

Analysis Of Factors That Influence K Content *Escherichia Coli* Bacteria In Dairy Cow Milk In Bendungan District Trenggalek Regency

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ABSTRACT

Milk quality is determined by bacteria contained in milk because bacteria can damage and change the chemical, physical and organoleptic properties of milk. Unhygienic milking process can cause bacterial contamination. **Purpose:** To determine the factors that influence the presence of *Escherichia coli* in fresh cow's milk. in Bendungan sub-district. **Method:** The research design is quantitative with a cross-sectional approach. The population is 32, data collection techniques with laboratory examinations and observations with sampling techniques using Cluster sampling . This study was conducted from February to March 2020. Data collection using questionnaires. Data is processed using the SPSS program with the Logistic Regression test . **Results:** personal hygiene (43.8%) is not good , there is a significant influence of personal hygiene on the content of *Escherichia Coli* (P Value 0.043), equipment hygiene (37.5%) is not good, there is an influence of equipment hygiene on the content of *Escherichia Coli* (P Value 0.045) , cage sanitation (50.0%) is not good, there is a significant influence of cage sanitation on the content of *Escherichia Coli* (P Value 0.048) , cow cleanliness 53.1% , not good, there is a significant influence of cow cleanliness on *Escherichia Coli* content (P Value 0.039) and for the content of *Escherichia Coli* included in the category of not meeting health requirements, namely 21 respondents (66%) of the total 32 respondents . All variables have a significant effect on the content of *Escherichia Coli*. This is caused by the improper milking process and bacteria can move from one object to another. **Conclusion :** personal hygiene, equipment hygiene, barn sanitation, and cow cleanliness can affect the content of *Escherichia Coli* in cow's milk. It is recommended that the Animal Husbandry Service increase milking supervision to ensure the quality of cow's milk .

Keywords: Cow's milk, *Escherichia Coli*, Hygiene, Sanitation

INTRODUCTION

Fresh milk is a highly nutritious food because fresh milk contains various complete and balanced nutrients such as protein, fat, carbohydrates, minerals, and vitamins that are very much needed by the human body. The high nutritional value of milk causes milk to be a medium that is very much liked by microorganisms that encourage the growth and development of microbes, so that in a very short time milk becomes unfit for consumption if not handled properly and correctly. One way to process milk so that it lasts a long time in a certain time is by pasteurization (Chrisna 2016).

Fresh milk production in Indonesia in 2009-2018 showed that in 2010 milk production was 909.5 thousand, in 2011 it was 974.7 thousand, in 2012 it was 959.7 thousand, in 2013 it



was 786.8 thousand, in 2014 it was 800.7, in 2015 it was 835.1 thousand, in 2016 it was 912.7 thousand, in 2017 it was 928.1 thousand and in 2018 it was 906 thousand. (Central Statistics Agency (BPS), 2019)

Unhygienic milking process can cause contamination or bacterial contamination in it so that it can reduce the quality of the milk. Based on this, one way to measure this quality is to count the number of *Escherichia coli* bacteria which have been determined as indicator microorganisms for determining the quality of fresh milk. Statistical data on livestock and animal health 2018 shows that the dairy cattle population in East Java ranks first. From 2015 as many as 255,947, in 2016 as many as 265,002, in 2017 as many as 273,881 and in 2018 as many as 280,364. (Directorate General of Livestock and Animal Health East Java, 2018). The amount of cow's milk production in Trenggalek is 18 thousand liters of milk production, this is the accumulated amount from several areas producing cow's milk. Namely Pule, Suruh, and Bendungan Districts, Dairy cow milk producing villages in Bendungan District, namely Surenlor, Masaran, Sumurup, Depok, Dompiong, and Botoputih (Head of Livestock Production and Business Development, Trenggalek Agriculture and Food Service, 2019).

One indication of contaminated milk is the presence of *Escherichia coli* bacteria that contaminate the milk exceeding the microbial contamination limit set by the National Standardization Agency. The National Standardization Agency sets the maximum limit of microbial contamination in milk at <3 APM/ml (SNI 7388: 2009). According to Irianto (2002), *Escherichia coli* has long been formulated as an indicator microorganism for determining milk quality and the number of these bacteria in milk can be used as a quality indicator.

