

DEVELOPMENT OF A NUTRITIONAL FOOD SUPPLEMENT FROM SPINACIA OLERACEA LINN , BRASSICA RAPA AND PRUNUS AMYGDALUS

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Abstract

Almond, raisins, sesame seeds, spinach and turnip leaves are a combined source of beauty, alertness, food and medicine. The reason for selection of these foods is their antioxidant quality. This work is focused on the development and laboratory analysis of a food supplement which was developed from a variation of Spinach (*Spinacia oleracea Linn*), Turnip leaves (*Brassica rapa* variety *rapa*), Raisins (*Vitis vinifera*), Almonds (*Prunus amygdalus*) and Sesame seeds (*Sesamun indicum*). The different ratios of various samples were divided to get the best out of all. This judgement was made by a panel of semi- trained experts with the method of Sensory Evaluation. The sample with the most accepted sensory evaluation was then taken up for nutritional analysis was done. The results from the nutritional testing revealed the product to be energy dense, rich in proteins, fats and carbohydrate per 100g of the sample. This work has the aim of developing a food supplement for people with rich phytochemical composition with natural medicinal uses and pharmacological properties yielded by raisins, sesame seeds, almonds, spinach and turnip leaves.

Introduction

Plants are one of the most usable and available form of food and medicine all around us. Green leafy vegetables are often ignored in the diet despite of having all healthy pigments , phytosterols , and oils to be healthy. These plant compounds are not designated as traditional nutrients since they are not essential to sustain life, but play a role in health and longevity and have been linked to a reduction in the risk of major chronic diseases. The medicinal plants are rich in secondary metabolites; which are potential sources of medicinal drugs; and essential oils of therapeutic importance. In 1989, the National Academy of Science expanded their message in another report, *Diet and Health*, which promoted the consumption of at least 5 servings of fruits and vegetables per day in order to reduce risk of both cancer and heart disease. In 1991, the National Cancer Institute started the national "5 A Day for Better Health" program (Produce for Better Health, PBH), which called for the consumption of 5 or more servings of fruits and vegetables daily. In 2003, the recommendations were expanded to encourage people to eat from 5 to 9 servings a day: "Eat 5 to 9 A Day for Better Health [18]

The main ingredients used were Turnip, Spinach , Almonds, Raisins and Sesame seeds. The turnip or white turnip is of the *Brassica rapa* specie and *rapa* as sub-specie. Turnip is a root vegetable commonly grown and is white and purple in color. The turnip leaves are excellent forage crops for livestock especially dairy cows. The important therapeutic benefits of the medicinal plants are their safety, economical, effectiveness and easy availability [12]. Turnips, like other members of the Brassica family, are seen to have the potential of lowering

the risk of colon, lung, prostate, and stomach cancers since Clarke and Ho showed in their studies that the vegetable have an anti-carcinogenic activity [20].

Almonds are prunes that are placed in the family, the *Prunaceae* (or *Amygdalaceae*) [13]. There are three classes of almonds which are edible, sweet and some are bitter and poisonous [10]. Almonds are nuts, fruits of an almond tree. There have been series of researches being carried out on almonds in areas including heart health, digestive health, weight management, diabetes prevention and treatment, and nutrient composition. More interest are being seen in the aspect of weight management and smart snacking which has prompted a shift in emphasis from the well-established body of evidences on heart health and toward weight management and satiety research to support a healthy and active lifestyle (Abbey *et al.*, 1994; Blomhoff *et al.*, 2006)

Sesamun indicum is the scientific name for sesame seeds. Since ancient times grapes were sundried to produce raisins. Raisins naturally have both an array of valuable nutrients and a pleasantly sweet flavour. Including raisins as part of the daily diet provide essential nutrients, soluble and insoluble fiber and health protective bioactive compounds, or phytochemicals [1].

The anti-oxidant and anti radical activities of the phenolics extracts present in almonds, spinach, turnip greens, sesame seeds may be helpful in preventing or slowing the processes of various oxidative stress related diseases such as ageing, prostate, breast, colon, cervical cancers, liver damage, and so on. The presence of the unsaturated oils in them also help in treating and managing serum cholesterol levels, lowering LDL and preventing scores of cardiovascular diseases [2,3].

Aims and Objectives

- 1.To study the organoleptic properties of the developed food supplement with preparation of different variations.
- 2.To find the nutritional composition of the developed supplement in terms of calories, carbohydrates, proteins fat and other nutrients.

Review of Literature

Turnips

Turnips can be prepared as a vegetable, meshed variety for pickles and other processed foods [18]

Nutritional Aspects of Turnip

The different nutrients present in Turnip greens or leaves are vitamin A, vitamin K, vitamin C, copper, dietary fibre, calcium, foliate, manganese, vitamin E and vitamin B6. They are also a very good source of potassium, magnesium, pantothenic acid, vitamin B2, iron and phosphorus [1]. Turnip leaves are very rich in Nutrition and is often neglected to develop food products [5].

