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Microbial Contamination of Languan Satay Lilit In Goa Lawah Tourism Area Klungkung Bali

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ABSTRACT

Bali is famous for its traditional culinary tourism. One of the culinary is satay lilit languan. Diarrhea is one of the diseases that often occurs in tourist areas. Based on data from the Bali Provincial Health Office in 2021, diarrhea cases in Bali Province amounted to 118,174 cases. The purpose of this study was to determine the food safety of satay lilit languan sold by satay lilit languan traders in the Goa Lawah Tourism Area. The type of research used is observational analysis with cross-sectional design and Non Probability Sampling technique with a total of 16 samples. Then an assessment of food safety scores, TPC, MPN, and *Escherichia coli* testing was carried out. Based on the results of the food safety score, 10 samples (62.5%) were in the vulnerable category, but safe for consumption, then 2 samples (12.5%) were in the vulnerable category, not safe for consumption. Based on the TPC test, 5 samples (31.3%) had total microbial contamination >1 x104 or more than the maximum limit, then the MPN *coliform* test results were 9 samples (56.3%) had the number of *coliform* contamination >3/gram or more than the maximum limit, and the *Escherichia coli* bacteria test results were 2 samples (12.5%) positive for *Escherichia coli* bacteria. After the Mann-Whitney statistical test, there was no difference between total microbial contamination based on the food safety score (p-value) of 0.91 or >0.05, while there was a difference between MPN *coliform* bacterial contamination and *Escherichia coli* bacterial contamination with a food safety score (p-value) <0.05. It can be concluded that the food safety of languan satay sold in the Goa Lawah Tourism Area is categorized as vulnerable, but safe for consumption.

Keywords: Satay lilit, food safety score, microbes, coliform, Escherchia coli.

Introduction

Bali is a leading tourist destination in Indonesia. Bali's tourist attractions include nature, cultural traditions, nature, artwork, and culinary. One of the traditional culinary choices of tourists is satay lilit laguan. Satay lilit languan is a type of processed fish specialty originating from the

Klungkung area of Bali. Satay lilit languan is unique in its ingredients and method of preparation. The main ingredients of satay lilit languan are sea fish, base even and coconut while for the method of making it, the fish is mashed and mixed with base even seasoning or Balinese spices and then added coconut then glued or wrapped by hand on a bamboo / coconut leaf skewer until the lump of satay dough covers the bamboo / coconut leaf skewer after which it is burned until it is cooked and has a fragrant aroma typical of spices (Parwanayoni, 2015).

One of the things that is of particular concern in local culinary or traditional food is the lack of food safety. Based on data from the Bali Provincial Health Office in 2021, diarrhea cases in Bali Province amounted to 118,174 cases (Bali Provincial Health Office, 2021). Food safety can be assessed using the Food Safety Score (SKP). The number of cases of food poisoning, one of which is diarrhea cases in tourists, is still a problem and a topic that continues to be discussed (Pathiassana and Izharrido, 2021).

The making of languan satay is thought to have a risk of microorganism contamination from the method of manufacture, the tools used, the storage temperature and the materials used are not good.

Research Method

The type of research used is observational analytic. This study used a cross-sectional design where all research subjects were observed at the same time in one observation without any intervention. This research was conducted in Goa Lawah Klungkung Tourism Area and Panureksa Utama Laboratory (Jl. Genitri No.11, Tonja, East Denpasar Kec.) from December 2023 to February 2024.

The population used was 16 satay lilit languan traders who sell around the Goa Lawah Tourism Area, Klungkung Regency. The sample used is satay lilit languan which is around the Lawah Cave Tourism Area, Klungkung Regency. The sample size was obtained as many as 16 samples which were the entire population used as samples and in accordance with the sample criteria. This study uses Non Probability Sampling technique, then to determine the sample using Saturated Sampling Technique. The data collected consists of primary data and secondary data. The analysis used in this study was univariate analysis which was analyzed descriptively and bivariate analysis using the Mann-Whitney test. This research has received ethical approval with Number DP.04.02 / F.XXXII.25 / 0806 / 2023

Results and Discussions

1. Characteristics of Languan Satay Lilit Trader

The sample characteristics are divided into two, namely data on the characteristics of the respondent's identity and data on the characteristics of languan satay production. The distribution of sample identity characteristics data consists of gender, age, latest education, length of work, history of attending food safety training which has been described in Table 1.

