Sirte University Scientific Journal Vol. 16, No. 1 (2026) 131-145
Sirte University Scientific Journal (SUSJ)
Journal home page: http://journal.su.edu.ly/index.php/susj

Dietary Literacy and the Perception of Diet's Impact on Dental Health: A Cross-Sectional Study among Students of the Faculty of Dentistry, Sirte University

Fathia Efhema S[1], Najla Abdelsalam Emhmmad[2], Salma Efhima Suliman[3]

1,2 Department of Oral Pathology, Faculty of Dentistry, Sirte University, Sirte, Libya.

3 Department of Preventive and Community Dentistry, Faculty of Dentistry, Sirte University, Sirte, Libya.

Corresponding author E-mail: fis.dent@su.edu.ly[1].

DOI: https://doi.org/10.37375/susj.v16i1.4156

ARTICLE INFO:

Received 5 May 2026.
Accepted 6 June 2026.
Available online 24 Jsune 2026.

Keywords: *Dietary Literacy, Dental Students, Oral Health, dental caries , periodontal diseases, Nutrition, Dental Education, Preventive Dentistry, Sirte University.*

A B S T R A C T

This study aimed to assess the level of dietary literacy and the perception of nutritional impacts on oral health among undergraduate dental students. A descriptive, cross-sectional research design was employed at the Faculty of Dentistry, Sirte University.

The study population consisted of students enrolled from the first through the fourth academic years. A total of 114 participants were recruited using a randomized convenience sampling method. Data were collected via a validated, self-administered questionnaire designed to evaluate knowledge across four key domains: cariogenicity, protective factors, periodontal nutrition, and oral physiology.

The results indicated an overall "Moderate" level of dietary literacy (Mean = 3.46). While students demonstrated high awareness regarding the systemic role of calcium and the risks of solid sticky foods, they significantly underestimated the cariogenic potential of sugar-sweetened beverages. Additionally, knowledge concerning the specific biochemical impact of micronutrients on periodontal health was found to be superficial.

Statistical analysis revealed no significant differences between second- and third-year students across most domains ($P>0.05$). However, a small statistically significant difference was observed in the Protective Dietary Factors domain ($P=0.048$), although the overall pattern suggested a plateau in learning during the pre-clinical transition

Consequently, the study recommends the vertical integration of nutritional science within the curriculum, with an emphasized focus on correcting misconceptions regarding liquid sugars and reinforcing the clinical application of periodontal nutrition.

الثقافة الغذائية وإدراك أثر النظام الغذائي على صحة الأسنان: دراسة مقطعية بين طلاب كلية طب الأسنان بجامعة سرت

فتحية افحيمة سليمان[1]، نجلاء عبد السلام امحمد[2] سالمة افحيمة سليمان

1,2 قسم أمراض الفم، كلية طب الأسنان، جامعة سرت، سرت، ليبيا.

3 قسم طب الأسنان الوقائي والمجتمعي، كلية طب الأسنان، جامعة سرت، سرت، ليبيا.

الـمُخلص

هدفت هذه الدراسة الوصفية مقطعية الطابع إلى تقييم مستوى الثقافة الغذائية وإدراك آثار التغذية على صحة الفم لدى 114 طالباً بمرحلة البكالوريوس (السنوات 1–4) بكلية طب الأسنان في جامعة سرت. جُمعت البيانات عبر استبيان مُعتمد شمل أربعة مجالات: مسببات التسوس، العوامل الوقائية، أمراض اللثة والتغذية، وفيزيولوجيا الفم.

أظهرت النتائج مستوى "متوسطاً" في الثقافة الغذائية العامة (المتوسط = 3.46). ورغم الوعي المرتفع بدور الكالسيوم ومخاطر الأطعمة اللزجة، إلا أن الطلاب استهانوا بمخاطر المشروبات المحلاة، وكان علمهم بآثار المغذيات الدقيقة على اللثة سطحياً. لم تظهر فروق إحصائية هامة بين طلاب السنتين الثانية والثالثة($P>0.05$) ، باستثناء فارق طفيف في العوامل الوقائية($P=0.048$) ، مما يشير إلى ثبات مؤقت في التعلم خلال المرحلة الانتقالية قبل السريرية.

توصي الدراسة بدمج علوم التغذية رأسياً في مناهج طب الأسنان، والتركيز على تصحيح المفاهيم حول السكريات السائلة وتطبيقات تغذية اللثة.

الكلمات المفتاحية: الثقافة الغذائية، طلاب طب الأسنان، تعليم طب الأسنان، صحة الفم، تسوس الأسنان، أمراض اللثة

1 Introduction

1.1 Dietary Intake and Dental Diseases

Over the years, experimental studies have established the important role of diet in the development of dental diseases. Dental diseases are highly prevalent worldwide, and their impact on health is evident alongside other systemic diseases, such as cardiovascular diseases and tumors, according to the World Health Organization (WHO) (1,2). The burden of dental diseases on general and oral health, as well as on dental services, has been widely studied. Moreover, these studies have demonstrated a significant economic impact of oral diseases (3).

The Global Burden of Disease Study (2017) reported that oral diseases affect approximately 3.5 billion people worldwide (3).

The results indicated that dental caries is the most common chronic disease, affecting about 2.43 billion people globally (4).

Despite the widespread nature of dental diseases, their prevalence shows considerable geographical variation

between developed and developing countries. In most industrialized countries, dental caries levels have declined due to improved preventive programs and increased access to dental health services. However, dental caries remains prevalent among underprivileged communities within these countries (5). In contrast, dental caries levels in many developing countries were relatively low until recent years, after which an increase was observed. This rise has been attributed to increased sugar availability, insufficient fluoride exposure, and limited access to oral healthcare services (6).

