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Acceptability and evaluation of protein and phyto-nutrients rich ready to cook flour mix using lotus stem, chis seeds & flax seeds

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Abstract
Convenience food created as an easy way to get and consume but they have excessive amounts of sodium, sugar, and saturated fats. This study is aimed to develop a protein and phyto nutrient rich ready to cook flour mix using lotus stem, chia seeds and falx seeds. Lotus stem have been found to be rich in dietary fiber, vitamin C, potassium, thiamin, riboflavin, vitamin B_6 and iron while low in saturated fat. Flax seeds and Chia seeds are rich in omega-3 fatty acid, fibre, minerals and high quality protein. The developed products were made protein rich by supplementing protein powder. Many variations of flour mix were prepared using various amounts of protein power, lotus stem, chia seeds and falx seeds and their sensory evaluation were performed. Chemical evaluations were also performed using acceptable products. The results showed that the developed products very rich in nutrients compared to branded product.

Keywords: lotus stem, chia seeds and falx seeds, flour mix (ready to cook)

1. Introduction

Nutrients present in various foods plays an important role in maintaining the normal functions of the human body. The major nutrients present in foods include carbohydrates, proteins, lipids, vitamins, and minerals. Besides these, there are some bioactive food components known as "phytonutrients" that play an important role in human health. They have tremendous impact on the health care system and may provide medical health benefits including the prevention and/or treatment of disease and various physiological disorders. Phytonutrients play a positive role by maintaining and modulating immune function to prevent specific diseases.

Most convenience foods provide little to no nutritional value and have excessive amounts of sodium, sugar, and saturated fats although it doesn't require a lot of preparation and is easy for consumption. Everyone should avoid these types of foods, mainly those individuals with health conditions like heart disease, hypertension, or diabetes [1, 2]. Although phytonutrient is very important for our health, proteins are building block of bones, muscles, cartilage, skin, and blood. Our body uses protein to build and repair tissue. We need it to make enzymes, hormones, and other body chemicals. In this present investigation we tried to make a protein and phyto nutrient rich ready to cook flour mix using lotus stem, chia seeds and falx seeds.

Fig 1: Lotus Stem

Lotus stem is an indigenous vegetable (underwater rhizome of plant lotus) confined to selective cuisines of South East Asia. Lotus stem is a nutritionally balanced food-low in fat but high in protein, minerals and vitamins. Lotus stem have been found to be rich in dietary fiber, vitamin C, potassium, thiamin, riboflavin, vitamin B_6, phosphorus, copper, manganese, and iron while very low in saturated fat [3].

Flax is a blue-flowered plant grown in the cool, northern climate of the western Canadian prairies and northern United States. The seed from flax can be consumed in whole seed, milled (ground), or oil form. It is a powerhouse of disease-fighting compounds, such as the omega-3 fatty acid, alpha-linolenic acid (ALA), fibre, lignans (which are powerful antioxidants) and high quality protein. Flaxseed has been found to help protect against heart disease, inflammatory disorders and certain cancers. The mild nutty flavour of flaxseed adds flavor, nutrition, and health benefits to a variety of foods [4, 5].

Chia seeds come from the desert plant *Salvia hispanica*, a member of the mint family. *Salvia hispanica* seed often is sold under its common name "chia". Its origin is believed to be in Central America where the seed was a staple in the ancient Aztec diet. The seeds of a related plant, *Salvia columbariae* (golden chia), were used primarily by Native Americans in the southwestern United States. Chia seeds have recently gained attention as an excellent source of omega-3 fatty acid. They also are an excellent source of fiber, and contain protein and minerals including iron, calcium, magnesium and zinc. Emerging research suggests that including chia seeds as part of a healthy diet may help improve cardiovascular risk factors such as lowering cholesterol, triglycerides and blood pressure [6].

2. Materials and Methods

2.1 Procurement of raw materials

All the raw material including Lotus stem, Flax seeds and Chia seeds were purchased from the local market of Kolkata, India. To prepare ready to cook flour mix Lotus stem, Flax seeds and Chia seeds were sundried and ground into a fine powder using household grinder.