Spinach

This green is found in all seasons but in India its eaten in winters. It has unique properties which can serve as healing factor in various nutrient deficiency diseases [9].

Nutritional Aspects of Spinach

Flavonoids: *Spinacia oleracea* is very rich in the flavonoids [6].

Phenolic Compounds: The polyphenols isolated from the plant are para-coumaric acid, ferulic acid, ortho-coumaric acid [7].

Carotenoids: Different carotenoid varieties are present in Spinach. Spinach contains carotenoids like lutein, β -carotene, violaxanthin and 9'- (Z)-neoxanthin [9].

Vitamins: *Spinacia oleracea* contains high concentration of vitamin A, E, C, and K. and also folic acid, oxalic acid [9].

Minerals: Various minerals are present in the spinach. They include; magnesium, manganese, calcium, phosphorus, iron, Zinc, copper and potassium [9]. It also contains vitamin A, and C, thiamine, riboflavin, and niacin. Calcium, phosphorus, iron, sodium, and potassium are also found in spinach greens.

Almonds

Heart-healthy snack.

The high- almond diets significantly lowers average total cholesterol (-10 mg/dL) and LDL cholesterol (-10 mg/dL) as compared to the control diets, while also increasing vitamin E levels in a dose-response manner. This was a second study which assessed the effect of eating either a control diet (no almonds), a low-almond diet (10% of calories) and a high-almond diet (20% of calories) in 16 healthy men and women (mean age 41 years). Dietary modifications are often the first and one of the most effective ways to reduce the risk of cardiovascular diseases, and series of researches suggests that eating almonds can help in maintaining a healthy heart. [3,4].

Almonds and diabetes control.

Dietary and lifestyle changes are a critical factor in diabetes management, and series of findings continues to come up supporting the different roles of almonds and other tree nuts as a part of an overall dietary pattern that is useful for those with type 2 diabetes. The nutrient profile of almonds having low-glycemic index and providing a satisfying combination of protein (6 grams per ounce), fiber (4 grams per ounce), and monounsaturated fats, makes them a perfect snack and addition to meals for individuals with glucose intolerance or type 2 diabetes [20].

In Amnesia

In a recent study done suggests that almonds possess a memory enhancing activity. Since ancient times its eaten as a diet for brain. A study have shown the remarkable improvement in patients of Amnesia when fed with almonds [11]. Almonds also were found to induce a significant decrease in the Herpes simplex virus (HSV-2) replication [2].

Sesame seeds

In India, where sesame meal is an important food which is known for its high protein content, and found to be rich in methionine and tryptophan which are not present in other sources of vegetable protein such as soy, sesame meal or flour can be added to recipes to give a better nutritional balance to health food products [14]. Sesame oil, other than its use as cooking medium, has certain industrial applications as it is used to make hair oil, hydrogenated oil and certain medicines [15,16,17]

Raisins

Raisins can contain up to 72% sugars by weight, most of which is fructose and glucose. They also contain about 3% protein and 3.7%–6.8% dietary fiber. Raisins, like prunes and apricots, are also high in certain antioxidants, but have lower vitamin C content than fresh grapes. Raisins are low in sodium and contain no cholesterol [19].

Raisins, like other fruits, are naturally void of fat; saturated fat and cholesterol. They also provide an ample amount of the daily fiber requirements for both soluble and insoluble fibers at levels that benefit cardiovascular health. Raisins are a source of fructo oligosaccharides (fructans), which act as prebiotics, contributing to colonic health, and are a major dietary source of tartaric acid, a fruit acid that is fermented by colonic bacteria and has been shown to have a beneficial role in intestinal function. A prebiotic has been recently defined as “a non-

digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon.”[5].

Methodology

Turnip greens and spinach were purchased from the local grocery stores in the rajiv chowk area of Gurgaon, Haryana, India. Although, it was quite tasking to get them, because many farmers cultivate these leaves only in winters and many as livestock feed. The almonds, sesame seeds and raisins were also purchased from the local area stores and vendors. The selection of the seeds, nuts and dried fruits were carefully done to ensure that the best quality and adequate quantity is being purchased. The seeds, nuts and dried fruits were readily available in the local area stores.

Blanching

Blanching is a pre-treatment procedure that precedes other storage or packaging procedures. Blanching is a preservation process which stops or inactivates enzyme activity and loosens leaf tissues which sometimes fixes the natural colour and affords more rapid drying of many vegetables and fruits. Blanching can be done in a number of ways which usually includes water, steam and oil blanching. Blanching in itself is not a preservative procedure, but a part of it, prior to further processing. After purchasing of leaves, the leaves were picked out, removing the bad ones and dirt from them. The leaves are then washed and made to undergo the process of blanching. The leaves were immersed in the boiling water at boiling point for few minutes and water is allowed to return to boiling point for another 1-2 minutes. Leaves are then immediately transferred into a sifter to collect the leaves and further held in ice-cold water. Both spinach and turnip leaves were blanched and then drained out for drying.