Numerous studies have demonstrated a clear relationship between diet and oral diseases, although other contributing factors are also involved. Oral health is a fundamental component of overall health, and a strong association exists between dietary habits and oral health status (6,7).

Dietary intake plays a vital role in maintaining oral health and preventing dental diseases. The type, frequency, and quantity of foods and beverages consumed directly influence the development of dental caries, periodontal diseases, and dental erosion (8). Diets rich in fermentable carbohydrates, particularly sucrose, promote the growth of harmful oral bacteria that produce acids, leading to dental caries.

In contrast, a balanced diet rich in vitamins, minerals, and protective nutrients such as calcium, phosphorus, fluoride, and vitamin D contributes to strong teeth and healthy gingival tissues (8,9).

Carbohydrate intake, particularly sugars, is a critical risk factor for caries development. Diets low in dietary fiber may further increase this risk (8,9).

The balance between carbohydrate and fiber intake is an important indicator of dietary quality.

The carbohydrate-to-fiber ratio (CFR) and the fiber-to-carbohydrate ratio (FCR) are considered practical tools for evaluating dietary quality (10).

The primary determinant of dental caries development is the availability of dietary sugars. The World Health Organization recommends that the intake of free sugars should not exceed 10% of total daily energy intake (2). Research has shown that frequent consumption of high-sugar snacks and beverages between main meals poses a significant risk to oral and general health, as they provide the necessary substrate for the caries process (11).

Meal frequency is also an important factor, as short intervals between meals can interfere with the anti-cariogenic effects of saliva (11,12). Therefore, healthy eating guidelines recommend intervals of 3–4 hours between meals. Additionally, snacking in the evening should be avoided due to reduced salivary flow during nighttime. For caries prevention and management, dietary modifications should favor protective foods over cariogenic ones (11,13).

In addition to diet, several other factors contribute to the development of oral diseases, including poor oral hygiene, salivary dysfunction, socioeconomic status, and genetic predisposition.

1.2 Dental Caries and the Role of Fluoride

Dental caries is a multifactorial disease resulting from the interaction between fermentable carbohydrates, cariogenic microorganisms, susceptible tooth surfaces, and time. Fluoride plays a crucial role in caries prevention by enhancing remineralization and inhibiting demineralization of enamel. Fluoride ions incorporate into the hydroxyapatite crystal, forming fluorapatite, which is more resistant to acid dissolution (14,15). Additionally, fluoride inhibits bacterial metabolism, thereby reducing acid production by cariogenic bacteria. The presence of fluoride in saliva and plaque fluid is essential for continuous protection against caries (14).

The caries-preventive effect of fluoride is closely linked to the availability of calcium and magnesium, as these ions are required for the formation, stabilization, and maturation of remineralized enamel.

1.3 Role of Calcium, Magnesium, and Vitamin D in Caries Prevention

Adequate calcium and magnesium levels are essential for strengthening tooth structure and enhancing enamel resistance to caries. Calcium directly contributes to enamel remineralization, while magnesium supports crystal growth and influences the physicochemical properties of dental hard tissues. However, the biological effectiveness of these minerals is highly dependent on vitamin D status (16,17).

Vitamin D plays a critical role in calcium and magnesium homeostasis by enhancing their intestinal absorption and regulating mineral metabolism. Adequate vitamin D levels facilitate proper mineralization of enamel and dentin, thereby improving resistance to demineralization and caries development (16). Several studies have demonstrated a strong association between sufficient dietary vitamin D intake, optimal calcium levels, and improved dental and periodontal health (16,17).

Adequate levels of calcium, magnesium, and vitamin D are essential for optimal mineralization and maintenance of dental hard tissues, contributing to increased resistance against demineralization and caries

development. Moreover reinforce dental hard tissues, leading to increased caries resistance and reduced susceptibility. Therefore, ensuring sufficient intake of calcium, magnesium, and vitamin D should be considered as an integral component of comprehensive caries prevention strategies (15,16,18).

1.4 Gingival and Periodontal Diseases

Periodontal disease is defined as an inflammatory condition that begins with bacterial infection of the periodontal tissues. Several factors influence periodontal health, including oral hygiene status, systemic health conditions, nutritional status, and vitamin C levels.

Vitamin C (L-ascorbic acid) is an essential nutrient that cannot be synthesized by humans and must be obtained through the diet (19). Approximately 90% of daily vitamin C intake is derived from fruits and vegetables, furthermore fruit and vegetables are considered as a primary sources of vitamin C (19 20). The National Institutes of Health recommends a daily intake of 75 mg for adult women and 90 mg for adult men. Severe vitamin C deficiency can lead to scurvy, a potentially life-threatening condition (20).

Studies have shown that periodontal disease progression is more severe in individuals with low vitamin C levels compared to those with adequate intake (19,20). Furthermore, sufficient vitamin C levels are associated with reduced gingival bleeding, highlighting its role in maintaining gingival health (21). Ascorbic acid is highly sensitive to air, light, and heat, and its content can be significantly reduced by prolonged storage and overcooking of food. Since vitamin C cannot be stored in the body, regular dietary intake is essential (19,22).

Natural antioxidants possess strong anti-inflammatory properties and may reduce serum levels of key periodontal disease markers, such as tumor necrosis factor (TNF) and interleukin-1 (IL-1). Some antioxidants have demonstrated effectiveness in the management of periodontal diseases (23).

Additionally, dietary vitamin D and calcium have been shown to be strongly associated with periodontal health. Several studies have reported a positive relationship between adequate intake of these nutrients and improved periodontal tissue status (16,24).

1.5 Oral Hygiene Practices and Oral Disease Prevention

Alongside dietary factors, proper oral hygiene practices are essential for the prevention of dental caries and periodontal diseases. These include regular tooth brushing, which is recommended at least twice daily (25,26). After nighttime brushing, eating and drinking should be avoided, except for water, due to reduced salivary flow during sleep. Tooth brushing should last approximately two minutes to ensure effective plaque removal and optimal fluoride activity (27).

