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Formulation of ready to eat high protein chunks (HPC)

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Abstract
The present investigation entitled Formulation of ready to eat high protein chunks (HPC) was conducted with an idea to prepare protein rich convenient product. To cater the demands of protein in daily requirement of the individuals or for individuals who are required to build muscles, during pregnancy or breast feeding. There is a need to develop protein rich product that can supplement individual's protein requirements. Ready to eat foods are group of products that already went through the processing and are packed and ready for consumption. According to 2009 US Food code (FDA, 2009) RTE food should be in edible form without any additional step achieving food safety. For chunks (70g): Soy Nuggets (6.2g), Protein Crisp (6g), Whey protein concentrate 80% (5g), Skim milk powder (13g), Almond flakes (2.3g), Almond pistachio (2.3g), Honey (21g), Sun flower oil (11g), Quinoa (4g), For chocolate coating 30g: Cocoa (5%), Powdered Sugar (6%), Lecithin (1%), Skim milk powder (15%), Water (3%) were used in the preparation of Gluten free high protein Chunks (HPC). These HPC were analysed for their nutritional and sensory parameters. The developed product was highly liked by the participants. This product can be a good source of protein for the individuals who required to supplement their protein intake and in a ready to eat convenient form.

Keywords: High protein chunks, protein supplementation, ready to eat

Introduction
Protein malnutrition is widely recognized health problem and majorly prevalent in the cereal-based dietary pattern of population. Globally, human dietary patterns range substantially in the degree of inclusion vs. avoidance of animal-based foods. Food such as nuggets and chunks are the good example of convenience food that is preferred by consumers. Many consumers wanted a product with high nutrition and sensory characteristic similar to meat products either for personal perception or health, consumers prefer product that can accurately mimic High protein animal product and, if possible, add nutritional values and acceptable functional properties and in some cases reduce product cost as well. [12, 15]

1. Soy Nuggets: They are the high source of protein and poly-unsaturated compounds and only legumes which have ample amount omega 3 fatty acid. In 100 grams of soy nuggets it contains 446 calories, 36.4 gram of protein, 19.9 gram of fat. It enhances bone health and digestibility and very good source of minerals namely – magnesium, iron, calcium. It is also known to reduce osteoporosis in menopausal women. It has certain anti-thyroid compounds which help to cure thyroid. It has all essential amino acid.[12]

2. Whey Protein Concentrate: It is protein rich, dairy by product. It is popular protein supplement. It includes weight loss and lowering cholesterol. It is a mixture of beta-lactoglobulin, alpha lactalbumin, bovine serum albumin and immunoglobins. It has anti-cancer properties.[11]

3. Quinoa: Quinoa is the seed of a plant known as Chenopodium quinoa. It is very high in nutrients, and known as superfood. It has crunchy texture and nutty flavor moreover it is gluten free. It is usually boiled and consumed as side dish. It consists of 4.4% protein and 1.92% fat. It consists of manganese, phosphorus, copper.

4. Honey: Nectar is a sweet fluid made by honey bees utilizing the nectar from blooms. It is reviewed by shading, with the reasonable, brilliant golden nectar frequently getting a higher retail cost than the darker assortments. The kind of a specific sort of nectar will fluctuate dependent on the sorts of bloom from which the nectar was collected. Both crude and sanitized types of nectar are accessible. Crude nectar is expelled from the hive and packaged straightforwardly, and in that capacity will contain follow measures of yeast, wax, and dust. Devouring neighborhood crude nectar is accepted to help with regular sensitivities, because of rehashed presentation to the dust in the region. Purified nectar has been warmed and prepared to expel pollutions. Nectar has elevated amounts of mono saccharides, fructose, and glucose, and it contains around 70 to 80 percent sugar, which gives its sweetness. Nectar additionally has germicide and antibacterial properties. Present day medicinal science has figured out how to discover utilizes for nectar in incessant injury the board and battling contamination.[13]

5. Sunflower Oil: Sunflower oil, often referred to as sunflower seed oil or sun oil, is obtained from the seed of the plant Heliantbus annus which is native to North America. The wax concentration from high-oil hybrid seed for non-dehulled oil to be .03% to .05% with dehulled oil from 0.008% to 0.015%. About 85% of the wax in crude sunflower oil comes from the hull, the rest from the seed

and pericarp. [8]

6. Skim Milk Powder: Skim milk powder is nutritious. Powdered milk has the same nutrition as fresh milk. It provides bone-building nutrients such as protein, calcium, vitamin D and vitamin A. Children under two years of age should not drink skim milk or milk made from skim milk powder because it does not have enough fat for healthy growth.[7]

7. Lecithin: Lecithin is a nonexclusive term to assign any gathering of yellow-caramel greasy substances happening in creature and plant tissues, which are amphiphilic – they pull in both water and greasy substances, and are utilized for smoothing nourishment surfaces, emulsifying, homogenizing fluid blends, and repulsing staying materials.[2]

8. Almond flakes: The almond is a species of tree native to Mediterranean climate regions of the Middle East, but widely cultivated elsewhere. The almond is also the name of the edible and widely cultivated seed of this tree. It has 3.5 fibre, 6 grams of protein and 14 grams of fat.[4]

The use of protein sources like soybean and whey concentrates along with Quinoa, as a supplement to the regular diet may be a possible solution to fulfil protein and to overcome the malnutrition problem in the vulnerable groups. The present investigations were carried out to formulate and develop a high protein chunks as convenient food. Nutritional and sensory quality characteristics of the product were evaluated. [10]

2. Materials and Methods

Procurement of Raw Material

All the raw material used in the formulation of product was procured from local market.

