

The Development of Teak Leaf Cookies for BUMDes Gajah Mada, Pokdarwis, and PKK in Kebontunggul Village, Mojokerto

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Article history

Submitted: 2023/11/27; Revised: 2024/0405; Accepted: 2024/04/29

Abstract

Kebontunggul village (Gondang district, Mojokerto, East Java, Indonesia) is abundant in teak (*Tectona grandis* L.) leaves, but their utilization is still lacking. Based on this potential, supported financially by *Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi* (The Ministry of Education, Culture, Research, and Technology/Kemendikbudristek) University of Surabaya (UBAYA) and Widya Mandala Surabaya Catholic University (WMSCU) collaborated with *Badan Usaha Milik Desa* (Village-owned Enterprise/BUMDes) Gajah Mada, *Kelompok Sadar Wisata* (Tourism Awareness Group/Pokdarwis), and *Organisasi Pemberdayaan Kesejahteraan Keluarga* (Family Welfare and Empowerment Organization/PAKK) Kebontunggul village in *Pemberdayaan Desa Binaan* (Community Engagement Program/PDB). The program aims to produce cookies from teak leaves to increase the economic activity of the Kebontunggul residents. The methods used are community education, consultation, training, science and technology transfer. The focus of this specific program was before-after knowledge assessment, skill development, and community participation in teak leaf-based cookies innovation. There was an increase in the knowledge and skills of the Kebontunggul people, as indicated in the pre-test and post-test results. The training output was the procedure and formulation development of teak leaf powder and teak leaf cookies to support its production scale and increase the residents' economic activity.

Keywords

Community Engagement Program; Cooke's product from teak leaves; University of Surabaya; Widya Mandala Surabaya Catholic University



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1. INTRODUCTION

Kebontunggul village is in the Gondang district of Mojokerto Regency, East Java, Indonesia. It has an area of 263.22 Ha or around 27,15% of the Mojokerto regency area. It consists of residential area (22.4 Ha), agriculture (142.22 Ha), moor (73.615 Ha), and public facilities (24.980 Ha). Based on occupations, the population of Kebontunggul village is dominated by agricultural workers. In 2020, it reached 759 people, followed

by workers in the private sector and processing industry, 83 people, and 24 civil servants. So, Kebontunggul village has huge potential from its natural and human resources.

One of the natural potentials in Kebontunggul village is teak (*Tectona grandis* L.). Kebontunggul village has a large teak forest (130 Ha) (Figure 1). Teak is a tropical plant species distributed in Nigeria, Myanmar, India, Thailand, and Indonesia (Suryanti et al., 2020). The young teak leaves contain phenolic compounds such as flavonoids, tannins, quinones, and anthocyanins. They have various activities, such as antitoxicity, antibacterial, and antioxidants (Edi, 2020). The young leaves are proven to have very strong antioxidant activities. Antioxidants can protect the body against harmful free radicals that can cause disease. Teak leaves also contain moisture (10,0%), ash (25.0%), crude fiber (12,0%), crude fat (11,1%), crude protein (23,1%), and carbohydrate (15,1%) (Oke & Ogunjimi, 2016). However, young teak leaves are generally underutilized and become agricultural waste. So far, young teak leaves have only been utilized as traditional medicine, animal feed (Hariyono, 2021), food packaging and coloring in *Gudeg* (a traditional dish from Yogyakarta made from young unripe jackfruit stewed with coconut milk for hours), *jamblang* rice, *tempe*, fresh meat, and fish, especially in Java region (Dewi, Supriyadi, & Santoso, 2021). Fresh teak leaves were also used as a preservative and natural coloring for beef sausage (Arief et al., 2014). Recent studies are developing teak leaf in cosmetic products, such as blush-on (Siwi, Rahayu, & Sekti, 2022) and natural dye in nail polish (Darmirani, 2023). The high antioxidant potential benefit from young teak leaves should be utilized more in food products.



Figure 1. Teak Forest in Kebontunggul Village.

