods of pre or postoperative BC. MATERIALS AND METHODS: Integrative literature review performed in SciELO, Medline, and Lilacs databases. Data collection took place between March and June 2020. For the analysis of this study, articles published after 2015 with research proposals in line with the objective of this research were considered. **Duplicate articles between the databases, dissertations, theses, monographs, academic abstracts, and gray literature were excluded from the analysis.** RESULTS: The initial sample of articles with the application of the inclusion and exclusion criteria were 114 articles. After selecting manuscripts that met the scope of this review, the total number of works selected for the study of its content was 33 articles. CONCLUSIONS: The articles indicate that the change in consumption of sweets and fatty foods in the preoperative period is due to behavioral changes aimed at weight loss. However, after BC, the reduction in the consumption of these foods with high energy density may be associated with intestinal neuroendocrine alterations related to satiety, as well as a reduction in the palatability of these food groups.
Keywords: nutritional assessment; obesity management; feeding behaviour.

Resumo
INTRODUÇÃO: Pacientes submetidos à cirurgia bariátrica (CB) relatam alterações em seus comportamentos alimentares que podem advir de causas comportamentais, anatômicas e neuro endócrinas decorrentes dos impactos da cirurgia. Entretanto, não há consenso na literatura científica sobre os impactos da CB nos comportamentos alimentares associados,

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especificamente, ao consumo de alimentos muito calóricos. OBJETIVO: Analisar a produção científica que discorra acerca da associação entre consumo de alimentos com alta densidade energética por pacientes e seus respectivos períodos de pré ou pós operatório da CB. MATERIAIS E MÉTODOS: Revisão integrativa de literatura realizada nas bases de dados SciELO, Medline e Lilacs. A coleta de dados ocorreu entre março à junho de 2020. Foram considerados, para análise deste estudo, artigos publicados após 2015 com propostas de investigação consonantes com o objetivo desta pesquisa. **Foram excluídos da análise artigos duplicados entre as bases de dados, dissertações, teses, monografias, resumos acadêmicos e literatura cinza.** RESULTADOS: A amostra inicial de artigos com aplicação dos critérios de inclusão e exclusão foi de 114 artigos. Após seleção buscando manuscritos que atendessem ao escopo dessa revisão, o número total de trabalhos selecionados para estudo do seu conteúdo foi de 33 artigos. CONCLUSÕES: Os artigos indicam que a alteração de consumo de doces e alimentos gordurosos em período pré-operatório decorre de alterações comportamentais visando perda de peso. Entretanto, após a CB, a redução do consumo desses alimentos com alta densidade energética pode estar associada a alterações neuro endócrinas intestinais relacionadas à saciedade, bem como redução na palatabilidade desses grupos alimentares.
Palavras-chave: avaliação nutricional; manejo da obesidade; comportamento alimentar**.**

Introduction

Obesity is classified as a disease resulting from the excessive accumulation of body fat[1]. It is mainly caused by a food intake greater than the individual's actual energy need[2]. In addition, obesity is a risk factor for the development of other non-communicable chronic diseases[2].

Bariatric surgery (BS) is one of the options available for treating obesity. However, despite the current strategies for treating the disease, there is a possibility of its recurrence over the years[3]. One explanation for this would be the inadequate eating habits of patients after the surgical procedure[4].

Researchers report that some of the obese individuals who are candidates for BS have difficulties in changing their eating habits[5]. Some patients, in the postoperative period of BS, consume milk, fats and sweets in inadequate amounts. Milk is ingested at values below the recommended[6]. Foods rich in fat[7,8], sweets[9] and carbohydrates[7] are consumed in amounts above the recommended.

Excessive consumption of sweets and fats by patients after BS has multifactorial causes[10]. Some researchers claim that the high consumption of sweets may come from eating habits prior to surgery. Others, that after BS, there is no change in the palatability of sweets among patients that would justify the increase or reduction in their consumption[11,12]. The high consumption of fats among these individuals could be due to the performance of small-volume meals after the BS. Fat consumption, on the other hand, has been associated with a lower feeling of satiety among patients[13].