2.2 Development of product

For the product development muffins were made from the ready to cook flour mix. Basic ingredient of the of the flour mix given below, which is considered as basic recipe (Table: 1).

Table 1: Basic recipe / Basic ingredient of flour mix

Ingredients	Amount (gms)
All-purpose flour	35
Powdered Milk	10
Sugar	5
Baking powder	5
Cooking soda	2.
Butter	5 (need to add)
Cold water	As per required

Based on this basic recipe variations were done in the ingredients (Specially with 35 gms of all purpose flower) to make the ready to cook flower mix, which is protein and phyto neutrient rich. List of the variation was given below (Table: 2).

Table 2: Different variation of ready to cook flour mix (variation was done with only all purpose flour, while other ingredients remain constant)

Variations code	Ingredient
Variation A	2.5 gm of lotus stem powder + 10 gm of protein powder + 22.5 gm flour
Variation B	5 gm of lotus stem powder + 10 gm of protein powder + 20 gm flour
Variation C	7.5 gm of lotus stem powder + 10 gm of protein powder + 17.5 gm flour
Variation D	10 gm of lotus stem powder + 10 gm of protein powder + 15 gm flour
Variation E	5 gm of lotus stem powder + 5 gm flax seed + 5 gm Chia seed + 20 gm flour
Variation F	5 gm of lotus stem powder + 7.5 gm flax seed + 7.5 gm Chia seed + 15 gm flour
Variation G	5 gm of lotus stem powder + 10 gm flax seed + 10 gm Chia seed + 10 gm flour
Variation H	5 gm of lotus stem powder + 15 gm flax seed + 15 gm Chia seed + 10 gm flour

2.3 Sensory Evaluation

Muffins were made with different variation and sensory evaluation performed by 20 panel members of J.D Birla Institute, Kolkata. Attributes to be scored were colour, appearance, flavour, texture, taste and overall rating. A sensory evaluation sheet was placed. The panel members were briefed with the process of evaluation. Acceptability of recipes was evaluated from the ratings obtained through the score card using 9 point hedonic scale during the sensory evaluation and comparative study between the products was done [7].

2.4 Chemical Analysis

For chemical analysis Protein [8], Fats [9], Carbohydrate [10], Iron [11], Calcium [12] and Vitamin C [13] levels were estimated. All the chemical analysis was done for the most accepted variations and a popular branded product. Protein was estimated by Biuret method. Carbohydrate was estimated by Anthrone method. Fat was estimated by Soxhelt method. Iron was estimated by thiocyanate method. Calcium was estimated by EDTA titration method and Vitamin C was estimated by redox titration method.

3. Result & Discussion

All the results were analyzed statistically using mean and Standard Deviation.

3.1 Sensory Evaluation

Acceptability of variation product/ recipe including basic were evaluated from the ratings obtained through the score card using 9 point hedonic scale during the sensory evaluation and comparative study between the products was done.(Table 3) Results showed that Variation B, C, F. G is most accepted recipe compared to others.

Table 3: Sensory evaluation of different variations

	Appearance	Colour	Taste	Texture	Odour	Overall rating
Variation A	8.7 ± 0.44	8.6 ± 0.49	8.6 ± 0.36	8.6 ± 0.37	8.4 ± 0.49	8.6 ± 0.51
Variation B	8.3 ± 0.49	8.5 ± 0.45	8.5 ± 0.35	8.5 ± 0.33	8.5 ± 0.17	8.7 ± 0.23
Variation C	8.5 ± 0.53	8.4 ± 0.51	8.4 ± 0.82	8.5 ± 0.74	8.5 ± 0.79	8.5 ± 0.45
Variation D	8.0 ± 0.53	8.1 ± 0.5	8.0 ± 0.49	8.1 ± 0.46	8.0 ± 0.49	8.0 ± 0.49
Variation E	8.0 ± 0.52	8.5 ± 0.5	7.3 ± 0.6	7.4 ± 0.7	8.1 ± 0.35	7.5 ± 0.71
Variation F	8.0 ± 0.53	8.5 ± 0.51	8.1 ± 0.35	7.5 ± 0.5	8.1 ± 0.35	7.8 ± 0.64
Variation G	8.5 ± 0.75	8.5 ± 0.51	7.8 ± 0.46	7.5 ± 0.88	7.8 ± 0.7	7.8 ± 0.46
Variation H	7.5 ± 0.53	7.6 ± 0.75	6.4 ± 0.88	6.7 ± 1.3	7.6 ± 0.75	6.8 ± 1.06

