

Effectiveness of Good Dairy Farming Practice (GDFP) Implementation on the Number of Milk Microorganisms in Smallholder Dairy Farms in Malang District

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Abstract:

Good Dairy Framing Practice (GDFP) is a detailed standard guide for dairy farmer practices, to obtain quality-assured and efficient milk. The application of GDFP by smallholder farmers in Malang Regency is not yet known to be effective on milk quality. The purpose of this study was to determine the effectiveness of GDFP implementation by smallholder farmers in Malang Regency on milk quality by measuring the number of microorganisms produced from the farmers' fresh milk. This study used an interview survey method to 100 dairy farmers in Malang Regency and tested milk quality by measuring the number of bacteria using the Total Plate Count (TPC) method. The results showed the value of GDFP implementation in Malang District in Wagir District and Ngajum District with an average rating of 3.65 and 3.45 included in the good category. The application has effectiveness on the quality of milk produced by measuring TPC found the average number of microorganisms 10.54×10^2 CFU/mL and 12.26×10^2 CFU/mL. The status of fresh milk is safe for consumption according to SNI.

Keywords —Good dairy farming practice, maintenance, total colony count, microorganisms, smallholder farming, dairy cattle.

I. INTRODUCTION

The Central Bureau of Statistics (2022) noted that East Java is one of the regions with the most dairy farmers in Indonesia. East Java's smallholder dairy farmers also have an average score categorized as good in the application of Good Dairy Framing Practice (GDFP). Good dairy farming practices (GDFP) is a standard or detailed guide to good agricultural practices for dairy farmers, emphasizing safe, quality-assured and sustainable milk that supports the future of dairy farming on a local, national and international scale (FAO, 2011). Farmers in Kediri District and Batu City are among those in the good category with an average score of 3.59 and 3.81 (Maurifah, et. al.,

2023). The implementation of GDFP in all strata of smallholder farmers in East Java covers the territory of Indonesia in 6 aspects, some of which are categorized as sufficient or even poor. Research conducted by Susilorini, et. al. (2022), the results of the implementation of all strata of East Java farmers are as follows: animal health is good enough score 2.68-2.70, milking hygiene is good score 3.19-3.42, nutrition is good enough score 2.86-2.97 in strata I and III and good in strata II score 3.03, animal welfare is good enough score 2.56-2.60, environment is good enough 2.34-2.50 and socio-economic management is not good score GDFP = 1.60-1.92.

On smallholder dairy farms in Pondok Ronggon Village, Jakarta is categorized as good

enough 2.28. The highest GDFP average value is in the aspect of breeding and reproduction of 3.14 good category and the lowest value is in the aspect of livestock health of 1.17 poor category (Anggraeni & Mariana, 2016). Technical evaluation of people's dairy cows in Karo Regency, the highest GDFP value is in the management aspect of 3.05 in the good category and the lowest GDFP value is in the livestock health aspect of 1.52 in the poor category (Simamora, et. al., 2015). Farm management carried out by farmers is the key to success in a dairy farming business (Firman et. al., 2017). In its application, smallholder farmers have not realized that the quality of milk produced is related to the application of GDFP standards by farmers. Therefore, smallholder farmers tend to underestimate the 6 aspects of GDFP implementation in their farms.

The implementation of maintenance management in 6 aspects of GDFP is necessary to maintain the quality of dairy products (Arrifien, et. al., 2023). If not applied, it causes a decrease in the quality of milk produced by farmers. One of the decreases in milk quality is due to the presence of contamination in milk from dirty cage conditions, poor equipment sanitation and hygiene, to low maintenance management (Asmaq & Marisa, 2020). Thus, food safety of cow's milk is an important factor to maintain the quality of milk produced from dairy cows so as not to experience damage and microorganism contamination (Diannisa, 2023).

