



# The Role of Weight Loss and Nutrition in the Management of Hidradenitis Suppurativa

**Agnese E<sup>1\*</sup>, Christoforides S<sup>1</sup> and Fromowitz J<sup>2</sup>**

<sup>1</sup>Graduate Medical Education, Lake Erie College of Osteopathic Medicine, USA

<sup>2</sup>Department of Dermatology, Florida Atlantic University, USA

**\*Corresponding author:** Erica Agnese, Graduate Medical Education, Lake Erie College of Osteopathic Medicine, New York, USA, Tel: 203530-4855; Email: EAgnese06754@med.lecom.edu

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## Abstract

Hidradenitis suppurativa (HS) is an inflammatory skin condition affecting the pilosebaceous unit. It is characterized by the formation of painful nodules, abscesses, and sinus tracts in intertriginous regions. HS has numerous, well documented risk factors including obesity, metabolic syndrome, and diabetes mellitus. Weight loss is frequently recommended as a lifestyle change for patients diagnosed with HS. There is evidence that shows weight loss improves disease severity in most cases. However, there are reports of patients who have experienced stable, worsening, or de novo disease development after undergoing bariatric surgery. Nutrition is proving to be an increasingly important aspect in the management of HS. Deficiencies in micronutrients, such as Vitamin D and zinc, as well as the consumption of triggering foods including dairy and brewer's yeast, are implicated in HS. Encouraging patients to consume a healthy diet with supplementation of micronutrients and avoidance of dairy and brewer's yeast has been linked to decreased HS severity. Physical activity is commonly recommended to aid in weight loss, but has been understudied in HS patients. There are reports of increased levels of physical activity decreasing disease severity, but more research is needed on this topic.

**Keywords:** Pilosebaceous; Intertriginous; Worsening; Hidradenitis Suppurativa

**Abbreviations:** HS: Hidradenitis Suppurativa; QoL: Quality of Life; BMI: Body Mass Index.

## Introduction

Hidradenitis suppurativa (HS) is an inflammatory skin condition affecting the pilosebaceous unit. It is characterized by the formation of painful nodules, abscesses, and sinus tracts in intertriginous regions [1]. The most commonly affected areas are the axilla, inframammary folds, gluteal cleft, and inguinal region [2]. It primarily affects younger individuals between the ages of 18-34 and there is a female

predominance [1,3]. Patients with HS report lower quality of life (QoL) and high rates of comorbid depression [4]. The disease is associated with pain and malodor from the draining abscesses and sinus tracts leading to impairment and embarrassment in affected patients [2-4].

HS has numerous, well-documented risk factors including obesity, metabolic syndrome, diabetes mellitus, smoking, genetic predisposition, hormonal imbalance, and microbiome dysregulation [1,5-7]. Patients with HS are 4x more likely to have a BMI greater than 25 compared to controls [3] and higher BMIs are associated with greater

disease severity [2,7,8]. Obesity is associated with chronic inflammation due to dysregulation of adipokine signaling [6]. Decreased insulin sensitivity associated with metabolic syndrome and diabetes contributes to high levels of insulin and hyperglycemia, which affects local protein signaling further contributing to hyperkeratosis and follicular occlusion [6].

Weight loss and lifestyle changes such as smoking cessation are commonly recommended for patients with HS. Several studies and case reports have shown patients with HS to get symptomatic relief with weight loss, however there are also reports of worsening or new onset HS following weight loss procedures (i.e. bariatric surgery) [3,9]. Proper nutrition is an additional factor that needs to be implemented in the management of hidradenitis suppurativa [10,11]. Addressing malnutrition and micronutrient deficiencies along with the avoidance of disease triggering foods have shown to benefit HS patients [11]. This paper aims to discuss the contributions of obesity and nutrient deficiencies to the development of HS and the role of weight loss and nutrition as targets to reduce disease burden.

## Pathogenesis

The inciting event in the development of HS is hyperkeratosis of the pilo-sebaceous unit [12]. This leads to follicular plugging, inflammation, and eventual rupture and abscess formation [10]. Activation of inflammatory pathways and aberrant cytokine signaling drive the hyperkeratosis by promoting the proliferation of keratinocytes [12]. High levels of macrophages, neutrophils, Th-17 cells, and TNF-alpha as well as increased FOXO1 and mTORC1 activity are all implicated in disease development [11,13,14].

Obesity is known to promote an inflammatory state and is associated with increased insulin resistance [13,15]. Higher levels of insulin and insulin-like growth factor-1 (IGF-1) are associated with obesity, metabolic syndrome, and diabetes mellitus [6,11,13]. Increased levels of insulin and IGF-1 result in increased activation of FOXO1, which is a transcription factor and regulatory protein that exerts effects on mTORC1 [6,11]. Higher activity of FOXO1 removes inhibition from mTORC1 allowing it to promote keratinocyte and sebaceous gland proliferation [6,13]. Overactivation of mTORC1 also increases androgen signaling and activity [6]. Local hyperandrogenism further contributes to hyperkeratosis and increased sebum production [11].

Increased body habitus in obesity results in a higher number of frictional areas [16]. This friction results in mechanical irritation, follicular injury and excess sweat accumulation, which induces further proinflammatory cytokine expression [16,17]. It also creates an environment

that promotes bacterial growth, which may disrupt the cutaneous microbiome [11]. High BMI may also affect response to medical management [8]. One study assessing the correlation between BMI and response to the biologic adalimumab showed that higher BMI was associated with a lower response to treatment [8].

