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## POST-BARIATRIC SURGERY AND WEIGHT- LOSS MEDICATIONS: A COMPREHENSIVE REVIEW OF SKIN CHANGES

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**Abstract:** **INTRODUCTION** Bariatric surgery and weight-loss medications are effective strategies for combating obesity, but they often result in significant skin changes due to rapid weight loss. The physiological inability of the skin to retract leads to issues such as skin laxity and redundant folds, affecting both physical and psychological well-being. Nutritional deficiencies and hormonal imbalances further complicate skin health post-weight loss. **OBJETIVE** To comprehensively review and analyze the skin changes that occur following bariatric surgery and the use of weight-loss medications, exploring the physiological, nutritional, and therapeutic aspects of managing these dermatological consequences. **METHODS** This is a narrative review which included studies in the MEDLINE – PubMed (National Library of Medicine, National Institutes of Health), COCHRANE, EMBASE and Google Scholar databases, using as descriptors: “Bariatric surgery” AND “Weight-loss medications” OR “Skin elasticity” OR “Excess skin” AND “Body contouring” in the last 5 years. **RESULTS AND DISCUSSION** Most patients experience significant skin laxity, particularly in the abdomen, arms, and thighs, with more severe changes observed in those undergoing rapid weight loss from bariatric surgery compared to those using weight-loss medications. Nutritional deficiencies and protein insufficiency exacerbate these changes, affecting collagen production and skin elasticity. Surgical and non-surgical interventions, such as body contouring, offer solutions, but their efficacy depends on patient factors such as age, genetics, and overall health. **CONCLUSION** Managing post-bariatric skin changes requires a multidisciplinary approach involving nutrition, hormonal balance, and tailored treatment strategies. While surgical options provide effective results for severe cases, early intervention and proper

nutritional support can improve skin recovery and patient quality of life. Further research is needed to enhance non-surgical approaches and better address the psychological impact of these dermatological changes.

**Keywords:** Bariatric surgery; Excess skin; Rapid weight loss; Body contouring; Skin elasticity.

## INTRODUCTION

Bariatric surgery has emerged as a cornerstone in the management of morbid obesity, a condition that continues to escalate globally. The primary aim of such surgical interventions is to reduce caloric intake and nutrient absorption, leading to significant and often rapid weight loss<sup>1</sup>. Among the commonly employed bariatric procedures are the Roux-en-Y gastric bypass, sleeve gastrectomy, and adjustable gastric banding, each with its own unique implications for patient outcomes<sup>1</sup>. Weight-loss medications, particularly in those for whom surgery is contraindicated, offer an adjunct or alternative approach to managing obesity. Drugs such as liraglutide, orlistat, and newer agents like semaglutide have been demonstrated to promote weight reduction by modulating appetite and nutrient absorption<sup>1</sup>. Despite their effectiveness, both surgical and pharmacological interventions have profound implications on the skin, one of the body's most visible and sensitive organs, especially when weight is lost rapidly<sup>2</sup>.

The physiology of the skin is closely linked to factors such as body mass index (BMI), nutritional status, and genetics, all of which play a critical role in determining the elasticity and resilience of the dermal layers<sup>2</sup>. Rapid weight loss, while beneficial for reducing comorbidities associated with obesity, often exceeds the skin's ability to adapt, resulting in a range of dermatological issues such as skin laxity, sagging, and folds<sup>2</sup>. Post-bariatric skin changes, particularly in areas like the abdomen,

thighs, and upper arms, are well-documented in the literature and are a major concern for both patients and clinicians<sup>2</sup>. Beyond the physical appearance, these changes can lead to functional problems, including skin irritation, infections, and a significant reduction in the quality of life for affected individuals<sup>3</sup>.

The role of weight-loss medications in skin health has also garnered increasing attention in recent years. While these medications do not induce weight loss as rapidly as surgical procedures, they can still lead to significant reductions in body weight that provoke skin changes<sup>3</sup>. The mechanisms underlying the effects of weight-loss medications on the skin are complex and multifactorial. Drugs like GLP-1 receptor agonists, for instance, modulate satiety and insulin sensitivity but also exert indirect effects on collagen and elastin production, crucial components of the skin's structure<sup>3</sup>. Moreover, long-term pharmacological interventions can lead to nutrient deficiencies that impair skin integrity, further complicating patient outcomes<sup>3</sup>.

