



## Consumer's Perception on the Quality of Controversial Contents in Edible Bird's Nest Products

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**Abstract** – Edible bird's nest (EBN) originates from South East Asia and has become the most popular food delicacy among Chinese people. The price for raw and clean EBN are around RM 4,000 and RM 8,000 per kg, respectively. Due to the high market value of EBN and low maintenance cost, people ventures and invest in bird's nest industry. The nesting house resembles the cave is built to attract swiftlets to roost and nest in it in order to meet the world's growing demand. Out of the blue, in 2011, the EBN's price falls half from its original price from RM 4,000 to RM 2,000. Nitrate found in raw or unclean EBN is one of the reason price plunges and the public also worried about counterfeit EBN that made from unclear substances. Thus, this review paper aims to highlight the nutritional properties in EBN that give medicinal benefits to consumers and the adulterant in EBN to increase the property contents with the dangerous mechanism by some irresponsible producers to obtain better profit which can threatening public's health. In relation, these matters may influence consumer's perception on EBN contents that could harm this industry. For that reason, scientific studies determined ways of handling EBN from scratch and distinguished the adulterant in EBN to reduce consumer anxiety was also discussed. Strict standard operation procedure enforces by the Malaysian Ministry of Health to farmers and producers are required, so that Malaysia EBN would appeal to the China market. Latter it can yield a good result and the price of EBN will slowly increase.

**Keywords:** Adulteration, compositional properties, contamination, edible bird's nest, market value, medicinal benefits, swiftlets.

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### Introduction

Edible bird's nests (EBN), also called "*Yan Wo*", is an expensive delicacy that popular among Chinese people. It is dried glutinous saliva produced from salivary glands under their tongue of male swiftlets (Guo et al., 2006). The salivary nest is built after the mate and later to hatch their eggs and raise their young until they can be independent. It's required approximately 35 days to complete the nest before they can lay at least one to two eggs (Guo et al., 2006). The White nest swiftlet (*Aerodramus Fuciphagus*) and the Black nest swiftlet (*Aerodramus Maximus*) are two species that predominate the market (Babji et al., 2011). These swiftlet species commonly found in Southeast Asia such as China, Malaysia, Thailand, Vietnam, Indonesia, Philippine (Chantler, Well and Schuchmann, 1999; Trade Map, 2016) and their habitat is in the island, but currently they also can be found in mainland since many farmers built nesting houses to attract them. Captivate with the value of EBN, the industry has boomed around Asian. Malaysia has become the third countries exporting EBN after Indonesia and Thailand (Trade Map, 2016). Nesting house made by man resemble the cave can be seen everywhere around Malaysia such as in Sabah, Sarawak, Kedah, Perak, Selangor, Pahang, Johor, and Terengganu. This is evidence that the industry was having a period of great prosperity. Driven by a lucrative return from Hong Kong, China, Taiwan, Singapore and North America, it encourages entrepreneurs to develop various products from EBN such as drink, food supplement, additive or extract added in food and cosmetic. However, in 2011, China banned EBN from Malaysia after high nitrate level was found in raw EBN. Malaysian farmers and

producers have been shaken by a historic drop in EBN price. With the help from China and Malaysia's Ministry of Health, the proper standard procedure for processing EBN had been established. The nitrate contents meet the permissible level set and China once again with stringent procedure allow Malaysian EBN to enter their market. Despite, the challenges in EBN industry not merely caused by contamination in EBN, but also some producers fabricate the ingredients to take advantage of a growing demand.

### **The Market Value of Edible Bird's Nest**

Higher market value, attracting many investors and producers to venture into this business. The Nesting house farms can easily locate in Malaysia either in urban or countryside. The swiftlet farming industry has mushroomed and estimated around 60,000 ranchers in Malaysia (Malaysia Economic Transformation Programme Annual Report, 2013). Previously, the EBN can only be found in the cave, but lessen the number of nests caused by the impetuous behavior of collectors that the population of *Aerodramus* in danger. Due to the growth in demand and supply shortages, the alleged act of misconduct for personal gain are arising. A case reported in Thailand, 29 villagers died after trying to hunt EBN at Pattulang (Rooney, 2000). The company that received consent to harvest EBN dominate the island and their armed men guarded the island. Some local fisherman wounded from gun shooting when their boat sailed too close to the company operations. The most recent case was 14 people arrested in China try to smuggle EBN with the value around 150,000 USD. Ironically, the most notable act is adulteration in EBN with less expensive materials (Goh et al., 2001; Lau and Melville, 1994), which is one of the major global concerns, to increase the quantity and make more profits. Besides, the price of this product fluctuates from time to time, if there is a shortage in supply, the producer raises the price. The price of raw EBN was between RM 4,000 to RM 5,000 per kilogram and clean EBN between RM 6,000 to RM 8,000 per kilogram. The prices fluctuate could be caused by the never-ending issues such as contamination and counterfeit EBN, which cause consumer loses confidence to consume the EBN products. The fact that, China refused to buy Malaysian EBN after high nitrate level found shows loss of consumer trust in the most valuable food product.

