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Good dairy farming practices (GDFP) implementation on smallholder dairy farmers in East Java, Indonesia

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ABSTRACT: GDFP is a standard guideline for producing good milk quality and efficient production system. GDFP implementation has been less attention among the dairy smallholder farmers. The smallholder farmers are classified into three categories depending on animal ownership; strata 1 (1-3 AU), strata 2 (4-6 AU), and strata 3 (>7 AU). This research determines the score of GDFP implementation on smallholder farmers in East Java. The total respondents were 56, with 325 dairy cattle. A questionnaire and field observations were used to collect data using the survey method. The farmers were interviewed using a prepared questionnaire with general information about their farms and questions about GDFP implementation. The result showed that the score of GDFP implementation in all strata of smallholder farmers in East Java Indonesia in 6 aspects as follows: animal health was "good enough" (score 2.68-2.70), milking hygiene was "good" (score 3.19-3.42), nutrition was "good enough" (score 2.86-2.97) in strata I and III and "good" for strata II (score 3.03), animal welfare was "good enough" (2.56-2.60), the environment was "good enough" (2.34-2.50) and socio-economic management is "not good" (score GDFP = 1.60-1.92).

Keywords: Animal welfare; Dairy cow; Environment

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INTRODUCTION

In Indonesia, the fresh milk price from the farmer is determined according to milk quality. Implementing good dairy farming practices (GDFP) in farming management becomes the main factor for milk quality. More than 90 % of dairy farming is managed by smallholder farmers, which spread in Java Island with ownership of 3-6 lactating cows per farmer and average milk production of 11 liters/head/day. The population of dairy cattle in Indonesia in 2020 was 565,001, and approximately 60 % is located in East Java Province (BPS, 2022). After collection, milk is transported to the cooperative dairy unit and sent to factory sites for further processing. The fresh milk should be fulfilled milk quality standards from them.

GDFP is the standardization of dairy farming business management, including animal health, milking hygiene, nutrition (feed and water), animal welfare, environment, and socio-economic management (FAO-Food and Agriculture Organization, 2011). GDFP aims to run a dairy cattle business correctly and adequately according to the procedure and maintain to keep cows healthy, ensure the creation of dairy products that are safe and healthy for consumption, and minimize environmental impact.

Many types of research about GDFP in Indonesia were reported with various statuses. According to Asminaya *et al.* (2018), the implementation of GDFP in smallholder dairy farmers in South Sulawesi showed inadequate feeding conditions, water management, housing and equipment, and animal welfare, while the breeding and reproduction, daily management, and animal health were categorized good. On the other hand, in West Java, the dairy farm management has the highest (very good) score, while the lowest aspect was animal health (Anggraeni and Mariana, 2016). In addition, Ali et al. (2019) stated that augmenting extension increased the knowledge adoption in all GDFP aspects in Pakistan.

Therefore, it is necessary to explore the implementation of GDFP in East Java as the largest dairy cow population in Indonesia. This research aims to determine the score of GDFP implementation on smallholder farmers in East Java.

MATERIALS AND METHODS

Materials

The research was conducted on smallholder dairy farms located in Malang Regency and Batu City. Both of those regions, called Malang Raya, are centers of the dairy farm in East Java Province. The total respondents were 56, and the total dairy cattle was 325 heads. The respondents are classified according to the ownership of dairy cattle (Table 1). Two villages represent Malang Regency (Wonoagung Village) and Batu City (Sumber Brantas Village).

Table 1. The classification of respondents

Strata	Ownership (Animal Unit)	Respondents		
		Sumber Brantas Village	Wonoagung Village	Total
I	1-3	9	9	18
II	4-6	8	13	21
III	>7	8	9	17

Methods

A questionnaire and field observations were used to collect data using the survey method. Questionnaires and interviews were conducted to collect all information from the farmers regarding technical components of running a dairy farm business, such as breeding and reproduction, feed and water,

management, enclosure and equipment, and animal health and animal welfare. Technical components were assessed based on the GDFP (Good Dairy Farming Practice) guidelines, which have been amended according to FAO-Food and Agriculture Organization (2011).

The respondents' performance scores show a farm classification are declared in Table 2.

Table 2. The grade of the performance score

Implementation 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

The farmers were interviewed using a prepared questionnaire about general information about their farms and questions about GDFP implementation. The survey contained three questions about the farmers' background, ten questions about general farm statistics (such as farm and herd size, milk production, and farm cost), 23 questions about animal health, 14 questions about nutrition (feed and water), 24 questions about animal welfare, 21 questions about milking hygiene, 13 questions about environmental and 14 questions about socio-economic management.

