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Original Article

Disparities in Oral Health Literacy and Behavior Between Hearing-Impaired and Non-Hearing-Impaired Jordanians: A Matched Comparative Analysis

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ABSTRACT

People with hearing loss often encounter major difficulties obtaining oral-health guidance, which can affect their daily hygiene routines and dental status. This research set out to evaluate differences in oral-health knowledge and dental habits between Jordanian individuals with hearing impairment and those without it. A comparative cross-sectional design was used to survey 289 people, including 149 with hearing impairment and 140 without. A validated, researcher-developed questionnaire composed of closed-ended items was employed to measure oral-health awareness and self-care behaviors. Participants were selected through convenience sampling from facilities that serve individuals with hearing loss. Data analysis was carried out in SPSS® version 22, using $P < 0.05$ as the indicator of statistical significance. Group differences were explored using Chi-square tests and contingency tables. Those with hearing impairment exhibited noticeably weaker understanding of toothbrush-bristle firmness, recommended brushing frequency, the necessity of regular dental checkups, and symptoms associated with gingival disease ($P < 0.05$). A smaller share of this group reported brushing once or twice per day (82.8% vs. 93.3%, $P < 0.001$), and they were less likely to floss, use mouthwash, or choose fluoridated toothpaste ($P < 0.05$). They also consumed soft drinks more frequently ($P < 0.001$). The pronounced limitations in dental knowledge and hygiene practices among people with hearing impairments underscore the importance of tailored educational strategies. Approaches such as visually based materials, instructional videos, and specialized oral-health programs may improve everyday hygiene behavior, decrease oral-disease risk, and enhance their quality of life.

Keywords: Oral health, Hearing-impaired, Non-hearing-impaired, Jordanian

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Introduction

Hearing loss is identified as the third most common disability globally [1]. It can arise from genetic, congenital, or acquired causes and may involve conductive, sensorineural, mixed, or central forms. Levels of impairment range from mild (<40 decibels) to profound (>40 decibels), with onset occurring before, during, or after language development [2]. The WHO estimates that more than 5% of the world's population—around 432 million adults and 34 million children—require intervention for hearing loss, and this figure is projected to exceed 700 million people by 2050, or about 1 in 10 individuals [3].

Research repeatedly shows that individuals with hearing impairments tend to have poorer oral hygiene than the general population, largely because of communication obstacles and reduced access to preventive information [4, 5]. A study by Bhadauria *et al.* [6] involving 500 people with hearing difficulties in India revealed a 30% higher caries rate than in the general population. Cannobbio *et al*., working in Italy, found a 20% reduction in the use of preventive dental services among individuals with hearing impairments.

Because most health education is conveyed verbally, people with hearing loss may receive incomplete or unclear oral-health messages, contributing to limited awareness and elevated disease rates [7, 8]. Misinterpretation of dental terms, oral-care instructions, and the rationale for periodic dental visits further complicates their ability to maintain oral hygiene. Differences in sensory processing also influence comprehension. High-income-country studies consistently show poorer oral-health indices in children with hearing loss; one systematic review reported average plaque and gingival scores of 0.99 and 1.27, respectively [3]. Visual teaching methods yield promising results—for example, a UK randomized controlled trial demonstrated that video-based instruction reduced plaque and gingival indices by 0.37 and 0.39, respectively [9].

Oral-health literacy includes understanding correct brushing methods, choosing appropriate toothbrushes, diet-related issues, and recognizing the importance of routine professional care. Communication limitations often restrict how effectively people with hearing impairment acquire such information [10]. Visual communication tools and customized programs have shown positive impacts on knowledge and behavior [11, 12]. Another randomized trial in the UK found that visual instruction significantly improved plaque and gingival scores in children with hearing loss [13].

Despite the acknowledged connection between oral-health knowledge, behavior, and clinical indicators, data regarding the oral-health profile of individuals with hearing impairments in Jordan remain scarce. Dental practitioners may also find it difficult to treat this population due to communication barriers and limited training in providing adapted care.

