

Knowledge Level and Frequency of Swimming to the Incidence of Otitis Externa in Swimming Athletes in Medan

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ABSTRACT

Introduction: Otitis externa, also called swimmer's ear, is a common disease in swimmers and poses a significant public health problem. Frequent exposure to water for long periods is very susceptible to infection. This study aimed to ascertain the level of knowledge regarding the connection between otitis externa and swimming and investigate whether there was a correlation between the frequency of swimming and the occurrence of otitis externa.

Methods: Using a questionnaire, the sample comprised 74 Tirta Prima Medan Swimming Association members in 2022. Apart from evaluating descriptive comparisons of pretest and post-test knowledge levels, this study also conducted a Spearman rank correlation test to determine the correlation between knowledge level and frequency of swimming with the incidence of otitis externa. The chosen significance level (p) was 0.05. Variables were considered related if the p -value was < 0.05 and not considered related if the p -value was > 0.05 . The International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) version 26.0 for Windows was used for statistical analysis.

Results: Of the 74 study participants, pretest knowledge was categorized as follows: good level of knowledge (6.8%) of respondents, sufficient (58.1%), and (35%) poor. In the post-test assessment, respondents showed good (75.7%), sufficient (21.6%), and poor (2.7%) knowledge. The results of the Spearman analysis test showed a significant correlation (p -value = 0.042) between swimming frequency and the incidence of otitis externa. Meanwhile, there was no significant correlation between the level of knowledge about otitis externa and the incidence of otitis externa, with a p -value of 0.785.

Conclusion: The level of knowledge for the pretest was sufficient. For the same respondents, the post-test results showed good knowledge. There was a correlation between swimming frequency and the incidence of otitis externa. However, there was no significant correlation between the level of expertise and the incidence of otitis externa at the Tirta Prima Medan Swimming Association.

Highlights:

1. The level of knowledge of respondents who had experienced otitis externa and often do swimming activities had sufficient knowledge about otitis externa.
2. Frequent swimming can cause a person to experience otitis externa.

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Introduction

Otitis externa, also known as swimmer's ear, is an infection mainly affecting swimmers.¹ It is also one of the most common illnesses seen in otorhinolaryngology practice and a major public health concern. It is an inflammatory process in the outer ear caused by bacterial, viral, or fungal infections.² A study on otitis externa cases in North America proved that 98% were caused by bacteria, the two main species being *Pseudomonas aeruginosa* and *Staphylococcus aureus*.³

Around 10% of people have experienced cases of otitis externa worldwide.³ In 2007, there were approximately 2.4 million visits for otitis externa sufferers (8.1 visits per 1,000 population) in the United States (US), which was obtained from Ambulatory Care Centers and Emergency Departments.⁴ This means that otitis externa occurs in 1 in 123 residents in the US.⁴ Tropical countries like Indonesia have a high risk of otitis externa. Otitis externa can be found in various age groups, with the highest incidence in children aged 7 to 12 years old.⁵

Risk factors for otitis externa include exposure to water (most often swimming), trauma to the ear canal due to cleaning using cotton buds and scratches, use of hearing aids, history of dermatitis, diabetes, weak immunity, old age, and previous ear surgery.⁶ Frequent and sustained exposure to swimming pool water is the most common cause of otitis externa. According to a retrospective case-control analysis conducted at the Rijeka University Hospital Center, Clinic of Otorhinolaryngology, Head and Neck Surgery in Rijeka, Croatia, the study focused on a specific group of individuals, explicitly swimming athletes and water polo players.⁷ The study determined that prolonged and frequent water exposure increased the risk of otitis externa.⁷

Prolonged and frequent contact with water can cause damage to the ear canal and remove the protective acidic wax, increasing the vulnerability of the ear to infections. Engaging in diving activities in swimming pool water for three to four weeks demonstrates a notably elevated occurrence of otitis externa.⁸ A study from the United Arab Emirates states that *Pseudomonas aeruginosa* strains in swimming pools can become multidrug-resistant, putting swimmers at high risk of infection, including otitis externa.⁹

