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Development and Standardization of Protein Mix Products for Enhancing Nutritional Recovery and Performance

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ABSTRACT

Protein is an essential macronutrient for body function and to improve athletic performance by enhancing the right muscle mass in the athlete. Protein and amino acid supplements are popularly known for sports personalities and active individuals as muscle-boosting, performance-intensifying products, and high-protein, low-carbohydrate diets are traditionally applied for weight-loss purposes. The study aimed to identify different protein sources for the mix, assess its protein content, and evaluate its acceptability and palatability. The present study aims to develop a protein mix product that provides intensified nutritional support for recovery and enhances athletic performance. The ingredients were chosen for their protein content, micronutrient profile, and potential muscle recovery and growth benefits. Two variants of the protein mix were prepared and analyzed for their macronutrient composition. Sensory evaluation of both variants was conducted using the 9-point hedonic scale, assessing parameters such as color, appearance, aroma, consistency, taste, and overall acceptability. The results showed that Variant 2 received higher mean scores in all parameters compared to Variant 1, indicating its superior acceptability among the panelists and chosen for further study. It was found that Variant 2 of the protein mix contains 22.35 kcal of energy, 2.3g of carbohydrates, 1.1g of protein, and 0.9g of fat per 5g of powder; hence, it can be recommended as a recovery drink mix for athletes, providing a balanced ratio of carbohydrates and protein.

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Abbreviations

ICMR: Indian Council of Medical Research

NIN: National Institute of Nutrition

ACSM: American College of Medical Research

FSSAI: Food Safety and Standards Authority of India

Introduction

Protein – the body-building warrior, plays a critical role in countless physiological processes in the body. In sports nutrition, athletes are more concerned about muscle gain, which is increased by protein supplementation. Protein and amino acid supplements are widely marketed for athletes and habitually active consumers as muscle growth and performance-enhancing products, and high-protein, low-carbohydrate diets are traditionally applied for weight-loss purpose. The protein source is vital for muscle protein synthesis after any workout and maintains the balance between protein breakdown and synthesis. For athletes, it is essential to maintain a positive protein balance. Protein helps in muscle repair, growth, and differentiation of cells. The demand for protein supplements is increasing enormously, according to a study conducted by. Protein requirements are increased by hard training, and it is often recommended that the protein intake of

strength athletes should be 50 – 100% greater than their sedentary counterparts. In resistance-trained subjects younger than 49, protein supplementation has been suggested to maximize skeletal muscle's anabolic reactions and enhance the adaptive response to resistance training. Some biomarkers of high protein intake have been found to correlate with enhanced muscle function in young adults. Protein consumption before and after resistance training may enhance recovery, resulting in hypertrophy and strength gains. Studies show beneficial effects such as reduced muscle soreness and markers of muscle damage become more evident when supplemental protein is consumed after daily training sessions. A review stated that protein supplements are used during resistance training to enhance gains in muscle mass and strength and during an aerobic- or sport-based training program to enhance gains in aerobic and anaerobic power [1-4].

Problem Statement

The protein mixes currently available are expensive and have some preservatives not recommended for athletes. This product, which has been developed, contains the common ingredients commonly used in households and is very cost-effective. The preparation process is easy and does not require special skills. Athletes need protein after training; instead of supplements, they can mix this protein with carbohydrates and protein.

Materials and Methods

Protein Source Selection

For the preparation of the mix, the following ingredients are selected as

Procurement of Raw Material

The ingredients such as Makhana, Milk powder, Bengal gram, Sunflower seeds, Pumpkin seeds, Cashew nuts, Almonds, and Fennel seeds were procured (per the standards laid down by FSSAI). They were stored in an air-tight container to protect them from pests and insects.

Product Standardization

It is establishing and maintaining a set of product specification. For this purpose, the protein mix is standardized such that the product's overall weight is 100 grams, distributed among the ingredients

Formulation of Protein Mix

Ingredients were roasted well. The ingredients are carefully blended together to retain maximum flavor and nutrition. Composition of the protein mix variants are shown (Table:1)

Table 1: Composition of Protein Mix Variants

Ingredients (g)	Variant1	Variant 2
Milk powder	25	25
Makhana	0	20
Cashew nuts	10	15
Oats	10	10
Almonds	10	10
Pumpkin seeds	5	5
Sunflower seeds	0	5
Fennel seeds	0	5
Bengal gram	35	5
chia seeds	5	0
Total	100g	100g

*V1 is variant 1, V2 is variant 2

Table 2: Macronutrient Analysis of Variants Based on Ifct Food Composition Tables

PARAMETERS	VARIANT -1	VARIANT-2
Energy(kcal)	401	447
Carbohydrate(g)	39	44.8
Protein (g)	22.1	22.2

Results

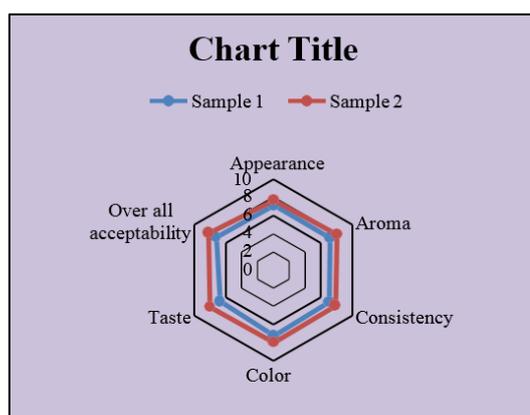
The two variants of protein mix macronutrient contents are analyzed based on IFCT food composition tables (Table:2). Both variants were subjected to sensory evaluation to evaluate texture, color, taste, consistency, aroma and appearance. The Mean and SD of overall acceptability of sample one is 7.32, 0.97, and sample two is 8.23, 0.80. The standard deviation of the sample one parameter is higher except for aroma when compared to sample 2 parameters. The overall acceptability standard deviation is less in sample one when compared to sample 2. (Table:3) (Fig.1). The variant accepted after the hedonic rating scale is further tested for proximate analysis of 7 nutrients (Table:4).

