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Food Safety Study From Microbiological Aspect at Spring Rolls Production in Tourism Area, Sanur Beach

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ABSTRACT

Background: Foodborne disease is a health issue of the society as a result of consume food that contaminated with microorganisms or chemicals. Food contamination can happen at any stage of food production to the food consumed. Spring rolls is one of food that common sale in tourist areas which susceptible to microorganism contamination due to hygiene and sanitation practices that are not up to standard . The purpose of this study was to determine food safety from microbiological aspect at production of spring rolls in tourism area, Sanur Beach. This type of research is analytic observational with a cross sectional design. Data obtained by some method such a observation, interviews and laboratory tests. The samples of this research were 16 samples of spring rolls that sale at Sanur Beach. The results showed that 10 samples (62,5%) were in the category vulnerable but safe for consumption. The results of total microbes contamination showed that 13 samples (81,25%) met the requirements for total contamination but there were 3 samples (18,75%) that did not meet the requirements for coliform and 1 sample (6,25%) contained E.coli. Based on statistical tests found the differences of total microbes contamination with food safety scores with Asymp.Sig = 0,01.

Keywords: E.Coli, Food Safety Score, Spring Roll, Total Microbes Contamination



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INTRODUCTION

Tourism destinations are developed based on potential tourist attractions which are developed synergistically with the development of tourist facilities, public facilities, accessibility/infrastructure, and community empowerment in a complete and sustainable system. The achievement of foreign visits in 2019 in Indonesia reached 80.50% (Kemenparekraf, 2020). One type of activity done by tourists is culinary tourism, so the topic of food safety has become an increasingly important issue in recent years. The emergence of foodborne diseases affects society in health, economic, and social aspects (Karaca et al., 2017).

Foodborne disease is a growing public health problem throughout the world. This foodborne disorder is the result of consuming contaminated food. Contamination can be caused by environmental contamination, including water, soil, or air contamination which can occur at every stage of the food production process until the food is consumed. The most common clinical manifestation of foodborne disease is gastrointestinal symptoms (Rahmayani & Simatupang, 2019). One of the pathogenic bacteria that causes foodborne disease is *Escherichia coli* or *E. coli*. The presence of these bacteria is often associated with contamination originating from feces because *E. coli* generally lives in the intestines of humans (and animals) so the presence of these bacteria in water or food indicates that a processing process has come into contact with feces (Rahayu et al., 2018).

The data from the World Health Organization (WHO) states that foodborne diseases and diarrhea due to water

contamination kill around 2 million people per year (Sari, 2017). Based on the report from the Food and Drug Supervisory Agency of the Republic of Indonesia (BPOM RI) in 2020, 45 extraordinary incidents of food poisoning were discovered, with a total of 3276 people exposed and 1528 of them experiencing symptoms of illness (attack rate of 46.62 %). Meanwhile, 6 people died (case fatality rate was 0.18%). The most common cause of KP outbreaks was microbiology (suspected) with 24 incidents (53%) and 1 incident (2%) was confirmed (BPOM RI, 2020).

Food poisoning cases in Bali Province reached 387 cases in 2018 based on the Health Service report (Dinas Kesehatan Provinsi Bali, 2018). In 2018, through the weekly SKDR (Early Alert and Response System) recap in Denpasar City, the highest case was acute diarrhea with a total of 4,588 cases (Denpasar City Health Service, 2018). Research conducted by Masyeni in 2017 stated that *E. coli* was the main microorganism that causes diarrhea in tourists in Bali (Masyeni et al., 2017). Research conducted by Lumanauw in 2019 stated that as many as 76% of food traders at the Sindu Night Market, Sanur, Bali did not practice personal hygiene 54% had poor equipment sanitation and 46% had poor presentation sanitation which could be a possibility of contamination. biological, chemical, and other objects that can be annoying and detrimental (Lumanauw, 2019).

One of the massive snacks sold in the Sanur Beach tourist area is Lumpia. The contents of spring rolls can be varied into various types, but generally have a savory-salty taste (Anwar, 2012), Preliminary observation results show that spring roll traders who sell spring rolls around



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Sanur Beach do not use gloves when cutting spring rolls, which increases the chance of food contamination, especially microbiological aspects. In addition, with the opening of international visits for tourism during the COVID-19 pandemic, special attention is needed regarding food safety to prevent the occurrence of foodborne diseases. Based on the problems that have been described, researchers are interested in researching the microbiological aspects of food safety in spring rolls sold in the Sanur Beach.

