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NUTRITIONAL PROPERTIES OF EDIBLE BIRD NEST

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ABSTRACT

Edible bird nest (EBN) is a dried glutinous secretion from the salivary glands of several different swiftlet species. It is widely consumed as a health food due to its high beneficial effects to human health and has been considered to be one of the most precious food items by the Chinese for thousands of years. The aim of this study was to evaluate the nutritional properties of clean and unclean EBN collected from the swiftlet species Aerodramus fuciphagus at several geographical locations : Malaysia (Perlis and Langkawi), Indonesia (Java, Balikpapan and Kalimantan), Thailand and Philippines from swiftlet species. The nest type from Langkawi is of the cave type while the others are of the house nest type. Analytical results showed protein content as the most abundant component in EBN ranging from 59.8-65.4%, followed by carbohydrate content ranging from 8.5%-16.4%. EBN from Philippines showed highest percentage of carbohydrate content. Fat content determined using Soxtec method showed the lowest percentage ranging from 0.01%-0.07%. The study showed EBN with a high concentration of nitrite and nitrate, particularly EBN of the cave nest type collected from Langkawi followed by EBN of Java and Balik Papan. EBN from Kalimantan and Perlis were devoid of nitrite and nitrate. There is no significant differences in moisture and ash content (5.58-13.88%) among all EBN from different locations. This study profiled the nutritional properties of EBN from different geographical locations indicating a high *protein content in all EBN followed by a declining trend of carbohydrate, moisture, ash and fat contents.*

Keywords: Edible bird nest (EBN), *Aerodramus fuciphagus*, nutritional properties, different locations

INTRODUCTION

Edible bird nest (EBN) is the dried glutinous secretion from the salivary glands of male swiftlets during their breeding season (Guo *et al.*, 2006). EBN consists of high valued glycoprotein rich with amino acids, carbohydrate, calcium, sodium and potassium (Norhayati *et al.*, 2010). It is commonly referred to as the 'Caviar of the East' because of it fetches a premium price and regarded as an esteemed food product in the East (Marcone, 2005). Normally, people consumed EBN products nests for health, power and prestige. As a rich source of amino acids, carbohydrates and mineral salts, bird nests have also been used for hundreds of years as an important health supplement in traditional Chinese medicines. Its use include as a treatment for malnutrition, a boost to the immune system, and to enhance the body's metabolism. More recently, bird nests have been used as a component in cosmetic products (Zainab *et al.*, 2013).

There are more than 24 species of insectivorous, eco-locating swiflets distributed around the world, but only a few produce nests that are deemed 'edible'(Koon, 2000). The majority of EBN traded worldwide come from two heavily exploited species, the White nest swiftlet (*Aerodramus fuciphagus)* and the Black nest swiftlet (*Aerodramus Maximus) (*Babji *et al., 2011)*. The EBN used in this study are from the swiftlet species *Aerodramus fuciphagus.* These white nest swiftlets are normally resident birds on islands, but currently they are also distributed on the mainland in large populations (Tan, 2001). EBN has been an esteemed food tonic for the Chinese people due to its highly evaluated function of being nutritious (water soluble protein, carbohydrate, iron, inorganic salt and fiber) and of medical benefit (anti-aging, anti-cancer and immunity-enhancing). The composition of EBN from genus *Aerodramus* includes lipid (0.14-1.28%), ash (2.1%), carbohydrate (25.62-27.26%) and protein (62.0-63.0%) (Marcone, 2005). One of the major glyconutrients in EBN is sialic acid (9.0%) (Colombo *et al.*, 2003) and (Kathan and Weeks, 1969). Sialic acids have beneficial effect on neurological and intellectual advantages in infants (Chau *et al.*, 2003). As an excellent immune system moderator, sialic acid affects the flow resistance in mucus which in turn repels bacteria, viruses and other harmful microbes. In terms of nutritional contents, the main components of edible bird's nest includes water-soluble proteins, carbohydrate, trace elements such as calcium, phosphorus, iron, sodium and potassium and amino acid which play a vital role in promoting body vigor. Bird nest contains highest amount of calcium and sodium compared to other minerals. It has been reported that the amount of calcium content in processed EBN ranged from 503.6 to 2071.3 mg/g and sodium content ranged from 39.8 to 509.6 mg/g which are higher than other minerals (Norhayati *et al.*, 2010)

