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Assessment of knowledge, attitude, and practice of ear care among Jazan general population, Saudi Arabia

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Abstract

Objective: The present study aimed at determining the knowledge, attitude, and practice of ear care among Jazan population and its association with sociodemographic variables.

Methods: This is a cross-sectional study conducted between January and June 2022 in the Jazan region, Saudi Arabia. Data was collected using an Arabic electronically questionnaire and analyzed using SPSS software version 23.

Results: About 446 of the participants were included in the study. Two-hundred sixty-two (58.7%) of the participants were females. Most of the participants 200 (44.8%) were within the age group of 18–23 years old. Marital status of 315 (70.6%) of the participants was found to be single. Out of a total score of 5, regarding mean \pm standard deviation for scores of respondents, knowledge score is 3.7 ± 0.88 , 3.7 ± 0.94 for attitude score, and 3.6 ± 1.12 for practice score. About 91.9% of the respondents were found to be having good knowledge about ear care, whereas 8.1% of the participants were considered as having poor knowledge about ear care. In regards to attitude, about 90.4% was having good attitude regarding ear care, and 9.6% was with poor attitude. Considering practice, about 83.9% of the respondents were having good practice. Gender was found to be associated with good practice (p -value = 0.005) with males tend to have better practice compared to females. Educational level was found to be associated with good knowledge about ear care (p -value = 0.006) with university/postgraduate educational level having higher knowledge scores compared to other educational level.

Conclusion: Good knowledge, attitude, and practices among participants in regards to ear care were documented. Efforts should be directed towards raising the knowledge level, and this will result in improvements in attitudes and practices. This could be accomplished through health education campaigns, community events, and augmentation of the role of media.

Keywords: Knowledge, Attitude, Practice, Ear care, Jazan general population

Background

Ear is an important and visible part of the human body. Because it plays crucial role in the hearing mechanism, therefore, care for this organ is an important approach every individual should have in life. Ear hygiene is a kind

of social cleanliness. It does not demand much attention, but proper care is essential for its optimal functions. There are certain ways by which ear care can be attained. These ways include maintaining ear hygiene, safety from noise, protection against injuries, and prevention of ear infection and diseases [1].

One of the main components of ear cleaning is the regular cleaning of the earwax. Earwax also known as cerumen is normally secreted from ceruminous and

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sebaceous glands in the external ear canal. There is a need of specific amount of earwax for keeping ears healthy [2]. The normal external canal has a self-cleaning mechanism called the “conveyor belt” process of epithelial migration, aided by jaw movement without any external effort in this mechanism [3]. By this process, cerumen is removed from the ear along with dust dirt and particles within the canal. Incorrect self-ear cleaning can cause cerumen impaction, otitis externa, and injury [4].

However, people tend to use cotton buds and hairpins to clean wax from the ears, but these objects have harmful effects towards ears and their function. These objects can impair ear function drastically. Exposure towards noise and heavy constructions could lead to loss of hearing. The use of mobile or hearing music at high volume sound for long period can cause hearing impairment [2].

Moreover, self-ear cleaning is a widespread practice, but people still lack some basic information in this regard, and therefore, there is a need for public health education to aware people regarding cerumen cleaning, its role, and the associated effects [3]. A study was published in the Birat Medical College in 2020, showed that knowledge and attitude and practice of ear care between preclinical students was good, but surprisingly, a little percent of students demonstrated poor knowledge, attitude, and practice, despite the fact that medical students are expected to know more than nonmedical members of society [5]. Another study was published in Nigerian on 2015 and showed that the vast majority of participants (92.8%) cleaned their ears with cotton buds. And the most common reason for using a cotton bud is to relieve ear itching. Their knowledge, attitude, and awareness about the use of cotton buds are very poor, with the mistaken belief that it is beneficial. It is not widely known that doctors advise against cleaning one’s ears. There is a need to raise public awareness through education and health promotion [6].

Considering the importance of ear care in daily life, the current study is aimed at analyzing the knowledge, attitude, and practice of people from Jazan region in Saudi Arabia. The study will focus the middle-aged adult population for the data collection process to better understand the general norms and behaviors in the specific community with respect to ear care. Another reason to select this age group lies in the fact that most people in this group are parents; hence, assessing their knowledge, attitude, and practice will help in understanding the prospective ear health of the children from that population.

