

# Influence of intestinal dysbiosis on the worsening of cellulite and fluid retention: A mini-review

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## Abstract

Intestinal dysbiosis is characterized by a change in the diversity and abundance of microbial species, which can impair the normal functions of the gastrointestinal tract, directly affecting health. These alterations have been associated with some pathologies, such as cellulite and fluid retention. Thus, the objective of this study is to understand the influence of intestinal dysbiosis on the worsening of cellulite and fluid retention, discussing the possible pathophysiological mechanisms involved and the clinical implications of this interaction. To this end, a descriptive study of bibliographic review and explanatory approach is undertaken. It is concluded that intestinal dysbiosis is a disorganization in the microbiota characterized by a maladjustment of bacterial colonization, and this can contribute to a worsening of cellulite and fluid retention through interconnected mechanisms, causing chronic systemic inflammation, with reduced absorption of nutrients important for hormonal regulation, potentially leading the individual to an imbalance in the body.

**Keywords:** systemic inflammation, hormonal regulation, reduced absorption.

## Influência da disbiose intestinal na piora da celulite e retenção de líquidos: Mini-Revisão

### Resumo

A disbiose intestinal caracteriza-se por uma mudança na diversidade e na abundância das espécies microbianas, podendo prejudicar as funções normais do trato gastrointestinal, afetando diretamente a saúde. Essas alterações vêm sendo associadas a algumas patologias, como a celulite e a retenção de líquidos. Deste modo, o objetivo deste estudo é conhecer a influência da disbiose intestinal na piora da celulite e da retenção de líquidos, discutindo os possíveis mecanismos fisiopatológicos envolvidos e as implicações clínicas dessa interação. Para tanto, empreende-se um estudo descritivo de revisão bibliográfica e abordagem explicativa. Conclui-se que a disbiose intestinal é uma desorganização na microbiota, qualificada por um desajuste da colonização bacteriana e esta pode contribuir para uma piora da celulite e da retenção de líquidos por meio de mecanismos interligados, causando inflamação sistêmica, crônica, com redução da absorção de nutrientes importantes para a regulação hormonal, podendo levar o indivíduo a um desequilíbrio no corpo.

**Palavras-chave:** inflamação sistêmica, regulação hormonal, absorção reduzida.

### 1. Introduction

In recent years, intestinal health has increasingly been recognized as one of the fundamental pillars for maintaining overall physiological balance (Mecalser et al., 2025). The intestine, in addition to performing digestive and absorptive functions, plays a crucial role in immune modulation, metabolism, and the preservation of human tissues (Chuluck et al., 2023).

The intestinal microbiota comprises a complex community of microorganisms that inhabit the gastrointestinal tract, acting symbiotically with the host and influencing several physiological processes (Silva Júnior et al., 2022). However, alterations in this ecosystem, known as intestinal dysbiosis, have been associated with multiple

inflammatory and metabolic conditions (Gandra et al., 2021).

Dysbiosis is characterized by an imbalance between beneficial and pathogenic microorganisms, typically marked by a reduction in commensal bacteria and the proliferation of potentially harmful species. This microbial disruption may contribute to increased intestinal permeability, systemic inflammation, and gastrointestinal disturbances, factors that directly influence the worsening of cellulite, fluid retention, and overall skin health (Pacheco; Soares, 2021).

Among the systemic effects associated with dysbiosis, the repercussions on the skin and subcutaneous tissue are particularly noteworthy, especially regarding increased inflammation, impaired microcirculation, and interstitial fluid accumulation — changes that favor the progression of cellulite (Vieira, 2020; Andrade; Gurevich, 2023). Recent evidence suggests that microbiota imbalance may promote the activation of inflammatory mediators, compromise intestinal barrier integrity, and modify the extracellular matrix, contributing to structural and functional alterations in skin tissue (Silva, 2021; Andrade; Gurevich, 2023).

Thus, understanding the relationship between intestinal health and skin physiology becomes essential for the development of integrative and effective therapeutic approaches. In this context, the present article aims to analyze the influence of intestinal dysbiosis on the worsening of cellulite and fluid retention, discussing the possible pathophysiological mechanisms involved and their clinical implications.