Based on research conducted by Fitka Romanda (2016), based on the research results, it was concluded that there is a relationship between personal hygiene of food handlers and the presence of *Escherichia coli* in food at the food processing facility (TPM) buffer area of Adi Soemarmo Surakarta Airport.

Based on the results of observations conducted on dairy cow milkers in Bendungan Trenggalek sub-district, there are still milkers who do not maintain the cleanliness of their hands before milking, cow dung that is still around the cow when milking, an unclean milking place and milkcan (milk container) containing milk sediment/crust. On October 21, 2019, researchers conducted an examination for the presence of *Escherichia coli* in cow's milk in the Kediri laboratory with positive results containing *Escherichia coli*. This is what prompted researchers to conduct research to determine the influence of hygiene and sanitation factors on the content of *E. scherichia coli* bacteria in cow's milk. dairy in Bendungan sub-district, Trenggalek.

RESEARCH METHODS

The research design used was observational with a cross-sectional approach. This research was conducted on milkers who use their hands in Bendungan District, Trenggalek Regency. The population in this study was 32. The sampling technique used in this study was *cluster sampling*. This study aims to analyze the factors that affect the content of *Escherichia Coli* in cow's milk in Bendungan District, Trenggalek Regency. Respondents who meet the research criteria are then given informed consent before filling out a questionnaire containing personal identity, questionnaire. The data obtained are then processed using logistic regression statistical tests and analyzed using the SPSS program. The analysis is carried out to see whether there is a relationship between each independent variable and the dependent variable.

RESEARCH RESULT

Respondent Characteristics

Based on the research results that have been collected by researchers from the characteristics of respondents, the following results were obtained:

a. Respondent Characteristics Based on Education

Table 3.1 Characteristics of Respondents' Education in Bendungan District

No	Education	Frequency	(%)
1	SD	14	43.8
2	JUNIOR HIGH SCHOOL	10	31.3
3	SENIOR HIGH SCHOOL	8	25.0
Total		32	100.0

Based on the table above, it can be seen that the characteristics of respondents based on education are Senior High School (SMA) is 25.0% or 8 people, Junior High School (SMP) education is 31.3 % or 10 people and Elementary School (SD) education is 43.8 % or 14 people.

b. Respondent Characteristics Based on Information Sources

Table 3.2 Respondent characteristics based on information sources

No	Resources	Frequency	(%)
1	Mass media	12	37.5
2	Health workers	20	62.5
Total		32	100.0

Based on Table 3.2 Based on the diagram above, it can be seen that the characteristics of respondents based on information sources from mass media are 37.5%, namely 12 respondents, and information sources from medical personnel are 62.5%, namely 20 respondents.

c. Respondent Characteristics Based on Milking Duration

Table 3. 3 Respondent Characteristics Based on Milking Duration

No	Milking Time	Frequency	(%)
1	> 6 months	2	6.3
2	1 year	4	12.5
3	> 1 Year	26	81.3
Total		32	100.0

Based on Table 3.3, it is known that the duration of milking > 1 year is 81.3 %, namely 26 respondents, the duration of milking for 1 year is 12.5%, namely 4 respondents, and the duration of milking > 6 months is 6.3%, namely 2 respondents.

A. Special Data

1. Personal hygiene

Table 3.4 Personal hygiene of cow milkers in Bendungan District Trenggalek Regency in 2020

No	Personal Hygiene	Frequency	(%)
1	Not enough	17	53.1
2	Enough	7	21.9
3	Good	8	25.0
Total		32	100.0

Based on table 3.4, it is known that the personal hygiene of milkers is in the poor category for 17 respondents (53.1%), the sufficient category for 7 respondents (21.9%), and the good category for 8 respondents (25%).

2. Equipment sanitation

Table 3.5 Sanitation equipment in Bendungan District, Trenggalek Regency

2020

No	Equipment Sanitation	Frequency	(%)
1	Not enough	16	50.0
2	Enough	8	25.0
3	Good	8	25.0
Total		32	100.0

Based on table 3.5, it is known that the sanitation of equipment in the category of less than adequate was 16 respondents (50%), the sanitation of equipment in the category of sufficient was 8 (25%) and the sanitation of equipment in the category of good was 8 respondents (25%).

