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Socialization and Practice of Processing Coconut Cooking Oil based on SNI 3741:2013 Quality Standard for Residents in Gondoruso Village, Pasirian Lumajang

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Abstract

Gondoruso village, Pasirian Lumajang has many coconut trees. However, the coconuts were only harvested and sold in the local market at a price of IDR 2,000-3,000/fruit. Some local residents had initiated efforts to process coconuts into cooking oil, but the resulting oil smelled rancid so they stopped it. This paper reported the results of our community service activities in assisting Gondoruso Village residents to proceed coconut into cooking oil that meets the SNI 3741:2013 quality standard. The aim was to train the residents' skills in producing qualified coconut cooking oil so they could earn extra family income. Eight old coconuts were grated, and thick coconut milk was taken. The coconut milk was left overnight in the refrigerator to produce lumps of coconut milk. The lumps of coconut milk were taken and cooked over low heat. About 10 minutes later, the oil started to come out, and the cooking process continued for 40-45 minutes until all the oil-came out, and 550 ml of cooking oil was produced. The SNI 3741:2013 quality test revealed that the cooking oil was of very good quality because the values of 6-SNI parameters met the standard, i.e., organoleptic is liquid, clear yellow, sweet coconut, and tasteless; moisture content=0.13% w/w; acid number=0.06% w/w; peroxides number=0; the pelican oil=negative, and the linoleic acid=0.13%. The production and market analyses stated that the production cost of 550 ml of coconut oil=IDR 27,600, while the selling price in the market=IDR 80,000/500 ml.

Keywords: Gondoruso Pasirian Lumajang; Coconut cooking oil; SNI 3741:2013 quality standard

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INTRODUCTION

Gondoruso Village in Pasirian Lumajang is a highland area with a temperature of 25-26 °C, and rainfall of 100-200 mm/day. The total area of Gondoruso village is 15,443,500 m^2 with boundaries: Kalobendo Village (North), Bades Village (East), Indonesian ocean (South), and Jugosari Village (West). The current population of Gondoruso Village is 7,441 people, i.e., 3,556 men and the rest are women and children spread over five small villages (*dusun*), eight community pillars (*rukum warga*) and, 29 neighbouring pillars (*rukun tetangga*). The main occupations of the residents are farming and gardening by planting cassava, corn, banana, cucumber, papaya and, watermelon trees. In addition, coconut trees are also widely found in that village. However, so far, the coconuts are only picked to be cooked at home or sold to the local market for IDR 2,000-3,000/fruit. Some coconut trees have been processed into coconut sugar by taking the coconut (*nira*) water. The local residents initiated efforts

to process coconuts into cooking oil previously, but the oil product still smells rancid, so they stopped doing that.

The field survey and interviews carried out with the head of Gondoruso village and some residents identified three main problems: 1) after working in the fields, there is still a lot of productive time that has not been utilized by the residents. 2) There is the residents had made no other efforts to increase the economic value of coconuts. 3) The residents need knowledge and skills to process coconuts into cooking oil (VCO) that meets SNI quality standard so that they can independently produce and sell it to increase their family's income and welfare. (Boateng, Ansong, Owusu, & Steiner-Asiedu, 2016; da Silva Lima & Block, 2019; Dhanasekara et al., 2022; Kappally, Shirwaikar, & Shirwaikar, 2015; Korrapati et al., 2019; Malaeb & Spoke, 2020; Rabail et al., 2021; Suryani et al., 2020; Valente et al., 2018) reported that consumption of VCO is beneficial for health, including for skin and hair care, stress relief, weight-loss, and fat-free-mass improvement, cholesterol-levels maintenance, cardiovascular and Alzheimer's disease use. VCO contains medium-chain-fatty-acids (MCFA), i.e., fatty acids which are beneficial in the metabolic process; MCFA is absorbed by the intestines quickly so energy will also be produced quickly. It would be useful if anyone, including Gondoruso's residents, had the skills to produce this quality coconut oil themselves as the VCO price in the market is very expensive, IDR 20,000-30,000/125 ml. Therefore, this community service activity is in line with the 3rd-goal of the SDGs, i.e., "Good Health and Well-Being".

