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INNOVATION AND DEVELOPMENT OF AN INSTANT PROTEIN MIX POWDER

Divyakameshwaran.V
Teaching Assistant
Department of Deen Dayal Upadhyay Kaushal Kendra
The Gandhigram Rural Institute – Deemed To Be University, Gandhigram.

Abstract: This study details the formulation, sensory optimization, nutritional profile, packaging selection, and cost efficiency of an innovative, low-cost instant protein mix powder designed to counter Protein Energy Malnutrition (PEM) and meet modern dietary demands. Developed from a blend of curry leaves, oats, peanuts, and pumpkin seeds, three product variations (IPM 1, IPM 2, IPM 3) were processed through roasting and milling. Sensory evaluation using a 9-point hedonic scale established IPM 2 as the significantly superior formulation across all criteria (overall acceptability score: 8.9). Laboratory analysis of 100g of the optimized mix revealed a dense macronutrient profile yielding 452 Kcal, 21.8g of protein, 13.5g of fat, 60.7g of carbohydrates, and 2.5g of dietary fiber. Economically, the cost of production was determined to be ₹112 per 100g, translating to ₹1,120 per kilogram, presenting a highly scalable, shelf-stable commercial alternative to existing synthetic protein supplements.

Keywords: Innovative, Nutrition, Ergonomics

I. INTRODUCTION

Mild or moderate malnutrition in pediatric demographics is conventionally evaluated via weight-for-age deficits. However, this framework often fails to differentiate between height-for-age deficits ("stunting") and weight-for-height deficits ("wasting"). Differentiation is critical to providing accurate clinical interventions. Protein Energy Malnutrition (PEM) constitutes a primary deficiency disease driven by a nutritional "food gap" between caloric or amino acid intake and biological requirements. Primarily micro-targeting children under five within underprivileged communities during critical post-weaning windows, severe PEM can induce catastrophic pathologies such as kwashiorkor, marasmus, or profound growth retardation.

Concurrently, modern urbanization has shifted consumer dynamics toward highly functional, ready-to-eat (RTE) or instant dietary options. While protein supplements have experienced a massive surge in commercial volume among athletic and wellness consumers globally, standard protein sources (milk, meat, eggs, fish) remain economically inaccessible to low-income populations. This research bridges this economic and nutritional gap by innovating a low-cost, multi-source, plant-based instant protein mix powder.

Research Objectives

- To systematically develop an instant plant-based protein mix powder.
- To evaluate the sensory and organoleptic properties of various ingredient iterations.
- To biochemically assess the macro and micronutrient properties of the developed mix.
- To select and analyze the performance of suitable packaging material.
- To calculate the cost efficiency and commercial feasibility of the final product.

II. REVIEW OF LITERATURE

1. Curry Leaves (Murraya koenigii Spreng)

Belonging to the family Rutaceae, Murraya koenigii is a highly aromatic indigenous Indian herb. Its characteristic aroma profile is driven by volatile chemical fractions such as P-gurjunene, P-caryophyllene, pinene, sabinene, and caryophyllene. Therapeutically, curry leaves act as cellular stimulants and are utilized to mitigate calcium deficiency, dysentery, and emesis. Matured leaves exhibit an ash content of 13.06%, carbohydrates at 14.6%, and are heavily saturated with bioactive carbazole alkaloids (such as koenigin and cyclomahanimbine) that showcase prominent antimicrobial and pharmacological properties.

2. Oats (Avena sativa L.)

Oats are globally recognized functional grains prized for their exceptional concentration of \beta-glucan soluble dietary fiber. Regular consumption is clinically proven to lower low-density lipoprotein (LDL) cholesterol by 5% to 10%, thereby curbing the incidence of cardiovascular disease. Oats are dense in polar phenolic compounds, tocols, and avenanthramides, which exert powerful anti-inflammatory and anti-carcinogenic properties while actively inhibiting lipid rancidity. Grinding groats yields fine oat flour, a stable, non-allergenic, cost-effective base highly suited for mass infant nutrition. . The World Health Organization (WHO) recommends a dietary fibre intake of at least 25g per day. The average intake is only 12-18g in the USA and 15-20g in Europe, but 40-60 g in Africa.

3. Peanuts (Arachis hypogaea)

As a highly nutritious legume, the peanut serves as a powerhouse of dense lipids, calories, and essential minerals. Unlike most individual plant foods, peanuts exhibit a comprehensive amino acid profile. They contain critical concentrations of tryptophan (preventing pellagra), phenylalanine (supporting catecholamine neurotransmitter synthesis), and methionine (serving as the initiating amino acid during cellular translation). Thermal roasting is functionally vital, as it enhances specific flavor matrices while systematically destroying trace contaminants of carcinogenic Aflatoxin fungi.