One of the food products that could be made with young teak leaves during this Community Engagement Program is cookies. Cookies are small, flat, sweet foods made from flour, fat, and sugar. The advantages of cookies are that they have a long shelf life, are easy to carry, have various shapes, and do not take long to make (Bakara & Rumida, 2022). Besides, cookies are loved by almost everyone. There haven't been any

innovations in teak leaf cookies, even though there have been many studies about cookies made with leaf powder, such as moringa leaf flour cookies (Miranda, Kawareng, & Sastyarina, 2022), (Dewi, 2018). So, it opens up the possibility of using young teak leaves as forcookies. Cookies are suitable for development in Kebontunggul because most residents who can participate in the program are housewives who can use their spare time to earn extra income. In the village, there is a bakery ingredient shop providing bulk cookie material purchases. Kebontunggul also has a tourist area known as Lembah Mbencirang (Mbencirang Valley), where cookies can be sold as souvenirs. So, it would be promising to utilize young teak leaf powder in cookie-making for large-scale production. Making or adding teak leaves into food products is a way to increase their health benefit and, hence, the economic value of teak leaves. Cookies are highly favored, so young teak leaves cookies were expected to be marketed in relatively large quantities and can increase the Kebontunggul residents' income.

The Community Service Team which consists of experts in Biotechnology, Business and Economics, Creative Industries, and Food Technology from University of Surabaya (UBAYA) and Widya Mandala Surabaya Catholic University (WMSCU), then collaborates with Village-owned Enterprise (*Badan Usaha Milik Desa/BUMDes*) Gajah Mada, Tourism Awareness Group (*Kelompok Sadar Wisata/Pokdarwis*), and Family Welfare and Empowerment Organization (*Organisasi Pemberdayaan Kesejahteraan Keluarga/PKK*) from Kebontunggul village in Development of Assisted Village Program (*Pengembangan Desa Binaan/PDB*). This program aims to increase the utilization of young teak leaves by making powder and cookies from young teak leaves and to increase the economic activity of the Kebontunggul residents.

From the discussion with Kebontunggul residents, *BUMDes* Gajah Mada and *PKK* also require training on how to produce teak leaf powder and cookies (including sanitation, hygiene, storage, and standardization), increased knowledge on Good Manufacturing Process (GMP), training on packaging selection and providing product information, transfer of science and technology including procedures and assistance in obtaining P-IRT certificates (the Indonesian Health Ministry's license for processed food products) for products that have been marketed. Meanwhile, *Pokdarwis* needs guidance on strategies to improve marketing networks, increase online marketing, and diversify processed herbal products.

The Community Service Team provides knowledge of the health benefits and product development from young teak leaves ideas and standard operational procedure (SOP) to develop and produce the young teak leaf powder and cookies, including the storage instruction and packaging, as well as the marketing and monitoring of teak leaf

cookies production. BUMDes Gajah Mada, Pokdarwis, and PKK Kebontunggul village participate actively in cookie production training and production. This part needs to add a reference from previous studies about the development of the use of teak leaf, how to increase the economic value of teak leaf, and why cookies are more suitable for BUMDes. To improve residents' knowledge about teak leaves and their utilization (especially the young ones), how to make cookies from teak leaf powder, and how to sell the cookies to increase the residents' income.

2. METHODS

The program will begin in June 2023 through discussion, training, production, and mentoring. The design of the activities that would be carried out in Kebontunggul village includes socialization about the Development of Assisted Village Program (*Pengembangan Desa Binaan/PDB*) and teak leaf-based product training. The main strategy for both activities was participatory rural appraisal (PRA). PRA is a way for rural and urban people to examine living conditions, exchange results, and organize their activities (Sontakki, Venkatesan, & Rao, 2019). This program used several methods: community education, consultation, training, and science and technology transfer.

