

FOOD DIVERSIFICATION TO SUPPORT FOOD SCURITY

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Abstract

Rice is the main food for most people of Indonesia. Level of rice consumption in Indonesia reached 139 kg/capita/year. This value is very high when compared to other countries such as Japan 45 kg/capita/year, Malaysia 80 kg/capita/year and Thailand 90 kg/capita/year. This data shows that Indonesia relies heavily on one of the foodstuffs. To meet the needs of the rice Indonesia to import as much as 24 929 tons of rice (Anon, 2004a; Santosa, 2016).

To reduce dependence of rice and import, so that food diversification program by using local food, like cassava is one alternative that can be done. Diversification of staple food have to do with the development and introduction of alternative materials substitute of rice that resembles rice in both form and content of nutrients. Cassava (*Manihotesculenta*) is a kind of tubers that contain high carbohydrates with low levels of amylose and high amylopectin contents so it can be used as food source of carbohydrates instead of rice (Rismayani, 2007).

Diversification of food made people more healthy. In addition, diversification is able to create new jobs with the growth of small-middle business which process foodstuffs and increasing of agricultural land planted non-rice crops. In an effort to support national food security so diversification program of the utilization of local food as a source of carbohydrate as one of cassava need to be developed. One of the products processed from cassava material that was developed is "analog rice".

According to Yuwono, *et al.*, (2013), rice analog is one form of diversification of staple foods prepared from carbohydrate-based raw material with the addition of certain substances to improve the quality of staple foods. Product diversification is expected to support national food security program to reduce rice consumption level without making major changes in people's eating traditions.

Keywords: rice, diversification, food security, analog rice

I. Introduction

Rice is the staple food for the majority of the Indonesian people. Rice consumption increased every year following with population growth. Indonesian rice consumption society approximately 139 kg/capita/year and became the highest rice consumption countries in Asia and during the previous three years as the country's rice

consumption is the highest in the world (Gultom, *et al.*, 2004).

Presented on International Seminar of "Food Savety and Food Scurity to Support Sustainable Development Goals". December 20, 2016 at Warmadewa University, Bali.

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Indonesia relies heavily on one of the foodstuffs. To meet the needs of the rice Indonesia has imported as much as 24 929 tons of rice (Anon, 2004a; Santosa, 2016). It is very dangerous and can create a high risk factor. When a current supply disruption due to natural disaster or crop failure, it can make problems of food

security. The problem of food security can be extended to economic and security problems.



Dependence on rice becomes a problem due to the level of rice consumption is very high but not matched by an increase in rice production. Though local ingredients such as flour mill products and starch are very diverse kinds and nutritional content is not inferior to rice, including cassava, sagu, and corn can be used instead of rice locally based (Gultom, R.J. *et al.* 2014).

Government programs in an effort to reduce the consumption of rice continue to be done through diversification, with a target of rice consumption of 70 kg/capita/year as well as Malaysia and Thailand namely 80 kg/capita/year. Indonesia has a great potential to produce agricultural products carbohydrates instead of rice. However, consumption of carbohydrate sources is still low at 14.4 kg/capita/year. The government wants to encourage the consumption of a variety of local carbohydrate is increased to 36 kg/capita/ year. (Gultom, R.J. *et al.* 2014).

Food diversification by using of local food, like cassava is one of the alternatives

to reduce dependence on rice. Diversification of staple food have to do with the development and introduction of alternative materials substitute of rice that resembles rice in both form and content of nutrients.

In an effort to meet the demand for food supplies, the necessary solutions through diversification, but the culture of Indonesian people who consume rice three times a day would be difficult to change. Thus alternative food that resembles rice as a staple food and nutrients are almost the same as that contained in the paddy rice (Sumardiono, S., *et al.*, 2014).

According to Gultom, R.J, *et al.* (2014), that Indonesian culture is very strong presumption that not eat if you do not eat rice. It is necessary to develop alternative food resembling rice, but not purely made from rice. Products approachable character from the original rice carbohydrate source materials locally so psychologically people feel consume rice. One of the products processed

carbohydrate source non rice has more developed nowadays “analog rice”.