Improper brushing techniques, excessive brushing, or the use of toothbrushes with inappropriate bristle hardness may damage enamel and gingival tissues (28). Cleaning of interdental spaces is also important and can be achieved using dental floss, interdental brushes, or oral irrigators (25,27).

Mouthwashes are considered an adjunctive oral hygiene measure. Some formulations contain antimicrobial agents such as chlorhexidine and fluoride (26,28). Chlorhexidine disrupts bacterial cell walls, particularly those of gram-positive bacteria such as Streptococcus mutans (27). Fluoride-containing mouth rinses enhance enamel hardness and inhibit cariogenic bacterial activity by maintaining adequate fluoride levels in saliva (14,15,27).

2 Methods and tools

2.1 Study Design and Setting

A descriptive, cross-sectional survey design was employed to assess the dietary literacy and dental health perceptions of undergraduate students. The study was conducted at the Faculty of Dentistry, Sirte University. This setting was selected as a primary educational hub for future dental practitioners in the region, providing an optimal environment to evaluate the integration of nutritional science into the pre-clinical and early clinical training of students.

2.2 Study Population and Sampling Strategy

The target population comprised undergraduate dental students enrolled from the first to the fourth academic years. During the study period, the total student cohort consisted of 136 individuals. Using a convenience sampling approach, a final sample of 114 participants was recruited, corresponding to a response rate of 83,8%.

To maximize coverage of the student body and minimize selection bias within the constraints of non-probability design, an inclusive recruitment strategy was adopted. Students physically present during scheduled academic

sessions were approached directly, while those with irregular attendance were reached through official digital communication platforms. The final sample was stratified according to gender and academic year to enable meaningful subgroup comparisons.

2.3 Data Collection Instrument

Data were collected using a structured, self-administered questionnaire tailored in alignment with the study's objectives. The instrument was developed in English and underwent content validation by a panel of three faculty experts in preventive dentistry, periodontology, and oral medicine. Based on their feedback, minor revisions were made to enhance clarity, relevance, and domain coverage.

2.3.1 The questionnaire consisted of two main sections:

Section I: Demographic Profile: This section collected data on Gender and Academic Year, which were treated as independent variables for comparative analyses.

Section II: Dietary Literacy Scale: This section comprised 20 items assessing students' knowledge and attitudes across four domains: *Cariogenicity & Erosion*, *Protective Dietary Factors*, *Periodontal Nutrition*, and *Oral Physiology & Dietary habits*.

Responses were recorded using a standard 5-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5), as summarized in **Table 1**.

Table 1: The 5-Point Likert Scale Scoring System

Response Option	Score
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Agree	5

2.3.2 Reliability and Validity of the Instrument

Content validity was established through expert evaluation, focusing on ítem relevance, clarity, and representativeness within each domain. Modifications were implemented base don expert consensus prior to finalization of the questionnaire.

Internal consistency reliability was assessed using Cronbach's alpha coefficient for the overall scale and each subdomain. The results are presented in Table 2.

Table 2: Internal Consistency (Cronbach's Alpha) of the Dietary Literacy Scale

Scale / Domain	Number of Items	Cronbach's Alpha	Interpretation
Domain I: Cariogenicity & Erosion	6	0.78	Acceptable
Domain II: Protective Dietary Factors	5	0.74	Acceptable
Domain III: Periodontal Nutrition	5	0.81	Good
Domain IV: Oral Physiology & Habits	4	0.72	Acceptable
Overall Scale	**20**	**0.86**	**Good**

All subscales demonstrated acceptable to good internal consistency ($\alpha \geq 0.70$), while the overall scale showed strong reliability ($\alpha = 0.86$), supporting its suitability for use in this study.

2.4 Data Collection Procedure

A dual-mode distribution strategy was employed to enhance participation and response rates. Paper-based questionnaires were administered during classroom and clinical sessions, while an electronic version was concurrently distributed via official student communication platforms. This approach ensured accessibility for students with varying attendance patterns.

Ethical approval was obtained from the relevant Research Ethics Committee prior to data collection. Participation was voluntary, anonymous, and based on informed consent.

2.5 Statistical Analysis

Data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS), version 25.0. Descriptive statistics, including frequencies (N) and percentages (%), were used to summarize demographic

variables, while means and standard deviations (SD) were calculated for questionnaire items.

To interpret dietary literacy levels, the 5-point Likert scale was divided into three equal intervals using the class interval formula [(Maximum − Minimum) / 3 = 1.33]. Accordingly, mean scores were classified into low, moderate, and high levels of agreement, with corresponding Relative Weights as shown in Table 3.

Table 3: Interpretation of Mean Scores and Relative Weight

Mean Score Range	Relative Weight (%)	Level of Agreement	Relative Importance
1.00 – 2.33	20% – 46.6%	Low	Low Priority / Poor Knowledge
2.34 – 3.66	46.8% – 73.3%	Moderate	Moderate Priority / Average Knowledge
3.67 – 5.00	73.4% – 100%	High	High Priority / Good Knowledge

Normality of domain scores was assessed using the Kolmogorov–Smirnov test, confirming an approximately normal distribution and justifying the use of parametric tests.

Inferential analysis was conducted using One-Way Analysis of Variance (ANOVA) to examine differences across academic years for each domain. Post hoc comparisons were performed using Tukey's Honestly Significant Difference (HSD) test to identify specific intergroup differences. Additionally, an Independent Samples t-test was conducted to specifically compare second- and third-year students, focusing on the transition from pre-clinical to early clinical training. A significance level of $p < 0.05$ was applied throughout.

3 Results

3.1 Demographic Characteristics of Study Participants

A total of 114 undergraduate dental students participated in the study out of 136 enrolled students, yielding a response rate of 83.8%. The distribution of participants across academic years and gender is presented in Table 4.

