

Traditional utilization and processing of gewang palm (*Corypha utan* Lam.) starch in Timor island, Indonesia

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Abstract

Gewang (*Corypha utan* Lam.), a palm species, is utilized by villagers as a source of starch in East Nusa Tenggara for daily needs. This study was to describe how local people in Nusa Tenggara produce and utilize *gewang* starch for their diet, particularly as a rice substitute. The starch is extracted from its trunk and consumed after being cooked with grated coconut. This dish, known as “*akarbilan*” or “*puta laka*”, becomes the most common food in that area during transition period. Based on our analyses, the nutrition properties of 100 gr *gewang* starch is composed by water 11.995%, ash 0.518%, fat 0.20%, protein 0.69%, carbohydrate 86.59%, amylose 32.726%, amylopectin 51.11%, glucomannan 12.27%, Calcium (Ca) 100.52 mg, Phosphorus (P) 136.74 mg, Iron (Fe) 3.390 mg, and Vitamin B1 0.108 mg. The results suggested that the nutrition properties of *gewang* starch almost similar with the sago starch. However, *gewang* has more prospective potency for food alternative, especially in dry land such as Timor island and adjacent regions in order to build food security in Indonesia.

Keywords: *Corypha utan* Lam., food, starch, Timor island, traditional utilization.

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Introduction

Food security has recently become a major concern around the world. Since 2006, the significant price, which reached its peak in 2008, has concerned in every country about food sustainability (FAO, 2009). Moreover, the increasing of food crops as biofuels might have negative impact on food security. The population growth and consumption in the future will also increase the global demand for food and indirectly force food prices up (Godfray et al., 2010).

In the future, food prices are easy being increased if agricultural intensification and extensification programs cannot fulfill national food demand in Indonesia. Hence, the Government of Republic Indonesia could have programs for developing alternative of food sources as important issues in the National Medium Term Development Plan (RPJMN) 2005-2009, following the RPJMN 2010-2014 and 2015-2019. An Increasing local knowledge and exploring biodiversity by local communities play a role as one of many possible solutions for food shortages. In the eastern of Indonesia, *gewang* starch, example of palm species, is utilized by local communities as an alternative food source.

Gewang (*Corypha utan* Lam.), also known as *gebang* or talipot palm, is a palm species distributed in dry areas from north-east India to northern Australia (Uhl & Dransfield, 1987; Dransfield & Govaerts, 2005). In Indonesia, this palm grows naturally in the savannas of Timor Island

and other adjacent islands, and it commonly determines the vegetation type of the area (Monk et al., 1997). *Gewang* is characterized as a single-stemmed palm, with height of up to 15 m. Its broad trunk grows up to 50 cm in diameter and tapering, faintly marked with closely-spaced hoops, and faint spiral marked. It has very large shaped, fan-shaped leaves up to 3 m across and a massive petiole with a toothed margin. It can be grown in subtropical to tropical climates with adequate sunlight, moisture and space. This species has a very large inflorescence which grows at the very top of the tree with stiff, spreading branches. It can produce millions of flowers and will die after fruiting. The fruit is round and up to 2 cm in diameter, and its seed can be up to 1.5 cm in diameter (Ellison & Ellison, 2001; Gibbons, 1998; Whitmore, 1973).

Like other large palm species, *gewang* is associated with human settlements. Most parts of this palm have been utilized to provide the daily needs of villagers in East Nusa Tenggara, including construction materials, handcrafts, animal feed, alcoholic beverages, sugar and food. The starch which extracted from its trunk is usually used as a food source (Naiola et al., 2007; Uhl & Dransfield, 1987). This study will describe how indigenous people in Nusa Tenggara produce and utilize *gewang* starch for their diet, particularly as a rice substitute.

Methods

This study was conducted in two different locations, in Fatubesi Village, Manulea District, Belu Regency and Oele'u Village, Ayatupas District, Timor Tengah Selatan Regency. Both are small villages located on Timor Island, East Nusa Tenggara province, Indonesia (Fig. 1). The

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majority people in East Nusa Tenggara, including in these villages, live as farmers, rice, maize, cassava and sweet potato for living. Agricultural products are considered to be an important source of their Gross Domestic Product after livestock (BPS-Statistics of Nusa Tenggara Timur Province, 2012).

