Community empowerment of Sumberpelas, Plabuan Village-Jombang to create independent and sustainable *Moringa oleifera* village

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Abstract. Plabuhan village, Jombang regency, East Java Province has a big potential in Moringa. Moringa is a plant that we encounter often around us that contains high nutrition. It is widely used especially for health. Potential that can be developed from Moringa's leaf by S community is tea. As a product of the Plabuan village, the tea standards produced must be in accordance with the Indonesian National Standard (SNI) and the eligibility according to the Food and Drug Supervisory Agency (BPOM). To maximize this potential, assistance is needed to the Plabuan village community to process the Moringa’s leaf into high quality tea product. Through this assistance, it is expected that independent and sustainable Moringa oleifera villages will be realized. The results of the study showed that the community in Plabuan village was very active to contribute to utilisation and production of Moringa oleifera based products.

1. Introduction

One of the villages that are still faced with poverty and infrastructure issues is Plabuhan Village-Jombang. Sumberpelas is in the northern part of Plabuhan village. This place has an area of 5.18 km². Most of the area is a residential area and forest with hilly relief. Sumberpelas is located at an altitude of less than 500 m but has a slope of 2.15%. With the slope and the type of karst soil, teak plants dominate Sumberpelas. Sumberpelas is one of the locations that is difficult to access. This is because Sumberpelas is 1.5 km away from the village activity center (Balai Desa). Road infrastructure to Sumberpelas is difficult to access by four wheels vehicle.

The condition of the houses in Sumberpelas is mostly wood walled because teak is easy to get. There are still many houses that have dirt floors because the land in Sumberpelas tends to be unstable, the soil is easily cracked when it is cemented or covered with ceramic. Most residents in Sumberpelas only get education of elementary level. It was noted that 117 out of 327 residents got advanced level of education, while only 3 persons got education of bachelor’s degree and 49 of the total residents in Sumberpelas are still illiterate or do not have any educational background. For communication, people who live there can operate mobile phones using certain signal providers. While the livelihoods of residents in Sumberpelas are in general, in the agricultural sector. This shows that the agricultural sector plays an important economy role in this community. In addition to considerable agricultural potential, Sumberpelas also has enormous potential in *Moringa*. *Moringa* has been underestimated by some people despite its amazing nutritional contents, since this plant is used in ancestral custom and tradition for ceremony of the death and to expel evil spirits.
Moringa oleifera known as horseradish tree or drumstick tree. It belongs to Moringaceae family (Order Capparales). It is commonly cultivated in tropical countries, such as Philippines and South India [1]. It is a small deciduous perennial tree. This plant can grow fast up to 10 or 12 m of height and classified as evergreen plant. It is mainly used in traditional medicine. Its roots, leaves, flowers, fruits, and seed oil are edible [2]. Each part of this plant contains rich source of vitamin A, vitamin C and protein. Some bioactive compounds are found in this plant’s leaves. They are classified as vitamins, carotenoids, polyphenol, alkaloids, phenolic acids, phytates, saponins, tannins, oxalates, isothiocyanates, and glucosinolates. Isothiocyanates, have antibacterial activity that may help to rid H. pylori, bacteria implicated in gastritis ulcers, and gastric cancer [3]. Some parts of Moringa such as leaves, roots, bark and seeds show anti-microbial activity against bacteria and fungi. This plant shows in vitro activity against bacteria, yeast, dermatophytes, and helminths by disc-diffusion method. The fresh leaves and aqueous extract from the seeds inhibit the growth of Pseudomonas aeruginosa and Staphylococcus aureus [4]. This plant also contains other treasured pharmacological activities like antipyretic, anti-asthmatic, anti-diabetic, analgesic, hepatoprotective, wound healing, anti-inflammatory, anti-allergic, anti-fertility, anti-ulcer, anti-cancer, and antioxidant [3]. Important minerals including calcium, potassium, iron, manganese, copper, magnesium, and zinc also present in Moringa oleifera. One hundred grams of dry Moringa leaves contain 25 times the iron of spinach, 9 times the vitamin A of carrots, 12 times the vitamin C of oranges, 15 times the potassium of bananas, and 17 times the calcium of milk [5].

