








Original Communication

Association between Taste Disorder and Dietary Quality and Macronutrient Intake in US Adults: A National Health and Nutrition Examination Survey (2011–2014)

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Abstract

Background: Taste disorders are associated with various health conditions, including COVID-19. However, the prevalence and correlation of taste disorders are not comprehensively described at the population level. This study aimed to (i) estimate the prevalence of taste disorders, (ii) identify modifiable and non-modifiable correlates, and (iii) investigate the association between taste disorders and diet quality and macronutrient intake. **Methods:** This cross-sectional study analyzed data from 7408 adults aged ≥ 40 years in the 2011–2014 National Health and Nutrition Examination Survey (NHANES). Taste disorders and sociodemographic factors were identified through self-reported questionnaires and interviews. Dietary quality was assessed using the Healthy Eating Index (HEI)-2015. Weighted logistic regression models were used to identify correlates of taste disorders, while Wilcoxon rank-sum tests and linear regression models were used to analyze dietary quality and macronutrient intake. Multivariable-adjusted models were adjusted for age, sex, race/ethnicity, socioeconomic status (as measured by educational attainment and family income level), smoking status, physical activity, body mass index (BMI), and a history of chronic diseases (hypertension, high cholesterol, cardiovascular disease, diabetes, and cancer). **Results:** Taste disorders had a prevalence of 5.1% (95% confidence interval (CI): 4.5–5.6). Higher rates were observed in individuals with lower educational attainment, lower income, and a history of diabetes (7.3%; 95% CI: 5.8–8.7), cardiovascular disease (9.7%; 95% CI: 7.7–12.0), and cancer (7.0%; 95% CI: 4.1–10.0). Those with taste disorders had poorer diet quality, lower energy intake, lower protein intake, and higher sugar consumption compared with those without (all $p < 0.01$). **Conclusions:** US adults exhibited a high prevalence of taste disorders, particularly among individuals with lower socioeconomic status, chronic conditions, and those who are non-Hispanic White, non-Hispanic Black, and Hispanic. An increased prevalence is associated with poorer diet quality, highlighting the need for targeted interventions to address the nutritional impacts. Due to the limitations of the cross-sectional design, this study could not establish causality between taste disorders and dietary intake or patterns, underscoring the need for longitudinal studies to confirm the observed relationships.

Keywords: taste disorder; dietary quality; macronutrient intake

1. Introduction

There are three general taste disorders, including a diminished sense of taste (hypogeusia), the complete loss of taste (ageusia), and an alteration or distortion in the perception of taste (dysgeusia) [1]. Although a small proportion of people can be born with a taste disorder, the most common causes include (i) upper respiratory and middle ear infections, (ii) head and neck cancer radiation therapy, (iii) chemical exposure (e.g., insecticides, some common

antibiotics and antihistamines), (iv) head trauma, (v) otolaryngological surgeries or third molar extraction, (vi) poor oral hygiene and dental complications [2]. Most recently, new-onset taste loss has been recognized as a symptom of COVID-19 [3,4].

Taste disorder has previously been shown to be a risk factor for multiple health complications. For instance, a study conducted in 1697 US adults aged 40 years and older with diabetes or prediabetes found that individuals with



sweet taste disorder were 2.45 times more likely to develop ischemic heart disease [5]. Additionally, research in patients with Type 2 diabetes has suggested that hypogeusia may serve as an early indicator of diabetic neuropathy [6], and children and adolescents with Type 1 diabetes were shown to have some taste recognition disorders [7]. Moreover, literature has identified a strong inverse association between greater taste perception and body weight, body mass index, and waist circumference in older subjects with metabolic syndrome [8]. It is plausible that taste disorders lead to further health complications in those with existing conditions (prediabetes, diabetes, metabolic syndrome) through poor compliance with dietary recommendations among these patients [9,10].

To date, research on taste disorders has predominantly focused on those with underlying health conditions, and knowledge regarding taste disorders in the general population remains limited. Specifically, the prevalence of the condition in the general US population remains unknown, and identified correlates of taste disorder are scarce. To understand the true burden of taste disorders in the US, it is essential to estimate their prevalence and identify correlates to develop and implement targeted interventions to improve the health of affected individuals. Furthermore, correlates can be categorized as modifiable (e.g., lifestyle behaviors such as smoking and dietary habits) or non-modifiable (e.g., demographics such as gender and ethnicity), with the former serving as potential intervention targets for eliciting change and the latter aiding in identifying populations at highest risk.

