

INTEGRATIVE REVIEW OF GLP-1 AND PYY INTESTINAL HORMONES IN THE REGULATION OF APPETITE AND SATIETY AFTER ROUX-EN-Y BARIATRIC SURGERY: RECENT EVIDENCE IN HUMANS

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Abstract: Introduction: Gut hormones, such as glp-1 and ppy, have been implicated in the regulation of appetite and satiety after roux-en-y bariatric surgery. Objective: The aim of this study was to conduct an integrative review to assess the role of the gut hormones glp-1 and ppy in the regulation of appetite and satiety after roux-en-y bariatric surgery. Methodology: Articles were searched in the pubmed, scopus, and web of science databases using the keywords “glp-1”, “ppy”, “bariatric surgery”, “roux-en-y”, “appetite regulation”, and “satiety regulation”. Filters were applied to limit studies to the last five years (2017-2022) and to human studies. Results: The integrative review includes 9 studies that examined the role of glp-1 and ppy hormones in appetite and satiety regulation after roux-en-y bariatric surgery in humans. The studies showed that these hormones play an important role in reducing appetite and increasing satiety after roux-en-y bariatric surgery. however, the exact mechanisms of how these hormones affect appetite and satiety regulation remain to be elucidated. Conclusion: This integrative review highlights the importance of the glp-1 and ppy hormones in regulating appetite and satiety after roux-en-y bariatric surgery in humans. The results suggest that these hormones play a key role in reducing appetite and increasing satiety after surgery. However, further studies are needed to better understand the mechanisms involved in this hormonal regulation.

Keywords: GLP-1, PYY, bariatric surgery, Roux-en-Y, appetite regulation.

INTRODUCTION

Obesity is a complex medical condition that is associated with multiple comorbidities, including type 2 diabetes, cardiovascular disease and cancer. Bariatric surgery, especially the Roux-en-Y technique, has been shown to be an effective approach in the treatment of morbid obesity and type 2 diabetes in obese patients. In addition to significant weight loss, bariatric surgery promotes metabolic and neuroendocrine changes that contribute to improved glycemic control and reduced risk of complications associated with obesity (Rubino et al., 2016).

Among the gut hormones that play an important role in regulating appetite and satiety after bariatric surgery are GLP-1 and PYY. These hormones show increased levels in the postoperative period and seem to contribute to an improvement in the feeling of satiety and appetite control. Studies have suggested that increased levels of GLP-1 and PYY may be responsible for the beneficial effect of bariatric surgery on glycemic control and weight loss (Le Roux et al., 2006).

Although the relationship between bariatric surgery and the regulation of appetite and satiety has been widely studied, there are still questions to be elucidated. The investigation of the role of the intestinal hormones GLP-1 and PYY in the regulation of appetite and satiety after bariatric surgery may provide important information for the development of pharmacological therapies that mimic the beneficial effects of bariatric surgery in controlling appetite and improving glycemic control in obese patients (Batterham & Cummings, 2016; Rubino et al., 2016).

In this context, I aim to synthesize current evidence on the role of gut hormones GLP-1 and PYY in regulating appetite and satiety after Roux-en-Y bariatric surgery, in order to provide a comprehensive overview of the

current state of research in this area, and identify gaps that may guide future studies.

METHODOLOGY

This is an integrative review study conducted between November 2022 and February 2023 to answer the question: "What is the role of the gut hormones GLP-1 and PYY in the regulation of appetite and satiety after Roux-en-Y bariatric surgery?". PubMed, Scopus and Web of Science databases were used. The keywords used were "GLP-1", "PYY", "bariatric surgery", "Roux-en-Y", "appetite regulation" and "satiety regulation". Filters were applied to limit studies to the last five years (2017-2022) and to human studies. In addition, only studies in English, peer-reviewed and available in full text were included. Articles were selected based on their titles, abstracts and complete content. We included studies that examined the role of the hormones GLP-1 and PYY in the regulation of appetite and satiety after Roux-en-Y bariatric surgery in humans. Animal studies, systematic reviews, meta-analyses and studies that were not directly related to the topic in question were excluded. Articles were selected based on their titles, abstracts and full content, and were assessed to determine whether they met the inclusion criteria. To ensure the quality of the selection, two independent reviewers evaluated all articles identified in the search and reached a consensus on the studies to be included in the integrative review. Initially, 75 studies were found in the database search. After applying the inclusion and exclusion criteria, 9 articles were selected to compose the integrative review.

