

A NUTRACEUTICAL FORMULATED DRINK FROM EDIBLE BIRD'S NEST
AND COLLAGEN WITH HIGH BIOAVAILABILITY PROPERTIES

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ABSTRACT

Nutraceuticals drinks formulated from phytochemicals or functional foods that contain natural bioactive and chemical compounds contributes to health-promoting, disease-preventing or therapeutic properties. In current trends, there is a high demand for nutraceutical products and functional food, particularly drinks or beverages. Formulation of nutraceutical drink containing Edible Bird Nest's (EBN) extract and collagen type II can result in preventing bone health disease as it gives great benefits and improve the bone strength. The aim of this study is to develop a nutraceutical drink from EBN extract and collagen type II for bone health properties with high bioavailability of collagen content. In this study, six different formulation was carried out with different concentrations of EBN extract (0%, 0.03% 0.025%, 0.050%, 0.075%, 1%) and two samples of collagen drink were purchased for benchmarking from market such as Kinohibitsu and Ecolite. All sample were analysed with *in vitro* bioavailability analysis and sensory analysis using Hedonic Test. Findings indicated that F4 (formulation 4) with 1% of EBN extract and 0.03% collagen type II showed the best results and contribute to high bioavailability of collagen (85.61%) when comparing with formulation of EBN extract with C1 (control 1) 0.03% of collagen type II, without EBN and F1 0.03% of collagen type II, EBN 0.025%. Findings indicated that with the increase in the addition of EBN extract caused significant difference ($p < 0.05$) in absorption of total collagen into the body when compare with C1 and F1. Sensory analysis findings revealed EBN collagen drink of F4 with 1% of EBN extract and 0.03% collagen type II is the most preferred among consumers. It caused significant difference ($p < 0.05$) in appearance, color, aroma, taste and overall acceptability for sensory analysis. In summary, nutraceutical drink of formulation 4 of 1% EBN extract and 0.03% collagen type II has high bioavailability of collagen and consumer acceptability.

ABSTRAK

Minuman Nutrasetikal yang dirumus daripada fitokimia atau makanan berfungsi yang mengandungi sebatian bioaktif dan kimia semulajadi menyumbang kepada sifat menggalakkan kesihatan, mencegah penyakit atau terapeutik. Dalam trend semasa, terdapat permintaan yang tinggi untuk produk nutrasetikal dan makanan berfungsi, terutamanya minuman. Formulasi minuman nutrasetikal yang mengandungi ekstrak Edible Bird Nest (EBN) dan kolagen jenis II boleh menyebabkan mencegah penyakit kesihatan tulang kerana ia memberi manfaat yang besar dan meningkatkan kekuatan tulang. Matlamat kajian ini adalah untuk membuat minuman nutrasetikal daripada ekstrak EBN dan kolagen jenis II untuk sifat kesihatan tulang dengan bioavailabiliti tinggi kandungan kolagen. Dalam kajian ini, enam rumusan berbeza telah dijalankan dengan kepekatan berbeza ekstrak EBN (0%, 0.03% 0.025%, 0.050%, 0.075%, 1%) dan dua sampel minuman kolagen telah dibeli untuk penanda aras daripada pasaran seperti Kinohibitsu dan Ecolite. Semua sampel dianalisis untuk analisis bioavailabiliti *in vitro* dan analisis deria menggunakan Ujian Hedonik. Dapatan menunjukkan bahawa F4 (formulasi 4) dengan 1% ekstrak EBN dan 0.03% kolagen jenis II menunjukkan hasil terbaik dan menyumbang kepada bioavailabiliti tinggi kolagen (85.61%) apabila dibandingkan dengan formulasi ekstrak EBN dengan C1 (kawalan 1) 0.03% kolagen jenis II, tanpa EBN dan F1 (formulasi 1) 0.03% daripada kolagen jenis II, EBN 0.025%. Dapatan kajian menunjukkan peningkatan dalam penambahan ekstrak EBN menyebabkan perbezaan ketara ($p < 0.05$) dalam penyerapan jumlah kolagen ke dalam badan jika dibandingkan dengan C1 dan F1. Penemuan analisis deria mendedahkan minuman kolagen EBN F4 dengan 1% ekstrak EBN dan 0.03% kolagen jenis II adalah yang paling disukai di kalangan pengguna. Ia menyebabkan perbezaan ketara ($p < 0.05$) dalam rupa, warna, aroma, rasa dan penerimaan keseluruhan untuk analisis deria. Secara ringkasnya, minuman nutrasetikal F4 dengan 1% ekstrak EBN dan 0.03% kolagen jenis II mempunyai bioavailabiliti tinggi kolagen dan kebolehterimaan pengguna.

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LIST OF SYMBOLS

°C	-	Degree Celcius
%	-	Percentage
-	-	Negative
+	-	Positive
<	-	Less than
>	-	More than
±	-	Plus-Minus
P	-	Probability
hr	-	Hour

Collagen added beverages are the new current trend on the global market now (Bilek & Bayram, 2015). Manufactures and product development scientists have formulated and developed varieties of collagen-based drink products such as cappuccino collagen, soy collagen, cocoa collagen and juice-based collagen (León-López et al., 2020) Adding collagen to develop functional beverages contribute to a good source of benefits. In the composition of human diets, they contribute valuable nutritive fibres and protein sources (Neklyudov, 2003). Collagen synthesis reduces when human age, causing tissues to become thinner, weaker, and less elastic. Adding collagen to develop beverages help consumers maintain healthy body tissue and body structure (King'ori, 2011).

