

Indomie Noodle Healthy Formulae Instead of the Commercial Formula

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Abstract

This investigation was carried out to evaluate some different seasoning made of onion, garlic, red chili, oregano, marjoram, basil, rosemary, cumin and black pepper to give light and healthy formulae to add to instant indomie noodle. Antioxidants were assessed in raw materials and their formulae, also sensory properties were evaluated in different instant indomie noodle seasoning formulae. The results in raw materials explored that the seasoning contains large amounts of antioxidants content, total carotenoids, volatile oil and antioxidant activity compared with the commercial formula. Corn oil was used as a carrier for the commercial formula and separated three tested spice formulae in ratio 1:100 w/w. Three chosen tested formulas; onion, garlic, red chili 1); oregano, marjoram, basil 2) and rosemary, cumin, black pepper 3) were used in the research. The results indicated that formula 3 has higher antioxidant activity (119.00%) than formula 1 and 2 (83.33% and 62.33%, respectively). Meanwhile, the results from sensory evaluation showed that no significant difference appeared from the different spice formulae. Biological experiment was carried out for these formulae and measured the liver reduced glutathione (GSH), superoxide dismutase (SOD), malonaldehyde (MDA), serum liver enzymes aspartate and alanine aminotransferases and alkaline phosphatase (AST, ALT and ALP), serum total protein, albumin and globulin also, renal function (uric acid, urea and creatinine) in rats fed on basal diet including oil carried the commercial formula or instant indomie noodle tested seasoning formulae. The results illustrated that the different instant indomie noodle seasoning formulae gave better results than the commercial formula in liver and renal functions. It could be recommended that consuming the suggested different seasoning formulae instead of the commercial questioned one as sodium glutamate prevent many harmful effects. It should be done occasionally, especially when the need for indomie noodles arises especially for children. This is because it contains the necessary nutrients as antioxidants and acceptable taste for healthy living in moderate proportion.

Keywords

Indomie Noodles, Seasoning Formulae, Sensory Evaluation, Antioxidant Activity, Male Albino Rats, Liver and Renal Functions

1. Introduction

Herbs and spices contain high levels of antioxidant compounds, which provide protection against harmful free radicals and have been associated with a number of health benefits [1] [2]. Herbs have been used for a large range of purposes including medicine, nutrition, flavorings, beverages, dyeing, repellents, fragrances, cosmetics, charms, smoking, and industrial uses. Since prehistoric times, herbs were the basis for of nearly all medicinal therapy until synthetic drugs were developed in the nineteenth century. Today herbs are still found in 40 percent of prescription drugs [3]. Culinary herbs have been grown and used for hundreds of years, and they are becoming increasingly popular in the United States for their ability to enhance and complement the flavors of a wide variety of foods [4].

Culinary herbs and spices have been long used as preservative agents to extend the shelf-life of food and also to enhance or improve the flavor and organoleptic properties of different types of food due to their sensory properties [5].

Phytochemicals in herbs and spices that are beneficial for human health, polyphenols are an attractive target, due to their antimicrobial, digestive stimulant, anti-inflammatory, antioxidant and anticarcinogenic activities. Also, flavonoids and hydroxycinnamic acids provide free-radical scavenging, modulation of enzymatic activity, metal chelation and inhibition of cellular proliferation. Additionally, polyphenols can extend the shelf-life of lipid-rich foods [6].

Indomie is a brand of instant noodles by Indofood, the world's largest instant noodle manufacturer, located in Indonesia. Indofood is one of the world's largest manufacturers of dried instant noodles based in Indonesia. Theindomie (the name derived from the Indonesian MiGoreng, which means fried noodle) is an instant noodle sold dried in packets or cups. The noodles are quick and easy to make, and can be eaten as a snack or as part of a main meal. Their versatility means that people can carry them to work or on trips, and cook them simply by adding hot water from a kettle [7].

Indomie noodles are consumed in large quantities worldwide. There is a public health concern about the possible mutagenic and genotoxic effects the seasoning might have on the consumers, especially on children of different developmental stages [8].