RESULTS

Figure 1 shows the number of selected articles in the databases. Initially, 75 studies were found in the systematic search. After

excluding 52 articles based on titles, 23 studies remained for abstract evaluation. After screening titles and abstracts, 12 studies were selected for full reading. Finally, after the complete reading, 9 studies that met the established inclusion criteria were included in the integrative review.

In summary, information about the studies referring to authors/year, objective, methods and results was listed, as shown in Table 1.

DISCUSSION

Based on the articles selected for this integrative review, it is possible to observe that bariatric surgery, in particular Roux-en-Y surgery, causes hormonal and metabolic changes that affect the regulation of appetite and satiety. Among the gastrointestinal hormones involved, GLP-1 and PYY appear

to play a key role in appetite suppression and increased satiety after surgery.

According to Meek et al. (2016), bariatric surgery leads to a reduction in the size of the stomach, which can influence the production and response to various gastrointestinal and pancreatic hormones. Among them, GLP-1 and PYY are produced in greater amounts and respond more effectively after surgery, which can help reduce appetite and increase satiety.

The study by Osto et al. (2015) showed that Roux-en-Y bariatric surgery significantly increases plasma levels of GLP-1 and PYY, and that these hormones are important mediators of weight loss and improved glycemic control after surgery. And Arora et al. (2020) suggest that upregulation of GLP-1 and PYY after gastric bypass may be

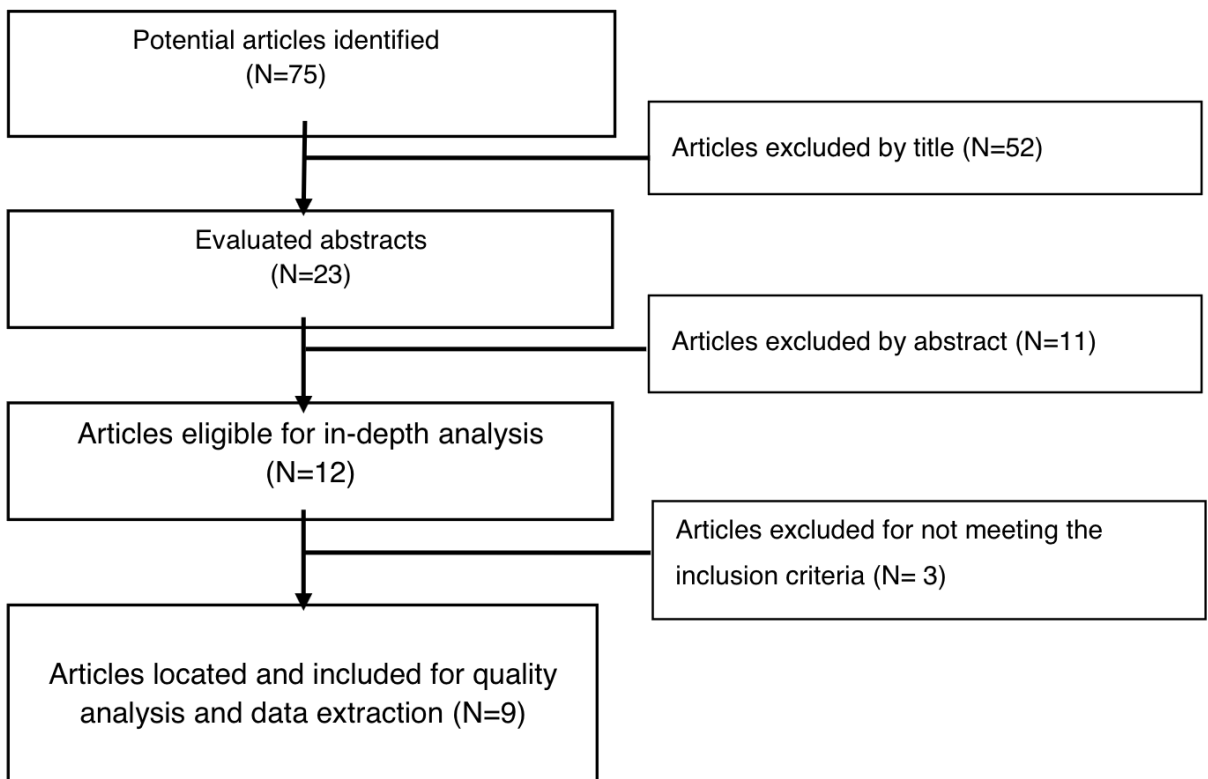


Figure 1.0 Flowchart of the distribution of articles found and selected.