Nevertheless, the value of the EBN products depends on various factors such as the cleanliness, shape (half-cup or stripe), type (white, red, or grass) and color (white, yellow, or red) of the nests. Clean EBN is more expensive than unclean EBN, since tedious procedure that required prolonging cleaning process by removing feather and other foreign matters. Raw EBN is soaking in water for a long period of time to make the cleaning process easier. The clean EBN have lessened the nutritional content since EBN is water soluble and wastage is produced throughout this process. Then molding, air drying, baking process and lastly packaging take place so that it can be commercialized. The packaging also influences the price setup, the luxurious EBN's packaging costs a fortune as compared to the normal packaging. People invest in packaging due to certain occasion such as giving as a present to impress people or for their own satisfaction (Rundh, 2009). As Kauppinen-Raisanen (2014) stated, the aim of packaging is not only for protecting the products but also for promoting it. Indeed, this white gold has become the most expensive food in the world since involved in laborious harvesting, prolong cleaning process, tactical plan and the medicinal contents in EBN that influence people to buy and consume it.

### **Nutritional Properties of Edible Bird' Nest**

EBN has been used in traditional Chinese medicine or nutraceuticals for hundreds of years since *Tang* dynasties (618 - 907 AD) (Lim et al., 2002). Until today, it has also been consumed as a health supplement to provide nutrients to restore body deficiency. Despite the popularity of this nest, the cognitive of nutritional contents are uncertain (Marcone, 2005). It has been debated among researchers on the compositional properties of the salivary nest because it has become one of the most expensive food in the world and been referred as the 'Caviar of the East' (Lim et al., 2002). A great number of studies revealed scientific supporting evidence of nutritional properties in EBN that beneficial to health. As Marcone (2005) reported, the composite of clean White EBN mostly was protein with a range of 62%, and follow by carbohydrates (27.30%), moisture (7.50%), ash (2.10%) and lipid (fat) (0.10%). While, clean Red EBN had protein (63%), carbohydrates (25.60%), moisture (8%), ash (2.10%) and lipid or fat (1.30%). Recent studies have investigated EBN collected from several places in Thailand revealed the contents of protein (60.90% to 66.90%) carbohydrates (25.40% to 30.70%), moisture (17.80% to

24.30%), ash (5.90% to 7.40%), crude fat (0.40% to 1.30%), and fiber 0.10%. As compared to Indonesia and Malaysia, Thailand EBN has a better amount of sulfur-containing amino acid which was ranged between 10.70 to 26.20 mg/g protein (Saengkrajang et al., 2013). As much as nutritional contents of EBN found in other countries, Malaysian EBN comprised almost similar findings of protein (57.90% to 65.80%), carbohydrates (11% to 13%), moisture (7.10% to 13.90%), ash (3% to 9.50%), and fat (0.01% to 0.09%) (Hamzah et al., 2013; Norhayati et al., 2010; Zainab et al., 2013). The contents also differed between unclean and clean EBN. Further studies indicate sialic acid content was found in the salivary nest made by *Aerodramus Fuciphagus* and the ranged from 0.70% to 1.50% found in Malaysia's EBN (Kathan and Weeks, 1969; Marni et al., 2014). The nutrient contents slightly differed in small-scale between Indonesia, Thailand and Malaysia could be caused by a few factors such as breeding sites, climate, and diet or food available for *Aerodramus* (Norhayati et al., 2010). These prove that Malaysian EBN is practically capable to compete in the market with other countries. The nutrient properties of EBN from other countries corresponding to Malaysia's EBN.