Swimming pool water can be contaminated by various microorganisms from the environment, one of which is swimmers. This makes the pool water a source of disease that can infect the outer ear and cause the mucosal lining to become irritated.¹⁰ A study conducted in the Netherlands, namely, the correlation between the occurrence of otitis externa in diving, was performed on the Dutch military diving team.⁸ Results were obtained from 30 out of 162 rescues of people who had experienced otitis externa.⁸ Almost all cases of otitis externa develop in the third and fourth weeks after rescue.⁸ Assessing the knowledge of swimmers in Medan regarding swimming, which is a risk factor for the incidence of otitis externa, is an essential first step to reducing the incidence of otitis

externa. Therefore, this study aimed to ascertain the level of knowledge regarding the connection between otitis externa and swimming and to investigate whether there was a correlation between the frequency of swimming and the occurrence of otitis externa.

Methods

This study used a descriptive-analytical type with a cross-sectional design by collecting data simultaneously with respondents. This study used a questionnaire as a data collection tool, which had been tested for validity and reliability. This study was conducted in Medan through the Tirta Prima Medan Swimming Association at the Selayang Medan Swimming Pool and was performed from July to September 2022. The sampling technique in this study used simple random sampling, where later, the authors could select samples by distributing equal opportunities to all members of the Tirta Prima Medan Pool to determine members of the study sample as well as meet the following inclusion criteria: willing respondents, men and women who regularly do swimming practice and the external ear pain experienced by the respondents were not due to picking their ears. The sample size was used to determine the number of samples using the Slovin formula.¹¹ This study found that the minimum sample size using the Slovin formula was 56 people.

The variables in this study included age, gender, and knowledge of otitis externa, which included pretest and post-test. Before the post-test was conducted, the authors provided material regarding otitis externa to the same respondents, where these variables would be performed by conducting univariate data analysis, where this univariate analysis was used to describe characteristics by using a frequency distribution table based on the independent variables and dependent variables that would be studied. The operational definition for measuring knowledge level variables employed an ordinal measuring scale, where 76%–100% indicated good knowledge, 75%–56% indicated sufficient knowledge, and a score of less than 56% indicated poor knowledge. For the swimming frequency variable, this study used an ordinal measuring scale. The measurement results showed that swimming frequency was rare if the members swam less than four times in a week, common if the members swam 4 to 6 times in a week, and very common if the members swam more than six times in a week. Meanwhile, the Spearman statistical test was utilized to analyze bivariate data for the variable swimming frequency and otitis externa occurrence. The Spearman's rank correlation test was used to determine the association between swimming frequency and otitis externa occurrence. The chosen significance level (p) was set at 0.05. Specifically, a variable was considered non-decomposing if the p -value was < 0.05 , while it was considered decomposing if the p -value was > 0.05 . The International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) version 26.0 for Windows comprehensively explained all variables.¹²

Results

Description of respondent characteristics based on age and gender

Table 1 shows that of the 74 respondents in this study, 58 people (78.4%) were dominated by the ages of 12-25 years old. Based on gender, it showed that of the 74 respondents in this study, 41 people (55.4%) were males, and 33 people (44.6%) were females. As this study showed, the majority of respondents were male.

Table 1. Characteristics of respondents based on age and gender

Characteristics	Frequency	Percentage
Age group (years old)		
6 – 11	10	13.5%
12 – 25	58	78.4%
26 – 45	4	5.4%
46 – 65	2	2.7%
Gender		
Male	41	55.4%
Female	33	44.6%

Source: Research data, processed

Distribution of respondents based on level of knowledge of otitis externa pretest and post-test

Table 2 shows that of the 74 respondents, the results of the pretest respondents were divided into three categories of knowledge levels: suitable, sufficient, and lacking. In the "Enough" knowledge level category, there were 43 people (58.1%), and this category showed the pretest results with the highest number of respondents. Furthermore, for the knowledge of the post-test results for the same 74 respondents, the post-test results were divided into three categories of knowledge level: good, sufficient, and poor. In the category of "Good" knowledge level in this study, there were 56 people (75.7%), whereas in this category, the post-test results showed the highest average number of respondents. After counseling about otitis externa among swimmers at the Tirta Prima Medan association, the level of knowledge of otitis externa changed to "Good."

