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Development of Functional Indomie Seasoning Mixtures from Natural Food Sources

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ABSTRACT

In view of the serious damage that has appeared recently as a result of the consumption of artificial flavorings, this research aims to development of functional indomie seasoning mixtures using cauliflower (formula 1), basaria fish (formula 2) and tomato (formula 3) powders. It was clear from the results of the analysis of these mixtures that the moisture, protein, ether extract and ash increased in formulas 1, 2 and 3, compared to control against a decrease in available carbohydrate. The formula (2) recorded the highest value in the protein, ether extract and ash contents while formula (1) recorded the highest value of fiber. All minerals except sodium increased in natural formulas compared to control. The antioxidant activity increased from 66.52 in control seasoning to 90.61, 83.94 and 98.11% in formulas (1, 2 and 3, respectively). The essential amino acids (EAA) gave values in natural formulas higher than those of control. Formula (2) gave higher values of TEAA (36.81%) than FAO/WHO. The proportion of lysine in formula (2) was twice as high as that in FAO. The formula (1) recorded the highest value of TEAA/TNEAA ratio (0.93). Finally, the sensory evaluation recorded the best results for taste and flavor in formula (3) while formulas (2 and3) recorded the best results in odor and over all acceptability.

***Keywords*:** Seasonings, Indomie, Cauliflower powder, Basaria fish powder, Tomato powder

INTRODUCTION

The population's eating habits suffered major change as a result of globalisation and the development of new technologies, which has led to the gradual introduction of foods contaminated with chemical additives into daily life in recent decades (Moura *et al*., 2016). The flavourings, also known as micro ingredients, are among these ingredients and serve as essential for the food operations since they give processed meals particular sensory qualities of taste and smell (Marques *et al*., 2015). Flavouring micro components are standardised and made accessible for use globally by international food safety organisations including the Food and Agriculture Organisation (FAO/WHO) and the Flavour and Extract Manufacturers Association (FEMA). The Acceptable Daily Intake (ADI) and the tolerated dose limit of flavourings for each food type have not yet been established by any of these regulatory authorities, and none of them describe in detail which chemicals and amounts are present in these substances (Sales *et al*., 2017). In many processed food and beverage items in the US, flavor additives are a fundamental and contentious ingredient. According to the FDA, anything that is intended to add flavour but is not made from a spice, fruit or fruit juice, vegetable or vegetable juice, edible yeast, herb, bark, bud, root, leaf, or other similar plant material, meat, fish, poultry, eggs, dairy products, or their fermentation is considered to be artificial flavour. After prolonged exposure in the body, flavoring agents have severe negative effects, including the formation of tumors (Murley and Chambers, 2019). Monosodium L-glutamate (MSG), which is made up of 78% glutamic acid, 22% sodium salt, and water, is a common glutamic acid salt. The most common food additive, MSG, has been added to food as a flavour enhancer since 1907.As a result, the majority of fast food and canned items contain varying levels of MSG (Helal *et al*., 2017). Monosodium glutamate can cause symptoms like headaches, dizziness, perspiration, numbness, and irritability. Asthma, urticaria, atopic dermatitis, arrhythmias, neuropathy, and abdominal discomfort are just a few of the problems that MSG may cause or make worse (Tawfik and Al-Badr, 2012). Because it influences the pituitary-adrenal axis in the hypothalamus nucleus of animals, monosodium glutamate at excessive dosages is neurotoxic. Furthermore, consuming too much MSG can harm kidneys and liver (Helal *et al*., 2019).

Sand smelt fish (*Atherina boyeri*) is a common species in the Mediterranean Sea and has shown distribution from northeast Atlantic to northwest coast of Scotland. The abundance of essential amino acids and high-quality, easily digestible protein found in fish is well known. Additionally, they have high levels of unsaturated fatty acids, notably omega-3 fatty acids, which are known to prevent oxidation, and low levels of saturated fatty acids (Prato and Biandolino, 2012). It is widely established that fish is an excellent source of oil-soluble vitamins. The minerals fluorine and iodine, in particular, which are necessary for the development of healthy teeth and the prevention of goitre in men, are also abundant in fish and are a good source of these nutrients. (El-Lahamy *et al*., 2018).