This study seeks to compare oral-health knowledge and dental habits between individuals with and without hearing impairment in Jordan. The results are intended to support the creation of targeted interventions that promote better oral-health awareness and improved outcomes for this underserved community.

Materials and Methods

An investigator-designed questionnaire written in Arabic—the official language of Jordan—was employed to measure oral-health knowledge and dental practices among participants with hearing impairment. Two specialists reviewed the instrument to confirm content validity. The average congruency percentage (ACP), representing agreement between the reviewers, reached 92%, demonstrating that the items were judged suitable and appropriate for the study's objectives. To evaluate stability over time, test–retest reliability was applied by administering the tool twice to the same group ($n = 10$). Internal consistency was examined using Cronbach's alpha, which yielded a value of 0.75, indicating acceptable inter-item correlation.

A pilot assessment involving 10 caregivers of individuals with hearing impairment was performed to obtain comments on clarity, layout, and item presentation. The questionnaire consisted of three sections: the first comprised five items addressing demographic traits; the second included 12 items assessing oral-health knowledge; and the third contained seven items related to dental behaviors.

The classification of hearing-loss severity was derived from diagnostic reports provided by school or center administrators; therefore, severity levels were based on clinical evaluation rather than participant self-report. Recruitment of individuals with hearing impairment was carried out using convenience sampling from specialized schools and care centers across Jordan, which may have resulted in selection bias. Only persons capable of reading basic Arabic were eligible in order to ensure consistent and autonomous completion.

The institutions were identified through the Ministries of Social Development and Education. Participation depended on administrators' agreement to disseminate the survey. Each participant received a printed questionnaire accompanied by an explanatory cover letter. Literate individuals completed the survey independently, while caregivers assisted those unable to do so. A comparison group without hearing impairment was recruited from the same regions using convenience sampling, which may likewise have contributed to selection bias. These participants were not matched for age or socioeconomic variables, potentially influencing group comparability.

Sample size estimation was performed with G*Power, assuming 80% statistical power and a 5% margin of error, following the criteria suggested by Alshatrat *et al*. [14]. Calculations indicated that each group required a minimum of 139 participants.

Out of 200 distributed questionnaires, 149 were completed by individuals with hearing impairment. Similarly, 140 questionnaires were returned from the 200 distributed to individuals without hearing impairment.

Data entry and analysis were conducted in IBM SPSS Statistics Version 25.0 (IBM Corp., NY, USA). Descriptive analyses summarized demographic variables and item responses as frequencies and percentages. Comparisons between the two groups were performed using two-tailed Chi-square tests, with significance set at $p < 0.05$.

Results and Discussion

A total of 289 participants were included: 149 with hearing impairment (HI group) and 140 without impairment. The mean age was 15 years, with most respondents younger than 18. Within the HI group, 57.1% exhibited severe hearing loss, while 32.9% had moderate impairment. Additional demographic variables—such as gender, educational attainment, and household income—are summarized in **Table 1**.

Table 1. Sociodemographic characteristics of participants with and without hearing impairments.

Characteristic	Group without hearing impairment, n (%)	Hearing-impaired group, n (%)
Sex		
Male	100 (67.1)	73 (52.1)
Female	49 (32.9)	67 (47.9)
Age (years)		
<18	149 (100)	123 (87.9)
18–40	0 (0)	13 (9.3)
>40	0 (0)	4 (2.9)
Family income (Jordanian Dinars, JD)		
<250	2 (1.3)	71 (50.7)
250–500	70 (47.0)	63 (45.0)
500–1,000	64 (43.0)	4 (2.9)
>1,000	13 (8.7)	2 (1.4)
Education level		
Elementary	132 (88.6)	96 (68.6)
Middle school	17 (11.4)	32 (22.9)
High school	0 (0)	7 (5.0)
College and higher	0 (0)	4 (2.8)
Health insurance		
No	49 (32.9)	45 (32.1)
Yes	100 (67.1)	95 (67.9)

Oral health knowledge

The comparison showed no significant distinctions between the HI group and the group without hearing loss regarding their understanding of how plaque forms, what causes dental caries, the impact of sugary items and soft drinks, or how oral conditions relate to general health ($P > 0.05$). Nonetheless, several other knowledge areas differed markedly.