The community education and consultation consist of lecturing and interactive question and answering (IQA) sessions. Lecturing is one of the teaching methods in which an instructor verbally presents facts and principles to the learners (Kaur, 2011). IQA lets people ask questions and, where possible, get the real answer to the query. If they require more information or if the outcome is not exactly what they were searching for, IQA also lets people ask follow-up questions (Konstantinova & Orasan, 2013). The lecturing was used to introduce the PDB program, to give awareness to the residents about the problems in Kebontunggul village, i.e., the lack of utilization of teak leaves, and to give awareness about the potential which can be explored and knowledge for teak leaf powder production. The transfer of science and technology includes the development of new technologies that can replace old technologies, such as food dehydrators, which can replace the current sunlight-drying method to dry the leaves. Using sunlight to dry the leaves has several disadvantages, such as being prone to contamination and uncontrollable drying temperature. The use of a food dehydrator can solve those problems. Pre-test and post-test questionnaires were also used to determine whether the Kebontunggul residents' knowledge about herbal plants and teak leaves increased.

The training method carried out in cookies training was live demonstration (requiring participation from *BUMDes*, *Pokdarwis*, and PKK members), interactive Q&A, and pre-test and post-test questionnaires to monitor the residents' understanding of making cookies from teak leaves. A live demonstration is a public show of a good, service, or talent in front of a crowd in real time. Community education and consultation were also applied during the teak leaf-based cookies training. These methods include giving the knowledge about the process of making cookies, such as sanitation and hygiene in product processing (e.g., wearing plastic gloves while making cookies), drying temperature and time for teak leaves, standardization of the powder's particle size, baking temperature and time for teak leaf cookies, the packaging used, and the estimate selling price of the cookies. The participants were also assisted in the next stage in producing teak leaf-based cookies to get the product's P-IRT (the Indonesian Health Ministry's license for processed foods). The transfer of science and technology includes using gas ovens that can increase the capacity of cookie production.

PDB Program socialization and teak leaf cookie production were held in Kebontunggul village hall. The number of participants for PDB socialization and teak leaf powder training was 24 people, and for teak leaf cookies was 32 people, including the team members, several students from both universities, *BUMDes* Gajah Mada, *Pokdarwis*, and PKK. The population for the PDB socialization, teak leaf powder training, and teak leaf cookies were the same as the number of participants (24 for socialization and 32 people for cookies training). The samples consisted of 15 people for the PDB socialization session and teak leaf powder training and 16 people for teak leaf cookies training session. The samples were selected from participants who participated actively in the session, and they should be from *BUMDes*, *Pokdarwis*, or PKK. The pre-test and post-test questionnaires have six "Yes/No" questions for the PDB socialization questionnaire. If the respondent answered "Yes," they would get 1 point, and if the respondent answered "No," they would get 0 points. The maximum score is 6 (if they answered all questions "Yes"). There were 10 "Yes/No" questions for teak leaf cookies for both pre-test and post-test questionnaires. If they answered right, they would be given 10 points, but if the answer were wrong, they would get 0 points. The maximum score is 100. All points for both questionnaires were averaged and visualized in a bar graph.

3. RESULTS AND DISCUSSION

The Community Service Team coordinates the development of the Assisted Village Program (*Pengembangan Desa Binaan/PDB*) from the University of Surabaya

(UBAYA) and Widya Mandala Surabaya Catholic University (WMSCU). The team collaborates with Village-owned Enterprise (*Badan Usaha Milik Desa/BUMDes*) Gajah Mada, Tourism Awareness Group (*Kelompok Sadar Wisata/Pokdarwis*), and Family Welfare and Empowerment Organization (*Organisasi Pemberdayaan Kesejahteraan Keluarga/PKK*) from Kebontunggul village. The village government initiated the use of teak leaves because of their abundance, but their utilization is still lacking. The Community Service Team has already discussed the utilization of teak leaves with the village government and has also conducted literature studies and direct practice to develop the procedure and processing conditions for making teak leaf powder and cookies.

The socialization mainly talked about the potential of Kebontunggul village as a herbal village, the main problems (such as the herbal preparation process still not meeting sanitary and hygienic requirements, the products manufactured do not yet have a P-IRT certificate and limited variety of herbal products), plans and methods to solve the problems and develop the village, the abundance and health benefits of teak leaves, and the ideas of products that can be made from teak leaves. The team also provided brief information about marketing (Figure 2).