The solutions to the main problems above are by running activities to process coconuts into cooking oil that meets the SNI 3741:2013 quality standard. The plan and approach to these problems is through socialization (sharing information), assistance and direct practice of making coconut cooking oil using simple methods and tools capable of producing SNI quality coconut oil.

This paper reports the results of our community service activities to introduce and practice processing coconut into cooking oil that meets the quality standard of SNI 3741:2013 to the residents of Gondoruso Village, Pasirian Lumajang. The aim is to optimize the abundant coconut fruit yields into high-quality and marketable products, and train the residents' skills in making coconut oil which has economic value so that it is expected to increase family income. Through these activities, the 3rd-goal of the SDGs: "Good Health and Well-Being", can hopefully be achieved gradually. Thus, the socialization activities, assistance and direct practice became the variables of manipulation. At the same time, the residents' level of understanding and skills in making coconut cooking oil was the response variable.

The efforts to process coconut into cooking oil has been widely reported, generally applied the fermentation method, including (Emilia, Putri, Novianti, & Niarti, 2021; Karouw & Indrawanto, 2015; Yuniwati, 2018). Emilia et. al. used a natural fermentation method without chemicals, dyes and preservatives added in Gunung Megang village, Muara Enim. However, 100 ml of coconut oil produced still smelled rancid. Karouw and Indrawanto used "genjah" coconuts and processing it by several methods, i.e., heating, fermentation and centrifugation. Heating of coconut milk was carried out after the coconut milk was stored at room temperature for more than 10 hours. Unfortunately, the water an free-fatty-acid contents of the coconut oil produced are high. Yuniwati empowered women in Sedayu village, Magelang through the skills to produce VCO by various fermentation methods, including natural fermentation, fermentation with yeast, and with acidification. However, how the quality of the oil produced, and how the economic potential was not reported. The service activity of processing coconuts into cooking oil reported here is different from what has been reported because it is very simple, without fermentation, acidification, or anything else

but produces coconut oil that meets SNI quality standards. Thus, the processing oil method applied in this service activity could be used as a reference for the following activities to produce quality coconut oil.

METHODS

The method used to carry out these three activities is by sharing information and direct practice while assisting. Table 1 lists the stages of this service activities, while Table 2 shows the stages of processing coconut into cooking oil carried out in this activity.

Table 1.The stages carried out in this community service activities

Stage 1	:	- Identify the main problems of Gondoruso's residents and take coordination steps with the local village head - Identification of needs related to the residents' main problems - Provide suggestions for solutions to the residents' problems
Stage 2	:	Formulate the implementation method for the proposed solution, i.e.: - Socialization - Assistance and direct practice
Stage 3	:	Carry out the service activities: - Delivering information about the steps to process coconut into cooking oil - Assisting the residents in the direct process of coconuts into cooking oil - Direct practice by the residents
Stage 4	:	Evaluation of the activity's success: - The residents satisfaction survey - Monitoring follow-up from the residents

Table 2. The stages of processing coconut into coconut cooking oil

1	8-old and fresh coconuts were cleaned and grated
2	Add 2 liters of clean water, squeeze to get thick coconut milk and store the milk in several plastic containers and close the containers tightly
3	The thick coconut milk was left overnight in a refrigerator to produce lumps of coconut milk
4	The lumps of coconut milk were separated from the remaining water & cooked while being stirred constantly over low heat
5	About 10 minutes later the oil starts to come out. The cooking process was continued for 40-45 minutes until all the oil came out
6	Let the oil cool down. Separate the oil from *blondo*, i.e. a by-product of processing this cooking oil, by filtering it using a cloth
7	Pour the cooking oil product into a dry and clean bottle and close the lid tightly.