Milk that is quality and safe for consumption must comply with SNI 3141.1 quality standards, (2011), one of the testing standards is total plate count (TPC) testing. Total Plate Count (TPC), is a test of microorganisms using agar media as a culture site for aerobic and anaerobic bacteria found in fresh milk (SNI 8984, 2021). In Krucil District, Probolinggo Regency, East Java, the microbiological quality of fresh milk using the Total Plate Count (TPC) method has an average TPC of 7.4×10^4 CFU/mL (Cahyono, et. al., 2013). Research conducted in Yogyakarta milk cooperatives by measuring the number of bacteria using the TPC method showed the total bacteria of cow's milk had an average total number of milk bacteria from KWM and KUTT exceeding the

requirements of the Indonesian National Standard (SNI) 3141.1-2011 which is 1.0×10^4 CFU/mL (Septiani & Darsini, 2014).

The purpose of this study was to determine the effectiveness of GDFP implementation of smallholder farmers in Malang Regency, on milk quality by measuring the number of microorganisms produced from the milk of smallholder farmers. The application of comprehensive Good Dairy Farming Practices (GDFP) can be the first step that has the effectiveness of maintaining milk quality in the scope of smallholder farmers (Susilorini, et. al., 2022). The aspects of GDFP used in maintaining milk quality by preventing contamination are carried out starting from the scope of farmers such as farm conditions and environment, livestock conditions, worker conditions, equipment used, and milking management (Diannisa, 2023). This research proves the effectiveness of GDFP implementation by smallholder farmers in Malang Regency with the quality of milk produced. It is expected that the results obtained from this study can provide useful information to improve the management of dairy cows, so as to improve the quality of milk of dairy cows.

II. MATERIALS AND METHODS

A. Material

This research was conducted for 1 month from November 01, 2023 - November 30, 2023. Located in Malang Regency, Wagir and Ngajum Districts. The total respondents used consisted of 100 Peranakan Frisien Holstein (PFH) dairy farmers spread across 2 sub-districts in Malang Regency, namely Wagir District as many as 45 farmers and Ngajum District as many as 55 farmers. Total dairy cows owned by respondent farmers are 1119 heads.

B. Methods

This study used survey and interview methods. Data were collected through field observations and direct interviews with farmers. The substance of the interview includes five aspects consisting of aspects of livestock health, hygienic milking aspects, livestock nutrition aspects,

livestock welfare aspects, and environmental aspects. The assessment of technical aspects of maintenance refers to the research of FAO (2011), which was modified. Furthermore, the research data were analyzed descriptively and then compared with the technical aspects of dairy cattle rearing qualitatively and quantitatively. The achievement of the implementation of technical aspects based on GDFP was assessed by giving points 4, 3, 2, 1, and 0 to each alternative answer in Table 1 (Muarifah, et. al., 2023).

TABEL I
THE GRADE OF THE PERFORMANCE SCORE

Implementatiopn of GDFP Score	Grade
0,00 - 0,50	Very Bad
0,51 - 1,00	Bad
1,01 - 2,00	Not Good
2,01 - 3,00	Good Enough
3,01 - 4,00	Good

Parameters for giving points that are categorized as good by looking at how farmers apply good dairy cattle maintenance according to the GDFP blend. The application of GDFP in the Health Aspect can be categorized as good if the farmer applies each point in the health aspect such as in the point Forming Cattle with Disease Resistance by selecting cattle that can adapt to the farm environment, considering maintenance management skills (availability of land, infrastructure, feed and water) and conducting vaccines based on recommendations by local animal health.

C. Measurement of Total Plate Count (TPC)

Total bacterial counts were performed under sterile conditions. Petrifilming is done by placing 1 ml of milk sample in the center of the petrifilm with a pipette, then the petrifilm is closed again carefully so that no air bubbles are formed. After that, press in the middle of the petrifilm with a special press called a spreader. Next, the petrifilm was put into an incubator for incubation at 34°C - 36°C for 2 x 24 hours (Widiyastuti, et. al., 2017). After that, the

calculation of total bacteria was carried out in accordance with the calculation guidelines of SNI 2897-2008 (Syaifulina, 2008).

$$TPC \text{ Value} = \frac{\text{Average Colony Count} \times (1)}{(DF)}$$

Description:

DF = Diluent Factor

III. RESULTS AND DISCUSSION

A. GDFP Assessment on Technical Aspects of Maintenance

The technical aspects of raising dairy cattle in Malang District in Wagir District and Ngajum District are presented in Table 2, and the average results show that the GDFP value of farmers in Wagir District and Ngajum District falls into the good category (3.65 and 3.45). The GDFP value of the technical aspects of maintenance in this study is higher than the research of Komala, et. al., (2022) on dairy cows in the Cijeruk Independent Livestock Group, Bogor Regency with an average value of 2.90 with a sufficient category. The GDFP value of smallholder dairy farmers in Cibungbulang, Bogor Regency in the dry season and rainy season found the results of 2.79 and 2.69 in the moderate category (Asminaya, et. al., 2018).

The GDFP value in the environmental aspect found the lowest implementation value in Ngajum Sub-district with a GDFP value of 2.70 including the sufficient category, this is because some farmers do not process livestock waste by leaving it alone and some process waste by making it into organic fertilizer by flowing waste into the forage land owned by farmers. A small number of farmers in Wagir and Ngajum sub-districts have modern waste management by processing it into biogas. However, the value of GDFP implementation in the environmental aspect in Wagir and Ngajum sub-districts is better than the Cijeruk Independent Livestock Group in Bogor district with a value of 2.00 in the environmental aspect implementation category (Komala, et. al., 2022).

TABEL II
THE IMPLEMENTATION LEVEL OF GDFP IN SMALLHOLDER FARMS

Aspects	Wagir Subdistrict		Ngajum Subdistrict	
	GDFP Score	Implementation Category	GDFP Score	Implementation Category
Animal Health	3.80	Good	3.75	Good
Milking Hygiene	3.75	Good	3.65	Good
Feeding and Water	3.81	Good	3.69	Good
Animal Welfare	3.66	Good	3.46	Good
Environment	3.24	Good	2.70	Good Enough
Average	3.65	Good	3.45	Good

B. Animal Health

The results of the GDFP assessment of Animal Health aspects in Figure 1 in Wagir and Ngajum sub-districts with a mean score of 3.80 and 3.75 are categorized as good. Farmers in Wagir and Ngajum sub-districts are able to recognize the symptoms of sickness and health of their animals. Farmers in East Java, one of which is in Kediri District and Batu City, have the same GDFP value results as this study, because in general it is in the good category, and farmers are able to recognize the symptoms of healthy and sick livestock (Muarifah, et. al., 2023).

Farmers in Wagir and Ngajum sub-districts also have Animal Health programs from the Livestock Service Office of Malang District, partnerships, and dairy cooperatives that work with dairy cattle groups in Wagir and Ngajum sub-districts. Sulastri and Maharjan (2002) stated that dairy worker cooperatives provide regular extension programs that focus on Cattle Health issues, feeding, forage cultivation, and breeding improvement. This Animal Health program includes routine vaccination, disease management due to microorganisms, disease management due to injury, forage poisoning, and the entry and exit of new livestock and strangers on the farm. According to Arifin, et. al. (2022), vaccination is given to provide

immunity to livestock so that they can fight antigens or microorganisms that cause disease. Vaccination is carried out by animal health. The role of animal health in the aspect of maintenance management is very important because it will affect the productivity of livestock both in terms of medical or non-medical and protect the balance of the environment and maintain the preservation of genetic resources (Munir, et. al., 2020).

