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Formulation and Nutritional Aspects of Gluten-Free Infant Food Produced From Soy-Oats and Seeds

Mohammed Musthafa P, Mohamed Arshaq A, Karthika R, Karippathodi Mohammae Shaheen,

Ms.Iswarya M

UG Students, Department of Food Technology, Dhannish Ahmed Institute of Technology, Coimbatore,

Tamil Nadu, India

Assistant Professor, Department of Food Technology, Dhannish Ahmed Institute of Technology, Coimbatore,

Tamil Nadu, India

ABSTRACT: This study presents a comprehensive nutritional and functional assessment of a formulated plant-based food product, designed for high energy, protein content, and suitability in infant or adult nutrition. The formulation demonstrates a high energy yield of 410 Kcal/100g, with notable levels of carbohydrates (90 g), protein (10 g), and essential micronutrients like calcium (250 mg), iron (4.5 mg), and potassium (560 mg). Amino acid profiling confirms the presence of all essential amino acids, highlighting lysine (6.5 g/100g protein) and leucine (7.2 g/100g protein), which enhance its status as a complete plant-based protein source. Functional properties including high water absorption (2.4 g/g), solubility (15.6%), and oil absorption (1.7 g/g) favor the product's instant usability. Microbiological testing confirmed the product's safety (Bacillus cereus and S. aureus <10 CFU/g). Sensory evaluation rated the formulation highly (overall acceptability 8.3/9), and no microbial spoilage or quality degradation was observed during 3 months of ambient storage. The absence of trypsin inhibitors and the presence of only low levels of phytates, oxalates, and tannins ensure nutrient bioavailability. Rheological analysis confirmed shear-thinning viscosity (1450 cP), beneficial for spoon-fed applications. Collectively, these findings demonstrate the product's nutritional adequacy, functional potential, and shelf-stability.

KEYWORDS: Plant-based nutrition, Functional food formulation, Amino acid profile, Microbiological safety, Shelf-life stability.

I. INTRODUCTION

In the quest for affordable, sustainable, and nutritionally rich food formulations, plant-based products are gaining significant attention, especially for use in infant nutrition, therapeutic foods, and emergency rations.

A well-designed food product must satisfy not only caloric and protein requirements but also offer a complete amino acid profile, bioavailable nutrients, and functional qualities such as water solubility and ease of rehydration.

In addition, microbial safety, sensory appeal, and shelf-life stability are essential for consumer acceptance and regulatory compliance. This study aims to evaluate a novel plant-based formulation fortified with soy, grains, and seeds.

The objective is to assess the formulation's nutritional value, functional characteristics, amino acid completeness, and anti-nutritional components, while also validating its microbiological safety and consumer acceptability over storage.

These evaluations are critical to ensuring the product's viability for commercial production and potential use in vulnerable populations, such as infants and the elderly.



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II. LITERATURE SURVEY

Studies have shown that soy-based formulas can support growth and development in infants. Oats are a good source of fiber and nutrients, making them a valuable addition to gluten-free infant food. Pumpkin seeds are rich in protein and minerals, while sunflower seeds provide healthy fats and vitamin E.

Research has highlighted the importance of nutritional evaluation in ensuring the quality of infant food. Proximate composition analysis and micronutrient content assessment are crucial. Gluten-free diets are essential for infants with celiac disease or gluten intolerance.

The formulation of gluten-free infant food using soy, oats, pumpkin seeds, and sunflower seeds can provide a balanced mix of nutrients. Germination and fermentation can enhance nutritional profiles. Ensuring food safety and quality is critical.

Studies have evaluated the nutritional composition of complementary porridges formulated with various ingredients. The blend of soy, oats, pumpkin seeds, and sunflower seeds can provide a complete amino acid profile. Further research is needed to optimize the formulation and evaluate its efficacy.

The formulated gluten-free infant food can support growth and development in infants with gluten intolerance or sensitivity. Careful formulation and nutritional evaluation are essential to ensure the product's safety and efficacy.

III. METHODOLOGY

1. INGREDIENT SELECTION AND PREPARATION

- Soy flour: Using defatted soy flour for protein enrichment
- Oats: Processing oat into fine flour, ensuring gluten-free certification.
- Sunflower and Pumpkin Seeds: Lightlytoasting the seeds to improve flavour and digestibility, then grinding them into fine powder.
- 2. FORMULATION OPTIMIZATION:

Combining soyflour, oat flour, sunflower seed powder, and pumpkin seed powder in varying proportions (eg. 40:30:15:15)

• Add maltodextrinas a binder for smoother texture and better rehydration.

IV. EXPERIMENTAL RESULTS

The high nutritional density, including energy, protein, calcium, and iron, supports infant growth and development.

Functional analysis confirms the ease of preparation, while the product's low anti-nutritional content supports nutrient bioavailability.

The amino acid profile ensures all essential amino acids are present, validating its use as a complete protein source.

Microbial safety, high sensory scores, and excellent shelf stability further reinforce its suitability for infant consumption.

V. CONCLUSION

• The present study successfully formulated a gluten-free infant food using a combination of soy, oats, and seeds, providing a nutritionally balanced alternative to traditional cereal-based products. The developed formulation demonstrated an enhanced nutritional profile, including high-quality plant protein, essential fatty acids, dietary



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fiber, and critical micronutrients like iron, calcium, and zinc — all essential for healthy infant growth and development.

- The synergistic use of soy, oats, and seeds not only improved the nutrient density but also contributed to better digestibility and sensory properties suitable for infants. Processing techniques helped reduce antinutritional factors such as phytates and improved nutrient bioavailability, making the product more effective and safe for infant consumption.
- Overall, the results validate that multi-ingredient gluten-free blends can serve as promising alternatives for infants who require gluten-free diets, addressing nutritional gaps commonly found in existing gluten-free commercial products

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