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**Relationship between Milker's Personal Hygiene and Sanitation with Contamination of *Escherichia coli* in The Fresh Cow Milk in People's Livestock in Umbulharjo, Cangkringan, Sleman**

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**ABSTRACT**

**Background:** Fresh cow's milk is an almost complete source of nutrition. The condition with a less clean environment can ease the occurrence of milk's contamination. The contamination can come from a variety of sources such as cow's skin, the udder water, soil, dust, human handling, equipment, and air. The most common contamination in cow's milk is from bacteria. One of the bacteria is *Escherichia coli*. The objectives of the research are to determine the relation of the personal hygiene of the cow milkers and sanitation with *Escherichia coli* bacterial contamination in fresh cow's milk. **Methods:** This research was a quantitative research with the cross-sectional approach with total sampling technique used which means the sample was all of the cow milkers in the village. The research used questionnaires, laboratory tests, and analysis of data used univariate and bivariate test with Fisher's exact statistical test. The laboratory tests used MPN *Escherichia coli*. **Results:** According to this research showed about 55% of respondent did not have good personal hygiene. The sanitation variable showed the majority of cow milkers did have no good sanitation about 62.5%. From 40 samples of fresh cows milk, 32 samples of milk were contaminated by the *Escherichia coli*. The relation between the personal hygiene of cow milkers with the contamination of *Escherichia coli* showed the (p-value 0.014) and for the relations between sanitation with the contamination of *Escherichia coli* in fresh cows milk bout (p-value 0.036). **Conclusion:** There was a relation between the personal hygiene of cow milkers and sanitation with *Escherichia coli* bacterial contamination in fresh cows milk in the people's farm of Gondang Umbulharjo, Cangkringan, Sleman.

**Keywords:** Cow milkers, Personal hygiene, Sanitary, *Escherichia coli*

**INTRODUCTION**

Cows produce about 50% of the world's meat needs, 95% of milk and 85% of skin needs. For centuries cows have always been chosen for high milk production, so now dairy cows are one of the most efficient milk producers. A dairy cow can produce about 5000 liters of milk per year<sup>(1)</sup>. The benefit of milk as a human food ingredient is that the proportion of nutrients is in an optimal ratio so that it is easily digested and has nothing left<sup>(2)</sup>. Unclean environmental conditions can facilitate the occurrence of pollution in milk. Pollution can come from various sources such as cow leather, udder, water, soil, dust, humans, equipment, and air. Subsequent pollution arises from unclean milking tools, air, flies and human handling<sup>(3)</sup>. Milk is considered a high-risk food and has been involved in many things related to foodborne diseases throughout the world both when consumed raw and processed<sup>(4)</sup>. Milk can cause a disease commonly referred to as milkborne disease because of its role as a medium of transmission. Cow's milk is a good food for humans and also for bacteria. Bacteria that contaminate milk in a short time will multiply to reach a large number so that the number of cases of infection with intermediaries of milk (cow) is quite high, in addition to humans also have low resistance<sup>(2)</sup>. Bacteria that can contaminate milk are divided into two groups, namely pathogenic bacteria and spoilage bacteria. The most bacteria found in milk is classified into Lactobacillaceae and Streptococaceae. *Escherichia coli* is a bacterium that is often found but its existence is undesirable and undesirable in any number because this bacterium is very influential on the quality of dairy products<sup>(5)</sup>.

The still low quality of milk from breeders, is generally due to the cleanliness of the cage, the health of udder cows, and the cleanliness of milking equipment is still lacking attention. Humans who are in the process of milking and processing milk can be a cause of the emergence of bacteria in milk. Hands and other limbs must be sterile when milking and processing milk. Even human breaths when milking and processing milk can be a source of bacteria. Therefore the chain of milk production to processing must be minimized from contamination of various kinds of microorganisms (harmful bacteria) through good milking management<sup>(6)</sup>. A combination of culture, low formal education, economic status, low awareness of food security and lack of adequate infrastructure have been identified as contributing to poor food and beverage handling practices in the informal food sector<sup>(7)</sup>.

