

Influence of Dietary and Non-Dietary Factors on Urticaria

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Abstract

Urticaria is a significant public health concern and common dermatological disease characterized by recurrent episodes of itching, redness, and wheals, which can be triggered by dietary and non-dietary factors, including food intake, psychological stress, vitamin D deficiency, and heat exposure, and have been implicated in triggering or exacerbating symptoms. A cross-sectional, self-reported survey was conducted in Zawia City, Libya, between November 2025 and February 2026 among patients attending multiple centers, including Alshorouk Clinic and Al Mutrad Hospital, as well as students from the Faculty of Medical Technology. The study aimed to identify the most commonly reported food allergens associated with urticaria and to evaluate the influence of non-dietary factors, including psychological stress, heat exposure, and vitamin D deficiency. Of 200 respondents with urticarial disease who completed the questionnaire, 92% were female. Nearly half of the participants had daily wheals, with half of the participants reporting three or more episodes per week; more than half of the participants reported a duration of wheals was 1- 12 h. Regarding associated symptoms, itching was reported by the majority of participants, followed by Redness and Angioedema. A significantly higher association between vitamin D deficiency and monthly episodes compared to those with normal levels (median: 4 vs 2 episodes, Mann-Whitney U test, $p < 0.001$). Furthermore, severe itching was significantly associated with both spicy food consumption and psychological stress $p < 0.001$. Environmental exposure was identified as a contributing factor, with 112 of the participants (56%) reporting heat exposure. In conclusion, urticaria is impacted by multiple dietary and non-dietary factors. Vitamin D deficiency, heat exposure, spicy food, and psychological stress were associated with more frequent urticaria episodes, while Food additives, Heavy meals, Tomatoes, and dairy were identified as important symptom triggers. Identifying these factors may help improve symptom control, and further studies are recommended to evaluate lifestyle.

Keywords. Urticaria, Dietary, Non-dietary, Wheals, Hives.

Introduction

Urticaria, or hives, is a common dermatological condition defined as a disease of allergic reaction characterized by localized itching, erythematous appearance of spontaneous wheals with or without angioedema lasting longer than six weeks [1,2], which occurs due to increased permeability of the blood vessels in the absence of an identifiable trigger or other inducible stimuli. Based on recent recommendations, urticaria is classified into acute (AU), in which symptoms disappear within six weeks, and chronic (CU), in which skin changes remain for more than six weeks [3]. Exposure to a certain food leading to an abnormal immunological response is called a food allergy [4]. Food allergies are associated with skin conditions such as atopic dermatitis, urticaria, and oral allergy syndrome. Exposure to specific food allergens activates mast cells and basophils via immunoglobulin E, resulting in the release of histamine and other inflammatory mediators that contribute to the development of skin symptoms. However, the mechanisms of the interaction between food antigens and chronic urticaria remain incompletely understood [5].

Food intolerances associated with chronic urticaria are more common than food allergies and are distinct from allergy [6]. These conditions are defined as food-related symptoms that are objectively reproducible but do not involve an immune mechanism. Many foods have been reported to exacerbate the symptoms of chronic urticaria; these trigger foods include: food additives, seafood, certain fruits and vegetables, fermented foods, and others [7]. Systemic immunity and skin barrier health are influenced by dietary patterns; the risk of allergies and allergic reactions increases with deficiencies in essential nutrients such as antioxidants, omega-3-fatty acids, and vitamin D [8]. Vitamin D supports epithelial integrity and immune tolerance, it impedes B cell proliferation and differentiation, and immunoglobulin secretion [9], and omega 3 fatty acids exert a protective effect in the development of allergic disease whereas increased dietary intake of omega 6 fatty acids is regarded as proinflammatory, as they contribute to the development and appearance of allergic symptoms, therefore, deficiency of vitamin D may predispose individuals to more frequent or more severe skin reactions upon exposure to allergens [10,11]. The development of the food industry, and the increased use of food additives including dyes, preservatives, and artificial sweeteners, and the overconsumption of highly processed foods are contributing to an increase in food-triggered reactions [12]. Histamine is released from mast cells, and it's one of the most important mediators for urticaria, and a vasoactive amine [13].

Certain foods contain higher levels of histamine, such as cheese, lettuce, or may be liberated by proteolysis during processing or storage, fermented foods, spinach, some fish types, meat, and others [14]. There are several other causes that cause increased spontaneous urticaria, such as medications, foods, food additives, infections (bacterial, viral, and fungal), parasitic infestations, allergens, internal diseases, malignities and other dermatologic diseases [15,16]. Many studies have demonstrated that psychological factors, such as depression and anxiety, are associated with urticaria

[17,18]. Although urticaria is considered as a significant health problem, studies investigating its prevalence and the most common food triggers remain limited in Zawiya. The aim of this study is to identify the most commonly reported food allergens associated with urticaria and to evaluate the influence of non dietary factors, including psychological stress, heat exposure, and vitamin D deficiency.