3. Cage Sanitation

Table 3.6 Sanitation of Cages in Bendungan District, Trenggalek Regency

2020

No	Cage Sanitation	Frequency	(%)
1	Not enough	21	65.6
2	Enough	5	15.6
3	Good	6	18.8
Total		32	100.0

Based on table 3.6, it is known that 21 respondents (65.6 %) are included in the inadequate category, 5 respondents (15.6 %) are included in the adequate category, and 6 respondents (18.8 %) are included in the good category .

4. Cow Cleanliness

Table 3.7 Cleanliness of Cows in Bendungan District, Trenggalek Regency 2020

No	Cow Cleanliness	Frequency	(%)
1	Not enough	20	62.5
2	Enough	10	31.3
3	Good	2	6.3
Total		32	100.0

Based on Table 3.7, it is known that 20 respondents (62.5%) have cow cleanliness that is categorized as lacking, 10 respondents (31.3%) have cow cleanliness that is categorized as sufficient, while 2 respondents (6%) have cow cleanliness that is categorized as good.

5. *Escherichia Coli*

Table 3.8 *Escherichia Coli* content in dairy cows' milk in Bendungan District, Trenggalek Regency in 2020.

No	<i>Escherichia Coli</i>	Frequency	(%)
1	Not eligible	21	65.6
2	Qualify	11	34.4
Total		32	100.0

Based on Table 3.8, it is known that the majority of respondents who milk cows, based on the results of the E-Coli examination, are included in the category of not meeting health requirements, namely 21 respondents (66%) out of a total of 32 respondents.

B. Statistical Test Results

Table 3.19 Results of Logistic Regression Statistical Analysis of the Influence of Hygiene and sanitation of *Escherichia Coli* content in dairy cow's milk in Bendungan District, Trenggalek Regency

No.	Variables	B	Wald	Sig	OR	R Square	Simultaneous Sig	Hosmer Sig
1.	Personal Hygiene	2.231	4.104	0.043	9.308			
2.	Equipment Sanitation	2.966	4.029	0.045	19,404			
3.	Cage Sanitation	2,900	3.920	0.048	18,181	0.571	0.002	0.559
4.	Cow Cleanliness	2.254	4.273	0.039	9,530			

Based on Table 3.19, we get:

1. There is a significant influence of *personal hygiene* on the content of *Escherichia Coli* in cow milkers in Bendungan District, Trenggalek Regency (*P Value* $0.043 < 0.05$, then H_0 is rejected). The magnitude of the influence is indicated by the OR value. Personal Hygiene variable with OR 9.308, then respondents with poor *personal hygiene* (code 0) are more at risk of being contaminated with *Escherichia Coli* bacteria. as much as 9,308 times more than respondents who have fairly good personal hygiene.
2. There is a significant influence of equipment sanitation on the content of *Escherichia Coli* in cow milkers in Bendungan District, Trenggalek Regency (*P Value* $0.045 < 0.05$ then H_0 is rejected). The magnitude of the influence is indicated by the OR value. Personal Hygiene variable with OR 19.404 then respondents who have poor equipment hygiene (code 0) are more at risk of being contaminated with *Escherichia Coli* bacteria as much as 19,404 times compared to respondents who have fairly good equipment hygiene .
3. There is a significant influence of barn sanitation on the content of *Escherichia Coli* in cow milkers in Bendungan District, Trenggalek Regency (*P Value* $0.048 < 0.05$ then H_0 is rejected). The magnitude of the influence is indicated by the OR value. The cage sanitation variable with OR 18.181 So respondents who have poor equipment hygiene (code 0) are at greater risk of being contaminated by *Escherichia Coli* bacteria. as many as 18,181 times higher than respondents who have fairly good cage sanitation .
4. There is a significant influence of cow cleanliness on the content of *Escherichia Coli* in cow milkers in Bendungan District, Trenggalek Regency (*P Value* $0.039 < 0.05$ then H_0 is rejected). The magnitude of the influence is indicated by the OR value. The variable of cow cleanliness with OR 9.530 So respondents who have poor equipment hygiene

(code 0) are at greater risk of being contaminated by *Escherichia Coli* bacteria. as many as 9,530 times higher than respondents who have fairly good cow hygiene .