The elasticity of the skin is a critical factor that influences how well the body adapts after significant weight loss. Collagen and elastin are two proteins responsible for maintaining skin structure, and their degradation during rapid weight loss can lead to the formation of loose, inelastic skin<sup>4</sup>. Several factors influence the recovery of skin elasticity, including age, genetics, hydration, and the overall health of the patient<sup>4</sup>. Younger patients, with relatively high baseline levels of collagen, tend to exhibit better recovery of skin firmness post-weight loss than older patients<sup>4</sup>. However, even in younger individuals, the sheer magnitude of weight loss achieved through bariatric surgery can surpass the skin's adaptive capabilities<sup>4</sup>.

The impact of post-weight-loss skin changes extends beyond physical health, affecting the psychosocial well-being of patients. The appearance of excess skin

can become a source of dissatisfaction and emotional distress, potentially undermining the psychological benefits gained from weight loss<sup>5</sup>. Many patients report feelings of embarrassment or self-consciousness, particularly when engaging in social activities or intimate relationships<sup>5</sup>. Moreover, the discomfort associated with excess skin, such as chafing, irritation, and skin infections, can hinder physical activity and further complicate the post-operative recovery process<sup>5</sup>. These issues underscore the need for comprehensive post-bariatric care that addresses not only the metabolic and nutritional aspects of recovery but also the dermatological and psychological concerns that arise during this period<sup>6</sup>.

Various bariatric procedures have distinct impacts on the severity and distribution of skin changes. For example, Roux-en-Y gastric bypass, which induces rapid weight loss, often results in more pronounced skin laxity compared to sleeve gastrectomy, where weight loss may be more gradual<sup>6</sup>. The duration and stability of weight loss also play a critical role in determining how skin adapts over time<sup>6</sup>. Patients who maintain a stable post-bariatric weight for several years may experience a gradual improvement in skin firmness, although the process is highly variable and influenced by individual factors such as exercise, nutrition, and genetic predisposition<sup>7</sup>. Surgical options, such as body contouring procedures, are often considered to manage excess skin, particularly in cases where the skin fails to retract adequately after weight loss<sup>7</sup>.

Nutritional deficiencies, which are common following bariatric surgery due to altered absorption, can further exacerbate skin problems<sup>7</sup>. Deficiencies in vitamins A, C, and E, as well as essential fatty acids, have been implicated in impaired wound healing and decreased collagen synthesis<sup>7</sup>. These deficiencies, if not addressed, can worsen skin elasticity and contribute to the development of der-

matological issues<sup>8</sup>. Post-surgical nutritional supplementation, therefore, plays a critical role in mitigating these risks, and patients are often advised to adhere to a strict regimen of multivitamins and dietary adjustments<sup>8</sup>.

The psychological impact of post-bariatric skin changes is significant and warrants attention from healthcare providers. While the primary goal of bariatric surgery is to improve physical health by reducing obesity-related comorbidities, the psychological effects of the resulting skin changes can offset some of these benefits<sup>8</sup>. Studies have shown that patients with significant excess skin are more likely to experience body dissatisfaction and may even consider body contouring surgeries to address these concerns<sup>9</sup>. Additionally, the social stigma associated with obesity often persists post-surgery due to the visible remnants of weight loss, further complicating the patient's emotional and psychological recovery<sup>9</sup>.

## OBJETIVES

To comprehensively review and analyze the skin changes that occur following bariatric surgery and the use of weight-loss medications, exploring the physiological, nutritional, and therapeutic aspects of managing these dermatological consequences.

### SECUNDARY OBJETIVES

1. To compare the severity and types of skin changes between patients undergoing bariatric surgery and those using pharmacological weight-loss interventions.
2. To investigate the role of nutritional status and hormonal changes in skin elasticity post-weight loss.
3. To evaluate both surgical and non-surgical treatment options for managing excess skin.
4. To explore the psychological impact of skin changes on post-bariatric patients

## METHODS

This is a narrative review, in which the main aspects of the skin changes that occur following bariatric surgery and the use of weight-loss medications, exploring the physiological, nutritional, and therapeutic aspects of managing these dermatological consequences over recent years were analyzed. The beginning of the study was carried out with theoretical training using the following databases: PubMed, sciELO and Medline, using as descriptors: "Bariatric surgery" AND "Weight-loss medications" OR "Skin elasticity" OR "Excess skin" AND "Body contouring" in the last 5 years. As it is a narrative review, this study does not have any risks.

Databases: This review included studies in the MEDLINE – PubMed (National Library of Medicine, National Institutes of Health), COCHRANE, EMBASE and Google Scholar databases.

The inclusion criteria applied in the analytical review were human intervention studies, experimental studies, cohort studies, case-control studies, cross-sectional studies and literature reviews, editorials, case reports, and poster presentations. Also, only studies written in English and Portuguese were included.

