Original article :

Cerumen knowledge and ear cleaning practices among medical students in Saudi Arabia: An observational study

Turki M. Bin Mahfoz[1]

1. Otolaryngology Department, College of Medicine,
Al Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh 13317, Saudi Arabia

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Corresponding Author:
Turki M. Bin Mahfoz
Assistant Professor , Otolaryngology Department, College of Medicine, Al Imam Mohammad Ibn Saud Islamic University (IMSIU) - Othman Bin Affan Road Al-Nada, Riyadh 13317, PO Box 7544, Saudi Arabia
Phone: 9662037100 - Fax: 9662037108 - Email: TMmahfoz@imamu.edu.sa

Abstract

Background and Aims:
Cerumen (earwax) is naturally secreted in human ears and can cause ear obstruction. When individuals attempt to remove cerumen from their own ears with tools, it can cause cerumen impaction, injuries, and otitis externa, which are risk factors for hearing loss. Clinicians need to educate their patients accordingly; thus, medical students should have sufficient knowledge of the topic. Here, we investigated the knowledge، awareness، and practices of cerumen and ear self-cleaning approaches among medical students at Al Imam Mohammad Ibn Saud Islamic University, Saudi Arabia.

Methods:
This cross-sectional study was conducted between June and July 2020. A questionnaire was distributed to medical students to determine their knowledge and practices of cerumen and ear cleaning. Correlations assessed relationships between demographic factors and knowledge.

الملخص

الخلفية و الاهداف:
يُفرز الصملاخ (شمع الاذن) بشكل طبيعي في آذان الانسان ولكن قد يسبب انسداد الاذن في بعض الاحيان، وذلك بسبب ازالة شمع الاذن من قبل الافراد مما يودي الى انحشار الشمع او اصابة القناة السمعية الخارجية او حدوث التهابات في الاذن الخارجية. وعلى ذلك فان تثقيف المراجعين من قبل الاطباء يعد امراً هاماً, كما يجب ان يكون لدى طلاب الطب المعرفة الكافية عن كل ما يتعلق بتنظيف شمع الاذن واضراره، وقد قمنا في هذه الدراسة بقياس مستوى المعرفة والممارسات لآلية التنظيف الذاتي لشمع الاذن بين طلاب وطالبات الطب البشري بجامعة الامام محمد بن سعود الاسلامية بالمملكة العربية السعودية.

طريقة البحث:
في هذه الدراسة المقطعية العرضية، تم مسح المعرفة والممارسات لتنظيف شمع الاذن مابين يونيو و يوليو ٢٠٢٠م في جامعة الامام محمد بن سعود الاسلامية بالمملكة العربية السعودية عن طريق توزيع الاستبيان على ٨١٤ من الذكور والاناث من طلاب وطالبات الطب البشري لتحديد مستوى معرفتهم و والممارسات بتنظيف شمع الاذن واضراره، حيث تم تحليل ردودهم باستخدام برنامج الحزمة الإحصائية للعلوم الإجتماعية (SPSS)، الإصدار البرمجي رقم ٢٢.

النتائج:
تم استكمال ٧٠٨ استبياناً مكتملاً للتحليل الاحصائي من اصل ٨١٤

Results:
Of 814 medical students who received the survey, 708 students completed the questionnaire (response rate = 86.9%). Males represented 61% of the sample. Most (73%) were aged 21 to 25 years; of them, 64% had cleaned their own ears, mostly with cotton buds (79%), in order to remove cerumen (30.8%). Overall, 85% of students had good knowledge; this was affected by gender and college years. Predominantly, 81% of students had high-risk practices.

Conclusions:
Although most medical students had a good level of knowledge about cerumen, many cleansed their own ears using cotton buds, despite knowing that it could harm the ear. As completing an otolaryngology course had marked effects on knowledge levels, we recommend further awareness programs to increase knowledge among preclinical students.

Keywords:
cerumen, cotton buds, ear self-cleaning mechanism, epithelial migration, external auditory canal, medical practitioners, otolaryngologists, students

(معدل الاستجابة =٨٦,٩٪) ، حيث ان ٦١٪ من المجيبين كانوا من الذكور وقد كان معظمهم ٧٣٪ تتراوح اعمارهم بين ٢١ و ٢٥ عاماً وقد كانو بالسنة الدراسية الثانية٢٤,٣٪ و الثالثة٢١,٥٪ . ومن بين هؤلاء قام ٦٤٪ منهم بتنظيف آذانهم باستخدام اعواد القطن بنسبة ٧٩٪ لتنظيفها من شمع الاذن . وبشكل عام فان ٨٥٪من طلاب وطالبات الطب لديهم معرفة جيدة وقد لُوحظ ان تلك النسبة تتأثر بالجنس وسنوات الكلية الدراسية ولكن وجدنا ان ٨١٪ من طلاب وطالبات الطب لديهم ممارسات عالية المخاطر بالرغم من معرفتهم بها.

