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Knowledge and Preventive Behaviour Regarding Diarrheagenic Escherichia Coli Infection Amongst Final-Year Medical Students in Universitas Sumatera Utara

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ABSTRACT

Background: *Escherichia coli*, a gram-negative facultative anaerobe bacterium is one of the most important etiologies of acute diarrhea, still a serious public health problem and cause of morbidity and mortality in infants, children, the elderly, and people with immune deficiency. The source of contamination is through the consumption of contaminated food, improperly processed dairy and agricultural products, and contact with people who have poor hygiene. The purpose of the study is to determine the level of knowledge and preventive behavior regarding Diarrheagenic *Escherichia coli* infection.
Method: The type of research in this study is descriptive. The research was conducted by collecting data using a Level of knowledge and preventive behavior regarding the diarrheagenic *Escherichia coli* infection questionnaire which will be given to respondents.
Result: The results were obtained from 100 people. For the level of knowledge, there were 64 (64%) people who had good knowledge, 29 (29%) moderate people, and 7 (7%) low people. For the level of preventive behavior, 81 (81%) people of good behavior were found, 18 (18%) people were moderate and 1 (1%) were low.
Conclusion: The majority of final-year medical students of Universitas Sumatera Utara are in a good category both in knowledge and preventive behavior regarding Diarrheagenic *Escherichia coli*.
Keywords: *Escherichia coli*, Knowledge, Preventive Behavior

ABSTRAK

Latar belakang: *Escherichia merupakan bakteri anaerob fakultatif gram negatif sebagai salah satu etiologi diare akut yang paling sering, merupakan masalah kesehatan masyarakat yang serius, dan penyebab morbiditas dan mortalitas pada bayi, anak-anak, orang tua, dan orang dengan defisiensi kekebalan tubuh. Sumber kontaminasi adalah melalui konsumsi makanan yang terkontaminasi, produk susu dan pertanian yang diproses secara tidak benar, dan kontak dengan orang yang memiliki kebersihan yang buruk. Tujuan penelitian ini adalah untuk mengetahui tingkat pengetahuan dan perilaku pencegahan mengenai infeksi iarrheagenic Escherichia coli.*
Metode: *Jenis penelitian dalam penelitian ini bersifat deskriptif. Penelitian dilakukan dengan mengumpulkan data dengan menggunakan parameter tingkat pengetahuan dan perilaku preventif terhadap infeksi dengan menggunakan kuesioner terhadap responden.*
Hasil*. Hasil diperoleh dari 100 orang, untuk tingkat pengetahuan, terdapat 64 (64%) orang yang memiliki pengetahuan yang baik, 29 (29%) orang moderat, dan 7 (7%) orang yang rendah. Untuk tingkat perilaku preventif, ditemukan bahwa 81 (81%) orang memiliki perilaku yang baik, 18 (18%) orang sedang dan 1 (1%) orang rendah.*
Kesimpulan: *Mayoritas mahasiswa kedokteran tingkat akhir Universitas*

Sumatera Utara berada dalam kategori baik dalam pengetahuan maupun perilaku preventif terkait diarrheagenic Escherichia.
***Kata Kunci**: Escherichia coli, Pengetahuan, Perilaku Pencegahan*

1. Introduction

Escherichia coli, a gram-negative facultative anaerobe bacterium is the normal flora in the human colon. Most of these bacterial strains are harmless, but some strains acquire bacteriophages or plasmid DNA encoding enterotoxins or invasive factors and then become a type of pathogen [1]. E. coli becomes pathogenic when these bacteria are outside the intestine or their normal habitat. E. coli bacteria with certain strains often cause acute diarrhea [2].

Diarrhea due to enteric infection is one of the main factors of morbidity and mortality worldwide. It is estimated that ± 4,480,400,603 episodes of diarrhea occur annually and the risk of death from diarrhea is increased in children less than five years of age and the elderly. It is estimated that in 2016, diarrhea caused 1,655,944 deaths among all ages and 446,000 deaths in children under five years [3].