Table 2. Distribution of respondents based on knowledge level of otitis externa pretest and post-test

Knowledge Level (Pretest)	Frequency	Percentage
Good	5	6.8%
Enough	43	58.1%
Less value	26	35.1%
Knowledge Level (Post-test)	Frequency	Percentage
Good	56	75.7%
Enough	16	21.6%
Less value	2	2.7%

Source: Research data, processed

Distribution of respondents based on swimming frequency

Table 3 shows that of the 74 respondents in this study, respondents were divided into three swimming frequency

categories: rarely, often, and very often. In the "Frequently" swimming frequency category, there were 33 people (44.6%), and this category showed the highest average number of respondents.

Table 3. Distribution of respondents based on swimming frequency

Swimming Frequency	Frequency	Percentage
Infrequent	24	32.4%
Often	33	44.6%
Very often	17	23%

Source: Research data, processed

Distribution of respondents based on the incidence of otitis externa

Table 4 shows that of the 74 respondents in this study, 51 people (68.9%) had otitis externa, and 23 people (31.1%) did not have otitis externa, where this study showed that most respondents experienced otitis externa.

Table 4. Distribution of respondents based on the incidence of otitis externa

Otitis Externa Incidence	Frequency	Percentage
Yes	51	68.9%
No	23	31.1%

Source: Research data, processed

Correlation between swimming frequency and the incidence of otitis externa

Table 5 shows the correlation between the frequency of swimming and the occurrence of otitis externa using the Spearman test, which yielded a significant p-value of 0.042. A p-value of < 0.05 indicated a significant association between the frequency of swimming and the occurrence of otitis externa.

Table 5. Correlation between swimming frequency and the incidence of otitis externa

Frequency Swim	Otitis Externa				Total		p
	Yes		No		n	%	
	n	%	n	%	n	%	
Infrequent	12	23.5	12	52.1	24	32.4	0.042
Often	26	51	7	30.4	33	44.6	
Very often	13	25.5	4	17.4	17	23	
Total	51	100	23	100	74	100	

Source: Research data, processed

Correlation between swimming knowledge and the incidence of otitis externa

Table 6 shows no correlation between knowledge of otitis externa and the incidence of otitis externa using the Spearman test, which produced a significant p-value of 0.785. A p-value > 0.05 indicated no significant correlation existed between knowledge of otitis externa and the occurrence of otitis externa.



Table 6. Correlation between knowledge level of otitis externa and the incidence of otitis externa

Otitis Externa Knowledge	Otitis Externa				Total		p
	Yes		No		n	%	
	n	%	n	%			
Good	5	9.80	0	0	5	6.75	0.785
Enough	25	49	18	78.2	43	58.1	
Less value	21	41.1	4	21.7	26	35.1	
Total	51	100	23	100	74	100	

Source: Research data, processed

Discussion

Description of respondent characteristics based on age and gender

Based on the results of this study, the survey respondents were predominantly aged 12-25 years old (youth), as much as 78.4%. This could be the case for the teenage age, which was dominant due to the grouping of the Tirta Prima Medan swimming club. Most of the population was still a middle or high school student compared to a swimming coach. This study aligns with the study performed in Kediri on the age of adolescents following swimming sports training.¹³ The study indicated that swimming was in the high category in the adolescent age.¹³ Gender in this study was dominated by males (55.4%). This could be the case for males dominating due to the group of Tirta Prima Medan coaching more men than women. This study is also in line with the study conducted on swimmers in the swimming pool of Manahan Surakarta on swimming frequency against the lung capacity of swimmers, which was obtained from the results of respondents who were more men than women.¹⁴