Table 4: Demographic Distribution of the Study Sample (N = 114)

Academic Year	M (N)	F (N)	Total (N)	P (%)
First Year	5	23	28	24.6%
Second Year	6	28	34	29.8%
Third Year	4	27	31	27.2%
Fourth Year	7	14	21	18.4%
Total	**22**	**92**	**114**	**100%**

The sample demonstrated a clear predominance of female participants across all academic years, reflecting the overall gender distribution within the faculty. The largest proportion of participants was from the second year (29.8%), followed by the third year (27.2%). This distribution provides adequate representation of both preclinical and early clinical stages of dental education, thereby supporting comparative analyses across training levels. The high response rate further suggests strong engagement from the student body and minimizes the likelihood of significant non-response bias, enhancing the internal validity of the findings.

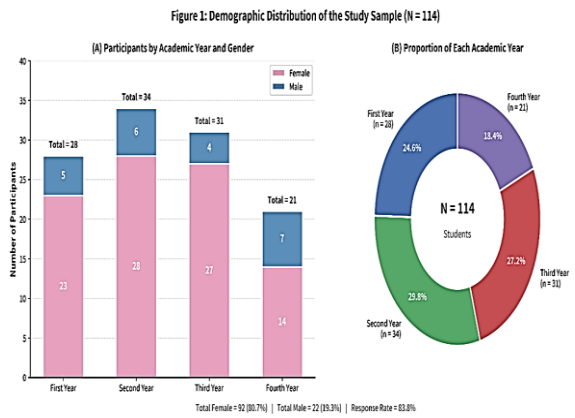

Figure 1 – Demographic Distribution (N = 114)

3.2 Assessment of Cariogenic Risk and Erosion Perception:

The participants' knowledge and perceptions regarding cariogenicity and dental erosion were assessed using six items (Domain I). Descriptive statistics, including means, standard deviations, relative weights, and interpretative levels, are presented in Table 5. The overall domain score was calculated to represent aggregate knowledge in this area.

Table 5: Descriptive Statistics for Cariogenicity & Erosion Risk Perception

It	Statement	Mean	SD	R.W. (%)	Level
1	High sugar intake is a primary risk factor for dental caries.	3.77	0.96	75.4%	High
2	The frequency of snacking is more detrimental to teeth than the total amount of sugar consumed.	3.71	0.92	74.2%	High
3	Acidic foods and carbonated drinks contribute directly to dental enamel erosion.	4.04	0.73	80.8%	High
4	Frequent consumption of sticky, processed foods increases the risk of tooth decay due to retention.	3.72	1.02	74.4%	High
5	Sugar-sweetened beverages (e.g., soft drinks) possess a high cariogenic potential despite their liquid form.	2.11	1.25	42.2%	Low
6	Strict dietary control of fermentable carbohydrates is a fundamental strategy for preventing pediatric caries.	3.41	1.21	68.2%	Moderate
T	**Domain I Average**	**3.46**	**1.01**	**69.2 %**	**Moderate**

The findings indicate a generally moderate-to-high level of awareness regarding key etiological factors associated with dental caries and erosion. The highest level of agreement was observed for the erosive potential of acidic foods and carbonated beverages (Item 3; Mean = 4.04), reflecting strong conceptual understanding of non-bacterial tooth surface loss.

Similarly, respondents demonstrated good awareness that snacking frequency exerts a greater cariogenic effect than total sugar quantity (Item 2; Mean = 3.71), indicating familiarity with fundamental preventive principles in cariology.

However, a notable deficiency was observed in relation to sugar-sweetened beverages (Item 5; Mean = 2.11), which represented the lowest score across all items. This reflects a persistent misconception that liquid sugars are less cariogenic due to presumed rapid oral clearance. This finding contrasts with established evidence demonstrating that frequent consumption and prolonged exposure from sipping behaviors significantly increase demineralization risk.

Overall, the domain mean (3.46) indicates a moderate level of knowledge, with specific conceptual gaps in applied dietary risk assessment.

3.3 Knowledge of Protective Dietary Elements

Domain II evaluated awareness of dietary components with protective effects against oral diseases. Results are presented in Table 6**.**

Table 6: Descriptive Statistics for Protective Dietary Factors

I	Statement	Mean	SD	R.W. (%)	Level
7	Drinking fluoridated water effectively enhances tooth resistance to demineralization.	3.32	1.02	66.4%	Moderate
8	Adequate Calcium intake is vital for maintaining the mineralization of teeth and alveolar bone.	4.06	0.79	81.2%	High
9	Fiber-rich foods (e.g., raw fruits/vegetables) aid in the natural mechanical cleaning of teeth.	3.20	0.98	64.0%	Moderate
10	Dairy products, such as cheese, help protect enamel by neutralizing plaque acids.	3.55	1.14	71.0%	Moderate
11	Chewing sugar-free gum (especially with Xylitol) is beneficial for salivary stimulation and clearance.	3.49	1.11	69.8%	Moderate
T	**Domain II Average**	**3.50**	**1.01**	**70.0 %**	**Moderate**

The highest level of knowledge in this domain was observed for the role of Calcium (Item 8) in maintaining mineralized tissues (Mean = 4.06), indicating strong understanding of systemic mineral metabolism in dental health.

Conversely, fiber-rich foods (Item 9) received the lowest score within the domain (Mean = 3.20), suggesting limited recognition of their mechanical cleansing and salivary stimulation effects. This indicates that “functional dietary concepts” are less emphasized in the current curriculum.

Moderate knowledge was observed regarding fluoridated water, dairy products, and xylitol, reflecting partial but incomplete understanding of bioactive dietary agents.

Overall, the domain score (3.53) reflects moderate knowledge, with stronger emphasis on biochemical rather than functional dietary protection mechanisms.