Methods

Setting and Population

The study population comprised patients diagnosed with urticaria at multiple centers, including Alshorouk Clinic and Al Mutrad Hospital, as well as students from the Faculty of Medical Technology. A total of 200 participants were included in the study. The data were collected using a self-administered questionnaire adapted from a previously published study [19]. Certain items were modified to improve clarity and ensure suitability for the general population. The questionnaire was divided into three sections: demographic data, history of present illness to assess the frequency of urticaria occurrences, duration of wheals and severity of pruritus among participants with urticaria, and the relation between foods and symptoms.

Study period

The study was conducted over a four-month period, from November 2025 to February 2026.

Inclusion Criteria

Patients with the following criteria were included.

Aged 15 years and older who had a history of suspected food allergy or previous cutaneous reactions following food ingestion.

Participants were also required to have the ability to complete the questionnaire or an interview regarding their dietary and clinical history.

Exclusion Criteria

Age under 15 years.

Patients receiving immunosuppressive therapy that could alter immune responses.

Individuals with chronic dermatological conditions unrelated to allergy, such as congenital skin disorders.

Statistical analysis

All data were arranged, cleared, entered into Microsoft Excel, then transferred to IBM SPSS Statistics for analysis. The Chi-square test was conducted to assess associations between categorical variables, while the Mann-Whitney U test and one-way ANOVA were applied to compare differences between groups where appropriate. All statistical tests were two-tailed and a P-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Libyan National Committee for Biosafety and Bioethics. It was also reviewed and approved by the Department of Medical Nutrition, Zawia Medical.

Results

Of 200 respondents with urticarial disease who completed the questionnaire, the majority of participants were female (92%), while males accounted for only (8 %) of the participants. The age of the patients was between 15-20 (57%), followed by ages 21-30 (33%). Regarding exercise frequency, (69%) reported exercising once per week, followed by 21% and 10% as shown in Table 1. Furthermore, 17% of participants reported an allergy to antibiotics, (7%) reported a gluten allergy, and 4% reported a histamine allergy. The demographic characteristics of the study participants are displayed in (Table 1). As clarification in (Figure 1) vitamin D deficiency was reported by the majority of participants (78%) whereas (22%) reported no vitamin D deficiency.

Table 1. Demographic characteristics.

Variable	Category	Frequency (n=200)	Percentage (%)
Age	15–20 y	114	57
	21–30 y	66	33
	31–40 y	16	8
	>41 y	4	2
Sex	Female	184	92
	Male	16	8
Exercise	1/week	138	69
	2/week	42	21

	3/week	20	10
Allergies	Antibiotic	34	17
	Gluten	14	7
	Antihistamine	8	4
Vitamin D deficiency	Yes	156	78
	No	44	22