Considering this background, the aims of the present study were to (i) estimate the prevalence of taste disorder, (ii) determine modifiable and non-modifiable correlates of taste disorder, and (iii) examine the association between taste disorder and diet quality among the US population aged 40 years and older, using a nationally representative sample.

2. Materials and Methods

2.1 Study Population

The National Health and Nutrition Examination Survey (NHANES) is a major program of the National Center for Health Statistics designed to monitor the health and nutritional status of US residents [11]. Briefly, the NHANES conducts a series of cross-sectional, nationally representative health examinations using a complex, stratified, multistage sampling design to evaluate the disease burden and risk factors among the civilian noninstitutionalized US population in 2-year cycles starting from 1999 [11]. Each participant provided written informed consent and underwent an in-person interview and a physical examination at a Mobile Examination Center (MEC). The present study extracted and aggregated data on sociodemographic characteristics, physical examination, lifestyle behavior, medical conditions, and dietary information among adults aged 40

years and older in two waves, 2011–2012 and 2013–2014, due to the availability of taste ability data [12]. Individuals who did not answer taste-related questions or refused to participate in the study have been excluded.

2.2 Assessment of Taste Disorder

Taste disorder identification was based on data from the taste and smell questionnaire, which collected self-reported information on taste ability via household interviews using the Computer-Assisted Personal Interviewing (CAPI) system [13]. This questionnaire was designed to estimate the prevalence of self-reported or medically diagnosed taste and smell disorders among US adults. Participants were asked, “During the past 12 months, have you had a problem with your ability to taste sweet, sour, salty or bitter foods and drinks?” Participants who responded “Yes” were categorized as having taste disorder, otherwise as not having a taste disorder [14]. This measurement was used to provide data to support the Healthy People objectives related to taste disorder [15].

2.3 Assessment of Dietary Quality and Macronutrient Intake

The NHANES 24-hour dietary recall, developed by the National Cancer Institute, was utilized to collect validated data on the quantity (in grams) of each food and beverage consumed in the 24 hours prior to the interview [16]. Daily total energy and macronutrient intakes (total energy, total carbohydrate, protein, fat, sugar, and dietary fiber) were extracted from foods and beverages documented in the total nutrient files. Dietary quality was indicated by the Healthy Eating Index (HEI)-2015, the most current version aligned with the 2015–2020 Dietary Guidelines for Americans. The HEI-2015 employs a scoring system (scores range from 0–100, with higher scores indicating better diet quality) to evaluate foods across 13 components reflecting the food groups and key recommendations in the 2015–2020 Dietary Guidelines for Americans [17].

2.4 Baseline Data

2.4.1 Sociodemographic Characteristics and Lifestyle Behaviors

Self-reported sociodemographic characteristics included age, sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and Others), family income-to-poverty ratio (<1.3 [lowest income], 1.3–3.5, ≥3.5 [highest income]), and educational attainment (less than high school, high school, and above high school) [18]. Smoking status was defined as never smokers (those who had not smoked ≥100 cigarettes and did not currently smoke), former smokers (those who had smoked ≥100 cigarettes but did not currently smoke), and current smokers (those who had smoked ≥100 cigarettes and currently smoked). Participants’ weight and height were measured at MEC following standard procedures. Body mass index (BMI) was calcu-

Table 1. Characteristics of the US adults ≥ 40 years according to taste disorder, NHANES 2011–2014^a.

Variables	Taste disorder		<i>p</i> value
	No	Any	
N	6990	418	
Weighted N	136,943,644	7,319,837	
Age (years)	57.7 (0.2)	59.4 (0.9)	0.049
Sex (%)			
Male	44.9	2.3	0.500
Female	50.0	2.8	
Race/ethnicity (%)			
Non-Hispanic White	67.6	3.6	0.170
Non-Hispanic Black	10.1	0.6	
Hispanic	10.6	0.5	
Other	6.7	0.3	
Family poverty ratio (%)			
<1.3	17.4	1.5	0.001
1.3–<3.5	37.2	1.8	
≥ 3.5	40.4	1.7	
Education (%)			
<High school	15.8	1.3	0.005
High school	20.7	1.0	
>High school	58.5	2.7	
Body mass index (kg/m ²) ^b			
<25	24.3	1.0	0.043
25–<30	35.3	1.8	
≥ 30	35.3	2.3	
Leisure-time physical activity (%) ^c			
Inactive	48.6	3.1	0.031
Active	46.3	2.0	
Smoking status (%)			
Never	50.0	2.3	0.090
Past	27.6	1.7	
Current	17.3	1.1	
Diabetes (%)			
No	82.0	4.0	<0.001
Yes	13.0	1.0	
Cardiovascular disease (%)			
No	83.4	3.8	<0.001
Yes	11.6	1.2	
Cancer (%)			
No	85.2	4.3	0.140
Yes	9.7	0.8	

^a NHANES sampling weights were applied to adjust for demographic characteristics, lifestyle behaviors, and chronic diseases, ensuring national representativeness of the estimates.