3.4 Nutrition and Periodontal Health

The third domain assessed the students' perception of the relationship between nutrition and periodontal tissue integrity, focusing on micronutrients and antioxidants. The results are detailed in Table 7.

Table 7: Descriptive Statistics for Nutrition & Periodontal Health

I	Statement	Mean	SD	R. W. (%)	Level
12	Vitamin C deficiency is systemically linked to an increased risk of	3.37	0.91	67.4 %	Moderate

	periodontal disease (e.g., Scurvy).				
13	A balanced diet plays a significant role in modulating the severity of periodontal inflammation.	3.39	1.01	67.8 %	Moderate
14	Regular intake of fruits and vegetables supports the integrity of gingival tissues and oral mucosa.	3.51	0.96	70.2 %	Moderate
15	Dietary antioxidants contribute to reducing oxidative stress and inflammation in the gums.	3.35	0.97	67.0 %	Moderate
16	Micronutrient malnutrition can compromise the local immune response within the oral cavity.	3.45	0.89	69.0 %	Moderate
Total	**Domain III Average**	**3.41**	**0.92**	**68.2 %**	**Moderate**

All items in this domain demonstrated moderate agreement (range: 3.35–3.51), indicating a consistent but non-specialized level of understanding. The strongest recognition was observed for the general role of fruits and vegetables in gingival health (Mean = 3.51). However, lower scores for antioxidant activity (Mean = 3.35) and vitamin C deficiency (Mean = 3.37) suggest limited understanding of the underlying biological mechanisms, including oxidative stress modulation and collagen synthesis.

The uniformity of moderate responses suggests that students possess general awareness but lack mechanistic depth in periodontal nutrition.

3.5 Oral Physiology and Dietary Habits

Domain IV evaluated knowledge of salivary function, dietary habits, and oral environmental regulation (Table 8).

Table 8: Oral Physiology and Dietary Habits

I	Statement	Mean	SD	R.W. (%)	Level
17	Skipping meals can negatively affect salivary flow rates, reducing oral buffering capacity.	3.44	1.09	68.8%	Moderate
18	Drinking plenty of water improves oral clearance and helps maintain oral hygiene.	3.24	1.04	64.8%	Moderate
19	An unbalanced diet can be a contributing factor to halitosis (bad breath).	3.54	0.98	70.8%	Moderate
20	Limiting between-meal snacking is essential for maintaining a neutral pH in the oral environment.	3.66	0.72	73.2%	Moderate
T	**Domain IV Average**	**3.47**	**0.94**	**69.4%**	**Moderate**

In this domain, the highest scoring item was the necessity of limiting between–meal snacking to maintain neutral oral pH (Item 20, Mean = 3.66), which borders on the "High" knowledge threshold. This reinforces the findings from Domain I, reflecting good understanding of plaque pH dynamics and the Stephan curve.

In contrast, the role of water in oral clearance (Item 18) received the lowest score (Mean = 3.24), indicating underappreciation of passive physiological protective mechanisms compared to active interventions.

Overall, the domain mean (3.47) indicates moderate knowledge, with stronger conceptualization of dietary behavior than physiological salivary processes.

3.6 Overall Dietary Literacy Score and Comparative Analysis

Table 9 aggregates the findings to provide an overview of dietary literacy across all assessed domains.

Table 9: Overall Dietary Literacy and Domain Comparison

Rank	Domain	Mean Score	SD	R.W. (%)	Level
1	Protective Dietary Factors	3.52	1.00	70.4%	Moderate
2	Oral Physiology & Dietary Habits	3.47	0.94	69.4%	Moderate
3	Cariogenicity & Erosion Risk	3.46	1.00	69.2%	Moderate
4	Nutrition & Periodontal Health	3.41	0.92	68.2%	Moderate
-	**Overall Questionnaire Score**	**3.47**	**0.97**	**69.4 %**	**Moderate**

The overall mean score for the dietary literacy was 3.47 ± 0.97, indicating a moderate level of knowledge among participants. Domain scores were closely clustered (3.41–3.52), suggesting a uniform distribution of knowledge across categories.

Protective dietary factors ranked highest, while periodontal nutrition ranked lowest. This pattern indicates relatively stronger understanding of nutritional prevention compared to host–response mechanisms.

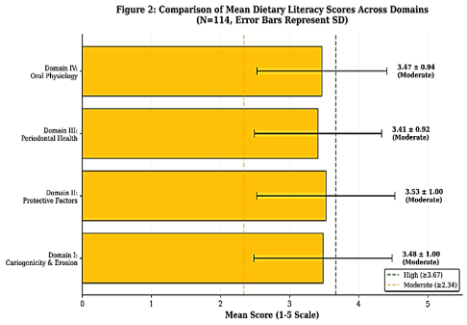

Figure 2: Comparison of Mean Dietary Literacy Scores

Across Domains (N=114, Error Bars Represent SD)

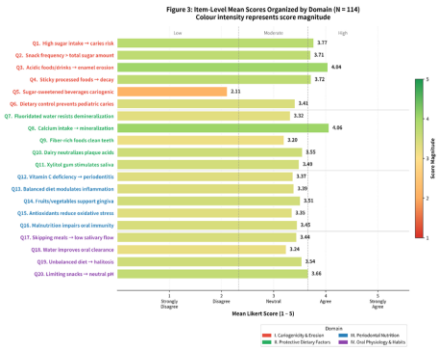

Figure 3: Item-Level Mean Scores Organized by Domain (N=114, Color Intensity Represents Score Magnitude)**Comparative Analysis across Academic Years**

To examine the progression of dietary literacy across the four academic years, a One-Way Analysis of Variance (ANOVA) was conducted separately for each of the four domains. The mean scores, F-values, and significance levels are reported in Table 10.