الخلاصة:
توضِّح الدراسة الحالية بأن طلاب وطالبات الطب البشري في جامعة الامام محمد بن سعود الاسلامية على علمٍ كافٍ بتنظيف شمع الاذن ومضاره، وبالرغم من ذلك فان العديد منهم قامو بتنظيف شمع الاذن باستخدام اعواد القطن، وكما انه تم ملاحظة ان طلاب السنوات السريريه واللذين اتمو مادة طب وجراحة الانف والاذن والحنجرة على مستويات اعلى بالمعرفة من غيرهم، نوصي بمزيداً من برامج التوعية عن اضرار ازالة شمع الاذن خاصة بين طلاب السنوات التحضيرية.

الكلمات المفتاحية:
الصملاخ، اعواد القطن، آلية تنظيف الاذن الذاتية، الهجرة الظهاريَّة، قناة السمع الخارجية، الاطباء الممارسون، اطباء الانف والاذن والحنجرة، الطلاب

Introduction

Cerumen (earwax) is a rich biological substance that occurs naturally in the ears of humans and many other mammals. However, cerumen is the primary cause of ear obstruction [1]. Ceruminous glands (subcutaneously found in the outer ear canal) and sebaceous glands secrete cerumen, which is a mixture of sweat secretions and fatty material [2, 3]. Chemically, cerumen is composed of fatty acids, cholesterol, fatty acids, wax esters, alcohols, cholesterol precursors, immunoglobulins, and ceramides [4]. Cerumen provides the ear with a natural barrier against water and insects, which reduces the incidence of infection [5], and acts as a cleanser and lubricant of the skin and inner part of external ear canal [6]. Additionally, cerumen possesses bactericidal power, which helps to keep the ear free of infections due to the

presence of lysosomes, immunoglobulins, glycoproteins, and lipids [7], in addition to an acidic pH that provides additional protection against microorganisms [8].

Cerumen is regularly removed from the ear through natural jaw movement, along with dirt, dust, and any particles trapped in the cerumen, without any external effort in a process called the conveyor belt or ear self-cleaning mechanism [9]. The conveyor belt is a mechanism of epithelial migration from the tympanic membrane (TM) to the external auditory axis, and is an important self-cleansing property as it provides the ear with an appropriate mechanism to protect these structures from damage, while also maintaining this passage clear for conduction of sound [10]. Epithelial migration plays a role in removing debris and keratinizing squamous epithelium, as well as repairing various injuries to the TM. During the migration of epithelial cells, they desquamate and combine with apocrine and sebaceous gland secretions to form cerumen in the ear canal [11]. Therefore, epithelial migration transports the cerumen from the TM towards the external ear canal opening [12].

Failure of the ear's self-cleaning mechanism to remove excess cerumen in some cases may lead to cerumen impaction [5, 13], which can cause blocking of the ear canal, and symptoms such as hearing loss, tinnitus, discharge, and itching [4, 5, 14]. However, not all subjectively blocked or itching ears are related to cerumen impaction [15]. Nevertheless, when cerumen accumulates enough to cause these symptoms, professional intervention should be considered for its removal [16]. Additionally, cerumen impaction is considered problematic for physicians, as it can hamper diagnoses by preventing complete evaluation of the external auditory canal and TM [10, 17, 18], and consequently it needs to be removed. Cerumen impaction affects 6% of people and its incidence increases in young adults [19] and with aging [20]. Cerumen removal is the most popular otolaryngological practice performed in primary care [21]. In the USA, approximately 12 million people seek medical care for cerumen impaction every year, and approximately 8 million cerumen removal procedures are performed annually [22].

To address symptoms caused by cerumen impaction, some individuals attempt to clean their ears themselves, inserting different tools to remove the cerumen [23]. This is further promoted by other misconceptions, such as that cerumen cleaning is an indicator of good hygiene and that removal of excess earwax is important for better ear function [24]. However, when an untrained person attempts to remove cerumen by means of tools such as cotton buds

or matchsticks, different complications can arise that affect the ear's self-cleaning process. These complications include cerumen impaction, injuries [24, 25], or otitis externa, which increase the risk of hearing loss. One percent of all visits to ear clinics is due to otitis externa, which is considered the most common cause of ear infection; it is mainly caused by unprofessional cleaning of the ear [26, 27].