Indomie noodles is usually prepared for consumption using its seasoning, therefore, the rate at which indomie noodles is consumed is proportional to the rate at which the seasoning is consumed. The major constituents of indomie noodle are wheat flour, vegetable oil, iodized salt, sodium polyphosphate, sodium carbonate, potassium carbonate, guar gum and tartrazine, while that of the

seasoning powder are iodized salt, mono sodium glutamate (MSG, E-621), hydrolyzed vegetable protein, soy powder, garlic powder, chicken flavor and chili powder [9]. The study of the same authors where indomie noodles spiced with the seasoning reduced the activities of alanine aminotransferase, an important antioxidant enzyme.

In the Modern World, the entrance of Chinese, Japanese, and ready to serve foods like 2-minute noodles, soups, sauces, etc., all containing monosodium glutamate (MSG), has tremendously increased especially in younger generation because of its palate pleasing favorite flavor. In the present era, MSG, an inducer of oxidative stress [10].

Indomie noodles contain also, tartrazine a synthetic lemon yellow azo dye primarily used as food coloring agent [11]. Tartrazine was believed to cause most of the allergic and intolerance reaction experienced amongst all the azo dyes, particularly in asthmatic patients and those with aspirin intolerance.

The aim of this investigation was carried out to evaluate some different spices made from onion, garlic, red chili, oregano, marjoram, basil, rosemary, cumin and black pepper to give three light and healthy formulae and it was added to instant indomie noodle. Total polyphenols, total flavonoids, total carotenoids, volatile oil and antioxidant activity were determined in raw materials and their formulae. Sensory properties and biological experimental (liver and renal functions) were evaluated using different formulae.

2. Materials and Methods

2.1. Materials

Powder materials (onion, garlic, chili, basil, oregano, marjoram, rosemary, cumin and black pepper) passed through the sieve 50 mesh was collected from herbs and Spices Company in Obour City, El Kalubia Governorate-Egypt. Preparation of different formulae is showed in **Table 1**.

2.2. Antioxidant Analyses

Total polyphenols, total flavonoids, total carotenoids, volatile oil and DPPH were determined in onion, garlic, red chili, oregano, marjoram, basil, rosemary, cumin black pepper and their formulae.

Table 1. Different instant indomienoodle seasoning formulae.

Formulae	Components	Mixture Ratio
Control	Monosodium glutamate (E-621), artificial chicken flavor powder, yeast extract, onion powder, garlic powder, ginger powder, pepper powder, chili powder, salt	Seasonings commercial powder
Formula 1	Onion:Garlic:Red chili:Salt	2:1:1:0.1
Formula 2	Oregano:Marjoram: Basil:Salt	2:1:1:0.1
Formula 3	Rosemary:Cumin:Black pepper:Salt	2:1:1:0.1

Total polyphenolic contents were measured using Folin-Ciocalteu method described by [12]. Also, total flavonoids content as rutin was determined by [13]. Total carotenoids as β -carotene was determined according to [14]. Ascorbic acid was determined according to the methods of [15]. Volatile oil was determined by International Standard Organization method [16].

The antioxidant activity was determined in different formulae using the 1,1-diphenylpicrylhydrazyl (DPPH) assay described by [17].

2.3. Sensory Evaluation

Sensory evaluation was carried out in order to get consumer response for overall acceptability of the different spices formulae compared to the control commercial spice. Products were evaluated by a panel of 10 judges for different sensory attributes like flavor, taste and overall acceptability according to [18].

2.4. Biological Experiment

Male Albino rats strain (30 animals, 6 rats for each group) weighting 160 - 180 g provided from Animal house in Food Technology Research Institute, Agricultural Research Center, Giza-Egypt. Animals were housed in individual cages with screen bottoms and fed on basal diet for one week. It consisted of casein 15%, corn oil 10%, fiber as cellulose 5%, salt mixture 4%, vitamin mixture 1% and corn starch 65% [19].

One gram from commercial formula or different seasonings formulae included in **Table 1** were taken and added separately to every 100 g of corn oil. The oil was left mixed in dark bottles and dark place for a day then filtered the corn oil to give corn oil as a carrier with commercial formula and three different spices formulae were used to biological experimental.

The experimental animals were randomly assigned into five groups. Group 1 as a normal control group, rats were fed on basal diet towards to the end of experimental period. Meanwhile, groups 2, 3, 4 and 5 rats were fed on the basal diet consisted of casein 15%, separately corn oil as a carrier with commercial formula or different spices formulae 10%, cellulose 5%, salt mixture 4%, vitamin mixture 1% and corn starch 65% for four weeks.