Table 10: One-Way ANOVA Comparing Dietary Literacy across the Four Academic Years

Domain	1st Yr	2nd Yr	3rd Yr	4th Yr	*P*
Cariogenicity & Erosion	3.41±1.0	3.44±1.0	3.46±0.98	3.62±0.9	0.867
Protective Factors	3.46±1.0	3.47±1.0	3.63±0.95	3.58±0.9	0.804
Periodontal Health	3.34±0.9	3.38±0.9	3.42±0.91	3.51±0.8	0.903

Oral Physiology	3.39±1.0	3.44±1.0	3.51±0.89	3.55±0.8	0.910
Overall Score	**3.40±0.9**	**3.43±1.0**	**3.51±0.93**	**3.57±0.9**	**0.847**

Note: Values are presented as Mean ± SD (Standard Deviation).

Yr = Year; F = F-statistic (ANOVA); P = P-value.

Statistical significance is set at P < 0.05.

One-way ANOVA revealed no statistically significant differences across academic years in any domain (all p > 0.05). Because the omnibus F-tests were non-significant, Tukey's HSD post-hoc tests did not identify any specific year-pairs with significant differences either; nonetheless, the pairwise comparisons were inspected and were all non-significant, confirming that no academic year stood apart from the others in terms of dietary literacy.

Despite the absence of statistical significance, the descriptive pattern is informative: mean scores rose only modestly from the First Year (overall 3.40) to the Fourth Year (overall 3.57). The gradient is small and inconsistent across domains, which collectively points to a relatively flat learning curve regarding dietary knowledge throughout the dental program.

Focused Comparison: Second vs Third Year Students

To complement the ANOVA and address the specific transition from the pre-clinical to the early-clinical phase, an Independent Samples t-test was conducted between Second Year (N = 34) and Third Year (N = 31) students. The results are presented in Table 11.

Table 11: Comparative Analysis of Dietary Literacy between Second and Third Year Students

Domain	Year	N	Mean	SD	P-value
Cariogenicity & Erosion	2nd Year	34	3.44	1.04	0.800
	3rd Year	31	3.46	0.98	
Protective Factors	2nd Year	34	3.47	1.02	0.048 *
	3rd Year	31	3.63	0.95	
Periodontal Health	2nd Year	34	3.38	0.98	0.609
	3rd Year	31	3.42	0.91	
Oral Physiology	2nd Year	34	3.44	1.01	0.307
	3rd Year	31	3.51	0.89	

*statistically significant at $p < 0.05$.

The focused t-test results were largely consistent with the ANOVA findings. No statistically significant differences were observed in three of the four domains (Cariogenicity & Erosion, Periodontal Health, and Oral Physiology), with p-values ranging from 0.307 to 0.800. A small but statistically significant difference was detected in the Protective Factors domain (p = 0.048), where Third Year students scored slightly higher than their Second Year counterparts. However, the magnitude of this difference is modest and should be interpreted with caution, given its borderline p-value and the absence of an overall ANOVA effect.

Taken together, these results suggest a plateau in nutritional knowledge during the transition from pre-clinical to early clinical years. The lack of substantial improvement implies that the current curriculum may not be effectively reinforcing or expanding upon the basic nutritional concepts introduced in the earlier years. The knowledge retained in the Third Year appears largely to be residual from earlier basic science courses rather than the result of new, clinically applied learning. The persistence of similar knowledge levels across these academic years points to a need for vertical integration of dietary education. In particular, re-introducing advanced nutritional counseling concepts during the clinical years could help bridge the gap between theoretical knowledge and clinical application.

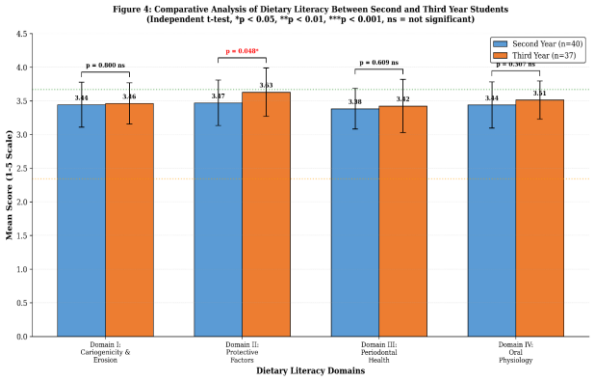

Figure 4: Comparative Analysis of Dietary Literacy between Second and Third Year Students (Error Bars Represent SD, P-values Displayed)

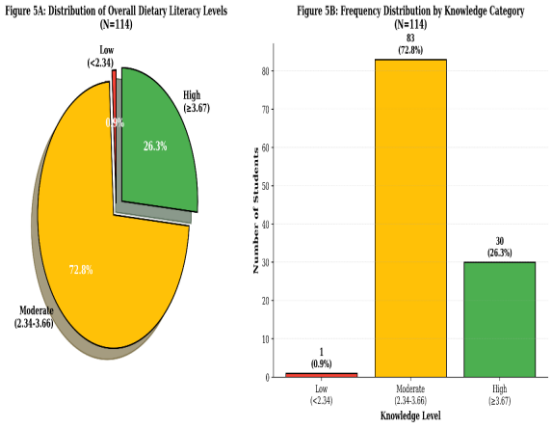

Figure 5: Distribution of Overall Dietary Literacy Levels Among Study Participants (N=114)

4 Discussion

The present study demonstrated a generally moderate level of dietary literacy among undergraduate dental students at Sirte University, with relatively limited variation across academic years and domains. The absence of marked progression suggests that dietary knowledge acquisition may occur early in the curriculum with insufficient reinforcement during later clinical stages. However, given the cross-sectional nature of the study, this pattern should be interpreted as descriptive rather than evidence of true educational stagnation.