Despite the existence of research on the eating habits of patients after BS, the intake of specific food groups, such as sweets and fatty foods, by these individuals, needs to be better studied. This, with a view to promoting a better understanding of the consequences of BS on palatability, neurohormonal regulation of satiety and binge eating for more caloric foods[14]. In this sense, conducting further investigations in the area can help propose adequate dietary guidelines for these patients. Aiming at the loss and maintenance of body weight before and after BS[15].

In light of the above, the hypothesis of the present study is that there is an association between the pattern of consumption of sweets and fatty foods by obese patients and their respective pre- and postoperative periods of BS. Thus, the objective of this study was to analyze the scientific production that discusses the association between consumption of foods with high energy density by patients and their respective periods of pre or postoperative bariatric surgery.

Materials e Methods

This study used an integrative literature review methodology, seeking to answer the following guiding question: "Is there an association between the consumption of foods with high energy density by patients and their

respective periods of pre- or postoperative period of bariatric surgery?".

To solve the research's problem, the steps proposed by Cooper16 for conducting integrative reviews were followed: I) establishment of an investigation hypothesis; II) construction of database; III) evaluation of articles; IV) analysis and interpretation of articles; V) presentation.

The databases in which the search was performed were: Scientific Electronic Library Online (SciELO), Online Medical Literature Analysis and Retrieval System (Medline) and Latin American Literature in Health Sciences (Lilacs). Data collection took place between March and June 2020.

The terms used to carry out this literature review were understood by descriptors available in the Virtual Health Library, Descriptors in Health Sciences (BVS, 2020), researched in English and Portuguese. Among these, the following were used: Food Behavior; Obesity; Bariatric surgery; Pre-Operative Period; Post-Operative Period; Weight gain; Candy; Unsaturated Fats. In addition, Boolean Operators were used to establish interaction between descriptors in the search for scientific articles in the databases.

Inclusion criteria for this study were: articles published in peer-reviewed journals; studies published in Portuguese and English, between 2015 and 2020, with study methodologies of the experimental and quasi-experimental research type or systematic reviews with an investigation proposal in line with the problem-question of this integrative review. The exclusion criteria were: articles already selected in one of the databases and present in another, materials comprised by scientific abstracts, monographs, dissertations or theses, as well as publications characterized as gray literature, according to the definition of this term put forward by Scott- Findlay and Estabrooks[17].

The synthesis of the collected material was arranged in tables with columns specifying the author of the work, objective, methodology used, main results and conclusions. This same stage of the research was carried out by two researchers who, in the end, carried out a comparative analysis between the tables constructed by both.

Finally, the articles suitable for the study were evaluated through descriptive analysis for integrative reviews proposed by Broome[18]. Then, the data collected was categorized into distinct groups that respected consonant themes.

The construction of tables and figures in this work was performed using the Microsoft Office Excel 2016 software.

This research does not require the approval of Research Ethics Committees (REP) because it uses information available in scientific databases for public consultation[19].

Results

The search in the three databases, as the first stage of the study, resulted in a total initial total sample of 114 articles. Specifically, the SciELO database presented 15 articles after a search with descriptors, after analysis, 8 met the inclusion criteria and 7 were excluded. Similarly, in the Lilacs database, 26 articles were initially found, 19 met the inclusion criteria and 7 were excluded from the study based on the exclusion criteria. In the MedLine database, 73 articles were initially found with application of the descriptors. Of this total, 45 articles were selected for analysis and 28 were excluded.