Globally, according to WHO, the two most common etiologies of acute diarrheal disease are Rotavirus and Escherichia coli [4]. Global estimates for the prevalence of bacterial diarrhea specifically among all causes of diarrhea include E. coli by 10% to 25%, Shigella by 10%, Salmonella by 3%, and Campylobacter 3 to 6% [5]. In a study conducted in India, using stool samples of children with diarrhea, Escherichia coli (EPEC, EHEC, STEC, EAEC, O157, O111) was detected as the main etiological cause as much as 30.07%, followed by Rotavirus (26.15). %), Shigella (23.84%), Adenovirus (4.61%), Cryptosporidium (3.07%), and Giardia (0.77%) [6]. According to research conducted on tourists from countries in Southeast Asia, it was found that the most common enteropathogens that cause diarrhea was Enteropathogenic E. coli (EPEC) (57.4%), Enterotoxigenic E. coli (ETEC) (31.1%), Vibrio parahaemolyticus (4.9%), Campylobacter (3.6%), Salmonella (1.4%) and Shigella (0.5%) [7].

Diarrheagenic Escherichia coli is known to have plagued several countries, causing many people to get hospital care and causing life-threatening complications, which as Hemolytic Uremic Syndrome (HUS) [8]. HUS is characterized by acute renal failure, hemolytic anemia, and thrombocytopenia, with a case-fatality rate ranging from 3 to 5% [4]. Symptoms of E. coli infection vary from person to person, but the most common are severe stomach cramps, diarrhea (which can be mild and watery, to severe and bloody), and vomiting [9]. Infants and children are the most vulnerable population to E. coli bacteria. This is reinforced by reports of poisoning or infection by E. coli found in children. Examples of food contaminated with pathogenic E. coli are meat, milk, vegetables, drinking water, minimally processed ready-to-eat foods, and street snacks that are popular with children [20]

The source of E. coli contamination to humans is thought to be primarily through the consumption of contaminated food, such as raw or undercooked meat products; improperly processed dairy products; and contaminated vegetables, nuts, or sprouts [4]. Pathotypes that cause diarrhea can be transmitted through the feces of humans and other animals. Transmission occurs via the fecal-oral route [10].

There has been research on the knowledge and preventive behavior regarding Escherichia coli infection in the community of Yogyakarta in 2015. The research was conducted by giving questionnaires to respondents and the results obtained were based on descriptive analysis. The study results among people in Yogyakarta were relatively low [13]. There is also a study that describes the knowledge of food vendors in a food store, as well as their attitudes and practices toward Escherichia coli bacteria. It has been found that the majority of food traders (65.6%) have knowledge and attitudes that belong to the good, but their practices are still low because E. coli can be identified in 50 percent of the hands of the food vendor [14].

Due to the lack of research regarding Diarrheagenic Escherichia coli in Indonesia, so in this occasion, researchers are interested in examining the knowledge and preventive behavior regarding Diarrheagenic Escherichia coli infection amongst final year medical students of Universitas Sumatera Utara, whether their knowledge and preventive behavior toward Diarrheagenic Escherichia coli infection were high or low, specifically about the common pathotype of Escherichia coli which causes diarrhea. So that the students can take preventive actions such as eating or drinking cooked food, keeping the environment and themselves clean, and the students can also educate their surrounding community about the risk of Diarrheagenic Escherichia coli infection.

The purpose study is to determine the level of knowledge and preventive behavior regarding Diarrheagenic Escherichia coli infection of final-year medical students of Universitas Sumatera Utara

2. Method

The type of research in this study uses descriptive statistics. The research was conducted by collecting data using a Level of Knowledge and Preventive Behavior regarding Diarrheagenic Escherichia coli infection Questionnaire that was given to respondents. The research was performed on the final-year medical students at Universitas Sumatera Utara when this research was conducted. From the sample size calculation using the categorical descriptive formula, the minimum sample size needed in this study is 97 people and there were 100 who met the criteria. The research was conducted online via the Google Form and the questionnaires must be filled in according to the predetermined time, which is 15 minutes.

This research was carried out after obtaining an Ethical Clearance from the Research Ethics Commission, Faculty of Medicine, Universitas Sumatera Utara, on August 28^{th,} 2020. The author ensures that the research does not conflict with human values and scientific ethical codes and is confidential as written in the ethical clearance.

3. Results

The level of knowledge and preventive behavior of respondents regarding Diarrheagenic *Escherichia coli* infection can be categorized as good, moderate, and low with the following criteria [11]: Good, if the score from each questionnaire is 76-100%, Moderate, if the score from each questionnaire is 56-75%, and Now if the score of each questionnaire is <56%.

