

Behavior of Catering Owners towards Foodborne Disease Outbreaks in Indonesia: A Cross-Sectional Study



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Abstract:

Introduction: Food poisoning is a serious public health concern that occurs when contaminated items containing bacteria, viruses, parasites, or harmful chemicals are consumed. In this context, Medan City experiences fluctuating incidents of food poisoning, highlighting the need for continuous monitoring to identify and address the causes.

Methods: This research included 62 catering entrepreneurs with A1 criteria and a capacity of less than 100 servings per day. The study, of a quantitative cross-sectional type, was conducted in Medan City in 2024. The exclusion criteria were individuals not classified in category A1 and those unwilling to participate as respondents. Data collection and analysis were carried out through questionnaires and module validation by experts, Chi-Square tests, and logistic regression

Results: The results showed that there was a substantial relationship in the behavioral characteristics of caterers/catering owners, including knowledge, attitudes, ingredient selection, storage, and processing. Furthermore, food ingredient selection and attitudes were the most dominant factors affecting these behaviors.

Discussion: The knowledge and attitude of catering business owners are important factors in the early detection and prevention of outbreaks. Therefore, ongoing education through structured modules is essential because the programs provide a systematic and continuous method of strengthening knowledge.

Conclusion: Selection of food ingredients and attitudes are dominant factors influencing food poisoning awareness compared to other factors. Therefore, an information and education module must be developed as an early warning tool to improve the knowledge and practice of catering business owners in Medan City.

Keywords: Behavior, Extraordinary event, Food poisoning, Catering owner, Foodborne disease outbreaks, Ingredient selection, Food safety challenges.

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1. INTRODUCTION

Food safety challenges are among the major issues that are constantly discussed in every international meeting. Reports from various countries show several cases of poisoning and foodborne diseases. The World Health Organization (WHO) reported that around 70% of diarrheal diseases in developing countries are caused by the consumption of contaminated food [1]. Food poisoning is a widespread and dangerous phenomenon worldwide. According to data from Novziransyah *et al.* [2], 1 in 10 people becomes sick after consuming contaminated food, resulting in 420,000 deaths every year. In the United States, there are approximately 48 million cases of foodborne diseases each year. WHO defines foodborne disease (FBD) as illnesses caused by microbes or other agents entering the body through the consumption of contaminated food [3].

Iqbal *et al.* reported that the increasing incidence of food poisoning was often associated with contamination, causing global public concern. Reliable statistical data on the disease are unavailable since the magnitude of the incidence cannot be estimated [4]. According to Agustaria and Syahrul, the severity of the situation can be comprehended by considering the high prevalence of diarrheal diseases among infants and children [5, 6]. On an annual basis, there are about 1,500 million cases of diarrhea in children under five. As a direct result, more than 3 million children die.

The Ministry of Health declared an outbreak of food poisoning, and the issue was ranked 2nd after diphtheria in reports submitted to the Public Health Emergency Operation Center (PHEOC) in 2018 [7]. Data on extraordinary events concerning food poisoning showed 163, 122, and 133 cases in 2017, 2018, and 2019, respectively. A total of 5,958 cases were recorded, with a Case Fatality Rate (CFR) of 0.4% in 2019. A trend of food poisoning outbreaks in the province showed that extraordinary cases fluctuated between 2017 and 2019. The decrease from 2017 to 2019 did not guarantee a reduction in extraordinary cases in Indonesia. Therefore, continuous data collection is necessary to monitor the trend of extraordinary cases.

As recorded in the Directorate General of Disease Prevention and Control, the number of food poisoning outbreaks in 2016 reached 106 incidents, with 4,161 cases and a CFR of 0.48%. Data on food poisoning outbreaks

from 2011 to 2016 were 177, 312, 233, 306, 164, and 48 incidents, respectively. The highest death rate was in 2016, with a CFR of 0.95%. Food poisoning outbreaks remain high every year because management is sub-optimal.

