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KNOWLEDGE AND AWARENESS OF DENTAL STUDENTS AND FACULTY MEMBERS ABOUT XYLITOL PRODUCTS FOR CARIES PREVENTION IN A PRIVATE DENTAL COLLEGE OF KHYBER PAKHTUNKHWA

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ABSTRACT

Background: Xylitol, a carbohydrate originating from xylose, is a naturally occurring sweetener that has been recognized for more than a hundred years. Initially identified in the late 1800s, it exists in small quantities of foods like strawberries and cauliflower.[1] The carbohydrate xylitol is derived from xylose, a natural sweetener. It has been identified for almost a century.

Methodology: A cross-sectional survey was carried out at Private dental colleges in KP, between February 2023 and May 2024. Participants included clinical-year BDS students, house officers, lecturers, and senior lecturers, while individuals who declined verbal consent were excluded. The calculated sample size was 196 using OpenEpi software. A purposive sampling method was employed for participant selection. Data collection involved a questionnaire administered by the principal investigator. The survey contained 19 items, split into two parts: demographic questions and awareness-related questions. Awareness was quantified by scoring correct answers as 1 and incorrect as 0.

Results: The response rate was 80%, with a median participant age of 23 years. Most respondents were female (52.6%), and a majority were students (58.2%) or house officers (21.4%). Regarding awareness, only 35.2% were aware of the recommended xylitol dosage, while awareness of potential side effects like diarrhea (50%), bloating (34.7%), nausea (30.6%), constipation (21.4%), and weight gain (20.9%) was low. Half of the participants knew xylitol was available in chewing gum form, followed by toothpaste (39.3%).

Conclusion: Awareness was notably influenced by the source of information, with academic references yielding better results.

Key Words: Awareness, xylitol, dental caries

INTRODUCTION

Xylitol, a carbohydrate originating from xylose, is a naturally occurring sweetener that has been recognized for more than a hundred years. Initially identified in the late 1800s, it exists in small quantities of foods like strawberries and cauliflower.[1] The carbohydrate xylitol is derived from xylose, a natural sweetener. It has been identified for almost a century.[2,3] It was first discovered in the late nineteenth century and is commonly found in trace amounts in a range of fruits and vegetables, including cauliflower and strawberries.[4] Commercially, it is commonly made from plant materials, maize cobs, and hardwood/beechwood trees, toothpaste, gels, and chewing gum are examples of commonly available commercial goods.[5]

Dental caries, more commonly referred to as cavities, represent a multifaceted oral condition where enamel, dentin, and cementum are gradually broken down.[6] The disease is influenced by several contributors such as oral bacteria, dietary patterns, saliva, the composition of teeth, and time. Globally, it poses a significant challenge to oral health, affecting approximately 2 billion people with permanent tooth decay and over 500 million children with decay in primary teeth.[7] In Pakistan, the national dental caries prevalence has been estimated at 56.6%, with Sindh having a slightly higher rate of 58.9%. Xylitol, a polyol used as a sugar substitute, occurs naturally and can be synthetically produced from plant matter.[8] It's notable for its antiplaque activity and capacity to reduce gum inflammation. Moreover, xylitol can aid in enamel remineralization by bonding with calcium ions. It disrupts the metabolic processes of bacteria like Streptococcus mutans, thereby reducing acid production and lowering the risk of decay. It also hampers bacterial adhesion to tooth surfaces and promotes saliva flow, aiding in food particle clearance and pH regulation in the mouth.[1,3] Thanks to its neutral pH, xylitol helps prevent the acidic conditions that favor cavity formation. However, correct dosage is key to balancing its benefits with potential side effects. Research supports the regular use of xylitol chewing gum to prevent caries, as highlighted by Mota et al. (2021),[4] who noted its effect in reducing Streptococcus mutans levels. Studies by Pienihäkkinen et al. (2024)[6] and Ortiz-Sáez et al. (2024)[2] also confirm its impact on reducing dental plaque. The recommended intake of 6 to 10 grams per day is effective for caries prevention, but overconsumption can cause gastrointestinal issues such as diarrhea and nausea. For dentists, awareness of such preventative tools is essential for managing caries risk and patient counseling. A thorough understanding of dental decay, diagnostic capabilities, and preventative measures like xylitol use can significantly enhance patient outcomes. Unfortunately, inadequate communication from dental professionals often hinders early oral disease management.[9] Currently, there's a scarcity of local data on dental practitioners' awareness of xylitol's role in oral health.