Drying

Drying is certainly the oldest method that humans have practiced to preserve food for future use. Drying foods reduced the weight and volume of the foods so that they could be more easily stored and transported from place to place. The leaves after blanching were oven dried at about 100 degree C for six hours, till they were fully dried. Leaves were carefully and properly stretched out for even rapid drying. The vegetables were considered dried when they are brittle or “crisp”, and literally shatter if hit with a hammer or heavier material. At this stage, they should contain less than 10 percent moisture. The oven was allowed for rest for few minutes after each hour of drying, to ensure proper maintenance.

Roasting

The reason for roasting the sesame seeds was to further dry it and enhance a roasted flavor in it. The seed was slightly browned and grounded also into a powder form. The ground sesame seeds are then put in an air-tight container as well, in order to reduce rancidity of the oil present in them.

Grinding

The dried leaves were finely ground to powder form using an electric grinder. The leaves were carefully placed in the grinder and set to grind slowly at an even speed, in order to get a finely blended powder. The spinach and turnip leaves were ground separately and put in an air-tight container. The almonds and sesame seeds also went through grinding.

Soaking

Almond seeds were seen to contain certain anti-nutrients on their skin cover, and the process of soaking is said to reduce this harmful anti nutrients. Aside the presence of anti-nutrients in almond skins, the soaking of this

wonder nut has lots of healthy benefits as well. Soaking almonds secretes lipase an enzyme which is important for fat digestion. They are a good amount of vitamin E in soaked almonds also. Some studies find that they contain Vitamin B17 which is vital for fighting cancer.

100grams of almonds was rinsed first in clean water and were soaked overnight in clean water for 8 hours. The water was double the quantity of the almonds. The bowl was covered with a towel and placed in a room temperature. After 8 hours, the almonds were collected and the water was drained out. The outer skins of the almonds were also peeled off. The seeds are then cut into smaller pieces to create a more even surface area in order for the seeds to dry faster. The almond is then oven-dried also to remove moisture from the seeds. The almond was dried for about 3 hours at 100° Celsius. The dried almond nuts are then put into the electric grinder for grinding. The almond flour was then put in an airtight container.

Sample Ratio distribution

Having made all required ingredients involved into powdered forms, the variation of samples was then carried out using Spinach as key variable for which all other variables were dependent. Five samples were made, from which contained different quantities of the dried ingredients.

Sample A: constituted of 40% spinach, 15% turnips, 15% raisins, 15% almonds and 15% sesame seeds. All these translated in quantities to be; 4grams of spinach, 1.5grams of turnip greens, 1.5grams of almonds, 1.5 grams of raisins, and 1.5grams of sesame seeds. Altogether made a 10g sample.

Sample B: constituted of 50% spinach, 12.5% turnips, 12.5% raisins, 12.5% almonds and 12.5% sesame seeds. All these translated in quantities to be; 5grams of spinach, 1.25grams of turnip greens, 1.25grams of almonds, 1.25grams of raisins, and 1.25grams of sesame seeds. Altogether made a 10g sample.

Sample C: constituted of 60% spinach, 10% turnip greens, 10% raisins, 10% almonds and 10% sesame seeds. All these translated in quantity to be; 4 grams of spinach, 1 gram of turnip greens, 1gram of almonds, 1 gram of raisins, and 1 gram of sesame seeds. Altogether made a 10g sample.

Sample D: constituted of 30% spinach, 17.5% turnip greens, 17.5% raisins, 17.5% almonds and 17.5% sesame seeds. All these translated in quantity to be; 4 grams of spinach, 1.75 grams of turnip greens, 1.75 grams of almonds, 1.75 grams of raisins, and 1.75 grams of sesame seeds. Altogether made a 10g sample.

Sample E: constituted of 20% spinach, 20% turnip greens, 20% raisins, 20% almonds and 20% sesame seeds. All these translated in quantity to be; 2 grams of spinach, 2 grams of turnip greens, 2grams of almonds, 2 grams of raisins, and 2 grams of sesame seeds. Altogether made a 10g sample.

Table 1: Distribution of samples in different variations according to percentage and grams

Samples Variables	Sample A		Sample B		Sample C		Sample D		Sample E	
	%	grams	%	Grams	%	grams	%	grams	%	grams
Spinach	40%	4g	50%	5g	60%	6g	30%	30g	20%	20g
Turnip greens	15%	1.5g	12.5%	1.25g	10%	1g	17.5%	1.75g	20%	20g
Raisins	15%	1.5g	12.5%	1.25g	10%	1g	17.5	1.75g	20%	20g
Almonds	15%	1.5g	12.5%	1.25g	10%	1g	17.5%	1.75g	20%	20g
Sesame seeds	15%	1.5g	12.5%	1.25g	10%	1g	17.5%	1.75g	20%	20g

The different variations were made into samples and were taken for sensory evaluation. The hedonic rating method was used, and the ratings were calculated and interpreted afterwards.