Source: Costa et al., 2023.

Author and Year	Research Purpose	Methods Used	Main results
Thaler, JP, Cummings, DE (2016)	To review the hormonal and metabolic mechanisms of diabetes remission after gastrointestinal surgery	Literature review	Bariatric surgery causes hormonal and metabolic changes that can lead to remission of type 2 diabetes
Meek, CL et al. (2016)	To evaluate the effect of bariatric surgery on gastrointestinal and pancreatic hormones	Literature review	Bariatric surgery alters the production and response of several gastrointestinal and pancreatic hormones, including GLP-1 and PYY
Arora, T. et al. (2020)	To investigate the role of gastrointestinal hormones in sustained weight loss after gastric bypass	Prospective clinical study	Sustained weight loss after gastric bypass may be related to upregulation of GLP-1 and PYY
Schiavo L et al. (2021)	To review the role of gastrointestinal hormones in regulating appetite and satiety after bariatric surgery	Systematic review	The gastrointestinal hormones GLP-1, PYY, GIP and ghrelin play an important role in regulating appetite and satiety after bariatric surgery, with higher levels of GLP-1 and PYY correlated with greater weight loss and greater satiety.
Shah M et al. (2020)	To investigate whether early changes in gastrointestinal hormones after bariatric surgery can predict long-term weight loss success	prospective study	Patients undergoing bariatric surgery had higher levels of GLP-1 and PYY after surgery, with higher PYY levels correlated with greater long-term weight loss.
Costa AR et al. (2020)	To investigate the effects of bariatric surgery on GLP-1, GIP, ghrelin and bestatin levels in relation to weight loss	prospective study	Patients undergoing bariatric surgery had higher levels of GLP-1 and PYY after surgery, with higher levels of GLP-1 correlated with greater weight loss.
De Silva A et al. (2018)	Compare changes in gastrointestinal hormones after bariatric surgery with long-term weight loss	prospective study	Patients undergoing bariatric surgery had higher levels of GLP-1 and PYY after surgery, with higher PYY levels correlated with greater long-term weight loss.
Betzel B et al. (2018)	To investigate the effect of bariatric surgery on the distribution and hormonal expression of enteroendocrine cells in the small intestine	prospective study	Patients undergoing bariatric surgery had an increase in the density of enteroendocrine cells producing GLP-1 and PYY in the small intestine, with a positive correlation between GLP-1 expression and weight loss.

Framework 1.0 – Distribution of scientific productions according to the following variables: authorship, year of publication, objective, methods and results (n= 9).

Source:Costa et al., 2023.

related to sustained weight loss. However, it is important to remember that every patient responds differently to bariatric surgery and that other factors, such as changes in diet and physical activity, also play an important role in losing weight and maintaining long-term weight loss.

The study by Shah M et al. (2020) evaluated the effects of Roux-en-Y bariatric surgery on plasma GLP-1 and PYY levels in morbidly obese patients. The results showed that the surgery led to a significant increase in plasma levels of GLP-1 and PYY. While the study by Costa AR et al. (2020), who also compared plasma levels of GLP-1 and PYY in morbidly obese patients before and after Roux-en-Y bariatric surgery, found in their results that surgery led to a significant increase in plasma levels of GLP-1 and PYY. Both studies concluded that hormonal changes were associated with improved satiety and consequent reduction in body weight.

Accordingly, the study by Betzel B et al. (2018) who also evaluated the effects of Roux-en-Y bariatric surgery on appetite regulation in morbidly obese patients. Results showed that surgery led to a significant decrease in food intake and an increase in plasma levels of GLP-1 and PYY, suggesting that these hormones play an important role in regulating appetite after surgery. But he points out that the regulation of appetite after bariatric surgery is a complex and multifactorial process, involving both hormonal and behavioral and psychological factors. Therefore, medical follow-up and nutritional guidance are essential for the long-term success of bariatric surgery.

The study by Jorgensen et al. (2017) highlights the importance of GLP-1 in regulating appetite and satiety after Roux-en-Y bariatric surgery. Patients with higher GLP-1 levels after surgery had greater weight loss and improved insulin sensitivity. While,

the study by Roux et al. (2016), who pointed out that Roux-en-Y bariatric surgery can also affect the secretion of other gastrointestinal hormones, such as ghrelin, justifies that this factor after surgery is responsible for the improvement in glycemic control.