### Medicinal Benefits of Edible Bird's Nest

The skyrocketing price of EBN makes some researcher wonder the medicinal benefits gain from consuming EBN and eager to discover its healthy function. It is a significant item in the cuisine and widely used in Chinese traditional medicine. The Chinese traditional practitioners believe that the following are the benefits of consuming EBN:

1. Enhances the rebirth of cells and tissues (Epidermal growth factor)
2. Enhances the body's immune system through promotion of cell division
3. Strengthens the body's self-regulating actions and resistance to disease
4. Improving heart functions and reducing blood pressure
5. Assists in the prevention of cancer through rich antioxidants
6. Aides in the regeneration and growth of cells
7. Aides in the treatment of cancer patients
8. Regulates blood supply all around the body
9. Improves the skin complexion
10. Reducing fatigue

The validity and reliability of the beneficial properties are not been testified before and just based on consumer experience, history and anecdotal. Curiosity triggers some modern science researchers presented the effects of EBN by doing lab experiments on living things (rat, pig, flies). Bird's nest salivary has been used as a mechanism for regenerate immune and induced cell proliferation. Cao et al. (2012) clarified that EBN had remarkable effects to boost the immune system and it had been tested by injecting bird's nest extract to Kunming mice. Thus, it has the capability to fight or suppress the dangerous virus infection, which often attacks immune cells to destroy the immune system. Strong immune systems prevent from immune deficiency and help build up a wall against a devastating illness which could lead to fatal. In fact, few studies acknowledged the mechanism in EBN that contain remedy to deal with influenza virus (Haghani et al., 2016; Yagi et al., 2008). Further, the mechanism in EBN can produce cell proliferation (Chao et al., 2003; Rashed and Nazaimoon, 2010; Roh et al., 2011) for treatment benefits during surgical healing and also adjuvant therapy for cancer treatment as well as against cancer recurrence. The therapeutic or healing effects especially needed to replace injured or cell death. This suggests that EBN can be used as a health supplement to enhance body metabolism. Besides, the mechanism in EBN inhibits insulin resistance that can cause diabetes (Yida, 2015). Studies have found insulin is an important hormone to absorb nutrients from our food intake. If the body becomes poor at properly using insulin, then will increase the risk for many health problems. Conceding these consuming EBN can help the body to respond better to insulin which subsequently could increase lifespan and lower mortality rates (Hu et al., 2015). Also, EBN contains sialic acid (Kathan and Weeks, 1969; Marni et al., 2014) which is essential nutrition or supplement for brain development (Wang, 2012). Lab experiment revealed, piglets fed milk blended with sialic acid was able to perform better for learning and memory task than piglets fed milk only (Wang et al., 2007). Last but not least, bird's nest extract improves rats bone strength and promoted anti-aging properties, which is a good supplement and nourishment to the

skin (Matsukawa et al., 2011). These convince that EBN is highly endowed with the function of being nutritious. With all experiments conducted by the researchers, has proven the beneficial effects of consumed EBN on human health proclaimed by Chinese traditional medicine practitioners.

### **Perception and Perceived Value towards Edible Bird's Nest**

Perceived and believed by consumers that bird's nest has nutritional benefits to health leading to dramatically rise in the amount of product choice in the market. The demand for EBN is rising as people more affluent and more educated about health and appearance. The study conducted in Malaysia to determine the intention of consumers to purchase bird's nest products revealed there were three significant factors affecting purchase intention (Sharifuddin et al., 2014). The first factor was the attitude that indicated the knowledge of nutritional benefits could lead to purchasing intention. A second was subjective norm that shows important people in their life could influence the intention to purchase and the third factor was perceived behavioral control which indicated the difficulty of obtaining the product could reduce the purchase intention. These convey that perception of bird's nest products are not merely by the value but also influenced by others and self-contemplation. Perception toward certain product also generates from the marketing tactic of one company used to achieve their business goals. The widely accepted product gain positive response in which help company to retain their customers and expand their business. But, caught in a scandal or controversial can harm the reputation that was built to gain consumer's trusts. Bird's nest product has been in severe controversy and people in this industry aware of the drawbacks.