As mentioned, the target of this community service activity is the residents in Gondoruso village. A total of 30 residents participated, mostly women. The residents' contributions were to provide the location for these activities and to show high commitment to: providing honest and truthful information about their conditions when being interviewed, participating in all the activities according to a mutually agreed schedule, willing to comply with health protocols during the activities, and willing to follow up the knowledge and skills obtained from this activities. The success of this activity was also supported by the Testing Service Center of the Faculty of Pharmacy, Universitas Airlangga Surabaya (TSC FP-UA), which tested the quality of coconut

cooking oil produced from coconut trees in Gondoruso village based on the SNI 3741:2013 quality standards.

Generally, coconut oil is made in two ways, i.e. dry- and wet-methods (Jasman, 2021; Karouw, Santosa, & Maskromo, 2019; Radu, 2015). The dry method requires pressing while the wet method includes evaporation, acidification, and fermentation. The dry method is a long process because it requires oil refining. In the evaporation method, a lot of fuel is needed and the oil produced is easily damaged (smells rancid). The acidification method requires the right mixture of acid and coconut milk, only people who have been trained can do it well. The fermentation method requires enzymes/microbes/yeast to the skim of coconut milk before being incubated for 24 hours for the oil, *blondo* and water are separated. Enzymes are expensive; pure microbial preparations require hygienic conditions, so this is difficult to apply; the yeast is used only once and cannot be reused because it is mixed directly into the coconut milk. The coconut cooking oil processing applied in this activity is very simple, only requires heating over low heat, and does not involve any evaporation, acidification or fermentation processes, so that anyone can imitate it. The coconut milk is only stored in a refrigerator overnight before being cooked over low heat until it turns into oil. Although the technique is very simple, the oil produced meets the SNI quality standards. Table 3 lists the data collection instruments used to see the success indicators of each stage of the activities.

Table 3. Data collection instruments used in this activities

No.	Activity	Data Collection Instrument
1	Sharing information on processing coconuts into cooking oil, followed by Assistance and direct practice to proceed coconuts into cooking oil	Questionnaire: The residents' satisfaction survey
2	Follow up with the residents after joining the activities	Interview and see the evidence first-hand
3	Testing the quality of coconut oil produced	The TSC FP-UA laboratory test is based on the SNI 3741:2013 quality standards using 6-parameters: i.e., organoleptic, moisture content, acid number, peroxide number, pelican oil and linoleic acid
4	The success indicators of this community service activity as a whole	Evaluation of the results obtained from the above data collection instruments

There are 7 questions in the questionnaire that must be answered by the residents/participants. Each question has two answers: "Yes" and "No". Each answer choice, it must be accompanied by reasons, i.e. open answers, which must be written by the participants. The participants' satisfaction with implementing of the activities was measured by their answers and reasons are written on the questionnaire instrument. The laboratory test results obtained from the TSC FP-UA for each parameter of organoleptic, water content, acid number, peroxide number, pelican oil and linoleic acid were compared to the quality requirements set by the SNI 3741:2013 (BSN, 2013). According to (BSN, 2013): (1) organoleptic observations of a test sample with the sense of smell and sight are carried out by trained panelists or competent for organoleptic testing. When a distinctive smell of cooking oil is detected, the result is

declared “normal”; but when it smells other than the typical smell of cooking oil, the result is declared "abnormal". When yellow to pale yellow or other colors according to type the oil was observed, the results are declared "normal". When the color is other than the colour mentioned above, the result is declared "abnormal"; (2) Moisture and vapour content are calculated based on the weight lost during heating in the oven at (130±1) °C; (3) In principle, the acid number represents the solubility of a sample in an organic solvent and is neutralized using an alkaline solution (potassium- or sodium-hydroxides). 4) The peroxide number is one of the parameters that can determine the level of damage to the oil. The peroxide number can be determined by the iodometric method, i.e., reaction between the iodide base in an acid solution and the peroxide bonds contained in the sample oil or fat(BSN, 2013). 5) The pelican oil is a mineral oil that cannot be saponified in an alcohol-water base solution. The test oil is given 0.5 N KOH, ethanol, and water in a certain amount, then boiled and shaken to form saponification. When the solution becomes cloudy, indicating the presence of pelican oil, it is said: “positive”. When the solution is not cloudy, it does not contain pelican oil, and it is called “negative”. The presence of pelican oil is the main cause of the rancid smell in coconut oil. 6) The linoleic acid parameter is determined based on the composition of the fatty acids in the oil utilizing their respective separations components by gas chromatography (GC). When the test results meet all the SNI 3741:2013 quality requirements. The coconut oil is said to be high quality.