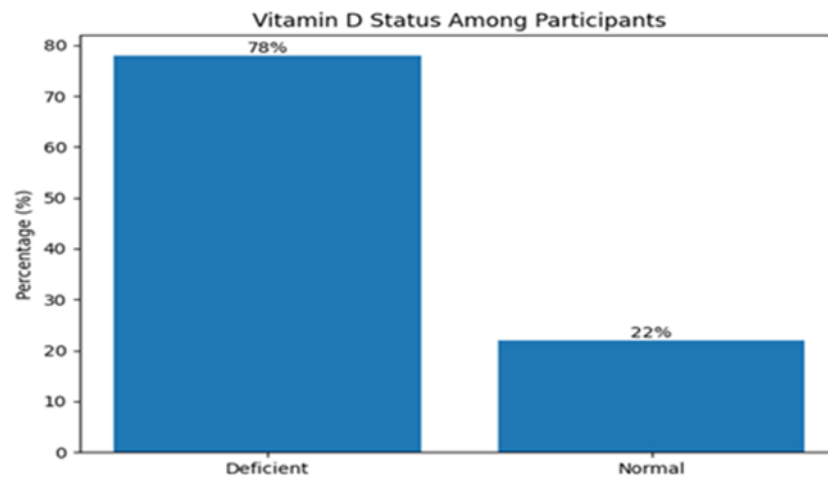
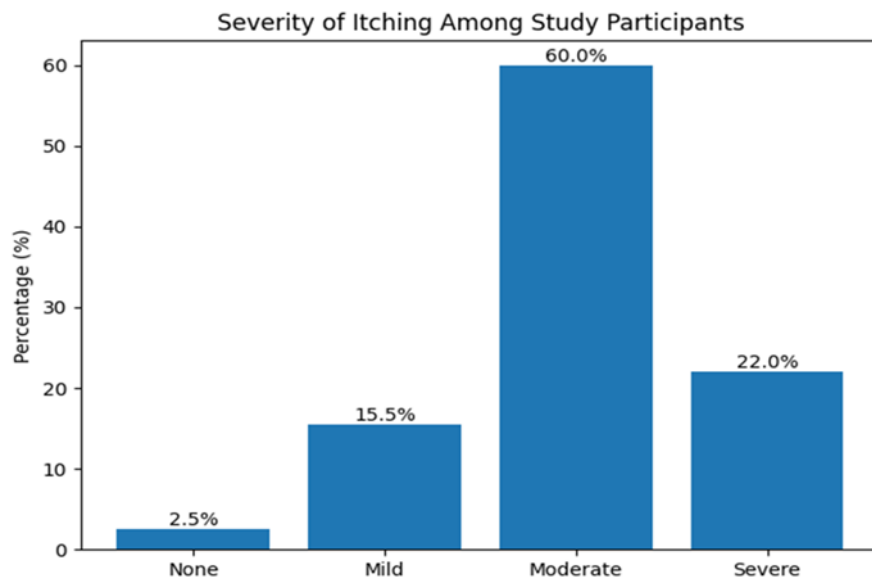
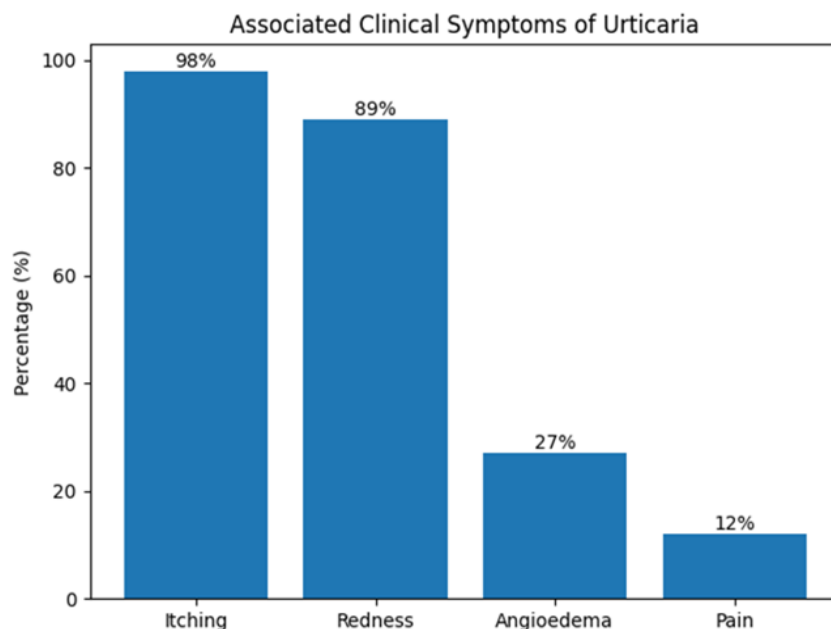


Figure 1. Vitamin D status among participant

(Table 2) Presents the frequency of urticaria occurrences, duration of wheals and severity of pruritus among participants with urticaria. The average age at onset of urticaria was 18.4 years. A considerable proportion of participants reported frequent disease activity, with (48%) experiencing daily episodes and (50%) reporting three or more episodes per week. The majority of wheals persisted for 1-12 hours (64%), while a smaller proportion lasted 12-24 hours or longer. In addition, moderate to severe pruritus was reported by (82%) of participants, as shown in (Figure 2). Overall, these findings are consistent with the typical clinical presentation of chronic urticaria, characterized by frequent wheals and severe pruritus, as shown in (Figure 3).

Table 2. history of present illness

Variable	Category	Frequency (n=200)	Percentage (%)
Age of onset	Mean $\pm$ SD	18.4 $\pm$ 3.2	-
Frequency of hives	Daily	96	48
	Several times/week	74	37
	Occasionally	30	15
Duration of wheals	<1 h	20	10
	1–12 h	128	64
	12–24 h	42	21
	>24 h	10	5
Monthly episodes	1/week	40	20
	2/week	60	30
	≥ 3 /week	100	50
Itching severity	None	5	2.5
	Mild	31	15.5
	Moderate	120	60
	Severe	44	22
Associated symptoms	Itching	196	98
	Redness	178	89
	Angioedema	54	27
	Pain	24	12

**Figure 2. severity of itching****Figure 3. Associated clinical symptoms**

(Table 3) shows the distribution of all 19 reported food allergens among participants with urticaria. Spicy food was the most frequently identified dietary trigger, reported by (74%) of participants, followed by food additives (52%) and tomatoes (41%). Dairy products were reported by (34%) of participants, while caffeine and strawberries were identified by (29%) and (28%), respectively. Moderately reported food allergens included eggplant (24%), egg (22%), garlic (15%), and kiwi (13%), whereas avocado, spinach, and wheat were less frequent triggers. Overall, as (Figure 4) presents, spicy food and food additives were the most commonly reported dietary factors associated with urticaria symptoms among the participants.