METHOD

The type of research used observational analytics with a cross-sectional research design. Research time: This research was conducted in November-December 2021. Research location: The research was conducted in the Sanur Beach tourist area which is located in Sanur Kaja Village and Sanur. Researchers choose research locations based on several considerations, that were: There had been no similar research at this location, it is one of the most visited tourist destinations in Bali, and there were sufficient samples available according to the criteria. The population was spring roll traders in the Sanur Beach tourist area. The sample size in this study was 16 traders who produced their spring rolls. The sampling technique in this research used the Saturated Sampling technique. In this study, all members of the population were used as samples because the population was relatively small, less than 30 people. Data collected in the research included primary and secondary data.

Primary data collection methods, were trader identity and production characteristics were collected by interview, food safety score data by observation, and data on total microbial

and E.Coli contamination were tested in the laboratory using the Total Plate Count (TPC) method for total microbial contamination, and Most Probable Number (MPN) for coliforms then followed by Eosin Methylene Blue Agar (EMBA) to identify coliforms of the E. Coli type. Spring roll samples were purchased after doing a sales process of at least 4 hours. The spring roll samples taken a cut by the trader then put in sterile plastic containing a sample code, then put in a cool box to maintain the ideal sample temperature of 4oC - 10oC g and delivered to the Panureksa Utama Public Health Laboratory. The data was then processed and presented in the form of a frequency distribution table and analyzed descriptively. The data on food safety scores and total microbial contamination were analyzed using the Kruskal-Wallis test with the type of data and objectives to be achieved. Research ethics samples are selected if they meet the requirements and are willing to be researched and fill out a statement of willingness to be a sample.

RESULTS

Respondent Characteristics

The research was done in coastal areas located in Sanur Kaja Village and Sanur , Denpasar City from the Bali Beach area to Karang Beach. This beach is located just east of Denpasar City, Bali Province. The respondents in this research were 16 spring roll traders spread from the Bali Beach area to Karang Beach. Based on the results of data research regarding respondents, that were spring roll traders, the distribution was based on gender, age, highest level of education, and history of following socialization regarding food safety. The



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distribution of respondent characteristics can be seen in Table 1.

Table 1. Distribution of Respondent Characteristics

No	Variable	f	%
1.	Gender		
	Man	6	37.5
	Woman	10	62.5
	Amount	16	100
2.	Age		
	18-26	2	12.5
	27-35	3	18.8
	36-44	2	12.5
	45-53	4	25
	54-62	4	25
	63-71	1	6.3
	Amount	16	100
3.	Education		
	No School	3	18.8
	Elementary School	7	43.8
	Junior High School	2	12.5
	Senior High School	3	18.8
	Diploma/Bachelor	1	6.3
	Amount	16	100
4.	History of Participating in Food Safety Socialization		
	Once	0	0
	Never	16	100
	Amount	16	100

Based on the results of the characteristics of the respondents shown in Table 1, it is known that the gender of female respondents is greater than that of male respondents, that were 10 (62.5%) female respondents and 6 (37.5%) male respondents. The distribution of respondents based on age shows that the productive age range is 24-64 years. Most of the respondents were aged 45-53 and 54-62 years with a frequency of 4 respondents each (25%), while the ages of respondents with the least frequency were respondents aged 63-71 years with a total of 1 respondent (6.35 %).

Respondents' recent educational history varied from no school to a bachelor's degree.

The educational history with the largest percentage was an elementary school with 7 respondents (43.8%) and the lowest was undergraduate education with 1 respondent (6.3%). Based on their history of participating in socialization regarding food safety, 16 respondents (100%) had never participated in socialization regarding food safety.

Production Characteristics

Based on production characteristics, that were the distance from the production site to the beach, travel time, time from start of production to end of sale, number of spring rolls produced per day, and whether there are other products produced by the trader. The distribution of characteristics regarding the production of lumpia sold can be seen in Table 2.

Table 2. Distribution of Lumpia Production Characteristics

No	Variable	f	%
1.	Production Mileage to Sanur Beach		
	6-10 km	15	93.8
	> 10 km	1	6.3
	Amount	16	100
2.	Production Location Travel Time to Sanur Beach		
	11-15 minutes	3	18.8
	16-20 minutes	12	75
	> 20 minutes	1	6.3
	Amount	16	100
3.	Start of Production-End of Sales Time		
	1-4 hours	3	18.8
	5-8 hours	3	18.8
	9-12 hours	8	50
	> 12 hours	2	12.5
	Amount	16	100
4.	Number of lumpia production per day		
	20-50	4	25
	51-100	5	31.3
	101-150	4	25
	151-200	2	12.5
	>200	1	6.3
	Amount	16	100
5.	Traders who produce other foods		
	Yes	14	87.5
	No	2	12.5
	Amount	16	100