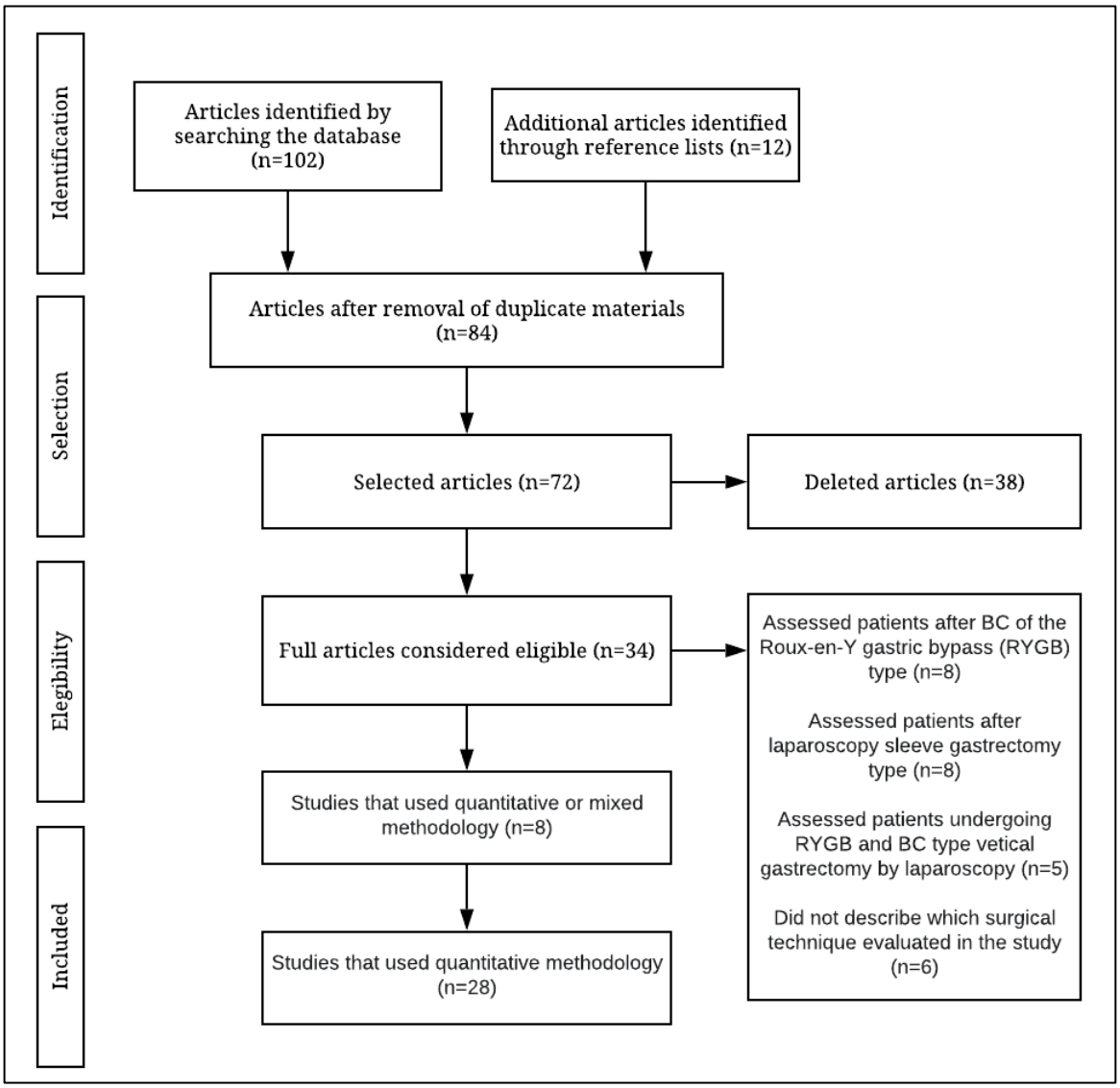

Figure 1 - Flowchart for conducting the integrative review in the SciELO, Medline and Lilacs databases, 2020.
Source: The authors themselves, 2021.

After analyzing the content of the 72 articles selected in the first stage, the final sample of articles from the three databases that met the study criteria for this integrative review was 33 articles in Portuguese and English. The material selection flowchart is shown in Figure 1.

Table 1. Identification of articles according to title, author(s), objective(s), main results and year of publication, 2020.