Table 3. Self-Reported Food-Triggered Exacerbations

Food Item	Yes (n=200)	Percentage (%)
Spicy food	148	74
Food additives	104	52
Tomatoes	82	41
Dairy	68	34
Caffeine	58	29
Strawberries	56	28
Eggplant	48	24
Egg	44	22

Fish	22	11
Beef	20	10
Wheat	16	8
Ginger	14	7
Kiwi	26	13
Garlic	30	15
Pineapple	24	12
Spinach	12	6
Banana	18	9
Avocado	10	5
Soy sauce	24	12

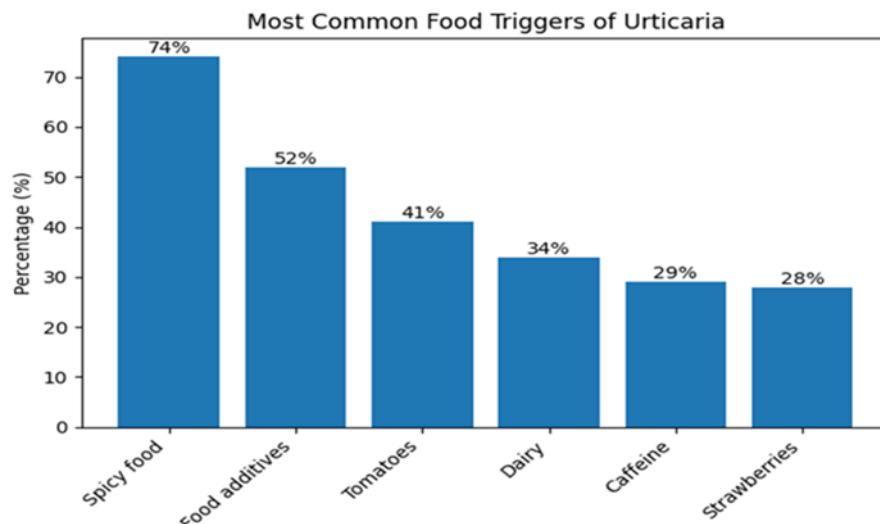


Figure 4. most common food triggers of urticaria

Table 4. triggers and worsening factors

Trigger	Frequency (n=200)	Percentage (%)
Heavy meals	142	71
Fast food	Sometimes 136	68
	Frequently 40	20
Stress	172	86
Food	148	74
Heat exposure	112	56
Cold exposure	32	16
Drugs	46	23
Other triggers	15	7.5

Based on participants' reports presented in (Table 4), several factors were identified as contributing to exacerbation of urticaria symptoms, and psychological stress was the most common aggravating factor reported by (86%) of participants, followed by food-related factors (74%) and heavy meals (71%). Fast food consumption was also commonly associated with symptom aggravations, with (68%) of participants' reactions following fast food intake. Environmental exposure was also identified as a contributing factor, with (56%) of participants reporting heat exposure, while cold exposure was reported at less frequently. Drug-related triggers were reported by (23%). These findings highlight the important contribution of psychological, dietary, and environmental factors that contribute to exacerbation of urticaria symptoms.

Table 5. Association between clinical variables and severity of urticaria (p-values)

Variable	Comparison	Test	Result	p-value
Vitamin D	Deficient vs Normal	Mann-Whitney U	Median episodes: 4 vs 2	<0.001
Spicy food	Severe vs Mild itching	Chi-square	n(%): 120/28	<0.001
Stress	Severe vs Mild itching	Chi-square	n(%): 140/10	<0.001
Sex	Female vs Male	Mann-Whitney U	Median episodes: 3 vs 2	0.12
Age group	15–20 vs >20	ANOVA	Mean episodes: 3.5 vs 3.0	0.08

A statistical analysis was performed to assess the relationship between clinical and lifestyle factors and the severity and recurrence of urticaria symptoms. It was observed that a significant correlation exists between vitamin D deficiency and the frequency of urticaria episodes. Participants with vitamin D deficiency had a higher average number of episodes compared to normal vitamin D levels (median: 4 vs 2 episodes, Mann-Whitney U test, $p < 0.001$). A significant Chi-square test was conducted to assess the relationship between spicy food consumption and severity of itching among participants. It was observed that a greater proportion of participants with severe itching reported consuming spicy food compared with those with mild itching. This association was found to be statistically significant (Chi-square test $p < 0.001$). In contrast, females had a slightly higher median number of episodes than males (median : 3 vs 2 episodes), but this difference was not statistically significant (Mann-Whitney U test, $p = 0.12$). Likewise, no significant difference was observed between the younger age group (15-20 years) and participants older than 20 years regarding the average number of episodes (mean: 3.5 vs 3.0 episodes, ANOVA $p = 0.08$).