Figure no.1. Final developed supplement sample

The super food supplement composed of spinach (*Spinacia oleracea* Linn) turnip leaves (*Brassica rapa* variety *rapa*), raisins (*Vitis vinifera*), almonds (*Prunus amygdalus*) and sesame seeds (*Sesamun indicum*) in varying proportions.

Result and Discussion

Sensory Evaluation After the sensory evaluation tests was carried using the hedonic rating test, the results were therefore collated and analysed also calculating the mean and standard deviations for each samples as well as the overall mean and standard deviation.

Table no.2 ; Sensory Evaluation of Sample A by twenty experts

Parameters					
Subjects	TASTE	COLOUR	TEXTURE	ACCEPTABILITY	OVERALL
Subject 1	8	7	6	8	8
2	9	9	9	8	8
3	2	3	4	3	3
4	2	3	4	3	3
5	7	8	6	5	5
6	6	5	8	8	6
7	7	8	8	8	8
8	8	9	8	9	8
9	8	9	9	8	9

10	7	8	8	8	8
11	8	9	9	9	8
12	8	8	9	9	9
13	8	8	8	7	8
14	8	8	7	6	5
15	8	9	8	8	9
16	8	9	8	7	7
17	7	8	4	7	6
18	8	8	9	8	3
19	8	5	6	7	7
20	5	9	8	3	3
MEAN	7	7.5	7.3	6.95	6.55
STD DEV.	1.870829	1.884144	1.676305	1.909843	2.10891

Table 3: Sensory Evaluation of Sample B by Twenty experts

Parameters Subjects	TASTE	COLOUR	TEXTURE	ACCEPTABILITY	OVERALL
SUBJECTS 1	9	7	8	7	9
2	8	9	8	7	7
3	2	3	4	3	3
4	5	6	6	5	5
5	5	6	6	4	4
6	4	5	6	8	3
7	6	8	6	6	7
8	7	9	9	8	8
9	8	9	9	9	9
10	8	7	8	8	7
11	7	8	8	8	8
12	7	8	8	9	9
13	8	8	8	7	8
14	7	8	7	6	5
15	7	8	7	7	7
16	9	8	7	8	8
17	7	8	4	6	6
18	3	8	9	8	3

19	3	3	3	2	4
20	4	3	5	2	3
MEAN	6.2	6.95	6.8	6.4	6.15
STD DEV.	2.039608	1.935846	1.720465	2.107131	2.151162

Number of subjects are 20. All subjects are of different age between 18-25 years old. The mean value and standard deviation of all samples made scoring easy and helped in identifying the most accepted sample based on the ratings style employed.

Table 4: Sensory Evaluation of SAMPLE C by twenty experts

Parameters Subjects	ACCEPTABILITY				
	TASTE	COLOUR	TEXTURE	OVERALL	
SUBJECT 1	10	8	8	8	9
2	7	8	8	8	7
3	2	2	3	3	3
4	3	3	3	6	6
5	4	5	5	3	3
6	4	3	6	7	3
7	5	6	7	6	6
8	8	8	9	9	9
9	9	8	9	9	9
10	6	8	8	7	8
11	8	9	9	8	9
12	8	8	8	8	9
13	8	7	8	7	8
14	5	7	6	6	5
15	6	8	7	6	6
16	6	7	6	7	6
17	6	8	4	7	6
18	3	8	8	3	2
19	9	5	10	9	9
20	3	2	5	2	2
MEAN	6	6.4	6.85	6.45	6.25
STD DEV.	2.280351	2.2	1.981792	2.085066	2.467286

Number of subjects are 20. All subjects are of different age between 18-25 years old. The mean value and standard deviation of all samples made scoring easy and helped in identifying the most accepted sample based on the ratings style employed.

Table 5: Sensory Evaluation of SAMPLE D by twenty experts

Parameters Subjects	ACCEPTABILITY				
	TASTE	COLOUR	TEXTURE		OVERALL
SUBJECTS 1	5	5	6	5	5
2	7	7	7	6	6
3	3	3	4	4	4
4	4	3	4	4	4
5	3	3	5	2	1
6	4	3	6	7	3
7	7	9	8	8	8
8	9	9	9	8	9
9	8	9	9	9	9
10	8	9	8	8	8
11	8	8	8	9	9
12	8	7	8	8	9
13	7	7	7	7	7
14	3	7	6	6	5
15	7	8	7	8	8
16	7	8	7	7	7
17	5	8	4	7	6
18	2	7	8	2	2
19	5	5	4	4	4
20	7	7	7	7	7
MEAN	5.85	6.6	6.6	6.3	6.05
STD DEV.	2.056089	2.107131	1.624808	2.076054	2.397394

Number of subjects are 20. All subjects are of different age between 18-25 years old. The mean value and standard deviation of all samples made scoring easy and helped in identifying the most accepted sample based on the ratings style employed.