## **2. Materials and Methods**

### *2.1 Review process*

The present study employed a descriptive research design with an explanatory approach, developed through a bibliographic review. Regarding methodological procedures, a literature review was conducted, as per Gil (2012), who states that bibliographic research involves the use of books, dissertations, theses, and scientific articles. Explanatory research, as described by Gil (2012), seeks to establish relationships between identified factors and ideas in order to understand the causes and effects of a given phenomenon.

Data collection was carried out through online searches of scientific publications in databases such as Bireme, Medline, SciELO, ScienceDirect, Lilacs, among others. The literature survey included publications in Portuguese and English, such as scientific articles, journals, and dissertations, accessed through online search systems such as Google Scholar. Following the initial selection, an exploratory reading was undertaken, which, according to Losch, Rambo, and Ferreira (2023), is essential for deepening the understanding of the subject, guiding the construction of research questions, organizing the collected material, and providing a comprehensive overview of the literature.

Subsequently, a selective reading was performed. This technique, as noted by Schotten (2024), is effective for quickly identifying and absorbing the most relevant sections of the texts, excluding less essential information and allowing the researcher to determine which materials are truly pertinent to the study. The following descriptors were used: “Intestinal dysbiosis,” “Cellulite,” “Fluid retention,” and “Intestinal microbiota.” The selection of materials was limited to the period from 2016 to 2025, except for specific or classical literature.

## **3. Literature Review**

### *3.1 Intestinal dysbiosis*

The term intestinal dysbiosis refers to the imbalance in the composition of the intestinal microbiota, characterized by alterations in the number and diversity of microorganisms within the gastrointestinal tract. This imbalance leads to the predominance of pathogenic microorganisms over beneficial species, such as short-chain fatty acid (SCFA)–producing bacteria, which play a protective role in both intestinal and systemic health (Sharma et al., 2025; Sinha, Haileselassie; Nguyen, 2020; Vieira, 2020).

Intestinal dysbiosis is marked by changes in the diversity and abundance of microbial species, impairing the normal physiological functions of the gastrointestinal tract and potentially affecting overall health (Oliveira et al., 2020; Pacheco; Soares, 2021). This condition has been strongly associated with a wide range of pathological states, particularly within metabolic, immunological domains, and pre-eclampsia in a mouse model (Oliveira et al., 2020; Pereira et al., 2025; Zhao et al., 2025).

According to Bistafa (2022), dysbiosis represents a disorganization of the microbiota caused by imbalances in bacterial colonization, frequently characterized by the predominance of harmful bacteria over beneficial ones.

This imbalance is now considered an important factor in the diagnosis of several conditions, including diarrhea, lethargy, depression, spondyloarthritis, and rheumatoid arthritis (Mauro et al., 2025).

In this context, intestinal dysbiosis has significant implications for the development of metabolic disorders such as obesity, type 2 diabetes, insulin resistance, and dyslipidemias. It also plays a central role in immune-related dysfunctions, including autoimmune diseases, chronic inflammation, and inflammatory bowel disorders (Di Tommaso et al., 2021; Santos; Aguiar, 2024).

Several factors are associated with the onset of dysbiosis, including inadequate diets, excessive antibiotic use, chronic stress, autoimmune diseases, infections, and environmental influences (Pantoja et al., 2019; Santos; Aguiar, 2024). These factors disrupt the intestinal environment, promoting the proliferation of harmful microorganisms while reducing beneficial species, resulting in an imbalanced microbiota (Di Tommaso et al., 2021; Santos; Aguiar, 2024).

Dysbiosis often leads to an increase in pathogenic microorganisms, including certain strains of Proteobacteria, Clostridium, and Salmonella, which may colonize the gastrointestinal tract and trigger inflammation, infections, and other intestinal disturbances (Pacheco; Soares, 2021; Silva Júnior, 2022). This condition may also contribute to more severe diseases such as Irritable Bowel Syndrome (IBS), Inflammatory Bowel Disease (IBD), and colitis, resulting in digestive dysfunction and systemic health impacts. Additionally, dysbiosis can lead to nutritional deficiencies due to reduced absorption of fiber, vitamins, and essential minerals.