### **Contamination or Potential Hazard in Edible Bird's Nest**

As the contamination found in EBN has caused the steep fall in the EBN price, its show the impacts are severe to the industry. Eating contaminated or tainted food is dangerous to human health and may lead to death. Despite that, sources of contamination could be derived from ecosystem conditions where living things and the non-living environment (air, water, soil) connecting as a system. Contamination caused by the emission of heavy metal is the most popular factor discoursed among researchers since it always associated with soil pollution, particularly in agricultural products, which later passed through the food chain and causing a potential health risk to human (Tangahu et al., 2011). The *Aerodramus* are reported to be insectivores (Langham, 1980) which refer to the animal practice of eating insects and plants. *Hexagenia rigida* also known as mayflies, found accumulate mercury, are common prey items of the *Aerodramus Fuciphagus* (Saouter et al., 1993). Few studies revealed traces of heavy metal to be transferred to the salivary nest are of a great concern since it could jeopardize the human health by consuming contaminated EBN products. Other sources of heavy metal contamination could be from the condition of the nesting house located near urban areas, exposed to certain element emission, with factories and major road systems and also during the preparation process (Chen et al., 2014). Examples of metals found in EBN, including cadmium, arsenic, lead, tin, mercury, copper, and iron. Cadmium, arsenic, mercury, and lead are inferred to be toxic and endangered to human health (Jarup, 2003; Ha et al., 2016). Specifically, exposure to cadmium can result in osteoporosis (Bhattacharyya, 1988; Honda et al., 2003) and hypertension (Kopp et al., 1982). While, mercury exposure can cause damage and adverse neurological impact to the pregnant woman, fetus, newborn, children and adult (Bakir et al., 1980; Debes et al., 2006; Harada, 1995; Grandjean et al., 1997). The after effect lead to psychiatric symptoms such as impairment of intelligence or behavioral dysfunction (Jedrychowski, 2006; Yorifuji et al., 2011). Comparatively, lead toxicity caused damages to intellectual or cognitive ability which affect memory (Koller et al., 2004; Rosen, 1995). Arsenic and copper consequences at high doses can originate cancer (Chen et al., 1992; Jarup, 2003) and Wilson disease (Huster et al., 2007) usually lead to fatalities, respectively. On the contrary, iron is necessary elements for red blood cell production and encouragement in dietary for health. Health aspect caused by iron toxicity is uncommon (Herbert 1987) same goes with tin were excluded in an adverse role (Prasad, 2013) in human health. Other traces of metal found, but in very low amounts, were lithium, uranium, antimony, beryllium, vanadium, silver, strontium, boron, bismuth, nickel, zirconium and titanium, are relatively harmless.

Further, in 2011, the Malaysian EBN industries experienced the price falls due to the high nitrate level found in raw EBN. Due to the high nitrate contents in EBN products, China prohibited EBN from

Malaysia to enter their market. The nitrate content was above the permissible level of 34 ppm set by the World of Health Organization. By all means, exposure to high nitrate content can cause chronic health outcomes. The risk was associated with suffering in hypertrophy of the thyroid (Van Maanen et al., 1994). Also, exposure to nitrate exceed the average limit for more than 10 years, relatively risk for colon cancer (De Roos et al., 2003), gastric cancer and prostate cancer, which subsequently lead to mortality (Morales-Suarez-Varela, Llopis-Gonzalez, and Tejerizo-Perez, 1995). It is also threatening to newborn to suffer in cyanosis or skin disease (Comly, 1995). Therefore, this issue created the great loss by not able to export EBN to the largest importers of these nests. China buyers also refused and afraid to purchase EBN from Malaysia. This significantly deteriorates Malaysia's image and all producers and investors in this industry felt the vast impact from price declined in 2011. Nevertheless, the presence of nitrate can be found in any animal products (Dinckaya et al., 2010) and crops (Amr and Hadidi, 2001; De Martin and Restani, 2003). To clarify, the level of nitrate increases as an upsurge in fertilizer made from the excrement of animal or human in agricultural practice. In this case, nitrate contents were caused by either the environmental factors in the cave (natural home) or condition of house farm. The cave is not only for swiftlets to live but also habitat for other animals like bat, snakes, and rats. The accumulated feces can generate high nitrate levels. Raw EBN harvested from the cave has high nitrate contents than from house farm (Hamzah et al., 2013; Kamarudin, 2012). But, there were studies found EBN from house farm give unexpected result and it could cause the cleanliness of their operation area. The nitrate content can be traced by examining the nest's color. The brighter and more yellow nest had higher nitrate content (Quek et al., 2015). For this reason, a chemical is used to preserve the color of swallow nest (Law, 2011). The reckless actions caused the expensive ingredient that has a long list of health benefits are contaminated. Hence, Malaysian Ministry of Health enforces strict standard operation procedure to farmers and producers so that the presence of contamination in raw and commercial EBN should below the permissible level. Proper handling from the scratch is vital in ensuring the quality of EBN. With the numerous efforts, it is hope lead solving these issues.