Table 6: Sensory Evaluation of SAMPLE E twenty experts

Parameters Subjects	ACCEPTABILITY				
	TASTE	COLOUR	TEXTURE		OVERALL
SUBJECT 1	9	8	8	7	9
2	6	8	8	7	7

3	4	4	3	4	4
4	8	7	7	7	7
5	8	7	7	5	6
6	4	6	6	7	3
7	8	9	8	9	9
8	8	8	8	8	8
9	8	9	9	9	9
10	7	8	8	8	7
11	7	8	8	8	8
12	9	9	9	8	9
13	7	7	8	7	7
14	5	7	6	6	5
15	9	9	9	9	9
16	6	7	6	7	6
17	6	8	4	6	6
18	4	8	9	3	2
19	7	5	8	7	7
20	8	5	7	8	7
MEAN	6.9	7.35	7.3	7	6.75
STD DEV.	1.609348	1.388344	1.584298	1.549193	1.971674

Table 6: sensory evaluation scores of SAMPLE E evaluated based on different parameters.

Table no.7. Interpretation of the Sensory Evaluation Scores

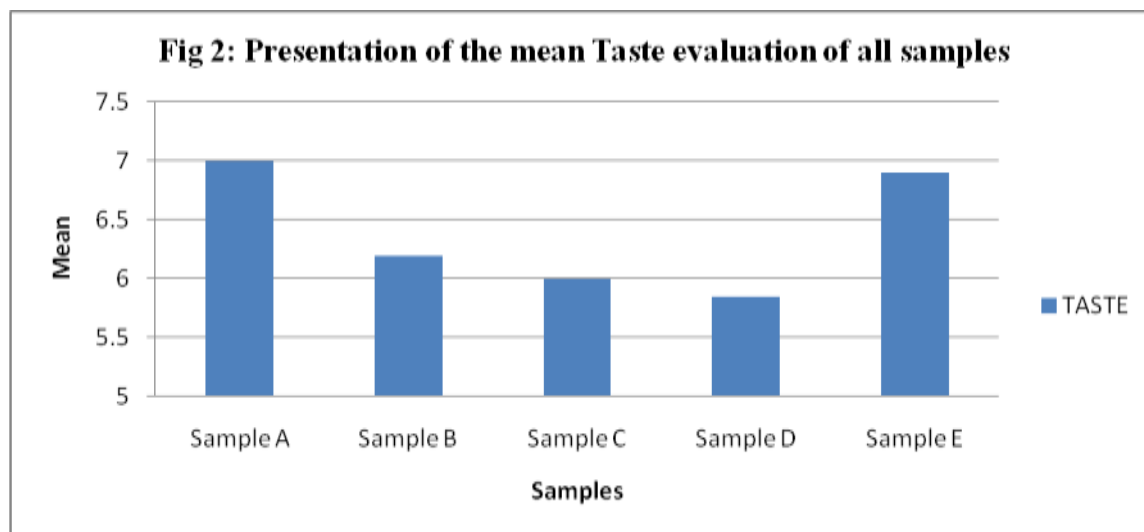
Samples	Sample A	Sample B	Sample C	Sample D	Sample E
Parameters					
TASTE	7.0±1.87 ^a	6.2±2.03 ^c	6.0±2.28 ^d	5.85±2.05 ^e	6.9±1.60 ^b
COLOUR	7.5±1.88 ^a	6.95±1.93 ^c	6.4±2.2 ^e	6.6±2.10 ^d	7.35±1.38 ^b
TEXTURE	7.3±1.67 ^a	6.8±1.72 ^c	6.85±1.98 ^b	6.6±1.62 ^d	7.3±1.58 ^a
ACCEPTABILITY	6.95±1.90 ^b	6.4±2.10 ^d	6.45±2.08 ^c	6.3±2.07 ^e	7.0±1.54 ^a
OVERALL	6.55±2.10 ^b	6.15±2.15 ^d	6.25±2.46 ^c	6.05±2.39 ^e	6.75±1.97 ^a