Increasing public knowledge about the importance of natural cerumen, of the ear's self-cleaning mechanism, and of the danger of cerumen removal by an untrained individual may help to reduce the incidence of these complications and improve aural health care [23]. Otolaryngologists and general medical practitioners play a major role in improving this knowledge through educating their patients. Therefore, it is important that medical students should have sufficient knowledge about cerumen. Thus, in this study, we assessed the knowledge of cerumen and awareness of the ear's self-cleaning mechanism, as well as related ear cleaning practices, among medical students at Al Imam Mohammad Ibn Saud Islamic University, Saudi Arabia. Specifically, we investigated whether there is a difference in this knowledge between preclinical and clinical years students, and between sixth-year medical students (who have taken an otolaryngology course) and fourth and fifth-year students; and also whether knowledge and ear cleaning practices differed between male and female students.

Methods

Study Design

This cross-sectional study was conducted at Al Imam Mohammad Ibn Saud Islamic University, Saudi Arabia. Data was obtained through a questionnaire survey.

Study Subjects

This study included medical students of Al Imam Mohammad Ibn Saud Islamic University who agreed to complete the questionnaire. The random sampling technique was used to select participants from students in year 2 to year 6. Students from other universities, lecturers and employees of the university, students who refused to complete the questionnaire, first year preparatory students, and medical student interns were excluded.

Data Collection

This study used a pre-designed, English language, self-administered questionnaire with a cover letter explaining the purpose of the study. The questionnaire was randomly distributed using online techniques, such as the WhatsApp application, to stu-

dents in years 2 to 6. The questionnaire first asked demographic information and asked if each participant had completed an otorhinolaryngology course. They were also asked if they cleaned their own ears, which tools they used for this, and the reasons behind their habit. The next group of questions assessed their level of knowledge, using 15 true and false questions. Each correct answer was awarded 1 point; therefore, the total score of this section was 15. Students were considered to have good knowledge if they had scores ≥ 66%, while a score of < 66% was considered to indicate poor knowledge, as also previously reported [22]. The demographic data included age, gender, medical year, and nationality.

Data Management and Analysis Plan

Data analysis was performed using IBM SPSS version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all study variables, and included measures of prevalence, means, standard deviation, and shape of distribution. Moreover, correlations and P-values were calculated to describe any relationship between demographic factors and knowledge. Significance was set at $P < 0.05$.

Ethical Considerations

The protocol used in this cross-sectional study was approved by the Ethics Committee at King Fahad Medical City (IRB Log Number: 20-367E). All study participants provided written informed consent after receiving an explanation of the aims of the study and were provided assurance that their responses and identity would be kept confidential. No reward was offered for completing the questionnaire.

Results

The questionnaire was delivered to a randomly selected sample of 814 medical students. Of these, 708 students (response rate = 86.9%) completed the survey (Table 1). In order to test the reliability of the questionnaire, we calculated Cronbach's alpha coefficient of the questionnaire, which in this case was 0.619. The age of the sample ranged from 18 to 26 years. A majority (73%) were aged between 21 to 25 years, while 27% were between 26 and 30 years, and only 1% were older than 26 years.

Table 1. Distribution of responses per year

	Clinical	Male	Female	TOTAL
Second year	Preclinical years	97	64	161
Third year	Preclinical years	89	74	163
Fourth year	Clinical years	63	62	125
Fifth year	Clinical years	90	45	135
Sixth year	Clinical years	92	32	124
Total		431	277	708
		73 Male students	33 Female students	

The proportion of males was markedly higher than that of females (males 61%; females 39%) (Table 2), and the total number of female students in each medical year was smaller than the total number of male students. Most students in this sample study were in their second year (24.3%) or third year (21.5%); while 18.9% of them were in their fifth year, 17.8% in their fourth year, and 17.5% in their sixth year (Table 2).

Table 2. Demographic distribution.

		Frequency	Percent
Age (years)	18–20	188	26.6
	21–25	513	72.5
	> 26	7	1.0
	Total	708	100.0
Gender	Male	431	60.9
	Female	277	39.1

Regarding the ear's self-cleaning mechanism, 51% of the participants stated that they had heard about it before this study, while 49% had not. Overall, 80% had not yet completed an otorhinolaryngology course, while 20% had completed such a course. Moreover, 64% had a habit of cleaning their own ears (Table 3).