Cauliflower (*Brassica oleracea L.*) as one of the most-consumed vegetables recently has become popular due to its high nutritional value (Amin, 2020). The main constituent in cauliflower is water, and it contains little in its composition of proteins, carbohydrates, and lipids. Although it only contains a limited quantity of other B group vitamins and minerals, particularly potassium and phosphorus, it is regarded as an

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excellent source of dietary fibre, vitamin B6, folic acid, and vitamin B5. With its bioactive components, glucosinolates and indole-3-carbinol, cauliflower has significant phytochemicals that have been shown to offer significant protection against diabetes, cancer, and cardiovascular disease (Sharma and Prasad, 2018).

Tomatoes (*Solanum lycopersicum*) are an excellent source of minerals and phytochemicals, including lycopene, vitamin C, potassium, folate, and iron. (Collins *et al*., 2022). In addition, tomatoes produce phenolic chemicals, flavonoids, pigments (including lycopene and beta-carotene), phytoalexins, protease inhibitors, and glycoalkaloids. The metabolites have been demonstrated to have positive impacts on animal and human health, as well as protecting the plant from harmful phytopathogenic fungus, bacteria, viruses, and insects (Elbadrawy and Sello, 2016; Friedman *et al*., 2021).

Instant noodles are sold under the name Indomie by Indofood. Based in Indonesia, Indofood is one of the biggest producers of dried instant noodles worldwide. The expression "indomie" refers to a dry instant noodle that is available in packets or cups and is derived from the Indonesian word "migoreng," which means "fried noodle." The noodles can be consumed as a snack or as a major course and are quick and simple to prepare. Due to their portability, people may take them with them on travels or to the office, and all it takes to prepare them is the addition of hot water from a kettle (Ejembi *et al*., 2014). Worldwide, there is a high consumption of indomie noodles. Public health authorities are worried about the seasoning's potential mutagenic and genotoxic effects on people, particularly on youngsters at various developmental stages. Since seasoning is typically used to produce indomie noodles, the rate at which indomie noodles are consumed is directly related to the rate at which seasoning is consumed (Alabi, 2014). Therefore, the purpose of this study is to develop healthy indomie utilising natural flavourings alternatively to hazardous to health mono sodium glutamate, such as tomato powder, basaria fish powder, and cauliflower powder.

MATERIAL AND METHODS

Materials:

Iodized salt(salt), powdered of onion, garlic, chili, cumin, black pepper and ginger was collected from herbs and Spices Company in Tanta City, El Gharbia Governorate-Egypt. Commercial indomie seasoning, basaria fish (*Atherina hepsetus*), tomato (*Solanum lycopersicum*) and cauliflower (*Brassica oleracea L var.botrytis*) were obtained from local market in Tanta City, El Gharbia Governorate-Egypt.

Methods:

Preparation of materials:

Iodized salt, powdered of onion, garlic, chili, cumin, black pepper and ginger were sieved to pass through a sieve 50 mesh. Cauliflower, basaria fish and tomatoes were washed many times with water, cauliflower and tomato chopped into small pieces. Cauliflower, basaria fish and tomatoes were laid out on trays in the air-drying oven at 40±5ºC then ground and sieved to pass through a sieve 50 mesh to prepare the mixtures.

Preparation of different indomie seasonings formulae:

Table A. Preparation of different indomie noodle seasoning formulae

Blends	Components	Ratios (%)
Commercial formula	Monosodium glutamate (E-621), artificial chicken flavor powder, yeast extract, onion powder, garlic powder, cumin, ginger powder, pepper powder, chili powder, salt	commercial seasoning powder
Formula(1)	Cauliflower powder, onion powder, garlic powder, cumin, ginger powder, pepper powder, chili powder, salt	3:1:1:0.1:1:1:1:0.1
Formula(2)	Basaria fish powder, onion powder, garlic powder, cumin, ginger powder, pepper powder, chili powder, salt	3:1:1:0.1:1:1:1:0.1
Formula(3)	Tomato powder, onion powder, garlic powder, cumin, ginger powder, pepper powder, chili powder, salt	3:1:1:0.1:1:1:1:0.1

Analytical methods:

Chemical composition of seasoning mixtures:

Moisture, protein, ether extract, ash and crude fiber contents were evaluated according to **AOAC (2010)** and available carbohydrate were calculated by difference. The total energy value was determined based on the carbohydrate, protein, and lipid contents multiplied by a factor of 4, 4, and 9 respectively, and then added the results together according to (Sharoba *et al*., 2013).