Table 1 Data Distribution of Identity Characteristics of Languan Satay Traders in the Goa Lawah Tourism Area Klungkung

Trader characteristics	F	Presentase (%)

Gender		
Male	5	31,3
Female	11	68,8
Amount	16	100,0
Age (Year)		
20-30	3	18,8
31-41	4	25,0
42-52	7	43,8
53-60	2	12,5
Amount	16	100,0
Last Education		
Junior high school	5	31,3
senior high school	8	50,0
Bachelor's Degree	3	18,8
Amount	16	100,0
Length of Service		
1-5 year	2	12,5
6-10 year	4	25,0
>10 year	10	62,5
Amount	16	100,0
History of attending food safety training		
Never	16	100,0
Amount	16	100,0

Based on the data in Table 1, it is known that most of the traders, namely 11 people (68.8%), are female, as many as 7 people (43.8%) are in the age category of 42-52 years, for the last level of education, namely the SMA / SMK level as many as 8 people (50.0%), for the long duration of working as a languan satay lilit trader the longest is> 10 years there are 10 people (62.5%), and for a history of attending food safety training as many as 16 people (100%) traders have never attended training.

2. Food Safety Score

Food safety score is a medium used in describing the quality and quality of food. There are 4 categories, namely the good category with a score ≥ 0.9703 or 97.03%-100%, the moderate category with a score of 0.9332-0.9702 or 93.32- 97.02%, prone but safe for consumption with a score of 0.6217-09331 or 62.17-93.31%, and prone not safe for consumption with a score <0.6217 or <62.17%.

Table 2: Distribution of Languan Satay Lilit Food Safety Score

Food Safety Score	F	Presentase (%)
Good	1	6.3
Medium	3	18.8
Prone, but safe to consume	10	62.5
Prone, not safe for consumption	2	12.5
Jumlah	16	100.0

Based on Table 2, it is known that there are 10 samples (62.5%) in the vulnerable category, but safe for consumption, then 2 samples (12.5%) are in the vulnerable category, not safe for consumption.

3. **Microbial contamination of languan skewers**

Total microbial contamination of languan satay is calculated by conducting Total Plate Count (TPC) testing which allows all microbes in the sample to be counted and then categorized based on predetermined standards (BPOM, 2019). Based on the standards of the Food and Drug Monitoring Agency (BPOM) regulation No. 13 of 2019 concerning the Maximum Limit of Bacterial Contamination, it has been stated that the maximum limit of total bacterial contamination in fish and fishery products including molluscs, crustaceans, fried or grilled echinoderms (oven or coal) is 10^4 colonies/gram.

Laboratory testing using the MPN method was carried out to determine the presence or absence of *coliform* bacteria contamination in languan satay lilit samples. In the MPN method, three tests were carried out, namely the presumptive test, the reinforcing test, and the complementary test. Then, for EMBA media is done to determine the presence or absence of *Escherichia coli*.

Table 3. Microbial contamination of Languan Satay Lilit

Uji Mikroba	Kategori	F	Presentase (%)
TPC Value	<1 x10^4 CFU/Gram	11	68.8
	>1 x10^4 CFU/Gram	5	31.3
	Amount	16	100.0
MPN *Coliform*	<3/Gram	7	43.8
	>3/Gram	9	56.3
	Amount	16	100.0
Escherichia coli	Negatif	14	87,5
	Positif	2	12,5
	Amount	16	100.0

KDescription: <1x10^4 CFU/Gram within the maximum limit of total bacteria, >1x10^4 CFU/Gram exceeding the maximum limit, <3/Gram maximum limit of *coliform*, >3/Gram exceeding the maximum limit of *coliform*, negative result = no *Escherichia coli* identified, positive result = *Escherichia coli* identified

Based on Table 3, it is known that there are 5 samples (31.3%) have total microbial contamination (TPC) > 1 x104 or exceed the maximum limit, then 11 samples (68.8%) have total microbial contamination (TPC) < 1 x104 or still meet the requirements of the total bacterial distribution of food ingredients.

