

HIGH PROTEIN AND LOW CALORIE FOOD PRODUCT DEVELOPED FROM OATS, NUTS AND OILSEEDS

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Abstract

The chemical composition, textural and sensory characteristics of the four products i.e., chia seeds, dates, oats, and almonds was determined while making the product. Variations were made in the amount of chia seeds to get the desired result. Oats were roasted and were grounded along with dates and almonds and then, in the last all four ingredients were mixed. The nutritional composition of the product included 46.74gm carbohydrate, 13.65gm protein, 5.33gm fat, 1.65gm ash, 16.8gm dietary fiber, 289.53kcal of energy. Sensory evaluation results indicated that the product had high sensory ratings for all the attributes evaluated. The combination having 15% almonds, 30% chia seeds, 30% oats, and 25% dates resulted in highest scores for taste and overall acceptability. The taste was accepted to be the best in this variation. The product so developed aims to developing a nutritionally adequate food which could help in diseases like diabetes, cardiovascular diseases, and obesity.

Introduction

Food product development: “process of developing a brand new product or service for the market. This sort of development is taken into account the preliminary step in product or service development and involves variety of steps that has got to be completed before the merchandise is introduced to the market”(Sharma,2017)

Chia seeds: (*Salvia hispanica*) the plant belongs to the Lamiaceae. This plant is being adult for its seeds. The flowers made by the plant are measure typically white or purple. The color of the

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seed differs slightly that varies from black, gray and white noticed to black. The seeds have Associate in nursing oval form that differs in size and from 1-2mm (Bresson JL et al., 2009; Peirrtti PG et al., 2008; Reyes-Caudilo E et al., 2008; Cahil JP et al., 2002).

Another issue that will play a task in variations of chemical composition of chia seeds is that the biological process stages of the plant. It has been shown during a study that alpha-linolenic acid (ALA) content decreased by twenty third from early stage to the matured stage of the seeds (Peiretti PG et al., 2009).

Nutrient composition of chia seeds is appreciably smart because it contains (15-25%) of macromolecule, (30-33%) of fats, (26-41%) of carbohydrates, (18-30%) of ash, (4-5%), (90-93%) of minerals, vitamins, and dry matter. Antioxidants are gift in pretty high amounts . Chia seeds are known to contain varied active ingredients like essential fatty acids and phenolic compounds. Chia seeds are found to own bigger biological worth than cereals and have higher content of Ca, metallic element and metal than milk. (De Tucci 2006).

Dates: (*Phoenix dactylifera*) it is a spermatophyte belongs to the *Arecaceae*. It is being cultivated for edible sweet fruit. Cut dates are utilized in a spread of sweet and savory food things, from tajines (tagines) in Morocco to puddings, ka'ak (types of Arab cookies) and completely different desert things. Dates have occupied a special place in writing. In writing the *Phoenix dactylifera* is thought as "kharjura". Completely different elements of this plant are utilized in writing preparations together with the leaves, flower, roots, fruits, and seeds. Dates play terribly special role as a Rasayana (rejuvenation). In ayurvedic language Rasa, suggests that a typical nutrient pool that provides the nutrients to completely different tissues because it circulates within the body(Mainan, 2005)

Dates are loaded with nutrients. The biological process composition of dates: contains (70-80%) carbohydrates, (0.20-0.50%) fat, (2.30-5.60%) macromolecule, (6.40-11.50%) dietary fibers, (0.10-916mg/100gdry weight), and conjointly contain bound victuals (C, B1, B2, B3, and A). and has very little or no starch.(Mainan,2005)

Oats (*Avena sativa*): It may be a species of cereal grain and are primarily adult for its seeds. Oats grow best in temperate regions.

Oats are utilized in several forms, the foremost common kind is oatmeal, or typically it is grounded into a fine powder as oat flour. Variety of store merchandise conjointly involves the employment of oats like oatcakes, oatmeal cookies, oat bread, etc. Oats are used as Associate in nursing ingredient in several cold cereals like breakfast food, granola, etc. oats are used as a thickening in soups (Gauldie et al., 1981

Nutritional composition of oats varies as, per a hundred g of oats contain (389 kcal), (16.9 g) macromolecule, (66.3 g) carbohydrates, (6.9 g) fats, (10.6 g) fibre, (1.22 g) saturated fatty acids, (2.18 g) monounsaturated fatty acids, (2.54 g) unsaturated fatty acids, (0.11 g) omega-3 fatty acid, (2.42 g) omega-6 fatty acid. Oats are found to be smart supply of soluble fibre that will scale back the danger of heart condition. Oats contain smart quantity of soluble fibre, well balanced proteins, and several other vitamins and essential minerals for the human health. (Esposito et al. 2005). Oats are found to contain slightly higher amounts of lipids compared to different cereal grains with a considerable level of essential polyunsaturated fatty acid. Additionally oats contain some natural antioxidants like tocopherols, alk(en)ylresorcinols, and phenolic acids and their derivatives, and a singular supply of avenanthramides (N-cinnamoylanthranilate alkaloids) and avenalumic acids (ethylenic homologous of cinnamic acids), that are not ordinarily gift in different cereal grains. (Mattila et al., 2005). The dietary fibre of oats contains B-glucans, that have Associate in nursing inhibitor activity and participates in glucoregulation and lowering of body fluid steroid alcohol levels. (Esposito et al., 2005).