All x variables have a significant influence on the y variable where the sig x value is 0.002 . The ability of the independent variable to explain the dependent variable is 57%, this means that there are 43% other factors outside the research that explain the dependent variable.

DISCUSSION

A. The Presence of *Escherichia Coli* in Cow's Milk .

this study showed that most of the respondents who milked cows were reviewed from the results of the *Escherichia Coli* examination , including the category of not meeting health requirements, namely 21 respondents (66%) out of a total of 32 respondents. *Escherichia coli* is one of the bacteria that causes contaminants in milk. *Escherichia coli* is a bacteria that can cause diarrhea (Fikri et al., 2018).

Milk is a food that has the potential to be a medium for spreading bacteria (Yusuf, 2011). One indication of contaminated milk is the presence of *Escherichia coli* bacteria that contaminate milk exceeding the microbial contamination limit set by the National Standardization Agency. The National Standardization Agency sets the maximum limit for microbial contamination in milk at <3 APM/ml (SNI 7388: 2009). *Escherichia coli* is one of the bacteria that causes contamination in milk. *Escherichia coli* is a bacteria that can cause diarrhea (Fikri et al., 2018). *Escherichia coli* can ferment milk lactose by producing acid and gas (Pelczar and Chan 1988 , cited in Sofyan 2010) thereby causing damage and a decrease in the quality of milk.

Escherichia coli actually is type microorganisms Which normal found in the digestive system of livestock. Many of the *Escherichia coli* strains completely harmless, but some types can cause severe diarrhea and even death (Akmaliah 2006).

Symptoms of disease caused by pathogens arise because the bacteria enter the body through food and can multiply in the digestive tract and cause symptoms of stomach ache, diarrhea , vomiting, nausea and other symptoms. Such pathogenic bacteria include *Escherichia Coli*, *Salmonella typhi* and *Shigella dysenteriae*. To cause disease, the number of pathogenic bacterial cells consumed must be sufficient. This infectious dose varies between organisms and between individuals. One type of bacteria that contaminates milk is *Escherichia coli* .

Escherichia coli bacteria in milk indicates that the milk is not hygienic in its handling. Given the very easy occurrence of contamination in milk, especially contamination by microbes, the handling of contamination by microbes such as *Escherichia coli* must start from the stage when milk starts to come out of the udder (milking stage). When starting milking, the cow's udder and thigh fold area should be wiped with a clean cloth that has been moistened with warm water to minimize dirt on the udder. Cutting the hair in the thigh fold area will ensure the cleanliness of the milk. Cleaning by hand alone still dirty the udder. At the time of the first milking, the farmer wipes the udder and teats using a warm cloth .

It was found that most of the respondents who milked cows were reviewed from the *Escherichia coli* examination , including the category of not meeting health requirements. This is possible for bacterial contamination to occur, which can be caused by poor *personal hygiene* , poor equipment *hygiene* , poor *barn sanitation and cow cleanliness*.

B. The Effect of *Personal Hygiene* of Cow Milkers on *Escherichia Coli* Bacterial Content

Previous data obtained there is a significant influence of *personal hygiene* on the content of *Escherichia Coli* in milking cows in Bendungan District, Trenggalek Regency in 2020 (*P Value* 0.043 <0.05 then *Ho* is rejected). The magnitude of the risk of the presence of *Escherichia Coli* bacteria in cow's milk, poor milker hygiene has a risk of the presence of *Escherichia Coli* bacteria in milk by 9.3% times greater than good milker hygiene with the presence of *Escherichia Coli* bacteria that have met the requirements, it is known that personal hygiene with *Escherichia Coli* content is included in the less category, namely 14 respondents (43.8%).

This problem illustrates how important it is to maintain the safety and quality of dairy cow production so that it does not become a medium for bacterial growth. Bacterial contamination in fresh cow's milk can be prevented through good hygiene efforts such as maintaining and protecting the health of each milker and their cows. Hygiene in milking greatly affects the production and quality of milk produced by dairy cows. Wrong methods, poor personal hygiene of milkers can cause mastitis which will affect milk production (Nurhadi 2012).