Table 1 Frequency distribution based on level of knowledge

		Frequency	**%**
Level of Knowledge	Low	7	7,0
	Moderate	29	29,0
	Good	64	64,0
	Total	100	100,0

It was found generally the level of knowledge regarding Diarrheagenic *Escherichia coli* infection in the final year medical students of Universitas Sumatera Utara was in a good category as many as 64 (64%), people in the moderate category were 29 (29%) people and in the low category were 7 (7%) people. In this study, the results were dominated by a good level of knowledge.

This finding might not be parallel with a similar study that was conducted on the residents in Yogyakarta, showing that the respondents are in the low category of knowledge level. However, similar research results are shown in other studies, such as those conducted on food handlers in Semarang and drinking water depot operators in Kupang, which show that the respondents are in the good category of knowledge level. This may occur because the knowledge possessed by each respondent is different, where knowledge is closely related to education, even though knowledge is not obtained from formal education [12]. The final year medical students of Universitas Sumatera Utara themselves have received the lesson about diarrhea and its microbiological etiology during their educational period, which is considered able to help build the students' knowledge regarding Diarrheagenic *Escherichia coli* infection.

Table 2 Level of knowledge frequency distribution based on gender

	Level of Knowledge			
Gender	**Low (%)**	**Moderate (%)**	**Good (%)**	**Total (%)**
Men	3 (8.1)	11 (29.7)	23 (62.2)	37 (37.0)
Women	4 (6.3)	18 (28.6)	41 (65.1)	63 (63.0)
Total (%)	7 (7.0)	29 (29.0)	64 (64.0)	100 (100.0)

It can be seen, based on gender, that there are 23 men in the good category of knowledge (62.2%), 11 men in the moderate category of knowledge (29.7%), and 3 men in the low category of knowledge (8.1%). Then for

the women, there were 41 women in the good category of knowledge (65.1%), 18 women in the moderate category (28.6%), and 4 women in the low category of knowledge (6.3%).

Table 3 Frequency distribution based on level of preventive behavior

		Frequency	%
Preventive Behavior	Low	1	1.0
	Moderate	18	18.0
	Good	81	81.0
	Total	100	100.0

It was found generally the level of preventive behavior regarding Diarrheagenic *Escherichia coli* infection in the final year medical students of Universitas Sumatera Utara was in the good category as many as 81 people (81%), 18 people (18%) in the moderate category, and 1 person (1%) in the low category. In this study, the results were dominated by a good level of preventive behavior.

This finding might not be parallel with several other studies, such as a study that was conducted on the residents in Yogyakarta, on refill drinking water operators in South Tangerang, also on drinking water operators in Kupang, which shows that most of the respondents are in the low level of preventive behavior category. This is indicated, by the answers of respondents, that their daily activities are still at risk of *E. coli* infection and most respondents had poor personal hygiene. This finding shows a different level of preventive behavior, and it may occur because a person's behavior can be influenced by knowledge. The final-year medical students of Universitas Sumatera Utara relatively have good preventive behavior because they are considered to have sufficient knowledge so that they can carry out good and correct preventive behavior.

Table 4 Preventive behavior frequency distribution based on Gender

	Preventive Behavior			
Gender	**Low (%)**	**Moderate (%)**	**Good (%)**	**Total (%)**
Men	0 (0.0)	8 (21.6)	29 (78.4)	37 (37.0)
Women	1 (1.6)	10 (15.9)	52 (82.5)	63 (63.0)
Total (%)	1 (1.0)	18 (18.0)	81 (81.0)	100 (100.0)

It can be seen, based on gender, that there are 29 men in the good category of behavior (78.4%), 8 men in the moderate category of behavior (21.6%), and no men in the low category of behavior (0%). Then for the women, there were 52 women in the good category of behavior (82.5%), 10 women in the moderate category of behavior (15.9%), and 1 woman in the low category of behavior (1.6%).

4. Discussions

In Table 1, the majority of final-year medical students of Universitas Sumatera Utara are in the good category of knowledge regarding Diarrheagenic *Escherichia coli*. These results are not in line with research conducted by Ghulam Izza Zakki (2015), which shows that the level of public knowledge of *Escherichia coli* infection in Gondomanan subdistrict, Yogyakarta, is in the low category [13]. In research conducted by Lynda Puspita and Dyah Nur (2010), research was conducted regarding the knowledge, attitudes, practices, and identification of. *Escherichia coli* on the hands of food and food handlers at a food service venue in Semarang City, it was found that the majority of food handlers' level of knowledge and attitude was in a good category (65.6%), but the hygiene practices themselves were still relatively low because bacteria *Escherichia coli* was found on 50% of food handlers' hands. 56.3% of the food handlers who took part in this research had an educational level of completing high school and 25% had completed elementary school [14].