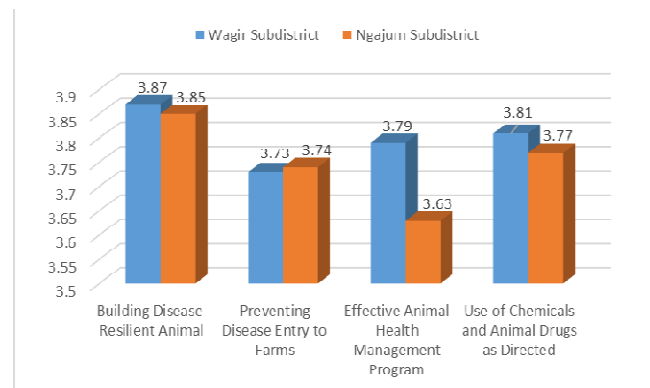


Fig 1. The Score of GDFP in Animal Health

C. Milking Hygiene

The results of the GDFP assessment of the cleanliness aspect of milking in Figure 2 in Wagir and Ngajum sub-districts with an average score of 3.75 and 3.65 with a good category. Before milking, Wagir and Ngajum sub-district farmers will clean the cage from cow dung, cow urine and grass debris in the cage at least 2 times a day. At BBPP Batu, the same cage cleaning is carried out as in Wagir and Ngajum, before milking the cows, cleaning the cage from cow dung, urine, grass debris both in the cage and around the cage location (Arifin, et. al., 2022).

When the pen is clean of dung and feed residue, the farmer will clean the cow by rubbing the cow's body surface, thigh folds, udder and other parts. Most farmers have realized how important it is to keep cattle and pens clean to maintain health and milk quality (Komala, et. al., 2022). In the study of Arifin, et. al. (2022), Before milking, the udder is cleaned first using water from a hose and then given a disinfectant, after which the udder is dried with a soft cloth. The pre-milking process of this study is also in accordance with Mihardi, et. al.,

(2019), stating that before milking the breeder cleans the udder using a towel moistened with warm water and then cleaned using alcohol with the aim of giving warm water and alcohol to prevent contamination from microbes.

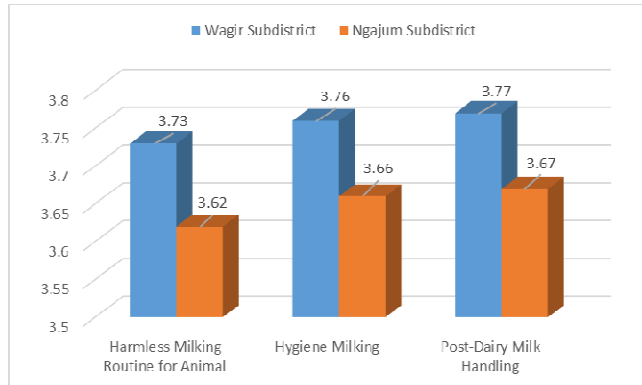


Fig 2. The Score of GDFP in Milking Hygiene

The results of the GDFP score for the hygiene aspect of the milking routine did not injure livestock received the highest score in the good category. This is because most farmers in Wagir and Ngajum sub-districts conduct pre-milking and milking processes in accordance with the GDFP guidelines, namely washing the udder then rinsing it with warm water and drying the udder with a dry towel. This treatment is like Kumssa (2018), the pre-milking treatment includes washing the teats (udder) and drying them with a towel. The treatment before milking also ensures that the milkers' hands are clean and hygienic by washing hands with soap and spraying disinfectants on the milkers' hands and drying the milkers' hands with a clean towel. Arifin et. al. (2022), stated that milkers must also maintain hygiene by washing their hands before milking, and also using a clean uniform/wearpack. This is in accordance with Hijriah et. al. (2016), stating that before milking, the milkers' hands and milking equipment are first washed with soap and brushed until clean.

Post-dairy milk handling in Wagir and Ngajum sub-districts in Malang districts scored 3.77 and 3.67 in the good category. Post-dairy milk handling is carried out immediately sent to the milk collection place at the group leader, partnership and cooperative. Group leaders, partnerships and milk collection cooperatives in Wagir and Ngajum sub-

districts have a tight timeline for farmers' post-dairy milk deposits. This strict timing is because the post-dairy collection points have milk quality tests such as specific gravity test, moisture content test, and bacteria count. This is done to avoid contamination of harmful microorganisms that reduce milk quality. This treatment is in accordance with Komala, et. al., (2022), milk is deposited into the cooling unit located at the holding post, testing the specific gravity test, fat content, total water content, and total bacteria individually.

