



## A Comprehensive Review of Edible Birds Nest Use in Cosmetics

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### ABSTRACT

Edible birds' nest is a dried gelatinized saliva secreted by the bird swiftlets which is distributed mainly in the suitable environmental conditions. Before consuming EBN product has to be undergone various processing technologies to remove the harmful substances, retain nutrition increase flavor and control content as it contains various impurities. EBN is composed of various amino acids, proteins, carbohydrates, sialic acid, high water content low amount of fat. As EBN has various nutritional benefits, birds nest soup has been prepared which was believed to improve the skin condition. EBN has been widely used in cosmetics as researchers demonstrated the activity of epidermal growth factor [EGF] activity as EGF increases the metabolism of skin cells and cell proliferation and improve the skin texture and lighten the skin. As higher content of NANA present in EBN, which shows the best lightening effect. The collagen content present in the EBN gives the anti aging effect. EBN waste is also considered as safe as it contains high protein content and carbohydrate content and also it devoid of nitrites, nitrates and leads so it is also used in the formulation of cream without any loss of nutritional benefits.

**Keywords:** EBN, swiftlets, skin whitening activity, anti-aging, N-Acetylneuraminic acid, Epidermal growth factor.

### 1. INTRODUCTION

Edible birds nest (EBN), a high-end product mostly marketed to Chinese consumers in Asian markets including China, Taiwan, Singapore, and Malaysia, is thought to be both a culinary treat and a nutritional supplement with health-promoting benefits. EBN is the dry production of sticky saliva from Swiftlet in the breeding season.<sup>[1]</sup> EBN often refers to the nests of the white-nest swiftlet, *Aerodramus fuciphagus* (*A. fuciphagus*), and the black-nest swiftlet, *Aerodramus maximus* (*A. maximum*), which are harvested for Southeast Asian cuisine. The development and procreation of Swiftlets need the right climatic factors, including a temperature range of 26 to 35°C, an approximate humidity of 80 to 90%, and an adequate supply of food.<sup>[2]</sup> Because of its high nutritional content, EBN is one of the priciest animal products that people consume.<sup>[3]</sup>

Modern scientific methods were used to demonstrate the advantageous qualities of EBN, revealing its several pharmacological activities, including antioxidative effects, anti-inflammatory, anti-influenza, and skin-whitening properties, as well as aiding in the healing of corneal wounds, enhancing stem cell proliferation, improving memory and neuroprotection in Parkinson's or Alzheimer's disease, promoting epidermal growth, improving osteoporosis, preventing obesity, and preventing cardiometabolic and diabetic diseases<sup>[4]</sup> and also popular for its nutrients such as sialic acid, epidermal growth factor (EGF) and anti-aging.<sup>[1]</sup> The market's use of EBN, which comes in a variety of easily ingested items as liquid beverages, dry powders, or capsules. For example, the sterilized ready-to-drink EBN has a longer shelf life when it is marketed as a beverage with light syrup. Commercial bird's nest extracts and dried gel powders from bird's nest-related products steeped in rock sugar solution are also available.<sup>[1]</sup>

The swiftlet industry's Center of Excellence (COE) was created in 2011 to coordinate research and development related to swiftlets and their edible nests in order to guarantee the industry's sustainability and competitiveness.<sup>[5]</sup> This review can provide efficacy guarantees for the use of EBN as cosmetics.

### 2. EBN:

Indian swiftlets, edible-nest swiftlets, and other swiftlets of the genera *Aerodramus*, *Hydrochous*, *Schoutedenapus*, and *Collocalia* produce edible bird's nests, commonly referred to as swallow nests, out of solidified saliva and are gathered for human food.