Hence, this study was initiated to evaluate awareness among dental students and faculty at a private dental college in Karachi regarding the preventive potential of xylitol products.

MATERIALS AND METHODS

A cross-sectional survey was carried out at Private dental colleges in KP, between February 2023 and May 2024. Participants included clinical-year BDS students, house officers, lecturers, and senior lecturers, while individuals who declined verbal consent were excluded. Assuming a 50% outcome frequency to ensure a conservative estimate, and with 95% confidence level and 7% precision, the calculated sample size was 196 using OpenEpi software. A purposive sampling method was employed for participant selection. Data collection involved a questionnaire administered by the principal investigator. A pilot test on 10% of the sample assessed its reliability, resulting in a Cronbach's alpha of 0.713, indicating acceptable consistency. Face validity was checked by verifying if participants found the questions relevant to assessing their xylitol awareness.

The survey contained 19 items, split into two parts: demographic questions and awareness-related questions. Awareness was quantified by scoring correct answers as 1 and incorrect as 0.

Respondents scoring 10 or more out of 12 awareness questions were considered adequately aware. Data entry and analysis were done using SPSS version 20. Frequencies and percentages were computed for categorical variables, and medians with interquartile ranges were reported for continuous data after normality checks via the Shapiro-Wilk test. Logistic regression was applied for inferential statistics, with variables from univariate analysis ($p < 0.25$) and others deemed important included in multivariate models. A significance level of $p \leq 0.05$ was used.
All procedures adhered to ethical research standards, including the Helsinki Declaration, and approval was obtained from the Baqai Institute of Health Sciences (FHM 28-2023).

RESULTS

The response rate was 80%, with a median participant age of 23 years. Most respondents were female (52.6%), and a majority were students (58.2%) or house officers (21.4%). Regarding awareness, only 35.2% were aware of the recommended xylitol dosage, while awareness of potential side effects like diarrhea (50%), bloating (34.7%), nausea (30.6%), constipation (21.4%), and weight gain (20.9%) was low. Half of the participants knew xylitol is available in chewing gum form, followed by toothpaste (39.3%). Awareness about its use in mouthwash and lozenges was limited. The main reasons cited for low prescription rates included lack of awareness (51%) and cost (28.1%). Only 13.3% of respondents demonstrated adequate awareness of xylitol for caries prevention. Most participants (43.9%) cited medical literature as their main source of information, followed by personal knowledge (31.6%) and academic texts (13.8%). Multivariable regression showed a significant association between the source of information and awareness: participants relying on personal knowledge had much lower odds of being adequately aware compared to those referencing academic texts (aOR = 0.12, 95% CI: 0.02–0.50, p = 0.004).

Table 1: Awareness regarding xylitol.

Awareness Regarding Xylitol (n = 196)	Count	
	Yes (%)	No (%)
Are you aware of numerous natural sweeteners?	182 (92.9)	14 (7.1)
Can xylitol have preventive role in oral diseases?	188 (95.9)	8 (4.1)
Can xerostomia be prevented by xylitol?	181 (92.3)	15 (7.7)
Can dental caries be prevented by xylitol?	177 (90.3)	9 (9.7)
Are you aware of recommended daily dose of xylitol?	69 (35.2)	127 (64.8)
Is constipation a potential side effect of xylitol?	42 (21.4)	154 (78.6)
Is bloating a potential side effect of xylitol?	68 (34.7)	128 (65.3)
Is diarrhea a potential side effect of xylitol?	98 (50.0)	98 (50.0)
Is nausea a potential side effect of xylitol?	60 (30.6)	136 (69.4)
Is weight gain a potential side effect of xylitol?	41 (20.9)	155 (79.1)
Should xylitol products be recommended?	167 (85.2)	29 (14.8)
Future research on xylitol is important?	184 (93.9)	12 (6.1)

Table 2: Source of information, commercial availability, and prescription trend.