Distribution of respondents based on level of knowledge of otitis externa pretest and post-test

The results of this study show that the level of pretest otitis externa knowledge mostly shows that knowledge at the Tirta Prima Medan swimming association is classified as "Enough." One internal factor that can influence a person's level of knowledge is experience. Experience is not only limited to personal experience but can also come from the experiences of those closest to the person.¹⁵ This study shows that the level of knowledge of respondents who had experienced otitis externa was higher than respondents who had never experienced otitis externa. This was because the incidence of otitis externa in Tirta Prima Medan swimmers often occurred. Hence, they would find out about otitis externa and tell their friends about the disease they had experienced, namely otitis externa. The results on the pretest knowledge level regarding otitis externa align with a study regarding the level of knowledge regarding the prevention of type 2 diabetes mellitus (DM) at Senior High School (SMA) 1 Medan.¹⁶ The study stated that respondents with a family history of DM had a better level of knowledge than respondents who did not have a family history of DM.¹⁶

In this study, the post-test otitis externa knowledge level mostly showed that knowledge at the Tirta Prima Medan

swimming association was classified as "Good" (75.7%). Before distributing the post-test questionnaire, counseling was conducted regarding otitis externa material, and a question-and-answer session was conducted regarding otitis externa. This is in line with a study regarding the influence of education about Clean and Healthy Living Behavior (PHBS) on the level of knowledge at the Jage Kestare Foundation.¹⁷ This education assesses people's understanding of maintaining and actively improving their health conditions independently. The study stated that there was an effect of increasing the post-test knowledge score by 20.22 with a standard deviation of 1.968, which indicated that knowledge was getting better.¹⁷ It could happen after conducting PHBS education. The study concluded that education was necessary to increase a person's knowledge.¹⁷ Therefore, remembering knowledge will be made easier through education.

Furthermore, this study aligns with a study conducted by Putri, *et al.* (2019), which compared the question-and-answer lecture method and focus group discussion in increasing students' knowledge and attitudes about human immunodeficiency virus (HIV).¹⁸ The study found that the question-and-answer lecture method and focus group discussion had a significant influence on increasing students' knowledge and attitudes.¹⁸

Distribution of respondents based on swimming frequency

This study shows that the respondents were dominated by frequent swimming activities, as many as 33 people (44.6%). This could happen to respondents at the Tirta Prima Medan Swimming Association, who performed swimming activities regularly, where the weekly schedule was scheduled four times a week. Even athletes who are seniors or ahead of competitions can swim more than five times a week. This research aligns with the study by Akbar (2014), examining how swimming at the Arwana Yogyakarta Swimming Club affected fitness and swimming performance.¹⁹ The study found that members of the Arwana Yogyakarta Swimming Club performed routine swimming training every week to achieve achievements in swimming competitions. The results showed a positive correlation between swimming regularly and the achievements of the Arwana Yogyakarta Swimming Club.¹⁹

Distribution of respondents based on the incidence of otitis externa

Based on this study, 74 respondents indicated that otitis externa had occurred as much as 68.9% and those who had not experienced otitis externa as much as 31.1%. For the duration of exposure to water on the ears, homogeneous respondents followed the schedule made by the Tirta Prima Medan swimming association. In this study, Tirta Prima Medan swimming athletes were said to have experienced otitis externa if they had experienced ear pain (otalgia), which varied from mild to severe and was not due to picking their ears. Another symptom they might or might never have is a history of otitis externa, confirmed by an



examination at a clinic or other health facility. The history of someone who is said to have otitis externa is known from the guidelines published by the Indonesian Doctors Association, where the main symptoms are pain in the ear (otalgia) and a feeling of fullness in the ear, as well as additional complaints such as reduced hearing, buzzing sounds (tinnitus), accompanying complaints.²⁰ Others include fever and wet ears.²⁰ This study is similar to a study conducted on military diving training in the Netherlands.⁸ Of the 162 military divers, 30 people experienced otitis externa and had complaints such as ear pain (otalgia), itching, or otorrhea.⁸