Minerals of seasoning mixtures:

Ashing samples were digested by concentrated nitric acid. Minerals content (Ca, Mn, Na, K, Zn, P and Fe) were measured as described in the AOAC (2010) using atomic absorption spectrophotometer (Perkin Elemr Model 4100 ZL).

Antioxidant activity of seasoning mixtures (DPPH Radical Scavenging)

2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity was measured following the method of Nanjo *et al*., (1996). Methanol extracts with varying concentrations were taken in different test tubes, and the volume was made up to ml. DPPH was added to each test tubes and the contents were incubated for min. The absorbance of the solution was read at 517 nm. The radical scavenging activity was calculated as follow.

Inhibition % (DPPH) = (A blank – A sample/ A blank) x100

Where:

A blank = the absorbance of the control reaction (containing all reagents except the test compound).

A sample = the absorbance of the test compound.

Amino acid profile of seasoning mixtures:

According to Block *et al*. (1958), acid hydrolysis was used to assess the amino acid content. Making use of (a Beckman Model 119 CL amino acid analyser). In a sealed tube at 110°C for 24 hours, the dried, ground material (100 mg) was hydrolyzed with 10 ml of 6N hydrochloric acid and 0.1% mercaptoethanol. The hydrolyzed samples were filtered through Whatman No. 1 filter paper after cooling at room temperature, and the filtrate was diluted with distilled water to 25 ml in a volumetric flask. A vacuum desiccator was used to dry 5 ml of the diluted filtrate while potassium hydroxide was

present. The resulting dried residue was dissolved in 1 ml of sodium citrate buffer (pH 2.2) and kept at 4 °C pending amino acid analyzer examination.

Sensory Evaluation of seasoning mixtures:

Consumer perception of the overall acceptability of the various spice formulations in comparison to the commercial spice used as the control was obtained through sensory evaluation. After boiling the Indomie noodles and adding the seasoning mixtures, the products were assessed by a panel of 10 members from the Food Science and Technology Department, Faculty of Home Economics, Al-Azhar University, Tanta, Egypt for various Sensory characteristics such astaste, odour, flavor and overall acceptability, according to Sales *et al*. (2017).

Statistical analyses

The findings were statistically evaluated using SPSS's analysis of variances (Coakes, 1997) Duncan's multiple range tests were used to examine differences between individual means that were statistically significant (Duncan, 1995).

RESULTS AND DISCUSSION

Chemical composition of seasoning mixtures

The chemical composition of different dry seasonings formulae control and their containing cauliflower powder Formula (1), containing basaria fish powder Formula (2) and containing tomato powder Formula (3) observed in Table (1). The results indicated that there were no significant differences ($p<0.05$) between the natural mixtures and some of them in moisture content compared to the control. As for the protein and ether extract contents, it was observed that there were no significant differences between the mixture containing cauliflower powder (0.71 and 4.50%, respectively) and the mixture containing tomato powder (0.60 and 4.99%, respectively). The mixture containing fish powder recorded the highest protein content (2.58%), this may be attributed to the fact that fishes are good source of pure protein. Furthermore, the investigated fish sample studies here belonged to high protein (15 -20) fish group according to the classification of (Silva and Santos, 2008). On the other hand, the commercial formula recorded the lowest protein and ether extract contents (0.18 and 2.91%, respectively).

It was noted from the same table that there were significant differences ($p<0.05$) in the ash content of all mixtures, where the mixture containing fish powder gave the highest value (4.590%), while the commercial formula recorded the lowest value (1.302%). The crude fiber recorded the highest value in formula containing Cauliflower powder (5.585%) while the formula containing Basaria fish powder gave the lowest value (2.991%), these results are similar to Xia *et al.* (2015) who concluded that Cauliflower is an outstanding supplier of fibre, which is crucial for those who have high cholesterol and for aiding in colon cleansing (Zhao *et al*., 2007). Despite the low carbohydrate content in the mixture containing Basaria fish powder (75.43)it gave the highest energy values (370.05,).It is may be due to the high content of fat in basaria fish compared to other sources.

