Title: Alleviating and exacerbating foods in hidradenitis suppurativa
Running head: Diet in hidradenitis suppurativa

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ABSTRACT

Background: While dietary triggers have been investigated in acne and other inflammatory follicular dermatoses, there is a paucity of data on diet and HS. We sought to identify exacerbating and alleviating foods in HS patients.

Methods: An anonymous survey was distributed via HS Facebook support groups and in person at HS specialty clinics. Participants were asked to select all that apply from a list to indicate foods that worsen and make HS better including sweet foods, breads and pasta, red meat, chicken, fish, canned foods, fruits, vegetables, dairy, high-fat foods, I do not know, and no.

Results: Only 12.0% (n=89/744) identified alleviating foods while 32.6% (n=237/728) identified HS-symptom-exacerbating foods. The most commonly reported exacerbating foods were sweets (67.9%), bread/pasta/rice (51.1%), dairy (50.6%), and high-fat foods (44.2%). The most commonly reported alleviating foods included vegetables (78.7%), fruit (56.2%), chicken (51.7%), and fish (42.7%).

Conclusion: Further studies are required to evaluate the mechanistic links between diet and HS. HS patients may benefit from receiving dietary counseling as part of a comprehensive HS management plan.

Key words: hidradenitis suppurativa, diet, nutrition, food, improve, worsen

INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic dermatosis associated with painful inflammatory nodules and draining sinus tracts in intertriginous areas. Dietary triggers have been investigated in acne and other inflammatory follicular dermatoses, but there is a paucity of data on diet and HS. Studies on diet and HS are limited in number and sample size, and no randomized controlled trials have been conducted to date.

Much of the literature on diet in HS is extrapolated from the effect of diet on acne. The Western diet, a diet typically high in refined carbohydrates and dairy products but low in fruits and vegetables, is hypothesized to exacerbate HS in a similar mechanism to acne.[1] Dairy and simple carbohydrates have been shown to increase insulin and insulin-like growth factor 1 (IGF-1) levels, which activate FOXO1, a transcription factor and regulatory protein that normally suppresses mTORC1 (kinase mammalian target of rapamycin complex 1)-mediated cell proliferation within the pilosebaceous unit.[2–6] FOXO1 activation disinhibits the mTORC1 signaling pathways to induce cellular hyperproliferation within the follicular epithelium and sebaceous glands. [2–6] Additionally, FOXO1 activation by IGF-1 also exposes androgen receptors within the pilosebaceous units to further potentiate theses hyperproliferative effects.[2–6] Thus, activation of mTORC1 signaling and androgenic hyperactivity induce excessive sebum lipogenesis, predisposing to follicular occlusion which is thought to be an inciting event for both acne and HS.[3,4,6] Dairy and brewer's yeast have been specifically implicated in HS exacerbation.[1,7] We aimed to evaluate dietary patterns and identify exacerbating and alleviating foods in HS patients.

METHODS

An anonymous web-based cross-sectional questionnaire on diet and HS was distributed via social media to international Facebook HS support groups and at three North American HS specialty clinics between December 2017 - June 2019. Research personnel contacted group administrators from Facebook HS support groups including Hope For HS, the International Association of HS Network, and HS Warriors who shared the survey link with their members. Specialty clinics included the University of Arizona -Tucson, University of California Los Angeles, and University of California Davis.

The survey queried demographics, disease characteristics, and dietary patterns. In response to "Does eating certain types of food worsen your HS?" and "Does eating certain types of foods make your HS better?", participants were asked to select all that apply from a list of foods including sweet foods (juice, ice cream, baked goods, soda, candy, chocolate), breads and pasta, red meat (beef, lamb, pork), chicken, fish, canned foods, fruits, vegetables, dairy (cheese, milk, yogurt), high-fat foods (fast food, pizza), I do not know, and no. Foods reported to worsen HS were considered to be exacerbating foods, and foods reported to make HS better were considered alleviating. Statistical differences were determined using the Wilcoxon and Kruskal-Wallis tests (significance level $p<0.05$) (RStudio version1.2.5019, Boston, MA).

RESULTS

Participant demographics are summarized in Table 1. While 32.6% (n=237/728) of participants identified HS-symptom-exacerbating foods, only 12.0% (n=89/744) identified alleviating foods. The most commonly reported exacerbating foods were sweets (67.9%), bread/pasta (51.1%),

dairy (50.6%), and high-fat foods (42.2%). Alleviating foods included vegetables (78.7%), fruit (56.2%), chicken (51.7%), and fish (42.7%) (Figure 1).

Those with Hurley stage II or III had a significantly higher mean BMI than stage I (36.6 and 36.4 vs. 31.9 kg/m^2 respectively, $p<0.001$). Those who lived closer (<8 km) to a grocery store had a significantly lower BMI (35.4 kg/m^2) than those who lived further (>16 km, BMI 38.0 kg/m^2, $p=0.013$); distance from grocery store was not significantly associated with Hurley stage ($p=0.36$). Only 35.2% of the participants reported receiving dietary counseling from a healthcare provider.