According to Mustika, food poisoning cases have a fairly high incidence rate [8]. In 2017, 5,293 people were exposed to food poisoning, according to data from the Indonesian Food and Drug Administration. There were 2,041 food poisoning outbreaks with an attack rate (AR) and CFR of 38.56% and 0.15%, respectively. This shows that outbreaks of food poisoning remain a public health concern requiring attention.

Mustika stated that the most common locations for outbreaks of food poisoning were houses, educational institutions, elementary schools, and junior high schools, with 25 (47.17%), 15 (28.30%), 9, and 6 incidents, respectively [8]. Food poisoning outbreaks in houses often occur during family events or religious ceremonies, including weddings, circumcisions, aqiqah, tahlilan, and others. The householders prepare the food served at these events. Food poisoning outbreaks in elementary schools are often caused by snacks contaminated with bacteria.

Data in the North Sumatra Provincial Health Service Profile showed that extraordinary food poisoning incidents were found in North Sumatra Province, where 33 regencies/cities had fluctuations in the last 5 years [9]. The highest mortality was recorded in 2017 when two individuals died. However, a single death was reported in 2021 due to food poisoning outbreaks.

Medan City recorded 132, 45, 127, and 54 cases in 2017, 2018, 2019, and 2021, respectively. These figures indicate a fluctuating trend of outbreak incidents over the past 5 years. Therefore, the situation demonstrates the necessity of establishing an early warning system to ensure ongoing monitoring and timely response to potential outbreaks.

Feeding Asian Cities 2000 stated that several investigations were conducted to comprehend the characteristics of food in Asia, Africa, and Latin America. This research documented the importance of food safety from a social and economic perspective. The overall food trade in various cities can reach millions of dollars. The negative aspect is a low level of food hygiene, which can disrupt the environment [10].

According to Palupi *et al.*, the government needs to enhance food supervision and management by prioritizing hygiene and sanitation in accordance with established food safety standards, increasing public awareness, and effectively managing food to improve safety [11]. Mutebi *et al.* reported that Uganda recorded 211 cases of food poisoning [12]. This was based on the results of interviews using a structured questionnaire regarding potential exposure, history of receiving and eating aid food, eating other foods, drinking unsafe water, and avoiding social gatherings. Tarent'ev [13] and Dwiyantri [14] demonstrated that some catering services failed to meet physical eligibility requirements in terms of hygiene and sanitation. These aspects are expected to be met before obtaining a certificate from the Health Service to verify the application of hygiene and sanitation in catering businesses.

The effects of food poisoning on the body include symptoms and the accompanying events. The basic symptoms of food poisoning are vomiting, abdominal pain, and diarrhea. There is no definite time limit for the symptoms to appear in an individual. Symptoms may be observed within an hour after consuming contaminated food. Common symptoms include stomachache, nausea, vomiting, diarrhea, fever, and headache [15, 16].

The effectiveness of early detection and prevention programs highly depends on the collaboration between health workers and food business operators. This was also emphasized in recent research that proposed a prevention model for stakeholders [17]. A current challenge arises when inspectors fail to detect food poisoning cases based on interviews with public health officers and the head of the surveillance work team in the field of disease prevention and control at the Medan City Health Office. This situation may have serious consequences for public health. After collecting food poisoning samples, health officers must conduct investigations to ensure measures are taken to prevent similar problems from occurring in the future. Furthermore, coordination among programs implemented at the Medan City Health Office is crucial for maintaining public health. The absence of permits for catering business owners indicates noncompliance with food safety standards set by health authorities, such as maintaining cleanliness and ensuring the safety of raw materials. Catering owners must be aware of the importance of early warning systems to avoid food poisoning outbreaks.

Many catering owners lack a comprehensive understanding of food safety. They are often unaware of the risks associated with stale or expired food, appropriate storage and cooking methods, and the use of cheaper but less safe ingredients. The importance of selecting safe food and reporting poisoning incidents to health authorities must be understood. To address these challenges, close collaboration between health workers and catering owners is necessary to enhance early warning systems and improve the quality and safety of food in Medan City. Targeted education and counseling campaigns are crucial for raising awareness among catering owners about the importance of prevention and safe practices in selecting, processing, and storing food. Therefore, this research

aims to analyze the dominant factors affecting the behavior of catering owners in preventing food poisoning outbreaks in Medan City.