D. Nutrition (Feed and Water)

The results of the GDFP assessment of livestock health aspects in Figure 3 in Wagir and Ngajum sub-districts with an average value of 3.81 and 3.69 are in the good category. The same results as the research of Muarifah, et. al. (2022), the application of livestock nutrition aspects in smallholder farmers in Kediri District and Batu City was 3.46 and 3.56 in the good category. In Wagir and Ngajum Districts, farmers have their own forage land, while concentrate feed is obtained by farmers from partnerships and cooperatives to meet the nutritional needs of cows in milk production. Variations in the amount of feed given, feed adequacy and water availability will affect milk production (Pasaribu et. al., 2015). Feed availability will greatly affect milk production and livestock holding capacity of dairy farm scale and feeding scenarios (Peters et al., 2016). This shows that aspects of feed and drinking water management have not received good attention from farmers (Asminaya, et. al., 2018).

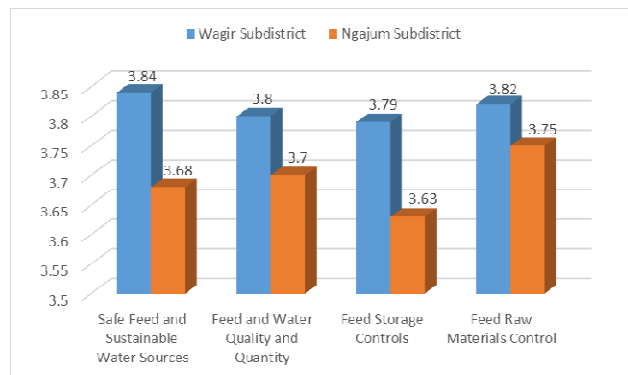


Fig 3. The Score of GDFP in Nutrition (Feed And Water)

E. Animal Welfare

The results of the GDFP assessment of livestock welfare in Figure 4 with the average results of livestock welfare on dairy farms in Wagir and Ngajum sub-districts have a value of 3.66 and 3.46 with the application of GDFP in the good category. Farmers are well aware of the needs of dairy cattle by providing adequate feed and drinking water so that livestock are free from hunger and thirst (Muarifah, et. al., 2022). Animal welfare is a condition related to the non-detrimental condition of farm animals on a farm (Fernandes, et. al., 2021). The aspect of livestock welfare has an impact on the stress level of livestock kept, the more prosperous the livestock is prone to stress and will produce high milk production (Mardhilla and Amini, 2022).

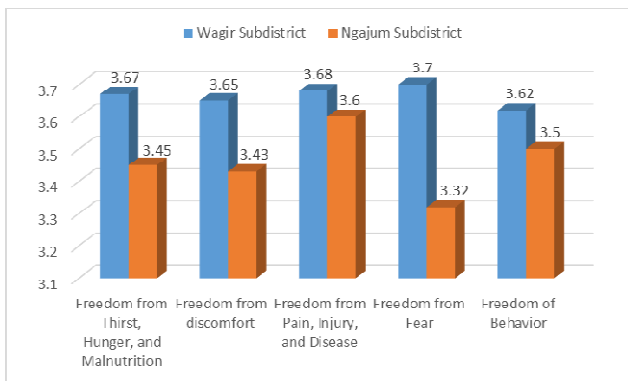


Fig 4. The Score of GDFP in Animal Welfare

F. Invironment

The results of the GDFP assessment of the environment in Figure 5 show that the average GDFP assessment of environmental aspects on dairy farms in Wagir and Ngajum Sub-districts received a score of 3.24 in the Good category and a score of 2.70 in the Fair category. The results of the GDFP value of environmental aspects in Ngajum Sub-district are influenced by the fact that most smallholder farmers do not have good and environmentally friendly livestock waste treatment

(biogas) compared to Wagir Sub-district farmers who have waste treatment. Similar results in Ngajum Subdistrict occurred in the research of Muarifah, et. al., (2022), the place of waste storage in farmers in Kediri District received a fair value (2.73) because farmers pay less attention to the place of storage of livestock waste. Generally, livestock manure waste is only piled together and then waits for the party who will buy or take it for fertilizer (Subagio, et. al., 2020). Only a small proportion of farmers carry out waste treatment, most farmers still accumulate their manure and are not processed (Komala, et. al., 2022).