## Weight Loss

Weight loss is encouraged in all patients who are diagnosed with HS [9,16,17]. Weight loss reduces the risk of developing comorbid cardiovascular disease, atherosclerosis, and diabetes [13,18]. In addition weight loss is known to improve insulin sensitivity and decrease levels of inflammation, two things that are known to drive the development of HS [3,13]. There is evidence that weight loss modifies disease activity in HS with some studies showing 15% or more reduction in weight to improve disease severity [6,15,19].

Medications that improve insulin sensitivity and promote weight loss have also been used in the treatment of HS [20,21]. Metformin improves insulin resistance, promotes weight loss, and decreases the activity of mTORC1. It is well-documented in the use of HS, especially in cases of patients with comorbid metabolic syndrome and diabetes mellitus [21]. Liraglutide, a GLP-1 agonist, improves insulin sensitivity, decreases glucagon levels, and slows gastric emptying to promote weight loss. In one case report, a patient experienced a decrease in HS severity following the use of liraglutide with subsequent weight loss [20]. There are currently no trials studying GLP-1 agonists in HS and this may present another pharmaceutical option in the treatment of HS.

In one case report of a patient treated with metformin and liraglutide with subsequent weight loss, the patient had disease improvement after a delayed period of 3 months. She subsequently regained the weight, but did not have a relapse in disease [21]. Studies of patients undergoing bariatric surgery showed that there were some patients who had disease improvement and there are case reports of patients experiencing disease resolution following bariatric surgery [18,22-24]. However, there are also reports of patients experiencing stable, worsening, or even new onset HS following bariatric surgery [23,25]. This suggests there are factors unrelated to BMI that are influencing disease activity.

Bariatric surgery with subsequent weight loss results in an abundance of loose skin, which can worsen frictional areas [22,23,25]. This increased mechanical irritation may account for some of the worsening disease activity seen among HS patients undergoing bariatric surgery [3,15]. It also causes malnutrition and micronutrient deficiency [3,12,23,25]. In

the study conducted by Garovic S, et al. [23] it was found that there was an increased risk of worsening disease in patients undergoing malabsorptive bariatric surgery compared with restrictive bariatric surgery.

## Nutrition

Recent research shows that nutrition is an important component in the management of HS. Studies have proposed a bidirectional connection between the skin and gut health, linking a healthy gut microbiome to homeostasis of the skin [11,15]. A disruption of the gut microbiome could induce the pathogenic pathway of an inflammatory pilosebaceous disorder, such as HS [11,14,17].

Studies assessing nutritional status in HS patients showed deficiencies in micronutrients, particularly vitamin D and zinc, were more prevalent among HS patients [3,11]. HS patients treated with supplementary vitamin D led to reduced nodules and flares [3]. Vitamin D is known to regulate immunity by increasing the expression of Toll-like receptor-2 (TLR-2) and antimicrobial peptides. In addition to its role in immunity, vitamin D also regulates keratinocyte proliferation, which helps to prevent the hyperkeratosis that is central to the development of HS [19]. Zinc has been reported to be anti-inflammatory and anti-androgenic in HS via inhibition of both isozymes of alpha 5 reductase [11]. Zinc supplementation of 90mg daily led to reduced disease severity in all patients and up to 36% of patient's attained complete remission. Vitamin B12 supplementation has also been used and showed improved symptom control. One study supplementing vitamin B2 (riboflavin) showed decreased lesions, which was maintained even after cessation of riboflavin supplementation [19].

Unsurprisingly, diets that are rich in these micronutrients have been correlated with less severe HS [17,19]. Two studies analyzing adherence to a Mediterranean diet in HS patients both showed that increased adherence was inversely related to disease severity [10,12,14]. The Mediterranean diet is rich in anti-inflammatory foods such as fruits, vegetables, whole grains, and fish [14]. It limits the consumption of dairy products and processed sugars. Exclusionary diets such as the elimination of dairy and brewer's yeast have also shown to manage disease symptoms and there are reports of patients reintroducing these foods into their diet experiencing subsequent relapse [11,19].

## Physical Activity

Physical activity is often recommended in conjunction with a healthy diet to aid in weight loss and may be beneficial for HS patients [14,26]. Exercise improves insulin sensitivity and reduces inflammation [3,14]. There are not many studies

on the effects of physical activity and HS severity. Two studies assessing the possible benefits of mediterranean on HS also assessed the physical activity of participants [14,26]. A study by Velluzi, F, et al. [26] of a Sardinian population noted that patients had similar disease severity regardless of lifestyle changes, but they all had similar levels of physical activity and postulated that physical activity may have a protective effect leading to less severe disease activity. A Mediterranean diet study of a Spanish population by Lourite-Fuentes, I. et al. [14] showed an inverse relationship between physical activity levels and disease severity. There are no studies specifically addressing the effects of exercise on HS severity and it may be beneficial to study this in the future.

## Conclusion

Physicians should continue to encourage weight loss as a lifestyle modification for patients diagnosed with HS. The benefits of weight loss in HS include reducing HS symptoms and the risks of common comorbid conditions such as cardiovascular disease, atherosclerosis, metabolic syndrome, and diabetes mellitus. There is the possibility of patients having stable or worsening disease following bariatric surgery due to micronutrient deficiencies and increased skin folds. Managing micronutrient deficiencies and removal of excess skin may help reduce this risk.

A healthy diet should also be encouraged for all patients with HS. An anti-inflammatory diet rich in fruits, vegetables, and whole grains along with the avoidance of dairy and brewer's yeast may provide better disease control. Supplementation of micronutrients that are commonly deficient in HS patients such as vitamin D and zinc may provide an added benefit.

Physical activity is understudied in HS patients. Exercise provides the benefits of increased insulin sensitivity, decreased inflammation and promotes weight loss. This may be an important lifestyle modification that HS patients can make to control disease severity along with a healthy diet. There are still gaps in the knowledge regarding exercise in HS and this area should be actively explored.

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