^b Weight status was defined by body mass index (BMI = weight (kg)/height (m)²).

^c Leisure-time physical activity level was defined by engaging in no (inactive) or any (active) moderate or vigorous recreational physical activity over the past 30 days.

lated as weight in kilograms divided by height in meters squared and categorized into three groups based on CDC

guidelines (<25 kg/m², 25.0–29.9 kg/m², ≥ 30 kg/m²) [19]. Leisure-time physical activity status was defined as sedentary (no moderate or vigorous recreational physical activity over the past 30 days) or active (any moderate or vigorous recreational physical activity over the past 30 days) [20].

2.4.2 Chronic Diseases

Medical history of chronic diseases was documented through the medical condition questionnaire administered during the in-person interview. Cardiovascular disease was identified based on self-reported diagnoses of congestive heart failure, angina, heart attack, coronary heart disease, or stroke [20]. Diabetes was defined as a self-reported physician diagnosis of diabetes. Participants were considered to have a history of cancer if they self-reported a physician diagnosis of any cancer type [21].

2.5 Statistical Analysis

2.5.1 Data Processing

All statistical analyses were conducted in accordance with the NHANES analytical guidelines. We included all participants with available information on taste disorders, and used median values to impute missing data for dietary outcomes and covariates. NHANES sampling weights were used to adjust for demographic characteristics, lifestyle behaviors, and chronic diseases, and applied survey analysis procedures to account for the complex survey design, ensuring national representativeness of the estimates [18].

2.5.2 Data Analysis Methods

The distribution of participants' characteristics was stratified by taste disorder status, with linear regression used for continuous variables and chi-square tests for categorical variables. Estimates on weighted prevalence and 95% confidence intervals (CIs) of taste disorder were calculated according to sociodemographic characteristics, lifestyle behaviors, and chronic diseases. Multivariable-adjusted weighted logistic regression model was used to estimate odds ratios (ORs) to identify the correlates for taste disorder. Multivariable-adjusted models accounted for age, sex, race/ethnicity, socioeconomic status (including education attainment, and family income level), smoking status, physical activity, body mass index, and chronic disease history (including hypertension, high cholesterol, cardiovascular disease, diabetes, and cancer).

Weighted mean scores of the HEI-2015 and its subgroups, as well as weighted mean macronutrient intakes, were calculated by taste disorder status and age groups, respectively. Due to the violation of the normality assumption, the Wilcoxon rank-sum test was used to compare median HEI-2015 scores by taste disorder status. Additionally, radar charts were plotted using median values of total and domain-specific HEI-2015 scores by taste disorder status. Finally, weighted linear regression models, adjusted for age and total energy intake, were applied to test differences in

Table 2. Prevalence and correlates of taste disorder among US adults ≥ 40 years, NHANES 2011–2014^a.

Variables	Taste disorder	
	Prevalence (95% CI)	Odds ratio (95% CI)
Overall	5.1 (4.5–5.6)	–
Sex		
Male	4.8 (4.1–5.6)	1 [Reference]
Female	5.3 (4.4–6.1)	1.13 (0.86–1.50)
Age group (years)		
40–64	4.9 (4.1–5.6)	1 [Reference]
≥ 65	5.6 (4.4–6.8)	0.86 (0.58–1.26)
Race/ethnicity		
Non-Hispanic White	5.1 (4.4–5.8)	1 [Reference]
Non-Hispanic Black	5.7 (4.9–6.5)	0.97 (0.79–1.19)
Hispanic	5.3 (3.9–6.7)	0.83 (0.57–1.20)
Other	3.7 (2.6–4.8)	0.77 (0.54–1.09)
Family poverty ratio		
< 1.3	8.0 (6.3–9.6)	1 [Reference]
$1.3–< 3.5$	5.0 (3.9–6.1)	0.63 (0.42–0.95)
≥ 3.5	4.2 (3.0–5.3)	0.66 (0.39–1.11)
Education		
$<$ High school	7.6 (6.4–8.8)	1 [Reference]
High school	4.8 (3.3–6.3)	0.67 (0.46–0.97)
$>$ High school	4.5 (3.6–5.3)	0.72 (0.51–1.02)
Weight status ^b		
< 25 kg/m ²	4.0 (2.8–5.1)	1 [Reference]
$25–< 30$ kg/m ²	4.9 (3.7–6.0)	1.22 (0.85–1.76)
≥ 30 kg/m ²	6.2 (4.9–7.4)	1.43 (1.01–2.01)
Leisure-time physical activity ^c		
Inactive	5.9 (4.9–6.9)	1 [Reference]
Active	4.1 (3.2–5.1)	0.84 (0.56–1.27)
Smoke status		
Never	4.4 (3.5–5.3)	1 [Reference]
Past	5.9 (4.7–7.1)	1.26 (0.91–1.74)
Current	5.8 (4.2–7.4)	1.13 (0.76–1.69)
Diabetes		
No	4.7 (4.1–5.3)	1 [Reference]
Yes	7.3 (5.8–8.7)	1.17 (0.89–1.55)
Cardiovascular disease		
No	4.4 (3.8–5.0)	1 [Reference]
Yes	9.7 (7.7–12.0)	2.02 (1.39–2.92)
Cancer		
No	4.8 (4.2–5.5)	1 [Reference]
Yes	7.0 (4.1–10.0)	1.40 (0.81–2.42)