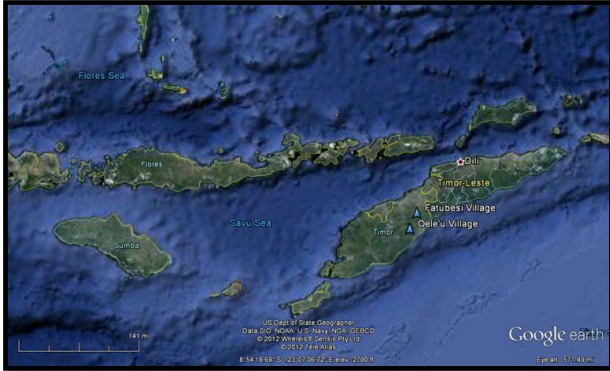


Figure 1. Site locations: Fatubesi and Oele'u Village, Timor, East Nusa Tenggara. (Source: Google Earth)

Ecologically, East Nusa Tenggara is composed of several forest types, including tidal forest, coastal forest, moist primary forest, riparian forest, moist submontane forest, limestone forest and savanna forest (Monk et al., 1997). Savanna forest in East Nusa Tenggara is usually mixed with scattered, isolated clumps of trees and considered to be mixed savanna. Although there are several types of mixed savanna, the palm savanna, where *Corypha utan* occurs in usually dense stands, is the most common.

In October 2009, *gewang* palms were obtained from Fatubesi Village, Manulea District, Belu Regency (three samples) and Oele'u Village, Ayatupas District, Timor Tengah Selatan Regency (three samples). The trees were

cut down and processed using the traditional method to extract starch. The extraction process was observed and documented. Several samples were collected from each tree, and proximate analyses were performed by the Laboratory of Agricultural Post Harvest, Indonesian Center for Agricultural Post Harvest Research and Development (ICAPOSTRD) to determine the nutritional properties using official AOAC International methods (AOAC, 1999).

Results

Traditionally, *gewang* has been widely used among local people in Timor Island. Almost the entire plant, from leaves to trunk, can be utilized. The young leaves are used to weave mats, hats, bags and nets, while the adult leaves are used for thatching and making umbrellas or coarse mats. The petiole is used to make house-walls and, the trunk is used for house construction, as beams. Additionally, the inner part of the trunk can also be extracted for sago or starch.

Starch is one of the most important usages of *gewang* palms, as a rice substitute during food scarcity (famine season). In the past, before rice was introduced, the main diet of Timor peoples were dominated by wild tubers, roots and corn. However, all of these foods are becoming very scarce, especially during dry season. Other food substitutes, usually commonly available, are also scarce during the dry season. Only *gewang*, which is easily grown in such a dry land, is easy to find and can be processed as food source during times of need. Nutrition properties of *gewang* starch was composed of many components with phosphorus, calcium and carbohydrate as the most dominant component (Tab. 1).

Table 1. Nutrition properties of *gewang* starch compared with sago starch (per 100 g)

No.	Nutrition Component	Sample		Gewang Starch	Sago Starch
		Fatubesi village	Oele'u Village		
1	Water (%)	14.159 (1.861±2.177)	9.830 (2.798±4.382)	11.995	14.00 ^b
2	Ash (%)	0.421 (0.019±0.017)	0.613 (0.024±0.027)	0.518	0.06-0.43 ^b
3	Fat (%)	0.166 (0.029±0.037)	0.238 (0.130±0.219)	0.202	0.20 ^b
4	Protein (%)	0.915 (0.765±1.521)	0.467 (0.050±0.058)	0.691	0.70 ^b
5	Carbohydrate (%)	84.336 (1.400±1.078)	88.852 (4.526±2.843)	86.594	84.70 ^b
6	Amylose (%)	31.055 (1.725±1.725)	33.840 (0.370±0.200)	32.726	24-31 ^a
7	Amylopectin (%)	52.460 (1.360±1.360)	50.210 (0.310±0.480)	51.11	-
8	Glucomannan (%)	5.950 (5.440±5.440)	16.497 (1.227±0.613)	12.278	-
9	Calcium (mg)	68.600 (10.500±19.200)	132.443 (3.743±7.347)	100.52	11.00 ^b
10	Phosphorus (mg)	45.863 (26.113±47.227)	227.613 (1.193±0.657)	136.74	13.00 ^b
11	Fe (mg)	3.280 (1.330±1.710)	3.500 (0.320±0.420)	3.390	1.50 ^b
12	Vitamin A (IU)	0	0	0	0 ^b
13	Vitamin B1 (mg)	0.165 (0.055±0.040)	0.050 (0.005±0.006)	0.108	0.01 ^b

Note: ^aAhmad et al. (1999), ^bDirektorat Gizi Departemen Kesehatan RI (1981).