Table 1. Proximate chemical composition of different indomie seasoning formulae

Characteristics	Formula			
	Commercial formula	Formula (1)	Formula (2)	Formula (3)
Moisture (%)	5.961±0.19^{b}	8.810±0.98^{a}	7.959±0.88^{a}	8.971±0.73^{a}
Crude protein (%)	0.188±0.15^{c}	0.714±0.11^{b}	2.589±0.16^{a}	0.607±0.35^{b}
Ether extract (%)	2.912±0.82^{c}	4.502±0.12^{b}	6.443±0.43^{a}	4.992±0.17^{b}
Crude ash (%)	1.302±0.12^{d}	2.612±0.12^{c}	4.590±0.12^{a}	2.980±0.22^{b}
Crude fiber (%)	4.626±0.87^{ab}	5.585±0.11^{a}	2.991±0.53^{c}	4.485±0.08^{b}
Available carbohydrates (%)	85.011±0.32^{a}	77.777±0.12^{b}	75.428±0.25^{c}	77.965±0.12^{b}
Energy (Kcal/100g)	367.004±0.17^{b}	354.482±0.12^{d}	370.055±0.20^{a}	359.216±0.33^{c}

Each value is expressed as mean of triplicates ± standard deviations, Different letters in the same row means significantly differences ($p<0.05$). (1)=containing Cauliflower powder, (2) = containing Basaria fish powder and (3) = containing tomato powder

Minerals of seasoning mixtures

The body's metabolism and equilibrium depend on minerals for a variety of functions, and a lack of these bioactive components can lead to an abundance of common diseases and disease symptoms (Onyema *et al*., 2014).

Minerals including Ca, K, Mn, Fe, Zn, P and Na of commercial formula (control) and natural formulas (1, 2 and 3) seasoning mixtures were determined in Table (2). The results revealed that Ca value was higher in the natural mixtures (29.85, 37.86 and 27.86 mg/100g in formula (1), (2) and (3), respectively) than commercial mixture (25.37 mg/100g)). Ca plays an important functionas it aids blood clotting and muscle contraction (Abulude *et al*.,2006). K and P were the most abundant elements in all mixtures. The mixture containing basaria fish powder (Formula,2) gave the highest content of K and P (48.826 and 88.042 mg/100 g). According to Adrogue and Madias (2007) and Sadawarte *et al*. (2018) , the body needs a lot of K Because of it serves as an essential electrolyte in the neurological system and P is a part of nucleic acids, which are crucial for the cellular metabolism of other nutrients like carbohydrates and fats.

Table 2. Minerals composition of different indomie seasoning formulae (mg/100g)

Minerals	Formula			
	(control)	Formula (1)	Formula (2)	Formula (3)
Ca	25.379	29.853	37.865	27.86
K	39.955	45.827	48.826	46.365
Mn	1.232	5.802	4.260	6.019
Fe	19.366	28.928	31.633	29.17
Zn	12.938	16.926	19.722	15.681
P	75.195	87.350	88.042	85.567
Na	36.098	34.165	26.076	24.971

Where: Ca = calcium, K= Potassium, Mn= manganese, Fe= iron, Zn= zinc, P= phosphors and Na= sodium, (1)=containing Cauliflower powder, (2)= containing Basaria fish powder and (3)= containing tomato powder

Manganese (Mn) reached to the most value in mixture containing tomato powder (6.019 mg/100g), while Fe and Zn reached to the most value in mixture containing basaria fish powder (31.63 and 19.72 mg/100g, respectively). According to Sousa *et al*. (2019) Micro minerals (Fe, Mn, and Zn) are essential for the structural portion of enzymes, the development of erythrocyte cells, the control of blood glucose levels, the activation of antioxidant enzymes, and maybe other immune system functions. Na decreased in natural mixture

from 36.09 mg/100g to 24.97 mg/100g in mixture containing tomato powder.

Antioxidant activity of seasoning mixtures

Antioxidant activity is of great importance in the packaged food industry as it resists degenerative diseases, decreases the threat of heart, and increases the products' life by impeding or retarding oxidation reactions (Phukan *et al*., 2023). From Fig. (1) It was noted that, the mixtures containing natural flavors had antioxidant activity higher than the control mixture (66.52, %).