Diet is widely recognized as a central modifiable factor in the development of dental caries and periodontal diseases, and its role in preventive dentistry has been strongly emphasized in global oral health strategies (1,2). The Global Burden of Disease data further highlight the magnitude of oral diseases worldwide, reinforcing the importance of integrating preventive nutritional education within dental curricula (3,4). In this context, the observed moderate literacy level suggests that students hold an acceptable theoretical foundation, although the depth of applied understanding appears inconsistent across domains.

In relation to cariogenicity and erosion, students demonstrated relatively solid understanding of classical risk factors such as sugar intake frequency and acidic dietary exposure. This is consistent with established cariology models that emphasize the dynamic interaction between fermentable carbohydrates, biofilm metabolism, and enamel demineralization (13,18). However, a clear weakness was identified in the recognition of sugar-sweetened beverages as a significant cariogenic risk factor. This misperception has also been reported in previous literature and is often attributed to the assumption that liquid sugars are less harmful due to rapid oral clearance, despite evidence showing that frequent exposure and sipping behaviors maintain prolonged acidogenic challenge (6,11,12). This suggests that students may understand "what is cariogenic" at a conceptual level, but have difficulty translating this knowledge into realistic dietary risk evaluation.

Regarding protective dietary factors, calcium was consistently well recognized as essential for mineralization of dental hard tissues, reflecting adequate understanding of its biological role in enamel and bone maintenance (14,15). In contrast, functional dietary mechanisms—particularly the role of fiber-rich foods in mechanical plaque control and salivary stimulation—were less well understood. This imbalance suggests that

nutritional teaching may still emphasize biochemical mechanisms of remineralization over functional dietary behaviors that contribute to oral clearance and plaque control (10,11). Such an orientation is common in preclinical dental education, where molecular concepts tend to dominate over behavioral nutrition science.

For periodontal nutrition, students showed moderate and relatively uniform knowledge across all items, indicating general awareness without mechanistic depth. While the association between diet and gingival health was recognized, understanding of antioxidant function and vitamin C–related collagen synthesis appeared limited. This is noteworthy given the established role of vitamin C in connective tissue integrity and immune response modulation, and its deficiency being associated with increased periodontal breakdown and impaired healing capacity (19–22). The findings suggest that host-modulatory nutritional mechanisms remain less emphasized compared to microbial and mechanical determinants of periodontal disease (9,16,23).

Similarly, knowledge related to oral physiology and dietary habits remained moderate. Students showed acceptable awareness of the role of snacking frequency in influencing oral pH dynamics, yet physiological protective mechanisms such as salivary buffering, hydration, and clearance were less consistently appreciated. Saliva is a key biological determinant of oral homeostasis, contributing to acid neutralization, antimicrobial defense, and remineralization processes (25,26). The relatively lower emphasis on these intrinsic protective mechanisms may indicate a tendency among students to prioritize behavioral control strategies over physiological resilience factors.

Across academic years, no statistically significant differences were observed in dietary literacy scores. Although a slight upward trend was noted in higher years, this was not consistent or statistically meaningful. This finding may reflect limited reinforcement of nutritional concepts during clinical training rather than true absence of learning progression. Similar patterns have been reported in dental education literature, where knowledge retention without progressive conceptual integration is observed in curricula with limited vertical integration of preventive sciences (7–9).

A statistically significant difference was identified only in the protective dietary factors domain between second- and third-year students; however, the effect size was small and not consistently observed across other domains. Therefore, its educational relevance appears limited and should be interpreted cautiously rather than as evidence of meaningful curricular impact.

Overall, the findings suggest that dental students possess adequate foundational knowledge of dietary influences on oral health, but this knowledge remains largely descriptive rather than analytically or clinically integrated. The gap between theoretical understanding and applied preventive reasoning is a recurring issue in dental education and has implications for the development of effective nutritional counseling skills in future practitioners (7–9).

From an educational standpoint, these results support the need for stronger vertical integration of nutritional science throughout the dental curriculum, with reinforcement during clinical training rather than confinement to early theoretical courses. Additionally, incorporating case-based learning and patient-centered dietary counseling exercises may enhance the translation of knowledge into clinical practice.

4.1 Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design does not allow for assessment of changes in dietary literacy over time or establishment of causal relationships between academic progression and knowledge development. Longitudinal studies would be required to better understand learning trajectories across the dental curriculum.

Second, the study relied on self-administered questionnaires, which may introduce response bias, including social desirability bias and potential overestimation of knowledge levels. Although the instrument demonstrated acceptable internal consistency, self-reported data do not necessarily reflect actual clinical competency.

Third, the use of convenience sampling from a single institution limits the generalizability of the findings to other dental schools with different curricular structures, teaching methodologies, or student demographics.

Finally, the study evaluated perceived knowledge rather than observed clinical behavior. Therefore, the extent to which dietary literacy translates into actual patient counseling and clinical decision-making remains uncertain

5 Conclusions

Based on the findings of this study, it can be concluded that dental students at Sirte University possess a moderate level of dietary literacy. The students demonstrated a solid grasp of fundamental concepts regarding the physical consistency of cariogenic foods and the systemic importance of calcium, but significant gaps remain in their understanding of specific risk factors. Notably, there is a marked underestimation of the cariogenic potential of sugar-sweetened beverages, which contradicts current epidemiological evidence. Furthermore, the students' knowledge regarding the specific biochemical impact of micronutrients on periodontal health appears to be superficial and lacks the depth required for targeted clinical management. The statistical analysis—using both One-Way ANOVA across the four academic years and an Independent Samples t-test between Second and Third Year students—revealed no meaningful progression in dietary knowledge across the program, with only a small borderline difference in the Protective Factors domain. This pattern suggests that the current educational model effectively introduces basic nutritional concepts but does not sufficiently reinforce or expand this knowledge into the clinical training phase.