Almonds: (*Prunus Dulcis*) the fruit of almond is not associate in nursing actual nut; however it is within the shell. Nutritional composition of almonds per a hundred g : (20.8 g) macromolecule, (58.9 g) fat, (2.9 g) minerals, (10.5 g) carbohydrates, (655 kcal) energy, (230 mg) Ca, (490 mg) phosphorus, (5.09 mg) iron, (0.24 mg) B, (0.57 mg) B-complex vitamin, (4.4 mg) nicotinic acid. (C.Gopalan, B.V. Rama Sastri & S.C. Balasubramanian. ICMR book). The fat content of almond is as (62 %) monounsaturated fatty acids, (24 %) unsaturated fatty acids. (Ros, Mataix and Chen, et al., 2006). Skin of almonds contains polyphenols consisting of flavonols, flavan-3-

ols, hydroxybenzoic acids and flavanones (Mandalari et al., 2010). These phenolic compounds and skin prebiotic dietary fibre have special business interest as is used as food additives or dietary supplements (Mandalari et al., 2010; Liu Z et al., 2014). Almonds is ingested on its own, raw or cooked. Besides that almonds are the ingredients of the many dishes. Almonds within the market are out there in several kinds like whole almonds, sliced almonds (flaked, silvered), and as flour. Almond milk, almond butter, and sweet almond oil is out there too within the market. Almonds are accustomed garnish several dishes as they went over breakfasts and deserts.

Methods and materials

Chia seeds, Dates, almonds and oats were purchased from market in Gurgaon, Haryana.

The almonds and dates were selected so carefully to get the best quality and in adequate quantity.

Roasting

The process of cooking the food by using dry heat where hot air envelops the food, cooking it well from all sides a temperature around 150 °C from an open flame, oven, roasting pan, or other source.

Oats were roasted over a medium flame to enhance a roasted flavor in it. Oats were roasted until they turned light brown and gave a toasty smell. Roasted oats were further grounded to make a fine powder.

Grinding

Oats were grinded after roasting into a fine powder like form using an electric grinder. The oats were carefully placed in the grinder and set to grind gradually at an even speed, in order to get a fine blended powder. The dates were ground separately and carefully as dates were hard to grind, dates were placed in the grinder and grounded slowly, in order to get a fine paste of dates. Almonds were also went through grinding.

Soaking

Chia seeds were soaked in water 15 minutes prior to their incorporation into all other ingredients. Soaked chia seeds were stirred every 4-5 minutes, in order to get a fine gel. A gel like substance was obtained at the end of 15 minutes period as chia seeds absorbs water and forms a gel jelly like substance.

The 3 ingredients were mixed into one another one by one and at last the soaked chia seeds were poured into the mix. All the 4 ingredients were evenly mixed and given a ball shape.

Variation of samples.

All the ingredients were used to make five different samples. Chia seeds were kept as a key variable for which all other variables were dependent. Five samples were prepared contained different quantities of all the ingredients.

Sample A: constituted of 15% almonds, 15% chia seeds, 35% oats, and 35% dates. All these translated in quantities to be; 15g of almonds, 15g of chia seeds, 35g of oats, and 35g of dates. Altogether made a 100g sample.

Sample B: constituted of 15% of almonds, 20% of chia seeds, 35% of oats, and 30% of dates. All these translated in quantities to be; 15g of almonds, 20g of chia seeds, 35g of oats, and 30g of dates. Altogether made a 100g sample.

Sample C: constituted of 15% of almonds, 25% of chia seeds, 30% of oats, and 30% of dates. All these translated in quantity to be; 15g of almonds, 25g of chia seeds, 30g of oats, and 30g of dates. Altogether made a 100g sample.

Sample D: constituted of 15% of almonds, 30% of chia seeds, 30% of oats, and 25% of dates. All these translated in quantity to be; 15g of almonds, 30g of chia seeds, 30g of oats, and 25g of dates. Altogether made a 100g sample.