Based on the characteristics of spring roll production shown in Table 2, it can be seen that the distance traveled from spring roll production to the selling location is mostly between 6-10 km, that were 15 samples (93.8%) with an average distance of 10.74 km. The travel



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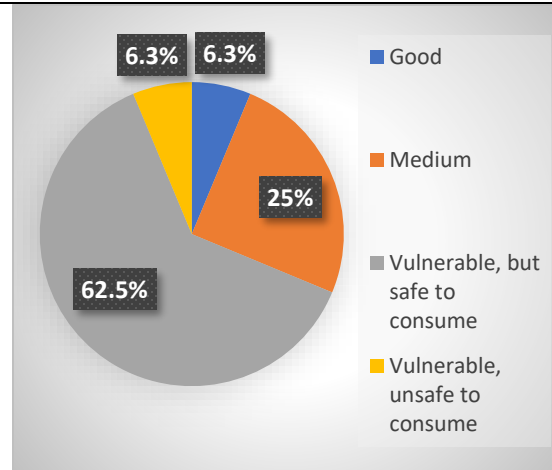
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time from spring roll production to the selling location is between 16-20 minutes with a frequency of 12 samples (75%). The average travel time is 17.5 minutes. Spring roll production time until the end of sales hours for each trader varies with the largest percentage between 9-12 hours, frequency of 8 samples (50%). There were also 2 traders selling spring rolls for more than 12 hours totaling 2 samples (12.5%).

The number of spring rolls produced by traders per day varies, some traders produce large quantities and small quantities. Spring roll production ranges between 25-400 spring rolls with the largest percentage of spring roll production between 51-100 spring rolls with a frequency of 5 samples (31.2%). Regarding other food production from 16 traders, 14 traders (87.5%) sold other types of food, that were tempeh, tofu, and also others in various quantities ranging from 20 to 100 pieces.

Food Safety Score

Based on the results of research on 16 samples, the distribution of food safety scores can be seen in Figure 1. The largest SKP category is vulnerable, and safe for consumption with a total of 10 samples (62.5%). A food safety score in the good category was only found in 1 sample (6.3%) and the SKP category was also found to be vulnerable, and unsafe for consumption with a frequency of 1 sample (6.3%). The medium SKP category was found in 4 samples (25%).



Picture 1. Sample Distribution Based on Food Safety Score

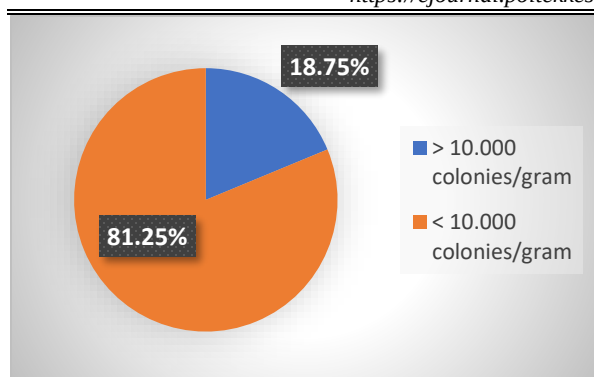
Microbial Contamination

According to BPOM RI regulation Number HK.00.06.1.52.4011 of 2009 concerning the Determination of Maximum Limits for Microbial and Chemical Contamination in Food, the maximum limit for microbial contamination with the total plate number test (ALT) on processed food products is set, that were 1×10^4 colonies/g or 10,000 colonies/g. Based on the distribution of samples according to total microbial contamination in picture 2, of the 16 spring roll samples tested, there were 3 samples (18.75%) that had a total plate number $> 1 \times 10^4$ colonies/gram which indicated that the samples did not meet the requirements, while the other 13 samples (81.25%) met the requirements where the sample had a total plate number $< 1 \times 10^4$ colonies/gram.



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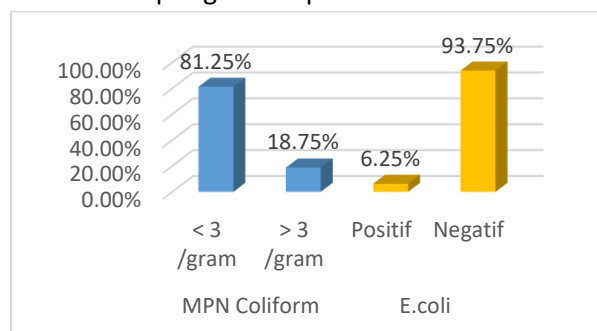
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Picture 2. Sample Distribution Based on Total Microbial Contamination

Based on data on total microbial contamination in spring roll samples, the minimum value of total microbial contamination was 0 colonies/gram and the maximum value was 88,800 colonies/gram. The average total microbial contamination in spring rolls was 10,775.31 colonies/gram with a standard deviation of 23,848.29 colonies/gram.