RESULTS AND DISCUSSION

Figures 1a-h show the socialization among the residents and when the residents practiced proceeding coconuts into cooking oil while being assisted by the Team member. Figure 2 presents the TSC FP-UA laboratory test results on the coconut oil proceeded from coconuts in Gondoruso village based on the SNI 3741:2013 quality standards using the 6-parameters: i.e., the organoleptic, the moisture content, the acid number, the peroxide number, the pelican oil, and the linoleic acid.

Socialization of cooking coconut oil to the Gondoruso residents

A resident was grating eight coconuts using a machine-assisted by the Team member

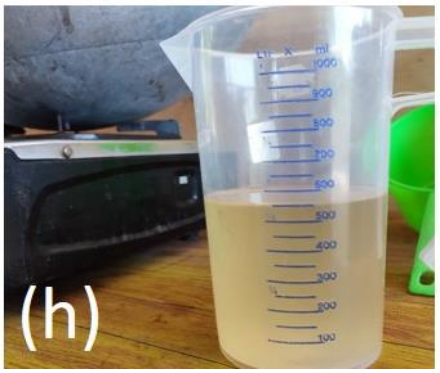
The coconut milk after being stored overnight in the refrigerator. The coconut milk clumps on top, while water on the bottom

The clumps of coconut milk after being separated from the water and ready to be cooked

A resident was cooking the coconut milk clumps over low heat, accompanied by the Team member

After 20 minutes, a lot of oil has come out of the coconut milk

The coconut oil produced after 50-60 minutes cooking. It was cooled and separated from *blondo*