Previous qualitative research has emphasized the importance of health workers' roles in developing early warning systems for food poisoning outbreaks among catering businesses in Medan City [17]. Based on this description, this research aims to quantitatively assess behavioral determinants required to propose a structured intervention model. The need to conduct an investigation was recognized as an early warning effort to anticipate food poisoning outbreaks. Therefore, this research aims to improve and maintain public health and safety, as well as enhance the quality of catering services through the principles of food hygiene and sanitation.

2. METHODS

A cross-sectional quantitative design was employed. This research was conducted in the working areas of Medan Tuntungan and Medan Area Health Centers in North Sumatra Province, Indonesia, in 2024. The locations of the Health Centers were determined based on the available data. The population consisted of 62 proprietors, who also served as the sample, focusing on household kitchens classified as A1 catering services. This group comprised catering services with a food processing capacity of 100 servings per day. The exclusion criteria included unwillingness to participate as respondents, not being classified under category A1, and discontinuation of business operations [18, 19].

Data collection was conducted from April to September 2024, following the issuance of research permits by the Medan City Health Office and the Regional Research and Innovation Agency. Data collection activities focused on extraordinary events of food poisoning as the dependent variable, while knowledge, attitudes, processing, storage, and food selection were the independent variables. An educational module for catering owners was developed using a preventive approach, with its content reviewed by public health experts and food safety practitioners prior to testing. The contents of the module included food material selection, food storage, food processing, hygiene and sanitation principles, and food handling. The module was registered with copyright number EC002024230825 dated November 21, 2024.

Furthermore, the validity and reliability of the questionnaire were tested. A validity test was carried out to determine the extent to which the measuring instrument was appropriate in assessing the intended target. The reliability test of the questionnaire assessed the precision and accuracy of the measuring instrument by determining the correlation between the scores of each question [20]. Pearson correlation analysis was used to evaluate the validity of the questionnaire. The results showed that 44 question items had a calculated *r*-value greater than the table *r*-value (0.361), while the reliability was reported as a Cronbach's Alpha value of 0.60. Data were considered valid when the calculated *r*-value exceeded the table *r*-value in the statistical test [21, 22].

3. RESULTS

The results show the characteristics of respondents.

Table 1 shows that the dominant age group was 20-40 years, covering 32 respondents (51.6%). The majority of respondents were female, consisting of 42 people (67.7%). Most participants (34 or 54.8%) were Elementary School Graduates. In addition, 35 or 56.5% have been running a catering business for 19-24 months.

The results of the univariate analysis showed that 80.6% of respondents failed to express concern about food poisoning outbreak. Approximately 33 (53.2%) and 35 (56.5%) respondents incorrectly identified the independent variable of food selection and practiced improper food storage, while 37 (59.7%) reported low knowledge and negative attitudes. The results of the bivariate

analysis showed that 32 (97.0%) respondents were classified as having poor food selection. A total of 33 (94.3%) and 31 (93.9%) respondents reported inadequate food storage and identified limitations in processing, respectively. Furthermore, 35 (94.6%) with limited knowledge significantly contributed to the effective awareness initiative on food poisoning. Approximately 34 (91.9%) showed unfavorable attitudes for insufficiently contributing to effective awareness initiatives on food poisoning outbreaks. The multivariate analysis showed that all independent variables had a p -value < 0.25 , as reported in. A p -value of 0.003 and 0.006 was reported for the meal selection and attitude variables, respectively. These variables having a p -value less than 0.05 were considered as essential components in the model for reducing food poisoning outbreaks (Tables 2-5).

Table 1. Respondent characteristics of catering owners in Medan city.