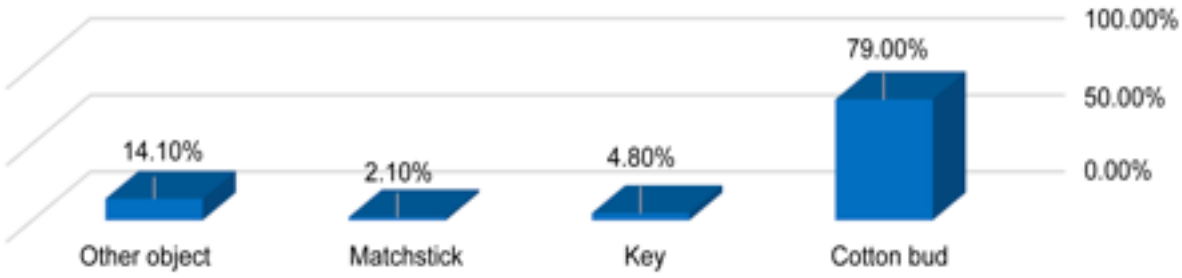
Table 3. Awareness of ear self-cleaning mechanisms.

		Frequency	Percent
Did you hear about self-cleaning mechanisms for the ear before?	YES	362	51.1
	NO	346	48.9
Did you complete an otorhinolaryngology course?	YES	140	19.8
	NO	568	80.2
Do you usually practice ear self-cleaning?	YES	453	64
	NO	255	36

In the next part of the questionnaire, we sought to elucidate the reasons for and the object(s) they used for cleaning their own ears; students who did not clean their own ears did not need to complete this part of the questionnaire. As shown in Figure 1, cotton buds were the tools most commonly used by students to clean their own ears

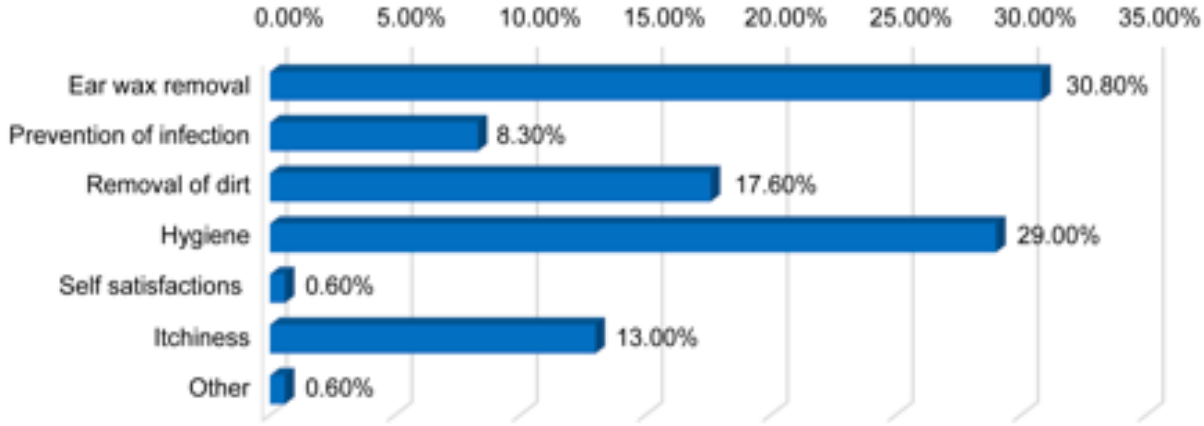
(n = 559, 79%), while 4.8% (n = 34) used a key, 2.1% (n = 15) used a matchstick, and 14.1% (n = 100) used various other objects.

Fig. 1. objects used most commonly to clean your ears.



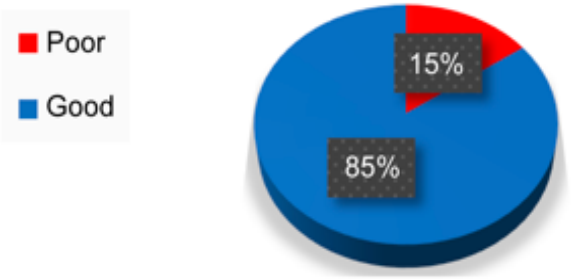
Ear-wax removal was the most common reason for students to clean their own ears (n = 219, 31%). Other reasons included hygiene (n = 205, 29%), removal of dirt (n = 127, 18%), self-satisfaction (n = 4, 0.6%), to relieve itchiness (n = 92, 13%), and because they thought it would prevent ear infection (n = 57, 8.3%) (Figure 2).

