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**Can Farmers' Wives Adopt New Technology?
Case: Milk Processing during the Covid-19 Pandemic in the Tahunan Village, Pacitan
Regency, Indonesia**

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Abstract

This paper draws from our experience in assisting the midwives of milk farmers in learning how to process milk to raise their family income. We focus on 136 housewives of dairy farmers (all members of dairy farmer groups) in Tahunan village, Tegalombo sub-regency, Pacitan regency in Indonesia. There is only one collector in the area, PT DAS, sub-contracting from Nestle Indonesia. The problem happened when there is an over-supply, and the milk collector refuses to process the farmer's milk. For this reason, we have been assisting the dairy farm wives to process the milk and sell it to the local market since 2018. We start with the introduction of the plan to all dairy farm members (both the husband and the wives), then survey the availability of time the wives have. We focus on the wives because the husband is responsible for taking care of the cows. Also, we investigate the potential of local products (empon-empon, traditional roots such as ginger, turmeric) that can be processed together with the milk. The local product is chosen because of the familiarity of the potential customer with the flavor of the product. Introduction of the new technology to process milk at the beginning and the accompaniment are the keys to the acceptance of the activities.

Keywords: empowerment, accompaniment, milk processing technology, house-wives

JEL Classification: D1, J16, Q12

1. Introduction

This report draws on our experience in helping dairy farmer mothers learn how to process milk to increase family income. The mothers who were the targets of this activity were 136 wives of dairy farmers. They are all members of a dairy farmer group in Tahunan Village, Tegalombo District, Pacitan Regency in Indonesia. There is only one collector in the area, PT DAS, which is a sub-contract company from Nestle Indonesia. The problem occurs when there is an overproduction of milk, and milk collectors refuse to process milk from the farmers. For this reason, we have introduced a simple way to process milk (pasteurization) so that it is easy for breeder mothers to do. Next, we introduce how to pack milk and label it, and market it in the local market. We have started this activity since 2018. We started with the introduction of the plan to all members of dairy farmers (both husband and wife), then conducted a survey regarding the availability of time that the wife has. We focus on wives because husbands have run out of time to take care of cows, from cleaning the stables to looking for food, milking and depositing them at

the collection point in the hamlet. We also observed the potential for local products (empon-empon, traditional plants such as ginger, turmeric, lemongrass, brown sugar) which could be processed together with milk. Local products are chosen because potential customers' knowledge of the taste of these products when used for cooking. We found that the orientation and introduction of the introduction of milk processing technology programs at the beginning of the program, for example, assistance was the key to the program being acceptable to farmers and their families.

We organize the presentation as follows. Section one setting up the issue. Section two describe the location and context of the activities. Section three outlines the activities introducing new technology to farm dairy wives, followed by section four, discuss the result. The last section, section five, outlines the conclusion.

2. Description of the Location and Context

Tegalombo Sub-District is located in Pacitan Regency, East Java. Tegalombo Sub-District consists of 11 villages, namely Tegalombo, Ploso, Annual, New Year, Gemaharjo, Pucangombo, Kasihan, Kemuning, Ngreco, Gedangan and Kebon Dalem. Based on published data from the Central Statistics Agency (BPS), in 2019, the population in Tegalombo Sub-District was 53.25 thousand people or 8.93 per cent of the total population in Pacitan Regency, which amounted to 597 thousand people. Tegalombo Sub-District has an area of 149.26 km² or 10.74 per cent of the total area of Pacitan Regency and is located at an altitude of 500 m above sea level. The location of Tegalombo Sub-District is quite remote, 34 km from the capital of Pacitan Regency. The altitude of the site and the natural conditions of the mountains make Tegalombo Sub-District suitable for raising dairy cows.

The people in Tegalombo Sub-District have various activities, including breeders, farmers, labourers and others. The Pacitan Regency Government, through the Agriculture Office, pays close attention to the livestock business sector, especially dairy cows. In 2014, the Government of the Agriculture Office promoted an empowerment program for dairy farming. The Pacitan Regency Government provides assistance, i.e. dairy cows to people who are interested in running a dairy farming business. Until 2019, the Pacitan Regency Government has assisted 144 dairy cows.

One hundred thirty-six households have dairy farming businesses in Tegalombo Sub-District. These households are members of ten farmer groups spread across four villages in Tegalombo Sub-District. The following is data on farmer groups in Tegalombo Sub-District.