Figure 2. PDB Program Socialization in Kebontunggul Village; Socialization by Mr. Tjje Kok (Community Service Team Leader); Marketing Knowledge Sharing by Ms. Noviaty Kresna Darmasetiawan; Participants from Kebontunggul Village.

In teak leaf powder training, *BUMDes*, *Pokdarwis*, and *PKK* were given the procedure and explanation for making teak leaf powder since it could not be practiced on-site due to time constraints. Young teak leaves were plucked and selected based on some criteria, e.g., fresh green-colored, intact, not contaminated with pests, not brown-spotted, not perforated, and coming from 1-3 levels below the top of the leaf shoots. Then, the leaves were washed, separated from the leaf bone, cut into pieces (5x5 cm),

spread on a baking tray, aerated for ± 24 hours, dried (50°C , 5-7 hours), cooled at room temperature, ground using herb-grinder (± 1 minute), sieved with flour sieve, and



packed in airtight container contains silica gel pack. The team also provided a food dehydrator for drying the leaves to village residents (Figure 3).

Figure 3. Handover of Food Dehydrator from Community Service Team to Kebontunggul Village Residents.

Almost all people participated in making the cookies while listening to the explanation given by the team. Village residents were also given a procedure and formulation for making the cookies to try by themselves next time. First, margarine, vegetable oil, and brown sugar were mixed evenly, and then egg yolk and vanilla flavoring were incorporated. After that, the dry ingredients (cornstarch, baking powder, baking soda, wheat flour, and teak leaf powder) were sieved and mixed thoroughly into the mixture. After the mixture became dough, it was rolled into a small ball (5 g each) and flattened using a fork. After that, the flattened dough can be directly baked or given topping first (e.g., chocolate chips) and then baked (170°C , 10 minutes) using top and bottom heat oven. Then, the cookies were cooled until they were at room temperature and packaged in plastic jars containing silica gel and baking paper (Figure 4).



Figure 4. (a) Briefing on Teak Leaf Cookies Training; (b) Making of Teak Leaf Cookies by the Residents; (c) Baking; (d) Group Photo with Community Service Team, Students, and Kebontunggul Residents.

Besides the training, the team gave the residents a brief knowledge of packaging design (Figure 5).



Figure 5. Information Sharing about Packaging Design from Ms. Hany Mustikasari. The team also provided a gas oven to support the cookie production (Figure 6).



Figure 6. Handover of Gas Oven from Community Service Team to Kebontunggul Village Residents.

The residents were given pre-test and post-test questionnaires on PDB Program socialization and teak leaf cookies training to determine their understanding of PDB and how to make it. The results are presented in Figure 7 and Figure 8.

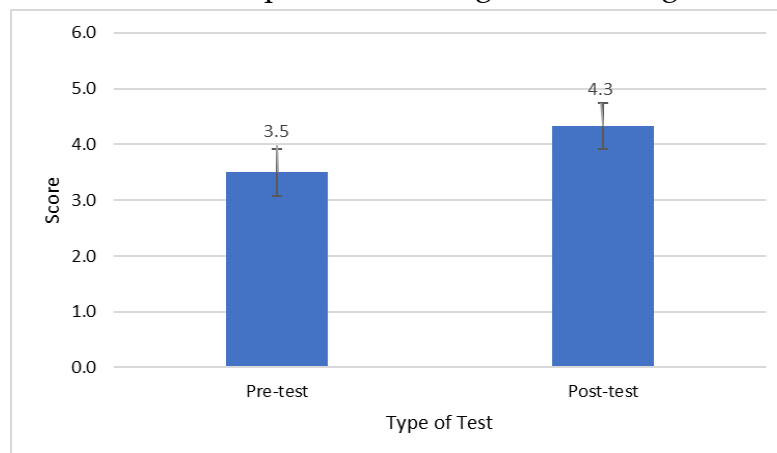


Figure 7. Results of PDB Program Socialization Pre-test and Post-test (Maximum score = 6.0).