Formulations and preparation of HPC

Two formulations of high protein chunks were done with different percentage of outer covering. Ingredients which were used for the main body constitutes of 68.5g which are soy nuggets (6.2%), protein crisp (6%), Whey Protein concentrate 80% (5%), Skim Milk Powder (13%), Almond Flakes (2.3%), Almond Pistachio (2.3%), Honey (21%), Sunflower oil (11%) and Quinoa (4%). These formulations were formulated with slide modifications of chunks according to Mona *et al*. (2011)

Ingredients which were used for the outer covering constituted of 30g which consisted by Cocoa (5%), powdered sugar (6%), Lecithin (1%), Skim Milk Powder (15%), Water (3%). (As depicted in Table 1 and Table 2)

HPC preparation started by mixing all the dry ingredients of main body which included soy nuggets, protein crisp, WPC 80%, skim milk powder, almond flakes, almond pistachio, Quinoa. After that, Honey is mixed for 3 minutes. Subsequently, sunflower oil was mixed together for 3 minutes. In order to ensure that all the ingredients were smoothly mixed together. Finally, the mixture was refrigerated at 40C before coating process.

To prepare the mixture of outer covering, first mix dry ingredients which included cocoa powder, powdered sugar, skim milk powder after mixing it then add lecithin in to it and mix well after that add water in to it and after that heat the mixture at 50C until unless it becomes thick.After this, mix outer covering and main body and moulded in to desire shape and then keep it in to deep freezer with 100C for 24 hrs. (Figure 1 and Figure 2)

Moisture content

Moisture content of HPC was analysed using mechanical moisture analyser (HPC-FND/004). Initially, each crunch was weighed at 4.0 g and was heated at 105 ºC. Heating pattern in this apparatus was used the standard drying where the temperature was maintained throughout the whole analysis. The percentage of moisture content was measured by calculating difference of wet weight and dry weight of sample.

Ash content

The total ash content of fried nuggets was determined according to the AOAC (1990) Method 923.03 using conventional dry-ashing according to manufacturer's instruction. The percentage of crude ash was calculated using the following equation.

Crude ash (Dry basis) (%) = [W1 / W2] x 100

Where: W1 = weight after ashing; W2 = weight before ashing.

Protein content

The nitrogen content of fried nuggets was analysed using Kjeldahl method (AACCI, 1995) Method 46-11.02. It has 3 steps. The percentage of crude protein is expressed as total of nitrogen percentage and was multiplied by a factor of 6.25, which was the nitrogen-protein conversion factor for meat and grain sample. The percentage of crude protein was calculated using the equation.

Crude protein (%) = Nitrogen (%) in samples x 6.25

Fat content

Fat analysis was done using Automatic Soxhlet extraction method (Soxhterm® extractor, Gerhardt). Prior to analysis, each 5.46 g of chunks is converted in to smaller size with the help of pastel mortar and then put the sample in thimble which plugged in lightly with cotton wool. After that, the thimble was put into the extraction beaker that contained boiling stones, and subsequently was added with 150.0 mL of petroleum ether. Finally, the residue of extracted was dried in air drying oven at 105°C for overnight, and cooled in desiccator. The percentage of fat content of samples was calculated using following equation.

Fat (%) = [(W1 – W2)/ W0] x 100

Where: W0 = weight of chunks sample; W1 = Total weight of extraction beaker with boiling stones and extracted fats; W2 = Total weight of extraction beaker and boiling stones.

Carbohydrate content

The carbohydrate content of HPC was determined as available carbohydrate and was calculated using following equation.

Carbohydrates (%) = 100 – [moisture (%) + ash (%) + protein (%) + fat (%)]

Hedonic test

Sensory test of HPC was conducted in individual booths at the Sensory Laboratory. A total of 50 panelists were participated in this test to evaluate the products. In this study, a Hedonic scale of 9-points was used and the attributes were appearance, texture, odour, taste, mouth feel and overall acceptance. Both samples were moulded in to circular shape and it was presented to panelists in a plate with three-random-digit coded number to avoid bias. The score was based on a 9-point Hedonic scale ranging from 1 (extremely dislike) to 9 (extremely like).