This article discusses food diversification efforts in order to maintain national food security, with a focus on national rice production can not meet the needs, the use of local food as food diversification efforts, and the development of analog rice by using cassava as raw material. The conclusion of this article will be able to provide information relating to government policies that only given of priority on the increased production program of rice, corn and soybean production without regard to the other crops such as tubers.

In addition, to provide information that to meet the demand for calories to humans not only have to come from the paddy rice but may also take advantage of rice originating from tubers, known as "rice analog". Rice analog made from cassava health better than the rice from paddy.

Another objective of this paper is to appeal of the public in other to reduce the consumption of paddy rice by trying to replace with other food materials gradually, so that the habit of eating rice every day three times will be reduced. This movement should be supported by national and regional governments through concrete programs and the dissemination and promotion continuously until the goal to

reduce the consumption of rice so that the import and the dependence on rice can be reduced.

II. DISCUSSION

2.1. National Rice Production and Supplies

Rice is one of the most important staple food for the population in some countries in the world. Rice is the staple food for the majority of the population in Asia, especially for the middle to lower (Santosa, 2016). Santosa (2016) stated that global rice production is projected to decrease from 478.76 million tons in 2014/2015 be 469.50 million tonnes in 2015/2016 (WASDA-USDA, March 2016), or by 1.9%. Some of the world's rice exporting countries such as India, Pakistan, Thailand and Vietnam production decreased respectively by 2.4; 1.6; 2.0; and 0.1%. Thus, International rice market in 2016 will allow the rigorous International rice prices increased. The price of rice is likely to increase often leads to the phenomenon of "countercyclical, namely rice exporting countries will actually hold their stock for the stabilization of prices in the country.

Some of the world's largest rice-producing countries in 2014 include: Table 1. The five largest rice producer in the world of 2014.

No	Country	Amount of Production (Ton)
1	China	208,100,000
2	India	155,500,000
3	Indonesia	70,600,000
4	Bangladesh	52,400,000
5	Vietnam	44,900,000

Value in *unmilled tons*

Sources :FAOSTAT(2014);Santosa, (2016)

Based on the Table 1 above, Indonesia including to -3 rice producer in the world, but the reality of the national rice production has not been able to meet the

needs of the national rice so that the rice import policy is still being done by the government to maintain the stability of national food security. This situation is

caused by farmers using agricultural techniques that are not optimally coupled with per capita consumption of rice were great. In fact, Indonesia has the highest per capita consumption of rice in the world. Everyone Indonesia consumes about 140

kilograms of rice per year is equivalent to 0:31 kg/day = 310 g/day/person (Santosa, 2016). National rice production from 2008 to2015 as shown in the following Table 2 below:

Table 2. Production of Rices in Indonesia(2008-2015).

No		2008	2009	2010	2011	2012	2013	2014	2015
1	Production of Rices ⁽¹⁾	60.3	64.4	66.4	65.4	69.1	71.3	70.9	75.4

⁽¹⁾ value in *unmilled tons*

Sources :FAO of the United Nations and Kementrian Agricultur (2015); Santosa, (2016)

Total rice production in the country has not been able to meet national requirements, so as to meet the national demand for rice Indonesian government needs to import to meet the domestic demand for rice. Rice imports increased from 0.844 million tons to 0.862 million tons, an increase of 2.0 percent and cassava by 0.6 million tonnes (64.4 percent). Total food imports in 2015, deplete the foreign exchange 8.846 billion US dollars, or Rp. 116.5 trillion. (Ministry of Agriculture, 2014-2016).

The Indonesian government uses two ways to achieve self-sufficiency in rice. On the one hand the government encouraged farmers to increase their production by increasing of technological innovation and provide subsidized fertilizer, on the other hand tried to reduce rice consumption society through campaigns like "one day without rice" (every week), as well as promoting the consumption of foods other staple. This strategy can not be said to be successful because of the amount of rice production increased only slightly and most Indonesian people refuse to replace rice with other food ingredients.