Each question in the questionnaires has a score that contributes to the total scoring of the GDFP components. Each component of GDFP proportionally has a 16.66 % score (100% divided by several components). The percentage score is converted based on (Table 1) (Nur *et al*., 2018). Descriptive analyses were used to analyze the data and explain it clearly in the following chapter.

RESULT AND DISCUSSION

According to FAO (2011) statement, GDFP includes six aspects: the implementation level of GDFP in smallholder farmers based on three categories of Strata based on ownership of dairy cattle. Strata 1 has 1-3 AU; Strata 2 has 4-6 AU, and Strata 3 has>7 AU. GDFP includes animal health, milking process, nutrition aspects, animal welfare, surrounding environment, and socio-economic management.

Implementation Level of GDFP

In general, implementation of GDFP in smallholder farmers is “good enough” except for the socio-economic management aspect in strata I and II, which was “not good," while “good” criteria were found in the aspect of milking hygiene in all strata (Table 3).

Regular extension of GDFP implementation has been done by dairy cooperative unit staff and dairy industry staff. Sulastri & Maharjan (2002) stated that cooperative dairy workers provide regular extension programs focusing on animal health issues, feeding, forage cultivation, and breeding improvement. Nevertheless, dairy farming is only secondary due to the small herd size (the core business is horticulture farming). It contributes to a "good enough" score in most aspects of GDFP implementation.

Socio-Economic Management became the lowest aspect implemented, particularly in Strata I and Strata II, 39.99 % and 39.85%, respectively. Meanwhile, milking hygiene has a good percentage of GDFP. The farmers are fully concerned about health issues regarding milking hygiene. The cooperative staff has been assisted in improving dairy cattle production. Animal health has the highest priority due to the animal's impact on producing milk. In addition, the main focus is nutrition (feed and water) because it is directly related to the quality and quantity of

milk production. Because feed accounts for 80% of overall production costs, it must be prioritized to boost milk quality and quantity (Priyanti & Soedjana, 2016).

Table 3. The implementation level of GDFP in smallholder farmer

Aspects	Implementation level of GDFP (%)	GDFP Score	GDFP Grade
Strata I			
Animal health	67.45	2.70	Good Enough
Milking hygiene	85.44	3.42	Good
Feeding and Water	73.42	2.94	Good Enough
Animal welfare	64.19	2.57	Good Enough
Environment	62.36	2.50	Good Enough
Socio-Economic		1.60	Not Good
Management	39.99		
Average	65.48	2.62	Good Enough
Strata II			
Animal health	67.59	2.71	Good Enough
Milking hygiene	84.59	3.38	Good
Feeding and Water	74.84	2.99	Good Enough
Animal welfare	64.96	2.60	Good Enough
Environment	60.21	2.41	Good Enough
Socio-Economic	39.85	1.60	Not Good
Management			
Average	65.34	2.62	Good Enough
Strata III			
Animal health	67.02	2.68	Good Enough
Milking hygiene	80.20	3.21	Good
Feeding and Water	68.76	2.75	Good Enough
Animal welfare	64.81	2.60	Good Enough
Environment	58.42	2.34	Good Enough
Socio-Economic	47.56	1.92	Good Enough
Management			
Average	64.46	2.58	Good Enough

Milking hygiene aspects have been carried out by 80.20%, and the criteria are "good." It showed that the farmers have been aware of the milking cleanliness. To be considered that teat is the main entrance for bacteria. Therefore, every farmer has the responsibility to their dairy cows. In addition, teat cleaning is required before milking, and teat dipping is common in developing countries (Kummee *et al*., 2015).

Animal Health

Animal health has become an essential aspect of dairy farming. A healthy animal can produce healthy milk with good quality and quantity. Dairy cows can produce optimally if in a healthy condition (Mekonnen et al. 2006). The score of GDFP in animal health is presented in Table 4.

Roughly, the GDFP score of animal health for all strata ranges from 2.68 to 2.70. The average grade of animal health was "good enough." Particularly, smallholder dairy farmers attempting to establish the herd with disease resistance were "good." Most smallholder dairy farmers accept Friesian Holstein (FH) as a standard breed well adapted to the Indonesian climate. This breeds more resistance to the tropical climate and the disease (Widyas *et al*., 2018). Mostly, the farmer has a group to share all information and discuss the

problem of dairy cattle raising that they face. It could be one of a solution to prevent the entry of disease. For all strata, the GDFP score pattern of all aspects was the same. The farmer has full access to veterinarian services to treat sick animals on the farm regarding animal health.