Fig. 2. The most common reasons for cleaning your ears.



In the next part of the questionnaire, we assessed the level of knowledge about ear self-cleaning mechanism. We found that 85% of students had good knowledge of this topic, while 15% had little knowledge about this (Figure 3).

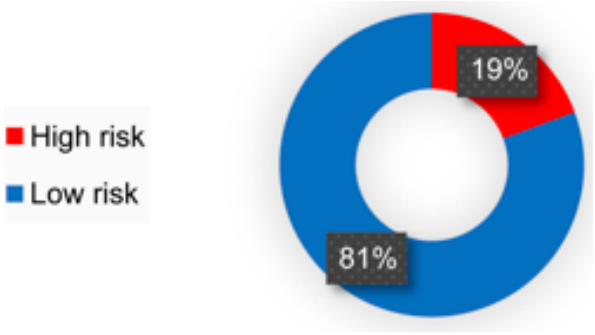
Fig. 3. Level of knowledge



Furthermore, we found that 81% of students had high-risk practices for cleaning

the ear, while 19% did not (Figure 4).

Fig. 4. Risk of practice



The high-risk population represented those who answered < 66% of questions related to cleaning practices correctly, indicating they had less information about the dangers of improper cleaning habits, thus making them at higher risk of using those practices. As shown in Table 4, 59% of students with good knowledge were male, while women represented 26% of students with poor knowledge. In general, gender had a significant effect on participants' knowledge about the ear self-cleaning mechanism (P = 0.003). Moreover, 22% of students with good knowledge were second-year students, while third- and fifth-year students each accounted for 20%, and fourth-year students represented 18% of such students. Moreover 65% of students in preclinical years had poor knowledge about ear self-cleaning, while 57.7% of students in their clinical years had a good level of knowledge. When we compared knowledge between students in preclinical years and those in other years, the preclinical student represented the highest percentage of students with good knowledge (42.3%), followed by the fifth-year (20%), sixth-year (19.6%), and fourth-year students. The college years has a significant effect on participants' knowledge about ear self-cleaning (P = 0.001).

The study also assessed the effect of the otolaryngology course, which is given to sixth-year students, where students who had finished this course represented 19.6% of those with good knowledge and 5.6% of those with poor knowledge, while students who did not finish the course represented 80.4% of those with good knowledge and 94.4% of those with poor knowledge. Generally, it seemed that the otolaryngology course had a significant effect on the level of knowledge (P = 0.001).

Table 4. Level of knowledge.

		Poor Knowledge	Good Knowledge	P-value
Gender	Male	73.8%	58.6%	0.003*
	Female	26.2%	41.4%	
College years	2nd	36.4%	22.1%	0.001*
	3rd	29.0%	20.1%	
	4th	15.9%	18.1%	
	5th	13.1%	20.0%	
	6th	5.6%	19.6%	
	Preclinical	65.4%	42.3%	0.001*
	Clinical	34.6%	57.7%	
Finishing ENT course	6th finished the course	5.6%	19.6%	0.001*
	Other students who did not finish the course	94.4%	80.4%	

*significant at P-value < 0.05
ENT: ear, nose, and throat

Discussion

In this study, we evaluated the level of knowledge of cerumen and the ear's self-cleaning mechanism, as well as habits related to cleaning of own ears among medical students in Al Imam Mohammad Ibn Saud Islamic University, Saudi Arabia. Most students had a good level of knowledge (85%). Gender and college year had an effect on the level of knowledge; females had a higher level of knowledge than males, and students in later college years had a higher level of knowledge, particularly sixth-year students who had completed the otolaryngology course, over preclinical years and other clinical year students.

In general, 79% of students thought that cerumen should be removed regularly as it should not be in the ear, while 63.3% of them considered that cotton buds could be safely used at home. However, 93.4% agreed that cleaning one's own ears at home could cause ear injuries. Nevertheless, about two-thirds of the sample (64%) commonly cleaned their own ears with cotton buds (79%), typically to remove cerumen (31%), while hygiene, removal of dirt, and itching was the reason for this practice in 29%, 18%, and 13% of cases, respectively.