Sample E: constituted of 15% of almonds, 35% of chia seeds, 25% of oats, and 25% of dates. All these translated in quantity to be; 15g of almonds, 35g of chia seeds, 25g of oats, and 25g of dates.

Table 1: Five Sample variations in percentages and grams

Samples variables	Sample A		Sample B		Sample C		Sample D		Sample E	
	%	grams	%	grams	%	grams	%	grams	%	grams
Chia seeds	15%	15g	20%	20g	25%	25g	30%	30g	35%	35g
Oats	35%	35g	35%	35g	30%	30g	30%	30g	25%	25g
Dates	35%	35g	30%	30g	30%	30g	25%	25g	25%	25g
almonds	15%	15g	15%	15g	15%	15g	15%	15g	15%	15g



Sample A- 15% almonds, 15 % chia seeds, 35% oats, 35% dates.

Sample B- 15% almonds, 20% chia seeds, 35% oats, 30% dates.

Sample C- 15% almonds, 25% chia seeds, 30% oats, 30% dates.

Sample D- 15% almonds, 30% chia seeds, 30% oats, 25% dates.

Sample E- 15% almonds, 35% chia seeds, 25% oats, 25% dates.

Standardization of a recipe

A standardized recipe is a recipe that has been tried, tested, evaluated and adapted for use by a food service. It produces a consistent quality and yield every time the exact procedures, equipment, and ingredients are used.

Steps involved in standardization of a recipe

1. Prepare a recipe to be standardized and test it until a high-quality product is produced that is acceptable to students. This step of the standardization process should include taste testing by student to judge the appearance, texture, flavor, and overall acceptability of the product. In addition, evaluate ease of preparation and time commitment to prepare the recipe.
2. Determine portion size if that information is not available from the quantity recipe that is being standardized for the food service operation.
3. Calculate what a portion contributes to the meal pattern and make adjustments, where needed.
4. Determine if portion size will vary by grade groups and do necessary computations to determine number of portions sizes in recipe given the variation.
5. Retest the recipe if any changes were made.
6. Develop a written recipe that includes:
 - Name of recipe (reflects contents and appeals to customers).
 - Number/category /meal type for easy access.
 - Exact ingredients by form to use (canned, frozen dehydrated) and any pre-preparation steps needed (diced, chopped, grated).
 - Detailed step-by-step procedures for preparation, cooking and serving. Include all steps for assembling ingredients.
 - Cooking temperatures, cook time, and holding temperatures.
 - Portion sizes (s) for single serving.
 - Total recipe yield (measured or weighed), pans size, number of pans (if more than one), weight or measure in a pan.
 - Equipment and specific serving utensils (s).

Sensory evaluation

When the quality of a food product is assessed by means of human sensory organs, the evaluation is said to be sensory or subjective or organoleptic. Every time a food is eaten a judgment is made. Sensory quality is a combination of different senses of perception coming into play in choosing and eating a food. Appearance flavor and mouth feel decide the acceptance of the food. The effective characteristic is not the property of the food, but the subject's reaction to the sensory qualities of foods. This reaction is highly conditioned by a variety of physiological and social factors and in the final analysis, plays a role in the acceptance and preference of foods. Surface characteristics of food products contribute to the appearance. Interior appearance can also be evaluated. Sight plays a role in the assessment of the lightness of foods like bread, cakes and idli. Transparency, opaqueness, turbidity, dullness and gloss are mediated by the organs of sight. Colour is used as an index to the quality of a number of foods. The flavor of food has three components-odours, taste and a composite of sensations known as the mouth feel. Taste sensations are less intense as the temperature of food is lowered below 20 °C and raised above 30 °C. Careful sampling of the food is necessary for sensory evaluation. Samples to be tested should be prepared by identical methods. All samples should be at the same temperature, optimum level and kept constant during the test. Stainless steel forks and spoons can be used for tasting the samples. The sensory evaluation was done using 10 point hedonic scale. For each variation, 20 hedonic tests were conducted by 20 different semi-trained panel of judges. Each panel member which were taste, colour, firmness, texture, stickiness, and overall acceptance.