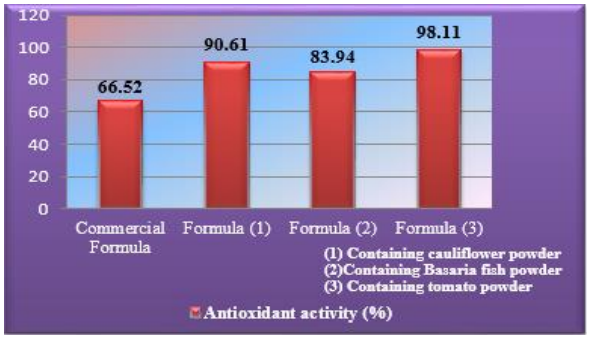

Fig. 1. Antioxidant activity (%) of different indomie seasoning formulae

The data observed that the mixture containing tomato powder gave the highest antioxidant activity (98.11 %) followed by the mixture containing Cauliflower powder (90.61, %), then the mixture containing Basaria fish powder (83.94, %). When the weather is unsuitable for the eating of fresh tomatoes, tomato powder which is high in antioxidants is advised for use in people's diets. (Selimovic *et al*., 2023)

Amino acids composition of dry seasoning formulae:

From data presented in Table (3), it can be seen the essential and non-essential amino acids of commercial and natural indomie seasoning formulas. Formulas containing Cauliflower, basaria fish and tomato powders recoded the highest value compared to control. Formula (2) which containing basaria fish powder showed higher values of essential amino acids compared to the rest of the mixtures.

Compared to FAO/WHO (2007) for school children the methionine, leucine, isoleucine, lysine, phenylalanine, therionine, histidine and valine represented higher values in the mixture containing basaria fish powder which reached 3.16, 5.77, 3.63, 8.75, 3.66, 3.96, 4.37 and 3.78 %, respectively. The proportion of lysine in fish mixture was twice as high as that in FAO. Lysine is essential for the body's creation of hormones, enzymes, and antibodies as well as for the body to absorb calcium, create muscle protein, recuperate from surgery or sports injuries, and build hormones (Daiel, Cécile, 2007). The total essential amino acid (TEAA) in all mixtures gave values higher than control.

Table 3. Amino acids profile (g/100g protein) of different indomie seasoning formulae

Amino acids	Formulas				FAO/WHO (2007)	
	(control)	Formula (1)	Formula (2)	Formula (3)	School children	Adult
			Essential Amino Acids (EAA)			
Methionine	0.70	1.49	3.16	1.68	2.30	1.60
Leucine	0.89	1.50	5.77	2.34	6.00	5.90
Isoleucine	0.77	1.39	3.63	1.92	3.00	3.00
Lysine	0.90	1.47	8.75	2.07	4.80	4.50
Phenylalanine	0.79	1.29	3.66	1.59	4.10	3.80
Theronine	0.80	1.52	3.96	1.70	2.50	2.30
Histidine	0.95	1.58	4.37	1.87	1.60	1.50
Valine	0.81	1.41	3.78	1.96	2.90	3.90
TEAA	6.61	11.65	36.81	15.13	27.20	26.50
			Non-Essential Amino Acids (NEAA)			
Glutamic acid	1.66	2.79	13.75	9.25	-	-
Aspartic acid	0.72	1.59	10.03	2.79	-	-
Arginine	0.93	1.40	5.71	2.50	-	-
Tyrosine	0.80	1.35	3.60	1.65	-	-
Alanine	1.59	0.99	4.96	2.56	-	-
Glycine	0.84	1.70	3.51	2.30	-	-
Serine	0.76	1.38	4.49	1.59	-	-
Proline	0.83	1.23	4.86	2.01	-	-
TNEAA	8.13	12.43	50.91	24.65	-	-
TAA	14.74	24.08	87.72	39.78	-	-
E/N ratio	0.813	0.937	0.723	0.614	-	-

Where: (1)=containing Cauliflower powder, (2)= containing Basaria fish powder and (3)= containing tomato powder, TEAA= total essential amino acid, TNEAA= total non-essential amino acid, E/N= essential amino acid/ total non-essential amino acid Similarly, in non-essential amino acids, the formulas containing natural powders 1, 2 and 3 recorded higher values (12.43, 50.91 and 24.65%, respectively) than the control (8.13%). The mixture containing cauliflower powder (formula, 1) gave the highest value of E/N ratio (0.937).

Sensory Evaluation of seasoning mixtures

Table (4) observed the sensory evaluation of natural indomie seasoning mixtures with Cauliflower powder (formula, 1), Basaria fish powder (formula, 2) and Tomato powder (formula, 3) compared to commercial indomie seasoning powder (control).

