



Identification Of *Acanthamoeba spp.* In Used Contact Lens Solution

Michelle Chan^{1*}, Dewi Saputri²

¹Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

²Department of Parasitology, Universitas Sumatera Utara, Medan, Indonesia

Abstract. Contact lenses are the most popular devices used by many people around the world for vision correction, aesthetics, and therapeutic purposes. Poor contact lens hygiene can cause various complications. One of the concerns regarding the use of contact lenses is the presence of *Acanthamoeba spp.* *Acanthamoeba spp.* is a free-living amoeba that can be found in many places including untreated fresh water, treated fresh water and unconventional water sources. One of the complications caused by *Acanthamoeba spp.* is *Acanthamoeba* keratitis which is an eye infection that is often caused by the use of contact lenses and contaminated contact lens solutions. **Objective.** The purpose of this study is to determine the description of *Acanthamoeba spp.* found in contact lens solution and contact lens care of Universitas Sumatera Utara students. **Method.** This study used univariate analysis. Data were obtained from the results of contact lens solution examination and questionnaire interviews. **Result.** Most of the samples (98%) did not have *Acanthamoeba spp.* Some respondents (60.8%) had fairly clean contact lens care behaviour and the rest (39.2%) had very clean contact lens care behaviour. **Conclusion.** One sample was found positive with *Acanthamoeba spp.* The positive sample had *Acanthamoeba spp.* cyst. Contact lens care was generally done well.

Keyword: contact lens, contact lens care, hygiene, *Acanthamoeba spp.*

Received 22 December 2021 | Revised 05 January 2022 | Accepted 05 January 2022

*Corresponding author at: Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

E-mail address: michelle.chan388@gmail.com

Copyright © 2021 Published by Talenta Publisher, ISSN: 2622-9234 e-ISSN: 2622-1357
Journal Homepage: <https://talenta.usu.ac.id/smj/>

1 Introduction

Contact lenses are the result of technological developments in the field of ophthalmology in the form of thin and clear plastics used on eyes to improve vision. The reason people prefer to use contact lenses instead of glasses based on the American Optometric Association is because contact lenses can follow the movement of the eyeballs and the field of view is not disturbed so that the quality of vision is good and not disturbed. In 2004, it is known that about 38 million US residents are contact lens wearers and the average contact lens wearer worldwide is about 128 million people [1].

Therapeutic contact lenses are used to treat eye dysfunctions, particularly corneal irregularities, and for post refractive surgery rehabilitation. Contact lenses were used as smart delivery systems to achieve extended drug releasing times, and as wearable biosensing platforms. On the other hand, contact lens wear was found to induce adverse effects, the most frequent being discomfort, microbial keratitis, allergies and corneal complications [2]. In addition, the use of contact lenses is also one of the main risk factors for *Acanthamoeba* keratitis [3].

Acanthamoeba spp. are free-living amoebae that reside in a remarkably wide range of habitats including hot springs, under ice, in soil, air and heating ducts, fresh vegetables, bottled water, eyewash stations, and in the nasopharyngeal washes from asymptomatic individuals. Although *Acanthamoeba spp.* primarily exist as free-living heterotrophs that feed on bacteria and fungi, they can on occasion be facultative parasites and produce corneal infections [4]. Trophozoites consume bacteria, so they thrive in swimming pools and spas with poor sanitation, and older water reticulation systems containing sludge and biofilm. Once on the cornea, some strains have the ability to invade the epithelium, take in nutrition, multiply at body temperature and survive the host response [5].

Lens handling greatly increases the incidence of lens contaminations: more than half of the lenses removed aseptically from the eye show microbial contamination. Studies show greater than 50% of lens cases are contaminated. All types of preserved solutions can become contaminated, including up to 30% of preserved solutions. Not surprisingly, infrequent contact lens wearers had a higher contamination rate. Rinsing lenses with saline or MPS appears to be effective in reducing contamination [6]. *Acanthamoeba* keratitis was initially reported in 1974 and is closely linked to the development and widespread use of soft contact lens [7]. As of 1990, approximately 200 cases have been reported, mainly in the US [8].

Acanthamoeba keratitis occurs in contact lens (CL) users of all lens types, and can culminate in severe vision loss. The demand for cosmetic CLs continues to increase, particularly in teenage girls and young women all over the world, accounting for 13% of CL use in 2012, because they can be used to drastically alter the appearance of the eye. For these reasons, the possibility of an increasing incidence of *Acanthamoeba* keratitis in cosmetic CL users should be considered. It has

been reported that complications that can arise when wearing CL occur more frequently and are more serious in patients using cosmetic CLs than conventional CLs [9].

A study on *Acanthamoeba spp.* from January 2019 and May 2019, examination of 53 postgraduate students' contact lenses at a university in Jakarta showed two positive results for *Acanthamoeba spp.* The study also conducted culture on tap water with the results showing five positive samples for *Acanthamoeba spp.* [10]. Thus, this study was conducted to see whether *Acanthamoeba spp.* would be found in contact lens solution which had been used by students of the Faculty of Medicine, Universitas Sumatera Utara in Medan, Indonesia.