Figure 1. Map of Tegalombo Sub-District, Pacitan Regency, East Java

Table 1. Livestock Groups in Tegalombo Sub-District

No	Farmer Group Name	Village	Number of Members
1	Gemah Ripah 4	Gemaharjo	22
2	Gemah Ripah 5	Gemaharjo	10
3	Gemah Ripah 5	Gemaharjo	25
4	Karya Makmur 4	Tahunan	9
5	Bumi Rahayu	Tahunan	14
6	Ngudi Rejeki	Tahunan	14
7	Mergo Makmur Abadi	Tahunan	5
8	Sido Rukun 1	Tahunan Baru	15
9	Sido Rukun 4	Tahunan Baru	12
10	Karya Makmur	Ploso	10
Total			136

The dairy farming business in Tegalombo Sub-District has been running since 2014, starting with the assistance of 14 dairy cows to 14 households in Gemaharjo Village. The dairy farming business in Tegalombo Sub-District continues to grow, in August 2020, the population of

dairy cows in Tegalombo Sub-District has reached 575 heads. The largest community is in Gemaharjo Village, with 258 dairy cows. The dairy farming business also provides economic benefits for households, i.e. the sale of milk produced by dairy cows. Based on the survey conducted, households running a dairy farming business in Tegalombo Sub-District can make as much as 3415 liters of milk per day. The average income from the dairy farming business is IDR 3.56 million per month.

Table 2. Profile of Dairy Farming Business in Tegalombo Sub-District

Village	Number of Farmers	Number of Dairy Cows	Average Income / Month (million)	Total Milk Yield / Day
Gemaharjo	57	258	3.29	1332 Liter
Tahunan	42	106	3.10	556 Liter
Tahunan Baru	27	168	3.93	1180 Liter
Ploso	10	43	3.74	347 Liter
Tegalombo	136	575	3.56	3415 Liter

In term of knowledge about milk, Yadav et al. (2007) stated that generally, cattle farmers already know the nature of milk, which is not durable. However, there are still many livestock farmers who still sell their milk products in fresh condition and do not process them if they are not sold out. Leftover milk is usually thrown away or stored in the refrigerator (for those who have it). Storage in the fridge is only able to maintain the quality of the milk for no more than two days. Consumers generally don't like buying fresh cow's milk that has been cooled in the refrigerator (Hadiwiyoto, 1994). Similar practice observed in Tahunan Village, Tegalombo Sub-District.

In term of farmer group, one of them Bumi Rahayu Group, currently has 25 farmer members. It located in the village of Tahunan and chaired by Mrs Susi. Currently, the Bumi Rahayu group has more than 50 cows with an average daily production of 6-10 liters / head per day with a sale value to the cooperative of IDR 5,500 / liter. Currently, breeders only depend on its sales to milk cooperatives. It is due to the nature of fresh milk, which is not durable (easily broken/damaged) and the absence of a place to store fresh cow milk (refrigerator). Sales of fresh milk are made when there is a demand from local residents.

The inability to diversify dairy food products means that the remaining fresh milk is usually only given free of charge to neighbours who want or mix it into cow's feed. It is due to the lack of

knowledge and skills about milk processing from the breeders' wives and limited business capital. This condition reduces the daily income of the breeders.

Based on the results of the interview with the group leader, it is known that sales of fresh milk after deducting the cost of purchasing feed (bran, tofu dregs, coffee bran, cassava dregs, grass), medicines, and operating costs, the average income of each farmer in this group is almost the same, which is IDR 80,000 per day or around IDR 2,400,000 per month. Most of the wives of these breeders do not work for a salary. They do house-work as housewives who only rely on income from their husbands, not to mention that the families of these breeders still bear the living costs of 2 children who are still in school / are not yet independent.

So far, the wives of the breeders of these two groups do not know and realize if cow's milk can be processed into various delicious, nutritious, long-lasting, and higher-selling dairy products. Moreover, Tahunan Village is one of the centres of empon-empon plants (traditional medicine and flavour) in Pacitan Regency. During this pandemic, demand for empon-empon increase. Producing processed milk with empon-empon have a high potential market.

3. Activities: Introducing New Technology to Farm Dairy Wives

We focus the activities on introducing simple processing milk to farm dairy wives. The purpose is to increase the productivity of the wives. Suppose the excess production of milk is processed into edible and more preserved. The methods used in this Community Partnership Program for farmer wives include:

1. Education

The online extension method is carried out to provide knowledge/explanation about the nutritional content of milk, and the potential for milk processing, techniques for making milk with a combination of empon-empon and milk packaging techniques. An extension is carried out by the implementation team (lecturers) to members of the two groups.

2. Training and Practice

The form of training was a demonstration on making pasteurized milk with a combination of empon-empon and continued by the participants' practice. This training aims to enable the breeder wives to produce pasteurized milk with empon-empon combination independently and to be able to use the infrastructure for the milk production equipment prepared by the Team.

3. Accompaniment

The next activity is field practice assistance/accompaniment (pasteurized milk production practice and product marketing). Independent field practice aims to enable partners to be able to apply the results of counselling and training on the processing of fresh cow's milk, the empon-empon combination, and to be able to package the milk products they produce attractively and market them.