^a Multivariable-adjusted models accounted for age, sex, race/ethnicity, socioeconomic status (including education attainment, and family income level), smoking status, physical activity, body mass index, and chronic disease history (including hypertension, high cholesterol, cardiovascular disease, diabetes, and cancer).

^b Weight status was defined by body mass index (BMI = weight (kg)/height (m)²).

^c Leisure-time physical activity level was defined by engaging in no (inactive) or any (active) moderate or vigorous recreational physical activity over the past 30 days.

macronutrient intakes by taste disorder status within each age group. All analyses were done using Stata, version 16.0 (StataCorp, College Station, TX, USA). All statistical tests were 2-sided and statistical significance was set at $p < 0.05$.

3. Results

3.1 Prevalence and Correlates of Taste Disorders

A total of 7408 adults aged ≥ 40 years with available information on taste ability were included in the current

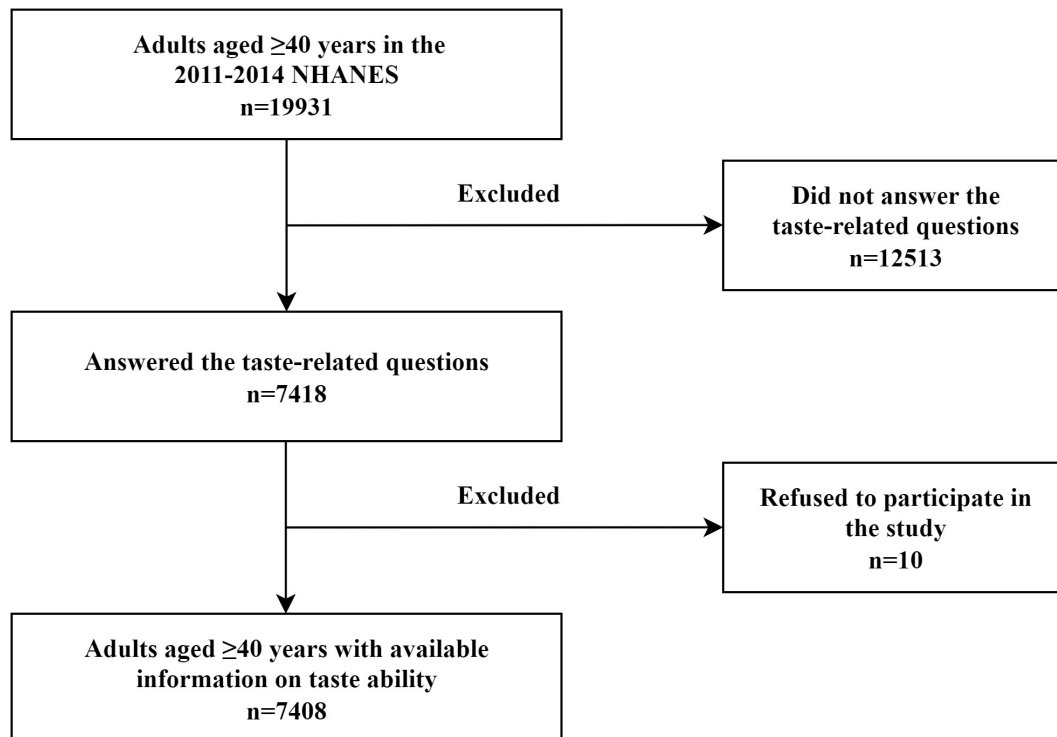


Fig. 1. Flowchart of the participants among US adults ≥ 40 years by taste disorder, NHANES 2011–2014. NHANES, National Health and Nutrition Examination Survey.