2.2. Independency and Food Scurity

Food is one of the basic human needs fulfillment becomes the right of every people of Indonesia, and is a trading commodity that was instrumental in the life

and economy. Therefore, food should always be available in sufficient quantity and quality for the realization of next-generation intelligent and prosperous.

Indonesia with a large population of 240 million people (Santosa, 2016), requires the availability of food in sufficient quantity and spread, as well as meet the criteria for consumption and other logistical needs. The level of food production in Indonesia is currently threatened in meeting the demand for food consumption. When food production in the country is inadequate, food imports necessary and justified economically.

Importing of food are frequently carried out by the Indonesian government are food staples, especially rice. This is because rice is the staple food for the majority of the people of Indonesia. Along with the increase in population, the demand for rice also increased. In addition, the diet and culture of Indonesian people who consume the rice is almost 3 times a day and not feel eating when not eating rice can also lead to greater demand for rice.

Rice is the major source of carbohydrates in the diet of people in Indonesia. Community dependence focus on only one source of carbohydrates gradually be reduced, as it will have an impact on food security. (Noviasari, *et al.* 2012). During the national rice requirement can not be met by domestic rice production,

the import policy conducted by the Indonesian government will continue to do, in order to maintain the stability of domestic food.

Dependence of Indonesia with staple food such as rice can be reduced through several programs and policies that have been carried out by the government, but to be able to achieve the expected goals it is necessary to take some measures such as (1) an increase in domestic rice production, (2) a reduction in rice consumption of 139 kg/capita/year to 70 kg/capita/year, (3) diversification of staple food, and (4) development of staple food based tubers as an alternative staple food rice.

The Cheap of Depok City Nur Mahmudi Ismail, stated that by reducing the consumption of paddy rice once a day and consume corn rice, tapioca, cassava and bananas twice a day would save 22 million tonnes of paddy rice and the government's budget as much as Rp161 trillion annually. The program is also useful to keep rice prices remained stable (Santosa, 2016).

According to Asnawi (2015), food security actually has four main dimensions, namely food availability, accessibility, price stability, and utilization. If one is missing, a country could face serious food insecurity.

2.3. Diversification of Food and Nutrition Fulfillment

Food is one of the basic needs of human rights fulfillment into every people of Indonesia, and is a trading commodity that was instrumental in the life and economy (Asnawi, 2015).

Rice is the main ingredient of Indonesian society. Other local food commodities such as tubers was not yet able to substituted of rice as a staple food (Handayani, *et al.*, 2013). According to Ariani (2010), the staple food consumption patterns of the Indonesian population has shifted from patterns vary

based on local resources into a pattern of rice and wheat (including derivatives). As a result, rice consumption level is still above 100 kg/capita/year. While, according to Trade Minister Gita Wiryawan (2011), the Indonesian people against the consumption pattern of rice today is very high, even the highest in the world. Indonesian society consumes up to 130-140 kilograms of rice per year/person. This amount is twice as high compared to other Asian people who only consume as much as 65-70 kilograms of rice per year/person.

Many countries are concerned if the price of rice continue to rise or remain in a high level it will dangerous of the economic and political conditions. Food is the most important expenditure items for families who are on the poor condition. If the price of staple foods such as rice increases, poor people do not have much choice but to reduce the consumption of food or choose a cheaper, which will mean a reduction of nutritional or economize by not sending children to school. All these choices have a huge impact for future generations. High food prices will increase political instability (Santosa, 2016).

Fulfillment of the energy derived from carbohydrates should not only come from the paddy rice, but can also come from other crops which contains nutrients, especially carbohydrates is equivalent to the paddy rice. Based on the total carbohydrate nutrient content mainly found in rice 78.69%, and 85.86% of fresh cassava, according to the carbohydrate content, cassava can be used as an alternative staple food for substituted of paddy rice. There is no single food that contains of complete nutrients, each has advantages and disadvantages. For the consumption of a varied diet is highly recommended for people to live better and healthier quality.