Methods

This is a cross-sectional study of the general adult population to measure the level of knowledge and awareness regarding ear care. This cross-sectional

community-based study was conducted throughout Jazan region *at the kingdom of Saudi Arabia*. Population with age ≥ 18 years, living in the Jazan region, was included in the study. The study was approved by the Standing Committee for Scientific Research, Jazan University (Reference No.: REC-43/08/177, dated 24 March 2022). Respondent’s anonymity and confidentiality were ensured. The submission of the answered survey was considered as consent to participate in the study.

The Raosoft sample size calculator (<http://www.raosoft.com/samplesize.html>) was used to calculate the requisite sample size, 385 individuals.

A pre-designed electronic questionnaire, containing yes and no questions, was translated to Arabic language by research team. Any ambiguities in the questions were removed before its implementation and then distributed randomly to the participants. The questionnaire included a number of questions related to participant’s sociodemographic data (seven questions) and awareness about ear care, including general knowledge (five questions), attitude (five questions), and practice (five questions). A common grading method was used to assess the level of knowledge, attitude, and practice of ear care as follows: 1 point was given to the correct option and 0 for the incorrect answer. After data collection, a participant who correctly answers 60% or more of the questions (3 points out of 5) was considered as good knowledge, attitude, and practice about ear care. Data management and analysis were done on Statistical Package for the Social Sciences (SPSS) software (IBM Corporation V. 23). The analysis was conducted by calculating means, percentages (%), and \pm standard deviation (SD) for the data. The chi-square test was used for comparison between the variables. This study was conducted according to ethical standards within the political borders of the Kingdom of Saudi Arabia. All participants were informed they were free to participate or withdraw from the research at any time. It was emphasized not to reveal the identity of the participants, and confidentiality was strictly enforced. Also, all collected data will be preserved and will not be used except for the purpose of research.

Results

About 446 of the participants were enrolled in the study. One-hundred eighty-four (41.3%) of the participants were males, and 262 (58.7%) were females. Most of the participants 200 (44.8%) were within the age group of 18–23 years old, 166 (37.2%) were within the age group of 24–33 years old, 53 (11.9%) were within the age group of 34–44 years old, 19 (4.3%) were within the age group of 45–54 years old, and 8 (1.8%) of the participants were aging 55 years old or more. About 315 (70.6%) of the participants were single, and 131 (29.4%) of the participants

were married. In regards to educational level, most of the participants 387 (86.8%) were at university/postgraduate educational level, 48 (10.8%) were of secondary school level, 10 (2.2%) were of intermediate level, and 1 (0.2%) was of primary school level. Place of residence was found to be village in 224 (50.2%) of the participants, 206 (46.2%) were city residents, and the mountain was the place of residents for 16 (3.6%) of the participants. Most of the respondents 298 (66.8%) were students, 100 (22.4%) were governmental or private sector employees, 28 (6.3%) were medical sector employees, 17 (3.8%) of the participants were housewives, and 3 (0.7%) were retired. Average monthly income was less than 1500 SR in most 209 (46.9%) of the participants, 166 (37.2%) of the participants with income of more than 3500 SR, and 71 (15.9%) were with monthly of 1500–3000 SR (Table 1).

In regards to knowledge about ear care, most of the participants 241 (54%) stated that ear wax should not be removed continuously, and 205 (46%) of the participants mentioned that wax should be removed continuously. Ear perforation does not require surgery as reported by 235 (52.7%), whereas 211 (47.3%) of the participants stated that perforation does need ear surgery. Two-hundred

eleven (90.1%) of the participants agreed on that sudden exposure to loud noise can damage hearing ability, whereas 44 (9.9%) do not believe that exposure to sudden loud noise affects hearing ability. Three-hundred forty-nine (78.3%) of the participants agreed that medical consultation and help due to poor hearing ability are required, and 97 (21.7%) do not agree that medical consultation because of poor hearing ability is required. High altitude or low altitude can cause ear pain as stated by 421 (94.4%), and 25 (5.6%) of the participants mentioned that high or low altitudes will not cause ear pain. About 261 (58.5%) of the participants believe that exposure to loud noise cause deafness, and 185 (41.5%) of the participants do not believe the same statement. About 401 (89.9%) of the participants recommend avoiding putting water while bathing, and 45 (10.1%) will recommend putting water while bathing. Two-hundred forty-nine (55.8%) of the participants think that ear piercing must be done as early as possible from birth, and 197 (44.2%) do not think that ear piercing must be done as early as possible from birth. Three-hundred four (68.2%) of respondents will visit your ENT specialist in certain interval, whereas 142 (31.8%) will not visit ENT specialist periodically. Four-hundred fifteen (93%) of the participants realize the importance of neonatal screening for hearing status, whereas 31 (7%) did not realized the importance of neonatal screening for hearing status. About 82 (18.4%) of the respondents have habit of ear cleaning with sharp objects like pencils, pins, and ear buds, and 364 (81.6%) of the participants were not doing this habit. Two-hundred twenty-nine (51.3%) of the participants normally blow their nose vigorously when having cold or influenza, whereas 217 (48.7%) do not blow their nose vigorously. About 352 (78.9%) of the participants did not use eardrops without doctor consultation when having an ear pain, and 94 (21.1%) of them used eardrops without doctor consultation. One-hundred eighty-seven (41.9%) of the participants use headsets when listening to loud music for long period of time, and 259 (58.1%) do not use headsets when listening to loud music for long period of time. About 421 (94.4%) do not use oils in ear, whereas 25 (5.6%) used oils in ear (Table 2).