Article	Title	Authorship	Goals	Results	Year
1	Evaluation of the nutritional status of postoperative patients undergoing bariatric surgery.	Leão, L. L.; Abrantes, A. L. O.; Gonçalves, R. V.; De Souza, S. A.; Soares, L. J.	"Evaluating the nutritional aspects of patients undergoing bariatric surgery in a private clinic in Montes Claros-MG"	75% of patients after BC reported consuming skimmed milk.	2018

		F.; Farias, P. K. S.			
2	Food Profile of Post Bariatric Surgery Patients	Paixão, A. L.; Lourenço, V. V.; Dias, J. S.; Nogueira, A. A. C.	"Knowing the dietary profile of patients after bariatric surgery in a private clinic in Belém-PA"	66.7% of patients after BC reported consuming skim-type milk daily.	2018
3	Weight regain after bariatric surgery: assessment of the nutritional profile of patients who are candidates for the endoscopic argon plasma procedure.	Cambi, M. P. C.; Marchesini, S. D. e Baretta, G. A. P.	"To investigate in patients undergoing Roux-en-Y gastroplasty the relapse of weight, nutritional deficiencies [...]"	There is a high consumption of sweets at values above the recommended among patients in the postoperative period of BC"	2015
4	*Analysis of the Association between Eating Behaviors and Weight Loss after Laparoscopic Sleeve Gastrectomy*	Nikiforova, I.; Barnea, R.; Azulai S. e Susmallian, S.	"Exploring the influence of abnormal eating habits on the outcome of sleeve gastrectomy."	There is consumption of sweets at values above the recommended among patients in the postoperative period of BC	2019
5	*Effect of Preoperative Eating Patterns and Preoperative Weight Loss on the Short- and Mid-term Weight Loss Results of Sleeve Gastrectomy*	Ruiz-Tovar et al.	"[...] to evaluate the effect of different preoperative dietary patterns and adherence to a preoperative diet on short- and medium-term postoperative weight loss."	There is consumption of sweets at values above recommended among patients in the postoperative period of BC.	2015
6	*Influence of nutrition on somatotropic axis: Milk consumption in adult individuals with moderate-severe obesity.*	Barrea et al.	"[...] to assess milk consumption through the 7-day food record in obese individuals".	Most BC candidates reported consuming low-fat dairy products.	2015
7	*Dairy consumption in association with weight change and risk of becoming overweight or obese in middle-aged and older women: a prospective cohort study.*	Rautiainen, S.; Wang, L.; Lee, I.-M.; Manson, J. E.; Buring, J. E.; Sesso, H. D.	"[...] prospectively investigate how the intake of dairy products is associated with weight change and risk of overweight or obesity in women"	Most of the bariatric surgery candidates evaluated reported consuming low-fat dairy products.	2016

8	*Hedonic changes in food choices following Roux-en-Y gastric bypass*	Hansen, T. T.; Jakobsen, T. A.; Nielsen, M. S.; Sjödin, A.; Le Roux, C. W.; Schmidt, J. B.	"summarize and discuss the scientific literature investigating different measures to evaluate shifts in drive to highly palatable foods after BC"	"There is a tendency for patients to reduce their consumption of very palatable and energy-dense foods after BFB type RYGB"	2016
9	Behavioral Modifications between the Pre and Post-Operative Period of Bariatric Patients	Justino, Y. A. C.; Tatagiba, T. N. B.; Pogian, L. P.; Pimentel, F. C.	"discuss the function of eating in the subject's life before BC"	Patients who reinforced pleasurable characteristics of food taste in their report of food consumption pattern were more likely to consume them more after CB. Example: "I just wanted to know how to eat [...] lasagna, chocolate, candy, pizza."	2018
10	*Bariatric Surgery Leads to Short-Term Effects on Sweet Taste Sensitivity and Hedonic Evaluation of Fatty Food Stimuli*	Nielsen, M. S.; Andersen, I.; Lange, B. et al.	"[...] investigate the effect of bariatric surgery on sweet taste sensitivity and hedonic assessment of sweet, salty and fatty food stimuli"	"The detection threshold for sweet taste decreased after diet-induced weight loss and 6 weeks after RYGB (both P≤0.03)."	2019
11	*Taste and odor preferences following Roux-en-Y surgery in humans*	Kittrell, H.; Graber, W.; Mariani, E.; Czaja, K.; Hajnal, A.; Di Lorenzo, P. M.	"[...] to determine the relationship between changes in taste and odor preferences and successful weight loss after bariatric surgery".	"The results revealed a shift in the preference for foods with fewer calories."	2018
12	*Predictors of lowest weight and long-term weight regain among Roux-en-Y gastric bypass patients.*	Yanos et al.	"[...] evaluate the relationship of well documented (eg health, diet, physical activity) after BC"	Non-adherence to healthy nutritional guidelines is associated with weight regain after BC	2015
13	*Associations between Weight Loss, Food Likes, Dietary Behaviors, and Chemosensory Function in Bariatric Surgery: A Case-Control Analysis in Women.*	Hubert, P. A.; Papasavas, P.; Stone, A. et al	"[...] to compare the chemosensory function, food taste and eating behaviors in morbidly obese women before bariatric surgery and those 1 year after bariatric surgery [...]".	"We showed a reduction in the taste of sweetness in the candy probe and with the taste of sweets and sweet drinks (ie, unhealthy foods), as well as significant correlations between sample sweet taste and	2019