Participants with hearing impairment were far less aware that healthy gums should not bleed or become swollen while brushing ($P < 0.001$). Misconceptions about toothbrush-bristle hardness were also more common: 77.1% of the HI group incorrectly believed that hard bristles are necessary for adequate cleaning, compared with 4.7% of those without hearing impairment ($P < 0.001$). Moreover, 54.3% of the HI group reported that dental appointments are needed only when a tooth is painful, whereas 21.5% of individuals without hearing impairment held this view ($P < 0.001$). Interestingly, awareness of the importance of dental floss use was higher among the HI group (87.9% vs. 75.8%, $P = 0.019$), possibly reflecting health education messaging delivered at the institutions from which participants were recruited. Full response details are summarized in **Table 2**.

Table 2. Oral health knowledge among individuals with and without hearing impairments.

Question	Group without hearing impairment, n (%)	Hearing-impaired group, n (%)	P-value
1. Dental plaque is caused by bacteria that settle and multiply on teeth			
Yes	90 (60.4)	66 (48.5)	0.069
No	4 (2.7)	9 (6.6)	
Don't know	55 (36.9)	61 (44.9)	
2. Dental caries (tooth decay) are primarily caused by bacteria			
Yes	117 (79.1)	95 (67.9)	0.073

No	18 (12.2)	22 (15.7)	
Don't know	13 (8.8)	23 (16.4)	
3. Consuming sugar can cause tooth decay			
Yes	140 (94.0)	135 (98.5)	0.080
No	8 (5.4)	1 (0.7)	
Don't know	1 (0.7)	1 (0.7)	
4. Drinking soft drinks/fizzy beverages harms dental health			
Yes	141 (94.6)	124 (88.6)	0.126
No	5 (3.4)	7 (5.0)	
Don't know	3 (2.0)	9 (6.4)	
5. Is there a connection between oral health and general health?			
Yes	125 (83.9)	111 (79.9)	0.620
No	15 (10.1)	19 (13.7)	
Don't know	9 (6.0)	9 (6.5)	
6. It is normal for gums to bleed when brushing teeth			
Yes	31 (20.8)	58 (42.0)	0.000*
No	112 (75.2)	62 (44.9)	
Don't know	6 (4.0)	18 (13.0)	
7. It is normal for gums to appear red			
Yes	49 (32.9)	16 (11.4)	0.000*
No	89 (59.7)	119 (85.0)	
Don't know	11 (7.4)	5 (3.6)	
8. It is normal for gums to be swollen			
Yes	5 (3.4)	120 (85.7)	0.000*
No	139 (93.3)	19 (13.6)	
Don't know	5 (3.4)	1 (0.7)	
9. Brushing teeth regularly helps protect them from decay			
Yes	142 (95.3)	120 (86.3)	0.021*
No	6 (4.0)	16 (11.5)	
Don't know	1 (0.7)	3 (2.2)	
10. You should visit the dentist only when you have tooth pain			
Yes	32 (21.5)	75 (54.3)	0.000*
No	116 (77.9)	31 (22.5)	
Don't know	1 (0.7)	32 (23.2)	
11. A hard-bristled toothbrush is needed to clean teeth properly			
Yes	7 (4.7)	108 (77.1)	0.000*
No	136 (91.3)	25 (17.9)	
Don't know	6 (4.0)	7 (5.0)	
12. Using dental floss is essential for keeping teeth clean			
Yes	113 (75.8)	123 (87.9)	0.019*
No	20 (13.4)	12 (8.6)	
Don't know	16 (10.7)	5 (3.6)	

Bold/italic values indicate significance at $p \leq 0.05$.
Significant result: $p < 0.05$.

