

Effect of Braising on Nutritive Content of Teak Leaf Cocoons

Suharwadji Sentana

Division of Industrial Physics and Environmental, Research Center for Physics
Indonesian Institute of Sciences (P2F – LIPI)
Jln. Sangkuriang, Gedung 60, Kompleks LIPI
Bandung 40135, Indonesia

Abstract— Purpose of the research was to see the effect of braising on nutritive content of teak leaves cocoons. The cocoons were collected from three different places in Gunungkidul Regency, Yogyakarta, Indonesia. Nutritive content of teak cocoons were triplicates analysed at the Chemical Laboratory, Technical Implementation Unit for Chemical Processes, the Indonesian Institute of Sciences in Gunungkidul, Yogyakarta. The nutritive content of braised teak cocoons were then analysed and compared with raw cocoons by t-test. The results show that raw teak cocoons contained 13,9% of protein, 10.01% fats, 0.99% ash, and 75.14% water. Braising significantly increased ($p = 0.01$) level of nutritive contents of teak leaves cocoons.

Keywords— Alternative nutritive resource; raw and braised cocoons; Gunungkidul local food; protein content; teak leaf cocoons.

I. INTRODUCTION

Indonesia is known as a country rich in natural resource with the highest biodiversity in the world after Brazil and Zaire. One of those is the teak trees scattered in various regions in Indonesia, such as Gunung Kidul (Yogyakarta); Blora, Rembang, and Jepara (Central Java); Bojonegoro, Bondowoso, and Tuban (East Java Province). Every year at the beginning of the rainy season, the butterfly eggs that live in teak hatch and become caterpillars that eat leaves of teaks, and in a specified period caterpillars will pupate (*Hyblaea puer* Cramer) [1,2,3] with a length of 1-2 cm [3] and an average weight of 0.7-1.3 mg, depending on the habitat [4]. Cocoon is stained dark brown, almost as big as cayenne pepper [4]. Teak leaves young caterpillars like to eat the soft leaves of teak and leaving the veins and bones, while the adult ones eat almost all leaves except the bones of large leaves [1].

When the caterpillars will pupate those fell from the trees to the ground by jumping using saliva that forms tendrils [1]. After moth identity to the ground they will immediately hide behind leaves or rocks. Then on these places teak leaf caterpillars wrap themselves with saliva and soil particle to change into pupae [1,2,3,4,5].

Protein and fat content in teak leaves cocoons those living in areas of Bojonegoro, Central Java have already been examined by [4] and the protein content of teak leaves cocoons living in Blora, Central Java have been examined by [8]. According to [4], protein and fat content teak leaves cocoons in Bojonegoro area, respectively, are 64.1 and 9.01% (dw), while the protein content of teak leaves cocoon in Blora was 52.08% [8]. Therefore the commodity could be used as an alternative protein source. In addition, cocoons could be cooked into various ways, it, however, only braising (*bacem*) is the most popular [9].

Nutritive content of both of raw and braised cocoon teak leaves, such as protein, fat, and ash in the area of Gunungkidul has not been reported yet. In general, the nutritive content of certain agricultural commodities depend on the habitat, different habitats will have different nutritive contents. Therefore it is necessary to investigate the nutritive content in raw and cooked cocoons live in the Gunungkidul region, Yogyakarta, Indonesia.

II. MATERIALS AND METHODS

A. Materials

Raw teak leaves cocoons (Fig. 1) come from three different areas, those are Nglipar, Karangmojo, and Semanu, Gunungkidul district, Yogyakarta on October-December 2012. The seasoning used for braising were: (1) garlics, (2) shallots, (3) brown sugar, (4) salt, and (5) water.

B. Methods

Shallots and garlic were sliced, mixed with a few water, were then added brown sugar, salt and were then pulverised. Pulverised seasoning was then mixed with cocoons homogeneously and put some more water, and finally cooked until the all water was gone. The cooked cocoons were then fried (Fig. 2), and finally ready to eat either as a meal with rice or as a snack.