Discussion

The role of nutrients, which are essential for life, in the etiology of urticaria has long been questioned. Urticaria is a common dermatological disorder that can be triggered by a variety of internal and external factors, including food allergens. In clinical practice, identifying potential dietary and non-dietary triggers, such as psychological stress, heat exposure, and vitamin D deficiency, is considered an important component in the prevention of recurrent episodes. Therefore, the current study aimed to identify the most reported food allergens associated with urticaria and to evaluate the influence of non-dietary triggers. A study conducted by Cooper KD.J 1991 reported a high prevalence of acute urticaria among females and young to middle-aged adults [20]. In this study, the urticaria commonly affects adolescents and young adults. This finding is similar to previous epidemiological studies that reported the onset of chronic urticaria mostly in early adulthood [21]. The current study also demonstrated a high prevalence of vitamin D deficiency among urticaria patients (78%), this finding is comparable with several studies that reported significantly lower serum vitamin D levels in patients with chronic spontaneous urticaria compared with healthy controls [22].

Similarly, a meta-analysis by Yajia Li et al. concluded that patients with chronic urticaria have significantly lower serum 25(OH)D levels and vitamin D supplementation contributed to symptom improvement [23]. Most of the studies in a recent review suggest that vitamin D3 has an important role in various skin diseases. It contributes to the regulation of structural proteins within the cornified layer of the skin and influences disorders associated with skin barrier dysfunction such as atopic dermatitis. In addition, vitamin D affects the number and immunosuppressive activity of regulatory T (Treg) cells while inhibiting normal T cell function [24].

It is demonstrated as a protective factor in allergy by inhibiting the production of pro-inflammatory cytokines such as interleukin (IL)-1, IL-6, IL-12, and IFN- γ [25]. A systematic review by Luintel et al. (2025) reported that approximately 10% of patients worldwide self-report penicillin allergy. In our study, 17% of patients with urticaria had self-reported antibiotic allergy, while antihistamine allergies represented 4% [26]. As the pathological of urticaria involves multiple triggers, including allergic reactions, infections, medications, and autoimmune disorders such as celiac disease [27]. Celiac disease is an immune disorder triggered by gluten ingestion that results in immune dysregulation and inflammatory damage to the small intestinal mucosa, responsible for nutrient absorption [28]. In our study, 7% of participants reported gluten sensitivity; the association between urticaria and celiac disease may be explained by shared autoimmune mechanisms and immune dysregulation, such as mast cell stimulation, cross-reactivity to non-gluten proteins and alterations in the gut microbiota influencing skin conditions [29]. Chronic urticaria is characterized by recurrent wheals occurring on most days of the week; according to our results, about half of participants experienced hives daily, while 37%, reported episodes several times per week, and most patients 64% reported lesions lasting between 1 and 12 h, while 21% reported wheals lasting 12-24hours. Mehta et al. observed that lesions in chronic urticaria are generally transient and disappear within 24 h, supporting the observations in the present study. Oedema persisting beyond 24h were observed in only 5% of participants [30] other manifests of chronic urticaria is itching and it was the predominant symptoms among of participant reported as 98% regarding to severity moderate itching was the most common presentation 60% followed by sever itching while only small proportion of patients reported mild or no itching, the observed predominance of moderate to severe pruritus is Consistent With Previous Research Jankowska-Konsur Et Al. Reported That Pruritus Was the most troublesome symptom in 75.8%of patients with chronic urticaria. Other characteristics of chronic urticaria shows as Redness Angioedema and Pain.

In the current study, redness was reported by 89% of participants, and it's the second most frequent associated symptom after pruritus because erythema Surrounding Wheals Is A defining clinical feature of urticaria it is high prevalence is expected. Previous research supports our findings, demonstrating that wheals are transient skin swellings that are almost invariably accompanied by erythema. The high frequency of redness in our population may indicate active inflammatory processes [31]. Libyan cuisine consists of distinctive spices, dishes rich in canned tomatoes and vegetables, and new dishes containing artificial colors and additives. The consumption of food from restaurants has also increased, along with the consumption of caffeine, and we do not know the amount needed to trigger an allergic reaction. Since chronic spontaneous urticaria can appear at any time, a patient may contribute to potential exacerbation triggers with food,

medications, and activities. In Western countries, the order of prevalence of common food allergens in all ages is citrus fruits, tomato, egg, strawberry, soy, wheat, and fish [32]. In our study, spicy food was the most frequently reported trigger 74% and it may reflect to dietary habits and cultural food in North African and Middle Eastern countries, including Libyan spicy and seasoned food, which constitute a main component of daily meals, otherwise, frequent exposure to spicy food may increase the likelihood of patients associating symptom exacerbations with their consumption.

Similar is reported by researches observed that spicy food can exacerbate chronic urticaria in sensitive patients despite the absence of true food allergy [33]. Addition of food additives was reported by more than half participate, indicating the association between processed foods and worsening symptoms. Additives can be natural or synthetic; natural additives contain sufficient molecular weight to induce an IgE-mediated response, but the synthetic ones contain low molecular weight and act as haptens. Haptens can induce an IgE-mediated response only if they are attached covalently to a large carrier molecule [34]. Food additives as dyes are usually added to food, beverages, medications, and cosmetics to improve their appearance and/or enhance their color. The natural red dye as carmine has been associated with urticaria and angioedema, recurrent intermittent bouts of generalized systematized dermatitis [35]. Another study about annatto is food or cosmetic dye that is deep yellow or orange, reported to cause reactions in children, both urticaria and angioedema. This finding supports our study [36].

