A Mini Review on Medicinal Effects of Edible Bird’s Nest

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Abstract

Edible bird’s nest is a famous and nutritious food which is well-known among Chinese community. It is made from the saliva of swiftlets and is consumed for various reasons, including as health tonic, complexion enhancer, asthma alleviator and immune system enhancer. It contains both macronutrients and micronutrients such as carbohydrates, glycoproteins, calcium, sodium, magnesium, zinc, manganese, iron and others. To date, a number of studies have reported on the health benefits of EBN consumption. Hence, this review describes the various medicinal values of EBN.

Introduction

Edible bird’s nest (EBN), also known as the “Caviar of the East”, is a renowned delicacy among the Chinese community for its nutritional and medicinal values[1]. EBN is made from the saliva of tiny cave-dwelling birds known as swiftlets that are commonly found in Southeast Asia, including Malaysia[2]. The first consumption of EBN dated back into the Tang Dynasty (618 - 907 A.D) where it was served to the courts of the China’s Emperor as a supreme delicacy. Since then, the medicinal benefits of EBN have been carefully documented and it was later recognized as one of the great four tonics in Traditional Chinese Medicine during the late Ming (1405 - 1433 AD) and early Ching (1644 - 1911 AD) Dynasties[1,3]. Due to its scarcity and rarity, EBN was regarded as a symbol of wealth, power and prestige[3]. For centuries, EBN had been consumed as health tonic, complexion enhancer, asthma alleviator and immune system enhancer[3].

The major nutrient components of EBN are carbohydrates and glycoproteins, along with minor essential trace elements such as calcium, sodium, magnesium, zinc, manganese and iron[2,3]. EBN contains many bioactive compounds which have health promoting effects such as glucosamine, lactoferrin, sialic acid, amino acids, fatty acids, triacylglycerol, vitamins, minerals and other antioxidants[3,4]. Despite many health effects were claimed to be associated with EBN consumption, its mechanism of action is unknown and there is no clinical evidence to support those claims. This article aims to provide an overview on EBN and its medicinal effects, with support from the latest evidence-based discoveries on the benefits of EBN consumption.

Medicinal Effects of EBN

Antiviral properties of EBN

In 2006, a research was conducted to study the antiviral efficacy of natural cave and house-cultured EBN[4]. The research demonstrated that EBN extract could effectively inhibit influenza infection independent of its strains—human, avian and swine, by directly binding to the influenza virus itself or inhibiting the hemagglutination of the virus to human erythrocytes (Figure 1). Furthermore, EBN was found to neutralize the virus infection in Madin-Darby canine kidney (MDCK) cells. In the experiment, EBN extracts treated with the protease pancreatin, has shown a stronger inhibitory activity against influenza virus, indicating that the lower molecular peptides (10 - 25kDa sialyl glycoprotein) were accounted for the antiviral properties of EBN. Conversely, EBN extracts treated with neuraminidase (NA), which cleaves the terminal sialic acid residues, causes reduction in the EBN/virus binding activity. This suggests that the virus binding effect of EBN is related to the presence of sialic acid. Generally, the viral inhibition activities of the wild EBN extracts were higher than the house-cultured EBN extracts. It was proved that the main antiviral effect of EBN was mediated by the sialyl glycol conjugates with Neu5Ac2-3Gal linkages. The study concluded that EBN could be a safe and effective natural source for the...
The antiviral activity of EBN is further supported in the 2016 study by Haghani and his colleagues[6]. The bioactive sialic acids or thymol derivatives in EBNs have shown to effectively inhibit the virus IAV strain A/Puerto Rico/8/1934 (H1N1) by decreasing the viral intracellular NA and extracellular non-structural protein 1 (NS1) genes which are required for the viral infection initiation and replication. However, these effects were only observed in untreated EBN. EBN which received enzymatic treatment (either pancreatin or NA) showed no effect on the NA gene, while EBN with pancreatin treatment showed increased extracellular NS1 copy number and reduced immunomodulatory property[6]. The observations suggested that some amino acids of EBN might cause an increase in the viral activities. On the other hand, EBN has shown to improve the outcome of influenza infection in BALB/c mice through modulation of immune responses by actively changing the cytokines patterns, such as activation of pro-inflammatory responses and cell-mediated immunity, depending on the infection phases. On top of that, pre-treatment with EBN showed protective effect against the virus in the mice. EBN which contains higher amount of acetylated sialic acid (Neu 2,4,7,8,9Ac6) displayed better antiviral activity regardless of the source locations they were obtained. It is recommended, however, to examine the bioactive metabolites of EBN before using it as an alternative antiviral medicine in clinical trials as the origin of EBN and the species of swiftlets might affect the EBN’s composition.