At the end of experimental period (4-weeks), all animals were sacrificed and blood was collected to separate serum for serum parameters. Liver was excised out, washed in saline and preserve in 10% formalin for lipid peroxidation analysis in liver.

In liver, reduced glutathione (GSH) was determined colorimetric method described by [20], superoxide dismutase (SOD) was measured using the method described by [21]. Malonaldehyde (MDA) was analyzed according to the method of [22].

Serum Aspartate aminotransferease (AST) and alanine aminotransferease (ALT) were determined according to [23], while serum alkaline phosphatase (ALP) detected according to [24]. Total protein, albumin and globulin were determined according to [25]. Serum uric acid was determined by the enzymatic

colorimetric method which described by [26]. Urea was determined by using the method of [27]. Creatinine was determined by the method of [28].

2.5. Statistical Analyses

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) for windows, Version 20 (SPSS Inc., Chicago, IL, USA). Collected data was presented as mean \pm standard deviation (SD). Analysis of variance (ANOVA) test was used for determining the significances among different groups according to [29]. All differences were consider significant ($P < 0.05$).

3. Results and Discussion

3.1. Antioxidant Assessment in Raw Materials and Their Different Formulae

Total polyphenols, total flavonoids, total carotenoids, volatile oil and antioxidant activity were determined in raw materials and their formulae and the results are reported in **Table 2** and **Table 3**. Data in **Table 2** shows that the marjoram and oregano were higher contents in polyphenols (22.32 and 20.17 mg/g, respectively) than other condiments. Meanwhile, red chili was the highest content of total flavonoids in (13.02 mg/g) followed by black pepper, rosemary and marjoram (4.20, 3.80 and 2.70 mg/g, respectively). Clearly, black pepper, cumin then red chili were the highest content of total carotenoids (116.23, 76.24 and 61.30 mg/g, respectively). Also, red chili was the best in volatile oil content (2.32 mL/100 g) and then oregano, cumin and black pepper were 1.83, 1.63 and 1.55 mL/100 g, respectively. These results is occurred by [30] who found the herbs contain large amounts of antioxidants other than vitamin C, vitamin E and carotenoids. The antioxidant effect is mainly due to phenolic components, such as flavonoids, phenolic acids, and phenolic diterpenes. Herbs have been investigated for their quenching activity of reactive oxygen species.

Table 2. Antioxidants content and its activities in different seasoning (mg/g).

Raw Materials	Total Polyphenols	Total Flavonoids	Total Carotenoids	Volatile Oil (mL/100 g)	Antioxidant Activity (%)
Onion	7.23 \pm 0.84*	1.82 \pm 0.13	0.73 \pm 0.12	0.23 \pm 0.03	52.00 \pm 3.22
Garlic	3.24 \pm 0.33	0.90 \pm 0.11	1.20 \pm 0.25	0.09 \pm 0.01	48.00 \pm 2.46
Red chili	4.15 \pm 0.25	13.02 \pm 0.73	61.30 \pm 0.08	2.32 \pm 0.18	88.00 \pm 5.42
Oregano	20.17 \pm 1.32	1.54 \pm 0.12	16.35 \pm 1.75	1.83 \pm 0.67	48.00 \pm 8.30
Basil	4.82 \pm 0.22	1.25 \pm 0.18	6.42 \pm 1.34	1.30 \pm 0.43	62.00 \pm 7.55
Marjoram	22.32 \pm 1.87	2.70 \pm 0.26	13.00 \pm 2.02	0.8 \pm 0.20	21.00 \pm 3.22
Rosemary	12.04 \pm 8.23	3.80 \pm 0.84	3.0 \pm 0.21	1.13 \pm 0.11	35.32 \pm 0.04
Cumin	10.30 \pm 0.65	1.00 \pm 0.03	76.24 \pm 2.45	1.63 \pm 0.43	82.00 \pm 8.43
Black pepper	2.21 \pm 0.05	4.20 \pm 0.54	116.23 \pm 0.10	1.55 \pm 0.32	110.00 \pm 9.82

*Values are means of triplicates \pm Standard deviation.

Table 3. Antioxidants content in different dry seasoning formulae.