Dental behavior

Group differences also appeared in dental habits. A smaller proportion of individuals with hearing impairments reported brushing their teeth one or two times daily when compared with individuals without hearing impairment (82.8% vs. 93.3%, $P < 0.001$). Although 91.3% of the HI group could brush independently, this was still significantly lower than the 100% reported in the group without hearing loss ($P = 0.001$).

Daily use of floss, mouthwash, and fluoridated toothpaste was reported less frequently among the HI group ($P < 0.05$). For example, only 5.8% of individuals with hearing impairments flossed each day, compared to 16.8% of those without hearing impairment ($P = 0.009$). Soda consumption patterns also differed, with the HI group reporting higher consumption (94.3% vs. 98.7% reporting no soda intake; $P < 0.001$).

No meaningful differences were noted in brushing duration or frequency of sweet intake ($P > 0.05$). Detailed findings are presented in **Table 3.**

Table 3. Dental behavior among individuals with and without hearing impairments.

Oral health practice / behavior	Group without hearing impairment, n (%)	Hearing-impaired group, n (%)	P-value
How often do you brush your teeth?			0.000*
Once or more times daily	139 (93.3)	116 (82.8)	
Occasionally / less than once a day	10 (6.8)	24 (17.1)	
Ability to brush teeth			0.001*
Independently (completely without help)	149 (100)	125 (91.3)	
Needs full assistance	0 (0)	12 (8.7)	
How often do you use dental floss?			0.009*
At least once a day	25 (16.8)	8 (5.8)	
Occasionally / rarely / never	124 (83.2)	128 (94.1)	
How often do you use mouthwash?			0.001*
At least once a day	40 (26.8)	16 (11.4)	
Occasionally / rarely / never	109 (73.2)	124 (88.6)	
Do you use toothpaste that contains fluoride?			0.022*
Yes	113 (75.8)	85 (61.2)	
No	6 (4.0)	12 (8.6)	
Don't know	30 (20.1)	42 (30.2)	
Frequency of eating sweets/candy			0.354
At least once a day	141 (94.6)	130 (97.1)	
Occasionally / rarely	8 (5.4)	4 (2.9)	
Daily consumption of soft drinks/soda			0.000*
1–2 cans	147 (98.7)	132 (94.3)	
3–4 cans	2 (1.3)	0 (0)	
None	0 (0)	8 (5.7)	

Bold/italic values indicate significance at $p \leq 0.05$.
Significant result: $p < 0.05$.

Hearing impairment is well established as a major communication challenge that affects social participation, educational progress, and health-related quality of life [15]. With projections indicating that 1 in 10 individuals will experience hearing loss by 2050 [3], understanding its broader impacts is increasingly important. In Jordan, significant hearing loss among infants was reported as 1.5% in 2014 [16], while a more recent 2024 study estimated impairment at 0.06% among people aged 12 and older [17]. The apparent lower rate compared with other countries may be associated with differences in newborn screening or reporting practices. The high proportion of participants with severe impairment in the current sample likely reflects recruitment from centers serving individuals with more substantial support needs.

Rates of dental caries, gingival bleeding, and dental trauma have been found to be higher in children with hearing loss than in children without such impairments in Jordan [18]. Oral diseases significantly influence daily comfort and overall health [19]. Although hearing impairment reduces the capacity to receive spoken information about oral hygiene, previous work indicates that targeted instruction—especially when incorporating visual materials—can enhance oral-health outcomes and improve perceived quality of life [20].

Despite this, research specifically examining dental knowledge and behaviors among Jordanian individuals with hearing impairment has been lacking. This investigation sought to address that gap by evaluating what this population knows about oral health and how they manage their daily dental care. Identifying

knowledge deficits is essential for shaping future recommendations and interventions.

The current findings show that individuals with hearing loss possessed levels of knowledge similar to their hearing peers in several fundamental domains—such as the involvement of plaque and bacteria in dental decay, the effects of sugary snacks and soft drinks, and the connection between oral and systemic health [21]. These observations differ from research conducted in Saudi Arabia, where many individuals with hearing impairment demonstrated limited understanding of even basic oral-health principles [22]. Such discrepancies may reflect successful awareness initiatives in Jordanian schools or specialized centers. That said, substantial differences emerged in other areas, with individuals without hearing impairment displaying better knowledge about appropriate tooth-brushing practices.