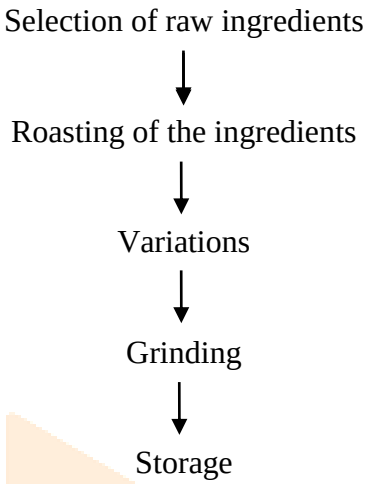
4. Pumpkin Seeds (Cucurbita sp.)

Pumpkin is a well-known multifunctional ingredient in the diet, full of nutrients, and has opened new vistas for scientists during the past years. The fruit of pumpkin including the flesh, seed, and peel are a rich source of primary and secondary metabolites, including proteins, carbohydrates, monounsaturated fatty acids, polyunsaturated fatty acids, carotenoids, tocopherols, tryptophan, delta-7-sterols, and many other phytochemicals. The pumpkin seeds have essential role in blood pressure lowering and relaxing of blood vessels.Frequently discarded as an agro-industrial processing byproduct, pumpkin seeds are highly nutrient-dense. They are extremely rich in polyunsaturated fatty acids (PUFAs), phytosterols.Researchers investigated in pumpkin seeds the phytosterol, tocopherol and squalene levels. The approach consists of acid hydrolysis and extraction by lipids observed through the means of alkaline saponification before the analysis by the means of HPLC (High performance liquid chromatography).

III. METHODOLOGY

The methodology pertaining to develop Instant protein mix is presented under the following flowchart:

PHASE I



PHASE II: (Recipe Application Development)

- To confirm functional consumer versatility, the developed Instant Protein Mix (IPM) powder was tested across three culinary delivery systems:
- Instant Protein Laddu: Prepared by compounding the IPM powder with specific quantities of cane jaggery and mildly heated clarified butter (ghee), which was then kneaded and manually formed into spherical confections.
- Instant Protein Milk: Created by dispersing 2 tablespoons of IPM powder into 50 mL of boiling whole milk, stirring thoroughly to generate a hot or cold beverage.
- Instant Protein Malt: Formulated by hydrating 3 tablespoons of IPM powder into 50 mL of boiling water, stirring rapidly, and garnishing with slivered almonds or cashews.

IV. RESULTS AND DISCUSSION

- **Organoleptic and Sensory Optimization**

Sensory attributes were systematically audited by an internal panel using a standard 9-point hedonic scale assessing appearance, color, flavor, taste, texture, and cumulative acceptability.

❖ **Biochemical and Nutritional Composition**

Laboratory evaluation of 100 grams of the optimized IPM powder yielded a rich nutrient composition, making it ideal for combating clinical wasting and stunting.

Laboratory results of developed instant protein mix for 100g of sample:

S.NO	PARAMETERS	UNITS	RESULT
1.	Energy	Kcal	452
2.	Carbohydrates	g/100g	60.7
3.	Fat	g/100g	13.5
4.	Protein	g/100g	21.8
5.	Crude fibre	g/100g	1.1
6.	Dietary fibre	g/100g	2.5
7.	Iron	mg/100g	1.1

Table 1: Sensory Profile and Hedonic Mean Comparison

IV. CONCLUSION

This research successfully developed a highly nutritious, plant-based instant protein mix powder utilizing local ingredients. Sensory testing verified that IPM Variation 2 (composed of 5g Curry Leaves, 45g Oats, 35g Peanuts, and 15g Pumpkin Seeds) provides the best flavor and overall profile. Containing 21.8% protein alongside substantial dietary fiber and iron, this product provides a natural alternative for vegetarian consumers seeking clean, chemical-free protein options.

Recommendations for Future Studies

❖ To build upon these findings, future research should focus on:
❖ Running real-time storage studies to map the accurate shelf-life of the product.
❖ Testing the functional properties of the mix, including its water/oil absorption indexes and solubility characteristics.
❖ Conducting quantitative and qualitative extraction procedures to profile the specific health-promoting phytochemicals within the mix.

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