Prevent disease from entering the farm has "good enough" grade, mainly dairy smallholder farmer was not applied biosecurity. For instance, when they purchase a cow from the traditional market, they put it directly in the shelter without any quarantine procedure.

Table 4. The score of GDFP in animal health

Factors	GDFP Score	GDFP Grade
Strata I		
- Develop disease resistance in the herd	3.39	Good
- Prevent disease from entering the farm	2.28	Good Enough
- Implement an effective herd health management program	2.58	Good Enough
- Follow the directions for all chemicals and veterinary medicines	2.54	Good Enough
Average	2.69	Good Enough
Strata II		
- Develop disease resistance in the herd	3.46	Good
- Prevent disease from entering the farm	2.33	Good Enough
- Implement an effective herd health management program	2.60	Good Enough
- Follow the directions for all chemicals and veterinary medicines	2.41	Good Enough
Average	2.70	Good Enough
Strata III		
- Develop disease resistance in the herd	3.26	Good
- Prevent disease from entering the farm	2.17	Good Enough
- Implement an effective herd health management program	2.35	Good Enough
- Follow the directions for all chemicals and veterinary medicines	2.97	Good Enough
Average	2.68	Good Enough

Even though this cow has no recording card that mentions health information, it was also reported by Can & Altuğ 2014 that the biosecurity score of smallholder dairy farmers in Turkey was determined to be moderate and less attention. Meanwhile, mastitis (mammary gland infection) is the most common and costly disease on a dairy farm in Indonesia. Knowing the symptoms of mastitis is one of animal health implementation.

Many farmers were aware of clinical mastitis, but few were aware of subclinical mastitis. This fact is similar to the Byarugaba et al. (2008) study in Jinja, Uganda, most smallholder dairy farmers, knew clinical symptoms of mastitis, but none were aware of subclinical mastitis. The majority believed mastitis to be a significant constraint to their milk output.

Milking Hygiene

Sanitation, particularly in the milking process, plays an important role in maintaining milk quality. Besides milk quantity, milk quality is considered to determine milk price. Raw milk is easy to contaminate, so sanitation is important to look at during milking time. The GDFP

value of milking hygiene can be seen in Table 5.

The data above mentioned that all strata had paid attention to the hygiene milking aspect, but milking without injuring the animals or introducing contaminants into milk had less attention. The smallholder dairy farmer does a manual milking technique. GDFP score of milking hygiene for all strata ranges from 3.19 to 3.42. Ensure milking routines do not injure the animals or introduce contaminants into milk in the "good enough" criteria, but the others were "good." Pre-treatment before milking included washing the teat and drying it with a towel (Kumssa, 2018). Instead of using a towel to dry the udder after washing it, they massage it with their bare hands. Hence manual milking potentially injures the teat if done carelessly.

Table 5. The score of GDFP in milking hygiene

Factors	GDFP Score	GDFP Grade
Strata I		
- Assure that milking procedures do not hurt the animals or introduce contaminants into the milk	2.88	Good Enough
- Assure that milking is done in a hygiene manner	3.56	Good
- Assure that milk is correctly handled after milking	3.82	Good
Average	3.42	Good
Strata II		
- Assure that milking procedures do not hurt the animals or introduce contaminants into the milk	2.91	Good Enough
- Assure that milking is done in a hygiene manner	3.48	Good
- Assure that milk is correctly handled after milking	3.78	Good
Average	3.39	Good
Strata III		
- Assure that milking procedures do not hurt the animals or introduce contaminants into the milk	2.85	Good Enough
- Assure that milking is done in a hygiene manner	3.14	Good
- Assure that milk is correctly handled after milking	3.60	Good
Average	3.19	Good

Nutrition (Feed and Water)

Nutrition is a crucial factor in dairy farming. Feed consumption that meets dairy cattle needs will contribute to milk yield and milk quality. Water has to provide ad libitum for the animal, and the farmers are good at securing water supplies for the animal (Table 6).

The GDFP-grade in nutrition ranged from "not good" to "good." Strata III has the lowest score for nutrition aspect implementation. The increasing number of animals per farmer (Strata III) declined the quality and quantity of dairy farming practices. The more cows, the more forages were required. Therefore, farmers with no labor except family members got a problem fulfilling it. It could be resulted in the grade of ensuring adequate quantities and quality of animal feed and water score GDFP “Not good” pada strata III.