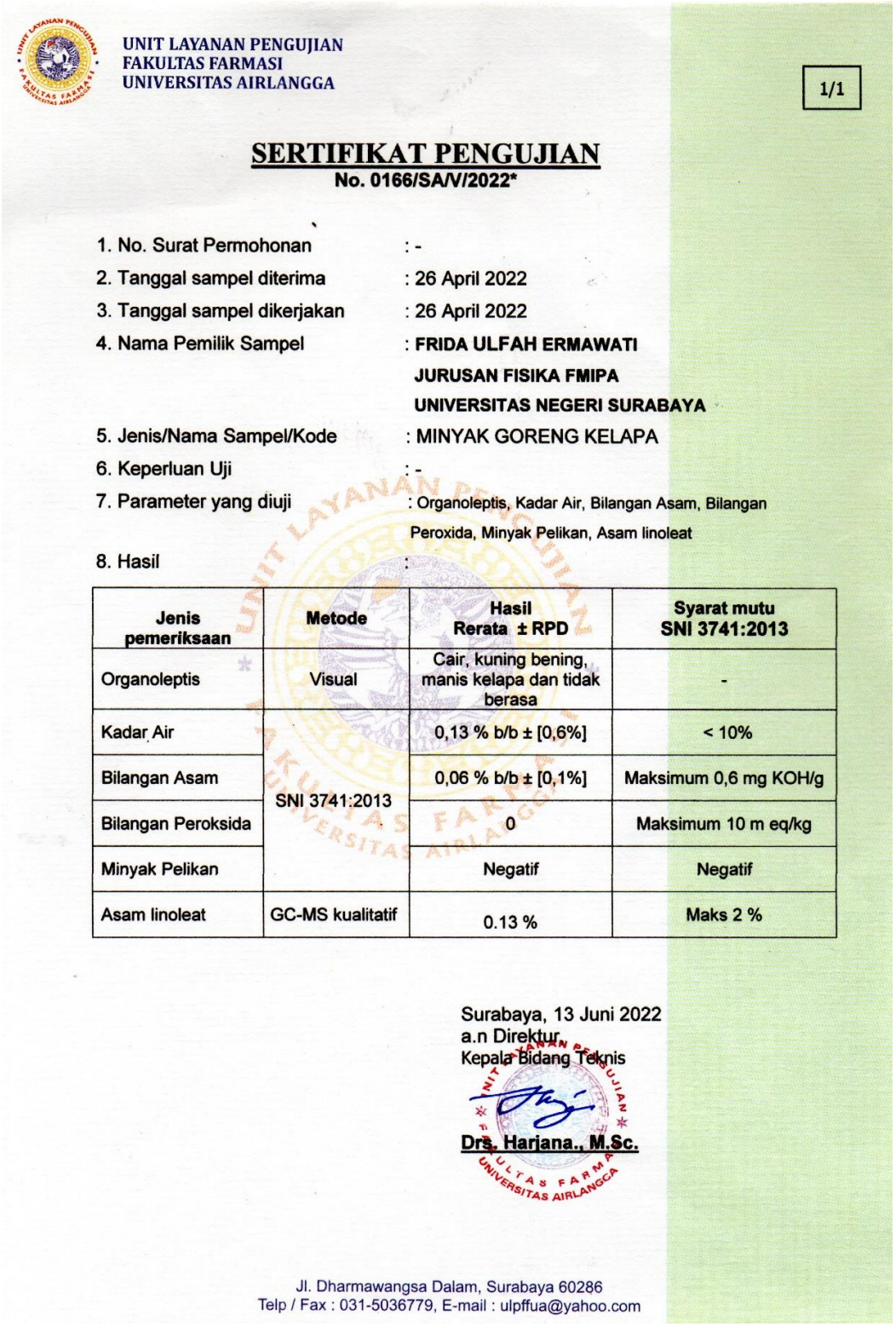
The 550 ml coconut cooking oil obtained

Figure 1. (a) The socialization and (b-h) the residents when practiced to proceed coconuts into cooking oil assisted by the Team member.

As shown in Figure 1h, 550 ml of coconut oil was produced from the clump of coconut milk squeezed from 8 coconuts over low heat for 50-60 minutes following the steps in Figures 1b-g. Using the coconut milk clumps like this, the oil started to come out at about the tenth minute since the cooking process started, followed by the subsequent releases of oil until all the oil came out in a total of 50-60 minutes. In Figure 2, 1) the organoleptic test result stated that the Gondoruso coconut oil is liquid, clear yellow, sweet and tasteless. Thus this coconut oil is normal. 2) Water content of the coconut oil is 0.13% w/w±[0.6%], which is much less than 10%. 3) The acid number of the coconut oil is only 0.06% w/w±[0.1%], far below the allowed maximum value, 0.6 mg KOH/g. 4) The peroxide number of the coconut oil is zero!, the maximum allowed value is 10 m eq/kg. This data confirmed that the oil contains no level of damage at all. 5) The pelican oil of the coconut oil is negative; this data also confirmed that the oil is of pelican oil free. 6) The linoleic acid value is 0.13%. This value is far below the maximum allowed value, 2%. This coconut oil has met all the SNI 3741:2013 quality requirements with all the data above. In other words, the processing coconut oil method applied in this activity is proven to produce quality coconut oil.

Previously, (Karouw & Indrawanto, 2015) reported that coconut oil proceeded from "*genjah*" coconuts using heating, fermentation and centrifugation methods. The water content, free fatty acid, color, odor and taste parameters were tested based on SNI 01-2902-1992. Karouw (Karouw et al., 2019) also reported processing coconut cooking oil from preheated blondo, a by-product of VCO. The quality of coconut

cooking oil processed from blondo was tested using SNI 01-3741-2002. Table 4 lists the test results for the five parameters for *genjah* coconut cooking oil, especially which was proceeded by heating, and for the blondo coconut oil proceeded by heating; these results are compared with the SNI 3741:2013 test results in Figure 2.