Another food-related cause of urticaria is histamine. While most people can tolerate foods high in histamine, some vegetables contain histamine, such as tomatoes, eggplant and pineapple; fruits that contain histamine-like substances as strawberries, kiwi, pineapple, banana, and avocado, have high histamine which can worsen symptoms, and other food can rise histamine as egg white, additive food. Similarly, findings have been reported that identify the natural food compounds, including tomatoes and other plant-derived foods were associated with symptom exacerbation in patient with chronic urticaria. These reactions may be related to histamine-rich substances or pseudoallergens present in these foods [37]. Fermented substances are the product of the metabolic activity of fermenting microorganisms, such as bacteria, yeast, and fungi, as microbes convert amino acids such as histidine to biogenic amines, fermented food is therefore also likely to have higher levels of histamine including aged sorts of cheese [38], dairy products were commonly demonstrated in our study may contributed with urticaria, similar observation have been reported in elimination diet studies where removal of dairy products resulted in symptom improvement among sensitive individuals [39]. In ultra-processed foods or additives, such as oxidative species, can trigger systemic oxidative stress and mast cell degranulation, although during the Maillard reaction free radical generated and leading to the formation of protein hydroperoxides, which may trigger urticaria reactions [40,41].

Our study showed that 29% of participants experienced urticaria in response to caffeine. Caffeinated beverages act as stimulants to the central nervous system and have both positive and negative impacts [42]. However, they are not common causes of urticaria. Nevertheless, a few studies of cases and clinical observation have described urticarial reactions associated with the consumption of caffeinated beverages [43]. Among non-dietary triggers, stress was major finding in our study, affecting more than four-fifths of participants. Furthermore, stress was strongly associated with severe itching. These findings align with previous research on psychological stress, which is known to exacerbate chronic urticaria symptoms, creating a vicious cycle where itching leads to increased stress, which in turn intensifies the itching [44].

Psychological stress activates Catecholamines secreted by the sympathetic-adreno-medullary system from the central nervous system and adrenal glands; stimulation of α - and β -adrenergic receptors leads to vasoconstriction, increased blood pressure, tachycardia, and elevated blood glucose levels to produce the “fight or flight” response. These hormones affect mast cells, which play a crucial role in the pathogenesis of urticaria, leading to their degranulation and the release of histamine—the main mediator of urticaria symptoms [45]. In addition, heat exposure causes physical urticaria induced by direct contact of the skin with warm objects or warm air. In that finding, 112 participants reported heat exposure as a trigger, while cold exposure was reported by 32 participants. As a previous study described, heat exposure is a rare type of acquired physical urticaria character of this relatively rare disorder has not been clearly delineated, though the role of mast cell-derived mediator release [46]. In this study, we observed a difference in heat exposure compared to cold exposure, and this may be related to the climatic conditions in Libya.

Conclusion

This study provided an overview of urticaria based on the relationship between diet and urticaria, indicating that dietary factors may impact the onset, severity, and duration of symptoms in some patients. In our study, it principally affects young females, with frequent and sometimes daily occurrence. Moderate to severe pruritus and transient wheals and redness were common, while angioedema was less prevalent. Dietary triggers, such as spicy foods, additives, and heavy meals, play an important role in exacerbating symptoms, and natural foods rich in histamine may also increase the severity of symptoms. Other etiological aspects, such as stress, heat exposure, and deficiency of vitamin D, were also key non-dietary triggers. This study was limited to a small area, and only the history given by the patient was taken into account; hence, future studies should also examine the long-term nutritional and psychological effects.