Statistical Analysis

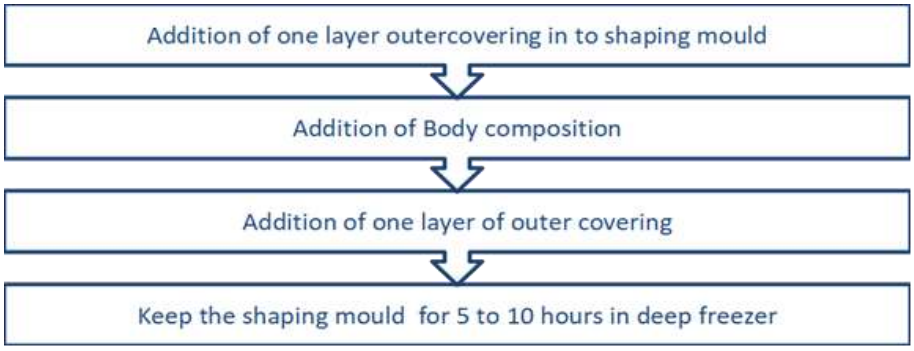
Means and Standard deviations were determined for all the parameters is reported.

Table 1: Ingredients used for the formulation of HPC

S. No.	Ingredients	Amount
1.	Soy Nuggets	6.2%
2.	Protein Crisp	6%
3.	WPC 80%	5%
4.	Skim Milk Powder	13%
5.	Almond Flakes	2.3%
6.	Almond Pistachio	2.3%
7.	Honey	21%
8.	Sun Flower Oil	11%
9.	Quinoa	4%

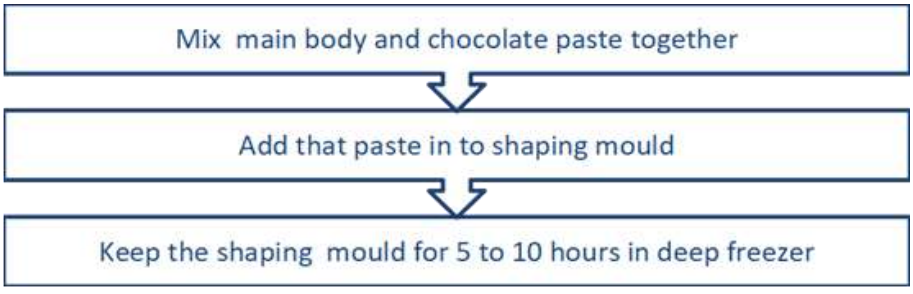
Table 2: Ingredients used for the coating of HPC

S. No	Ingredients	Amount
1.	Cocoa	5%
2.	Powdered Sugar	6%
3.	Lecithin	1%
4.	Skim Milk Powder	15%
5.	Water	3%



Sample 1:

Fig 1: Prepared Sample 1



Sample 2:

Fig 2: Prepared Sample 2

Results & Discussion

Proximate Analysis of the Product

The moisture, ash, protein, fat, and carbohydrate contents of both the samples are shown in Table 2. The protein content of both the samples was 23.23 and 22.98 percent (Table 2). A combination of diversified ingredients as used in this research project is highly effective to combat deficiency of protein as they provide a good quality protein. Using soy nuggets and skim milk powder together improved the protein quantity and sensory quality in crunches. This product may serve a good alternative to animal protein products and provide a convenient tasty protein source. Quinoa further improves the nutritional value is also a good functional component. The inclusion of nuts into crunches ensures better nutrition due to the presence of a combination of monounsaturated and polyunsaturated along with saturated fatty esters with glycerol molecules.

Table 3: Proximate Analysis of the HPC (100 gm)

Parameters	SAMPLE1	SAMPLE2
Moisture (%)	19.41 ± 0.21	17.37 ± 0.12
Fat (%)	10.72 ±0.14	9.86 ±0.17
Protein (%)	23.23 ±0.32	22.98 ±0.55
Carbohydrate (%)	39.58 ±0.04	41.96 ±0.47
Ash (%)	3.045 ±0.27	2.817 ±0.07

Values depicting Means ± standard deviation

Sensory Analysis

Mean sensory scores for color, flavour, taste, texture and mouthfeel and overall acceptability has been depicted in Table 3. Both the samples were liked by panellist. Flavor, texture, taste and overall acceptability, of the product was enhanced by the presence of nuts, andquinoa and colour has been attributed by cocoa covering on the sample.Soy nuggets are responsible for crisp nature and crunchy texture in addition to providing better taste and fruitful flavor to the final product.

Table 3: Sensory characteristics of NPC

Sample	Color	Texture	Flavor	Taste	Mouthfeel	Overall Acceptability
1	7.5±0.55	7.67±0.52	7.30±0.55	6.83±0.75	7.54±0.46	7.36±13
2	7.3±0.82	6.50±0.55	6.87ab±0.82	6.93±0.52	7.24±0.3	6.98±0.8

Conclusions

Nutritional property of the product was increased by adding protein rich sources such as soy nuggets, protein crisps, quinoa seeds. This product provides good amount of nutrition in terms of fats, proteins and carbohydrates and also help in giving high energy to the consumer on the go as it is convenience food. The product can be consumed by the all age group and need to be stored in cool place and preferably in a freezer. It is a ready to eat high protein convenient product. The developed product will help in supplementation of the individual's protein need of vulnerable segment and those having different physiological needs like during pregnancy, lactation or may be to athletes. Energy provided by sample 1 is 347.72kcal and sample 2 is348.37kcal. This can also solve a number of problems related to malnutrition which exist in our society like PEM in children.

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