The species of swiftlet, along with the nest's shape and color, determines the type or grading of the nest. Although it is often white, there is a red kind that is occasionally referred to as "blood nest." Traditional Chinese medicine claims that it encourages overall health, particularly for the skin.<sup>[15]</sup>

Researchers found that its redness results from a reaction between the mucin glycoprotein of the originally created white bird nest and the vapor of reactive nitrogen species in the cave's or bird house's atmosphere. Tyrosine found in red bird nests has joined forces with reactive nitrogen species to create 3-nitrotyrosine. While 3-nitrotyrosine generates the characteristic yellow, golden, and orange colors found in other types of bird's nest products at lower concentrations, it also provides a distinctly rich red color at higher concentrations. The red bird's nest has a high percentage of nitrite and nitrate, which are known to produce carcinogenic compounds, because the researchers observe that the bird nest easily absorbs these substances from the process' vapor. This could indicate that non-white birds' nests are bad for people's health.<sup>[16][17]</sup>

## 2.1. CHEMICAL COMPOSITION OF EBN

It was discovered that a number of EBN benefits were being promoted as functional foods and medications.

Since 1920, the composition analysis of EBN that focuses on protein components has been preserved.<sup>[6]</sup> According to the study, the primary building blocks of EBN are glycoproteins. Moreover, proteins and carbohydrates, which make up roughly 60% and 30% of the overall mass, respectively, were included.<sup>[7]</sup> EBN is believed that it could resist and turn musty even in a moist condition for several days.<sup>[8]</sup>

EBN is a low-fat food because its fat level is less than 0.5%. Polyunsaturated fatty acids (48.43%), of which linoleic acid accounts for 47.15%, saturated fatty acids (25.35%), represented by palmitic acid with a relative abundance of 21.33%, and monounsaturated fats (24.74%), of which oleic acid is the predominant component with 21.97%, are abundant in the triglyceride of EBN.<sup>[9]</sup>

Feather EBN has a little higher ash content than clean EBN, which has an ash content of roughly 5%. Feathers and other foreign objects are the cause of the variation in cleanliness amongst EBN. After examining 18 different types of mineral elements in EBN heavy metals, important microelements, and macroelements could be detected. In general, the levels of Ca, Mg, K, and Na were high. However, samples' concentrations of heavy metals like As and Hg as well as necessary microelements like Fe and Cu differed, which could be connected to swiftlets' hunting and nesting environments.<sup>[10]</sup> Protein content is followed by the amount of carbohydrates, which include galactose (Gal), mannose (Man), glucosamine (GlcN), galactosamine (GalN), sialic acid (SA), and fucose (Fuc).<sup>[11]</sup>

With a content of roughly 10%, SA is the most notable element in EBN as it is often referred to as "EBN acid". SA is a group of carboxylated monosaccharide acylated derivatives with nine carbons that are frequently found as glycolipids, glycoproteins, or oligosaccharides. SA can be separated into four categories based on the various linking groups on the fifth carbon: deamination neuraminic acid (KDN), neuraminic acid (Neu), N-acetylneuraminic acid (Neu5Ac or NANA), and N-hydroxyacetylneuraminic acid (Neu5Gc). According to Liu et al. (2010), the first two are the primary forms. In EBN, SA particularly refers to Neu5Ac.<sup>[12]</sup> 22 different types of amino acids were examined in 10 different types of EBN in a recent study.

Eight essential amino acids were among the 20 amino acids that were found. The absence of hydroxyproline (Hyp) and sarcosine (Sar) suggests that EBN lacked collagen. Aspartic acid (Asp), glutamic acid (Glu), histidine (His), glycine (Gly), threonine (Thr), arginine (Arg), alanine (Ala), tyrosine (Tyr), cysteine (Cys), valine (Val), methionine (Met), phenylalanine (Phe), isoleucine (Ile), leucine (Leu), lysine (Lys), proline (Pro), asparagine (Asn), glutamine (Gln), and tryptophan (Trp) were the remaining 20 amino acids.<sup>[10]</sup> Compared to other protein-rich foods like eggs (4.7–7.0 g/100 g) and milk (1.1 g/100 g), the total essential amino acid content of EBN samples (17.8 g/100 g) was noticeably higher, indicating that EBN was a possible supply of vital amino acids.<sup>[13]</sup>

## 3. ROLE OF EBN IN FOOD

In China, EBNs have been a common traditional dish since the Tang era (618-709 AD). EBNs were traditionally eaten as soup after being double cooked with sugar, which had both therapeutic and nutritional advantages. A range of food products, including beverages and food additives, were made from EBN once production reached a commercial level.<sup>[18]</sup> Flakes are another way that EBNs are consumed. Some of the recently developed EBN products are:



PRODUCT NAME	BENEFITS
Birds Nest Soup	Acts as a tonic as well as nutrient rich traditional Chinese cuisine
Birds nest instant energy drink	Boosting of energy
Vietnam birds nest powder	Increase the absorption rate as well as act as an antioxidant
Birds nest drink	Improving blood circulation
Birds nest pudding recipe	Delicious pudding made up of EBN extract
Instant Malaysian cubilose nourishing tonic	A kind of traditional Chinese medicine
Birds nest granules	Used as supplements

#### 4.EBN USE IN COSMETICS

In certain areas, such as tyrosinase inhibitory and antioxidant properties, EBNPs outperform EBNs. Given the aforementioned benefits, it is strongly anticipated that EBNP will be used by consumers, producers, and researchers as a component in medications, skin care products, and functional foods (cosmetics).<sup>[14]</sup> Human aging is caused by a number of factors, including excessive melanin synthesis, photoaging, difficulty in wound healing (slow cell proliferation), etc. Regretfully, despite reports that EBNP has skin-whitening activity, no in vivo experiment result has shown that EBNP could inhibit melanin synthesis in an animal body, and no effects of EBNP on anti-photoaging and wound healing (promoting cell proliferation) have been reported. For these issues that are closely related to human health, we hypothesized that EBNP could provide solutions. In this study, EBNP was prepared by hydrolyzing EBN using alkaline protease, and both in vitro and in vivo evaluation methods based on biochemistry, cell, and animal (zebrafish) were used to evaluate the EBNP.<sup>[14]</sup>

##### 4.1.SKIN WHITENING ACTIVITY

The detection and partial purification of epidermal growth factor (EGF) activity from EBN extract was demonstrated.<sup>[19]</sup> EGF promotes skin cell proliferation and metabolism, enhances skin texture, revitalizes skin cells, and helps lighten the skin.

Chan demonstrated how EBN may lighten skin.<sup>[20]</sup> EBN extracts were separated into three primary components. The best lightening impact was only displayed by the isolated fraction that included more N-acetylneuraminic acid.<sup>[21]</sup> More N-acetylneuraminic acid, a component of sialic acid, is present in Indonesian EBN (*Aerodramus fuciphagus*) than in those from Thailand and Vietnam.<sup>[22]</sup>

EBN, which is used in many cosmetics, is said to lighten and moisturize Indonesian skin. This study can offer the public efficacy guarantees for the use of EBN as cosmetics. Cream was selected since it is a popular choice among society for facial cosmetics. One benefit of cream is its ease of washing and rapid skin absorption.<sup>[23]</sup>

##### 4.1.1.EDIBLE NEST CREAM PREPARATION

Ingredient in Table was formulated into water in oil (W/O) and oil in water (O/W) creams.

INGREDIENTS	O/W CREAM [%]	W/O CREAM [%]
Edible birds nest	40	40
Cera alba	-	7
Cetaceum	-	7
Paraffin liquid	-	32.5
Propylparaben	0.02	0.02
Methyl paraben	0.18	0.18
Glycerin	9	-
Stearic acid	6	-
Triethanolamine	3	-
aquadest	Upto 100	Upto 100

#### PREPARATION

EBN was formulated into water in oil (W/O) creams and oil in water (O/W) creams. The main functions of glycerin in O/W cream formulation are humectant and emollient (9%; concentration <30%). Studies conducted in vitro have revealed that glycerin stop the stratum corneum model lipid mixture from crystallizing at low room humidity. Skin corneometer values dramatically increased after ten days of 20% glycerin therapy for normal skin, suggesting enhanced moisture. Stearic acid (6%; concentration <30%) is utilized



as a solubilizing and emulsifying agent. With a pH of around 8, TEA creates an anionic soap when combined with stearic acid that can be utilized as an emulsifying ingredient to create stable, fine-grained oil-in-water emulsions.

In skin-cleaning, moisturizing, and other skincare treatments, TEA stearic was utilized in concentrations of 10% or less. Cera alba in Water-in-oil emulsions are stabilized by the use of W/O cream formulation. The main emollient ingredients in this cream formulation are cetaceum and paraffin liquid.