METHODS

Materials

Clean and unclean EBN from swiftlet species *Aerodramus fuciphagus* were collected from different geographical locations, namely, from Malaysia (Perlis and Langkawi); Indonesia (Java, Balikpapan and Kalimantan); Thailand and Philippines. The EBN samples from Langkawi are of the cave nest type while others are of the house nest type.

Sample Preparation

Sample of unclean EBN were collected and soaked in water to soften the cement. Feathers and other impurities were manually removed using tweezers and forceps. Then, the EBN samples were dried for 24 hours at 60^0C in an oven. Finally, the clean EBN were grounded using a food grinder into fine particles. The finely grounded samples were transferred into air tight containers and labeled correctly according to the location and kept at room temperature for further analysis.

Moisture and Ash Analysis

The moisture content was determined using the moisture analyzer (Sartorius MA 35 Germany). 0.5g of samples were used to determine the moisture content. The samples were ashed in a muffle furnace at 550°C for 4 hours.

Protein Analysis

Protein analysis was determined using an automated CHNS/O analyzer (Perkin Elmer, Model 2400). 2mg of EBN samples were weighed and combusted in an CHNS/O analyzer. Then, nitrogen content of the samples was determined and a conversion factor (F) was applied to convert the measured percent nitrogen to percent protein.

Carbohydrate Analysis

Carbohydrate analysis was determined using phenol sulphuric acid method as described by Dubois *et al.* (1956). Glucose concentrations between 20-100µg were used in preparing the standard curves.

Fat Analysis

Fat analysis was determined using Soxtec extraction method. About 1.5 g of EBN sample were weighed in the thimbles. Then, six empty aluminium cups were weighed and 50mL of pet ether were put into it. Four extraction steps involved are boiling, rinsing, solvent recovery and lift up hot plate and eliminate risk for oxidation of fat. Then, samples were immersed in boiling solvent to dissolve soluble material. After that, sample was raised above the solvent surface to permit efficient washing of sample with solvent from condenser. After extraction, condenser valves were closed by turning the valve knobs a quarter turn. After a few minutes, most of solvent were collected in the condenser and residual solvent was evaporated with the pump on. Analysis will stop after 1hr

40min and aluminium cups were dried in oven at 100ºC for 30min. Aluminium cups were weighed and percentage of fat was calculated.