4. Results and Discussion

4.1. Descriptive Analysis

The results of descriptive statistics show that on average, women in households who have a dairy farming business have a value of women empowerment livestock index (WELI) of 0.723. The highest WELI value is 0.944, which means that the woman has a high contribution to the dairy farming business carried out by the household. Then, the lowest WELI value is 0.167, which means that the woman has a low contribution to her dairy farming business. Women are categorized as empowered in the dairy cattle business if they have a WELI value of more than 0.8 (Galiè et al., 2019).

The outcome variable used in this study is the yield on dairy farming as seen from two indicators, i.e. the milk production in one day and the income from the dairy farming business in one month. The results of descriptive statistics show that on average, households in Tegalombo Sub-District produce 25.11 liters of milk in one day with the highest milk production being 165 liters in one day and the lowest milk production is 5 liters in one day. Then, the average household income of farmers in Tegalombo Sub-District is IDR 3.52 million in one month with the highest revenue of IDR 20 million in one month while the lowest income is IDR 1 million in one month.

This study also uses several control variables which are divided into three characteristics, i.e. characteristics of women, characteristics of households and characteristics of dairy farming. The average age of female respondents is 41.94 years, with the oldest age being 72 years old, and the youngest respondent age being 21 years. Furthermore, for dairy cow ownership, on average, households in Tegalombo Sub-District have four dairy cows, which the household with the most dairy cow ownership is 16 heads and the household with the least dairy cow ownership is one head. The complete statistical results can be seen in table 3.

Table 3. Descriptive Statistics

Variables	Mean	Min	Max	Std Dev
Outcome Variables				
Milk yield (liter / day)	25,11	5	165	21,04
Income (million rupiah / month)	3.56	1	20	2.72
Indicators of women's empowerment				
Women empowerment livestock index (WELI)	0,72	0,16	0,94	0,15
Characteristics of women				
Women age (years)	41,94	21	70	10,08
Women education level (years)	9,07	6	16	2,72
Women have jobs other than farmers (1 = yes, 0 = no)	0,19	-	-	0,39
Total working time of women in the dairy farming business (hours/day)	5	0	8	2,02
Characteristics of household				
Age of household head (years)	47,15	21	77	10,88
Head of household education level (years)	8,96	6	16	2,94
Number of family members	4	2	9	1,22
Male (1 = yes, 0 = no)	0,98	-	-	0,15
Household expenses (million rupiah / month)	1,57	0,45	5	0,84
Head of household has jobs other than farmers (1 = yes, 0 = no)	0.08	-	-	0.27
Total working time of the head of household in the dairy farming business (hours/day)	5.22	0	12	2.14
Characteristics of a dairy farming business				
The number of dairy cows owned	4	1	16	2,82
Duration of business (years)	3,34	0,5	6	1,68
Number of workers involved (years)	3	2	6	0,70
Own dairy cow (1 = yes, 0 = no)	0,90	-	-	0,31
Distance between business location and the place to sell milk (km)	2,98	0,1	6	1,52
The distance between the business location and the place to look for animal feed (km)	1,36	0,1	6	0,94
Making business capital loans to loan institutions (1 = yes, 0 = no)	0,71	-	-	0,46
Provide additional nutrition (1 = yes, 0 = no)	1,95	0,33	15,5	1,92
Expenditures for business (million rupiah / month)	4,23	1	16	2,82
Utilizing waste (1 = yes, 0 = no)	0,75	-	-	0,43
Instrument variables				
Number of organizations (villages) attended by women	2	0	4	3,71
The age difference between household heads and women within the household (years)	5,21	-10	35	5,46

Differences in education of household heads and women within the household (years)	-0,11	-7	10	2,31
Women own personal assets (1 = yes, 0 = no)	0,32	-	-	0,47
Length of stay of women in the village (years)	35,12	1	70	16,27
Number of family members <5 years	1	0	1	0,38
Number of family members 5-9 years	1	0	2	0,48
Number of family members 10-14 years	1	0	2	0,48
Number of family members 15-19 years	1	0	2	0,56
Number of family members 20-44 years	2	0	4	0,86
Number of family members 45-60 years	2	0	3	0,87
Number of family members > 60 years	1	0	2	0,60
Number of observations				136

4.2. Assistance

Milk has enormous economic benefits because besides it can be drunk as fresh milk after being pasteurized. Milk processing is not only for diversifying products and tastes but also for preserving milk so that it is relatively more durable when stored. Some of these dairy products even have a positive impact on health and can economically increase the selling value of milk. Several alternatives to dairy products that can be made with simple methods and equipment, especially for a household scale, namely pasteurized milk, with a combination of flavours.