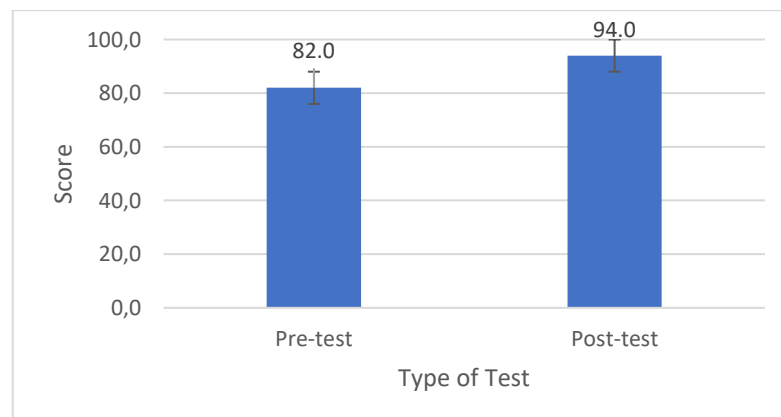


Figure 8. Results of Pre-Test and Post-Test of Teak Leaf Cookies Production Training (Maximum score = 100.0).

PDB Program socialization pre-test score is 3.5 (out of 6.0). Meanwhile, the post-test average score is 4.3 (out of 6.0). The questionnaire asked about the residents' knowledge about herbal and teak leaf products, whether teak leaves are also herbal plants, the utilization and efficacy of teak leaves, and whether teak leaf food products are interesting. Meanwhile, the cookies training pre-test average score is 82.0 (out of 100.0), and the post-test average score is 94 (out of 100). The questionnaire mainly asks about the procedure, ingredients used, knowledge about teak leaf powder, and processing condition of the cookies. Overall, both results showed that the understanding of Kebontunggul residents increased in PDB and teak leaves cookies training. From the training, two variants of cookies are created, namely original (without topping, only teak leaf powder added) and chocolate chip topping (Figure 9). The products have the potential to be developed further so that the residents of Kebontunggul village can be more productive and their economic condition may improve.

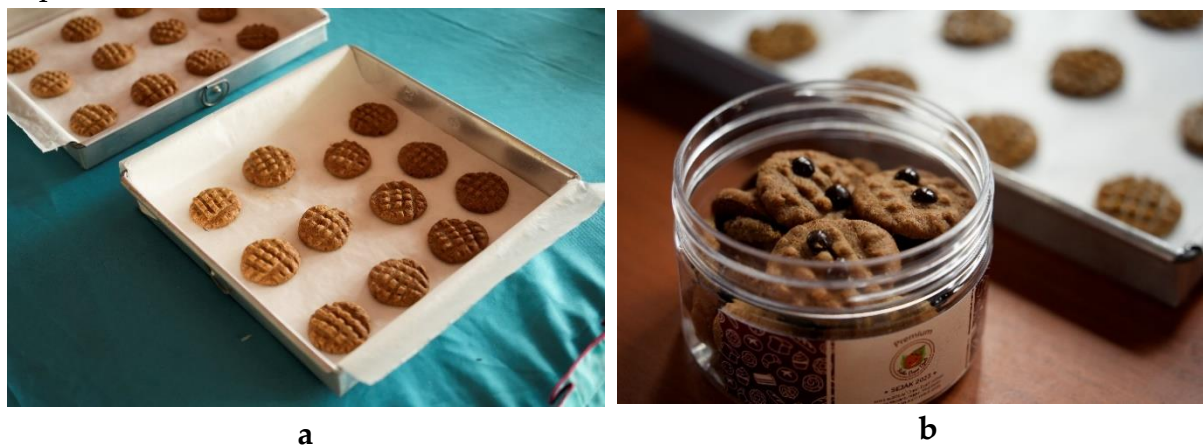


Figure 9. Teak Leaf Cookies (a) Original; (b) Chocolate Chip Topping.

a. Work Review

Using teak leaves in dry teak leaf powder is a way of preserving teak leaves and extending the shelf life of the leaves. Because the dry powder form has a low water content, microorganisms are difficult to live in the product. It can also minimize chemical reactions that could affect quality. Hence, the powder is more stable, and the shelf life increases. The breadth of the leaf surface, which is more exposed to sunlight than other parts of a plant, causes about 90% of the water in plants to be released through the stomata in leaves (Maylani, Yuniati, & Wardhana, 2020). In addition, when the leaves are already in dry powder form, it is easier to utilize and add to food products, such as cookies, bread, tea, and so on, than in the form of whole leaves or leaves cut into small pieces.