Table 3. The Nutritional contents of fresh cassava, cassava flour, and modified cassava flour (Mocaf)

No	Nutrition Contents	Fresh cassava ^(a)	Cassava Flour ^(b)	Mocaf ^(d)
1	Moisture content (%)	57,00	8,65	13,0
2	Starch content (%)	74,81	62,54	85-87
3	Amilosa (%)	-	-	23,03
4	Ash content (%)	2,46	2,55	0,2
5	Fat content (%)	0,2-0,4 ^(c)	6,54	0,4-0,8
6	Protein content (%)	0,5-1,2 ^(c)	1,81	1,0
7	Carbohydrate content (%)	85,86	80,45	-
8	Fiber content (%)		1,0 – 4,2 ^(c)	1,9 – 3,4

Sources : ^(a) Susmiati (2010), ^(b) Arnata (2009), ^(c) Novitasari, *etal*(2014), Subagio, *et al.* (2008)

Indonesia has the cassava area of 1.4 million hectares are spread across Indonesia, with an average of cassava production by 16 million tons per year. People in some parts of Indonesia consume cassava as a staple food. Cassava can be developed into various processed through agro-industries. (Darmawan, *et al.*, 2013).

Cassava (*Manihotesculenta*) is a kind of tubers that contain of high carbohydrates with low levels of amylose and amylopectin is high so it can be used as food source of carbohydrates instead of rice (Rismayani, 2007). According to Winarno (1992), the starch content contained in cassava by 34.6%. Cassava starch other than the usual in large quantities but also have functional properties that are beneficial to humans. Important functional properties include cassava starch content of resistant starch (RS) that are similar to dietary fiber (Nazhrah, *et al.* 2014).

According to Herawati, H. (2011), resistant starch (RS) is widely consumed because of the functional value. RS hydrolysis by the digestive enzymes generally requires a longer time so that the production process of glukosa becomes slower. It is further correlated with plasma glycemic response (Raben, *et al.* 1994; Herawati, H. 2011). Indirectly, the RS has a functional value to people with diabetes. According to the ADA (2003), for patients with diabetes mellitus (DM) rice consumption should be limited. DM is a metabolic disease which is indicated by

chronic hyperglycemia conditions and disorders of the metabolism of carbohydrates, fats and proteins.

Food diversification by using of local food, such as cassava is one of the alternatives to reduce dependence on rice. Diversification of staple food have to do with the development and introduction of alternative materials substitute of rice that resembles rice in both form and content of nutrients. Diversification of food made people healthier. In addition, diversification is able to create new jobs with the growth of small-medium business which process foodstuffs and the increase of agricultural land planted non-rice crops.

The protein content in rice analog can affect blood glucose levels. Protein can lower glycemic response due to the protein can extend the gastric emptying rate so that the rate of digestion and absorption in the small intestine is also slower (Alsaffar, 2011).

2.4. Development of Alternative Staple Food (Rice Analog)

According to Budijanto, *et al* (2011), rice is an analog artificial rice made from starchy not only from rice. Further said that rice is an analog artificial rice shaped like rice, can be made from rice and non-rice flour by adding water (Budijanto and Yuliyanti, 2012). Analog rice consumed like eating rice from the rice paddy. Rice analog can be designed so that it has almost the same nutritional content even exceeds

the paddy rice, and also may have functional properties according to the raw materials used. Product diversification is expected to support national food security program to reduce rice consumption level without making major changes in people's eating traditions.

According to Yuwono, *et al.*, (2013), rice imitation is a form of diversification of staple foods prepared from carbohydrate-based raw material with the addition of certain substances to improve the quality of staple foods. The raw material in the

manufacture of artificial rice can be derived from Modified Cassava Flour (Mocaf), rice flour and flour "porang".

Rice analog is another name for artificial rice. Analog rice is rice that are made from non-rice with carbohydrate content approaching or exceeding the rice with a shape like rice and can be derived from a combination of local flour or rice. Method for making analog rice consists of two ways, namely granulation method and extrusion.