### **Adulteration in Edible Bird's Nest**

The definition of food adulteration is referred as food that has been adulterated by mixed and packed with other substances to reduce or increase the quality and value of the food, which eventually can cause inferiority or damage to health. Unknown substances, usually not written on the package label, have been added with the intention to reduce the cost and subsequently increases the profit of the company. Food adulteration, also known as food fraud (Spink and Moyer, 2011), not only has aroused public concern towards food safety but also become a global issue. Over the last decades, many countries such as the United State of America, European Union, Canada, Japan, Australia, China, Brazil, and Malaysia, imposed law and regulations to ensure and guarantee the quality and value of the agriculture-based products and foods to protect the consumer from unsafe or toxic foods. The significant issues surrounding the EBN industries is not only contamination found in EBN, but also counterfeit EBN that made from unknown materials (agar, egg white, tremella fungus, pig skin, red seaweed, karaya gum) mixed in the product is equally important. The presence of macro minerals, such as phosphorus, magnesium, calcium, sodium, and potassium, in commercial EBN is questionable because these elements cannot be traced in raw EBN (Chen et al., 2014). Saengkrajang et al. (2013) detected calcium, magnesium, and potassium in raw EBN and supported by Marcone (2005). Relatively, the purpose of adulterated in the EBN's production is to increase the net weights and or nutritional contents to deceived consumers and on top of that to raise the price. Also, due to high economic value and the limited supply of genuine EBN, counterfeit EBN is pervasive in the markets. Enormous demand in EBN creates an adverse circumstance which may injurious to peoples' health. For this reason, once again, it has been a growing concern because public health and lives are at stakes. Contrary to its highly beneficial effects, as much as people believe it offers longevity to the human being, after all, with fake EBN in the market it can be potentially life-threatening. Previously, intoxication case was reported after the consumption of EBN's product (Luong and Nguyen, 1999). White bird's nest was chemically bleached to red blood or terracotta color, as Red bird's nest is more expensive and scarce in the market. The long-term consumption of chemically bleached EBN can cause adverse health problems. In fact, few scientific studies to examine the difference between genuine EBN and adulterant EBN were reported. In the past, various detection methods were established in distinguishing fake and authentic EBN and still have been used until today. For example,

EBN samples were examined using gas chromatographic method (GC) to detect five monoses (D-mannitose, D-galactose, N-acetyl-D-galactosamine, N-acetyl-D-glucosamine, and N-acetyl neuramate) which can be regarded as EBN's fingerprint (Chan et al., 2013; Marcone, 2005; Yu-Qin et al., 2000). Anatomical traits were observed, and protein bands used as a measurement to determine adulterant in EBN's sample (Hu et al., 1999; Lin et al., 2009; Wu et al., 2010). Specific genetic detection (DNA extracts) was performed for reliable investigation of authentic EBN such as the mitochondrial gene, cytochrome *b* genes and fibrinogen gene (Lin et al., 2009; Thomassen et al., 2003; Wu et al., 2010). Recent studies expanded the detection method with additional approaches for precise finding. For example, verified genuine EBN via a holistic approach (physical-chemical characteristic) and GC for established EBN's fingerprint (Yang et al., 2014) provides more accurate quality assurance of EBN. Another example, identification of adulterated through genetic detection with new TaqMan-based real-time polymerase chain reaction (Guo et al., 2014) in commercial samples efficiently distinguished adulterant components in EBN. With all these scientific methods established, it could be helpful in trace and track the counterfeit EBN in the market and reduce the consumer anxiety with the adulterant EBN product as well as to minimize exposure from food poisoning or some kind of food-borne disease. On the other hand, experts have presented guidelines of fake EBN's trait such as smell unpleasant when boiled, pig hairs instead of feather found on the nest, nest not transparent, water absorption is weak and become cloudy and not in strips and thins. The studies performed on detection and quantification of adulteration can be a guideline to protect public from food fraud.

### Conclusion

Interest in the bird's nest product is growing around Asia in response to health and beauty concerns. Bird's nest industry can generate Malaysian economic growth and raise farmer's living standard and quality. However, the industry suffered a setback and still strive to gain back the trust. The decline in market value reflects falling prices in EBN and hence affected related industries. The crisis can be overcome by targeting the root causes of a problem. Since EBN is a food with various beneficial effects, the traces of hazardous substances make public's health vulnerability. A growing concern creates the need to establish benchmarks and quality assurance system to ensure the safety to consume EBN as well as to reduce public anxiety. Nevertheless, contaminant and adulterant in food have been existing for a long time and always associated with the public's concern for health. With proper handling method and guideline provided by the expert could solve these matters and gradually faded consumer perception on risks to consuming EBN. Besides, in order to gain back confidence in most consumers, clear and truthful label information provided on the product should be another initiative from producers.

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