Formulae	Total Phenols (mg/g)	Total Flavonoids (mg/g)	Total Carotenoids (mg/g)	Volatile Oil (mL/100 g)	Antioxidant Activity %
Formula 1	13.80 ± 1.18*	6.42 ± 0.84	64.25 ± 2.43	1.12 ± 0.10	83.33 ± 6.73
Formula 2	23.47 ± 2.69	1.39 ± 0.23	51.24 ± 5.32	1.98 ± 0.16	62.33 ± 8.02
Formula 3	37.39 ± 4.13	2.26 ± 0.40	195.60 ± 11.46	2.03 ± 0.24	119.0 ± 11.43

*Values are means of triplicates ± Standard deviation.

According to formulae in **Table 1**, results in **Table 3** illustrate formula 3 contained rosemary, cumin and black pepper mixture was rich in total polyphenols (7.39 mg/g), total carotenoids (195.60 mg/g) and volatile oil (2.03 mL/100 g), while formula 1 had contained onion, garlic and red chili mixture was the highest content of total flavonoids (6.42 mg/g). The antioxidant contents reflected to DPPH activity, results indicated that formula 3 was higher antioxidant activity (119.00 %) than formulae 1 and 2 were 83.33 and 62.33%, respectively.

The hydroxyl radical is an extremely reactive free radical formed in biological system and has been implicated as a highly damaging species in free radical pathology capable of damaging almost every molecule found in living cells. This species is considered to be one of the quick initiators of the lipid peroxidation process, abstracting hydrogen atoms from unsaturated fatty acids [31].

3.2. Sensory Evaluation in Different Formulae

Sensory properties were evaluated in instant noodle seasoning formulae and the results are reported in **Table 4**. From the resultant it could be noticed that the commercial formula was the lowest in taste, flavor and total acceptability (8.42, 8.50 and 8.30, respectively). Meanwhile, the results showed that no significant differences were the different spice formulae. These means the raw materials spice had rich contained polyphenols, flavonoids compounds, total carotenoids and volatile oil.

Herbs and spices are not just valuable in adding flavor to foods. Their antioxidant activity also helps to preserve foods from oxidative deterioration, increasing their shelf-life. There has been increasing research in the role of herbs and spices as natural preservatives. Antioxidants, also play a role in the body's defense against cardiovascular disease, certain (epithelial) cancers and other conditions such as arthritis and asthma. Phenolic compounds such as flavonoids may help to protect against cardiovascular disease and intestinal cancer (black pepper, oregano, thyme and marjoram). Capsaicin in chili pepper is an effective counter-irritant used in both pharmaceuticals and cosmetics [32].

Herbs are generally composed of fiber, carbohydrate, fat, sugar, protein, gum, ash, antioxidant, volatile (essential) oil, and other nonvolatile components. All of these components impart each spice's particular flavor, color, nutritional, health, or preservative effects. The flavor components (volatile and nonvolatile) are protected within a matrix of carbohydrate, protein, fiber, and other cell

Table 4. Sensory evaluation of commercial formula and instant noodle seasoning formulae.

Formulae	Taste	Flavor	Overall Acceptability
Commercial formula	8.42 ± 0.34 ^b	8.50 ± 0.63 ^b	8.30 ± 0.44 ^b
Formula 1	9.35 ± 0.42 ^a	9.43 ± 0.50 ^a	9.46 ± 0.66 ^a
Formula 2	9.76 ± 0.63 ^a	9.61 ± 0.73 ^a	9.38 ± 0.63 ^a
Formula 3	9.55 ± 0.52 ^a	9.52 ± 0.65 ^a	9.47 ± 0.59 ^a

Data are presented as mean (n = 10 panelist) ± standard deviation, values with different superscripts within the column are significantly difference at P < 0.05, while those with have similar or partially are not significant.

components. When the herbs is ground, cut, or crushed, this cell matrix breaks down and releases the volatile components [33].

3.3. Biological Experimental

3.3.1. Effect of Instant Noodle Seasoning Formulae on Liver GSH, SOD and MDA Parameters

Rats fed on diet containing seasoning formula 2 appeared to the highest increase significant in liver GSH (310.55 mg/g) then rats fed on diet containing formula 1 and 3 were 282.52 and 275.67 mg/g, respectively compared to rats fed on diet containing commercial formula (188.73 mg/g) . While, data indicated no significant variance between rats fed on diet containing formula 2 and normal rats fed on basal diet in normal control group (Table 5).