The condition of dairy farms in Indonesia, especially community farms, so far has yet to pay attention to environmental sanitation, both sanitation enclosures, sanitation equipment, and sanitation of its own workers. This is evident from the cleanliness of the cages, livestock, and milk equipment that is poorly maintained<sup>8</sup>. Milker's personal hygiene and sanitation are factors that must be considered in order to reduce microbial contamination in fresh cow's milk. *E. coli* presence in fresh cow's milk is limited in "SNI 7388: 2009" which is <3 / ml, because bacterial contamination can reduce the quality of milk. This is supported by several results of previous studies that microbial contamination in cow's milk closely related to milking hygiene and sanitation.

Gondang Hamlet, Umbulharjo, Sleman is a hamlet located just below the slopes of Mount Merapi. There are around 40 active dairy farmers there. Dairy farmers there are on average aged 31-50 years with an education level of 45% of elementary school graduates. Based on a preliminary study conducted by researchers of the two milkers on May 16, 2016, the milker did not use a mask, boots, did not clean his hands with soap before flushing and had a cage very close to the house and lack of sanitary equipment. From the preliminary test of microbiology of cow's milk from the two breeders, the number of *Escherichia coli* APM was > 1,100 / ml. The *Eshcerichia coli* bacterial contamination certainly greatly exceeds the SNI 7388: 2009 quality standard which is allowed on fresh cow's milk which will be consumed directly or for further processing which is equal to <3 / ml.

Based on the above problem, researchers are interested in conducting research to find out whether the milker and sanitation personal hygiene is related to *Escherichia coli* bacteria contamination in fresh cow's milk.

### METHODS

This research was a quantitative study using a cross-sectional design. The sampling technique in this study used the Total Sampling technique which means that all respondents were sampled as research. The population and sample in this study were 40 milkers/dairy farmers in Gondang Umbulharjo Cangkringan, Sleman. The instrument used in this study was a questionnaire created by researchers that had been tested for validity and reliability testing. Laboratory tests are used to find out the most likely number of *Escherichia coli* bacteria in fresh cow milk samples taken during morning milking at 04.00 Western Indonesia Time.

### RESULTS

This study used 40 respondents of fresh cow farmers/milking farmers in Gondang, Umbulharjo Cangkringan, Sleman, Yogyakarta. Characteristics of respondents can be seen in the following table:

Table 1. Distribution of gender, age, educational level, milker's personal hygiene, sanitation and contamination of *Escherichia coli* in fresh cow milk

No.	Variable	Frequency	Percentage
1	Gender		
	a. Male	24	60
	b. Female	16	40
2	Age		
	a. ≤ 30 Years	2	5
	b. 31-50 Years	26	65
	c. > 50 Years	12	30
3	Educational Level		
	a. No school	3	7.5
	b. Primary school	18	45
	c. Middle school /equivalent	9	22.5
	d. High school /equivalent	9	22.5
	e. Diploma/Bachelor Degree	1	2.5
4	Milker's Personal Hygiene		
	a. Poor	22	55
	b. Good	18	45
5	Sanitation		
	a. Poor	25	62.5
	b. Good	15	37.5
6	Contamination of <i>Escherichia coli</i> Bacteria in Fresh Cow Milk		
	a. Contaminated	32	80
	b. Not Contaminated	8	20

Table 1 showed information that the distribution of breeders/milkers by sex the most were Male by 24 people (60%), the age at most aged between 31-50 years (65%), and the highest level of education was the level of elementary school education about 18 (45%). The distribution of milker's personal hygiene was mostly categorized as not good, that is 22 people (55%) and only 18 (45%) are good and sanitation for the milker was mostly 25 (62.5%) poor sanitation and about 15 milkers (37.5%) having good sanitation. The distribution of *Escherichia coli* bacterial contamination in fresh cow milk samples contaminated amounted to 32 (80%) and not contaminated 8 (20%).