Further Awareness Aspects	Count (%)
Most important source of xylitol info	
- Syllabus/Academic Text	27 (13.8)
- Other Medical Literature	86 (43.9)
- Personal Knowledge	62 (31.6)
- Social/Print Media	13 (6.6)
- Word of Mouth	8 (4.1)
From most commonly available	
- Chewing Gums	98 (50.0)
- Toothpastes	77 (39.3)
- Mouthwashes	12 (6.1)

- Tablets/Lozenges	9 (4.6)
Reason for low prescription	
- It is expensive	55 (28.1)
- It is inaccessible	32 (16.3)
- Lack of awareness	100 (51.0)
- Taste/Texture issues	9 (4.6)

DISCUSSION

Xylitol is endorsed as a supportive tool in caries prevention when used alongside routine oral hygiene. Its benefits are increasingly recognized within the dental community. High levels of general awareness about natural sweeteners and xylitol's oral benefits were reported, aligning with previous studies. Yet, only a small portion of respondents demonstrated sufficient knowledge to use xylitol effectively in a preventive context. This echoes previous findings and highlights a persistent awareness gap despite global promotion. More than 90% of respondents acknowledged the need for further research on xylitol's preventive role. There is a pressing demand for more comprehensive studies that evaluate optimal dosage, usage duration, and integration into dental care strategies. Interestingly, academic literature and formal curriculum were associated with higher awareness levels, emphasizing the importance of integrating xylitol-related content into dental education.[11] Low awareness despite global research progress indicates a need for revised dental curricula, professional training, and dissemination through seminars and publications. According to the current study's findings, 93.9% of participants agreed that additional research into xylitol's capacity to prevent dental cavities is needed. More study is needed to investigate and enhance strategies for effectively using xylitol products to prevent dental caries. To optimise the efficiency of xylitol-containing dental care products in preventing tooth decay, experts are looking at a variety of aspects such as dosage, frequency, duration of use, and potential synergies with other preventative measures. Overall, the demand for more study demonstrates a knowledge of the need to improve our understanding of dental caries prevention and, ultimately, patient outcomes for oral health.

The argument about xylitol's significance in reducing dental caries has been continuing for some time.[12] While sugar is widely considered as the primary cause of tooth decay, the efficacy of substituting sugar with xylitol for caries prevention is still debated. Research over the last three decades has helped us comprehend xylitol's potential advantages, but it is important to emphasise that the research does not yet definitively show that xylitol alone is the key to avoiding dental caries.[13] It can be a useful supplement to preventative methods, but it should not be depended on as the only treatment. According to the current study's findings, 43.9% of participants claimed medical literature was their most important source of information about xylitol, followed by syllabus (13.8%) and personal knowledge (31.6%). In a similar vein, Luo et al. (2021)[14] discovered that 44.4% of participants reported medical literature as their primary source of knowledge on oral health, with the popular press ranking second at 25%. The most recent medical literature is a valuable source of information on xylitol and its potential impact on oral health. Encouraging xylitol use through evidence-based education could significantly boost oral health outcomes, especially in populations with limited access to dental care.

CONCLUSION

The study found that only 13.3% of dental students and faculty had sufficient awareness regarding the use of xylitol to prevent dental caries. Awareness was notably influenced by the source of information, with academic references yielding better results.

To improve dental health outcomes, it's essential to enhance education and awareness regarding xylitol's benefits through curriculum updates, professional development, and continued dissemination of scientific evidence.

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