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Conflict of interest. Nil

References

1. Darlenski R, Kazandjieva J, Zuberbier T, Tsankov N. Chronic urticaria as a systemic disease. *Clin Dermatol*. 2014 May-Jun;32(3):420-3.
2. Bernstein JA, Lang DM, Khan DA, Craig T, Dreyfus D, Hsieh F, Sheikh J, Weldon D, Zuraw B, Bernstein DI, Blessing-Moore J. The diagnosis and management of acute and chronic urticaria: 2014 update. *J Allergy Clin Immunol*. 2014 May;133(5):1270-7.
3. Zuberbier T, Abdul Latiff AH, Abuzakouk M, Aquilina S, Asero R, Baker D, Ballmer-Weber B, Bangert C, Ben-Shoshan M, Bernstein JA, Bindslev-Jensen C. The international EAACI/GA²LEN/EuroGuiDerm/APAAACI guideline for the definition, classification, diagnosis, and management of urticaria. *Allergy*. 2022 Mar;77(3):734-66.
4. National Allergy and Infectious Diseases Panel. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol*. 2010 Dec;126(6 Suppl):S1-58.
5. Daley SF, Lopez CM, Mendez MD. Food allergies. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 May 5.
6. Zuberbier T, Aberer W, Asero R, Bindslev-Jensen C, Brzoza Z, Canonica GW, Church MK, Ensina LF, Giménez-Arnau A, Godse K, Gonçalves M. The EAACI/GA²LEN/EDF/WAO Guideline for the definition, classification, diagnosis, and management of urticaria: the 2013 revision and update. *Allergy*. 2014 Jul;69(7):868-87.
7. Theoharides TC, Valent P, Akin C. Mast cells, mastocytosis, and related disorders. *N Engl J Med*. 2015 Jul 9;373(2):163-72.
8. Warner JO. The foetal origins of allergy. *Curr Allergy Clin Immunol*. 2017 Jun 30;30(2):62-8.
9. Ryczaj K, Beken B, Akdis C. Feeding the skin barrier: the impact of macro- and micronutrients on skin barrier function. *Clin Transl Allergy*. 2025 Nov;15(11):e70105.
10. Rolf L, Muris AH, Hupperts R, Damoiseaux J. Vitamin D effects on B cell function in autoimmunity. *Ann N Y Acad Sci*. 2014 May;1317:84-91.
11. Barros R, Moreira A, Padrão P, Teixeira VH, Carvalho P, Delgado L, Lopes C, Severo M, Moreira P. Dietary patterns and asthma prevalence, incidence and control. *Clin Exp Allergy*. 2015 Nov;45(11):1673-80.
12. Ellwood P, Asher MI, García-Marcos L, Williams H, Keil U, Robertson C, Nagel G; ISAAC Phase III Study Group. Do fast foods cause asthma, rhinoconjunctivitis and eczema? Global findings from the International Study of Asthma and Allergies in Childhood (ISAAC) phase three. *Thorax*. 2013 Apr;68(4):351-60.
13. Sahu SC. Food additives: a special issue of the journal Food and Chemical Toxicology. *Food Chem Toxicol*. 2017 Sep;107(Pt B):529.
14. Antia C, Baquerizo K, Korman A, Alikhan A, Bernstein JA. Urticaria: a comprehensive review: treatment of chronic urticaria, special populations, and disease outcomes. *J Am Acad Dermatol*. 2018 Oct;79(4):617-33.
15. Chung BY, Park SY, Byun YS, Son JH, Choi YW, Cho YS, Kim HO, Park CW. Effect of different cooking methods on histamine levels in selected foods. *Ann Dermatol*. 2017 Dec;29(6):706-14.
16. Mathelier-Fusade P. Drug-induced urticarias. *Clin Rev Allergy Immunol*. 2006 Feb;30(1):19-23.
17. Balp MM, Vietri J, Tian H, Isherwood G. The impact of chronic urticaria from the patient's perspective: a survey in five European countries. *Patient*. 2015 Dec;8(6):551-8.
18. Engin B, Uguz F, Yilmaz E, Özdemir M, Mevlitoglu I. The levels of depression, anxiety and quality of life in patients with chronic idiopathic urticaria. *J Eur Acad Dermatol Venereol*. 2008 Jan;22(1):36-40.
19. Renuka SR, Latha S, Manoharan D, Geo DC, Ramesh TV. Knowledge, attitude and behaviour study on urticaria patients towards urticaria and diet. *Int J Res Dermatol*. 2021;7(6):822-6.
20. Cooper KD. Urticaria and angioedema: diagnosis and evaluation. *J Am Acad Dermatol*. 1991 Jul;25(1 Pt 2):166-76.
21. Maurer M, Weller K, Bindslev-Jensen C, Giménez-Arnau A, Bousquet PJ, Bousquet J, Canonica GW, Church MK, Godse KV, Grattan CE, Greaves MW. Unmet clinical needs in chronic spontaneous urticaria: a GA²LEN task force report 1. *Allergy*. 2011 Mar;66(3):317-30.
22. Siddiqui A, Bai A, Kumar H, Mandhwani YR, Bai A, Bai P, Kumar N, Muskan FN, Jatoi S, Ali Z, Parveen A. Chronic urticaria and vitamin D supplementations: a systematic review. *Eur J Med Res*. 2025 Jul 31;30(1):691.
23. Li Y, Cao Z, Guo J, Li Q, Su J. Effects of serum vitamin D levels and vitamin D supplementation on urticaria: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2021 May 5;18(9):4911.
24. Oda Y, Uchida Y, Moradian S, Crumrine D, Elias PM, Bikle DD. Vitamin D receptor and coactivators SRC2 and 3 regulate epidermis-specific sphingolipid production and permeability barrier formation. *J Invest Dermatol*. 2009 Jun;129(6):1367-78.
25. Yu C, Fedorich B, Anderson PH, Lopez AF, Grimbaldston MA. Vitamin D3 signalling to mast cells: a new regulatory axis. *Int J Biochem Cell Biol*. 2011 Jan;43(1):41-6.
26. Luintel A, Healy J, Blank M, Luintel A, Dryden S, Das A, Darzi A, Cooke G. The global prevalence of reported penicillin allergy: a systematic review and meta-analysis. *J Infect*. 2025 Feb;90(2):106429.
27. Deacock SJ. An approach to the patient with urticaria. *Clin Exp Immunol*. 2008 Aug;153(2):151-61.
28. Lebwohl B, Ludvigsson JF, Green PH. Celiac disease and non-celiac gluten sensitivity. *BMJ*. 2015 Oct 5;351:h4347.
29. Bracken SJ, Abraham S, MacLeod AS. Autoimmune theories of chronic spontaneous urticaria. *Front Immunol*. 2019 Mar 29;10:627.
30. Mehta S, Goldin J, Danosos GN. Chronic urticaria. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Mar 25.
31. Jankowska-Konsur A, Reich A, Szepietowski J. Clinical characteristics and epidemiology of chronic urticaria: a nationwide, multicentre study on 1091 patients. *Postepy Dermatol Alergol*. 2019 Apr;36(2):184-91.
32. Nwaru BI, Hickstein L, Panesar SS, Roberts G, Muraro A, Sheikh A; EAACI Food Allergy and Anaphylaxis Guidelines Group. Prevalence of common food allergies in Europe: a systematic review and meta-analysis. *Allergy*. 2014 Aug;69(8):992-1007.