Out of a total score of 5, the mean knowledge score \pm standard deviation for respondents in the current study was found to be 3.7 ± 0.88 . The mean attitude score \pm standard deviation was found to be 3.7 ± 0.94 . The mean practice score \pm standard deviation for respondents was found to be 3.6 ± 1.12 .

About 91.9% of the respondents were found to be having good knowledge about ear care, whereas 8.1% of the participants were considered as having poor knowledge about ear care. In regards to attitude, about 90.4% was having good attitude regarding ear care, and 9.6% was

Table 1 Sociodemographic characteristics of the participants ($n = 446$)

Variable	Category	Frequency	Percent
Gender	Male	184	41.3%
	Female	262	58.7%
Age (years)	18–23	200	44.8%
	24–33	166	37.2%
	34–44	53	11.9%
	45–54	19	4.3%
	55 or more	8	1.8%
Marital status	Single	315	70.6%
	Married	131	29.4%
Educational level	Primary	1	0.2%
	Intermediate	10	2.2%
	Secondary	48	10.8%
	University/postgraduate	387	86.8%
Place of residence	City	206	46.2%
	Village	224	50.2%
	Mountain	16	3.6%
Occupation	Housewife	17	3.8%
	Students	298	66.8%
	Governmental/private sector employee	100	22.4%
	Medical sector employee	28	6.3%
	Retired	3	0.7%
Average monthly income (SAR)	< 1500	209	46.9%
	1,500–3,000	71	15.9%
	> 3,000	166	37.2%

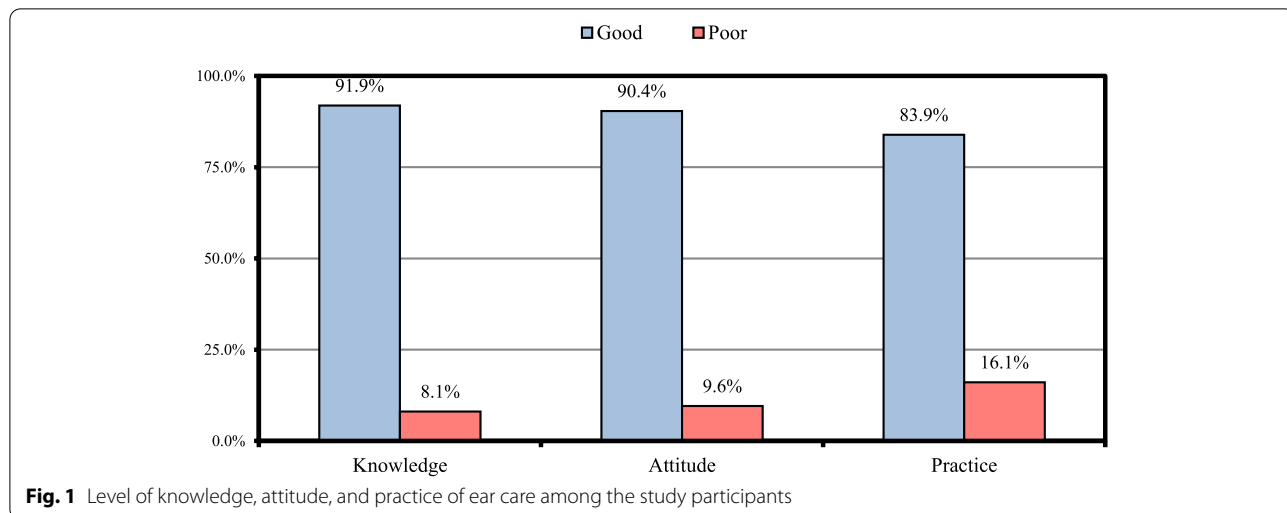
Table 2 Knowledge, attitude, and practice of ear care