Table 2. Distribution of milker's personal hygiene with contamination of *Escherichia coli*

Variable	Contamination of <i>Escherichia coli</i>				Total		RP (95% CI)	p-value
	Contaminated		Not Contaminated		n	%		
	n	%	n	%				
Personal Hygiene								
Poor	21	52.5	1	2.5	22	55	1.562 (1.068- 2.283)	0,014
Good	11	27.5	7	17.5	18	45		
Total	32	80	8	20	40	100		
Sanitasi								
Poor	23	57.5	2	5	25	62.5	1,533 (0.998- 2.355)	0,036
Good	9	22.5	6	15	15	37.5		
Total	32	80	8	20	40	100		

Table 2 above showed a significant relationship between the milking personal hygiene variables with the contamination of *Escherichia coli* bacteria. There were 2 columns with a nominal expected count of less than 5, the interpretation that can be used the Fisher exact test so that it is obtained the results p-value <0.05 (p = 0.014). The prevalence ratio value was 1,562 (95% CI: 1,068-2,283), which means that bad milker's personal hygiene will increase the risk of contamination of *Escherichia coli* bacteria in fresh cow's milk as much as 1,562 times greater than that of good category milker's personal hygiene. Prevalence ratio value >1 and CI range not including number 1 could be concluded personal milker's hygiene was a risk factor for bacterial contamination of *Escherichia coli* in fresh cow's milk.

From table 2 also was known that the results of the chi-square statistical test (fisher exact test) show a significant relationship between sanitation variables with *Escherichia coli* bacteria contamination because of p value <0.05 (p = 0.036). This was consistent with the theory that sanitation had an influence on the contamination of *Escherichia coli* bacteria.

## DISCUSSION

### Relationship of Milker's Hygiene Personal and Contamination of *Escherichia coli* Bacteria

Personal hygiene of the milker from a total of 40 respondents found that 55% of milkers were said to have bad personal hygiene while 45% of milkers had good personal hygiene. The majority of milkers rarely washed their hands with soap/disinfectant before or after milking and did not use warm water, they only washed their hands using water in the shelter that had been provided. It was very rare to find a milker who used a complete Personal Protective Equipment such as a mask and head covering / hat, whereas such Personal Protective Equipment was useful to reduce bacterial contamination from the mouth and head that had the potential to contaminate milk during the milking process. Milkers also did not have special clothing to wear during the milking process. In addition, most milkers did not carry out regular health checks to health workers to find out whether there was an infection or disease in themselves. In line with previous research, which states that milker's hygiene was related to the total plate count in cow's milk (p = 0.005) <0.05<sup>(9)</sup>. Contamination of fresh milk by *Escherichia coli* bacteria could be from the milker's hands because they wash their hands only with water instead of warm water, and some even did not use soap/disinfectant so that it was possible there were bacteria still attached to the palm of the milking hand. Incomplete was using of PPE by milkers in Gondang Hamlet such as masks, boots, gloves, and headgear/caps could cause bacterial contamination of milk. Germs from the mouth or hair could move at any time through any media such as air. Therefore the complete used of

PPE was aimed at such things. Wulandari et al. (2015) stated that the spread of *Escherichia coli* is from humans to other humans. This bacterium is spread by flies, through dirty hands, fecal contaminated food and drink<sup>(10)</sup>.

Pathogens that may be present in raw milk could come from animals (even from clinically healthy animals) or contamination from the environment during milk collection or storage. Milk is contaminated by direct transfer from the bloodstream (systemic infection) or from udder infection, and cross-contamination, where milk is contaminated by feces, skin or the environment (external contamination during or after milking)<sup>(11)</sup>. Several factors contribute to milk contamination including poor hygienic milkers conditions, contaminated equipment, milking equipment and poor personal hygiene of milk handling<sup>(12)</sup>. Improving environmental sanitation and milking can increase milk quality, as indicated by a decrease in milk acidity and the number of bacteria in milk. The treatment that significantly improves milk quality is washing and drying the udder with a clean cloth during pre-milking sanitation<sup>(13)</sup>.