Collagen provides healthy creatine and amino acid in new muscle growth after exercises (Czajka et al., 2018a). Collagen added beverages are beneficial to health and essential in maintaining good health. They help to sustain and improve skin hydration, elasticity, and reduce osteoarthritis pain. Studies have shown that daily consumption of collagen helps in slowing the aging process by making bones denser and less brittle (Czajka et al., 2018a). Collagen added beverages helps reduce wrinkles on the face or skin and increase hair's quantity, scalp coverage, and thickness. Nails grow faster and reduce to break or chip by consuming collagen beverages.

Collagen can be found and obtain from many natural sources. One of the promising collagen source can be found in Edible Bird's Nest (EBN) extract. EBN consumption provides multiple advantages and benefits to human health (Chye et al., 2017a). EBN has been used widely as functional food and therapeutic remedies due to its essential composition and biological activity. It has been applied as an intermediate ingredient for many food products to improve product's the variety, quality, taste, and bioavailability according to consumers need. Based on the previous studies' conducted, many value-added products were created using EBN such as beverages, noodles, chocolates, and ice-creams (Hanisah et al., 2021). EBN consists high percentage of protein and carbohydrates, followed by ash, fat, and minerals. The protein and carbohydrates content in EBN make up 60% and 30% of the overall EBN, respectively. EBN claims to be healthy and has a high nutritional

level of alcohol consumption, smoking, less exercise, as well as aging. This collagen contains all nine essential amino acids including glycine, and its proline concentration is close to twenty times higher than that found in other protein-rich foods that help to enhance this formulation (Sionkowska et al., 2020). Additionally, collagen intake also helps to decrease joint pain, reduce wrinkles, and improve skin with anti-aging properties (Czajka et al., 2018a).

Adding EBN extract to the diet helps to prevent bone diseases such as osteoarthritis (Chua et al., 2013). EBN are rich in protein-containing glycosaminoglycans, including non-sulfated chondroitin glycosaminoglycan that has similar properties to the matrix of cartilage and it helps to promote the collagen content with high bioavailability and absorbed into the body easily. EBN extracts and its beneficial bioactive compounds will be considered an asset for this formulation of a nutraceutical drink in preventing bone diseases. EBN extract enhances collagen content and contribute effectively to the formulation of drinks that are absorbed into the body, and indicate high bioavailability. Therefore, EBN helps to prevent osteoarthritis and regenerate cartilage at the same time (Chua et al., 2013).

Additional functional ingredients are therefore needed in order to create effective functional beverages. Having ordinary diet drinks is good for health and it would be better to consume drinks that have added ingredients with greater value such as EBN extract and collagen type II. Therefore, the consumption of nutraceutical drinks that developed with EBN and collagen type II extract is more nutritious and effective (Bilek & Bayram, 2015).

1.3 Objectives

The objectives of the research are:

1. To formulate a nutraceutical drink containing EBN extract and collagen type II for bone health properties with high bioavailability of collagen content.

2. To investigate the bioavailability of total collagen of formulated EBN collagen drink through *in vitro* study and benchmarking against the collected similar market samples.
3. To evaluate the sensory attributes of the formulated EBN collagen drink through sensory study

1.4 Scope of Objectives

The scopes of the research are:

1. Formulating nutraceutical drink with six different formulation containing EBN extract and collagen type II as active ingredients and rosehip extract, amino acid, ascorbic acid and peach extract as supplemented ingredients. The EBN extract concentration is varies for all the six formulation and EBN extract limits to 1% due to the price from EBN collagen drink in the market.
2. Investigating the bioavailability of total collagen in six different formulation of nutraceutical EBN collagen drink and two samples drink that purchased from market through *in vitro* study. *In vitro* digestion study help to examine the absorption and release of food components under simulated gastrointestinal conditions.
3. Evaluating the sensory attributes of the nutraceutical EBN collagen drink and two sample drink that purchased from market in terms of appearance, colour, aroma, taste and overall acceptability through sensory study. The sensory test is to perform with 20 panellist and to select the most preferred formulations.

1.5 Significant of study

This study is expected to produce a formulation of a nutraceutical drink using EBN extract and collagen type II as its active ingredient for bone health properties with high bioavailability of collagen content. Additional ingredient like rosehip extract, ascorbic acid, amino acid and peach extract create effectiveness to the drink. This formulation is beneficial for many range of consumers especially active people and the elder generation since it also maintain healthy gut and promotes immune function. Bone health problem is a chronic condition that effects millions people in the world. Examples are people with bone infections, osteoporosis, rickets and osteoarthritis. Current drugs are more to reducing pain and symptoms, yet there are side effects. This formulation will increase consumer demand for all natural and non-modified functional ingredient.

Apart from that, this formulation is easy to consume with improve taste and can be market with affordable price for all range of consumers. It also can emergence with variety of EBN based product that will create wider market and consumer will have more choices to choose. Therefore, this study help to produce a formulation that have good and excellent consumer acceptance and palatable. In addition, all the findings from this research will contribute to a good source of healthy beverage to the consumers with bone health problem in the market.

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