3.2 Chemical analysis

Protein, carbohydrate and fat were estimated using most accepted variation of ready to cook flour mix and popular branded product. It was found that the amount of protein is high in variation B C F G compared to basic and branded product. Whereas amount of carbohydrate is low in variation B C F G compared to basic and branded product. (Fig 1)

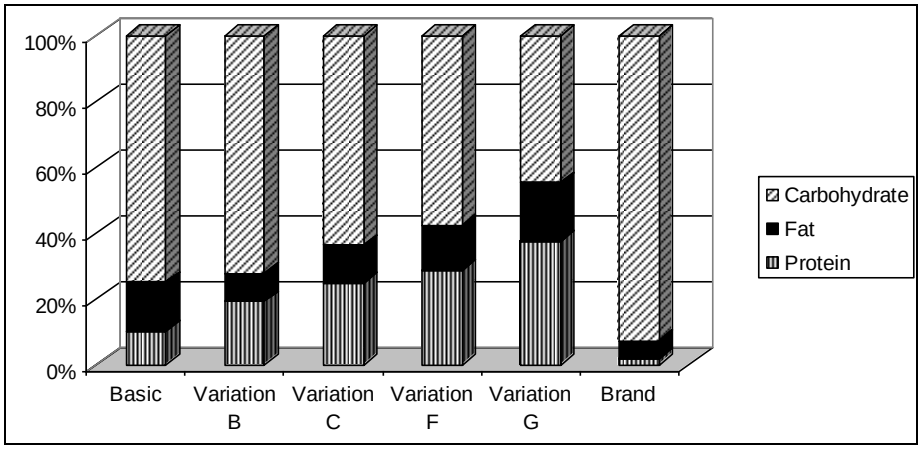

Fig 2: Graphical presentation of the amount of protein, carbohydrate and fat present in different variation and branded product.

In case of Iron, calcium and vitamin C, it was found that the amount of iron, calcium were high in variation B C F G compared to basic and branded product where as vitamin C showed not much variation (Table: 4)

Table 4: Amount of Calcium, Iron and Vitamin C in different variation and brander product.

Parameters	Basic	Variation B	Variation C	Variation F	Variation G	Brand
Calcium (mg/100 gm sample)	650 ± 15.5	930 ± 22.3	1040 ± 26.7	950 ± 21.9	1400 ± 26.3	680 ± 17.4
Iron (mg/ 100gm sample)	0.22 ± 0.06	0.26 ± 0.09	0.31 ± 0.09	0.32 ± 0.1	0.39 ± 0.1	0.2 ± 0.07
Vitamim C (mg/100 gm sample)	18.55 ± 4.5	17.25 ± 3.8	15 ± 2.7	16.25 ± 3.2	16.75 ± 2.7	15.5 ±2.9

4. Conclusion

All the results indicate that developed products are richer source of protein, iron and calcium compare to ready to cook brand and the basic products. Highest amount of protein and nutrients present in it Variation G followed by Variation F, C & B. The branded and the basic have the least amount of nutrients and are only rich in carbohydrates and/or fats. Analysis of results indicates that only protein supplement can not make the food nutrition rich. Supplementation of phytonutrient is also important. Here in this investigation it was found that Variation G and F were more nutrition rich compared to Variation B and C. Variation B and C was only supplemented with protein powder and Lotus stem. Whereas Variation F and G were supplemented with lotus stem, flax seed and chia seed, which make the product more calcium, iron and protein rich. So it can be concluded that developed ready to cook flour mixes were accepted by panel member (Table: 3, Sensory evaluation data) and nutritionally rich compared to basic and ready to cook branded product.

5. References

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