Results and Discussion

Table no.2. Interpretation of the sensory evaluation scores

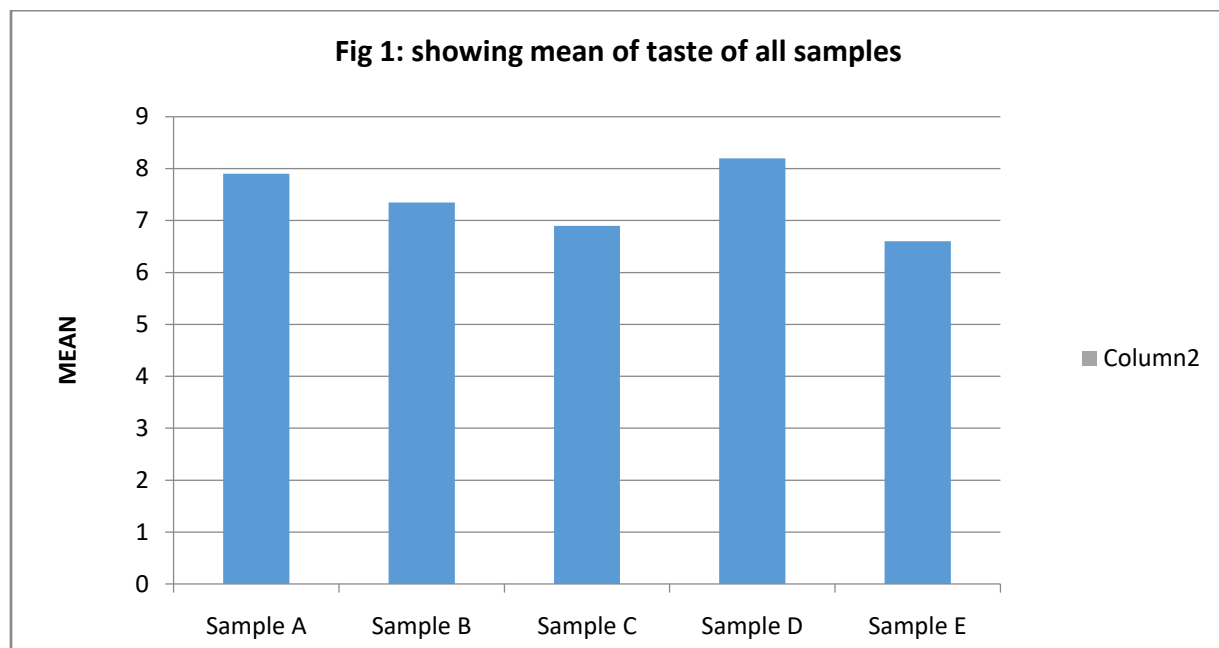
Samples	Sample A	Sample B	Sample C	Sample D	Sample E
Taste	7.95±0.68 ^b	7.35±0.48 ^c	6.9±0.71 ^d	8.2±0.69 ^a	6.6±0.50 ^e
Colour	7.9±0.788 ^a	7.05±0.60 ^d	7.2±0.52 ^c	7.75±0.44 ^b	6.6±0.59 ^e
Texture	7.8±0.77 ^a	7.5±0.15 ^b	7.1±0.78 ^d	7.45±0.60 ^c	6.55±0.68 ^e
Firmness	7.75±0.71 ^a	7.55±0.51 ^b	6.95±0.60 ^d	7.35±0.48 ^c	6.45±0.510 ^e

Stickiness	7.95±0.604 ^a	7.15±0.81 ^d	7.3±0.47 ^c	7.3±0.470 ^b	6.4±0.50 ^e
Crispiness	7.35±0.489 ^a	7.1±0.64 ^d	7.1±0.55 ^c	7.25±0.44 ^b	6.55±0.686 ^e
Acceptability	7.95±0.75 ^a	7.4±0.753 ^c	7.125±0.60 ^d	7.4±0.502 ^b	6.2±0.410 ^e
Overall	7.95±0.686 ^b	7.325±0.63 ^c	6.75±0.59 ^d	8.4±0.475 ^a	6.275±0.525 ^e