Mean±StdDev. Number of subjects, n=20. *a= highest value, e=least value

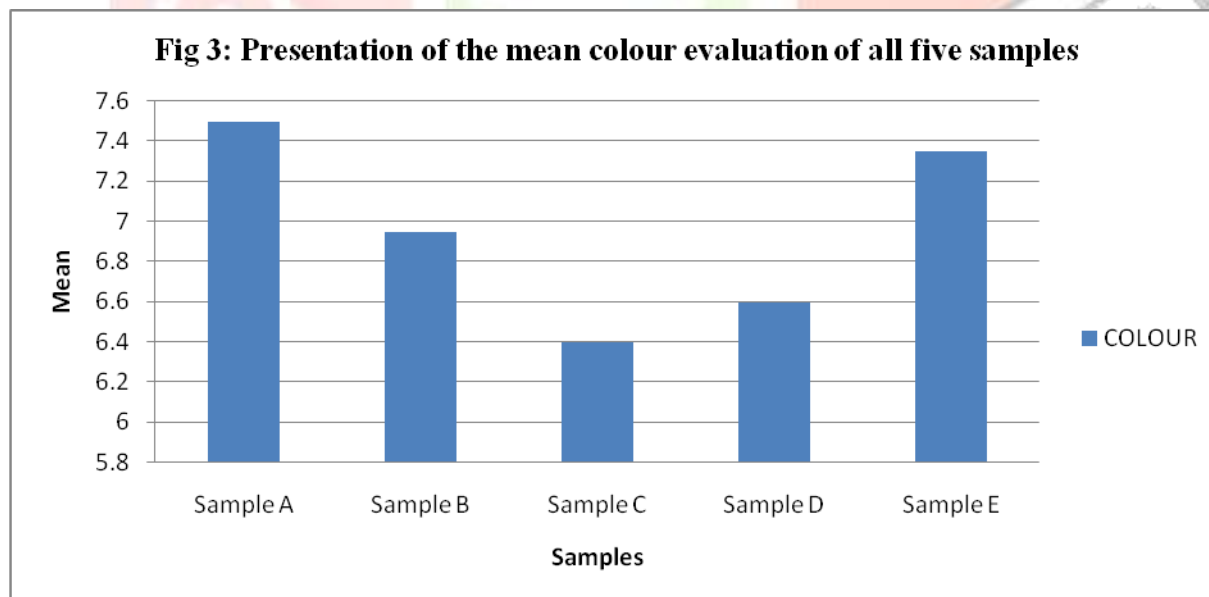
Table 7: Compiled mean and standard deviation results of the sensory evaluation carried out.

TASTE:

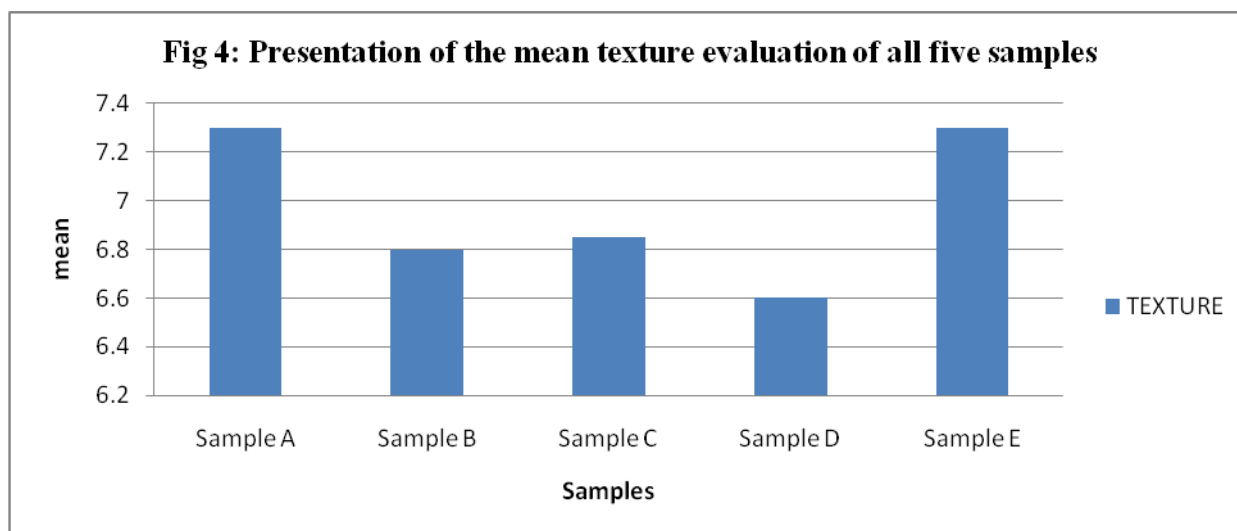
Sample A had the most preferred taste based on the assessment with a rating of 7.0. Sample E was the next preferred having a score of 6.9. Sample B was next in line with a taste score of 6.2. Samples C and Sample D were seen to have the least scores in the Taste category by the subjects who tasted.

**COLOUR:**

The colour category was led by Sample A with a rating of 7.5. This was followed by Sample E, having a 7.35 rating. Samples B and C followed respectively with 6.95 and 6.4. Sample C however had the least rating score of 6.4.

