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The Innovation of Coconut Processing To Virgin Coconut Oil (VCO) Using of the Centrifugal Method

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Abstract: The development in the agricultural sector which is uneven causes a disparity in economic conditions in rural areas. The level of knowledge and technical mastery that is still weak is also the cause of slow economic development in rural areas. The purpose of this activity is to provide technological innovation and skills to the people of Pangsan village, improve the yield and quality of the VCO produced, facilitate market access and increase the economic income of the participating groups. This activity was carried out in the "Mekar Sari" and "Sari Murni" groups in Pangsan village, Petang District, Badung Regency, Bali. The number of participants involved thirty people consisting of fifteen people from the "Mekar Sari" group and fifteen people from the "Sari Murni" group. The method of activity used is participatory empowerment which includes surveys, documentation, theory and discussion, practice, material assistance and tools, evaluation, and assistance. The data were analyzed with the descriptive method including qualitative and quantitative approaches. The activity was carried out for four months starting from August to November 2019. The results of the activity showed that the "Mekar Sari" and "Sari Murni" groups were very enthusiastic about participating in the program of activities provided. VCO produced using a centrifugal machine has a higher yield of 5-6 liters and better quality of properties (water content, free fatty acids, peroxide number) and has better organoleptic properties and meets the quality of Indonesia National Standard (SNI).

INTRODUCTION

The government of Badung Regency encouraging to development of the economy and create new jobs, especially in rural areas through the rural tourism development program. This is reinforced by the issuance of Local Regulation (Regency regulation) Number: 47 the year of 2010 decided of eleven Tourism Villages. One of the developed tourism villages is Pangsan village. Pangsan village is one of the villages included in the Petang District of Badung Regency. Pangsan village has an area of 5.67 km2 which consists of six customary villages "Desa Adat" and nine official villages "Banjar Dinas" with a total population of 2.597 inhabitants (in the year 2016). This village has good agricultural potential and most of the people are engaged in the agriculture sector: food crops, plantations, animal husbandry, and fisheries.

"Mekar Sari" group and "Sari Murni" group are a group consisting of productive women, mostly as housewives. The two groups were formed through formal legalization from the local Head of Pangsan Village Official where each group consists of fifteen members. These groups were built to facilitate community members, especially women, to easily get access to knowledge, skills, capital, and coordination as well as monitoring by the local official government.

Figure 1: Coconut tree in the home yard

Generally, almost the home yard in the Pangsan village has coconut plants. This coconut plant has many functions and benefits for Balinese people. In Bali culture, coconut and coconut leaves are often used as supporting material during ceremonial activities. In addition, the coconut tree can make people's houses look more attractive and beautiful.

The use of coconut plants is still very limited whereas the need for coconut while a ceremony in Bali is called "Upakara" increases. The coconut fruits are mostly sold in a fresh form with very cheap selling prices around IDR 2.500 per one coconut. Therefore, the coconut has a lower economic value. On the other hand, some members of the Pangsan village community have tried to process coconut fruit into traditional coconut oil. But unfortunately, the traditional processing that has not been able to provide significant benefits even from the sale of traditional coconut oil produced is still a loss because the selling price of coconut oil produced is cheaper than the price of coconut raw materials and production costs. According to Fachry *et al.,* (2006) that most coconuts in Indonesia are marketed in primary or unprocessed form, causing the economic value of coconut to below.

Some other problems found by the village local government and their communities include 1) most of the local official government, especially Pangsan village and several villages in Bali do not understand how to make program and planning of their community for providing the productive activities therefore most of the village budget owned is used for developing physical due to its considered the easiest to do, 2) the Pangsan village government and the community are not proactive to collaborate with various parties both with the other official government, especially related institutions, universities or the private sector in developing the potential they have, 3) the people do not have enough knowledge, skill, and technology how to process the coconut into VCO products that have higher economic value than traditional coconut oil, 4) in addition, Pangsan villages also do not have sufficient capital and adequate equipment for producing alternative products such as VCO, and 5) people are still doubtful and less optimistic about the VCO products that will be produced can be sold in the market.