S.No.	Respondent Characteristics	f (n=62)	%
1	Age (Years)	-	-
	20-40 Years	32	51.6
	>40 Years	30	48.4
2	Gender	-	-
	Male	20	32.3
	Female	42	67.7
3	Education	-	-
	Elementary School Graduate	34	54.8
	Junior High School Graduate	20	32.3
	High School Graduate	8	12.9
4	How long has the catering business been open	-	-
	6-12 months	1	1.6
	13-18 months	8	12.9
	19-24 months	35	56.5
	>25 months	18	29.0

Table 2. Level of knowledge, attitude, selection of food ingredients, storage, and food processing of catering owners in Medan city.

S.No.	Behavioral Factors	Measurement Results	f	%
1	Food Selection	Wrong	33	53.2
		Correct	29	46.8
2	Food Storage	Wrong	35	56.5
		Correct	27	43.5
3	Food Processing	Wrong	33	53.2
		Correct	29	46.8
4	Knowledge	Low	37	59.7
		High	25	40.3
5	Attitude	Negative	37	59.7
		Positive	25	40.3

Table 3. Analysis of the relevance between knowledge, attitudes, selection of food ingredients, storage, and processing of food in catering owners (n=62, chi-square test) in Medan city.

S.No.	Variables	Food Poisoning Outbreak Alert				Total		p-value	OR (CI 95%)
		Ineligible		Eligible					
		F	%	F	%	F	%		
1	Selection of Food Ingredients								
	Wrong	32	97.0	1	3.0	33	100	0.002	1.9
	Correct	18	62.1	11	37.9	29	100		2.3-16.4
2	Food Storage								
	Wrong	33	94.3	2	5.7	35	100	0.006	9.7
	Correct	17	63.0	10	37.0	27	100	-	1.9-49.3
3	Food Processing								
	Wrong	31	93.9	2	6.7	33	100	0.012	8.1
	Correct	19	65.5	10	34.5	29	100		1.6-41.3
4	Knowledge								
	Low	35	94.6	2	5.4	37	100	0.002	1.1
	High	15	60.0	10	40.0	25	100		2.2-59.7
5	Attitude								
	Negative	34	91.9	3	8.1	37	100	0.016	6.3
	Positive	16	64.0	9	36.0	25	100		1.5-26.7

Table 4. Analysis of knowledge, attitudes, food ingredient selection, food storage, and processing in catering owners (n=62, logistic regression test) in Medan city.

S.No.	Behavioral Factors	Significant	Result
1.	Selection of food ingredients	0.006	Significant
2.	Food storage	0.006	Significant
3.	Food processing	0.011	Significant
4.	Knowledge	0.003	Significant
5.	Attitude	0.011	Significant

Table 5. Selection process in selecting candidate models of knowledge, attitude, selection of food ingredients, storage, and food processing in catering owners (n=62, logistic regression test) in Medan city.

S.No.	Dominant Factor	Significant	Result
1.	Knowledge	0	No effect
2.	Attitude	0.006	Effect
3.	Selection of food ingredients	0.003	Effect
4.	Food storage	0	No effect
5.	Food processing	0	No effect

4. DISCUSSION

A significant correlation was observed between ingredient selection and awareness of food poisoning outbreaks. The findings support the hypothesis that proper ingredient selection positively influences individual awareness. Careful selection of food ingredients enhances

knowledge of preventive and control measures against foodborne illness. In contrast, unfresh or contaminated ingredients containing pathogens such as *Salmonella* and *Escherichia coli* pose serious health risks. Ingredients obtained from trusted sources and stored appropriately are safer than those lacking quality control. Furthermore,

the presence of hazardous chemicals, excessive pesticide residues, or illegal additives such as formalin and borax can result in chemical poisoning. Adhering to food safety principles, particularly selecting fresh and contamination-free ingredients, is therefore a critical step in preventing health problems caused by unsafe food consumption [23].

According to Putri and Susanna education is aimed at the public to improve the knowledge and attitudes of catering business owners, as well as to prevent early warnings of extraordinary events by selecting, storing, and processing food ingredients [24]. Improper food storage is among the major factors that can cause food poisoning. Pathogenic bacteria multiply rapidly when food is stored at an inappropriate temperature in the danger zone of 5–60°C [25, 26]. Unhygienic food storage practices, such as contact with contaminated surfaces or the use of non-irtight containers, also increase the risk of cross-contamination. Therefore, proper food storage is crucial in preventing the growth of disease-causing microorganisms and reducing the risk of food poisoning [27].