				sweet (sweet) and spicy taste or tasty foods (spicy sweets)."	
14	*Alteration Pattern of Taste Perception After Bariatric Surgery: A Systematic Review of Four Taste Domains*	Shoar, S.; Naderan, M.; Shoar, N.; Modukuru, V.R.; Mahmoodzadeh, H.	"[...] to study the pattern of change in the perception of four taste domains after different bariatric procedures".	"Our study showed that bariatric surgery is associated with a significant change in the sensitivity of the four domains of taste, especially salt taste, sweetness and acidity."	2019
15	*Taste Changes after Bariatric Surgery: a Systematic Review.*	Ahmed, K.; Penney, N.; Darzi, A.; Purkayastha, S.	"[...] identify all articles that investigate taste, olfaction and sensory perception in animal and human studies, after bariatric procedures."	"The taste sensitivity to sweet and greasy stimuli seems to increase postoperatively. In addition, patients also have a reduced hedonic response to these stimuli."	2018
16	*Food preferences and underlying mechanisms after bariatric surgery.*	Behary, P.; Miras, A.D.	"[...] explore changes in food preferences as a new mechanism that contributes to weight loss, and also focus on the underlying processes that modulate eating behavior after bariatric surgery."	"Patients after gastric bypass are less hungry and prefer healthier food options. They develop an increased acuity to the sweet taste, which is perceived as more intense. Intestinal hormones can be the mediators of these changes [...]"	2015
17	*Long-Term Modulation of Appetitive Hormones and Sweet Cravings After Adjustable Gastric Banding and Roux-en-Y Gastric Bypass*	Tsouristakis, A.I.; Febres, G., McMahon, D.J. et al .	"[...] to quantify the hormonal changes that regulate energy homeostasis and appetitive sensations before and after LAGB (n = 18) and RYGB (n = 38), in order to better understand the mechanisms underlying greater weight loss after the RYGB".	"Sweet cravings decreased after CYR-type BC."	2019
18	*Shifts in Food Preferences After Bariatric Surgery: Observational Reports and*	Kapoor, N.; Al-Najim, W.; le Roux, C.W.; Docherty, N.G.	"[...] review the available literature that documents changes in food preference in humans and	"Obesity is associated with a growing preference for sweet and high-fat foods.	2017

	Proposed Mechanisms.		experimental animals after RYGB and discusses current theory about the underlying mechanisms involved."	This changes after the BC"	
19	*Changes in Dietary Intake and Eating Behavior in Adolescents After Bariatric Surgery: an Ancillary Study to the Teen-LABS Consortium.*	Sarwer, D.B.; Dilks, R.J.; Spitzer, J.C. et al.	"[...] to investigate changes in food consumption and eating behavior of adolescents with obesity undergoing bariatric surgery (n = 119) or lifestyle modification (n = 169)."	"After bariatric surgery, greater weight loss between 6 and 12 months post-operatively was associated with self-reported awareness of craving for sweets and zinc consumption."	2017
20	*Altered neural responsivity to food cues in relation to food preferences, but not appetite-related hormone concentrations after RYGB-surgery.*	Zoon, H.F.A; de Bruijn, S.E.M; Smeets, P.A.M. et al.	"[...] to elucidate the potential mechanisms underlying this change in food preferences, evaluating changes in neural responses to food images and odors before and after RYGB."	"Patients demonstrated a shift in food preferences from high-fat/sweet foods and low-energy/salty foods, which correlated with decreased upper parietal lobe responsiveness to food odor"	2018
21	*Dopamine Links Gastrointestinal Rerouting to Altered Sweet Appetite.*	Han, W.; Tellez, L.A.; Niu, J. et al.	"[...] show that a duodenal-jejunal bypass (DJB) intervention inhibits maladaptive sweet appetite, acting on dopamine-responsive striatal circuits"	"The DJB disrupted the ability of recurrent sugar exposure by promoting sweet appetite in sated animals, thus revealing a link between recurrent duodenal sugar influx and inadequate sweet intake. Our findings point to a causal link between striatal dopamine signaling and the outcomes of bariatric interventions."	2016
22	*Changes in taste function and ingestive behavior following bariatric surgery.*	Nance, K.; Acevedo, M.B.; Pepino, M.Y.	"[...] summarize the literature on changes in taste function and ingestive behavior after RYGB type CB."	"We found that studies using surveys and questionnaires generally find that individuals report changes in taste and decrease their preferences and cravings for high	2020