All parts of Moringa oleifera can be used for varied purposes, but leaves are predominantly used than any other parts of the plant. Its leaves are used to increase human and animal food nutritional value and traditional medicine. These leaves are used to treat several diseases including parasitic diseases, malaria, typhoid, cuts, swelling, diabetes, hypertension, as well to elicit lactation and promote immune system. Moreover, Moringa seeds are also used as water clarifier [6]. Seeds of Moringa may protect against some effects of the arsenic toxicity. Contamination of ground water by arsenic has also become a cause of global public health concern. In this case, Moringa seeds have even been found good for water purification function [7]. The extensive usage of Moringa oleifera need to be supported by a breakthrough since the common generative propagation of this plant is quite hard to be done, because the viability of seed germination is low. Hence, there was a biotechnological method for synthetic Moringa seed through in vitro culture [8]. Dried leaves of Moringa oleifera contain higher amount of total minerals, ether extract, crude protein, crude fiber, and total carbohydrates, and moisture content than the fresh ones [9]. Ground and dried Moringa oleifera leaves are expected to be the promising source of carbohydrate with great caloric value. High nutritional value found in these dried leaves concentrate the amount of nutrients, facilitate conservation and consumption. It is more convenient to transport and consume in dried form. In this dried form, Moringa oleifera leaves can be easily transported to areas where it is not grown [10].

The potential that can be developed from the Moringa plant is quite a lot, ranging from herbal drinks made from Moringa or often called Moringa tea (dried and ground Moringa leaves) to Moringa chips (deep-fried and battered Moringa leaves). So, to maximize this potential, assistance is needed to the Women Empowerment Group to process the Moringa plant into numbers of products. The aim of the study was to investigate the empowerment community in Plabuan village-Jombang in the case of Moringa oleifera valorisation.

2. Methods

2.1 Obtaining Moringa Tea Sample
It is noted that 1 kg of Moringa tea made from dried and ground Moringa oleifera leaves produced by Woman Empowerment Group of Sumberpelas.
2.2 Sample Analysis
It is noted that 500 g of Moringa tea was taken to Testing and Calibration Laboratory, Surabaya Industrial Research and Standardization Center, Ministry of Industry of the Republic of Indonesia in 24th July 2019. This sample was tested to compare with the Indonesian National Standard of processed tea.

2.3 Conducting Training to Sumberpelas Residents
This program was held on 14th August 2019, at 09.30 am. The activity took place in Sumberpelas, as portrayed in Figure 1, especially at the Activity Center (Balai Dusun) and used a lecture approach and training/workshop as well as guidance and assistance by giving direct experience to the targeted audiences. This lecture was chosen to explain and equip participants to get understanding and knowledge of the technical implementation and development of this village potential, especially Moringa plants.

![Figure 1. Location of Sumberpelas](image)

After giving a lecture of all related matters with the potential of the village, there was a training for practical skill and business development derived from Moringa plants. Mentoring partners were also assisted in the application and preparation development of activities to meet recommended standards of the products. Therefore, Jombang Regency Health Office was also invited to take part in this program by giving the supplementary insights to the residents about registering and licensing home industry products.

3. Results and Discussions

3.1 Circumstances
Activities in the form of training about economical products that improve the audience’s insights about Moringa products as well as information about licensing Moringa products to be marketed, have been successfully implemented. Photographs as the documentation of the activity is exhibited in Figure 2. The training activities was held well, and the enthusiasm of the Sumberpelas village community was high in receiving the materials. This community also exhibited some creative and innovative Moringa oleifera products. Their enthusiasm was proven by the large variety of questions asked by the audience to the speaker. The residents frequently asked about licensing the products when product licensing session delivered by the Jombang District Health Office. This was because the products they have made were not yet registered as ready-to-sell products.