The product produced is pasteurized milk with fresh milk ingredients from the Tahunan village livestock group, Tegalombo, Pacitan. Assistance in making healthy pasteurized milk begins with training on how to express milk for a cow that is correct and healthy (minimizing contact with bacteria). Milking is done after breeders clean the cage and bathe the dairy cows so that the cow dung does not contaminate the milk because milk is an effortless medium for bacteria to flourish (Everitt et al., 2002). After the milking is complete, the training continues with the process of making simple pasteurized milk.

The method of producing milk, accompanied by the UGM team, tries to combine milk with local potential. The step is to put the milk in a saucepan, then heat it on a gas stove and keep it from bubbling. After finishing the manufacture, then add ginger powder or instant ginger which is a superior product before consumption. The uniqueness of the process of making pasteurized milk is done using natural and superior local flavours. The simple product manufacturing stages that have been carried out by breeders through UGM team assistance can be seen in the image below.

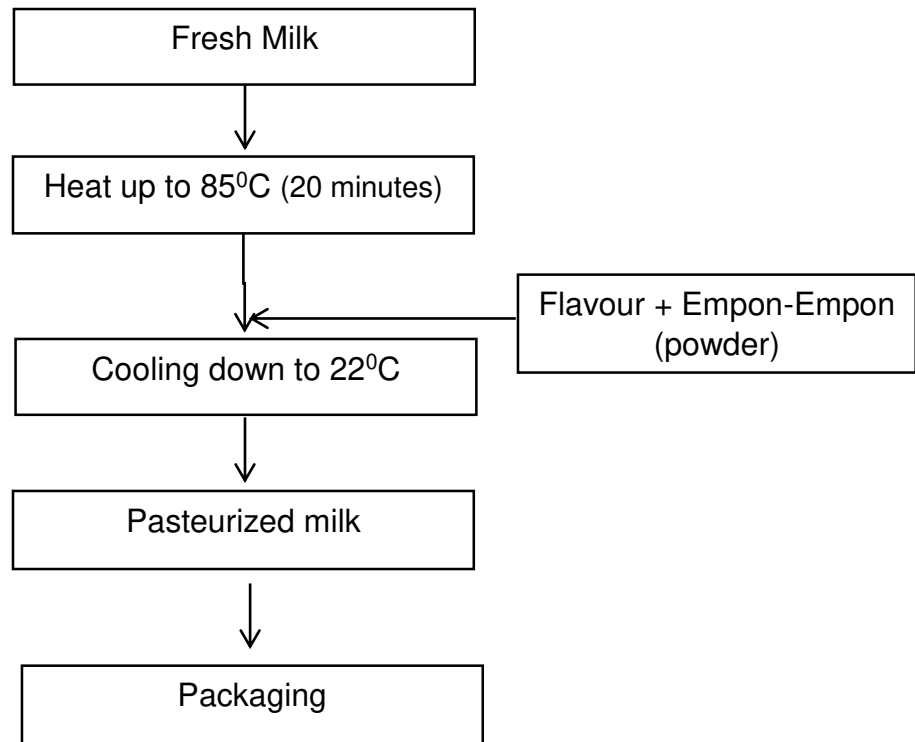


Figure 2. The Process of Making Pasteurized Milk (Winarno, 2007)

The second stage of product manufacturing is carried out by mathematical calculations referring to Winarno and Fernandez (2007). This second manufacturing stage is based on Widodo (2003) with steps as in the picture above. Previously, fresh milk was filtered using a filter cloth to obtain clean milk from the impurities that enter the milk can or milk bucket. Milk is heated in a skillet with a constant milk temperature, according to the literature. The temperature observation is carried out so that the heated milk does not damage the nutrients or the content in the milk. When finished, you can add flavour to the milk and lower the temperature to 22⁰ C and then put it in the previously labelled packaging. Cooling can be done by thawing method. After the milk insertion stage is finished, then the milk is set in the refrigerator. Milk lasts for 5-7 days if in the cupboard and several hours if not in the fridge (Syarief, 1989).

5. Conclusion

This paper draws from our experience in assisting the midwives of milk farmers in learning how to process milk to raise their family income. We focus on 136 housewives of dairy farmers

(all members of dairy farmer groups) in Tahunan village, Tegalombo sub-regency, Pacitan regency in Indonesia. From the survey we found that on average, wives who have a dairy farming business have a high value of women empowerment livestock index (WELI - 0.723). The highest WELI value is 0.944, which means that the women have high contribution in the dairy farming business carried out by the household. The introduction of milk processing technique was greeted enthusiastically by the farmer's wife. Such activities potentially increase the family income, as the milk was combined with the flavor from locally produced. Still, marketing and preserving the milk need to be introduced to anticipate high demand for the processed milk in the near future. We also underline that introduction of the new technology to process milk at the beginning to both the husband and the wives, and the accompaniment are the keys to the acceptance of the activities.

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