The results of this study are also supported by the research of Syarif et al in 2011, namely that contamination or contamination of microorganisms in milk can come from milked cows, one of which is from the hands of milkers who are not clean during milking. In addition, according to Navyanti and Andriani in 2015, which stated that milk hygiene and sanitation are included in the category of not meeting the requirements, this is because milkers do not always wash their hands, milkers only wash their hands with clean water without using soap or disinfectant.

This condition shows that the milker's hygiene is still poor, therefore the milker should pay more attention to the milking hygiene. Do not use lubricants to milk cows. Personal hygiene is important because it can stop the spread of bacteria from farmers who milk cows. Every individual can carry disease-causing bacteria on: skin, hair, dirty nails, clothes, and become a source of food contamination. However, as a carrier of disease or poison, milkers are often unaware of the symptoms of disease in their bodies that can cause contamination of cow's milk .

C. The Effect of Cow Pen Sanitation with *Escherichia Coli* Bacteria Content

From the research it was found that there was a significant influence *barn* sanitation on *Escherichia Coli* content in cow milking in Bendungan District, Trenggalek Regency in 2020 (*P Value* 0.048 <0.05 then *Ho* is rejected). The magnitude of the risk of the presence of *Escherichia Coli* bacteria in cow's milk, Poor barn sanitation has a risk of the presence of *Escherichia Coli* bacteria in milk by 18% times greater than good barn sanitation with the presence of *Escherichia Coli* bacteria that have met the requirements, it is known that barn sanitation with *Escherichia Coli* content is included in the less category, namely 16 respondents (50.0%).

It can be concluded that, there are still many farmers whose pen sanitation is poor, such as farmers do not clean the pen before milking and only move the cow dung under the cow, do not sweep the pen floor or provide disinfectant. And also there are still many cow dung only piled next to the pen and even very close to the pen there is no > 25 m from the pen. Based on the results of the questionnaire answers of 19 respondents, the distance of waste disposal to the pen/milking place is <25m, this is contrary to the theory

of waste disposal distance according to the Ministry of Agriculture, number 422/Kpts/O.210/7/2001, which is > 25 m from the pen. In addition, a clean pen makes the cows comfortable, and farmers are happy to work in the pen. Sweep the pen floor and collect the dung away from the milking place. Use a different broom/shovel for food and dung (Suardana and Swacita, 2009).

The results of this study were also strengthened by Permatasari (2018), who said that as many as 65% of the total respondents' sanitation status was still lacking. It can be concluded that there are still many farmers whose sanitation is poor, such as farmers who do not clean the cage before milking and only move the cow dung under the cow, do not sweep the floor of the cage or provide disinfectant. And also there are still many cow dung only piled next to the cage and even very close to the cage, there is no > 25 m from the cage.

Therefore, farmers should pay more attention to the cleanliness of their pens, especially the cleanliness of the pens during milking and make a cow dung house that is at least 20 m away from the pen and process it so that it can be used. If the pen is clean, it will prevent milk from dirt. Maintaining pen sanitation is one of the important things to maintain good milk quality. If the sanitation of the pen is poor, it will cause a lot of bacteria.

D. The Influence of Hygiene of Cow Milking Equipment on *Escherichia Coli* Bacterial Content .

The results of the study showed that there was a significant influence *equipment* hygiene on *Escherichia Coli content* in cow milking in Bendungan District, Trenggalek Regency in 2020 (*P Value* $0.045 < 0.05$ then H_0 is rejected). Milking equipment bad milk has a risk of the presence of *Escherichia Coli bacteria* in milk that is 19% greater compared to good milking equipment with the presence of *Escherichia Coli bacteria* that has met the requirements, it is known that the hygiene of equipment with *Escherichia Coli content* is included in the poor category, namely 12 respondents (37.5%).

Equipment hygiene greatly affects the presence of microorganisms in milk because the equipment is in direct contact with milk. So that it triggers bacteria to grow on the equipment and can eventually contaminate the milk. The total number of germs that exceeds the standard is partly caused by equipment sanitation that does not meet the requirements. This is mostly because farmers do not immediately clean the equipment for milking and some do not use soap.

This is in accordance with research. According to research by Feryalin Navyanti and Retno Adriyani (2015) , contamination is often caused by equipment. or container at the time of milking in dirty or not kept clean.