Based on BPOM RI regulation Number HK.00.06.1.52.4011 of 2009 concerning the Determination of Maximum Limits for Microbial and Chemical Contamination in Food, if a food contains MPN > 3 / gram then it is said not to comply with the food suitability criteria. An overview of Coliform contamination and E. coli bacteria in spring rolls is presented in Picture 3.



Picture 3. Sample Distribution Based on Coliform and E. Coli Contamination

Based on the Most Probable Number (MPN) test results, it was found that 3 samples

(18.75%) had Coliform contamination > 3/gram, which means the samples did not meet the requirements and 13 other samples (81.25%) had Coliform contamination < 3/gram which means the sample meets the requirements. Samples containing coliforms were then continued with the Eosin Methylene Blue Agar (EMBA) test to find out the specific colony, that were E. coli, and one sample (6.25%) was found to be positive for E. coli in the EMBA test, which was marked by a metallic green colony color.

Distribution of Total Plate Count Based on Food Safety Score

Table 3 shows that from the good SKP category, the TPC was obtained with an average of 0 colonies/gram, the medium category had an average TPC of 20.5 colonies/gram, the vulnerable category was safe for consumption with an average of 9,280 colonies/ gram, the vulnerable category was unsafely consumed an average of 88,800 colonies/gram.

Table 3. Distribution of Total Plate Count Based on Food Safety Score

SKP Category	TPC (colony /gram)		
	Mean	Min	Max
Good	0	0	0
Medium	20,5	2	50
Vulnerable, but safe to consume	9.280	90	42.400
Vulnerable, unsafe for consumption	88.800	88.800	88.800

Based on the Kruskal Wallis statistical analysis test, the Asymp.Sig value = 0.01 < 0.05, so it can be concluded that there is a difference in total plate count between the food safety score categories of good, medium, prone to safe consumption, and prone to unsafe consumption.

DISCUSSION

Food Safety Score

Food Safety Score is a value that describes the suitability of food for consumption, which is



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the result of observing factors that might contaminate food. The way to assess SKP is through observing parameters in the form of a checklist that has been found out by the Ministry of Health. Boring (checklist) assessment is divided into 4 components, that were selection and storage of food ingredients, handler hygiene, processing and distribution of food, and each component is further divided into several sub-components (Lestari, 2014).

Based on observations of spring roll production, it was found that of the 16 production sites observed, only 1 sample had good food safety. The low food safety score which is in the good category indicates that there is still low implementation of safe food provisions by spring roll traders, one of which is low awareness of maintaining cleanliness. This is in line with research by Kahlas, Febriani, and Chasanah in 2019 which showed that 85% of traders had poor sanitation hygiene behavior, one of which was influenced by the level of knowledge regarding sanitation hygiene which was less than 75.5% (Kahlas et al., 2019). This was also found in research where all traders never took part in socialization regarding food safety and sanitation hygiene, so this could be one of the reasons for low sanitation hygiene behavior which influences food safety scores.

Identification of Total Microbial and Coliform Contamination

Identify total microbial contamination using Total Plate Count (TPC). TPC is the number of mesophilic aerobic microbes per gram or per milliliter of sample found out using standard methods. ALT is generally not related to food safety hazards but is sometimes useful to indicate quality, shelf life/half-life,

contamination, and hygienic status during the production process (BPOM, 2012).

Based on laboratory tests that have been done, it shows that of the 16 samples tested, 3 samples (18.75%) showed a total of $> 1 \times 10^4$ colonies/gram of microbes. This value exceeds the maximum limit set by BPOM RI regulation Number HK.00.06.1.52.4011 of 2009. There are still spring rolls that have total microbial numbers that exceed the requirements, indicating that hygiene has not been implemented optimally. Apart from that, the length of time the product is sold at room temperature causes more bacteria to reproduce, this is because if cooked food is stored at room temperature for more than 4 hours in the danger zone temperature ($10^\circ\text{--}60^\circ\text{C}$) it will increase the potential for microbial growth. Under optimal conditions, almost all bacteria will divide by binary fission every ± 20 minutes, but certain types of bacteria require a cell regeneration time of ± 12 minutes (Kristiandi et al., 2021). It is feared that the production of bacteria that continues to grow will cause toxins or toxins. Toxin production will increase in line with the number of bacteria (Irawan, 2016).