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1/1

SERTIFIKAT PENGUJIAN
No. 0166/SA/V/2022*

1. No. Surat Permohonan : -
2. Tanggal sampel diterima : 26 April 2022
3. Tanggal sampel dikerjakan : 26 April 2022
4. Nama Pemilik Sampel : **FRIDA ULFAH ERMAWATI**
   JURUSAN FISIKA FMIPA
   UNIVERSITAS NEGERI SURABAYA
5. Jenis/Nama Sampel/Kode : MINYAK GORENG KELAPA
6. Keperluan Uji : -
7. Parameter yang diuji : Organoleptis, Kadar Air, Bilangan Asam, Bilangan Peroxida, Minyak Pelikan, Asam linoleat
8. Hasil :

Jenis pemeriksaan	Metode	Hasil Rerata ± RPD	Syarat mutu SNI 3741:2013
Organoleptis	Visual	Cair, kuning bening, manis kelapa dan tidak berasa	-
Kadar Air	SNI 3741:2013	0,13 % b/b ± [0,6%]	< 10%
Bilangan Asam		0,06 % b/b ± [0,1%]	Maksimum 0,6 mg KOH/g
Bilangan Peroksida		0	Maksimum 10 m eq/kg
Minyak Pelikan		Negatif	Negatif
Asam linoleat	GC-MS kualitatif	0.13 %	Maks 2 %

Surabaya, 13 Juni 2022
a.n Direktur,
Kepala Bidang Teknis

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Figure 2. The certificate of quality testing of coconut cooking oil from Gondoruso based on the SNI 3741:2013 quality standard using 6-test parameters obtained from the TSC FP-UA laboratory.

Table 4. Comparison of the quality test of cooking oil proceeded via heating in this work (Figure 2) and from other two reports based on SNI standards (Karouw & Indrawanto, 2015; Karouw et al., 2019)

SNI Test Parameter	This activity SNI 3741:2013	Genjah coconut oil Karouw (2015) SNI 01-2902-1992	SNI 01-2902-1992	Blondo coconut oil derived from VCO Karouw (2019) SNI 01-3741-2002	SNI 01-3741-2002
Colour	clear yellow,	Clear yellow	clear, pale yellow to yellow	Pale yellow	White, pale yellow to yellow
Smell	distinctive smell of cooking oil	distinctive smell of cooking oil	normal	normal	normal
Flavour	sweet coconut and tasteless (not rancid)	not rancid	normal	normal	normal
Water content	0.13 %	0.10	0.1-0.5	0.1	Max 0.1
Acid number	0.016 % w/w	0.15	< 0.6	0.3	Max 0.6
Peroxide number	0	-	-	-	-
Pelican oil	negative	-	-	-	-
linoleic acid	0.13 %	-	-	-	-

In Table 4, the genjah coconut oil has high content of water and free fatty acid, i.e. 0.1 for water content (while the upper limit of water content allowed by SNI 01-2902-1992 is 0.1-0.5), and 0.15 for free fatty acid content (the limit of fatty acid allowed by SNI 01-2902-1992 is < 0.6). Coconut oil with high water and free fatty acid contents is easier to damage due to hydrolysis and oxidation reactions which causes rancidity. This may relate to how the coconut milk was stored; Karouw stored the coconut milk at room temperature (RT) for 12 hours before being heated. Storage of coconut milk for a long time at RT will cause the compounds that make up the coconut cream emulsion to undergo a breakdown process. Coconut milk emulsion itself consists of 20-30% oil, 50-75% water and the rest is protein (Karouw et al., 2019). The breakdown of the compounds that make up the coconut cream emulsion causes the protein to coagulate while the water becomes more and more separated; this triggers the water content in coconut oil stored at RT to be high. The high content of water and free fatty acid was also shown in the blondo coconut oil in Table 4; the water content reached the limit (0.1), and the free fatty acid number is also high (0.3). Based on the above comparison, it is very clear that the quality of coconut oil from this service activity is very good and far above it.