analysis. Participants flowchart was shown in Fig. 1. Characteristics of the participants were shown by taste disorder in Table 1. The overall prevalence of taste disorder was 5.1% among US adults ≥ 40 years. The distribution of taste disorder significantly differed by family poverty ratio, educational attainment, weight status, leisure-time physical activity level, and history of diabetes and cardiovascular disease (all p values < 0.05). The estimated prevalence and correlates of taste disorder were presented in Table 2. The prevalence of taste disorder was higher among non-Hispanic White (5.1%; 95% CI: 4.4–5.8), non-Hispanic Black (5.7%; 95% CI: 4.9–6.5), and Hispanic (5.3%; 95% CI: 3.9–6.7) compared to other racial/ethnic groups. Participants with higher educational attainment (OR = 0.67; 95% CI: 0.46–0.97) and family poverty ratio (OR = 0.63; 95% CI: 0.42–0.95) were less likely to have taste disorder compared to their counterparts. In addition, patients with a history of diabetes (7.3; 95% CI: 5.8–8.7), cardiovascular disease (9.7; 95% CI: 7.7–12.0), and cancer (7.0; 95% CI: 4.1–10.0) had a higher prevalence of taste disorder compared to those without these chronic diseases.

3.2 HEI Scores

Considering that taste disorders may be associated with dietary choices, the study further evaluated dietary quality using HEI-2015 scores. Table 3 demonstrated the mean HEI-2015 scores among US adults ≥ 40 years by age

group and taste disorder. The total HEI-2015 score was statistically significantly lower in adults with taste disorder compared with those without taste disorder (54.68 vs. 56.09). Also, adults with taste disorders had lower dietary quality scores in greens and beans, whole grains, total protein foods, seafood and plant proteins, and added sugars compared with those without taste disorders (all p values < 0.05). However, participants with taste disorders had a better dietary quality score in sodium intake (p value = 0.03). The results were similar across age groups. Median scores for the total HEI-2015 and its individual components were illustrated in Fig. 2. Overall, adults with taste disorders had poorer dietary quality than those without taste disorders.

3.3 Macronutrient Intake

Building on the dietary quality results, the study further investigated macronutrient intake patterns. Mean macronutrient intakes were presented by taste disorder and age group in Table 4. Adults with taste disorder had less total energy intake than those without the disorder (1950.6 vs. 2086.4 kcal/d). After adjusting for age and total energy intake, participants with taste disorders consumed less protein (70.7 vs. 80.3 g/d) but more sugars (113.3 vs. 107.4 g/d) compared with individuals without any disorder (all p values < 0.01). The results also appeared in both younger and older age groups.

Table 3. Mean healthy eating index-2015 scores among US adults ≥ 40 years by age group and taste disorder, NHANES 2011–2014.

Component	Maximum points	Age groups								
		All Adults (≥ 40 years)			Adults (40–64 years)			Older adults (≥ 65 years)		
		Any taste disorder		<i>p</i> value ^a	Any taste disorder		<i>p</i> value ^a	Any taste disorder		<i>p</i> value ^a
		No	Yes		No	Yes		No	Yes	
Total HEI-2015 score	100	56.09	54.68	0.02	55.18	54.17	0.08	58.46	55.89	0.08
Adequacy										
Total fruits	5	2.51	2.51	0.56	2.34	2.26	0.29	2.98	3.11	0.91
Whole fruits	5	2.77	2.76	0.24	2.59	2.53	0.06	3.26	3.29	0.79
Total vegetables	5	3.41	3.33	0.50	3.38	3.30	0.19	3.50	3.40	0.61
Greens and beans	5	2.10	1.74	0.01	2.14	1.80	0.01	2.00	1.59	0.33
Whole grains	10	3.27	2.89	0.04	3.02	2.70	0.35	3.92	3.34	0.01
Dairy	10	5.31	5.37	0.29	5.25	5.27	0.91	5.46	5.60	0.14
Total protein foods	5	4.52	4.34	0.01	4.52	4.28	<0.01	4.51	4.47	0.55
Seafood and plant proteins	5	3.04	2.86	0.01	3.00	2.95	0.07	3.12	2.67	0.06
Fatty acids	10	5.32	5.03	0.13	5.35	5.22	0.69	5.25	4.58	0.06
Moderation										
Refined grains	10	6.55	6.94	0.22	6.42	6.98	0.21	6.89	6.85	0.75
Sodium	10	3.98	4.65	0.03	4.00	4.81	0.04	3.95	4.27	0.33
Added sugars	10	7.13	6.22	<0.01	6.97	6.04	<0.01	7.53	6.64	0.01
Saturated fats	10	6.18	6.04	0.37	6.21	6.02	0.80	6.08	6.10	0.28

^a *p* values were tested using Wilcoxon rank-sum test.