				energy foods (especially sweets and fats)"	
23	*Taste, Enjoyment, and Desire of Flavors Change After Sleeve Gastrectomy-Short Term Results.*	Van Vuuren, M.A.J; Strodl, E., White, K.M., Lockie, P.D.	"[...] to investigate the satisfaction with eating and the change in the perception of taste, desire and appreciation of the taste changes after BC"	"Most participants reported an increase in the intensity of sweet flavor (60, 55%) and associated with fatty foods (57, 70%). Participants also reported a decrease in enjoyment of sweet flavors (77, 61%)"	2017
24	*The Effect of Roux-en-Y Gastric Bypass and Sleeve Gastrectomy Surgery on Dietary Intake, Food Preferences, and Gastrointestinal Symptoms in Post-Surgical Morbidly Obese Lebanese Subjects: A Cross-Sectional Pilot Study.*	El Labban, S.; Safadi, B.; Olabi, A.	"[...] retrospectively compare food intake, food preferences and gastrointestinal symptoms in individuals with extreme obesity after Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG)."	"There were no major differences in food intake and food preferences between groups. There was a tendency to eat sweets in individuals with GS, with fewer symptoms of dumping, suggesting different mechanisms of action for each procedure, which can affect eating behavior."	2015
25	*The Relationship Between Bariatric Surgery and Diet Quality: a Systematic Review*	Zarshenas, N., Tapsell, L.C., Neale, E.P., Batterham, M., e Talbot, M. L.	"[...] examine the relationship between bariatric surgery and diet quality at least 1 year after surgery."	High-fat foods are consumed in amounts above what is recommended after BC.	2020
26	*Taste-related reward is associated with weight loss following bariatric surgery*	Smith, K.R.; Papantoni, A.; Veldhuizen, M.G. et al.	"[...] investigate changes in taste preferences and brain responses induced by taste after Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (VSG) and identify potential predictors related to taste-related weight loss. "	"The anatomical and/or metabolic changes associated with RYGB can "effectively redefine" the neural processing of reward stimuli, thus rescuing the forceful activation in the mesolimbic pathway found in patients with obesity. Furthermore, these findings suggest that RYGB may be particularly effective in patients with a	2020