DISCUSSION

A prior survey study of 242 participants reported that 75.6% of HS patients have practiced dietary alterations, with 30.9% reporting that HS was "much better" after implementing dietary changes.[8] In line with findings from this study, our study identified dairy as a commonly reported exacerbating food in HS.[8] We also identified sweets, bread/pasta/rice, and dairy as the most common dietary triggers, supporting prior hypotheses that the Western diet can worsen HS.[1] However, the impact of increasing intake of specific food groups in HS is less studied. In our survey, vegetables, fruits, chicken, and fish were the most commonly identified alleviating foods, many of which are building blocks for the Mediterranean diet. One previous study showed that adherence to a Mediterranean diet, defined as a diet high in fruits, vegetables, seafood, and nuts and low in refined carbohydrates and red and processed meats, has been associated with decreased HS severity, and possibly due to antioxidants and polyphenols from plants.[9]

Dietary consumption patterns can alter the gut microbiome, modulating the inflammatory response and potentially affecting disease activity.[10] The micronutrient profile of foods may also influence HS activity. Chicken, fish, and red meat were considered to be alleviating. This may be due to the high zinc and vitamin B12 content of these foods, as recent systematic reviews indicate that supplementation of these micronutrients improves HS symptoms.[11–14] Vitamin D supplementation may also lead to clinical HS improvement, and dairy products can be high in vitamin D.[15] However, as dairy was frequently considered to be exacerbating in our study as well as in a prior report,[1] obtaining adequate vitamin D through supplementation rather than through dietary intake may be preferred in HS patients.

Only 1/3 (35.2%) of participants reported receiving nutritional counseling from a healthcare provider, highlighting an opportunity to improve patient education. Some patients may benefit from keeping a log of dietary intake and HS symptoms to better identify disease-modifying foods.

Limitations of this study include recall bias along with self-reported diagnosis of HS and Hurley stage. Individuals recruited from HS specialty clinics and social media may have biased responses; they may have had more exposure to information on diet and HS, making them more attuned to and more likely to report on dietary influences. Additionally, foods are rarely eaten in isolation, making it difficult to link symptom changes to specific foods.

Dietary modifications have the potential to serve as a cost-effective adjunctive therapy for HS, but the ideal diet for HS remains largely unknown. It is also unclear whether it is more beneficial

to avoid “exacerbating” foods or to consume “alleviating” foods, or if both of these dietary changes should be implemented together. Our findings identified several food groups that may serve as targets for future interventional studies in diet and HS to help clinicians and patients better understand how dietary patterns may influence HS. However, these studies are challenging to conduct given lack of participant blinding, variability in food preferences among participants, and limited adherence to nutrition recommendations. Further research is needed to evaluate the mechanistic links between diet and HS. Patients may benefit from incorporating dietary changes into a comprehensive HS management plan.

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Table 1. Participant Demographics

Total Participants n = 770	**n (%)**	
Gender		
Female	705 (91.6%)	
Male	61 (7.9%)	
Other	4 (0.5%)	
	Mean +/- SD (range)	
Age, years (n = 769)[a]	36.5 +/- 10.8 (16-74)	
Age of onset, years (n = 688)[b]	18.9 +/- 9.0 (1-72)	
Duration of disease (n = 688)[c]	17.7 +/- 11.2 (0-60)	
Time to diagnosis, years (n = 647)[d]	11.0 +/- 9.8 (0-60)	
BMI, kg/m^2 (n = 725)[e]	36.0 +/- 9.4 (14.4-78.1)	
Smoking (n = 763)[f]		
Current smoker	295 (38.7%)	
Non-smoker	468 (61.3%)	
Diagnosed by (n = 711)[g]		
Dermatologist	339 (47.7%)	
Primary Care Provider	186 (26.2%)	
Other	186 (26.2%)	
Ethnicity (n = 770)		
Caucasian/White	547 (71.0%)	
Hispanic	79 (10.3%)	
African American/Black	73 (9.5%)	
South Asian	33 (4.3%)	
Native American	18 (2.3%)	
East Asian	10 (1.3%)	
Pacific Islander	8 (1.0%)	
Other	2 (0.3%)	
Comorbidities (n = 742)[h]		
Hypertension	157 (21.2%)	
High cholesterol	119 (16.0%)	
Diabetes mellitus	96 (12.9%)	
Lung disease	29 (3.9%)	
Heart disease	25 (3.4%)	
Other	211 (28.4%)	
Unknown	33 (4.4%)	
None	319 (43.0%)	
Reported Hurley stage (n = 671)[i]	**n (%)**	**Mean BMI +/- SD (kg/m^2)**

Stage 1	80 (11.9%)	31.9 +/- 8.8
Stage 2	335 (49.9%)	36.6 +/- 9.6
Stage 3	256 (38.2%)	36.4 +/- 9.5
Diet (n = 727)[j]		
Vegan	8 (1.1)	25.6 +/- 4.2
Vegetarian	27 (3.7)	31.8 +/- 9.7
Pescatarian	25 (3.4)	35.5 +/- 8.6
Omnivore	667 (91.7)	36.1 +/- 9.7
Grocery store distance (n = 727)[k]		
<8 km	597 (82.1)	35.4 +/- 9.5
8-16 km	83 (11.4)	37.4 +/- 11.3
>16 km	47 (6.5)	38.0 +/- 7.5

Missing responses: [a]1, [b]82, [c]82, [d]123, [e]45, [f]7, [g]59, [h]28, [i]99, [j]43, [k]43
SD, standard deviation. BMI, body mass index.

LEGEND

Figure I. Participant-reported exacerbating and alleviating foods.

32.6% (n=237/728) of participants identified exacerbating food; 12.0% (n=89/744) of participants identified alleviating foods.