**Figure 1:** Anti-influenza virus effects of edible bird’s nest.

### Anti-oxidant properties of EBN

Apart from antiviral activities, EBN is also well-known for its antioxidant properties. An in vivo study was carried out to elucidate the antioxidant and anti-inflammatory effects of EBN on high fat diet (HFD)-induced oxidative stress and inflammation in rat models[7]. The results demonstrated that EBN attenuated the HFD-induced oxidative stress and inflammation via transcriptional regulation of hepatic antioxidant and inflammation-related genes; and the effects were better than Simvastatin, a well-known lipid-lowering medication. In short, the study supported the use of EBN as an effective supplement for the prevention of obesity-related inflammation and oxidative stress.

The ability of EBN in reducing oxidative stress is believed to be attributed by its antioxidant content, as demonstrated in a study conducted by Yida et al.[8]. The EBN samples were first subjected to a simulated gut digestion model, and the digested samples were then tested for their antioxidant activities. Results showed that the digested samples displayed potent antioxidant activities that contributed to the reduction in oxidative stress markers. Similarly in another study, EBN displayed protective effect against hydrogen peroxide-induced toxicity in SH-SYSY cells[8]. Hydrogen peroxide is a chemical which induces oxidative stress in cells. The protective effect of EBN suggested that it had the ability to scavenge free radicals and decrease radical oxygen species, thereby lowering the oxidative stress. Hou et al., further suggested that the antioxidant properties of EBN were conferred by its constituents, namely lactoferrin and ovotransferrin[9].

### Neuroprotective effects of EBN

Several studies investigated that the neuroprotective effects of EBN were reported. Hou et al., demonstrated that EBN attenuated cortical and hippocampal neurodegeneration in ovarioctomized rats[10]. The data obtained showed that EBN supplementation improved estrogen deficiency-induced neurodegeneration of dopaminergic neurons principally through inhibition of apoptosis. Thus, it could be concluded that EBN might serve as a novel alternative therapy for oxidative-stress mediated neurodegenerative diseases such as Alzheimer’s disease and Parkinson’s disease[11].

### Effects of EBN on cardiometabolic diseases

To date, several studies which employed HFD or ovarioctomized rat models have reported that EBN might possess beneficial effects on cardiometabolic diseases such as diabetes and cardiovascular diseases (CVD)[12-14]. HFD and the lack of hormones in ovarioctomized rats worsen the metabolic indices (such as increased leptin and decreased adiponectin) and lipid profile. This would induce hypercholesterolemia along with insulin resistance, a condition which contributes to an increased risk for developing cardiometabolic diseases. Adiponectin and lectin are both important regulators of lipid metabolism and coagulation, whereby high metabolic indices are reflected by high adiponectin level and decreased level of leptin. In these studies, EBN has been proven to improve lipid profile and metabolic indices in rats, in comparison to the non-treated and Simvastatin-treated groups[12-14]. The effects were possibly mediated through the regulation of coagulation-related genes and insulin signalling genes.

### Effects of EBN on bone regeneration

The effects of EBN on bones and cartilages were also investigated in several studies. Matsukawa et al., showed that ovarioctomized rats fed with EBN had improved femur bone strength accompanied with an increase in dermal thickness[15]. It was also observed that oral administration of EBN significantly produced rats with heavier body weight along with higher fe-
Medicinal Effects of Edible Bird’s Nest

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Conclusion

Consumption of EBN has shown to bring multiple health benefits including antivirus, antioxidant and neuroprotection. It is also helpful in improving cardiometabolic diseases and bone degeneration. However many of these health effects were described in a handful of studies. More validation is required to not only confirm the findings but also to investigate the underlying mechanisms.

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