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

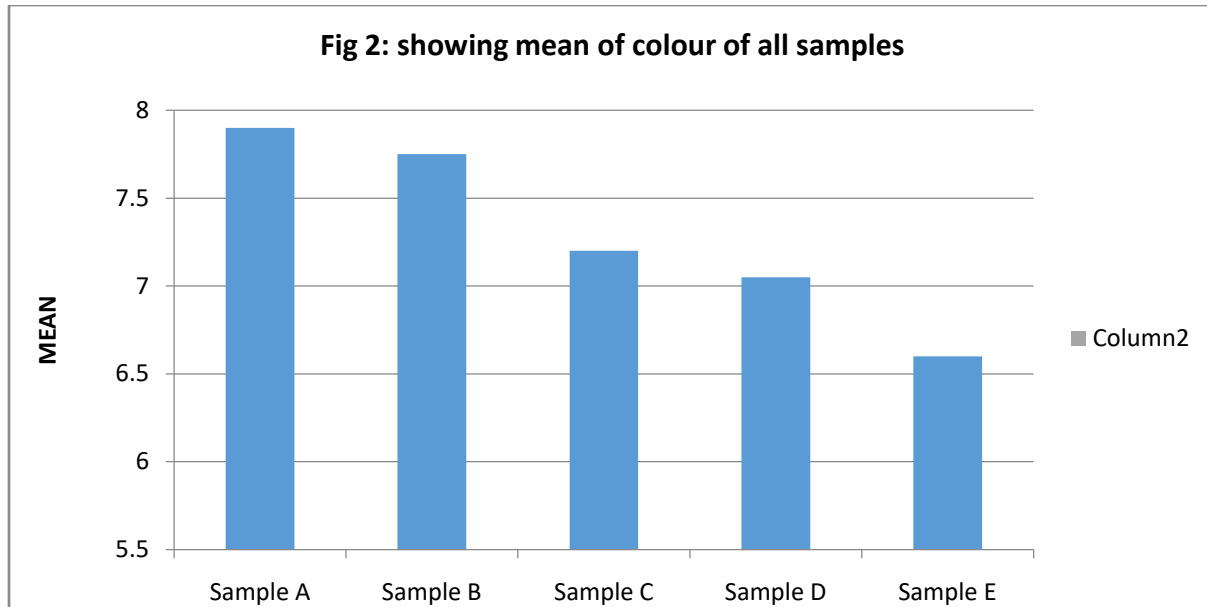
Taste:

Sample D had the most preferred taste based on the assessment with a rating of 8.2. Sample A was the next preferred having a score of 7.9. Sample B was next in the line with a taste score of 7.3. Sample C and sample E were seen to have the least score in the taste category by the subjects who tasted.



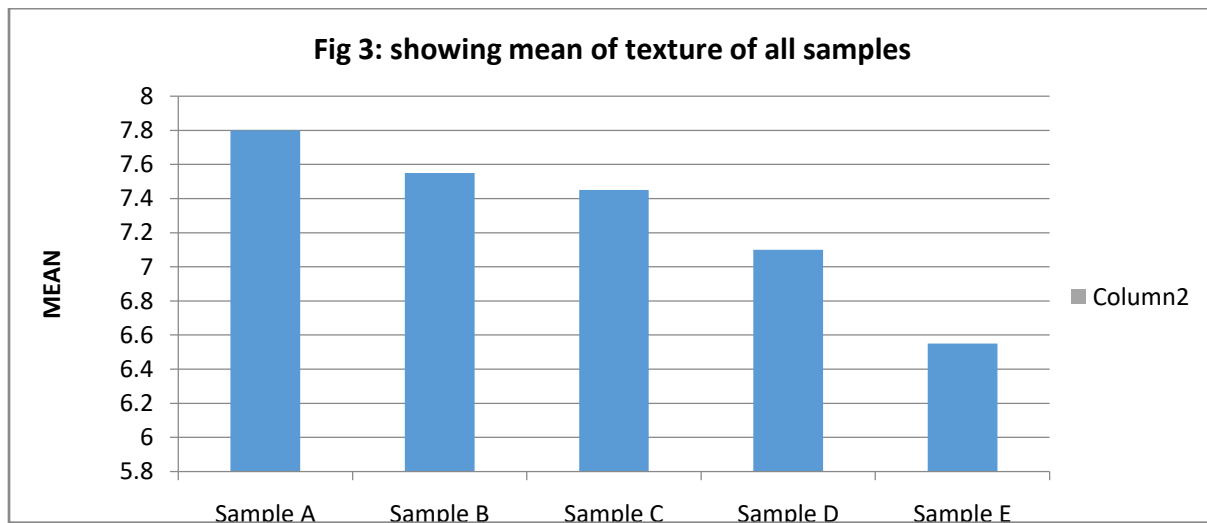
Colour:

The colour category was led by Sample A with a rating of 7.9. It was followed Sample D with rating score of 7.75. Sample C and Sample B were next in the line with the rating score of 7.2 and 7.05 respectively. This leaves the Sample E with the least scoring rate of 6.6.