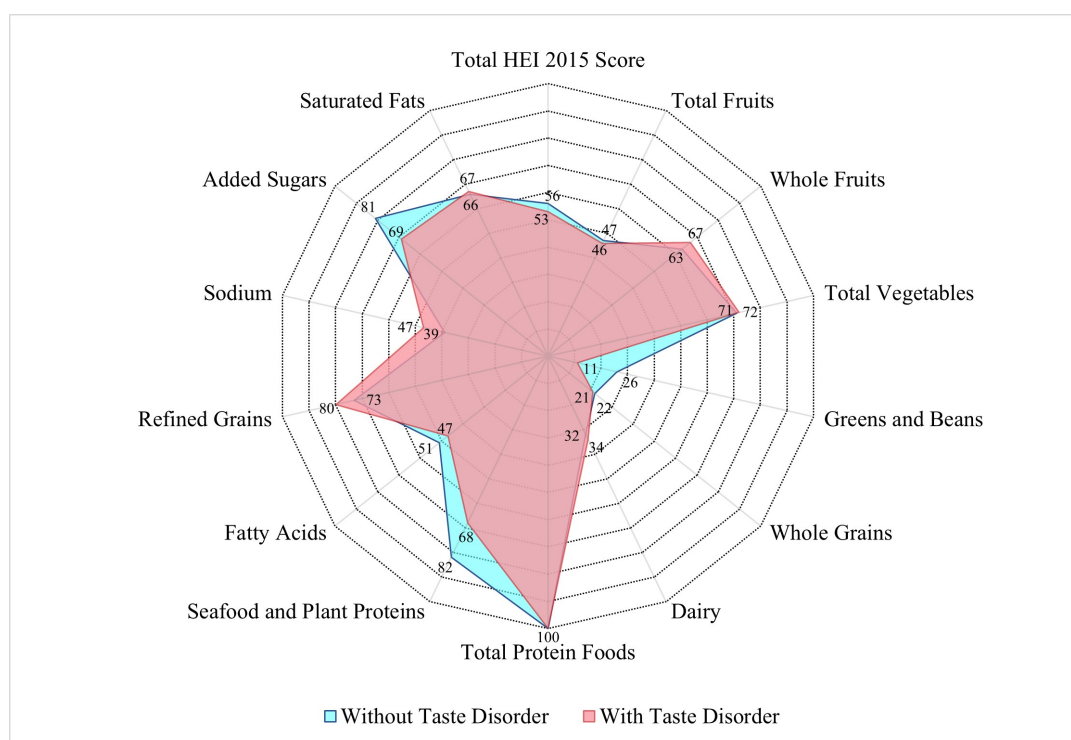


Fig. 2. Median healthy eating index-2015 scores among US adults ≥ 40 years by taste disorder, NHANES 2011–2014^a. ^a The score was transferred as the percentage of the maximal point for each component.

4. Discussion

In this large representative sample of US adults aged 40 years and older, a 5.1% prevalence of taste disorders was

observed. Taste disorders were more prevalent among non-Hispanic White, non-Hispanic Black, and Hispanic adults compared with other ethnic groups. Conversely, adults with higher educational attainment or family poverty ratio had

Table 4. Mean macronutrient intakes among US adults ≥ 40 years by age group and taste disorder, NHANES 2011–2014.

Component	Age groups								
	All adults (≥ 40 years)			Adults (40–64 years)			Older adults (≥ 65 years)		
	Any taste disorder		<i>p</i> value ^a	Any taste disorder		<i>p</i> value ^a	Any taste disorder		<i>p</i> value ^a
	No	Yes		No	Yes		No	Yes	
Total energy (kcal/d)	2086.4	1950.6	0.05	2178.6	2050.3	0.17	1846.3	1717.3	0.16
Carbohydrate (g/d)	247.4	240.7	0.04	256.9	250.0	0.14	222.9	218.9	0.12
Protein (g/d)	80.3	70.7	<0.01	83.6	72.7	<0.01	71.7	66.0	0.56
Total fat (g/d)	80.4	75.8	0.58	83.5	81.0	0.35	72.3	63.8	0.21
Total sugars (g/d)	107.4	113.3	<0.01	111.4	117.1	<0.01	96.9	104.5	<0.01
Dietary fiber (g/d)	17.6	15.8	0.11	17.7	16.3	0.29	17.1	14.6	0.07