It is clear from the obtained results that the natural mixtures gave higher values for all sensory evaluation factors taste, odor, flavor and Overall acceptability compared to the commercial formula (7.36, 6.87, 7.00 and 7.08, respectively) with significant differences ($P < 0.05$). The mixture containing tomato powder (formula, 3) gave the highest value for all sensory evaluation indicators, taste, odor, flavor and Overall acceptability. (8.75, 8.12, 9.00 and 8.62, respectively). There were no significant differences ($P < 0.05$), between formula (1) and formula(2) in taste parameter (8.28 and 7.62, respectively).

From the same Table it is clear that there are no significant differences in flavor and Overall acceptability between the mixtures containing cauliflower powder (formula, 1) and the mixture containing tomato powder (formula, 3).

Table 4. Sensory evaluation of different indomie seasoning formulae

Formula	Characteristics			
	Taste (10)	Odour (10)	Flavour (10)	Overall acceptability(10)
(control)	7.36±0.30^{b}	6.87±0.99^{b}	7.00±0.93^{c}	7.08±0.77^{b}
Formula (1)	8.28±0.75^{ab}	8.28±0.55^{a}	8.42±0.53^{ab}	8.33±0.61^{a}
Formula (2)	7.62±0.18^{ab}	7.87±0.35^{ab}	7.87±0.12^{b}	7.79±0.11^{ab}
Formula (3)	8.75±0.88^{a}	8.12±0.24^{a}	9.00±0.75^{a}	8.62±0.88^{a}

Each value is expressed as mean ± standard deviations n=10, Different letters in the same column means significantly differences (p<0.05)., (1)=containing Cauliflower powder, (2)= containing Basaria fish powder and (3)= containing tomato powder

CONCLUSION

In general, it could be concluded from the results obtained that natural materials can be used as flavorings for Indomie and as an alternative to monosodium glutamate, which has harmful, pathogenic effects. The natural mixtures gave higher values in protein content ranged from 0.607% in formula, 3 to 2.589 **%** in formula,2 compared to commercial formula 0.188%, Minerals expect sodium recorded high values in formula(1, 2 and 3) compared to commercial formula. Also, natural mixtures gave high antioxidant activity reached to 98.11% in formula 3 compared to commercial formula 66.52%. The total essential amino acid (TEAA) and non-essential amino acids (TNEAA) in formula (1, 2 and 3) gave values higher than commercial formula. Formula (1) gave the highest value of E/N ratio (0.937). In the sensory evaluation formula (3) recorded the highest value in taste and flavor, also seasoning formulas (1 and 2) recorded the highest values for odor and over all acceptability.

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تطوير خلطات توابل إندومي وظيفية من مصادر غذائية طبيعية

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الملخص

في ضوء الأضرار الجسيمة التي ظهرت مؤخرًا نتيجة استهلاك المنكهات الاصطناعية ، يهدف هذا البحث إلى تطوير خلطات توابل إندومي وظيفية من مصادر غذائية طبيعيةباستخدام مساحيق القرنبيط (الخلطة 1) ، أسماك البسارية (الخلطة2) والطماطم (الخلطة3)). اتضح من نتائج تحليل هذة الخلطات أن الرطوبة والبروتين والمستخلص الايثيري والرماد زادت في الخلطات 1 و 2 و 3 مقارنة بالكنترول مقابل انخفاض الكربوهيدرات المتاحة. سجلت الخلطة (2) أعلى قيمة في محتوى البروتين والمستخلص الايثيري والرماد بينما سجلت الخلطة (1) أعلى قيمة للألياف. زادت جميع المعادن ما عدا الصوديوم في التركيبات الطبيعية مقارنة بالكنترول. زاد نشاط مضادات الأكسدة من 66.52 في الكنترول إلى 90.61 و 83.94 و 98.11٪ في الخلطات (1 و 2 و 3 علي التوالي). أعطت الأحماض الأمينية الأساسية (EAA) قيمًا في الخلطات الطبيعية أعلى من تلك الخاصة بالكنترول. أعطت الخلطة (2) قيم احماض امينية اساسة كلية (TEAA, 36.81%) اعلي من منظمة الأغذية والزراعة / منظمة الصحة العالمية لأطفال المدارس. كانت نسبة اللايسين في الخلطة (2) أعلى بمرتين مما كانت عليه في منظمة الأغذية والزراعة. سجلت الخلطة (1) أعلى قيمة لنسبة TEAA / TNEAA (0.937) . أخيرًا ، سجل التقييم الحسي أفضل النتائج للطعم والنكهة في الخلطة (3) بينما سجلت الخلطتان (2 و 3) أفضل النتائج في الرائحة والقبول العام.