### Relationship of Sanitation with Contamination of *Escherichia coli* Bacteria

There was a relationship between sanitation and *Escherichia coli* bacterial contamination. The majority of breeders/milkers did not have a special shelter and only accumulate dirt behind the cage causing odor around the cage potentially contaminating milk. *Escherichia coli* bacterial contamination from poor sanitation was in accordance with previous studies, which mentioned the sample in the study contained *Escherichia coli* due to poor livestock sanitation due to the narrow cattle cage that the cattle feces disposal site was not too far from the cattle cage<sup>(14)</sup>. Some milk also doesn't cover the floor of the cage with piles/straw. Many milkers do not clean the udder of the cow before milking it with warm water or clean the folds of the cow's thighs. Cow's tail during the milking process is not tied with legs. Hanafi Research (2013) also states that the udder, nipples and some of the surrounding milk must be clean before milking, but when milking cows, the cows themselves and the cows were tied to the cows' feet because if the tail moves continuously at the time of milking the possibility of dung attached to the tail will fall so that the milk will be contaminated by dirt attached to the body of the cow because milk was a food that was easy to be contaminated<sup>(15)</sup>.

Most of the milkers in Gondang Hamlet did not wash milking equipment with warm water that had the purpose of killing microbes. Most only used storage water to clean it. Milkers also did not provide a special place far from the source of dirt to put the tools. So that it triggers the bacteria to multiply in the equipment and eventually can contaminate milk. Equipment before and after used for milking must be washed using clean water if necessary using detergent and rinsed with hot water (60-70°C) to kill microbes and dissolve milk fat attached to the tools, then the tools were dried<sup>(16)</sup>. Unclean equipment can cause milk to contain a lot of microbes / germs<sup>(11)</sup>. Consumers must be careful in consuming all types of raw milk, to avoid the risk of bacterial contamination from raw milk, it must be done by heating before consuming it. Research by Claeys et al. (2014) states that consuming raw milk can increase the risk of bacterial infection and avoid it by pasteurizing milk or by heat treatment<sup>(17)</sup>.

Milkers, milk sellers and milk collectors must prioritize the cleanliness of milk and the physical aspects of fresh milk. Routines to minimize contamination of fresh milk need to be put in place. Cow milk and milking hands must be washed carefully before milking starts and all containers used to store and transport milk must be cleaned every time the milk was emptied / before being used again<sup>(18)</sup>. Microbial contamination increases at the level of collection due to long holding time at room temperature and collecting milk from different producers in one container. In addition, further contamination might be caused by poor hygienic conditions practiced by milkers while handling milk<sup>(19)</sup>. In addition, milk must be pasteurized before it reached consumers. The cleanliness of milk after pasteurization could be maintained either by cooling milk or by fermenting milk and only selling fermented products. Even if milk was fermented, the temperature must be kept as low as possible to avoid contamination. It was also important to conduct an analysis to monitor the quality of milk production and marketing<sup>(18)</sup>.

### CONCLUSION

There was a personal relationship between hygiene and milking sanitation with contamination of *Escherichia coli* bacteria in fresh cow's milk at the Gondang Umbulharjo Cangkringan Sleman farm. To achieve the safety of fresh milk, it is expected to be able to increase coaching efforts and provide counseling to cow milking actors, especially those who have private cages in order to improve personal hygiene and sanitation in the milking process by District Animal Husbandry Service and the Milk Cooperative. So that the level of contamination of fresh milk by microbes can be minimized. For dairy farmers, it is expected to be able to improve personal hygiene and sanitation in milk in order to reduce microbial contamination in milked cow's

milk. Specifically the behavior of washing hands with soap/disinfectant before milking, the use of PPE, cow hygiene, milking equipment and making cow dung that is not too close to the cage.

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