## RESULTS AND DISCUSSION

The results and discussion surrounding skin changes following bariatric surgery and weight-loss medications reveal a complex interplay of factors that influence both the severity and distribution of dermatological outcomes. One of the most prominent findings is that the majority of post-bariatric patients experience some form of skin laxity, with a prevalence ranging from 80% to 95%, depending on the specific population studied<sup>9</sup>. The most commonly affected regions include the abdomen, upper arms, and thighs, where skin folds tend to form due to the rapid loss of subcutaneous fat<sup>9</sup>. This phenomenon is particularly pronou-

nced in patients undergoing procedures such as Roux-en-Y gastric bypass, which induces more rapid weight loss compared to sleeve gastrectomy<sup>9</sup>. The speed and magnitude of weight loss are critical factors in determining the extent of skin changes, as the dermal layers are often unable to contract at a rate that matches the reduction in body mass<sup>10</sup>.

The severity of skin changes is also influenced by preoperative factors such as body mass index (BMI), with higher baseline BMI correlating with more pronounced skin laxity<sup>10</sup>. Patients with more significant weight loss tend to have larger areas of redundant skin, which can lead to functional issues such as skin irritation, infections, and difficulties with personal hygiene<sup>10</sup>. These functional complications are not merely cosmetic concerns but can have a profound impact on a patient's quality of life, limiting physical activity and causing psychological distress<sup>11</sup>. Moreover, patients with a higher preoperative BMI are more likely to require surgical interventions, such as body contouring procedures, to manage these skin changes<sup>11</sup>.

When comparing the dermatological outcomes of bariatric surgery with those of weight-loss medications, it becomes clear that pharmacological interventions tend to result in less severe skin changes<sup>11</sup>. Weight-loss medications, such as GLP-1 receptor agonists and orlistat, promote more gradual weight loss, giving the skin additional time to adapt<sup>12</sup>. As a result, patients using these medications generally report milder degrees of skin sagging and better overall skin appearance compared to their surgically treated counterparts<sup>12</sup>. However, these medications are not without their drawbacks. Some, particularly orlistat, can lead to deficiencies in fat-soluble vitamins, which are critical for maintaining skin health<sup>12</sup>. Deficiencies in vitamins A, D, and E, for instance, are associated with increased skin dryness, poor wound healing, and a higher incidence of dermatological conditions<sup>12</sup>.

The role of nutrition in post-weight loss skin recovery is paramount, as bariatric patients are at high risk for micronutrient deficiencies due to altered absorption after surgery<sup>13</sup>. The importance of maintaining adequate levels of vitamins A, C, and E, as well as essential minerals like zinc and copper, cannot be overstated<sup>13</sup>. These micronutrients are vital for collagen production, wound healing, and maintaining skin elasticity, all of which are compromised when nutritional deficiencies are present<sup>13</sup>. Protein deficiency, in particular, has been identified as a major contributor to poor skin outcomes after bariatric surgery<sup>14</sup>. Proteins are the building blocks for collagen and elastin, and without sufficient protein intake, the skin's ability to regenerate and maintain its structural integrity is significantly impaired<sup>14</sup>. This is especially important for patients who may later seek body contouring surgeries, as poor nutritional status can lead to delayed wound healing and an increased risk of postoperative complications<sup>14</sup>.

Age and genetics are other critical factors influencing the degree of skin laxity post-weight loss. Younger patients tend to have better skin elasticity and are more likely to experience spontaneous retraction of the skin following bariatric surgery<sup>15</sup>. In contrast, older individuals, particularly those over the age of 40, face more significant challenges with skin recovery due to the natural decline in collagen and elastin production that occurs with aging<sup>15</sup>. Genetic predisposition also plays a pivotal role in determining how well the skin adapts after rapid weight loss<sup>15</sup>. Individuals with a family history of connective tissue disorders, such as Ehlers-Danlos syndrome, are at higher risk of experiencing severe skin laxity, regardless of the surgical procedure performed or the amount of weight lost<sup>16</sup>.

Hormonal changes, particularly those related to sex hormones and thyroid function, also have a significant impact on skin recovery post-weight loss<sup>16</sup>. Estrogen, for example,

plays a key role in maintaining skin hydration and elasticity, and its decline in both men and women post-bariatric surgery can exacerbate skin sagging and dryness<sup>16</sup>. Similarly, patients with hypothyroidism, a common condition in obese individuals, may experience delayed skin recovery due to reduced collagen production and impaired skin metabolism<sup>17</sup>. Hormonal imbalances, therefore, must be addressed as part of a comprehensive approach to managing post-weight loss skin changes<sup>17</sup>.