Table 4. The Chemicals Composition of Analog rice and Paddy rice

Contents	Analog rice (% d.b.)	Paddy rice (% d.b.)
Water	10,6	12,05
Mineral	0,52	1,31
Fat	1,17	0,92
Protein	6,75	8
Carbohydrate	91	89,86

Source: Widara, (2012) and Rohman, (1997).

Problems in products artificial rice is rice texture imitation tend to be hard due to the high content of amylose in mocaf and their distinctive aroma mocaf that are not readily accepted by consumers so it is

necessary to use additional raw materials such as rice flour and flour "porang" to improve the texture and taste of the rice analog (Yuwono, *et al.*, 2013).



III. CONCLUTIONS

Food is a basic requirement that must be met for the making of human being survival. FAO 2008: Suryana, 2008, states that food is a basic human need (HAM), the government is required to provide adequate food.

Therefore, developed of food security

should be the main priority to solving of food crisis, due to the condition of the food crisis has major implications for the nation and the impact on other sectors. The food crisis will lead to lower productivity and created of economic crisis, the food crisis will also lead to high commodity prices. It will also result in Indonesian society that

cause poverty which can eventually lead to condition unsafe. The other hand that the food crisis could affect the political stability of a nation into instabil.

For develop of sovereign nation independent of food and so the Indonesian government should take appropriate measures so that the availability and people's food needs can be met domestically in sufficient quantity and quality. Food policy conducted by the government should be able to guarantee food security which includes supply, diversification, security, institutional and food organizations. Food needs to be important and strategic in order to maintain the country's sovereignty is not dependent on imports from other countries.

Government programs in an effort to reduce the consumption of rice continue to be done through diversification, with a target of rice consumption of 70 kg/capita/year as well as Malaysia and Thailand amounted to 80 kg/capita/year. Indonesia has a great potential to produce agricultural products carbohydrates instead of rice.

However, consumption of carbohydrate sources is still low at 14.4 kg/capita/year. The government wants to encourage the consumption of a variety of local carbohydrate is increased to 36 kg/capita/year.

In achieving national food security, there are some efforts that can be considered and implemented by the Indonesian government, business and

society at the same time Indonesia which serves as food consumers, namely; (1) The government needs to increase the production of foodstuffs such as rice production through the expansion and intensification, but more importantly to be done by the government is a diversified food with the utilization of local food as a source of carbohydrates that can be used as an alternative to the rice staple food, so that dependence the rice will be reduced; (2) in addition, the dependence on rice staple food can also be reduced through a reduction in the consumption of rice such as "One Day No rice", by replacing the consumption of rice with staples of other non-rice, so that these efforts will reduce rice consumption nationally so rice imports can be reduced or discontinued. Promotion program of reduction in consumption of rice needs to be done in a holistic and sustainable by the government and the public, so that the program can succeed and achieve the expected goals, and (3) to reduce dependence on food staples of rice and reduce imports and to achieve national food security, it is necessary to develop an alternative staple food other than rice through the creation and development of "rice analog" sourced from raw materials tubers such as cassava is one of them. Utilization of cassava as an alternative staple food rice has advantages from the health aspect, which does not create the emergence of the disease Diabetes mellitus (DM) compared to eating rice from paddy.

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Table. The Physicochemicals Composition of Analog rice and Paddy rice

No	Contents/Parameters	Analog Rice	Paddy Rice (Control)
1	Colour Lightness (L*)	50,47	57,27
2	Texture (N)	1,27	2,3
3	Rehydration capacity (%)	177,00	149,49
4	Volume development (%)	1,25	-
5	Water content (%)	10,6	12,05
6	Mineral (%)	0,52	1,31
5	Fat content (%)	1,17	0,92
6	Protein content (%)	6,75	8
7	Carbohydrate content (%)	91	89,86
8	Fiber content (%)	-	1,0 – 4,2 ^(c)

Source: Widara, (2012); Rohman, (1997) and Yuwono *et al*, (2013)