Based on the respondents' answers, most respondents answered that the equipment was not washed with warm water before milking (19 respondents), some respondents said that the equipment used was not cleaned immediately after use (15 respondents), milkers who cleaned the milking equipment using warm water and soap (17 respondents), and only 16 respondents answered that they cleaned the equipment using disinfectant.

Washing equipment such as buckets, milk cans, bottles and others should be done using hot water. This can dissolve the milk fat that sticks to the equipment. Place the equipment in a dry place in an inverted position. Bacteria cannot grow in a dry place (Suardana and Swacita, 2009). From the respondents' answers, 18 people did not place the equipment in a dry place in an inverted position so that bacteria could easily grow.

Based on the research that has been done, it can be concluded that poor equipment sanitation causes the risk of *Escherichia Coli bacteria* in milk. There are still many farmers who do equipment maintenance in an incorrect way. Most farmers do not immediately wash the milk can (milk container) and when washing only use water without using soap and not scrubbing, causing the remaining milk to settle. If this happens often, the milk sediment will increase and be difficult to remove and eventually cause the presence of *Escherichia Coli bacteria* in the milk. For that, as a farmer, you should take care of the equipment for milking properly after use, the equipment should be washed immediately using soap and warm water and stored away from dirt. It is better if the equipment is really clean and dry before use. Washing and caring for food equipment is intended to prevent bacteria from growing and spreading in food. Bacteria will easily grow if they are in a dirty environment.

E. The Influence of Cow Cleanliness on the Presence of *Escherichia Coli* Bacteria .

The research results showed that there was a significant influence *cow* hygiene on *Escherichia Coli content* in milking cows in Bendungan District, Trenggalek Regency in 2020 (*P Value* 0.039 <0.05 then *Ho* is rejected). Poor cow hygiene has a risk of the presence of *Escherichia Coli bacteria* in milk by 9.5% times greater than good cow hygiene with the presence of *Escherichia Coli bacteria* that have met the requirements, it is known that cow hygiene with *Escherichia Coli content* is included in the less category, namely 17 respondents (53.1%).

Unhealthy and unclean cows when milked will produce milk that contains a lot of bacteria. Especially the health and cleanliness of the udder must be considered. This is in accordance with the opinion of Santoso et al. (2010), that the cleanliness of the pen and the body of the livestock is closely related to the quality of milk.

Based on the research, it can be seen that the majority of dairy farmers pay less attention to the cleanliness of their cattle, especially in terms of bathing the cattle, the water used to clean the thighs, udders and teats. If the cattle are not prepared as well as possible, when the cattle are milked, it will affect the number of germs in the milked milk. The total number of germs that exceeds the standard is partly caused by the health and cleanliness of the cattle that do not meet the requirements.

Cleanliness and health of cows can directly affect the number of bacteria in milk, because clean cows will produce good milk. Maintaining the cleanliness and health of cows is done by bathing and cleaning important parts such as the thigh folds and around the anus, udders and nipples . Before milking, the thighs, udders and nipples are cleaned first using warm water. The use of warm water is intended to kill bacteria or microorganisms found in these parts. The body of the cow, especially the skin, is often dirty due to peeling skin, dust, mud, and cow dung that sticks with sweat and cow fat . If the cow is not prepared as well as possible, when the cow is milked it will affect the number of germs in the milk. The total number of germs that exceeds the standard is partly caused by the health and cleanliness of the cow that does not meet the requirements.

CONCLUSION

Based on the results and discussion of the research, it can be concluded that :

1. Most of the milking respondents reviewed from the *Escherichia Coli examination* were included in the category of not meeting health requirements, namely 21 respondents (66%) of the total 32 respondents.
2. There is a significant influence of personal hygiene on the content of *Escherichia Coli* in cow's milk in Bendungan District, Trenggalek

3. There is a significant influence of cattle pen sanitation on the content of *Escherichia coli* bacteria in Bendungan District, Trenggalek
4. There is a significant influence of the hygiene of cow milking equipment on the content of *Escherichia coli* bacteria in Bendungan District, Trenggalek
5. There is a significant influence of cow cleanliness on the presence of *Escherichia coli* bacteria in Bendungan sub-district, Trenggalek .

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