Discussions

Timorese, the common way, traditionally extract starch from the *gewang* trunk comprised of several steps (Figs. 2-5) (Witono et al., 2010). The selected palm must be mature (height ≥ 5 m), a large size (diameter reach 50 cm or more), never have tapped and flowered. The palm was felled using a traditional axe, or a chainsaw. Afterwards, the trunk was crosscut into several logs of 1-2 m long to make it easier the process of removing the bark (Fig. 2A). The logs were left drying under the sun for approximately 3 days.

The bark was removed from each logs using a traditional axe (Fig. 2B). The inner part of the logs, called ‘pith’, is the only part containing starch (Fig. 2C). The valuable bark commonly used for firewood or chipboard (Naiola et al., 2007). After the bark was removed, the pith

was chopped into smaller pieces (called ‘chips’) using a machete (Fig. 3A). The chips were dried in the sun for several hours to reduce water content (Fig. 3B).

After dried, they were placed in a long wooden mortar called a “*lesung*” and pounded using a wooden pestle called an “*alu*” (Fig. 3C). This process was used to separate the starch from the fiber as embedded starch within the *gewang* trunk fibers. The process took several minutes per bag of chips. After that, the resulting coarse starch was filtered using a sieve made of *lontar* (*Borassus flabellifer*) leaves, and filtered again using a piece of fabric to obtain finer starch (Figs. 4A-B). The results of this process were a fine starch (Fig. 5A), a fiber called “*puta’ kra’af*” (Fig. 5B), and a coarse starch called “*puta’ smiak*” (Fig. 5C).



Figure 2. The first steps of the traditional method of *gewang* starch extraction: *gewang* palm was felled and cut into several lengths (A); the bark was separated from the pith using an axe (B); then the pith was split into smaller pieces (C).



Figure 3. Second stage of the traditional method of *gewang* starch extraction: the pith was chopped and sliced into small pieces (A); the chips were dried in the sun (B); then the chips were pounded using ‘*lesung*’ and ‘*alu*’ to separate the coarse starch from the fiber (C).

The fine starch was washed with water in the ratio 1: 10 (kg/liter). The starchy liquid was precipitated on a plaited mat made from *lontar* leaves (Figs. 6A-C). Finally, the clean starch, in the form of sediment on the mat, was kneaded by hand and the resulting dough dried in a globular shape (Fig. 6D-E). After being dried, the starch is ready to be stored and used for cooking. The Timorese usually store the starch dough on top of ashes to absorb water from the starch.

The amount of starch extracted from a single *gewang* tree are various according region. In Malaysia, a single *gewang* tree can yield 100 kg of starch (Whitmore, 1973). In the Philippines, the amount of yield decreases to 90 kg per palm (Nasution & Ong, 2003). However, in East Nusa

Tenggara (Indonesia), one *gewang* tree can reach more than 250 kg of starch (Witono et al., 2010). Ecological, habitat and climatic characteristic such as soil type, soil properties, precipitation etc. may contribute to the different yield.

The most common starches consumed today are derived from cereals (corn, wheat, rice, sorghum), tubers (potato, sweet potato), roots (cassava), legumes (mung bean, green pea) and sago palm (Karim et al., 2008). These kinds of starches contain high levels of nutrients, both macronutrients (fats, proteins, and carbohydrates) and micronutrients (vitamins and minerals). *Gewang* starch looks very similar to the more common starches in appearance, except for its yellowish color.