The results have important practical implications for the prevention and control of food poisoning outbreaks. Effective prevention requires interventions targeting catering owners to improve food storage and overall food handling practices. Unhygienic processing, inadequate cooking temperatures, and improper storage conditions can promote bacterial growth, while cross-contamination between raw materials and cooked food is a frequent cause of outbreaks. In addition, the excessive use of food additives may lead to allergic reactions or chemical poisoning. Therefore, the consistent application of sanitation and hygiene principles at every stage of food processing is essential to reduce the risk of foodborne illness [28].

Cognition is a crucial domain influencing individual behavior. The effective execution of actions requires a solid knowledge base that extends beyond descriptions to include theories and practical procedures. Knowledge develops when individuals employ cognitive processes to recognize and understand objects or events that they have not directly observed or experienced [29, 30].

The prevention and management of food poisoning outbreaks must be strengthened through the implementation of effective regulations designed to anticipate similar incidents in the future. Public education, delivered by health workers, is also essential to enhance the knowledge of catering owners regarding prevention and management strategies for food poisoning outbreaks.

Attitude reflects supportive (positive) or opposing (negative) tendencies toward an object. It is a behavioral disposition or readiness to respond within a social context, representing a coordinated reaction to social stimuli. Attitude can be understood as a positive or negative evaluation of an object and is expressed through feelings of affection or aversion, agreement or disagreement.

An individual who understands the impacts and risks of food poisoning outbreaks is more likely to adopt effective preventive measures. These measures include appropriate

attitudes, sufficient knowledge, proper food selection, as well as safe food storage and processing [31].

Risk factors for catering owners, based on respondent characteristics such as education level and length of service, contribute to the possibility of food poisoning due to a lack of knowledge about hygiene practices. Therefore, educational modules that cover the principles of food hygiene are still necessary. This module is expected to enhance the knowledge and attitudes of catering owners regarding the implementation of more effective preventive measures [32].

CONCLUSION

In conclusion, this research demonstrated a significant relationship between ingredient selection, storage, processing, knowledge, and attitude with food poisoning outbreak awareness. However, multivariate analysis identified food ingredient selection ($p = 0.003$, $\text{Exp}(B) = 29.579$) and attitude ($p = 0.006$, $\text{Exp}(B) = 10.393$) as the most influential factors. Developing a comprehensive educational module can enhance the knowledge of catering business owners and strengthen their awareness of food poisoning outbreaks.

AUTHORS' CONTRIBUTIONS

The authors confirm contribution to the paper as follows: R.S., H., A., F.F.Y., N.I., H.Y., I., and H.H.: The concept of the study was developed; R.S. and H.: The design was prepared; H., A., and F.F.Y.: Supervision was carried out; R.S.: Data collection was performed; R.S., H., and N.I.: The analysis and interpretation were conducted; R.S.: The manuscript was written; H., A., F.F.Y., N.I., H.Y., I., and H.H.: With critical review and editing provided. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

CFR = Case Fertility Rate

WHO = World Health Organization

PHEOC = Public Health Emergency Operation Center

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research was conducted after obtaining approval from the Research Ethics Commission of the Faculty of Medicine, Andalas University. The approval number is No. REFERENCE 242/UN.16.2/KEP-FK/2023, dated May 26, 2023, and Regional Research and Innovation Agency Number: 000.9/0757, May 29, 2023, and Medan City Health Service Number: 440/220.03/VI/2023.

HUMAN AND ANIMAL RIGHTS

All research procedures were conducted on human participants and were performed in accordance with the ethical standards of the institutional and research committees, as well as the principles outlined in the 1975 Helsinki Declaration, revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The relevant additional data are available from the corresponding author [R.H] upon reasonable request, provided the approval is obtained from the institutional review board of the university.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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