Diagnosis is primarily clinical and based on symptoms associated with malabsorption syndrome. Common contributing factors include indiscriminate antibiotic use, laxative abuse, excessive consumption of ultra-processed foods, repeated exposure to environmental toxins, stress, circadian rhythm disruption, alcohol intake, hepatopancreatic dysfunctions, and diverticulosis (Oliveira et al., 2020; Andrade; Gurevich, 2023; Pereira et al., 2025; You et al., 2025). Moreover, dysbiosis is influenced by age, intestinal transit time, the availability of fermentable substrates, and the individual's immune status (Andrade; Gurevich, 2023; Pereira et al., 2024).

### *3.2 Causes and consequences of intestinal dysbiosis*

Among the main causes of dysbiosis is the indiscriminate and irrational use of pharmaceutical drugs, especially antibiotics such as ampicillin, amoxicillin, cephalosporins, and clindamycin. These medications produce devastating consequences for the balance of the microbiota, affecting both harmful and beneficial bacteria, and favoring the growth of fungi that produce toxins that irritate the intestinal mucosa (Souza et al., 2022).

Another relevant cause of intestinal dysbiosis is the excessive consumption of ultraprocessed foods, prolonged exposure to environmental toxins, consumptive diseases such as cancer and Acquired Immunodeficiency Syndrome (AIDS), hepatopancreatic dysfunctions, stress, disease phenotype, bacterial community, and diverticulosis (Buttó; Haller, 2016). The absence of certain vitamins—particularly B-complex vitamins, essential fatty acids, and nutrient deficiencies due to impaired absorption may also lead to dysbiosis (Silva et al., 2020; Pacheco; Soares, 2021).

Among its consequences, the dysregulation of the microbiota can be highlighted, which leads to the loss of vitamins and causes enzymes to stop performing their functions due to inactivation, resulting in toxin production and destruction of the intestinal mucosa, thereby reducing nutrient absorption (Silva et al., 2020; Gomes et al., 2024). In addition, the relationship between increased intestinal mucosal permeability and the establishment of abnormal microbiota characterizes a dysbiosis condition. In this scenario, the situation becomes even more severe because it promotes irregular peptide breakdown and toxin reabsorption (Silva et al., 2020; Vilela et al., 2025).

Irritable Bowel Syndrome (IBS) is also a pathology caused by the imbalance of the intestinal microbiota, which prevents the colon from performing its normal functions (Gamwell et al., 2025). It is common in individuals who constantly experience intestinal difficulties, resulting in frequent diarrhea episodes (Silva et al., 2020; Vilela et al., 2025). Treatment in most cases involves changes in dietary habits. However, in some cases, the use of probiotic supplements, prebiotics, symbiotics, and fecal microbiota transplantation may be necessary, depending on the severity (Wu et al., 2024). This procedure aims to restore the intestinal flora and rebalance the concentrations of hydrochloric acid and essential digestive enzymes (Gamwell et al., 2025).

Therefore, it is essential to instruct patients to follow a non-irritating and hypoallergenic diet, along with the administration of prebiotics, probiotics, dietary supplements, and synbiotics (Pantoja et al., 2019; Santos; Aguiar, 2024; Wang et al., 2025). The treatment of dysbiosis consists of two approaches: one dietary, involving the intake of foods containing probiotics and/or prebiotics, and the other pharmacological, which resolves the

majority of cases. In more severe situations, intestinal cleansing procedures may be required to remove putrefactive contents and allow lymphatic drainage of the colon (Nesi et al., 2020; Quaresma et al., 2022).

### *3.3 Cellulite*

Cellulite, scientifically known as gynoid lipodystrophy (fibroedema geloid), is an alteration of the skin's surface topography characterized by an "orange peel" appearance (Pinto et al., 2019; Seguin et al., 2024; Santos, 2025). It is extremely common in women, with an incidence of approximately 95% among those aged 15 to 45 years. It frequently affects the buttocks and lower limbs; clinical symptoms may include edema, pain, paresthesia, a sensation of heaviness, and tenderness on palpation (Atamoros et al., 2018; Dias et al., 2023; Khalil; Galadari, 2024).