In parallel, liver SOD level in rats fed on diet contained formula 2 was the highest increase significant (715.00 µg/g) then rats fed on diet contained formula 1 then formula 3 (693.40 and 688.44 µg/g, respectively) compared to rats fed on diet containing commercial mixture and normal control group.

In the same table, diet containing formulae 2 and 3 were significant decreased in rat's serum MDA level (8.99 and 9.32 nmol/g, respectively) then formula 1 (10.54 nmol/g). While, no significant variances were observed in rats fed on formulae 2 and 3 which compared to serum MDA in rats fed on basal diet (8.02 nmol/g). Data indicated that the antioxidants content in seasoning formulae improve liver GSH, SOD and MDA levels.

These data complied to [34] they showed that, superoxide dismutase (SOD), catalase (CAT) and the enzyme of the glutathione redox cycle *i.e.* glutathione peroxidase (GSH-Px) and glutathione reductase (GSH-Rd) are the primary intracellular antioxidants and are considered to be preventive or primary, antioxidant as they prevent free radical chain reaction by decreasing the available concentration of free radical to initiate the process.

3.3.2. Effect of Various Instant Noodle Seasoning Formulae on Serum AST, ALT and ALP Parameters

Table 6 shows the effects of instant noodles seasoning formulae on liver function indices of rats. Feeding with the various seasoning formulated diets significantly reduced the activity of alanine transaminase (ALT) compared to control. The activity of aspartate transaminase (AST) was significantly reduced

Table 5. Effect of instant noodle seasoning formulae on liver GSH, SOD and MDA parameters.

Groups	GSH mg/g	SOD μ /g	MDA nmol/g
Basal Diet	290.54 \pm 18.54 ^{ab}	600.52 \pm 32.43 ^c	8.02 \pm 1.30 ^c
Commercial	188.73 \pm 12.74 ^c	470.63 \pm 27.42 ^d	14.20 \pm 1.98 ^a
Formula 1	282.52 \pm 16.40 ^b	693.40 \pm 35.55 ^{ab}	10.54 \pm 1.62 ^b
Formula 2	310.55 \pm 20.22 ^a	715.00 \pm 38.90 ^a	8.99 \pm 1.54 ^c
Formula 3	275.67 \pm 18.47 ^b	688.44 \pm 33.65 ^b	9.32 \pm 1.89 ^c

Data are presented as mean (n = 6 rats) \pm standard deviation, values with different superscripts within the column are significantly difference at P < 0.05, while those with have similar or partially are not significant.

Table 6. Effect of various instant noodle seasoning formulae on serum AST, ALT and ALP parameters (IU/L).

Groups	sAST	sALT	sALP
Basal diet	51.04 \pm 5.54 ^b	30.00 \pm 3.73 ^b	172.05 \pm 2.54 ^b
Commercial formula	72.33 \pm 3.88 ^a	40.04 \pm 5.44 ^a	225.00 \pm 5.50 ^a
Formula 1	34.72 \pm 4.22 ^c	23.50 \pm 4.52 ^c	168.51 \pm 6.60 ^b
Formula 2	35.54 \pm 4.10 ^c	25.00 \pm 5.55 ^c	165.70 \pm 8.44 ^b
Formula 3	23.88 \pm 6.36 ^d	18.98 \pm 8.43 ^d	170.32 \pm 4.62 ^b

Data are presented as mean (n = 6 rats) \pm standard deviation, values with different superscripts within the column are significantly difference at P < 0.05, while those with have similar or partially are not significant.

in the groups 3 instant noodles seasoning formula and increased significantly in the group fed commercial formula to control. While, rats fed on different seasoning formulae were significant decrease in sALP (168.51, 164.70 and 170.32 IU/L, respectively) compared to rats fed on diet containing commercial formula (225.00 IU/L). Also, Data indicates no significant variance between seasoning formula groups.

The above may be due to the activity of ALT and AST in the serum are markers of liver injury [35]. Changes in the activities of these enzymes indicate injury to organelles such as mitochondria leading to release of soluble enzymes like AST [36].

3.3.3. Effect of Various Instant Noodle Seasoning Formulae on Total Protein, Albumin and Globulin

Concentrations of albumin, bilirubin and total protein in the blood can indicate the functional state of the liver [37]. Albumin in conjunction with other plasma proteins exerts a colloidal osmotic pressure which serves to maintain a normal blood volume. Thus, the decrease in serum albumin and protein concentration might be due to a diminished synthetic function of the liver [38].