The rate of routine tooth cleaning for maintaining oral hygiene among the Jordanian participants in this study exceeded that reported in comparable groups of individuals with hearing impairments from neighboring countries, including Saudi Arabia and Iran [22, 23].

Additionally, most respondents with hearing loss indicated that they sought dental care mainly when they experienced oral symptoms. In contrast, a large proportion of those without hearing impairments stated that they attended dental appointments even without pain. This limited understanding of the importance of preventive checkups may place hearing-impaired individuals at risk of worsening oral conditions. When dental visits occur only after symptoms arise, early-stage problems are less likely to be detected, ultimately resulting in more severe disease, discomfort, and poorer outcomes—consistent with observations by Mustafa *et al*. (2018) and Suma *et al*. (2011) [22, 24]. Irregular utilization of dental services has also been linked to higher rates of caries-related complications [25], potentially increasing the financial burden of oral healthcare for this group.

Furthermore, participants with hearing impairments were less able to identify swollen or bleeding gums as indicators of periodontal issues, pointing to gaps in how oral health information is communicated to them.

A notable pattern emerged, however: hearing-impaired individuals demonstrated stronger knowledge about the value of dental floss and correctly recognized that healthy gums should not appear red. This mix of better conceptual understanding in some areas alongside poorer everyday habits deserves additional investigation. One possible reason may be the influence of visual educational aids—such as illustrated materials or videos—which may highlight particular messages more effectively [26]. Research from wealthier nations also supports the usefulness of visual and interactive teaching approaches for this population [27, 28]. Another explanation could be earlier exposure to customized educational sessions at the institutions from which participants were recruited, though this could not be confirmed.

Despite this stronger theoretical awareness of flossing, individuals with hearing impairments reported less frequent use of floss, mouth rinses, and fluoride toothpaste than other participants.

This disparity between what they know and what they do reinforces a fundamental public health insight: understanding health recommendations does not automatically lead to consistent preventive behavior. Factors such as product cost, limited availability, and misconceptions about preventive care may play a role in this disconnect [29, 30]. Comparable gaps between awareness and behavior have been observed in other groups as well [31].

Additional variables—including socioeconomic conditions, educational background, and whether the participant attended mainstream or special-education schools—may also help explain these outcomes. Lower household income and reduced access to healthcare services, which are more common among individuals with hearing impairments, may limit their ability to act on their oral health knowledge [32].

A further inconsistency was observed: although many hearing-impaired participants acknowledged that sugary snacks and soft drinks are harmful, their consumption of these items remained high. This trend illustrates a broader challenge in the field of public health—transforming awareness into sustained behavioral modification [24, 33]. It highlights the need for comprehensive strategies that combine education with improved access, affordability, and culturally attuned messaging [26, 27].

Multiple studies have repeatedly shown that hearing-impaired groups exhibit poorer oral hygiene, increased caries experience, and lower oral health-related quality of life compared with hearing individuals [34, 35]. The results of this study suggest that tailored educational programs that use visual tools and culturally appropriate resources may help narrow these disparities.

Interventions implemented in high-income settings have demonstrated positive outcomes, including better oral hygiene practices and reductions in plaque and gingival inflammation [26, 28].

Although the present work employed a validated survey instrument, its dependence on reading ability may have limited participation for some individuals with hearing impairments. Future investigations should

consider modifying data collection to suit this community better, such as employing sign-language-based interviews or image-supported questionnaires. Recruitment in the current study was also based on convenience sampling, which may introduce selection bias. While data were gathered from several Jordanian centers, increasing the sample size in later studies would enhance external validity and allow analyses by age, gender, and socioeconomic background.

To the authors' knowledge, this investigation represents the first attempt in Jordan to assess oral health knowledge and behaviors among individuals with hearing impairments. The outcomes provide an essential reference point for developing interventions aimed at narrowing oral health gaps and improving equitable access to dental care.

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