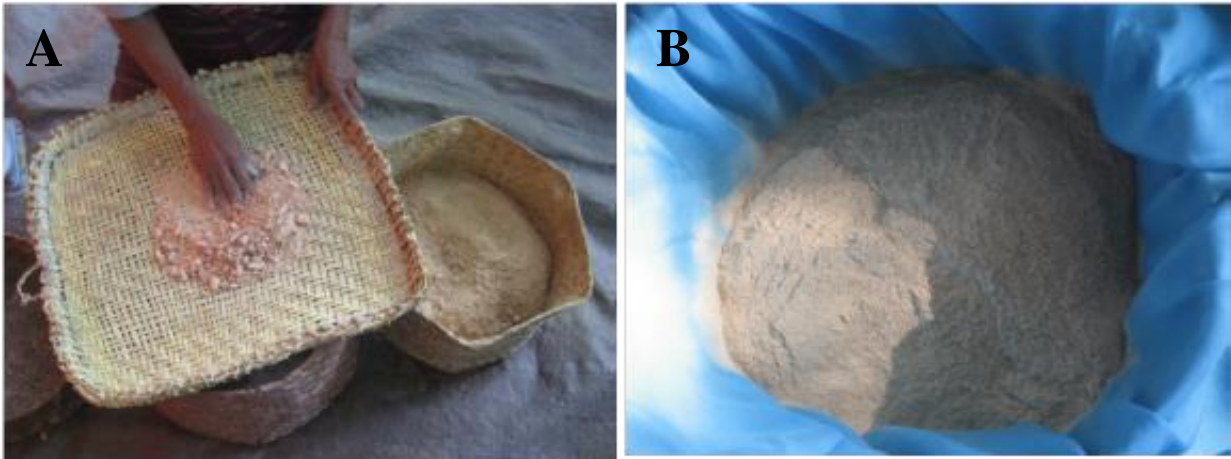


Figure 4. Third stage of the traditional method of *gewang* starch extraction: filtering the coarse starch using a sieve made of *lontar* (*Borassus flabel-lifer*) leaves (A) and then using fabric (B).



Figure 5. Products of *gewang* trunk extraction: starch (A) fiber “*puta' kra'af*” (B), *puta' smiak* (C).



Figure 6. Final stage of the traditional method of *gewang* starch extraction: the fine starch was washed with water (A); left to precipitate on a woven mat made of *lontar* (B, C); then kneaded by hand (D) and the resulting dough left to dry (E) before being stored for future use.

In East Nusa Tenggara, *gewang* starch is usually consumed as a dish called “*akarbilan*” or “*puta’ laka*”. The process of making this dish is described in Figure 7. *Akarbilan* is the primary dietary component for local people, especially during seasons of food scarcity. It also consumed as a snack during the rest of the year, making *gewang* starch a common diet of local people in Nusa Tenggara.

According to our proximate analysis, the nutritional properties of *gewang* are similar to sago starch (Tab. 1). However, *gewang* starch is more yellowish than sago, which is usually almost pure white. It is expected that some additional components presented in *gewang* starch. These components may be antinutritional compounds, which could become an impediment for further use of *gewang* starch as food source. One of the additional component that was detected from our analysis is tannin. Tannin is commonly found in many angiosperm plants including palm species (Mole, 1993). Antinutritional effect of tannin such as decrease in feed intake and protein digestibility had been reported in several studies (reviewed

in Chung et al., 1998). In some cases antinutritional components may be not only toxic, but could also be lethal in extreme situations (Bhat & Karim, 2009). However, as *gewang* has been consumed by locals for years with no reports of any negative effects, it is very possible that the additional components such as tannin in this starch are neither toxic nor lethal.

The results of nutritional analyses suggest that the nutritional properties of *gewang* starch are similar to that of sago starch which is extracted from sago palm (*Metroxylon sagu*). However, sago starch does not contain tannin. Thus, tannin in *gewang* starch need to be removed in the post process extraction to improve the nutrition quality. Nevertheless, in dry land areas such as East Nusa Tenggara and adjacent regions *gewang* has more potential as an alternative food source, particularly to improve food security in Indonesia. Further detailed investigation of the physical characteristics of this starch, non-nutritional properties, and processing must be carried out to fulfill its potential as a viable agricultural product.



Figure 7. Traditional food preparation by local people of East Nusa Tenggara: *gewang* starch (A) and grated coconut (B) were mixed, and then baked in a wok (C). The cooked dish, called “*akarbilan*” or “*puta’ laka*”, is ready to serve (D).

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