Correlation between swimming frequency and the incidence of otitis externa

Based on this study, the Spearman test results showed a significance value (p-value) of 0.042, showing a significant correlation between swimming frequency and the incidence of otitis externa. This aligns with the study on military training in diving exercises in the Netherlands.⁸ In the study, 30 of 162 divers experienced otitis externa, which began to develop in military divers after continuous diving activities for three weeks.⁸ The study supported the idea that prolonged exposure to water would make the outer ear canal susceptible to otitis externa.⁸ The study concluded that the incidence of otitis externa in military divers could be related to frequent and continuous exposure to water.⁸ Moreover, the results of this study are similar to those of the study that compared the risk of otitis externa using a retrospective case-control analysis in groups of swimming, water polo, and football athletes who visited and were treated at the Rijeka University Hospital Center, Clinic of Otorhinolaryngology, Head and Neck Surgery in Rijeka, Croatia.⁷ The study concluded that water sports athletes were susceptible to inflammation of the ear skin.⁷ It has been proven that frequent exposure to pool water and prolonged exposure to water will increase the risk of otitis externa.⁷

The most common risk factor for otitis externa is swimming. Exposure to air over a long period frequently damages the ear canal and clears the acid cerumen, making the ear very susceptible to bacterial infections and making it easier for bacteria to enter the ear.²¹ Another factor influencing the incidence of otitis externa is the number of etiological microorganisms found in swimming pool water. A study from the United Arab Emirates stated that *Pseudomonas aeruginosa* strains in swimming pools could become multidrug-resistant, putting swimmers at high risk of infection, including otitis externa.⁹ It is not just swimming pool water. Various environmental microorganisms, including swimmers can contaminate it. This makes the pool water a source of disease that will infect the outer ear, irritating the mucosal lining.¹⁰

Correlation between swimming frequency and the incidence of otitis externa

Based on this study, the Spearman test results showed a significance value (p-value) of 0.785, indicating no

significant relationship between knowledge of otitis externa and the incidence of otitis externa. This could occur because, during the data collection process, the respondents needed to understand the definition of otitis externa, and there was a lack of educational material available about diseases related to otitis externa. Education about the importance of otitis externa for this disease is not directly related to its incidence. However, other factors, such as humidity from frequent swimming, bacterial infections, and injuries to the ear canal, play a more significant role in triggering otitis externa.

Strength and Limitations

The strength of this research lay in the respondents, where this study involved respondents who often do swimming activities. One of the risk factors for otitis externa is swimming. For further research, this study can be developed by expanding research, including research locations and the number of respondents, to be more useful in the growing health sector. This study can be produced by examining the ears to strengthen the diagnosis of otitis externa. Due to the frequency of swimming activities that can affect the incidence of otitis externa otitis externa, it is recommended for swimmers to use protection or ear plugs when doing swimming activities.

Conclusion

The description of the level of knowledge at the Tirta Prima Medan swimming club for the pretest was adequate. Using the same answers from the post-test, the degree of expertise in the Tirta Prima Medan swimming association was well described. According to the Tirta Prima Medan Swimming Association, there was a correlation between swimming frequency and the prevalence of otitis externa. There was no significant correlation between the knowledge of otitis externa and its incidence.

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Conflict of Interest

The authors declared there is no conflict of interest.

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Ethical Clearance

This study had received ethical clearance from the Ethics Committee for Health Research, Universitas Sumatera Utara (No. 741/KEPK/USU/2022) on 12-08-2022.

Authors' Contributions

Data collection and analysis: FR. Examining and verifying the gathered data: FR, TSHH. Writing the manuscript: FR, TSHH. All authors reviewed and approved the final version of the manuscript.

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