The research conducted by Argente et al (2020), shows the association of street food vendors' knowledge, attitude, and practices on food safety. The study shows that the higher the scores on knowledge, attitude, and practices, the lower the level of contamination. Thus, selected street food vendors who are knowledgeable and have good attitudes and practices on food safety are likely to produce safe street foods. Conversely, street food vendors with poor knowledge, attitudes, and practices on food safety are likely to produce foods contaminated with E. coli [15].

These students from the Faculty of Medicine, Universitas Sumatera Utara class of 2017 have received teaching about bacteria *Escherichia coli* on BBS block 2 (*Basic Biomedical Science* 2) through the Microbiology course, in GIS 1 and 2 (*Gastrointestinal System* 1 and 2) regarding gastrointestinal infections through Internal Medicine and Microbiology courses, and currently receiving teaching about Diarrhea and its microbiological etiology in TMD block 1 (*Tropical Medicine* 1) through the Microbiology and Pediatrics course when this questionnaire was given. This is considered to help build students' knowledge of *Diarrheagenic Escherichia coli* infection so that the majority of students were categorized as having a good level of knowledge.

According to Notoatmodjo (2012), knowledge is closely related to education where it is expected that someone with higher education will have a relatively good level of knowledge, even though knowledge is not obtained in formal education [16].

In Table 4, The majority of final-year medical students of Universitas Sumatera Utara are in the good category of preventive behavior regarding Diarrheagenic Escherichia coli. These results are not in line with research conducted by Ghulam Izza Zakki (2015), which shows that people's preventive behavior against bacterial infections *Escherichia coli* in the Gondomanan subdistrict, Yogyakarta, is in the low category [13]. Inconsistent results were also shown in research conducted by Yudhi Suyudhi (2013), which looked at the knowledge, habits, and existence of bacteriology E. coli in drinking water refills with diarrhea incidents in South Tangerang City. This research shows that the majority of respondents still have the habit of not boiling water (85.3%) and the habit of not washing their hands with soap (61.8%). Respondents who took part in this research were characterized by an education level of less than high school, which is 60%. [17]

According to research conducted by Afriyanti (2019), which examines the presence of *Escherichia coli* in food sold in elementary school canteens. The conclusion of the study showed that there was a relationship between the condition of sanitation facilities and the hygiene of the handler with the presence of *Escherichia coli* bacteria in the food sold. Based on conditions in elementary school canteens in Semarang City, there are still many handlers who have not attended handler hygiene courses from related agencies. Food vendors generally know that poor behavior will reduce the quality of food produced and can cause illness. However, good knowledge and attitudes are not fully accompanied by good behavior in processing food or drinks [18].

This is contrary to research conducted by Damayanti et al (2021), who examined the relationship of knowledge and food handling behaviors with the possibility of *Escherichia coli* in food in pesantren. 95% of food handlers had good knowledge and 5% did not have good knowledge. Food handlers were 100% good behavior in preventing *Escherichia coli* contamination. Qualitative test results for the presence of *Escherichia coli* from food samples showed that 66.7% were positively contaminated with *Escherichia coli* bacteria. There is no significant relationship between knowledge and preventive behavior with a p-value > 0.05, so there is no significant relationship between knowledge and the presence of *Escherichia coli* in food.

This may happen because changes in a person's behavior can be influenced by knowledge (knowledge), attitude (attitude), and practice (practice). People who have good knowledge will have more correct or appropriate attitudes and actions as they should be done (Notoatmodjo, 2012) [16]. The results of this study show that students at the Faculty of Medicine relatively have good preventive behavior because students are considered to have sufficient knowledge so they can carry out preventive behavior properly and correctly.

The strength of this study is to provide information that students of the Faculty of Medicine have good behavior, knowledge, and attitude towards *Escherichia coli* infection. The weakness of this study is based on a questionnaire because the cause of the discharge can be caused by various other factors.