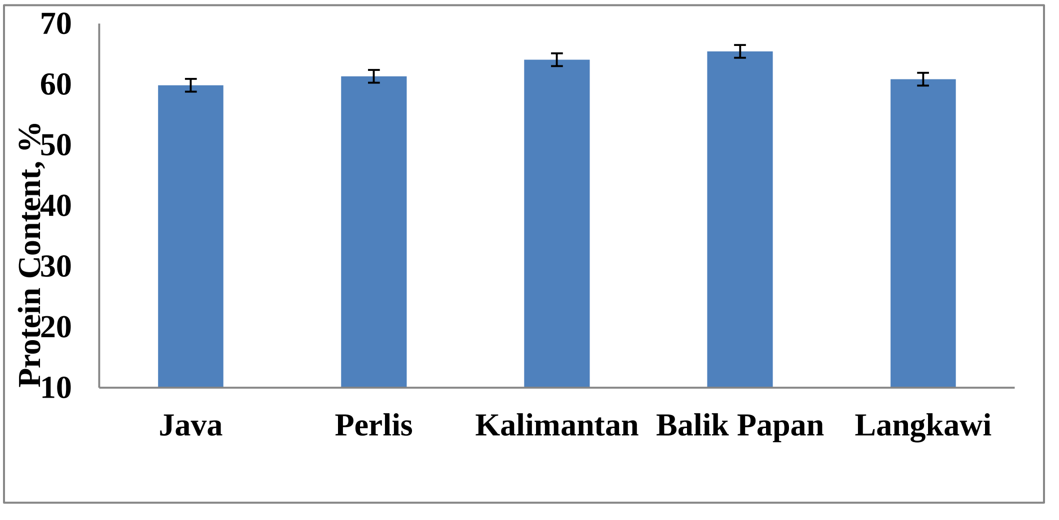
Nitrite and Nitrate Analysis

Nitrite and nitrate analysis was determined using ion chromatography spectrometer (Dionex, ICS-1000). About 1g of dry solid EBN samples, clean and unclean, was weighed in the conical flask. Then, 100 mL of water were poured into the flask before putting it in the water bath.The mixture was stirred occasionally while heating to make sure it is homogenized. The mixture was heated to boiling, allowed to cool and then filtered. The solutions were analyzed using ion chromatography instrument.

RESULTS AND DISCUSSION

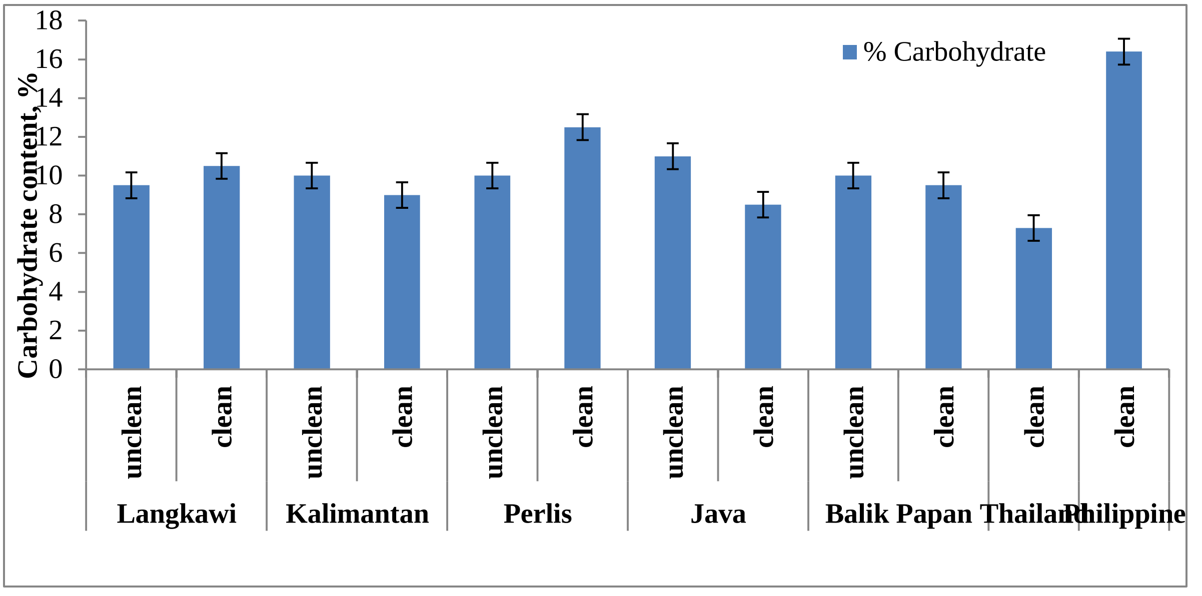
One of the major nutrient components in edible bird’s nest (EBN) is protein. Proteins are constituents of cells and play a crucial role in most of the biological process.