The nutrition management practices with a "not good" grade were observed only in one factor in Strata III (ensure adequate quantities and quality of animal feed and water), while the other factors remained ranged from "good enough” to “good." Strata I and strata II showed the same pattern in all factors of nutrition aspect.

The average grade from “good enough” to “good” indicates that the farmers have been provided good quality feed

insufficient amount. In strata III, the farmers do not ensure animal feed and water in terms of quality and quantity in a good way. The more animal, the more attention to feeding and water access. Utami *et al*. (2014) stated that natural grasses became an alternative when forages were insufficient. Like forage, concentrate has been given twice per day, amounted 8-10 kg per head. There was no interaction between concentrate and forage on ruminal pH, preventing acidosis (Rustomo et al. 2006).

Table 6. The score of GDFP in nutrition (feed and water)

Factors	GDFP Score	GDFP Grade
Strata I		
- Ensure reliable feed and water supply	3.11	Good
- Ensure adequate quantities and quality of animal feed and water	2.73	Good Enough
- Monitor feed storage conditions	2.82	Good Enough
- Assure the traceability of feedstuffs transported onto the farm	3.23	Good
Average	2.97	Good Enough
Strata II		
- Ensure reliable feed and water supply	3.23	Good
- Ensure adequate quantities and quality of animal feed and water	2.75	Good Enough
- Monitor feed storage conditions	2.99	Good Enough
- Assure the traceability of feedstuffs transported onto the farm	3.15	Good
Average	3.03	Good
Strata III		
- Ensure reliable feed and water supply	2.63	Good Enough
- Ensure adequate quantities and quality of animal feed and water	1.84	Not Good
- Monitor feed storage conditions	2.56	Good Enough
- Assure the traceability of feedstuffs transported onto the farm	3.67	Good
Average	2.86	Good Enough

In addition, the animals have free access to water to be free from hunger and thirst. This is in line with Golher *et al*. (2021). Water is an essential nutrient in the diet of lactating cows and serves multiples roles, including digestion, transfer of nutrients and excretion, metabolism, and body temperature regulator.

Animal Welfare

Feeding management is an important issue concerning comfort animals and animal welfare. Conventional feeding twice per day, morning and evening after milking, applied to smallholder dairy farmers. Sometimes at night, the farmers provide forages to the animal if needed. According to the data analysis, the score of GDFP in animal welfare is in Table 7.

The management of animal welfare for dairy cattle in the location of study can be categorized GDFP grade "good enough." However, the aspect of freedom to engage in relatively normal animal behavior patterns for all strata was "not good." The smallholder farmers kept the dairy cow in a shelter on a rope tied the whole day. The limitation of land to provide enough space for the animal is the primary constraint. Furthermore, the grade of freedom from thirst, hunger, and malnutrition" was "good"

for all strata. The result was an agreement with the previous aspect (nutrition), stating that the farmer secured feed and water supplies, particularly in strata I and strata II. On the other hand, feeding frequency strongly affects animal behavior representing animal welfare (Fregonesi and Leaver, 2001; Mattachini *et al*., 2019).

The forages amounted to 10% of body weight (as fresh), and it is sufficient for animals and fulfills their nutrients requirements.

Table 7. The score of GDFP in animal welfare

Factors	GDFP Score	GDFP Grade
Strata I		
- No more thirst, hunger, or malnutrition	3.26	Good
- No more discomfort	2.40	Good Enough
- No more pain, injury, or disease	2.77	Good Enough
- Fearlessness	3.27	Good
- The ability to engage in reasonably regular animal behavior patterns	1.11	Not Good
Average	2.56	Good Enough
Strata II		
- No more thirst, hunger, or malnutrition	3.24	Good
- No more discomfort	2.26	Good Enough
- No more pain, injury, or disease	2.92	Good Enough
- Fearlessness	3.20	Good
- The ability to engage in reasonably regular animal behavior patterns	1.39	Not Good
Average	2.60	Good Enough
Strata III		
- No more thirst, hunger, or malnutrition	3.26	Good
- No more discomfort	2.59	Good Enough
- No more pain, injury, or disease	2.60	Good Enough
- Fearlessness	2.96	Good Enough
- The ability to engage in reasonably regular animal behavior patterns	1.56	Not Good
Average	2.60	Good Enough

Environment

The minimum and maximum temperature on the farm during the study from 17-26° C, and the altitude of 500-818 meters above sea level (asl) is ideal for a tropical dairy farm. The environment may be more critical to comfort cows and to perform milk production.