^a *p* values were adjusted for total energy intake and age using linear regression models.

a lower prevalence of taste disorders. Participants with a history of diabetes, cardiovascular disease, or cancer had a higher prevalence of taste disorder than those without these chronic diseases. In addition, the present study also found that those with taste disorders had a worse overall diet quality than those without. However, some nuances were observed in the findings: participants with taste disorders had a better dietary quality score in sodium intake. Finally, adults with taste disorders had lower total energy intake, less protein but more sugar intake compared with those without.

Similar to previous studies [22], we observed a 5.1% prevalence of taste disorders. The present study identified that non-Hispanic Whites, non-Hispanic Blacks, and Hispanics had a higher prevalence of taste disorders than other ethnic groups (including Asian and Multiracial individuals). Genetic disorders such as familial dysautonomia may cause complete or severe loss of taste papillae, leading to reduced or absent taste perception [23]. But the factors contributing to the higher taste disorders prevalence among these ethnic groups remain unclear. It remains undetermined whether the racial disparities in taste disorder prevalence are associated with genetic factors (such as genetic variations in taste receptor genes), cultural dietary patterns, or lifestyle habits [24–26]. Notably, those with higher educational attainment or family poverty ratio, both proxies for higher socioeconomic status, exhibited lower taste disorder prevalence. Existing research has shown that individuals from lower socioeconomic backgrounds were more prone to upper respiratory and middle ear infections [27], which are common causes of taste disorders. This is mainly owing to increased exposure to infectious agents and decreased host resistance to infection [27]. Moreover, low socioeconomic status is also one of the strongest predictors of illness and early death worldwide [28,29]. These findings partially explained the disparities in taste disorder prevalence by linking educational attainment and family economic conditions to infection risk.

In our findings, adults with a history of diabetes, cardiovascular disease, or cancer exhibited a higher prevalence

of taste disorders relative to their counterparts without such chronic diseases. Impaired taste perception may lead to altered eating habits: some individuals consume insufficient food and experience weight loss [10], while others add excessive seasonings (such as sugar, salt, and fats) to compensate for taste loss, further compromising dietary quality and creating a vicious cycle [2,6]. Reduced taste sensitivity may prompt individuals to increase their discretionary sugar and salt intake to improve food palatability, increasing their risk of obesity, diabetes and cardiovascular disease [30–33]. Besides, studies have pointed out that taste disorders were also associated with numerous conditions: specific cancers [34], dementia [35,36], depression [37–40]. Importantly, reverse causality may underlie the observed associations. Diabetes and cardiovascular disease are known to alter taste perception—hyperglycemia impairs sweet taste sensitivity, while hypertension impairs salt taste perception [41,42]. These metabolic changes could exacerbate taste dysfunction, leading to compensatory behaviors (e.g., increased sugar/salt intake) that further degrade diet quality. Moreover, cancer chemotherapy medications have been reported to adversely affect taste perception and eating behaviors [43,44]. Specifically, aggressive treatments targeting the head and neck may damage taste buds or leave bitter/metallic flavors in the mouth interfering with regular taste perception [45,46]. These associations likely reflect bidirectional relationships, whereby taste disorders and diseases may influence each other dynamically.

Individuals with taste disorders showed poorer overall diet quality (HEI-2015 score: 54.68 vs. 56.09, *p* value = 0.02). This dietary discrepancy may stem from multiple mechanisms: taste disorders likely reduce the palatability of fibrous and plant-based foods [47], which are often characterized by subtle taste profiles. This may result in decreased intake of nutrient-dense foods (e.g., greens, beans, whole grains), often perceived as bland, and increased consumption of energy-dense, sweetened foods to compensate for taste loss [32,33]. Additionally, individuals with taste disorders might avoid seafood and plant proteins due to perceived taste abnormalities, contributing to lower scores in

these categories [48]. Paradoxically, taste disorder participants had better sodium intake scores, as HEI-2015 rewards lower sodium consumption. Potential mechanisms for this phenomenon include: (1) As previously mentioned, taste disorders may decrease appetite, thereby reducing overall sodium intake; (2) Abnormal salt perception weakens the “pleasure” feedback from the limbic reward pathway (amygdala, nucleus accumbens), prompting voluntary reduction of high-sodium foods [49,50]; (3) The use of non-salt condiments (e.g., sugar, spices, salt substitutes) to improve palatability may indirectly decrease natural sodium intake [51]. Collectively, these mechanisms highlight how taste disorders disrupt dietary patterns through both sensory impairment and compensatory behaviors.