5.1 Recommendations:

1) In light of the study findings and the identified gaps in knowledge, the following suggestions are proposed to enhance the nutritional curriculum and student competency:
2) It is recommended that the dental curriculum be revised to place greater emphasis on the specific cariogenicity of liquid sugars and carbonated beverages to correct the prevalent misconception regarding oral clearance.
3) The teaching of periodontal nutrition should be deepened to move beyond general healthy eating advice, focusing specifically on the biochemical roles of antioxidants and micronutrients in immune modulation.
4) Educational modules could benefit from highlighting the local, mechanical protective effects of fibrous foods to balance the students' current focus on systemic chemical factors such as calcium.
5) Vertical integration of nutritional science is recommended throughout the academic years to prevent the observed knowledge plateau between pre-clinical and clinical phases.
6) Practical training sessions involving dietary analysis and counseling for patients could be introduced in the third and fourth years to bridge the gap between theoretical knowledge and clinical application.
7) Further research is encouraged to evaluate the effectiveness of implementing specific nutritional workshops on the long-term retention of dietary literacy among students.

Acknowledgements

The authors would like to thank the Faculty of Dentistry at Sirte University for its support, and express their gratitude to all the dental students who voluntarily participated in this study. This research did not receive any specific grant or funding from public, commercial, or non-profit sectors.

Conflict of Interest

The authors declare that there are no conflicts of interest.

References

American Dental Association. (2020). *Brushing recommendations*.

Carr, A. C., & Maggini, S. (2017). Vitamin C and immune function. *Nutrients*, *9*(11), 1211. https://doi.org/10.3390/nu9111211

Chapple, I. L. C., Bouchard, P., Cagetti, M. G., et al. (2017). Nutrition and periodontal health. *Journal of Clinical Periodontology*, *44*(Suppl 18), S153–S168.

Dietrich, T., Nunn, M., Dawson-Hughes, B., et al. (2005). Vitamin D and periodontal health. *Journal of Periodontology*, *76*(2), 181–192.

Featherstone, J. D. B. (2000). Fluoride and remineralization. *The Journal of the American Dental Association*, *131*(7), 887–899.

Fejerskov, O. (2004). Changing paradigms in caries etiology. *Caries Research*, *38*(3), 182–191.

GBD 2017 Oral Disorders Collaborators. (2020). Global prevalence of oral conditions. *Journal of Dental Research*, *99*(4), 362–373.

Hodges, R. E., Baker, E. M., Hood, J., et al. (1969). Experimental scurvy. *The American Journal of Clinical Nutrition*, *22*(5), 535–548.

Husseini, A., Slot, D. E., & Van der Weijden, G. A. (2008). Oral irrigators and plaque removal. *International Journal of Dental Hygiene*, *5*(4), 237–244.

Kassebaum, N. J., Smith, A. G. C., Bernabé, E., et al. (2017). Global burden of untreated caries. *Journal of Dental Research*, *96*(4), 380–387.

Levine, M., Rumsey, S. C., Daruwala, R., Park, B. J., & Wang, Y. (1999). Criteria and recommendations for vitamin C intake. *Proceedings of the National Academy of Sciences*, *96*(7), 3683–3687.

Marsh, P. D. (2004). Microbial ecology of dental plaque. *Caries Research*, *38*(3), 204–211.

Moynihan, P., & Petersen, P. E. (2004). Diet, nutrition and oral health. *Public Health Nutrition*, *7*(1A), 201–226.

Moynihan, P. J. (2005). The role of diet in dental caries. *Caries Research*, *39*(Suppl 1), 3–16.

NIH Office of Dietary Supplements. (2021). *Vitamin C fact sheet*. National Institutes of Health.

Petersen, P. E. (2003). *The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century*. World Health Organization.

Pinto, J. M., Ribeiro, C. C., de Andrade, J. K. B., et al. (2022). Dietary vitamin D and calcium and periodontitis: A population-based study. *Frontiers in Nutrition*, *9*, 1016763. https://doi.org/10.3389/fnut.2022.1016763

Radomska, A., Krawczyk, M., Matusiak, M., et al. (2026). The role of Vitamin D3 in periodontal health: Implications for bone metabolism and inflammation. *Nutrients*, *18*(4), 577. https://doi.org/10.3390/nu18040577

Reynolds, A., Mann, J., Cummings, J., et al. (2019). Carbohydrate quality and health. *The Lancet*, *393*(10170), 434–445.

Sambunjak, D., Nickerson, W. J., Poklepovic, T., et al. (2011). Flossing for periodontal disease prevention. *Cochrane Database of Systematic Reviews*, *(12)*, CD008829. https://doi.org/10.1002/14651858.CD008829.pub2

Sheiham, A., & James, W. P. T. (2015). Diet and dental caries. *Journal of Dental Research*, *94*(10), 1341–1347.

Slavin, J. (2005). Dietary fiber and body weight. *Nutrition*, *21*(3), 411–418.

Slot, D. E., Dörfer, C. E., & Van der Weijden, G. A. (2008). Interdental brushes effectiveness. *International Journal of Dental Hygiene*, *6*(4), 253–264.

Ten Cate, J. M. (1999). Current concepts on fluoride mechanisms. *Acta Odontologica Scandinavica*, *57*(6), 325–329.

Vavetsi, K., Nomikos, T., Vassilopoulos, S., & Bobetsis, Y. A. (2024). Effect of nutritional antioxidants on periodontal disease and periodontal therapy. *Nutrients*, *16*(2), 262. https://doi.org/10.3390/nu16020262

Watt, R. G., Daly, B., Allison, P., et al. (2019). Social determinants of oral health. *Community Dentistry and Oral Epidemiology*, *47*(1), 3–9.

World Health Organization. (2022a). *Global oral health status report*.

World Health Organization. (2022b). *Oral health*.