Fig 1. Raw teak leaves cocoons



Fig. 2 Braised teak leaves cocoons

C. Nutritive Content Analysis

Nutritive content analysis of teak leaves cocoons were carried out at The Chemistry Laboratory of Technical Implementation Unit for Development of Chemical Engineering Processes, Indonesian Institute of Sciences (UPT BPPTK LIPI) Gunungkidul, Yogyakarta, Indonesia.

Water and ash, protein, and fat contents were subsequently determined by thermogravimetry, Mikro Kjeldahl Method, and Soxhlet extraction [10], at triplicates. Nutritive contents of cooked cocoons were then compared with those of raw cocoons to see the effect of braising.

D. Data Analysis

Nutritive content data of both raw and cooked cocoons were analysed by t-test [11], which consists of two treatments and three replicates) to see the differences among them due to cooking.

III. RESULTS AND DISCUSSION

Analysis result of the nutritive contents of teak leaves cocoons are presented in Table 1.

3.1 Water Content

According to [12] and [13] water is a substance forming the majority of the human body, which sums reaching 55-80% of a person's body without fat tissue (lean body mass) and depends on body weight. Water acts as a construction material in each cell / tissues. The body fluid has a very important function, examples, to regulate body temperature and provide a suitable environment and good for metabolism [13]. The body fluid is an electrolyte or contains electrically charged atoms and alkaline. Therefore, the water used in the body as a solvent, a part of lubricants, chemical reagents, regulating body temperature, as a source of minerals, as well as to help maintain the shape and structure of the body [13].

Table 1 shows that raw teak leaves cocoons contain moisture content of 75.14 %. (wb) These results are consistent with the reports of [13] which states that the body water content about 55-80%. Water content of foodstuffs closely linked to the shelf lives. The lower the water contents of a food the longer the shelf life. The water content of teak leaves cocoons quite high (75.14 %), therefore, it can not be stored for a long time.

Water content of braised cocoons decreased significantly ($p = 0.01$) by 46.34%. It may was due to cooking (boiled and fried), therefore the water level of cooked cocoons was lost. This result agree to [12] who reported that cooking may decreased or increased the water content. This is an advantage because less of water will make cooked cocoons could be stored for longer periods.

Table I. Nutritive contents of cooked and raw teak leaves cocoons

Nutritive Contents (% wb)	Teak Leaves Cocoons	
	Raw	Braised
Water	75.14 ^a	40.29 ^b
Ash	0.99 ^a	3.33 ^b
Fat	2.33 ^a	10.01 ^b
Crude protein	13.93 ^a	17.95 ^b

Note: - Different letters in the same row means significance at $p = 0.01$.
- Values are mean of triplicates.

The water content of a commodity including teak cocoons will also affect other chemical constituents [12,14], for examples, ash, protein, and fat, the higher the water content the lower the ash, protein, and fat contents.

3.2 Ash content

Ash is an inorganic substance which is produced from combustion of organic compounds [14]. Ash content in foodstuffs greatly affects the properties of certain foodstuffs [14]. The higher the ash content of foodstuffs more dull in color. The ash content can also be used to represent the content of the minerals. The higher the ash content the higher the mineral contents.

Minerals are inorganic materials and are essential, if the mineral is not used up by the human body it will be released by the body [13]. Mineral maintains the acid balance of the body by the use of acid-forming minerals, namely chlorine, phosphorus and sulfur, and alkaline forming minerals, namely calcium, iron, magnesium, potassium, and sodium. Minerals also functions in the growth and maintenance of bones, teeth and other body tissues, namely calcium, phosphorus, and fluorine [13].

Determination of ash content and levels of minerals such as calcium, potassium, sodium and chloride is strongly influenced by the determination of water content. The levels of minerals in food affect the physical properties of foodstuffs and in a certain amount able to inhibit the growth of certain microbes [14].