The finding showed that adults with any taste disorder had significantly lower total energy intake, less protein, and more sugars than those without the disorder. The lower energy intake was primarily driven by diminished appetite due to impaired taste perception. When basic taste stimuli (sweet, sour, bitter, salty) are blunted, the sensory appeal of food decreases, reducing the hedonic reward of eating and prompting voluntary food intake reduction [47,49,50]. Protein-rich foods (e.g., seafood, legumes, lean meat) may be perceived as having “fishy” or “bitter” taste due to taste distortion, leading to intentional avoidance [48,51]. Even if individuals attempt to compensate for taste loss by increasing intake, protein-rich foods induce stronger satiety, further limiting total consumption. Sweetness is one of the most detectable tastes, and high-sugar foods provide stronger taste feedback, alleviating the hedonic deficit caused by hypogeusia [33]. Some patients exhibit “taste compensation behavior”—adding sugar to mask taste abnormalities in other foods, creating a vicious cycle of “increased sugar intake-higher taste threshold” [6]. Taken together, these findings provide a basis for the observed differences in energy and nutrient intake among individuals with taste disorders.

Integrating the findings of this study with prior research, the following strategies could be implemented to better address taste disorders as a public health issue: (1) For individuals of low socioeconomic status, particularly non-Hispanic Whites, non-Hispanic Blacks, and Hispanics populations, implement taste disorder awareness lectures, taste function screening, and nutritionist consultation services. (2) Incorporate the NHANES-standard taste disorder self-assessment questionnaire (e.g., “Have you experienced reduced taste in the past 12 months?”) into routine chronic disease management for patients with diabetes, cardiovascular diseases, or cancer during regular follow-ups. (3) Design high-protein (target 80 g/d) and low-sugar (≤ 100 g/d) diets for individuals with taste disorders. Encourage flavor enhancement through cooking techniques (e.g., steaming, roasting) to improve overall dietary quality. These approaches may serve as interventions in taste disorders management.

The large sample size and exploration of novel correlates of taste disorder are clear strengths of this study. This study covered diverse racial, socioeconomic, and disease statuses, ensuring generalizability and providing new evidence for taste-diet interactions. However, our study also had several limitations. First, the cross-sectional design limits causal inference, potentially introducing bias in interpreting associations. Longitudinal studies should integrate data on disease onset and taste function changes to clarify temporal relationships. Second, self-reported taste disorder (past 12 months) and 24-hour diet recall may have temporal discrepancy and recall bias, this limitation could be addressed by integrating clinical taste tests with multiple-time-point dietary records and validating self-report data with objective measures. Third, since NHANES did not collect detailed information on the types of taste disorders, we did not distinguish hypogeusia, ageusia, and dysgeusia, leading to overgeneralization of the results. Last, owing to the lack of NHANES data on oral health, medications, and appetite-affecting disorders, we were unable to analyze these potential confounders, which might result in residual confounding. Future studies should include oral examinations, medication history assessments, and mental health screenings, controlling for additional confounders via multivariable models.

5. Conclusions

In conclusion, in this larger sample of US adults a high prevalence of taste disorder was identified and thus justifying further research into this area. It may be prudent to target interventions towards those from a low socioeconomic status and those who are non-Hispanic White, non-Hispanic Black, and Hispanic. Clinicians and dietitians should be made aware that those with diabetes, cardiovascular disease, and cancer are more likely to experience taste disorders and incorporate this into disease management and dietary quality improvement. Due to the limitations of the cross-sectional design, this study cannot establish causality between taste disorders and dietary intake or patterns, underscoring the need for longitudinal studies to confirm the observed relationships.

Availability of Data and Materials

Data collected for this study, including de-identified individual participant data and a data dictionary defining each field in the dataset, as well as additional related documents such as the study protocol, will be available to others upon publication, without any restrictions, from the website <https://wwwn.cdc.gov/nchs/nhanes/Default.aspx>.

Author Contributions

ZZ analyzed the data and drafted original manuscript; NW and RW were responsible for the acquisition of experimental data, including sample collection and preliminary data sorting; LY participated in the analysis and interpretation of experimental results; NW, RW, and LY provided

help and revised manuscript; JL, CC and XZ designed and supervised the study. All authors have contributed to the editorial changes made to the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflict of Interest

The authors declare no conflict of interest.

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