It is known that the results of laboratory testing with the MPN *coliform* method are with the results of 9 samples (56.3%) having the number of *coliform* contamination> 3 / gram, then for the results of 7 samples (43.8%) having the number of *coliform* contamination < 3 / gram. So, it can be said that most of the Languan satay samples are still above the maximum limit of contamination, which means they do not meet the food safety requirements.

After knowing the samples with *coliform* contamination >3/gram with the MPN *coliform* method, it will be continued using EMBA media. From EMBA media, 2 samples (12.5%) were positive for *Escherichia coli* bacteria and 14 other samples (87.5%) were negative for *Escherichia coli*.

4. Total microbial contamination based on food safety score

The results showed that of the 5 samples with microbial contamination > 1 x 104 colonies/gram, there were 1 sample (6.3%) that had a good food safety score, as many as 1 sample (6.3%) had a moderate safety score, and as many as 3 samples (18.8%) had a vulnerable safety score, but were safe

for consumption. Then of the 11 samples with microbial contamination <1x 104 colonies/gram, there were 2 samples (12.5%) that had a moderate safety score, 7 samples (43.8%) had a vulnerable safety score, but were safe to consume and 2 samples (12.5%) had a vulnerable safety score, not safe to consume.

Table 4. Total Plate Count (TPC) Based on Food Safety Score (FSS)

Score Food safety	TPC Microbial Contamination						*(p-value)*
	<1x10^4		>1x10^4		Amount		
	n	%	n	%	F	%	
Good	0	0	1	6,3	1	6,3	0,91
Medium	2	12,5	1	6,3	3	18,8	
Prone, but safe to consume	7	43,8	3	18,8	10	62,5	
Prone, not safe for consumption	2	12,5	0	0	2	12,5	
Amount	11	68,8	5	31,3	16	100	

Judging from the results of the Mann-Whitney statistical test, the results (p-value) 0.91 or> 0.05 or it can be concluded that there is no significant difference between total microbial contamination (TPC) and food safety score results, meaning that the high TPC value in the sample is not influenced by food safety scores. The absence of differences in the total microbial contamination test on the safety score can be caused by the different results of the total bacterial contamination test in each sample. Although based on statistical results there is no difference, it is important to maintain and pay attention to food safety from bacterial, viral, parasitic, or toxic contamination in food that can pose a risk of foodborne disease. Foodborne disease can be prevented by the application of hygiene and sanitation so that food safety will be better maintained. From the results of observations, there are traders when finished winding languan satay wrapped around languan not immediately baked / burned so that it should be put back into the freezer with a temperature of <0^o C to prevent microbial growth, because the temperature factor can be one of the things that affect microbial growth. Microbes such as Escherchia coli, Salmonella spp. and Lactobacillus spp are classified as mesophile microbes, which are microbes that can grow optimally at room temperature or room temperature between 20^{o}C- 45^{o}C (Richter, Carlos and Beber, 2024). Furthermore, the cooked satay lilit languan should be placed in a closed place that can prevent contamination from dust or insects or disease-carrying animals. According to the guidelines for food storage based on (Ministry of Health, 2023) "Environmental Health Quality Standards and Health Requirements for Water, Air, Soil, Food, Facilities and Buildings, and Vectors and Disease-Carrying Animals" food storage should avoid contamination from insects, rats, bacteria, or other animals.