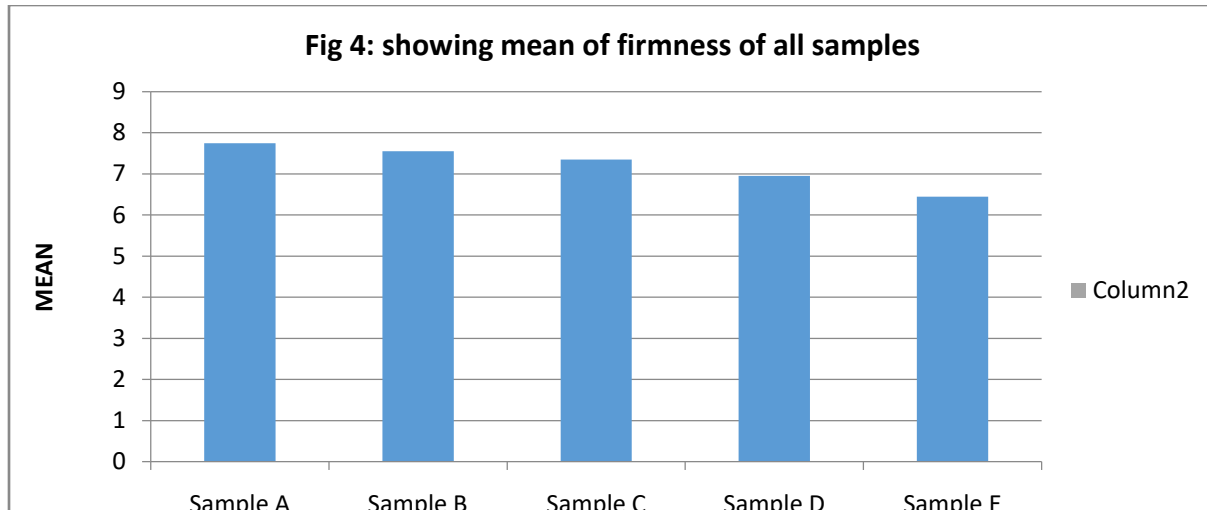
Texture:

The texture category was led by the Sample A with a rating score of 7.8. Sample B was next in the line with a scoring rate of 7.5. It was followed by the sample D and sample C with a rating score of 7.4 and 7.1 respectively. Sample E received least scoring rate of 6.55.



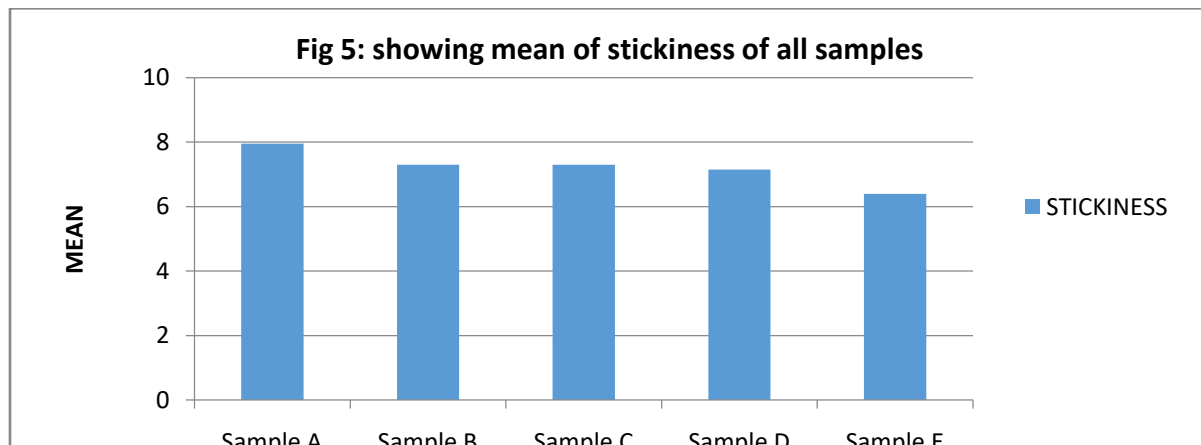
Firmness:

Firmness category was led by the sample A with a scoring rate of 7.75. Sample B followed the Sample A with a rating score of 7.55. Sample D was next in the line with a scoring rate of 7.35. Sample C and Sample E received the least scoring rate of 6.95 and 6.45 respectively.



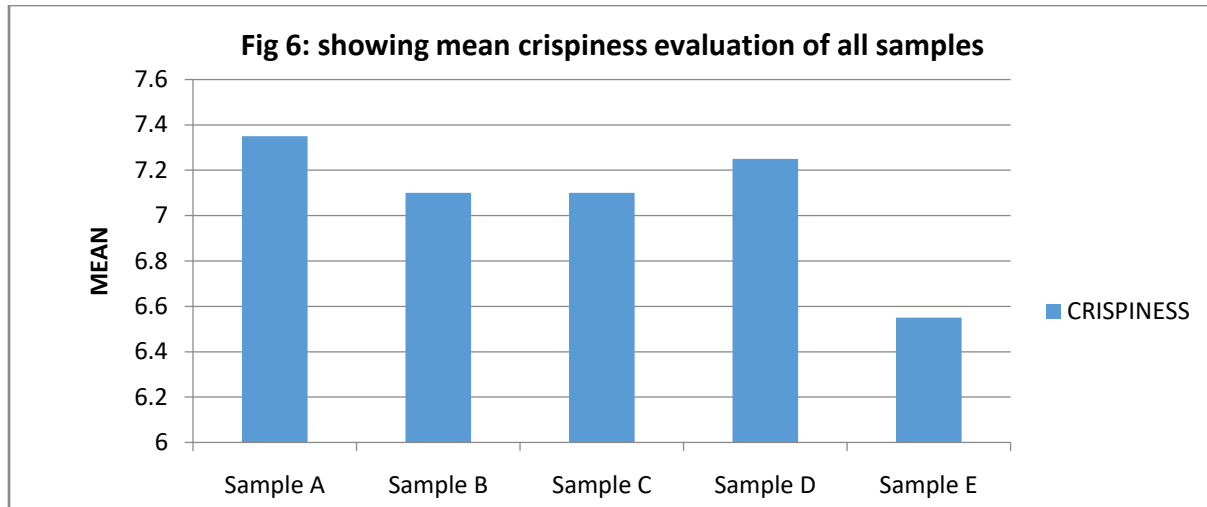
Stickiness:

Sample A was first in the category of stickiness with a rating score of 7.95. There was a tie in the rating scores of Sample D and sample C with a rating score of 7.3. Sample B and Sample E received the least scoring rate of 7.15 and 6.4 respectively.

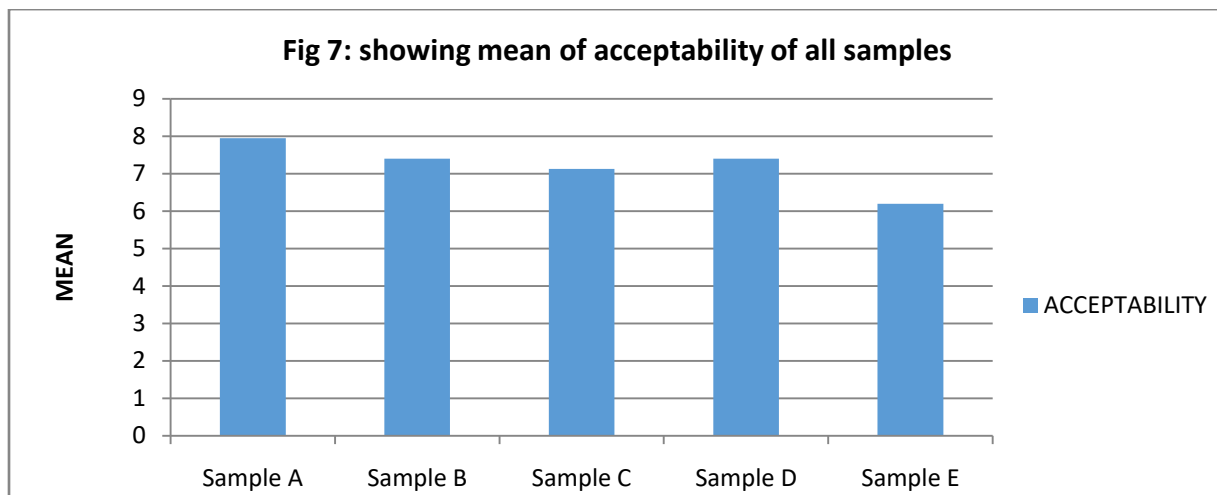


Crispiness:

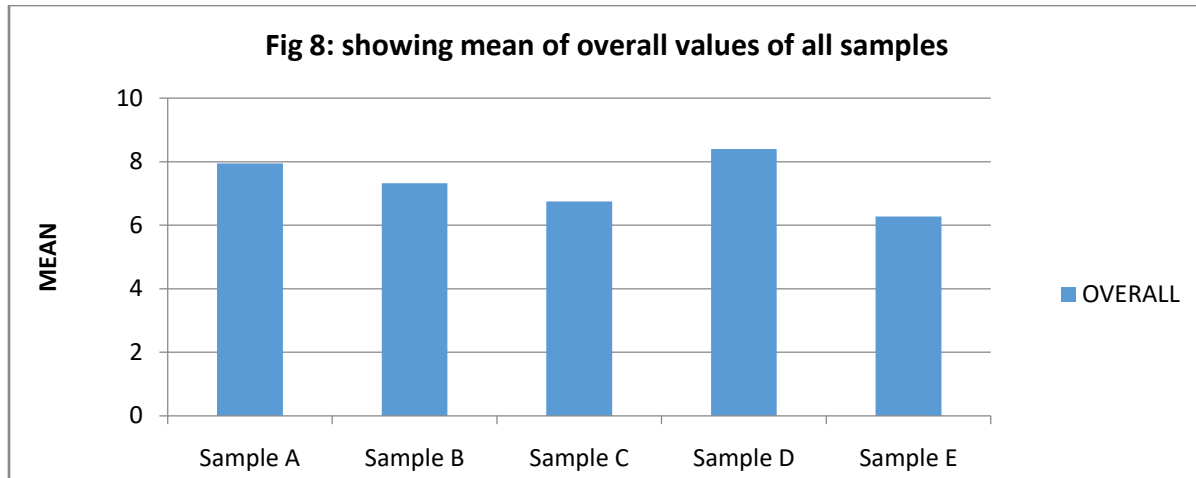
This category was led by the Sample A with a rating score of 7.35. It was followed by the Sample D which had a score of 7.25. Sample B and Sample C had a tie for this category with the scoring rate of 7.1. This leaves the Sample E in the last with a scoring rate of 6.55.