These results highlight the importance of gastrointestinal hormones in regulating appetite and satiety after surgery and may help guide the development of treatments for obesity and type 2 diabetes. The study by Schiavo et al. (2021) investigated the role of gut hormones GLP-1 and PYY in weight loss and remission of type 2 diabetes after Roux-en-Y bariatric surgery. The results showed that the surgery significantly increased plasma levels of GLP-1 and PYY, and that the improvement in blood glucose and weight loss were correlated with these hormonal increases.

The study by De Silva et al. (2018) investigated the effects of Roux-en-Y bariatric surgery on plasma levels of GLP-1 and PYY in patients with type 2 diabetes and obesity. Results showed that surgery led to a significant increase in plasma levels of GLP-1 and PYY, and that these hormonal increases were associated with improved glycemic control and weight loss due to improved insulin resistance.

In summary, the gastrointestinal hormones GLP-1 and PYY play an important role in regulating appetite and satiety after Roux-en-Y bariatric surgery, contributing to weight loss and improved glycemic control. Additional studies are still needed to fully understand the mechanisms involved in this hormonal regulation and how they can be used to improve the efficacy and safety of bariatric surgery.

CONCLUSION

Gut hormones GLP-1 and PYY play an important role in regulating appetite and satiety after Roux-en-Y bariatric surgery in humans. The studies included in the review suggest that bariatric surgery increases the release of GLP-1 and PYY in the intestine, which results in a decrease in appetite and increased satiety. In addition, evidence was also found that the response of GLP-1 and PYY hormones to food can be altered after bariatric surgery.

Although the reviewed studies indicate the importance of these hormones in controlling appetite and satiety after Roux-en-Y bariatric surgery, there are still many gaps to be filled. New research is needed

to better understand the mechanisms by which these hormones act postoperatively, especially in the long term, and how they can be used more effectively to improve clinical outcomes after bariatric surgery. In addition, studies that evaluate the combination of pharmacological and dietary interventions, aiming to potentiate the action of the hormones GLP-1 and PYY, may provide new perspectives in the prevention and treatment of obesity and its comorbidities.

REFERENCES

- ARORA, T. et al. Investigating the Role of Gut Hormones in Sustained Weight Loss After Roux-en-Y Gastric Bypass. *Journal of Clinical Endocrinology and Metabolism*, v. 105, n.8, p. e2935-e2944, 2020.
- BATTERHAM, R. L. & CUMMINGS, D. E. Mechanisms of Diabetes Improvement Following Bariatric/Metabolic Surgery. *Diabetes Care*, v. 39, n. 6, p. 893-901, 2016.
- BETZEL, B. et al. Effect of Roux-en-Y gastric bypass surgery on the distribution and hormone expression of small-intestinal enteroendocrine cells in obese patients with type 2 diabetes. *Diabetologia*, v. 61, n. 2, p. 464-473, 2018.
- COSTA, A.R. et al. Effect of bariatric surgery on GLP-1, GIP, ghrelin, and obestatin in relation to weight loss. *Surg Obes Relat Dis*, v.16, n.2, p.255-262, 2020.
- DE SILVA, A. et al. Effects of Roux-en-Y gastric bypass and sleeve gastrectomy on gastrointestinal hormones and their relationship with changes in body weight. *Surg Obes Relat Dis*, v. 14, n.7, p.1001-1008, 2018.
- LE ROUX, C. W. et al. Gut Hormones as Mediators of Appetite and Weight Loss After Roux-en-Y Gastric Bypass. *Annals of Surgery*, v. 244, n. 5, p. 780-786, 2006.
- MEEK, C. L. et al. The effect of bariatric surgery on gastrointestinal and pancreatic peptide hormones. *Peptides*, v.77, p.28-37, 2016.
- RUBINO, F. et al. Metabolic Surgery in the Treatment Algorithm for Type 2 Diabetes: A Joint Statement by International Diabetes Organizations. *Diabetes Care*, v. 39, n. 6, p. 861-877, 2016.
- SCHIAVO L et al. Gastrointestinal Hormones and their Role in Obesity Treatment After Bariatric Surgery. *Obes Surg*. v.31, n.3, p.1241-1252, 2021.
- SHAH M., et al. Early Changes in Gut Hormones and Metabolites After Bariatric Surgery Predict Long-term Weight Loss Success. *Obesity (Silver Spring)*, v.28, n.7, p. 1322-1331, 2020.
- THALER, J. P., CUMMINGS, D. E. (2016). Minireview: Hormonal and metabolic mechanisms of diabetes remission after gastrointestinal surgery. *Endocrinology*, v.157, n.8, p.11-18, 2016.