Table 3: Results of the Sensory Evaluation

S.NO.	Mean Score Obtained for Protein Mix		
	Parameters	VARIANT-1	VARIANT- 2
1	Colour	7.32±1.12	7.5±1.07
2	Appearance	7.26±0.9	7.7±0.88
3	Aroma	7.141±0.5	8.09±0.65
4	Consistency	7.11±1.03	7.88±0.89
5	Taste	6.9±1.08	8.11±1.06
6	Overall Acceptability	7.32±0.97	8.23±0.80

Table 4: Proximate Analysis of Accepted Variant-2

Name Protein mix	Energy (kcal)	Carbohydrates(g)	Protein(g)	Fat(g)	Moisture(g)	Total Ash (g)	Dietary fiber (g)
Variant -2	464	54.8	19.95	18.2	3.98	2.98	10.2



*Sample 1 is variant 1
*Sample 2 is variant 2

Figure 1: Graphical representation of the Results of Sensory Evaluation

The above picture depicts acceptability of two variants of protein mix

Protein

To estimate the protein content of the blend, the Kjeldhal method is used from the FSSAI manual for food grains.

The fat content of the protein mix is estimated using the Soxhlet extraction method by the FSSAI manual for food grains.

The carbohydrate content is estimated using the general formula: the total amount of product(100g) minus moisture, Ash, fat, and protein.

Carbohydrates =100 (fat, protein, moisture, Ash) in the protein mix.

Moisture is estimated using the method demonstrated in the FSSAI manual.

Total ash content is estimated by the drying method demonstrated in the FSSAI manual for food grains.

Dietary fiber is estimated using the enzymatic gravimetric method demonstrated by AOAC 985.29, 22nd edition.

Discussion

The main intention of the study is to make a healthy, budget-friendly protein mix for athletes, which will enhance their recovery. The main ingredients used in the protein mix are natural products, and no preservatives are added. All the core ingredients are gluten-free, so athletes sensitive to gluten can also have this protein mix. Makhana is a popped kernel obtained from the gorgon nut, which is gluten-free, rich in protein and can be used for the vegan population. It is used to make gluten-free biscuits and starchy powders. Concerning the above study, makhana is used in the protein blend as it is gluten-free and a good source of protein. Studies reported that oats are a good source of dietary fiber and add satiety. It is gluten-free and a good source of carbohydrates. Considering the above study, oats increase the satiety feel and improve the mix's carbohydrate quality as athletes need enough carbohydrates and protein for healthy recovery. Cashew nuts are added as they are rich in protein and healthy fats. Cashew nut proteins represent an abundant nutrient with a well-balanced amino acid composition and could meet the requirements recommended by FAO/WHO. Cashew nuts are added to increase the protein quality of the blend. Fennel seeds are also one ingredient in the mix as they give a pleasing aroma and help digestion. The gastrointestinal tract is improved by fennel seed extract, suggesting the potential utility of this agent as an alternative or adjunctive therapy in IBD. So, concerning the protein mix, fennel seeds are used for digestion. Apart from the ingredients used, the nutrient profile of the mix is much appreciated as it is rich in energy, healthy fats, protein and carbohydrates. The moisture content of the protein mix is less than 4%; it can be stored for approximately 60 days. Dietary fiber is crucial as it cures other health complications like constipation and improves gut health [5-8].

Conclusion

We developed the protein mix of two variants, 1 and 2, for the benefit of the athletes after training. From the above results among the two variants, Variant 2 has more ratings in all the parameters than Variant 1 and is accepted as a recovery drink mix, giving a 2-3: 1 ratio of carbohydrate and protein for 5g of powder. As per the American College of Sports Medicine, the carbohydrate and protein ratio are 3:1 for optimal glycogen replenishment. So, the protein mix fulfils the requirement as a post-work drink for athletes.

Energy is 23.14 kcal for 5g of powder. Carbohydrates are 2.74g for 5g of powder. Protein is 0.99g for 5g of powder. Fat is 0.9g. since the protein mix requires macronutrients, it can be used as a recovery drink for athletes. This protein mix offers an affordable and accessible alternative to expensive commercial protein supplements. Its development process is simple, requiring no special skills. Utilizing common household ingredients provides athletes a convenient and cost-effective option to support muscle repair, growth, and recovery after training.

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Declarations

The work described has not been published before (except in the form of an abstract. It is not under consideration for publication elsewhere. It's submission to Journal Of Food Technology And Nutritional Sciences publication has been approved by all authors as well as the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright holder, and Journal Of Food Technology And Nutritional Sciences will not be held legally responsible should there be any claims for compensation or dispute on authorship. Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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Consent for publication: Not Applicable

Availability of data and material: Not Applicable

Code availability: Not Applicable

Authors contribution: SP developed the product, done the sensory evaluation and also proximate analysis of the product developed.

Novelty Expression File

Our current study develops a protein mix which is free from preservatives, added sugars and gluten. So, this protein mix can help individuals with celiac disease. The main scope of this product development is to help athletes as a post workout drink. As of now there is no such products which is free from artificial ingredients. This is a new product which is not available in the market.

Research Highlights

- This is the new product which is free from preservatives and added sugars.
- The main thing in this product is it is satisfying the protein and carbohydrate requirements of post workout/ training recommended by American College of Sports Medicine for a healthy recovery.

- This protein mix is an instant one and can easily prepared at household.

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