5. Conclusions

The majority of final-year medical students of Universitas Sumatera Utara are in the good category of knowledge regarding diarrheagenic *Escherichia coli* and the good category of preventive behavior regarding diarrheagenic *Escherichia coli*. It is hoped that from this study, the incidence of diarrhea can be prevented in the wider community

References

[1] Makvana S, Krilov LR. Escherichia coli Infections. Pediatrics in Review. 2015 Apr 1;36(4):167–71.
[2] Gomes TAT, Elias WP, Scaletsky ICA, Guth BEC, Rodrigues JF, Piazza RMF, et al. Diarrheagenic Escherichia coli. Brazilian Journal of Microbiology [Internet]. 2016 Dec;47(1):3–30.
[3] Troeger C, Blacker BF, Khalil IA, Rao PC, Cao S, Zimsen SR, et al. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet Infectious Diseases [Internet]. 2018

Nov;18(11):1211–28.
[4] World Health Organization. E. coli [Internet]. World Health Organization. 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/e-coli
[5] Akhondi H, Simonsen KA. Bacterial Diarrhea [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020.
[6] Shrivastava AK, Kumar S, Mohakud NK, Suar M, Sahu PS. Multiple etiologies of infectious diarrhea and concurrent infections in a pediatric outpatient-based screening study in Odisha, India. Gut Pathogens. 2017 Apr 11;9(1).
[7] Jung KS, Jang YM, Hwang JH, Park GJ, Son TJ. Risk of Water and Food-Borne Communicable Diseases in Travelers Entering Korea. Osong Public Health and Research Perspectives [Internet]. 2019 Aug 1;10(4):215–20.
[8] CDC. Outbreaks of E. coli Infections [Internet]. E. coli Infection (Escherichia coli). 2024 [cited 2024 May 24]. Available from: https://www.cdc.gov/ecoli/outbreaks/?CDC_AAref_Val=https://www.cdc.gov/ecoli/outbreaks.html
[9] Centers for Disease Control and Prevention. CDC Yellow Book 2020: Health Information for International Travel. New York: Oxford University Press; 2017.
[10] Penakalapati G, Swarthout J, Delahoy MJ, McAliley L, Wodnik B, Levy K, et al. Exposure to Animal Feces and Human Health: A Systematic Review and Proposed Research Priorities. Environmental Science & Technology [Internet]. 2017 Oct 9;51(20):11537–52.
[11] Arikunto, S. Prosedur Penelitian : Suatu Pendekatan Praktik. Edisi Revisi VII. Rineka Cipta. Jakarta; 2011.
[12] *Notoatmodjo, S. Pendidikan dan Perilaku Kesehatan. Rineka Cipta. Jakarta; 2012.*
[13] *Zakki, G.I. Pengetahuan Dan Perilaku Preventif Terhadap Bakteri E–Coli Pada Masyarakat Kecamatan Gondomanan Di Kota Yogyakarta [Internet]. lib.unnes.ac.id. 2015*
[14] *Sugiyono LP, Subandriani DN. Gambaran Pengetahuan, Sikap, Praktik serta Identifikasi Bakteri Escherichia Coli Dan Staphylococus Aureus Pada Penjamah dan Makanan di PT PSA (Pelita Sejahtera Abadi). Jurnal Riset Gizi [Internet]. 2014;2(2):56–66.*
[15] Myla Argente, Normahitta Gordoncillo, Africa L, Barba C, Dizon J. Assessment of Knowledge, Attitude, and Practices on Food Safety and Compliance to Microbiological Safety Guidelines among Vendors of Commonly Patronized Street Foods in Poblacion, Batangas City, Philippines. Journal of Human Ecology [Internet]. 2020;9(1).
[16] *Notoatmodjo, S. Pengembangan Sumber Daya Manusia. Rineka Cipta. Jakarta. 2012.*
[17] *Jayadisastra YS. Hubungan Pengetahuan, Kebiasaan, dan Keberadaan Bakteriologis E.Coli dalam Air Minum dengan Kejadian Diare pada Konsumen Air Minum Isi Ulang yang Berkunjung ke Puskesmas Ciputat Tahun 2013. http://repository.uinjkt.ac.id/dspace/handle/123456789/25909 [Internet]. 2015 Feb 4.*
[18] *Afriyanti LN. Keberadaan Escherichia coli pada Makanan di Kantin Sekolah Dasar. HIGEIA (Journal of Public Health Research and Development) [Internet]. 2019 Jul 31.*
[19] *Damayanti AY, Syafii NK, Fathimah F. Hubungan Pengetahuan Dan Perilaku Penangan Makanan Dengan Adanya Bakteri E.Coli Dalam Makanan Di Pondok Pesantren. Jurnal Kesehatan Tambusai. 2021 Mar 31;2(1):47–60.*
[20] *Rahayu WP. Escherichia Coli : patogenitas, Analisis dan Kajian Risiko. IPB Press; 2018*