Results in **Table 7** refer to serum total protein, albumin and globulin contents in rats fed on different formula compared to rats fed on commercial formula or basil diet. The results show a significant decrease in total protein (4.35, 4.66, 4.43 and 5.92 g/dL, respectively) and albumin (3.20, 3.12, 3.25 and 3.99 g/dL,

Table 7. Effect of various instant noodle spices formulas on serum total protein, albumin and globulin (g/dL).

Groups	Total Protein	Albumin	Globulin
Basal diet	5.11 ± 0.98 ^{ab}	3.58 ± 0.52 ^{ab}	2.60 ± 0.44 ^{ab}
Commercial formula	5.92 ± 0.27 ^b	3.99 ± 0.12 ^b	1.98 ± 0.10 ^b
Formula 1	4.35 ± 0.66 ^a	3.20 ± 0.42 ^a	2.67 ± 0.27 ^a
Formula 2	4.66 ± 0.76 ^a	3.12 ± 0.50 ^a	2.67 ± 0.26 ^a
Formula 3	4.43 ± 0.55 ^a	3.25 ± 0.33 ^a	2.71 ± 0.23 ^a

Data are presented as mean (n = 6 rats) ± standard deviation, values with different superscripts within the column are significantly difference at P < 0.05, while those with have similar or partially are not significant.

Table 8. Effect of various instant noodle seasoning formulae on renal functions parameters (mg/dL).

Groups	Uric acid	Urea	Creatinine
Basal diet	3.23 ± 0.52 ^b	39.43 ± 2.43 ^b	0.68 ± 0.12 ^b
Commercial formula	3.90 ± 0.98 ^a	50.56 ± 5.42 ^a	1.02 ± 0.23 ^a
Formula 1	1.89 ± 0.31 ^c	31.66 ± 7.30 ^{bc}	0.62 ± 0.08 ^b
Formula 2	2.00 ± 0.55 ^c	29.80 ± 6.66 ^c	0.60 ± 0.09 ^b
Formula 3	1.95 ± 0.20 ^c	29.14 ± 6.05 ^c	0.58 ± 0.08 ^b

Data are presented as mean (n = 6 rats) ± standard deviation, values with different superscripts within the column are significantly difference at P < 0.05, while those with have similar or partially are not significant.

respectively) in rats fed on seasoning formulae compared to commercial formula, respectively. In contrast, there was an increase in globulin in rats fed on seasoning formula compared with commercial formula (2.67, 2.67, 2.71 and 1.98 g/dL), respectively.

3.3.4. Effect of Various Instant Noodle Seasoning Formulae on Renal Functions Parameters

Urea, the major product of protein catabolism measuring urea is the most popular laboratory procedure for assessing renal function [39]. Creatinine is a catabolic product of creatine phosphate, which is used in skeletal muscle concentration [40]. In the skeletal muscle serum creatinine levels are elevated by renal disease and dehydration.

Data in **Table 8** indicate that the effects of different instant noodles seasoning formulae on the concentration of serum uric acid, urea and creatinine of rats. No significant variance between seasoning formulae 1, 2 and 3 (1.89, 2.00 and 1.95 mg/dL, respectively), while the level of uric acid was significant decrease in rats group fed on seasoning formulae compared with rats fed on basal diet or commercial formula (3.23 and 3.90 mg/dL, respectively). In the same trend, urea level in serum was significant decrease in rats groups fed on seasoning formula compared to basal diet and commercial formula. On the other view, serum creatinine was not significant concentrate between rats fed on seasoning formulae 1,

2 and 3 to basal diet group (0.62, 0.60, 0.58 and 0.68 mg/dL, respectively), but rats fed on seasoning formula and basal diet group were significant decrease in serum creatinine concentrate compared to commercial formula group (1.02 mg/dL).

4. Conclusion and Recommendations

From the obvious results it is clear that onion, garlic, red chili, oregano, marjoram, basil, rosemary, cumin black pepper and their mixture formulae had highly amounts in natural antioxidants as polyphenolic and flavonoid compounds. Whereas, the biological experiment gave the best results using different formulas, showing healthy and acceptable taste for consumers avoiding the harmful additives of commercial formula.

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