3.2 Advantages of Drying and Grinding on Moringa Leaves
The drying method is one of the methods for preserving harvested material. General benefits obtained by the drying process is to prevent decay by microorganisms and enzyme activity that will affect the nutritional content and shelf life. However, it should be noted that the drying process influences the
concentration and availability of important compounds significantly in food. This statement is reinforced by reports of loss of nutrients from vegetables during drying process [11]. Moringa plants have several advantages if they are processed by drying. According to reports, dried Moringa does not undergo nutrients changing significantly. So that it can be stored for a very long time without refrigeration [12].

Figure 2. Activities in Sumberpelas, (a) The program team from Institut Teknologi Sepuluh Nopember (ITS) and Universitas Darul Ulum (UNDAR) along with the Chief of Plandaan village; (b) Audiences and the team, (c) Products of Moringa named “Keripik Kelor” (Moringa chips) and tea

There are differences in the amount of nutrients between fresh moringa and dried leaves. The biggest difference is the amount of calcium (± 1563 g) and protein (± 113 g) [12]. The commercial benefits of the process of drying in Moringa leaves include decontaminating microorganisms, minimizing packaging, reducing shipping costs, and increasing the shelf life of Moringa plants. Therefore, the drying process plays a very important role for processed Moringa products to be certified [13]. The basic method of drying can be applied to the production of Moringa based brewed Moringa drinks and other herbal Moringa products that need to be stored in prolonged time.

3.3 Test Results on Moringa Tea Samples Compared to Indonesian National Standard
The Moringa tea content test was carried out with a sample of 500 g of dried and ground Moringa leaves which were produced directly from Sumberpelas, as listed in Table 1.

| Table 1. Test results of 500 grams of dried Moringa tea sample |
|---------------------------------------------------------------|
| Nutrient          | Units | Results | Methods |
| Taste             | -     | Normal  | Organoleptic |
| Aroma             | -     | Normal, typical tea | Organoleptic |
| Color             | -     | Normal, typical tea | Organoleptic |
| Moisture          | %     | 8.89    | Gravimetry |
| Ash               | %     | 7.91    | Gravimetry |
| Lead (Pb)         | mg/kg | 0.35    | AAS |
| Cadmium (Cd)      | mg/kg | <0.0024 | AAS |
| Mercury (Hg)      | mg/kg | <0.0002 | AAS |
| Tin (Sn)          | mg/kg | <0.0029 | AAS |
| TPC               | colony(s)/g | $7.5 \times 10^4$ | Pour Plate |
| Coliform          | APM/g | <3      | APM |
| Mold              | colony(s)/g | <10    | Pour Plate |
| Arsen (As)        | mg/kg | <0.0008 | AAS |
| Crude Fiber       | %     | 16.08   | Gravimetry |

Data Source: Surabaya Industrial Research and Standardization Center, 2019
The test was conducted at the Testing and Calibration Laboratory, Surabaya Industrial Research and Standardization Center, Ministry of Industry of the Republic of Indonesia. The test results would be compared with Indonesian National Standards for types of processed tea products. This test aims to determine the content of substances in Moringa samples in accordance with the national standards for processed tea products.

The results of the national standard test for Moringa tea produced by Sumberpelas village are in accordance with Indonesian National Standards. This has become one of the requirements that need to be fulfilled for later processed Moringa leaves can be packaged into a product ready for distribution in the form of steeping tea. However, what needs to be underlined from the test is that the water content is still quite high which is higher than required by the national standard. Moisture content can be reduced by extending the drying period or using some effective drying methods such as an oven or a microwave drying method [13].

4. Conclusions
Based on the activities that have been carried out, it can be concluded that the processed product of dried Moringa leaves can be developed into small industrial products in the form of Moringa steeping tea because the test result has met almost all parameters in national standard for processed tea. Through the provisioning that has been done, the processed product will be registered with the ready-to-sell product license through the Jombang Health Office.

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