The physicochemical properties of the cream was tested and the result showed that o/w and w/o creams of edible birds nest had a semisolid form, white bone color and odorless. Both varieties of EBN cream met the appropriate pH range for skin, which was 4.5–6.5 . Thus, both varieties of EBN cream are safe to use.<sup>[23][24]</sup>

## 5.EBN WASTE

EBN waste as residual water from cleaning raw EBN, kept a significant amount of its nutritional value compared to graded pure EBN. The waste's high protein content indicates the existence of collagen, which slows down the aging process of the skin.

The labor-intensive cleaning procedure for bird nests is one of the biggest issues facing the EBN sector. Cleaning a typical-sized nest takes around an hour for one person, making it a laborious task. About 30% (w/w) of trash is typically produced throughout these cleaning processes. Research on the makeup of the trash recovered during the cleaning process and its conversion into beneficial downstream products has not yet been done.

If the nutrients are preserved, the waste removed from the EBN cleaning businesses can be recycled and used again. Therefore, the purpose of this endeavor was to determine the waste's composition and turn it into a component for the production of beneficial downstream products. This will be helpful to the cosmetics business as a way to cut costs when producing high-end beauty products.<sup>[25]</sup>

### 5.1.FACIAL CREAM FORMULATION AND THE PRODUCTION PROCESS

A face cream was created using the sample's dried residue. A face cream formulation is described in Table 1. Separately, mixtures I and II were heated to 80°C. After that, mixture II was vigorously stirred into mixture I. Mixture III was heated to 60 degrees Celsius till combination I/II was combined with the dissolved active component (EBN waste). As the sample mixture cooled to room temperature, it was stirred.

MIXTURE	COMPOSITION (g)
MIXTURE 1	
Cetostearyl alcohol	7.0
Cremophor A 25	3.0
Liquid paraffin	12.0
Methyl paraben	0.2
Mixture 2	
Water	69.7
Mixture 3	
Propylene glycol	8.0
EBN waste	0.1

FTIR spectroscopy was used to compare the two face creams—commercial EBN face cream made from premium EBN and EBN waste face cream—in order to assess the creams' quality.

Similar spectrum and functional group shapes and patterns were present in both the cream product. This shown that the face cream derived from EBN waste is as good as with the market's commercial EBN-based face cream product.<sup>[3]</sup>

## 6.ANTIOXIDANT, ANTI INFLAMMATORY AND ANTIAGING EFFECT

By down-regulating the extracellular signal-regulated protein kinase/c-Jun N-terminal kinases and transcription factor activator protein-1 pathway, EBN can suppress the expression of matrix metalloproteinase-1, demonstrating its anti-aging qualities.<sup>[26]</sup> EBN can boost antioxidant enzyme activities and lower the amount of lipid peroxidation products in *Drosophila melanogaster*, particularly the components with molecular weights less than 3 kDa. This can postpone *Drosophila* senescence.<sup>[27]</sup> The EBN mixture enhanced the amount of superoxide dismutase in rat red blood cells and considerably decreased lipid peroxidation in mouse brain tissue due



to the compatibility of pearl powder, delaying aging.<sup>[28]</sup> The triglycerides of EBN are rich in unsaturated fatty acids, which have an important contribution to its antioxidant effect.<sup>[29]</sup>

## CONCLUSION

Edible birds nest, an ingredient with high nutritional value has been used since ancient times. EBN composition includes abundant amount of proteins, carbohydrates, aminoacids and sialic acids. Because of its high nutritional content and as well as no toxicity indicated, it is used as an active ingredient in cosmetics. Effectiveness of the EBN formulation in skincare improving skin texture such as reducing wrinkle, hydrating the skin and brightening the skin complex. In the cosmetics, EBN waste also offers good potential as a base material for the creation of value-added products. Using the EBN waste for nutritional health products is needs to be investigated. EBN also have several pharmacological effects such as an anti-inflammatory, anti-influenza, antioxidant, whiten the skin, strengthen bone, and enhance epidermal growth activities, immunity enhancement, neurological improvement, and brain development and as an health food supplement.

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