According to the data presented in Table 8, the worse point is to develop an environmentally sustainable farming system. Strata I, II, and strata III turn to the bad category for this. At the same time, establishing a proper waste management system and ensuring that dairy farming operations do not harm the surrounding environment showed "good" criteria for strata II and strata III. In general, respondents throw the waste directly into the water canal.

Meanwhile, some have digester for biogas and utilize the dairy cow feces for organic fertilizer. To establish good environmental management, good waste management is introduced to the farmer by cooperative staff and the government.

In terms of biogas establishment, smallholder dairy farmers are assisted and supervised by an expert from cooperative dairy staff in coordination with the dairy

industry. They built a site plant of biogas digester in one area for the pilot project. Line with Pandey *et al*. (2021) explained that biogas is a mature technology that has been developed for both small and large-scale dairy farms, and biogas may be transformed into a variety of valuable fuels. Moreover, farmers can earn extra money by making organic fertilizer made from dairy cows' feces (Muriith *et al*., 2014).

Table 8. The score of GDFP in the environment aspect

Factors	GDFP Score	GDFP Grade
Strata I		
- Develop an environmentally sustainable farming system	1.03	Not Good
- Establish a proper waste management system	2.90	Good Enough
- Assure that dairy farming operations do not harm the surrounding environment	3.43	Good
Average	2.50	Good Enough
Strata II		
- Develop an environmentally sustainable farming system	0.93	Bad
- Establish a proper waste management system	3.03	Good
- Assure that dairy farming operations do not harm the surrounding environment	3.30	Good
Average	2.42	Good Enough
Strata III		
- Develop an environmentally sustainable farming system	0.79	Bad
- Establish a proper waste management system	3.01	Good
- Assure that dairy farming operations do not harm the surrounding environment	3.25	Good
Average	2.34	Good Enough

Socio-Economic Management

Socio-economic management is an aspect that is directly related to business and the people involved. The data on this aspect reveals in Table 9.

The socio-economic aspect that has received more attention is related to financial viability. It was because of related to family income. The dairy farm was not the main business to earn money for the family. Most smallholder farmer has other jobs to support their family life. That was opposite to the report of Nakiganda *et al*. (2006) that in Uganda, dairy farming is one of the ways farmers make money to pay tuition fees, daily home maintenance, and other family expenses. Poor human resources will impact the GDFP score, and GDFP grades were "not good" at all strata. Management of human resources has the worst grade among them. The human resources of smallholder farmers come from family and relatives. Utami and Seruni (2013) stated that smallholder farmers' dairy farming activities were done by household labor, both male and female. They work based on trust without any specific rules. Respondents declared that they do not consider skills because the family member will learn gradually, time by time. This showed that the farmers ignore effective and responsible human resource management.

The socio-economic aspect that has received more attention is related to financial viability. It was because of related to family income. From the previous explanation of the GDFP aspect, the farmers fully paid attention to nutrition.

Table 9. The score of GDFP in socio-economic management

Factors	GDFP Score	GDFP Grade
Strata I		
- Establish effective and accountable management of human resources	0.00	Very Bad
- Assure farming tasks are performed safely and competently	0.98	Bad
- Run a business to assure its financial feasibility	3.84	Good
Average	1.60	Not Good
Strata II		
- Establish effective and accountable management of human resources	0.38	Very Bad
- Assure farming tasks are performed safely and competently	1.29	Not Good
- Run a business to assure its financial feasibility	3.61	Good
Average	1.60	Not Good
Strata III		
- Establish effective and accountable management of human resources	0.47	Very Bad
- Assure farming tasks are performed safely and competently	1.53	Not Good
- Run a business to assure its financial feasibility	3.72	Good
Average	1.92	Not Good

The animal received proper feed and free access to water. Utami and Seruni (2014) explained that the cost of forage feed accounts for 25-26% of the overall cost of dairy cow production, whereas concentrate accounts for 51-59%. Therefore, it could become the main reason to focus more on economic factors than others.

CONCLUSIONS

In conclusion, the implementation of GDFP in smallholder dairy farmers in Malang Raya, East Java, Indonesia, is "good enough," except for socio-economic management is "not good." To improve the implementation of GDFP, technical and institutional assistance is required.

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