The results (Table 1.) shows that braising significantly increased ($p = 0.01$) ash content by 70.27 %. It might because of seasoning which are consisted of garlicks, shallot, brown sugar, and salt (NaCl) added to the braised cocoons. Those componets are rich in mineral [15]. Besides, braising resulted in lost of water, therefore mineral content increased. The other reason is that particular mineral such as calcium may also be gained during processing of food in the hard water and iron may came from the cooking utensils [12]. Gunungkidul is well known as a carst area.

3.3 Fat Content

The fat contained in food is the most concentrated source of energy or energy savings for humans [12,16]. Fat has a role to save protein, and thiamin, makes satiety longer, and makes the food taste becomes more palatable [12,13,16].

The results show that the fat content in the raw cocoons of teak leaves is 2.33% (wb) and braising singnificantly ($p = 0.01$) increased fat content (10.01%) by more than three times (Table 1). The fat content of braised cocoons agrees to the figures of raw cocoons reported by [4], namely 9.01%, and it is equivalent to fat content of unfated mutton (10.00%). The other author [13] also reported that frying increased fat content of particular food. Increasing of fat content makes cocoons will be less healthier, it, however, becomes more palatable. In addition, cocoons are available in the beginning of reany season only, therefore those are not harmful for humans health.

3.4 Protein Content

Protein is a nutrient that is most abundant in the human body after water, and protein is part of all living cells. Animal protein is the best resource of protein for humans because it has the very similar amino acid pattern to the amino acids pattern of the human body [13]. It is known that protein function is for growth, development, repair, and replacement of the body.

The results shows that raw teak leaves cocoons contain 13.93 % (wb) protein, it is slightly above the protein content in chicken eggs (12.8%), equivalent to the protein content in yellow tail fish (14.0%), but slightly below meat (15.7%) [15]. The braising segnificantly ($p = 0.01$) increased protein content by 28.86 % (Table 1). The result disagrees with the data reported by [4] and [8]. This may be due to differences in sample origin of teak leave cocoons. Teak leaves cocoons used by [4] obtained from Bojonegoro in East Java teak forests. The results showed that the teak leaves cocoon from Bojonegoro contained 64.11% protein and may be based on the dry weight [4].

Cocoon of teak leaves used by [8] came from the village of Wulung, Randublatung Distric, Blora, Central Java were cleaned of shells. Additionally the method used in the analysis of protein content is also different. Protein content measurement was conducted by ultraviolet-visible spectrophotometry (UV-Vis) using biuret reagent. The protein content obtained on a sample teak leaves cocoon was 52.08% [8] without mentioning the water content, so it is unknown whether it based on the dry (dw) or wet weight basis (wb), because of water content will also affect proportion of the onther nutrient components. The other reason is may any differences in body condition which will also affect the protein content, injured body will less protein than the sound one. On the other hand, the growth tissues will contain more protein than the old one [12].

3.5 Braised Cocoons

Teak leaves cocoons can be cooked in various ways [9], among others are steamed in boiling water and then fried, pan-fried, stir fried, or braised with savory taste and delicious. This may be caused by the presence of fat in the cocoon (10.0%). It, however, only braising methods is the most popularin in Gunungkidul area, even Java [9] . According to [12] the presence of fat in food will cause a savory flavor. Cocoon of teak therefore can be used as an alternative source of nutrition of meat, eggs, and fish due to high crude protein content (13.93 %). Unfortunately, for particular people can not eat cocoons due to allergies. It is sugested to find out a right way to cook cocoons so that the cocoon can not cause allergies, for example, when cooking it is mixed with a few pieces of wood charcoal [1,2,3,5,7,18,19].

CONCLUSIOS AND SUGESTION

A. Conclusions

1. Teak leaves cocoons contain 13.93 % (wb) protein, slightly above the protein content in chicken eggs, equivalent to the protein content in yellow tail fish, but slightly below meat.

2. Other nutritive contents of teak leave cocoons are 2.33 % (wb) fat; and 0.99 % (wb) ash.

3. Braising of teak leaves cocoons significantly ($p = 0.01$) increased the nutritive content.

4. Teak leaves cocoons can be used as an alternative source of nutrition of eggs, meat, and fish with huge potential.

B. Sugestion

To avoid from suffer of allergic, the right way to cook the teak leaves cocoon has to be find out.