Processing of coconut fruit into VCO can increase the economic value of coconuts and can provide a greater profit compared to traditional coconut oil making. From the experience and results of the analysis conducted for the processing of VCO from five coconuts get about 350 ml of VCO, although the yield obtained is lower than traditionally produced coconut oil (600 ml for five coconuts), in terms of selling prices VCO is higher. For 60 ml (1 bottle) of VCO sold at IDR 25.000 x 6 bottles = IDR 150.000. This shows that processing coconut oil into VCO is more profitable than traditional coconut oil processing.

The increasing of coconut product varieties will be able to grow new home industry based on coconut in the village of Pangsan. Therefore, can create new jobs, increase employment recruitment and improve the welfare of the people of Pangsan village. VCO processing activities that will be developed by "Sari Murni" and "Mekar Sari" groups will be able to encourage the growth of coconut-based agro-industry that can support and collaborate with tourism villages that have been previously designed to improve the economy of Pangsan village. Activity objectives 1) to increase the knowledge and skills of participant groups how to process coconut into VCO, 2) to improve the quality and yield of VCO produced, 3) to increase the market access through promotions and marketing strategies, 4) help the group facilitated "PIRT" license for VCO, 5) increase group income and create new job opportunities for the community of Pangsan village, and 6) help provide an opportunity for women to be able to manage their time and mind by carrying out productive activities in making VCO so that it is more positive and useful for their family.

RESEARCH METHODS

Program of Product Desiminated to the Community (PTDM) in Pangsan Village using of participatory empowerment method (Hapsari *et al.,* 2018) and quantitative approach. The step of implementing the activities consist of 1) providing theory, 2) discussion, 3) VCO processing practices, and 4) evaluation of activities. The theory will be delivered directly through the oral presentation from the speaker/trainers to participants. The total number of participants of 30 people consists of fifteen women from the "Mekar Sari" group and fifteen women from the "Sari Murni" group in Pangsan village. In addition, during the activity to increase their knowledge the group was given modules and training materials as well as discussions regarding the training materials already given.

Analysis of VCO quality parameters such as water content using the distillation method (Apriyantono *et al*., 1985), free fatty acids (FFA) (Raharja and Dwiyuni, 2017), peroxide numbers were carried out according to the method (Raharja and Dwiyuni, 2017). The yield of VCO (Kataren, 1986: Anwar and Salima, 2016) and organoleptic tests using the hedonic method (Soekarto, 1985). The data obtained were analyzed descriptively and quantitatively.

This activity consists of several steps of implementation, namely the preparation, the socialization, lecturing of theories, the practice of VCO processing by the groups, the independent practice in each group, and the evaluation of activities and mentoring. This program was conducted for four

months starting from August to November 2019 in Pangsan Village, Badung Regency, Bali, Indonesia.

RESULTS AND DISCUSSION

General information on activities

Based on the survey stage and dissemination of the Program of Technology Products Desiminated to the Community (PTDM) showed that the response of the participants and local officials government was very good and fantasies to receive the program. The socialization activity aimed is to discuss the activity methods, objectives, benefits, and targets of activities to groups, community leaders, and the Head of Pangsan village and its officials. This socialization activity was attended by forty participants.

To increase knowledge specifically about the processing technology of coconut into VCO, the group of participants was given the theory by several competent speakers from Warmadewa University and related institution government: the Food Crops Office, Horticulture and Plantation of Bali Province, the Health Service Office of Badung Regency, and the Industry Service Industry and Badung Regency Trade. The purpose of providing this theory is to provide an overview to the group of participants so that knowledge and understanding of the potential of coconut plants, the process of making VCO, quality control of VCO, marketing, and promotion aspects will increase as well as licensing regulations.

Increasing the knowledge and skills of the group participating in the activity is not enough just to provide material or theory but it will be easier and faster to be understood if it is completed with direct practice especially the process of making VCO. Practical activities are given more intensively so that the group is clearer and understands the steps of the VCO making process. Each group member will directly observe and practicing of VCO production. Based on the activities is expected that each group member will be able to make VCO properly according to Standard Operation Procedure (SOP).