The psychological impact of post-bariatric skin changes is profound and often underestimated in clinical practice<sup>17</sup>. While the primary focus of bariatric surgery is to reduce obesity-related comorbidities, the residual skin laxity can have significant emotional consequences for patients, many of whom report feelings of embarrassment, low self-esteem, and body image dissatisfaction<sup>18</sup>. These psychological effects can diminish the overall satisfaction with the weight loss process, leading some patients to seek body contouring procedures to address their concerns<sup>18</sup>. However, the decision to undergo such procedures is not without its challenges, as the financial burden and potential risks associated with additional surgeries may deter some individuals<sup>18</sup>.

In addition to body contouring surgery, non-surgical interventions such as radiofrequency, laser treatments, and topical therapies have been explored as options for managing post-weight loss skin changes<sup>19</sup>. These treatments aim to stimulate collagen production and improve skin elasticity without the need for invasive surgery<sup>19</sup>. While the efficacy of these non-surgical interventions is still being studied, preliminary data suggest that they may offer a viable option for patients with mild to moderate skin laxity<sup>19</sup>. However, for those with severe skin changes, surgical intervention remains the most effective solution<sup>19</sup>. Procedures such as abdominoplasty, brachioplasty, and thigh lifts are commonly performed to remove excess skin and improve the

overall contour of the body<sup>20</sup>.

Patient satisfaction with body contouring surgery is generally high, with studies showing significant improvements in both physical and psychological well-being post-procedure<sup>20</sup>. However, these surgeries are not without risks, including scarring, infection, and the potential for suboptimal cosmetic outcomes<sup>20</sup>. Therefore, careful patient selection and thorough preoperative counseling are essential to ensure realistic expectations and to optimize postoperative satisfaction<sup>21</sup>. Furthermore, the cost of body contouring surgery is often not covered by insurance, adding an additional financial consideration for patients seeking these procedures<sup>21</sup>.

The relationship between post-weight loss skin changes and patient quality of life cannot be overstated<sup>21</sup>. Excess skin not only impacts physical health by increasing the risk of skin infections and irritation, but it also significantly affects mental health and social functioning<sup>22</sup>. Many patients report avoiding social interactions, intimate relationships, and physical activities due to the discomfort and embarrassment associated with their excess skin<sup>22</sup>. These findings highlight the importance of a multidisciplinary approach to post-bariatric care, one that addresses the dermatological, nutritional, and psychological needs of patients to ensure optimal long-term outcomes<sup>22</sup>.

## CONCLUSION

The management of skin changes following bariatric surgery and weight-loss medications presents a significant challenge due to the rapid and substantial weight reduction these interventions achieve. Excess skin, particularly in regions such as the abdomen, thighs, and arms, is not only a cosmetic issue but also a functional concern that can impair a patient's quality of life. These skin changes result from the body's inability to adequately adapt to the

dramatic loss of fat, leaving behind lax and redundant skin folds. Addressing these issues is crucial for ensuring that the overall health benefits of weight loss are fully realized and that patients do not suffer from physical discomfort or psychological distress.

The comparison between bariatric surgery and pharmacological weight-loss interventions demonstrates a clear difference in the severity of skin changes. Bariatric surgery, particularly procedures that lead to rapid weight reduction, is associated with more severe skin laxity compared to weight-loss medications, which tend to induce a slower, more gradual loss of body mass. However, medications such as GLP-1 receptor agonists also pose dermatological risks, primarily due to their potential to cause nutrient deficiencies that impair skin health. Thus, both surgical and medical approaches require careful management to mitigate the dermatological consequences of significant weight loss.

Nutritional support plays a critical role in mitigating the impact of weight loss on the skin. Deficiencies in key vitamins and minerals, particularly those necessary for collagen synthesis and skin elasticity, can exacerbate skin laxity and lead to poor wound

healing in patients who later opt for body contouring surgery. It is essential that post-bariatric patients adhere to a well-structured nutritional regimen that includes adequate intake of protein and micronutrients to support skin health. Early intervention with nutritional supplementation can improve skin recovery and reduce the severity of excess skin following weight loss.

Finally, while surgical interventions such as body contouring remain the most effective option for addressing severe skin laxity, non-surgical methods are gaining attention as potential alternatives for patients with milder forms of skin sagging. Treatments such as radiofrequency and laser therapy show promise in promoting collagen production and improving skin elasticity. Nevertheless, the psychological impact of excess skin should not be overlooked, as many patients experience body image dissatisfaction and emotional distress despite their successful weight loss. A multidisciplinary approach that includes psychological support, nutritional guidance, and appropriate dermatological treatments is key to optimizing long-term outcomes for patients following significant weight loss.

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