2 Methods

This research was conducted from September to October 2021. Microscope examination was done at the Parasitology Laboratory of Universitas Sumatera Utara. The research was approved by The Health Research Ethical Committee of Faculty of Medicine Universitas Sumatera Utara. Written informed consent was secured during contact lens solution collection.

Calculation formula for categorical descriptive data was used to determine the size of the population. This study included 51 students from Universitas Sumatera Utara who wear contact lenses. The subjects were asked to collect solution that had been used and fill out a questionnaire form. The inclusion criteria were students who wear contact lenses and came on the appointed days for collecting samples.

The contact lens solution was centrifugated at 1500 rpm for 10 minutes. The produced precipitate was then taken for Eosin staining and examined under a microscope to detect the presence of *Acanthamoeba spp.* The results of the *Acanthamoeba spp.* observation were categorized into positive and negative. Univariate analysis was used for this study to know proportion of the population and frequency distribution of respondents' answers regarding the contact lens care.

3 Results

From **Table 1**, it can be concluded that 50 of the samples were women. A small proportion of respondents (2%) was male.

Table 1. Gender Proportion of the Study Population

Gender	Total Sample (n)	Percentage (%)
Male	1	2
Female	50	98
Total	51	100

Based on **Table 2**, it was found that most of the samples, 50 samples, did not have cysts or trophozoites of *Acanthamoeba spp.* and only one sample had *Acanthamoeba spp.* cyst.

Table 2. Description of *Acanthamoeba spp.* in Used Contact Lens Solution

Result for <i>Acanthamoeba spp.</i> Examination	Total Sample (n)	Percentage (%)
Positive	1	2
Negative	50	98
Total	51	100



Figure 1. *Acanthamoeba spp.* cyst found with Eosin staining.

Based on **Table 3**, it was found that most of the respondents (47.1%) clean their contact lenses once in 3-7 days. Total of 19 respondents clean their contact lenses more than once a day. It was also found that a small proportion of respondents cleans their contact lenses every 1-3 days.

When viewed from contact lens cleaning method on **Table 3** below, it can be seen most of the respondents carried out contact lens cleaning by rinsing and soaking. A total of 3 respondents only rinsed their contact lenses. It was also discovered that only one respondent rinsed, soaked and cleaned contact lenses using cleaning protein enzyme.

From **Table 3**, it is also noted that most of the respondents with very clean contact lens hygiene where the respondents always wash their hands with antiseptic liquid before wearing contact lenses. It can also be seen that many respondents with fairly clean contact lens hygiene where they wash their hands with water before wearing contact lenses. A total of five respondents with poor contact lens hygiene where the respondents sometimes do not wash their hands before using contact lenses. It can also be concluded that a small proportion of respondents with unclean contact lens hygiene where the respondents never wash their hands before wearing contact lenses.

Table 3. Frequency Distribution of Respondents' Answers about Contact Lens Care

No	Contact Lens Care Review	Total Sample (n)	Percentage (%)
1	Contact Lens Cleaning Frequency		
	Once in 3-7 days	24	47.1

	Once in 1-3 days	8	15.7
	≥ 1x a day	19	37.3
	TOTAL	51	100
2	Contact Lens Cleaning Method		
	Only rinsed	3	5.9
	Rinsed and Soak	47	92.2
	Rinsed, soak and cleaned using cleaning protein enzyme	1	2
	TOTAL	51	100
3	Contact Lens Hygiene		
	Unclean	1	2
	Less clean	5	9.8
	Fairly clean	22	43.1
	Very clean	23	45.1
	TOTAL	51	100

In this study, the contact lens care scale was grouped by looking at the results of the answers to all questions on the questionnaire and adding up all the scores. The contact lens care rating scale is determined with the provisions that if the overall score is < 4 then the results are unclean, 4-6 means the results are less clean, 7-9 the results are quite clean and > 9 means the results are very clean. Based on **Table 4**, it is known that the population who has very clean contact lens care behaviour is 20 people and the population who has fairly clean contact lens care behaviour is 31 people. In addition, there was no clean or unclean contact lens care found in this study.

Table 4. Contact Lens Care Scale

Contact Lens Care Behaviour	Total sample (n)	Percentage (%)
Very clean	20	39.2
Fairly clean	31	60.8
Total	51	100

4 Discussion

In this study, respondents who used contact lenses mostly were female and only one respondent was male. This is similar to the study by Susanto et al. [10] which revealed most respondents were female and only a small proportion was male. Furthermore, this study also in accordance with the study done by Idayati et al. [11] that stated only one respondent was male and the rest were female.

From this study, one sample of contact lens solution was found positive *Acanthamoeba spp.* This is almost similar to the research done by Susanto et al. [10] which showed two contact lens

solution samples were positive *Acanthamoeba spp.* from 53 postgraduate students at a university. In spite of that, this study is not in consonance with the study of Ghani et al. [12] which showed no positive samples for *Acanthamoeba spp.* from 57 contact lens solution samples.