Quality and Yield of *Virgin Coconut Oil* (VCO)

Virgin Coconut Oil produced by the group before being given activity the quality is lower, that is indicated the appearance of VCO colors that are still turbid or less clear and smell a little rancid. In terms of quantity, the yield of VCO produced is also still low. According to information from group members, the amount of yield produced from processing 50 of coconut can produce 3-3.5 liters of VCO. This is probably due to the group using a mixer that has a weak rotation strength (± 500 rpm) so that the ability to break the bond between fat and protein is not optimal. According to Fachry *et al*., (2006), the amount of oil produced is affected by the centrifuge speed, the higher the centrifuge speed, the more oil is produced. Setiaji and Prayugo (2006) said that the greater the rotating speed of the centrifuge, the breakdown of the fat-protein bond would be faster so that the amount of oil produced would increase.

Based on the results of activities using a centrifugal machine the VCO yield produced increased to 5-6 liters of 50 coconuts. This means that the use of centrifuges with a rotational speed of 2800 rpm can produce more VCO. According to Anwar and Salima (2016), the use of centrifuge can increase the yield of VCO, and the higher the speed and time of centrifuge, the higher the VCO obtained so that the higher the percent yield obtained. It was further said that the yield of VCO was also determined by the quality of the fresh coconut, the better the quality of the coconut used, the quality of the VCO produced was also better and the yield was also higher.

In addition to improved yield, the quality of the oil produced is better in terms of water content, free fatty acid content (FFA), clearer color, and organoleptically, therefore fulfill the standard quality of VCO. Water content is one of the parameters that determine the quality and shelf-life of oil. According to Wong and Hartina (2014), the higher the water content, the oxidation process that causes rancidity. Kataren (1986): Anwar and Salima (2016) state that the presence of water in oil can cause hydrolysis. The oil will be converted into free fatty acids and glycerol which produce a rancid flavor and odor in the oil. Furthermore, it meant that high water content in oil can cause bacterial contamination which can hydrolyze fat molecules. The results of research conducted by Anwar and Salima (2016) show that the water content in VCO decreases with increasing centrifuge rotation and length of centrifugation time. The experimental results show that the VCO water content without using a centrifugal machine and using a centrifugal machine is 0.12% and 0.08% respectively both water content still lower than the SNI quality requirements (7381-2008), the maximum water content of 0.5%. However, according to the percentage of water content, the VCO produced using a centrifugal machine is much lower than without using a centrifugal machine. Therefore to improve the quality and shelf life of VCO, the use of a centrifugal machine is better to apply.

The peroxide number produced by VCO without using a centrifugal machine is 0.25% higher than using a 0.19% centrifugal machine. The higher the peroxide number, the lower the oil quality. The high peroxide number indicates that VCO has undergone an oxidation process. According to Nurhasnawati *et al*., (2015), high peroxide numbers indicate fat or oil has oxidized. Based on the organoleptic test of VCO, it was found that the VCO produced without using a centrifugal machine did not meet the specified requirements, especially in terms of color, odor, and taste. The resulting VCO color is turbid, smells, and tastes slightly rancid. Whereas the VCO produced by using a

centrifugal machine fulfills the SNI (Indonesian National Standard) requirements that the oil color is clear, odorless, and has a normal taste (Table 1). Anwar and Salima (2016) found that the higher centrifuge rotation causes protein bonds to be released entirely from fat so that the oil produced increases and the color are clearer. According to Lisna and Pumama (2010), the VCO produced by the centrifugation method has a clearer color, smell, and normal taste than the VCO produced by the fermentation and heating methods. The level of quality, organoleptic properties, and yield of VCO produced before and after training activities using centrifugal and without centrifugal machines are shown in Table 1.