	Yes	No
Knowledge		
Should earwax be removed continuously?	205 (46%)	241 (54%)
Does perforation in ear require surgery?	211 (47.3%)	235 (52.7%)
Does sudden exposure to loud noise can damage your hearing ability?	402 (90.1%)	44 (9.9%)
Do you require medical consultation and help because of poor hearing ability?	349 (78.3%)	97 (21.7%)
Does high and low altitude may cause ear pain?	421 (94.4%)	25 (5.6%)
Attitude	Yes	No
Do you believe exposure to loud noise cause deafness?	261 (58.5%)	185 (41.5%)
Do you recommend putting water while bathing?	45 (10.1%)	401 (89.9%)
Do you think that ear piercing must be done as early as possible from birth?	249 (55.8%)	197 (44.2%)
Should visit your ENT specialist in certain interval?	304 (68.2%)	142 (31.8%)
Do you realize the importance of neonatal screening for hearing status?	415 (93%)	31 (7%)
Practice	Yes	No
Do you have habit of ear cleaning with sharp objects like pencils, pins, and ear buds?	82 (18.4%)	364 (81.6%)
Do you normally blow your nose vigorously when you have cold or influenza?	229 (51.3%)	217 (48.7%)
Do you normally use eardrops without doctor consultation when you have an ear pain?	94 (21.1%)	352 (78.9%)
Do you use headsets when listening to loud music for long period of time?	187 (41.9%)	259 (58.1%)
Do you use oils in ear?	25 (5.6%)	421 (94.4%)

with poor attitude. Considering practice, about 83.9% of the respondents were having good practice regarding ear care, and 16.1% were with poor practice regarding ear care (Fig. 1).

Gender was found to be associated with good practice (p -value = 0.005) with males tend to have better practice compared to females. Gender was not found to be associated with knowledge nor attitude (p -value = 0.448 and 0.681, respectively). No significant association was found between age and knowledge, attitude, and practice regarding ear care (p -value= 0.575, 0.121, and 0.711, respectively). Marital status was not found to be associated with knowledge, attitude, and practice about ear

care (p -value = 0.191, 0.201, and 0.810, respectively). Educational level was found to be associated with good knowledge about ear care (p -value = 0.006) with university/postgraduate educational level having higher knowledge scores compared to other educational level. Educational level was not found to be associated with attitude nor practice about ear care (p -value = 0.751 and 0.204, respectively). No significant association was found between place of residence and knowledge, attitude, and practice about ear care (p -value = 0.929, 0.405, and 0.398, respectively). Occupation was not found to be associated with knowledge, attitude, and practice about ear care (p -value = 0.380, 0.476, and 0.283, respectively).



No significant association was found between monthly income and knowledge, attitude, and practice regarding ear care (p -value = 0.426, 0.766, and 0.756, respectively) (Table 3).

Discussion

Assessing the level of knowledge, attitude, and practice regarding ear care will result in demonstration of knowledge gaps and poor attitudes and practices which eventually could lead to hearing loss; thus, it needs to be addressed through various methods in order to reduce incidence and prevalence of hearing loss [7]. The current study aimed to assess knowledge, attitude, and practice

about ear care and its association with sociodemographic variables among the Jazan population, Saudi Arabia.

Concerning the most notable sociodemographic characteristics of the participants, which is important when discussing the other variables, more than half (58.7%) of the respondents were females, and 41.3% were males. Less than half of the participants (44.8%) were within the age group of 18–23 years old, and more than one-third (37.2%) were within the age group of 24–33 years old. More than two-thirds (70.6%) of the participants were single, and the rest of them (29.4%) were married. In regards to educational level, the vast majority of participants (86.8%) were at university/postgraduate educational level. In about 50.2% of the participants, place of

Table 3 Association between sociodemographic characteristics and level of knowledge, attitude, and practice about ear care