Cellulite affects approximately 90% of women at nearly all stages of life, beginning after puberty. In healthy men, cellulite is rare but may occur due to medical conditions that result in androgen deficiency, requiring estrogen therapy (Ellervik, 2021; Hernandez et al., 2022; Eber et al., 2024). Cellulite is highly prevalent among women because it tends to occur in areas where fat deposition is influenced by estrogen, such as the hips, thighs, and buttocks, but it may also be present in the breasts, lower abdomen, arms, and nape—regions associated with the female pattern of adipose tissue distribution (França et al., 2016; Queiroz et al., 2019; Ellervik, 2021).

The changes that occur during the development of cellulite include fibrosis and sclerosis, which clinically manifest as a wavy course of the skin surface and multiple nodules. These nodules are palpable, and their pathophysiology is still complex, as this apparently multifactorial disorder is believed to be caused by anatomical alterations, microcirculatory failure, reduced production of the vasodilatory hormone adiponectin by subcutaneous cells, genetic polymorphisms, changes in dermal connective tissue, and inflammatory processes (Atamoros et al., 2018; Pinto et al., 2019).

Cellulite may be classified according to its clinical appearance. As described by Dias et al. (2023), it is categorized into four grades, indicating the severity of skin alterations. Mild cellulite, or grade 1, is visible only when the skin is pinched or during voluntary muscle contraction. Moderate cellulite, or grade 2, is visible without skin compression, and the dimpled appearance worsens when the skin is pinched or during voluntary muscle contraction; local temperature reduction and edema may occur. Severe cellulite, or grade 3, is evident upon simple inspection and in any body position, with palpable, painful, and firm nodules. Grade 4 cellulite presents with flaccidity and low muscle tone, swelling, a padded appearance, and palpable, painful nodules.

### *3.4 Fluid retention*

Fluid retention, commonly known as edema, swelling, or accumulation of fluids in the body, occurs due to the leakage of a protein-poor fluid from the blood, which exits the blood vessels and moves into the subcutaneous tissue (Brasil, 2022; Bruna, 2023). Fluid retention is characterized by the accumulation of fluids and may have various causes, ranging from dietary habits and physical inactivity to more serious medical conditions such as renal, cardiac, and hormonal disorders (Araújo, 2020; Suriani et al., 2020).

Fluid retention, considered an accumulation of water between cells, involves several contributing factors, including poor diet, medications, circulatory problems, blood pressure alterations, and disorders of the kidneys, liver, and heart, as well as thyroid diseases and sedentary behavior (Cortez, 2022; Vilela et al., 2025). Fluid retention can be observed in the feet, legs, eyelids, face, and abdomen (Araújo, 2020; Bruna, 2023). This swelling may be localized to a single area, such as the feet, or may be generalized, temporarily leaving an indentation or groove on the skin. Additionally, signs can be detected by pressing the affected region with the fingertips, leaving a mark. Fluid retention may also cause intestinal discomfort, body aches, stress, and worsening of cellulite (Brasil, 2022; Mecalsar et al., 2025).

When fluid retention occurs, there is an imbalance between the amount of fluid entering and leaving the cells and blood vessels, causing the body to retain more water than it eliminates. In temporary situations, such as after long periods of standing or during hot weather, this retention may be transient. However, when it persists, it may indicate an underlying health condition that requires investigation (Brasil, 2022; Santos, 2025). Among the main causes of fluid retention are physiological factors, which may be temporary, and pathological factors, which include physical inactivity, poor circulation, hormonal alterations, sodium-rich diets, medication use, renal, cardiac, or hepatic diseases, and lymphatic dysfunction (Cortez, 2022).

The diagnosis of fluid retention begins with clinical evaluation, observing the swelling, its location, and its

intensity. Treatment may vary depending on the underlying cause, but generally includes measures such as reducing salt and processed food intake, increasing water consumption, performing regular physical exercise, elevating the legs, undergoing manual lymphatic drainage, using compression stockings, and administering diuretic medications (Araújo, 2020; Brasil, 2022).