Figure-1. Protein content of unclean EBN from different geographical locations



The protein content in EBN from the different geographical locations did not differ significantly (Figure 1). The EBN protein content ranged from 59.8%-65.8% which is considered on the high side. The high protein in EBN is a good indicator of a good feeding environment and abundance of feed for the swiftlets in the geographical location under study (Marcone, 2005).

Figure 2. Carbohydrate content of unclean and clean EBN from different locations



Carbohydrate analysis in all EBN samples are shown in Figure 2. The carbohydrate content is the second highest component in all EBN samples. EBN from Philippines had slightly more carbohydrate content compared to EBN from other locations. Fat content gives the lowest percentage in all EBN samples with 0.01% to 0.07% as presented in the Table 1 below,

Table-1. Fat content in unclean and clean EBN from different locations

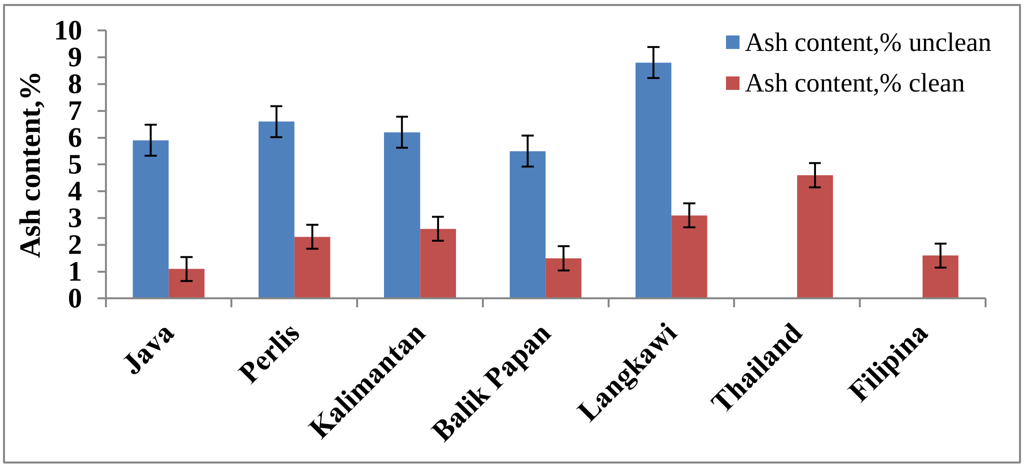
Sample	Fat Content, %	
	Unclean	Clean
Kalimantan	0.04	0.03
Java	0.05	0.03
Balikpapan	0.06	0.04
Langkawi	0.07	0.05
Perlis	0.04	0.01
Thailand	-	0.07
Philippines	-	0.05

Besides that, for moisture analysis, it can be seen in the Table 2 that unclean EBN had slightly lower moisture content than clean EBN. This maybe due to the cleaning process which make the moisture content for clean EBN become slightly higher than unclean EBN. The moisture content is frequently used as an index of stability and quality of bird nest. It is the most important and widely used analytical measurements in processing and testing of food products (Kok and Thurisingam, 2011).

Table-2. Moisture content of unclean and clean EBN from different locations

	Moisture Content,%	
Samples	**Unclean**	**Clean**
Java	6.92	13.29
Perlis	9.78	12.8
Kalimantan	10.45	13.88
Balikpapan	8.07	10.87
Langkawi	9.38	13.88
Thailand	-	8.73
Philippines	-	5.58