The frequency distribution of respondents' answers about contact lens care revealed that most of the respondents clean once in 3-7 days and a small proportion of respondents cleans their contact lens every 1-3 days. These findings are not in accordance with the study done by Idayati et al. [11] where most respondents cleaned their contact lenses more than once a day and a small proportion of respondents cleaned their contact lenses > 7 days once. Another result demonstrated that only one respondent rinsed, soaked and cleaned the contact lenses with cleansing protein enzyme. This is not in consonance with the study of Zhu et al. [13] which stated that more than half of the respondents (67.05%) used enzyme tablets. In addition, our study revealed that most respondents had fairly clean contact lens hygiene with approximately 43.1%. This is similar to the study by Idayati et al. [11] which stated that most subjects (49.74%) had fairly clean contact lens hygiene.

The presence of *Acanthamoeba spp.* in used contact lens solution which has been used can be caused by various factors, namely lack of contact lens cleaning, not washing hands with soap before wearing contact lenses and using tap water to rinse contact lenses. In the survey conducted, the one positive sample was found to be lack of contact lens cleaning and not washing hands with soap before wearing contact lenses, thereby increasing the risk of *Acanthamoeba spp.* In addition, the cysts of *Acanthamoeba spp.* found to be resistant to contact lens solution and can contaminate contact lens and contact lens case in asymptomatic contact lens wearers which can also be the factors in the presence of *Acanthamoeba spp.*

5 Conclusion

There was one contact lens solution sample positive *Acanthamoeba spp.* The form of *Acanthamoeba spp.* found was only cyst. Contact lens care carried out by the subjects was generally good which most of the subjects had fairly clean contact lens care and the rest had very clean contact lens care.

6 Acknowledgement

We would like to thank Department of Parasitology, Universitas Sumatera Utara and TALENTA Universitas Sumatera Utara for giving us the opportunity to conduct this study.

7 Funding

This research did not receive any fundings.

REFERENCES

- [1] S. Inayatullah, M. Yusran, & M. Sari, "Hubungan Perilaku Penggunaan Lensa Kontak Terhadap Kejadian Mata Merah Pada Pelajar Sekolah Menengah Atas Negeri Di Kecamatan Tanjung Karang Pusat," *Medula*, vol. 9, no. 1, pp.116.
- [2] R. Moreddu, D. Vigolo & A. K. Daniele, "Contact Lens Technology: From Fundamentals to Applications," *Advanced Healthcare Materials*, vol. 8, no.15, pp.1.
- [3] E. M. Tan, M. R. Starr, M. R. Henry & B. S. Pritt, "The Brief Case: A "Fresh" Pair of Contact Lenses," *Journal of Clinical Microbiology*, vol. 56, no. 5, pp.2.
- [4] J. Y. Niederkorn, "The Biology of Acanthamoeba Keratitis," *Experimental Eye Research*, pp.3.
- [5] P. R. Badenoch, "Prevention of Acanthamoeba Keratitis in Contact Lens Wearers: Is the Message Getting Through?," *Clinical & Experimental Ophthalmology*, vol. 46, no. 6, pp.591.
- [6] M. Yanoff & J. S. Duker, *Ophthalmology*, 4th ed., Elsevier, China, p.281, 2014.
- [7] R. C. Eagle, *Eye Pathology. An Atlas and Text*, 3rd ed., Wolters Kluwer, Philadelphia, p.180, 2017.
- [8] Departemen Parasitologi FKUI, *Parasitologi Kedokteran*, 4th ed., Fakultas Kedokteran Universitas Indonesia, p.127, 2016.
- [9] S. M. Lee, J. E. Lee, D. I. Lee & H. S. Yu, "Adhesion of Acanthamoeba on Cosmetic Contact Lenses," *Journal of Korean Medical Science*, vol. 33, no. 4, pp.1.
- [10] I. K. Susanto, S. Wahdini & I. P. Sari, "Potential Transmission of Acanthamoeba spp. from Contact Lens Solution and Tap Water in Jakarta, Indonesia," *Macedonian Journal of Medical Sciences*, vol. 8, no. A, pp.335.
- [11] R. Idayati & F. Meutia, "Gambaran Penggunaan Lensa Kontak pada Mahasiswa Universitas Syiah Kuala Ditinjau dari Jenis Lensa, Pola Pemakaian, Waktu dan Iritasi yang Ditimbulkan," Universitas Syiah Kuala, Banda Aceh, 2015.
- [12] M. K. A. Ghani, S. A. Majid, N. S. Abdullah, A. Nordin, Y. Suboh, N. A. Rahim, H. A. Mutalib & N. Ahmad, "Isolation of Acanthamoeba spp. from Contact Lens Paraphernalia," *International Medical Journal*, vol. 20, no. 1, pp.67.
- [13] Q. R. Zhu, Y. Bi, N. Deng, Y. F. Li, T. W. Wang, H. Qi & L. Q. Liu, "The Use of Contact Lenses Among University Students in Chengdu: Knowledge and Practice of Contact Lens Wearers," *Contact Lens & Anterior Eye*, vol. 41, no. 2, pp.4.