ACKNOWLEDGMENT

The author would like to thank The Technical Implementation Unit (UPT) of Chemical Process Development and Technology (BPPTK) LIPI Yogyakarta who agreed to perform the analysis of chemical composition of teak leaves cocoons, especially to Mr. Andri S. who had carried out a chemical analysis. Thanks greeting also goes to Mrs. Pardiman for her willingness to cook the cocoons.

REFERENCES

- [1] Anon., "Pupa teak has a high protein content". January 3, 2011, <http://id.shvoong.com/social-sciences/education/2095521-kepompomg-jati-berprotein-tinggi>. Accessed September 17, 2013.
- [2] Anon., "Cocoon (pupa) of silkworm teak is savory and delicious, Sorot Gunungkidul", <http://www.sorotgunungkidul.com/2012/12/ungkrung-kepompomg-ulat-pohon-jati.html>, Accessed September 16, 2013.
- [3] G. Jiwana, "Caterpillars hunters: for caterpillars teak, kilometer dozens are crossed". Jogja Daily, Wednesday, December 12, 2012.
- [4] N.E. Sulistyorini, "A study of fat and protein content on teak leaves cocoons (*Hyblaea puera* Cramer)". Thesis, University of Malang. 2001. Unpublished.
- [5] Anon., "Cocoon / pupa, an extreme culinary from Blora". <http://homepagekawasan.wordpress.com/2009/12/02/ungker/enthung-extreme-kuliner-dari-blora/>, Accessed September 16, 2013.
- [6] U. Barry, A.N. Islami, and M. Syahroni, "Potential of teak leaves cocoons (*Hyblaea puera*) teak forests in Blora". State University of Yogyakarta. 2012.
- [7] A. Ismiyanto, "Teak caterpillars and cocoons are extreme culinary in Gunungkidul". Tribune Jogja. Wednesday, December 12, 2012.
- [8] E. Hartono, "Comparisons between the protein content of silkworm pupa teak leaves and goldfish in UV-Vis Spectrophotometry". Faculty of Pharmacy, Surakarta: University of Setia Budi. 2012.
- [9] S. Sentana, "Teak leaves cocoons as locally alternative protein source at Gunungkidul". Jurnal Penelitian dan Pengembangan V(8): 105-113. 2013.
- [10] AOAC., "Official methods of analysis of the Association of Official Analytical Chemist". USA: Washington DC. 1990.
- [11] A. Sastrosupadi, "Experimental design for agricultural research". Yogyakarta: Kanisius. 2000.
- [12] M. Pyke, "Success in nutrition". London: The Chaucer Press Ltd. 1979.
- [13] E.S. Karsin, "Classification of food and nutrition". In: Y.F. Baliwati, A. Khomsan, and C.M. Dwiriani (Eds), Introduction to Food and Nutrition, Jakarta: Penebar Swadaya. 2004.
- [14] S. Sudarmadji, "Analysis of food and agriculture". The Inter-University Center for Food and Nutrition, Yogyakarta: Gadjah Mada University. 1989.
- [15] O.K. Nio, "List of analysis in food". Faculty of Medicine, Jakarta: University of Indonesia. 1992.
- [16] H. McGee, "On food and cooking". Sydney: Unwim. 1988.
- [17] S. Rimbawan and A. Siagian, "The glycemic index of ood, how to easily choose a safe food". Jakarta: Penebar Swadaya. 2004.
- [18] A. Hanafi, "Cocoon and silkworm teak were looked for citizens". seputartuban.com/2012/.../kepompomg-dan-ulat-jati-jadi-buruan-warga. Accessed September 17, 2013.
- [19] H. Fitri, "Cocoon-pupa an extreme culinary from Blora". Suara Merdeka. <http://berandakawasan.wordpress.com/2009/12/02/ungkerenthung-extreme-kuliner-dari-blora/>. Accessed September 17, 2013.