Apart from total microbial contamination, testing for Coliform and *E. coli* contamination was also done on spring rolls. In testing using the Most Probable Number (MPN) method, which is a method of determining the number of microorganisms using the liquid medium in a test tube, the principle is to count the number of positive tubes that grow microbes after incubation at a certain temperature and time. In this test, 3 stages are done, that were a prediction test, followed by a reinforcement test, and a complementary test with specific media that were EMBA to find out whether the



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Coliform indicated in the amplifier test is *E. coli* which is marked with a metallic green color. Based on the MPN test done on 16 spring roll samples, there were 3 samples (18.75%) that contained MPN > 3/gram, which means it exceeded the standard, that were MPN < 3/gram. Samples that exceed the standard in the boost test will proceed to the EMBA test and one sample will be found that shows a metallic green color, indicating that the sample is positive for *E. coli*.

The presence of *E. coli* is often associated with contamination originating from feces because this bacteria is generally a bacteria that lives in the human intestine. Factors that contribute to *E. coli* contamination in food are failure to fulfill processing process parameters, such as cooking temperature, pH value, water activity, and improper storage processes (Rahayu et al., 2018). Contamination of food can result in foodborne illness. Riana and Sumarmi's research in 2018 stated that the factors influencing the increase in the number of Coliform bacteria contamination were indicators of the presence of traders with sources of pollution. Traders who sell in locations close to sources of pollution trigger the transfer of dangerous microbes in rubbish or rivers to food via flies, insects, or the air (Riana & Sumarmi, 2018). Apart from that, one of the samples that were positive for containing *E. coli* was also suspected of being contaminated on the hands of food processors or handlers after defecating, food processors did not wash their hands thoroughly, which means food handlers could spread diseases that could be transferred to other people through food (Rauf, 2013).

If we look at the low food safety score, especially in the sub-component of food

processing, it is also a risk factor for coliform and *E. coli* contamination. When the finished spring roll product is put into the box selling spring rolls, it is held directly using the hand. Contaminated hands can contaminate equipment. Equipment used to serve food that has been contaminated with *E. coli* can also be a source of contamination of finished food. Contamination of cooked food influences the contamination of food served (Jiastuti, 2018).

Another factor that can cause contamination is poor storage of finished products. Based on observations, it was found that most traders put spring rolls in boxes or containers that were not kept clean, some traders used plastic lids which were used periodically as food covers. This is in line with research conducted by Ramadhani, Abidin, and Ardhyanti, 2018 which states that the relationship between food sanitation and the presence of *E. coli* bacteria can be caused by several factors, such as storage areas that are not kept clean, finished food storage areas that are not closed. and an open way of presenting (Ramadhani et al., 2018).

Total Plate Count Based on Food Safety Score

The total bacteria contained in food is influenced by the sanitation in each process, actions that can trigger bacterial growth, as well as efforts and processes done to prevent bacterial growth (Alwi et al., 2019). Judging from the lack of food safety scores and microbiology aspects of spring roll traders, the knowledge of spring roll traders regarding personal hygiene and environmental sanitation needs to be improved by providing counseling or socialization to traders. This is because all traders (100%) have never participated in socialization regarding food safety including



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hygiene and sanitation. One of the outreach programs that can be provided is about Good Food Production Methods (CPPB) known as Good Manufacturing Practices (GMP).

GMP is closely related to food safety. Food safety itself can be assessed from several aspects, including processing technology, ingredient content, processing sanitation, amount of microorganisms, packaging, and so on. Food safety will be guaranteed if there is standardization that is found out and implemented well by the industry in the food sector (Suprayogi, 2018).

CONCLUSION(S)

There are differences in total microbes based on the safety score of food sold in the Sanur Beach tourist area. The food safety score for spring roll production in the Sanur Beach tourist area was 13 samples in the vulnerable category, safe for consumption and based on laboratory tests for total microbial contamination using the TPC method and coliform contamination using the MPN method, 3 samples each did not meet the standards and 1 sample was found positive for *E. coli* which is of particular concern for improving the quality of handling of spring roll products in the future. Suggestions for related departments and institutions, so that they can do supervision and provide education to traders regarding the importance of personal hygiene, food sanitation, proper and correct food processing, as well as the dangers of food processing that lacks sanitary hygiene.

Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree

with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

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