The teak leaf powder content in the cookies is around 5.0% of the wheat flour. The team also provided cookie products with the proportion of teak leaf powder around 7.5% and 10.0%, but the most preferred cookies are with the 5.0% teak leaf powder content. Teak leaves have several active compounds, such as glycerine monoacetate, glycerine diacetate, 4-hydroxy-4-methyl-2-pentanone, and 1-policosanol, anthocyanins (petunidin-3-O- (6-O-acetyl)-5-O-glucoside and malvidin-3-o-(6-o-acetyl)-5-o-glucoside). Those compounds have hydroxyl groups in their structure, which provide antioxidant activity. Specifically for anthocyanin compounds, their structure also has heterocyclic rings and conjugated double bonds that can give very strong antioxidant activity (Suryanti et al., 2020). Tannins, steroids, flavonoids, terpenoids, and saponins are also in teak leaves. In addition to the active components, teak leaves also contain moisture (10.0%), ash (25.0%), crude fiber (12.0%), crude fat (11.1%), crude protein (23.1%), and carbohydrate (15.1%) that humans need. Cookies are usually high in carbohydrates and fats but low in fiber, vitamins, and minerals. However, teak leaves contain fiber and ash, so adding them to cookies could enhance their nutritional value.

Besides being healthy, teak leaf cookies also have an attractive appearance, sweet taste, and crunchy texture, and the characteristic flavor of the teak leaves is still present. Teak leaf cookies are also relatively easy to make, and the ingredients are readily available, making them easy to produce in large quantities and the long term.

However, several things need to be considered for improvement. First, the teak leaf cookies are still not well-known to consumers. The solution is branding by making publications on social media, news portals, promotions, and giving testers. Second, they are fragile because of the crunchy texture, and when shipped out of town, the cookies may crumble. The solution is to fill the jar or container with cookies until full and not shaky. The jar is wrapped with bubble wrap; then it is put in cardboard (as secondary packaging), while the inside is also given bubble wrap until the jar does not shake. Third, the level of hardness and crispness of the cookies is not always consistent. The solution is to practice several times, optimize the production, and then establish a written SOP (Standard Operational Procedure) that must be followed occasionally.

b. Impacts And Benefits of the Activity

Food trends are now moving towards natural and healthy products. COVID-19 might be the main driving force. In Indonesia, the demand for healthy food products has increased rapidly by 10% over the past decade (Hidayat et al., 2021). Besides, in the post-COVID-19 era, 54% of American consumers, and consumers above 50, care

more about the healthfulness of their food and beverage choices in 2020 than in 2010. Healthfulness is a major consideration, compared to taste and price. Also, the consumers shifted to smaller upstart brands with more innovative recipes, exciting flavors, and healthier profiles with more sustainable and simpler ingredients (Lempert, 2023). Utilizing natural and herbal resources in Kebontunggul village is one way to support this trend. With the participatory rural appraisal (PRA) strategy and several methods such as community education, training, consultation, transfer of science and technology by the Community Service Team and support from village government, *BUMDes Gajah Mada*, *Pokdarwis*, and *PKK*, the abundant source of teak leaves can be utilized optimally, especially for functional food products, such as teak leaf powder and teak leaf cookies.

Using teak leaves to produce teak leaf powder and cookies is in line with Kebontunggul Masterplan as Herbal Village. Kebontunggul village is one of the most famous herb-producing villages in Indonesia and was once appointed to represent East Java province as a pioneer village for National Toga-Based Agro-tourism (Agrowisata Berbasis Toga Tingkat Nasional) in 2007 (Romero & Wonoseputro, 2023). Herbal products have been made in the form of jam with simple equipment, such as Simon, second, wedding with, and wet on *songolas*, but it turns out that there is still more nature potential that has not been maximally utilized, which is teak.