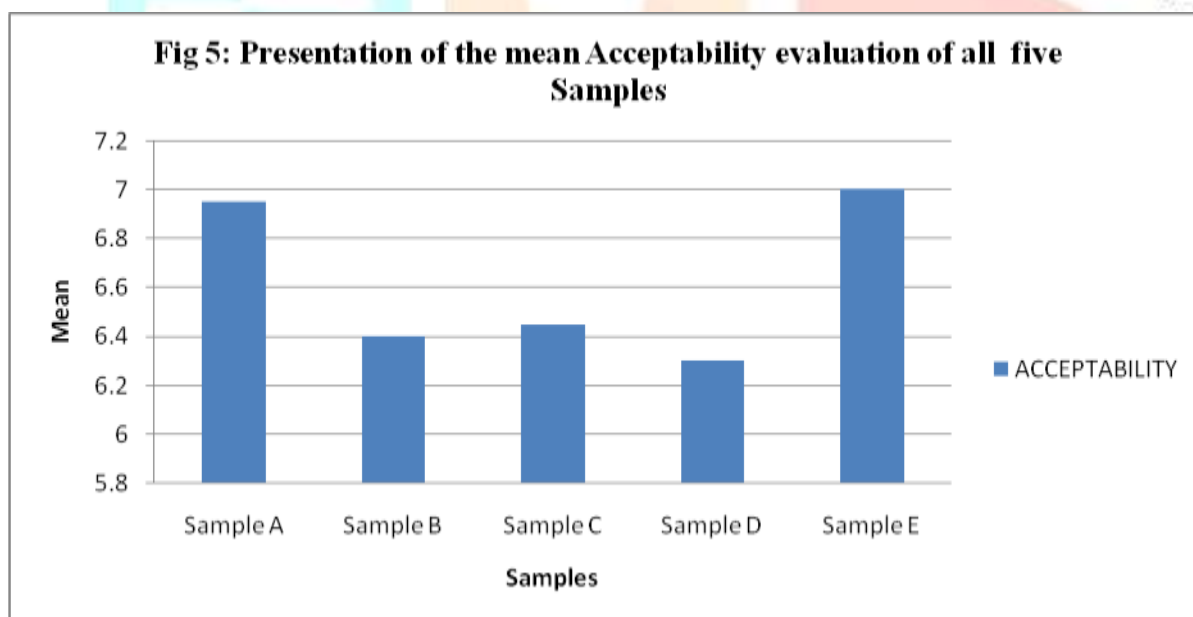
**TEXTURE:**

The texture category was almost a tie between all samples. Sample A and Sample D had the same texture rating of 7.3 each. Sample B and Sample C had a very slight difference in rating, each having 6.8 and 6.85 respectively. This leaves Sample E to the bottom in this category with a rating of 6.6.



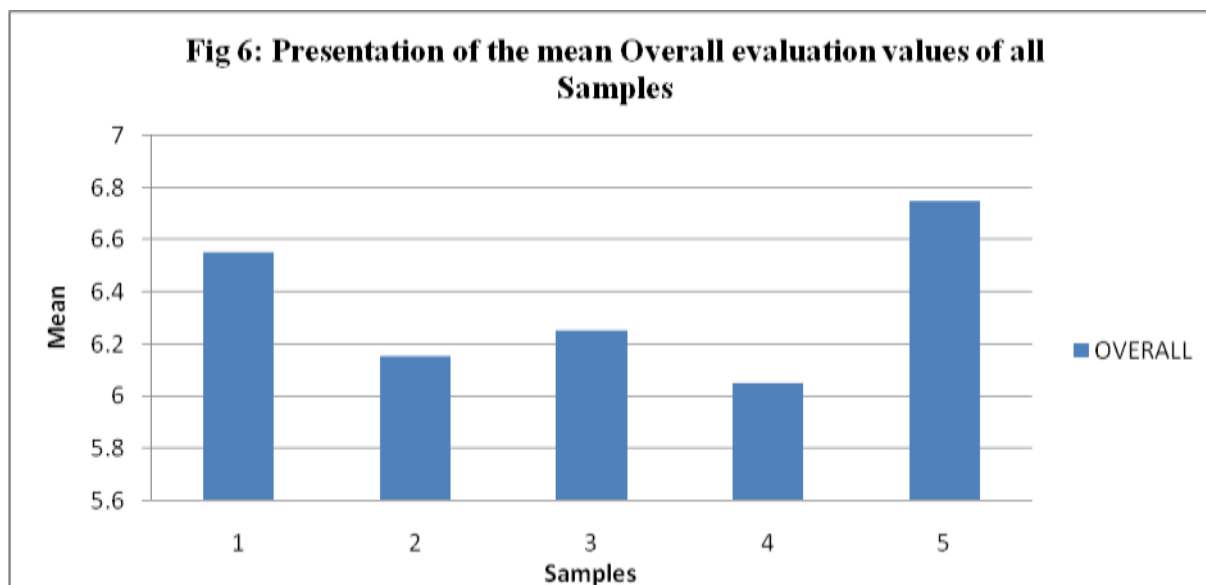
Acceptability:

The Sample E was most accepted by the subjects based on the high rating score of 7.0 it secured. Sample A was next with a score of 6.95. Here again, Samples B and C were also having a close score of 6.4 and 6.45 respectively. Making sample D the least rated with a 6.3 score. Therefore, Sample E was the most accepted of all, followed by Sample A.