Table 5 summarizes the local residents' answers to the questionnaire questions. Of the total 30 residents who attended, 28 of them returned their questionnaires, while the remaining 2 did not have time to fill out the questionnaires because they had to leave early for other purposes. Figure 3 shows the full team and the local residents taking a photograph together at the end of this service activity, while Figure 4 shows a screenshot of the video sent by a local resident to the Team when she was cooking the remaining coconut milk which had not been processed during this service activity and to be used as cooking oil. This video proves how eager the residents are to practice the knowledge and skills they have acquired from this service activity.

Table 5. The local residents' response on the questionnaires

No.	Questions	The residents' response and reasons
According to you,		
1	Was this socialization, mentoring and practice of processing coconut into cooking oil interesting and useful?	The 28 residents answered YES (interesting and useful) because the method is easy and simple, and this is very useful.
2	Was the explanation given by Team coherent, easy to understand and to imitate?	The 28 residents answered YES (coherently, easy to understand and imitate) because the explanations were coherent starting from the beginning of making it into oil.
3	Was the tool used to process coconut into cooking oil simple, readily available at home or easy to buy at the local market?	The 28 residents answered YES because the tools needed were simple, readily available at home, or easily purchased at the market.
4	After joining the socialization activity and practicing it yourself, do you want to try making this coconut cooking oil yourself at home?	The 28 residents answered YES, they wanted to try it and prove that we can actually process it into oil. Also, because the method of processing is new (coconut milk was stored in the refrigerator), it becomes curious to prove it for themselves.
5	Do you have the hope and desire to one day make this coconut cooking oil processing activity as a source of additional income for your family? Considering that the coconut oil produced is proven to meet the SNI quality standards so that it has economic value. Based on the results of production and market analysis, the following data were obtained, a. Production cost of 550 ml coconut oil = IDR 27,600 b. The selling price of coconut oil in the market = IDR 20,000/125 ml (IDR 80,000/500 ml) c. When this coconut oil is sold at a price of IDR 52,000/500 ml, then the economic potential = IDR 24,400/500 ml	The 27 residents answered YES, they really want to have additional family income and get a side job at home; and make the activity of processing coconut which is abundant in the local village into coconut oil as an additional source of income. The remaining 1 resident didn't write down the reason.

No.	Questions	The residents' response and reasons
6	Are you willing to tell your family or neighbours how to proceed coconut cooking oil?	The 28 residents answered YES, they were willing to tell their family or neighbours so that they can also make their own cooking oil.
7	During this service activity, are there any things that are lacking that need to be improved?	22 residents answered NO because the program was good, can provide new knowledge and skills, the method was simple, and very fun. The remaining 6 residents answered: the socialization was very short, it needed to be extended, or carried out again so that the villagers were satisfied.

Figure 3. The full team and the local residents taking a photograph together at the end of this service activity

Figure 4. A screenshot of the video sent by a local resident to the Team when she was cooking the remaining coconut milk which had not been processed in this activity, to be used as cooking oil.

Referring to the analyses provided in Figures 1-4 and Tables 4-5 above, the transfer of knowledge and skills to process coconut into SNI quality coconut oil given in this service activity is the main provision for local residents to become coconut oil producers so that they can increase the family welfare and health; this also means that the 3rd SDGs target is very potential to be achieved when the local residents are willing to implement the knowledge and skills obtained in this service activity. There are almost no obstacles in this activity. However, the potential obstacle that may arise is how to maintain the residents' enthusiasm and commitment to continue producing coconut oil soon. To overcome this concern, the Team will continue to communicate regularly with local villagers and make visits to monitor their follow-up to this activity.

CONCLUSION

In accordance with the criteria for the success of this service activity, i.e., when the coconut oil produced is of high quality and the residents are delighted with the transfer of knowledge and skills they have acquired, and that has all been achieved. This service activity can be declared successful. However, monitoring and communication with local residents must be carried out regularly to maintain this success.

RECOMMENDATION

As explained, to ensure that the results and objectives of this service activity can be achieved and maintained, the Team should communicate regularly with the Gondoruso residents and visit to monitor the progress and obstacles they face in making coconut oil.

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