The outcome of PDB Program socialization and cookie production training is the increased knowledge and skills of the Kebontunggul people, as indicated in the pre-test and post-test results. The procedure of producing teak leaf powder, teak leaf cookies, and cookie formulation was given to support its production scale and increase the residents' economic activity. The increased understanding of PDB from 3.5 (pre-test score) to 4.3 (post-test score) out of 6 means they are more aware and understand more about teak leaves and their benefits, especially the young ones. The increased post-test score of cookies training (94 out of 100) from the pre-test average score (82 out of 100) also means they understand more about making teak leaf cookies. The skills to make cookies could be improved through direct practice during the training. These improvements must be applied to sustainable, standardized, and long-term production. The P-IRT of cookies has also been obtained.

Young teak leaf cookies might also increase the economic value of the teak leaves. For example, the price of young teak leaves as food packaging is Rp. 12.000 per 500 grams, or Rp. 24 per gram (Tokopedia, 2024). However, if the leaf powder were incorporated into the cookies, one recipe would need 15 grams of teak leaf powder, which can be used to make ten jars of @100 grams. The selling price of the cookies with

chocolate chip per jar @100 grams is Rp. 20.000, and each jar contains 1,5 grams of teak leaf powder. Meanwhile, the price of brown sugar cookies with chocolate is Rp. 16.600 (Tokopedia, 2024b). It can be said that the teak leaf powder price is Rp. 3.400 per 1,5 grams (Rp. 2.267 / gram); hence, the teak leaf powder in cookies has a higher selling price than fresh young teak leaves.

The production capacity up until now (March 2024) is ten recipes per day. It is equal to 100 jars. A jar contains approximately 20 cookies. Up to 5.000 cookies can be made per month. Up to date (March 2024), around 1.500 jars have already been made and sold for various activities and events, such as periodic selling in Ubaya Baking Center (University of Surabaya's bakery), Musrenbang (Musyawarah Rencana Pembangunan) and exhibition in Mojokerto regency, *alumni* meeting at Widya Mandala Surabaya Catholic University, and professor inauguration at University of Surabaya. This shows that the residents of Kebontunggul village can be more productive and earn additional income.

The innovation doesn't just stop at this stage. One of the steps in making cookies, which is shaping, could be more efficiently done. All this time, the residents should weigh the dough (5 grams for one cookie) and shape it manually using hand and fork, which takes the longest time among other steps. In the future, they might use cookies press for efficiency. They must put the dough in the cylinder, choose the mold, and press the handle down. The dough should be shaped with the corresponding mold and have the same size and thickness. It should be faster and more efficient than before. Collaborations with other outlets and online marketplaces could increase sales.

4. CONCLUSION

The PDB Program socialization and the teak leaf powder and cookies production training have increased the knowledge and skills of Kebontunggul residents about the health benefits and utilization potential of teak leaves. The increase in understanding of the PDB program is from 3.5 (pre-test score) to 4.3 (post-test score) out of 6. The increase in understanding of cookie production is 82 (pre-test score) to 94 (out of 100). The production of teak leaf cookies could also increase the economic activity of the residents. There are two variants of teak leaf cookies: original and chocolate chip topping. Plans for the program include the more advanced marketing of teak leaf powder and cookies, including promotions and online marketing, and more diverse teak leaf products.

ACKNOWLEDGMENTS

Gratitude is expressed to the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), the Research and Community Service Institute (LPPM) of University of Surabaya, Kebontunggul Village Government, and partners from *Badan Usaha Milik Desa (BUMDes) Gajah Mada, Kelompok Sadar Wisata (Pokdarwis), dan Pemberdayaan Kesejahteraan Keluarga (PKK)* Kebontunggul Village for the support and collaboration in this Development of Assisted Village Program (*Pengembangan Desa Binaan/PDB*).

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