Parameters	Without of Centrifugal Machine (Control)	Using the Centrifugal Machine
Yield of VCO	3-3.5 liter	5-6 liter
Water content	0.12 %	0.08 %
Free fatty acid (FFA)	0.40 %	0.11 %
Peroxide number	0.25 %	0.19 %
Organoleptic Test:	cloudy	clear/colorless
Color	slightly rancid	odorless/normal
Odor	rather rancid	tasteless/normal
Taste		

Table 1 showed that the yield of VCO produced by using a centrifugal machine is higher than before using a centrifugal machine. The quality of VCO produced by using a centrifugal machine is better than without using a centrifugal machine in terms of water content, free fatty acids, peroxide numbers, and organoleptic properties. The lower the water content, free fatty acids, and peroxide numbers, the better the quality of the oil. Water content, free fatty acids, and peroxide numbers are indicators that determine the quality of the oil. According to Muharun and Apriyantono (2014), free fatty acids are caused by hydrolysis or oxidation reactions. The presence of water in oil can damage the quality due to the hydrolysis reaction (Ketaren, 1986).

The yield and quality of the VCO produced are not only influenced by the centrifugal machine rotation speed but also by the time rotation. In this activity, the cream is centrifuged for 30-40 minutes to produce 5-6 liters of VCO. To get oil with a clearer color, smell, and normal taste, a gradual filtering process is carried out using a filter device equipped with filter paper oil and carbon activated. The VCO produced by both groups in Pangsan Village is shown in Figure 2.

Figure 2: VCO produced by "Sari Murni" and "Mekar Sari" group using of Centrifugal Method

EVALUATION PROCESS

To determine the effect of the impact of the program activities before and after therefore were needed for the observation and evaluation of the activities. This evaluation activity is intended to observe and assess the level of success of the activities that have been carried out. Evaluation of the implementation of activities carried out starting from the initial step to the end of the activity. Evaluation of activities carried out includes, the level of knowledge, the level of skills, how to process VCO, the level of cleanliness and sanitation, and understanding of market access. From the results of the evaluation carried out it was found there were still some weaknesses that needed to be corrected and improved. Some problems or deficiencies that are still encountered include: the group does not yet understand how to produce VCO that is good and right according to Good Manufacturing Practices (GMP) standards, the condition of production house still does not meet sanitation and health standard, the group does not have a special VCO production site, production volume is still low, market access is still limited, promotion of VCO products produced is still lacking, and VCO products produced by groups do not have a formal certificate from the legal official.

However, there were still many weaknesses but there are some improvements achieved after the group was given PTDM activities including:

1. The level of knowledge and skills of the "Sari Murni" and "Mekar Sari" groups on the technology of processing coconut into Virgin Coconut Oil (VCO) increased. This can be known from the level of understanding and skills that is from not knowing to know and from a lack of understanding into more understanding.
2. The group has coconut processing equipment to be VCO that is following the standard so that the group can carry out VCO production or processing activities.
3. VCO products produced have organoleptic quality and properties that are following SNI quality standards and the VCO yield obtained has increased.
4. Increased commitment and attention from the Pangsan village government and Badung Regency government, which is indicated through the planning of sustainable activities such as assistance, guidance, training, equipment assistance, capital, and improving market access.

CONCLUSIONS

Based on the results of the activities of the Technology Products Program which are Desiminated to the Community (PTDM), several conclusions can be obtained, namely:

1. "Sari Murni and "Mekar Sari "groups can produce VCO with good quality and organoleptic properties based on tests conducted by the Government Institution of Controlling Drug and Food (BPOM) and meet SNI quality standards (7381-2008).
2. VCO produced by the two groups experienced an increase in yield compared to before the training was given, namely from 3-3.5 liters per 50 coconuts increased to 5-6 liters VCO per 50 coconuts.
3. The group has begun to try to promote VCO products produced by participating in several exhibition activities
4. The frequency of VCO production increases from every three weeks to two weeks.
5. The formal certificate for the VCO product was produced by the group is still in the process of being processed and is expected to be completed faster since this permit is needed to expand the market access of the produced VCO.
6. The group does not have a special production house for VCO.

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