**Acceptability:**

Sample A led the category with the rating score of 7.95. This was followed by Sample B and Sample D with a score of 7.4. Sample C was next in the line with a rating score of 7.125 and leaves the Sample E at the end which had a score of 6.2.

**Overall:**

Sample D was the most preferred overall sample of all with a rating score of 8.4. This was followed by the Sample A with the rating score of 7.95. Sample B was next in the line which had a rating score of 7.325. This leaves the Sample C and Sample E in the last with a rating score of 6.75 and 6.275 respectively.



Food Product Nutritive value result

Sample D 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, carbohydrates, protein, fat, ash, and dietary fiber was carried out on the developed food product. The result values are computed per 100g.

Table no.3. Nutritional Composition of the Final Food Product

Parameters	Results
Energy	289.53kcal
Carbohydrate	46.74gm
Protein	13.65gm
Fat	5.53gm
Ash	1.65gm
Dietary fiber	16.8gm

Interpretation of results.

The result indicates that the developed food product is low calorie product. It is observed to be rich in fiber, carbohydrates, and protein content. The healthy present in the product is in the form of omega-3 and omega-6.

Conclusion

This particular research was unique and quite interesting. The whole idea of this research was to develop a product which could be used as a snack which has good nutritional qualities and health benefits. The ingredients were chosen by doing a thorough study of the researches and keeping in mind the therapeutic uses of the final product that would be made out of the selected ingredients. The materials used in developing this product were collected from the market. Chia seeds were soaked for 15 minutes; oats were roasted till turned brown and developed a roasted flavor, dates and almonds were ground along with oats. Oats, almonds, and dates were ground together to form a fine paste kind of and then chia seeds were incorporated and in the last ladoos were made. Finally the five varied samples were made. This product used as a sweet dish and also with milk although this product provides the requirement of fiber and protein. Based on this research, we can say that this product is pretty low in calories. The product can be eaten as a snack or as a in between meal replacement. This product does not take too much time to be prepared and the ingredients used in developing this product are natural and does not have any side effect as such. It has good sensory properties. This product can be used for the people who are looking for weight loss, people who are diabetic, and who are suffering from cardiovascular disorders.

Researches have shown that chia seeds “superfood” are high in easily digestible protein, essential fatty acids, vitamins, soluble fiber, antioxidants, minerals, and are a digestive, disinfectant, febrifuge and ophthalmic. Chia seeds have been reported to be used for their nutritional and medicinal properties, endurance for athletes, for suppressing the appetite, weight loss, leveling blood sugar, and for aiding intestinal regularity.

This product is a good choice for diabetics as chia seeds forms a gel when they are consumed, thus creating a physical barrier between carbohydrates and digestive enzymes and slows the conversion of carbohydrates into sugars.

For weight loss this product would be the best choice as a meal replacement. Being high in fiber, and protein and low in calorie, it has potential to reduce weight. Because chia seeds are appetite suppressant. Chia seeds have hydrophilic properties, and can absorb more than 12 times its weight in water. Because of this, chia seeds can prolong hydration, helping retain moisture and

regulate more efficiently the body's absorption of nutrients and body fluids, including electrolyte balance. Oats being a part of this product give its additional aids in reducing hyperglycemia, hyperinsulinaemia, and hypercholesterolemia. Soluble fiber content of oats (β -glucan) makes it an appropriate choice for diabetics and people suffering from hypercholesterolemia. Because studies have found the effect of β -glucan in management of hyperglycemia, weight control, lipid levels. Almonds were chosen to make this product more effective in its beneficiary roles; almonds have a unique nutrient composition, such as monounsaturated fat, fiber, and α -tocopherol, minerals like magnesium and copper, and phytonutrients. This unique composition makes it suitable for hypercholesterolemia and modifiable cardiovascular and diabetes risks, such as body weight, glucose homeostasis, inflammation, and oxidative stress.

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