OVERALL:

Sample E was the most preferred overall sample of all with a rating score of 6.75. Sample A then followed closed in overall acceptance with a 6.55 rating score. Sample C invariably was next in line with a score of 6.25. This was respectively followed by Sample B, having a score of 6.15. Sample D was least in this category of evaluation having a score of 6.05.



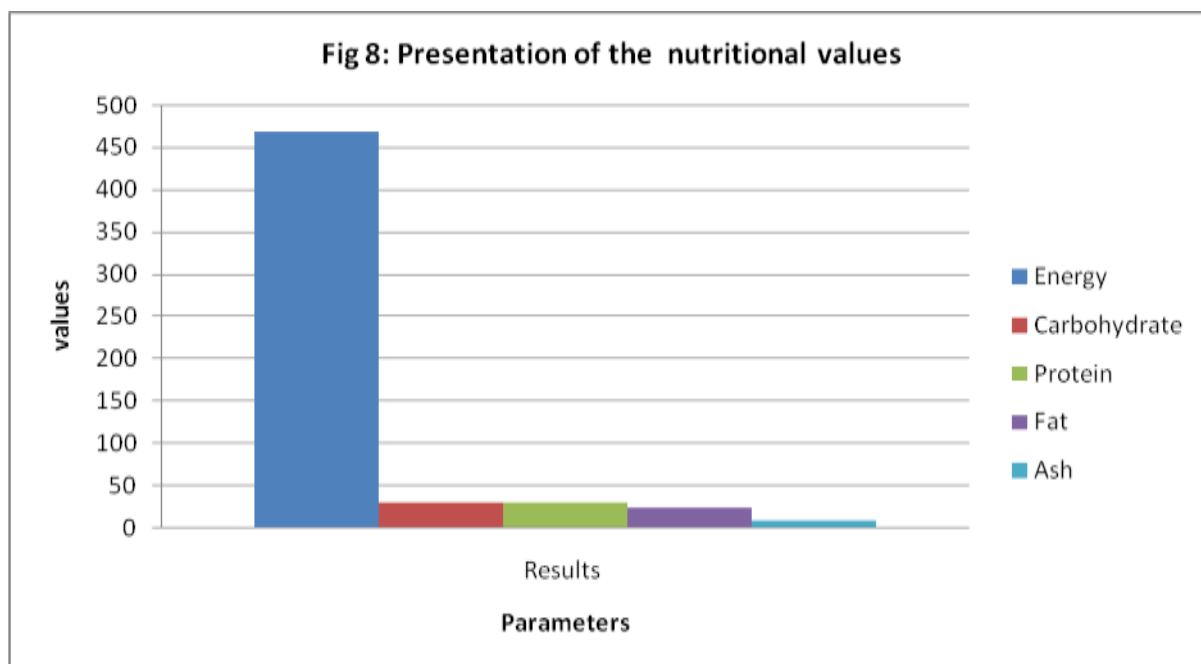
Nutritional composition of Selected Sample by experts evaluation

Sample E had the best hedonic rating (sensory evaluation) and was then taken for laboratory testing of basic food nutrients. The laboratory test for basic food nutrients such as energy, carbohydrate, protein, fat and ash was carried out on the developed food supplement. The result values are computed per 100g.

Parameters	Results Per 100 gms of the sample
Energy	468.87 Kcal
Carbohydrate	30.97g
Protein	30.65g
Fat	24.71g
Ash	8.90g

Interpretation of results.

The result indicates that the developed food product is energy-rich. It is also observed to be rich in carbohydrate and protein content. The healthy fat present in each of the sample ingredients still made its way into being noticed in the final sample fat contents. The presence of the omega-3 and other important oil contents are also made available.



The food supplement as a whole has an ample potential of supplying a reasonable value of the daily energy requirement which means that a spoon full of this can be snacked upon at work or at home. The protein and carbohydrate values suggest an important use of the product as it can be deduced to help balance up protein and carbohydrate requirements. Many of the fat content present here is from almonds and sesame seeds which have a long list of health benefit and importance to the human system. The developed food supplement can be taken by anyone and everyone alike irrespective of gender or age. Product can also be added to other flour in the baking or cooking process to enhance nutritional value of the food, since the developed product is rich in basic macro nutrients.

Summary and Conclusion

The combination of spinach, turnip leaves, sesame seed, raisins and almonds has been nutritionally synergized to develop a naturally unique and much healthier food supplement. The food supplement is seen to supply energy among other nutrients to the body almost at an instant. This testimony was given during the sensory evaluation as subjects having tasted all five samples rarely felt hungry few hours after the evaluation exercise. The supplement could be snacked upon if desired and also help meet up average daily energy requirements alongside the main meals of the day. The plant-based food supplement can be consumed by everyone regardless of their health status, age and gender at any geographical region, having its essence and relevance in the risk-lowering and prevention of various health-threatening diseases and also promote or maintain a properly functioning body. Also, such further work will be encouraged to be done on the product to see how the sense of taste and feel could be improved since the initial product has a much bitter taste which is thought to be due to the presence of the dried leaves used.

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