				preference for sweet foods.”	
27	*Effects of Sleeve Gastrectomy vs. Roux-en-Y Gastric Bypass on Eating Behavior and Sweet Taste Perception in Subjects with Obesity.*	Nance, K.; Eagon, J.C.; Klein, S.; Pepino, M.Y.	"[...] test the hypothesis that weight loss induced by BC RYGB type has greater effects on taste perception and eating behavior than sleeve gastrectomy (GV) type BC."	“We found that both types of surgery do not affect sweetness or salinity sensitivity. However, weight loss induced by BC RYGB or GV caused the same decrease in: (1) frequency of food cravings; (2) influence of emotions and external food signals on eating behavior; and (3) change in the palatability of sweetness from pleasant to unpleasant [...]”	2017
28	*Link Between Increased Satiety Gut Hormones and Reduced Food Reward After Gastric Bypass Surgery for Obesity.*	Goldstone, A.P.; Miras, A.D.; Scholtz, S. et al.	“[...] to investigate the role of the elevation of intestinal satiety hormones after CB of the RYGB type, in the food reward circuit”	"Improved gut satiety hormone responses after RYGB-type CB may be a causal mechanism by which anatomical bowel changes in obesity surgeries modify behavioral and brain reward responses to food."	2016
29	*Poor Health Behaviors Prior to Laparoscopic Sleeve Gastrectomy Surgery*	Oved, I.; Vaiman, I.M.;, Hod, K.; Mardy-Tilbor, L.; Torban, Y.; Sherf Dagan, S.	“[...] to assess eating behaviors and lifestyle trends among candidates for laparoscopy sleeve gastrectomy (LSG) and compare these trends between the sexes.”	"High occurrence of unhealthy eating habits and an inactive lifestyle were detected in morbidly obese candidates for LSG surgery."	2017
30	*Roux-En-Y Gastric Bypass and Sleeve Gastrectomy Does Not Affect Food Preferences When Assessed by an Ad libitum Buffet Meal.*	Nielsen, M.S.; Christensen B.J.; Ritz, C. et al.	"[...] investigate whether surgery with RYGB and SG leads to changes in food preferences"	“The reduction in energy intake after RYGB and SG surgery and subsequent weight loss appear to be primarily related to a reduction in portion	2017

				sizes and not to changes in food preferences towards less energy-dense foods. These results underscore the need to investigate eating behavior with a view to direct behavior.”	
31	*Food cravings and food consumption after Roux-en-Y gastric bypass versus cholecystectomy.*	Sudan, R.; Sudan, R.; Lyden, E., Thompson, J.S.	“[...] to study the cravings for foods with high energy density in patients after BC of the RYGB type and compare them with patients with cholecystectomy (CC) control”	“These findings indicate that RYGB-type CB may limit food consumption, but it does not affect the desire to consume certain types of foods. As food cravings are high in obese patients before surgery and remain high after surgery, these findings suggest a possible reason for non-compliance with dietary recommendations after BC.”	2017
32	*Food Intake and Changes in Eating Behavior After Laparoscopic Sleeve Gastrectomy*	Coluzzi, I.; Raparelli, L.; Guarnacci, L. et al.	“[...] to evaluate changes in caloric and macronutrient intake after LSG and the relationship between changes in taste and food tolerance over 2 years.”	"LSG reduced caloric intake both by the volume of food and the caloric density of the food consumed."	2016
33	*Effect of Roux-en-Y gastric bypass and sleeve gastrectomy on taste acuity and sweetness acceptability in postsurgical subjects.*	El Labban, S.; Safadi, B.; Olabi, A.	“[...] retrospectively compare the taste acuity and acceptability of sweetness after Roux-en-Y gastric bypass and sleeve gastrectomy.”	“The sour threshold was significantly higher among individuals who underwent Roux-en-Y gastric bypass (P = 0.0045). No other differences were obtained for the other thresholds or sweetness acceptability"	2016

Most articles were published in English between 2016 and 2017. Of the articles selected for analysis, 4 (12.12%) of them are the result of research conducted and published in journals in Brazil and 29 (87.87%) of them are published research. in English. Regarding the year of publication, 6 (18.18%) were published in 2015, 7 (21.21%) in 2016, 7 (20.58%) in 2017, 5 (15.5%) in 2018, 5 (15.5%) in 2019 and 3 (9.09%) in 2020.

When analyzing the methodology, most of the researches used quantitative investigation without describing, precisely, the statistical test used. Numerically, 28 (82.35%) studies employed a quantitative methodology in their investigation, 4 (12.12%) qualitative and 4 (12.12%) mixed. Regarding the statistical analysis performed, 9 (27.27%) articles used the Chi-Square Test, 6 (18.18%) the Pearson Correlation, 2 (5.88%) the ANOVA test, 5 (15.5%) the Mann–Whitney Test and 10 (30.30%) did not mention the statistical test used.

Most studies have evaluated the impact of Roux-en-Y gastric bypass BS (RYGB) on patients' food consumption. In this sense, 15 (45.6%) studies evaluated RYGB surgery, 8 (24.24%) laparoscopy sleeve gastrectomy, 5 (15.5%) both and 5 (15.5%) did not report the type of surgical technique evaluated.