5. MPN *Coliform* bacterial contamination based on food safety score

The results showed that of the 9 samples with *coliform* bacteria contamination > 3/gram, there were 7 samples (43.8%) that had a vulnerable safety score, but were safe for consumption, then 2 samples (12.5%) had a vulnerable safety score, not safe for consumption. Then of the 7 samples with *coliform* bacteria contamination <3/gram that there were 1 sample (6.3%) that had a good safety score,

as many as 3 samples (18.8%) had a moderate safety score, and as many as 3 samples (18.8%) had a vulnerable safety score, but were safe for consumption.

Table 5. MPN *Coliform* Based on Food Safety Score

Score Food safety	*Coliform* MPN						*(p-value)*
	<3/gram		>3/gram		Amount		
	n	%	n	%	F	%	
Good	1	6,3	0	0	1	6,3	0,01
Medium	3	18,8	0	0	3	18,8	
Prone, but safe to consume	3	18,8	7	43,8	10	62,5	
Prone, not safe for consumption	0	0	2	12,5	2	12,5	
Amount	7	43,8	9	56,3	16	100	

Judging from the results of the Mann-Whitney statistical test, the results (p-value) 0.01 or <0.05 or it can be concluded that there is a difference between the contamination of MPN *coliform* bacteria and the results of the food safety score, which means that the high value in the sample is influenced by the food safety score. These results are supported by observations that the traders did not use gloves when wrapping the satay, stirring the satay mixture did not use a spoon or when taking the satay did not use tongs or plastic gloves, did not wash their hands with soap, then put the wrapped satay in an open place which is certainly a lot of dust and insects that can contaminate it (Ministry of Health, 2023). Food safety scores and microbial contamination are interrelated because an increased or high safety score will certainly be followed by a decreased microbial contamination rate so that food safety in the sample will be good and safe for consumption. Therefore, consistency in the application of food safety is the key to food safety so it is necessary to increase awareness and knowledge of food handlers and processors (Abduh et al., 2024).

***6. Escherichia coli* contamination based on food safety score**

The results showed that of the 14 samples with *Escherichia coli* contamination with negative results, there were 1 sample (6.3%) that had a good safety score, as many as 3 samples (18.8%) that had a moderate safety score, as many as 10 samples (62.5%). Then from 2 samples with *Escherichia coli* contamination with positive results, there were 2 samples (12.5%) that had a vulnerable safety score, not safe for consumption.

Table 6. *Escherichia coli* by Food Safety score

Score Food safety	Cemaran *Escherichia coli*						*(p-value)*
	Positif		Negative		Amount		
	n	%	n	%	F	%	
Good	0	0	1	6,3	1	6,3	0,02
Medium	0	0	3	18,8	3	18,8	
Prone, but safe to consume	0	0	10	62,5	10	62,5	
Prone, not safe for consumption	2	12,5	0	0	2	12,5	
Amount	2	12,5	14	87,5	16	100	

Based on the results of the Mann-Whitney statistical analysis test, the result (p-value) is 0.02 or <0.05 or it can be concluded that there is a difference between the results of the *Escherichia coli* contamination test and the results of the food safety score, which means

that the high value in the sample is influenced by the food safety score. The difference is due to the application of hygiene and sanitation during production to food distribution which can affect the growth of *Escherichia coli* bacteria in food. Because, the higher the level of contamination of *coliform* bacteria, the higher the presence of pathogenic bacteria that live in human and animal feces, namely *Escherichia coli* bacteria that enter the digestive tract in large quantities will be very dangerous to health (Estrada-Garcia and Tarr, 2023).

Conclusion

Based on the results of the food safety score and total microbial test, MPN *coliform* and *Escherichia coli*, it shows that the results of satay lilit sold by traders in the Goa Lawah Tourism Area are vulnerable, but safe for consumption. For this reason, it is necessary to increase knowledge and skills in maintaining sanitary hygiene of food handlers.

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Conflic of Interest

The authors declare that they have no conflict of interest.

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