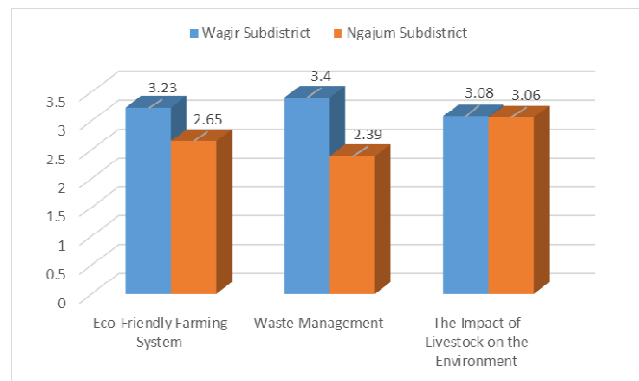


Fig 5. The Score of GDFP in The Environment Aspect

G. Measurement of Total Plate Count (TPC)

The results of Total Plate Count (TPC) measurements on fresh milk in Wagir and Ngajum sub-districts showed that on average the fresh milk produced by farmers did not exceed the limit set by SNI 3141.1-2011 which is 1×10^6 CFU/mL. Fresh milk produced by farmers in Wagir and Ngajum sub-districts is categorized as good and safe for consumption. The low number of TPC in fresh milk is proportional to the implementation of Good Dairy Farming Practice (GDFP) by farmers in Wagir and Ngajum Districts of Malang Regency.

According to Cahyono, et. al., (2013), the low number of TPC in fresh milk is caused by cleaning the cage more than twice a day, namely before morning milking and before afternoon milking and washing the nipples before milking. The implementation of good cage hygiene management can reduce TPC and milk sediment (Krik, 2005). Milking equipment is cleaned before and after milking using water and soap. Soap is a

surfactant group disinfectant (surface active agents) that can kill microbes by damaging cell membranes (Cahyono, et. al., 2013).

TABLE II
AVERAGE TOTAL PLATE COUNT (TPC) MICROBIOLOGY
MEASUREMENT RESULTS.

Average Measurements	Wagir Subdistrict (CFU/mL)	Ngajum Subdistrict (CFU/mL)	Standard SNI 3141.1- 2011 (CFU/mL)
TPC	10,54 x 10 ²	12,26 x 10 ²	1 x 10 ⁴

In the measurement of Total Plate Count (TPC) in fresh milk in Wagir sub-district, the average result was 10.54 x 10² CFU/mL and in Ngajum sub-district with an average of 12.26 x 10² CFU/mL. The variation in TPC counts among farmers in the two sub-districts was due to differences in the sanitation methods used by farmers. This is in accordance with Londa et. al., (2012) stated that cleaning the cage is done before milking, this is to keep the milk from milking later not contaminated by odors and bacteria. One sanitation that significantly affects the TPC test results is cow udder sanitation. The process of microbial contamination of milk begins when milk is milked due to the presence of microbes that grow around the udder, so that when milking the bacteria are carried with milk (Cahyono, et. al., 2013). The level of contamination comes from every source and depends on the sanitization methods used. A very significant source of contamination is from surfaces in direct contact with milk (Rombaut, 2005).

According to Cahyono, et. al., (2013), equipment can be a source of contamination if it is not cleaned optimally, especially parts that are in direct contact with milk. Equipment in direct contact with milk includes milking machines, milk cans, and milk collection buckets. Milk cans and milk collection buckets can be a source of contamination if residual milk or other impurities are still attached. Microorganisms such as *Bacillus subtilis* that can form spores will be able to grow and multiply in milk, coupled with temperatures that support the growth of these microorganisms.

IV. CONCLUSIONS

The conclusion of the effectiveness of the application of GDFP values on smallholder farmers of Malang Regency in Wagir and Ngajum Districts has a good category (3.65 and 3.45) has an effectiveness on the quality of milk produced with the number of bacteria produced 10.54 x 10² CFU/mL and 12.26 x 10² CFU/mL in accordance with Indonesian State Standard (SNI) 3141.1 - 2011. To maintain and improve its application, it is necessary to supervise technical and institutional assistance.

ACKNOWLEDGMENT

Thanks to the research team for helping.

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