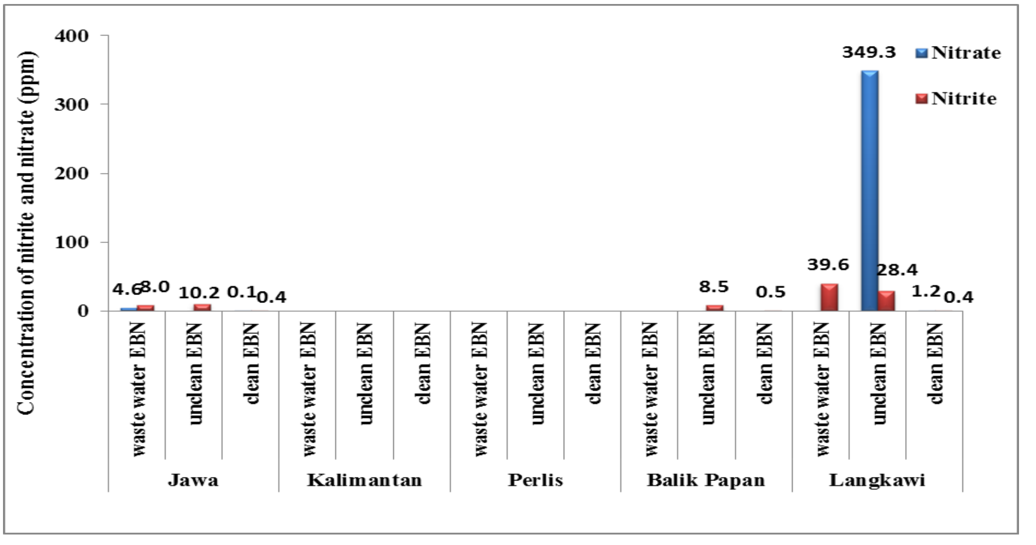
Figure-3. Ash content of unclean and clean EBN from different locations



Other than fat, ash content also remained the lowest in unclean and clean EBN. This may be due to the composition of EBN which is made exclusively out of the saliva and is highly digestible (Marcone, 2005). The amount of inorganic ash in unclean EBN is higher than in clean EBN as indicated in Figure 3.

Determination of nitrite and nitrate content in edible bird nest were caried out using ion chromatography. Ion chromatography is a very sensitive method which can detect until 0.1 ppm concentration. The graph bar below(Figure 4) indicates the concentration of nitrite and nitrate in five different locations namely Java, Kalimantan, Perlis, Balikpapan and Langkawi. Out of five locations, EBN from Kalimantan and Perlis were devoid of nitrite and nitrate. EBN from Langkawi (cave nest) showed the highest nitrite and nitrate content followed by EBN from Jawa and Balik Papan.Tthe cleaning process on Langkawi EBN showed that there was a reduction of nitrite content in the wastewater (39.6 ppm), unclean EBN (28.4 ppm) and clean EBN(0.4 ppm) . Similarly for Java EBN, nitrite content in wastewater was 8 ppm, unclean EBN was 10.2 ppm and clean EBN was 0.4 ppm. As for Balikpapan EBN, nitrite content for unclean EBN was 8.5 ppm and clean EBN was 0.5ppm. Thus, it can be concluded that, cleaning process can reduce the nitrite and nitrate content in EBN.

Figure-4. The concentration of nitrite and nitrate in five locations namely Jawa, Kalimantan, Perlis, Balik Papan and Langkawi



Langkawi EBN collected from a cave nest showed the highest amount of nitrite and nitrate contents. This is due to the uncontrolled ambient conditions where EBN is exposed to the influence of external environment. According to the Chinese report, the amount of nitrite in EBN from a cave nest can be as high as double or triple the amount present in EBN from a house nest. As swiftlets built their nests in the mountain cave, minerals from the mountain wall will infiltrate into the nest through rain drippings and coupled with the high humidity in the cave can cause a color change of the nest to a yellow color. This yellow color of cave EBN contributes to the high amount of nitrite and nitrate. Generally, the presence of nitrite and nitrate is a natural phenomenon in any swiftlet ranch or cave. The nitrite is produced by the nest itself and also being absorbed from the swiftlet nesting environment, particularly from the floor where organic materials are decomposed (Kamarudin, 2012).

CONCLUSION

It can be concluded generally edible bird nests from different geographical location contain a high protein content, followed by carbohydrate and fat content. The breeding sites and environmental surroundings as well as bird nest type have an effect on nitrite and nitrate presence in EBN.

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