Many studies have evaluated the level of knowledge about cerumen and the practice of cleaning of the ear. Gabriel et al. found that 22.5% of medical school par-

ticipants knew that cotton buds can cause complications, while 44.9% knew that it could cause damage; nevertheless, they found that 61.2% of students reported the usefulness of using cotton buds; this is similar to our results [28]. Aldawsari et al. conducted a cross-sectional study among medical students of Majmaah, Kingdom of Saudi Arabia, that included 258 students from the second to sixth year in a college of medicine, and used a questionnaire to assess knowledge, attitude, and practice related to cleaning their own ears; although this study was limited in its small sample size when compared to our study [23]. They found that 44.6% of their sample had good knowledge, while more than half of the sample had poor knowledge. However, they did not find any significant relationship between college level and level of knowledge [23]. Afridi et al. in 2016 had conducted a cross-sectional study among 250 randomly selected medical students from all years of a medical college in Peshawar, Pakistan. They found that 48% of the study sample were aware about complications related to using cotton buds, while 7.6% of students had suffered pain, 0.8% pus, and 2.4% ear discharge due to usage of cotton buds [29]. Other studies also indicated that approximately 90% of participants in their questionnaire thought that ears should be cleaned regularly and indicated that they regularly cleaned their own children's ears [8].

In contrast to our study, Khan et al. did not find a significant correlation between gender and the practice of ear cleaning [30]. However, in Aldawsari et al.'s study, gender had a significant effect on the overall knowledge of participants, where females seemed to have a higher level of knowledge than males, in line with our results[23]. Moreover, in our study, students at higher college levels had higher levels of knowledge, possibly because older students are more likely to have completed their otorhinolaryngology course, which seemed to improve students' knowledge significantly. This otolaryngology course aims to provide the students with the knowledge and skills that enable him/her to identify, analyze, manage, and/or refer clinical common ear, nose and throat (ENT) problems in order to provide efficient, cost-effective, and humane patient care; in addition to teaching them principles of prevention and management of common and life-threatening ENT conditions, including the importance of cerumen and risks of ear cleaning. Therefore, this study shows that this type of course has an important role in improving the knowledge of medical students about cerumen and ear cleaning mechanisms. In contrast, Aldawsari et al. did not find any significant relationship between college

level and level of knowledge [23].

Previous studies showed that hygiene, dirt removal, and relief of itching are the most common reasons for cleaning the ear; however, they differed in terms of the most common reason [31, 32]. Previous studies also differed in terms of the prevalence of using cotton buds: in a study conducted in England, the prevalence of using cotton buds was 68% [20], while in Kaduna, it was 90%, and in Osun, it was 44.9% [33]. Khan et al. [30] investigated self-ear cleaning practices in undergraduate students at KwaZulu-Natal University and found that 98% had engaged in self-ear cleaning and 75% indicated that this habit was beneficial. Cotton buds were the most common methods used in self-ear cleaning (79.6%). This usage of cotton buds was associated with an injury rate of 2.4% [30]. Aldawsari et al. showed that cotton buds were the most common tools used in self-ear cleaning (65.5%), while hygiene was the most common reason for this habit; they also found that 88.2% of students had low-risk practices (they correctly answered ≥ 66% of questions related to practicing) [23]. Other studies indicated that ear wax removal was the most reason for using cotton buds [4, 31, 32, 34].

Our study had some limitations. First, the study was performed at a single institution; therefore, the results may not be generalizable. However, this study extends research performed at another Saudi Arabian university [23]. Furthermore, the study involved self-reporting via a questionnaire, which may entail bias. Finally, Cronbach's alpha, although acceptable, was not high, which reduces the reliability of the questionnaire. Nevertheless, this questionnaire was used in another study to assess the same variables as our study however they had a limitation of small sample size that was modified in ours [24].

Conclusion

In this study, we found that there is a gap between knowledge and practice among medical students. While medical students had a good level of knowledge of cerumen, many of them were regularly cleaning their own ears primarily using cotton buds, despite knowing that it could harm ear function. Moreover, this study, in contrast to previous studies, found that completion of an otolaryngology course had marked effects on the development of this knowledge. Females had higher levels of the relevant knowledge than males. Therefore, there is a need to identify methods that can encourage these students to avoid self-ear cleaning practices, particularly among male students who have not completed the otolaryngology course. We rec-

ommend that more awareness programs and workshops be implemented to increase knowledge, particularly for preclinical male students. Further investigations at other universities in the Kingdom of Saudi Arabia are necessary in order to be able to generalize the results.

Conflict of interest:

None

Financial support:

None

Unblinded ethics statement

The protocol used in this cross-sectional study was approved by the Ethics Committee at King Fahad Medical City (IRB Log Number: 20-367E).

Availability of data and materials

All data available on request.

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