Variable	Good knowledge	<i>P</i> -value	Good attitude %	<i>P</i> -value	Good practice	<i>P</i> -value
Gender						
Male	90.8%	0.448	89.7%	0.681	89.7%	0.005
Female	92.7%		90.8%		79.8%	
Age (years)						
18–23	91.5%	0.575*	86.5%	0.121	85.5%	0.711
24–33	94%		94.6%		83.7%	
34–44	90.6%		90.6%		77.4%	
45–54	84.2%		94.7%		84.2%	
55 or more	87.5%		87.5%		87.5%	
Marital status						
Single	93%	0.191	89.2%	0.201	84.1%	0.810
Married	89.3%		93.1%		83.2%	
Educational level						
Primary	0%	0.006*	100%	0.751*	0%	0.204*
Intermediate	80%		100%		80%	
Secondary	85.4%		89.6%		85.4%	
University/postgraduate	93.3%		90.2%		84%	
Place of residence						
City	92.2%	0.929	90.3%	0.405	85.9%	0.398
Village	91.5%		89.7%		82.6%	
Mountain	93.8%		100%		75%	
Occupation						
Housewife	94.1%	0.380*	100%	0.476*	76.5%	0.283*
Students	91.9%		88.9%		84.9%	
Governmental/private sector employee	89%		92%		79%	
Medical sector employee	100%		92.9%		92.9%	
Retired	100%		100%		100%	
Average monthly income (SAR)						
< 1,500	91.4%	0.426	90%	0.766	82.8%	0.756
1,500–3,000	95.8%		88.7%		83.1%	
> 3,000	91%		91.6%		85.5%	

**P*-values were calculated using Fisher's exact test

residence was found to be village followed by city (46.2%) of respondents. Two-thirds (66.8%) of the respondents were students. Average monthly income was less than 1500 SR in most (46.9%) of the participants.

Regarding knowledge score, out of a total score of 5, the mean knowledge score for respondents in the current study was found to be 3.7. The mean attitude was found to be 3.7, and the mean practice score was found to be 3.6. Most (91.9%) of the respondents were found to be having good knowledge about ear care. In regards to attitude, about 90.4% was having good attitude regarding ear care. Considering practice, about 83.9% of the respondents were having good practice regarding ear care and the rest of them considered as poor knowledge, and this was found to be in contradiction to the study which is conducted by Dosemane et al. which revealed poor knowledge, attitudes, and practices, and this could be attributed to differences in social, cultural, and educational backgrounds of the communities [1].

Considering general knowledge about ear care, more than half (54%) stated that earwax should not be removed continuously, and 46% of the participants mentioned that wax should be removed continuously, and this was found to be consistent with the study which is conducted by Adoga et al. in which the vast majority of respondents use cotton and buds to remove wax [8]. Ear perforation does not require surgery as reported by nearly half (52.7%) of the participants. Sudden exposure to loud noise can damage hearing ability as agreed on by 90.1% of the participants. More than two-thirds (78.3%) of the participants required medical consultation and help due to poor healing ability, and this was found to be consistent with the study which is carried out by Mukara et al. which also revealed treatment-seeking behavior in the majority of the participants [9]. High altitude or low altitude can cause ear pain as stated by 94.4%. More than half (58.5%) of the participants believe that exposure to loud noise cause deafness. The vast majority (89.9%) of the participants recommend avoiding putting water while bathing. More than half (55.8%) of the participants think that ear piercing must be done as early as possible from birth. Slightly more than two-thirds (68.2%) of respondents will visit ENT specialist in certain interval. The vast majority (93%) of the participants realize the importance of neonatal screening for hearing status. About less than one-quarter (18.4%) of the respondents have habit of ear cleaning with sharp objects like pencils, pins, and ear buds, and this was similar to the finding reported in the parallel study of Haji et al., and poor ear cleaning practices were also reported [10]. About half (51.3%) of the participants normally blow their nose vigorously when having cold or influenza. The vast majority (94.4%) do not use oils in ear, whereas about 5.6% used oils in ear. Less than half (41.9%) of the participants use

headsets when listening to loud music for long period of time. More than two-thirds (78.9%) of the participants did not use eardrops without doctor consultation when having an ear pain, and the rest of them (21.1%) use eardrops without doctor consultation, and this was found to be consistent with the congruent study carried out by Alsuhaibani et al. in which most of the participants used eardrops only with medical prescription [11].