### *3.5 Intestinal dysbiosis versus cellulite and fluid retention*

Intestinal dysbiosis, known as an imbalance in the composition of the gut microbiota, has increasingly been recognized as a factor influencing not only digestive health but also aesthetic and metabolic aspects, such as cellulite and fluid retention (Gandra et al., 2021; Santos, 2024; Ullah et al., 2024; Silva et al., 2024). Although lifestyle factors are strongly associated with cellulite, it is also linked to intestinal function. Patients with intestinal dysbiosis may experience the colonization of microbial groups that alter circulating estrogen levels, since changes in this hormone may contribute to the development and worsening of cellulite (Dias et al., 2023; Liu et al., 2024; Zalaquetti et al., 2025).

According to Pereira et al. (2024), intestinal dysbiosis may affect cellulite in the following ways:

- With a dysbiotic gut, the body may enter a state of chronic inflammation, contributing to the appearance of cellulite.
- Intestinal imbalance may lead to fluid retention, one of the main factors involved in the onset of cellulite.
- Dysbiosis can impair metabolism, contributing to weight gain and fat accumulation, which are also related to cellulite.
- A dysbiotic body has difficulty eliminating toxins, which may worsen conditions such as cellulite.

Regarding the indirect effects of dysbiosis on cellulite, it is worth noting that cellulite is an alteration of subcutaneous tissue associated with inflammation, poor circulation, and fat accumulation. Moreover, dysbiosis may increase insulin resistance, favoring greater body fat storage. The production of short-chain fatty acids influences hormonal balance, including estrogen, which plays a relevant role in the development of cellulite (Pereira et al., 2024; Zalaquetti et al., 2025). Intestinal dysbiosis may also worsen fluid retention through several mechanisms, such as increased intestinal permeability, which allows endotoxins to enter systemic circulation, leading to systemic inflammation and metabolic imbalances that affect fluid regulation (Bruna, 2023; Rocha et al., 2025).

Chronic inflammation resulting from dysbiosis may impair kidney function, contributing to fluid retention, and may also deregulate hormones involved in fluid balance and metabolism (Suriani et al., 2020; Bruna, 2023). Among the impacts of intestinal dysbiosis on fluid retention, systemic inflammation may affect the lymphatic and venous systems, hindering proper drainage of body fluids, in addition to increasing pro-inflammatory substances that promote fluid retention (Brasil, 2022; Zalaquetti et al., 2025).

Within this context, it is evident that intestinal dysbiosis contributes to the worsening of cellulite and fluid retention through interconnected mechanisms such as systemic inflammation, impaired circulation, and metabolic dysfunction. Therefore, it is essential to maintain a diet rich in fiber, incorporate probiotics, and reduce the consumption of ultra-processed foods (Araújo, 2020; Suriani et al., 2020; Rocha et al., 2025).

## **4. Final Considerations**

Upon concluding this study, it is observed that intestinal dysbiosis is a disruption of the microbiota, characterized by an imbalance in bacterial colonization, with a predominance of harmful bacteria over beneficial ones. This condition leads to implications in the development of metabolic and autoimmune disorders. The diagnosis of dysbiosis is clinical, and among its main causes is the indiscriminate and irrational use of medications, especially antibiotics. Its treatment, in most cases, involves dietary habit changes, the use of probiotic supplements, and, depending on severity, fecal microbiota transplantation.

Regarding cellulite, it can be described as an alteration of skin topography, being more frequent in women. Cellulite primarily affects the gluteal region. Fluid retention, in turn, is characterized by the accumulation of water between cells. It involves several clinical conditions that may stem from poor diet, medications, and circulatory problems, among other disorders.

Within this context, it is evident that intestinal dysbiosis contributes to the worsening of cellulite and fluid retention through interconnected mechanisms, inducing chronic systemic inflammation and reducing the absorption of nutrients considered beneficial. Dysbiosis may alter hormonal regulation, leading the individual to bodily imbalance, impairing circulation, skin health, and metabolism, which significantly aggravates both cellulite and fluid retention.

## 5. Authors' Contributions

Rafaela Cintia dos Santos Silva: conceptualization; methodology; investigation; writing – original draft; writing – review & editing; project administration. Jacqueline Silva Guimarães Santos: supervision; conceptualization; writing – review & editing.

## 6. Conflicts of Interest

No conflicts of interest.

## 7. Ethics Approval

Not applicable.

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