Discussion

Initially, the findings of this literature review reinforced the existence of numerous studies in the scientific literature that support the existence of an association between consumption of foods with high energy density by patients and their respective pre- or postoperative periods of bariatric surgery (BS) . Specifically, the results found here indicate that Roux-en-Y gastric bypass (RYGB) BS type has been the modality most associated with changes in eating behaviors. Comparing the findings of this integrative review with other similar works, it appears that this observation was also verified by other researchers[35 14].

The articles analyzed support that the most altered eating behavior before BS among patients who are candidates for surgery was to reduce the consumption of high energy density foods aiming at weight loss in order to fulfill the prerequisites for performing the various types of BS. Other researchers have also reported an increase in the adoption of healthy eating habits by patients in the preoperative period of BS[32]. However, these habits are adopted by motivating weight loss, not by reducing the desire to consume these food groups. In other words, the adoption of new eating habits is not justified, in the studies analyzed, by reported patient's taste changes [32].

Other studies indicate that patients candidates for BS also report consuming dairy products with low fat content[25 26]. This dietary pattern may replace the consumption of high energy density beverages[25 26]. In this bias, it is possible that these patients report consuming dairy products skimmed or semi-skimmed for being in a period of change in their eating habits aiming at weight loss. Thus, this eating habit does not necessarily come from a period prior to the preoperative period of BS.

In contrast, after BS, the most common change in eating behavior reported by patients in the studies analyzed was the reduction in the consumption of foods with high energy density in association with the reduction in their palatability. There are reports in the scientific literature of a reduction in the taste perception of patients by very palatable foods, such as sweets. This, especially, in periods of marked weight loss or in the recent postoperative period[49]. As an example, up to 6 months since the performance of BS[49]. In this context, some studies that used tests carried out with sucrose solutions indicated that, after CB, there was a reduction in the perception of the solution to the taste of patients. It is important to note that this finding may be an important mechanism to boost weight loss after surgery[24]. In this scenario, it is known that the BS of the RYGB type results in a more accentuated reduction of food impulses among patients in their postoperative period [49].

It should be noted, however, that after RYGB BS, patients are submitted to a liquid diet for at least two weeks. Thus, the eating behavior of patients in this immediate postoperative period should be critically evaluated[49].

Another aspect is that the food preferences of patients undergoing BS for foods with high fat content decreased after surgery. This finding was associated with a reduced neural response of the parietal lobe of these individuals to the odors of fatty foods[25]. In addition, there are indications that individuals submitted to BS present more acute responses to intestinal satiety hormones after food ingestion. Therefore, reward neurohormonal alterations after food consumption may justify the lower intake of obesogenic foods in the postoperative period[46].

Despite this, other studies indicate that reduced consumption of some food groups is related to a decrease in food portion sizes after BS. This is due to the decrease in the gastrointestinal tract, which no longer holds large volumes of food[27 49]. In this sense, these researchers advise caution in interpreting the taste changes reported by patients after surgery, especially those linked to RYGB BS.

Conclusion

Differences were identified between the consumption of foods with high energy density by BS candidates and their respective pre- or postoperative periods. The articles analyzed indicated that the changes in the eating pattern of patients in the preoperative period of BS are mainly due to the change in eating habits typical of that period. These, aiming at weight loss before surgery through healthy eating habits. On the other hand, changes in dietary patterns, especially among patients in the postoperative period of BS, are mostly due to body morphophysiological changes secondary to the surgery itself. These, which alter the intestinal neurohormonal regulation responsible for satiety, as well as the palatability of obesogenic foods. Thus, resulting in these patients losing interest in food groups such as sweets and fats.

We consider as a limitation of this study the fact that the methodological quality of the analyzed studies was not evaluated. Furthermore, human behavior has multifactorial causes. More studies are needed to generalize the findings presented here. Therefore, it is suggested that future integrative reviews in the area seek to evaluate studies with application of dietary surveys different from those used in the articles analyzed here, as well as research with late longitudinal follow-up of patients after BS. The improvement of public health indicators in Brazil associated with obesity are results that may come from conducting these investigations.

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