33. Zuberbier T, Aberer W, Asero R, Abdul Latiff AH, Baker D, Ballmer-Weber B, Bernstein JA, Bindselev-Jensen C, Brzoza Z, Buense Bedrikow R, Canonica GW. The EAACI/GA²LEN/EDF/WAO guideline for the definition, classification, diagnosis and management of urticaria. *Allergy*. 2018 Jul;73(7):1393-414.
34. Wilson BG, Bahna SL. Adverse reactions to food additives. *Ann Allergy Asthma Immunol*. 2005 Dec;95(6):499-507.
35. Machler BC, Jacob SE. Carmine red: a potentially overlooked allergen in children. *Dermatitis*. 2018 Mar/Apr;29(2):92-3.
36. Ramsey NB, Tuano KT, Davis CM, Dillard K, Hanson C. Annatto seed hypersensitivity in a pediatric patient. *Ann Allergy Asthma Immunol*. 2016 Sep;117(3):331-6.
37. Jaros J, Shi VY, Katta R. Diet and chronic urticaria: dietary modification as a treatment strategy. *Dermatol Pract Concept*. 2019 Dec 31;10(1):e2020004.
38. Biji KB, Ravishankar CN, Venkateswarlu R, Mohan CO, Gopal TS. Biogenic amines in seafood: a review. *J Food Sci Technol*. 2016 May;53(5):2210-8.
39. Gupta R. Chronic urticaria due to milk. *J Pak Assoc Dermatol*. 2020;30(1):201-2.
40. Neha O, Rangasamy A, Surasani VK, Gnanasekaran L, Vinayagam S, Sundaram T, Mutum RD, Faraj TK, Alrefaei AF, Dara PK, Lackner M. Tropomyosin allergen from freshwater and marine water crabs: identification, structural-physicochemical, rheological and allergenic characterization. *Appl Food Res*. 2025 Jun;5(1):100894.
41. Perusko M, Al-Hanish A, Velickovic TC, Stanic-Vucinic D. Macromolecular crowding conditions enhance glycation and oxidation of whey proteins in ultrasound-induced Maillard reaction. *Food Chem*. 2015 Jun 15;177:248-57.
42. Al Hanish A, Almghairbi D, Almgerbe M, Shimu A, Ali H, Aqeel M. The association between coffee consumption and local anaesthesia failure. *AlQalam J Med Appl Sci*. 2025 Dec 25;8:2911-7.
43. Tognetti L, Murdaca F, Fimiani M. Caffeine as a cause of urticaria-angioedema. *Indian Dermatol Online J*. 2014 Dec;5(Suppl 2):S113-5.
44. Bangera A, Singh M, Godse K, Patil S. The incidence of depression and anxiety disorders in spontaneous chronic urticaria patients. *Qatar Med J*. 2023 Jun 5;2023(2):16.
45. Chu B, Marwaha K, Sanvictores T, Awosika AO, Ayers D. Physiology, stress reaction. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 May 7.
46. Koro O, Dover JS, Francis DM, Black AK, Kelly RW, Barr RM, Greaves MW. Release of prostaglandin D2 and histamine in a case of localized heat urticaria, and effect of treatments. *Br J Dermatol*. 1986 Dec;115(6):721-8.