Gender was found to be associated with good practice with males tend to have better practice compared to females; this is similar to the findings reported and demonstrated in two studies; both of them revealed that gender has strong association with ear care practices [4, 12]. Marital status was not found to be associated with knowledge, attitude, and practice about ear care. No significant association is found between monthly income and knowledge, attitude, and practice regarding ear care. Occupation was not found to be associated with knowledge, attitude, and practice about ear care. No significant association is found between place of residence and knowledge, attitude, and practice about ear care. Educational level was found to be associated with good knowledge about ear care with university/postgraduate educational level having higher knowledge scores compared to other educational levels, and this was found to be in consistent with other congruent study carried out by Mediawi et al. in which educational level was strongly linked to good knowledge and awareness levels regarding ear care [13].

Conclusion

Generally, good knowledge attitude and practices among respondents in regards to ear care were noted. Practice score was the lowest compared to knowledge and attitude scores. Few knowledge gaps were noticed mainly in causes of ear damage. More efforts should be directed and targeted towards raising the knowledge level which consequently results in improvements in attitudes and practices regarding ear care. This could be accomplished through health education campaigns and community events, and also the role of media in distribution of information about ear care should be supported.

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Authors' contributions

Prof. FAA (methodology, analysis, writing, and reviewing the manuscript), MAS (methodology, data collection, analysis, and writing the manuscript), NKM (methodology, data collection, and analysis), LID (methodology, data collection, and analysis), AAR (methodology, data collection, and analysis), FAA (methodology, data collection, and analysis), and WAS (methodology, data collection, and analysis). The author(s) read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations**Ethics approval and consent to participate**

The study was approved by Standing Committee for Scientific Research, Jazan University, Reference No.: REC-43/08/177, dated 24 March 2022. Respondent's anonymity and confidentiality were ensured. The submission of the answered survey was considered as consent to participate in the study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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References

1. Dosemane D, Ganapathi K, Kanthila J (2015) Knowledge, attitude and practice of ear care in coastal Karnataka. *J Clin Diagn Res.* 9(12):MC01–MMC4. <https://doi.org/10.7860/JCDR/2015/15401.6880>
2. Mahfoz T (2021) Cerumen knowledge and ear cleaning practices among medical students in Saudi Arabia: An observational study. *Majmaah J Heal Sci.* 9(1):80
3. Haji A et al (2021) The knowledge, attitudes, and practices of self-ear cleaning in Makkah Region, cross-sectional study: self-ear cleaning. *Saudi Medical Horizons J* 1(1):26–33
4. Olaosun AO (2014) Self-ear-cleaning among educated young adults in Nigeria. *J Fam Med Prim Care* 3(1):17
5. Koirala B, Manandhar S, Shah RK (2020) Knowledge, attitude and practice of ear care among pre clinical medical students at Birat Medical College Teaching Hospital. *Birat J Heal Sci.* 5(3):1236–1240
6. Gabriel OT, Mohammed UA, Paul EA (2015) Knowledge, attitude and awareness of hazards associated with use of cotton bud in a Nigerian community. *Int J Otolaryngol Head Neck Surg.* 04(03):248–253
7. Solheim J, Shiryayeva O, Kvaerner KJ (2016) Lack of ear care knowledge in nursing homes. *J Multidiscip Healthc.* 9:481–488. Published 2016 Sep 30. <https://doi.org/10.2147/JMDH.S113689>
8. Adoga AA, Nimkur TL (2013) Ear care: knowledge, attitude and practice amongst health professionals at the Jos University Teaching Hospital. *East Afr J Public Health* 10(1):3
9. Mukara KB et al (2017) Knowledge and care seeking practices for ear infections among parents of under five children in Kigali, Rwanda: a cross-sectional study. *BMC Ear Nose Throat Disord* 17(1):1–9
10. Kabli A, Alharthi B, Hagi A, Alharbi B, Alhazmi K, Siddiqui M (2021) Knowledge, attitudes, and practices of self-ear cleaning in Makkah region, cross-sectional study. *Saudi Med Horizons J* 1(1):26–33
11. Alsuhaibani M, Almijmaj M, Almushaigeh A, Alhomidani R, Aldakheel Y, Alaqeel A (2020) Awareness and attitudes of Saudi parents toward otitis media in children. *J Family Med Prim Care* 9(12):6177–6182. Published 2020 Dec 31. https://doi.org/10.4103/jfmpc.jfmpc_1690_20
12. Oladeji SM et al (2015) Self-ear cleaning among health workers in Nigeria. *J Dental Med Sci* 14:122–126
13. Bedaiwi RH, Salamah MA, Halawani RT (2022) Parents' awareness of ear health in Madinah region, Saudi Arabia. *Egypt J Otolaryngol* 38(1):1–8

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