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Formulation of Millet Based Extruded and Protein Rich Snacks.

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Abstract-

This study presents the development of a nutritious, ready-to-eat snack formulated to meet the growing demand for healthier food options. The product incorporates **17% jowar millet, soy, and whole wheat**, combined with **almonds and pumpkin seeds**, to deliver a balanced profile of macro- and micronutrients. The formulation achieves a high **protein content of 18.87% per 100g**, supporting daily protein requirements, while being **rich in dietary fiber** to aid digestion and promote satiety. A **no-frying processing method** is employed, resulting in a low-oil, clean-label snack that aligns with modern wellness and lifestyle needs. The use of traditional grains and plant-based ingredients makes the snack suitable for all age groups. Overall, the product demonstrates a viable approach to creating a wholesome, protein- and fiber-rich snack without compromising on health or quality.

Key Words- Millet, Soy, Extrusion, Snacks, Protein Mix & Jowar.

Introduction

The cost of manufacturing food is increasingly reliant on the value extracted from low market value products such as millets. In developing countries, processing these locally grown grains into value-added products are crucial for economic development (Taylor, 2004). Millets, considered minor cereals, are a staple food for many in India and Africa. Their consumption remains primarily among traditional users and those in lower economic strata, largely due to the lack of ready-to-eat forms of these grains (FAO, 1996; Singh et al., 2004). Millets are nutritionally superior to major cereals, offering higher protein, energy, vitamins, and minerals (Desikachar, 1977; Lue et al., 1991; Chakraborty et al., 2009). Devi et al. (2011). They are rich in dietary fibre, Phyto-chemicals, and micro-nutrients, with Indian ragi containing 18% fibre. Research highlights the health benefits of sorghum and millet, particularly their antioxidant properties and applications in nutraceuticals and functional foods (Taylor & Shewry, 2006). Extrusion is a versatile food industry operation used to transform ingredients into intermediate or finished products, producing a variety of foods, including snacks, ready-to-eat cereals, textured vegetable protein, confectioneries, and pet foods (Toft, 1979).

These foods offer nutritious products by combining quality ingredients and nutrients to create processed foods with precise nutrient levels (Cheftel, 1986). Extrusion cooking technology enables cost-effective large-scale processing of raw ingredients, showing potential for creating diverse and value-added food products from millet (Filli et al., 2006; Sumathi et al., 2007). The effectiveness of response surface methodology (RSM) in optimizing ingredient levels, formulations, and processing conditions in snack food has been documented by various researchers (Thakur & Saxena, 2000; Nath & Chattopadhyay, 2007; Altan et al., 2008). Response surface methodology is a statistical method that utilizes quantitative data in experimental design to optimize processes and products by solving multi-variate equations simultaneously products (Giovanni, 1983).

RSM is a valuable method for minimizing trials and facilitating optimization through multiple regression. With the increasing urbanization in developing countries, there is a rising demand for convenience foods that also offer health benefits and attractive sensory characteristics, leading to heightened interest in food extrusion technology for producing ready-to-eat items (Filli K, Jideani A et al., 2014). Food extrusion is a technique involving thermal and shear processing in a sealed barrel, where food doughs are cooked under controlled conditions. The process leads to pseudoplastic melt strand structures being forced through a fixed die (Singh S, Gamlath S et al., 2007). Key independent variables, including feed composition, moisture, and barrel temperature, influence the quality of the extrudate (Alam M, Kaur J, Khaira H, et al., 2016).

Material & Methodology-

Ingredients-

Soy nutri, whole wheat, jowar, peanuts, almonds, raisins, pumpkin seeds, and peas.

Sr. No.	Ingredients	Composition 1	Composition 2
1	Porridge	45%	45%
2	Soy Granules	12%	12%
3	Sorghum	10%	10%
4	Foxtail Crispy	7%	7%
5	Almonds	4%	0
6	Pumpkin Seeds	6%	6%
7	Peanuts	8%	5%
8	Green Peas	8%	5%
9	Raisins	0	10%

Fig. 1. Compositions of millet Based Snacks.

Methodology-

Step 1- Extrude the whole wheat, and jowar into flakes and crispies.

Step 2- Roast the peanut, peas and pumpkin seeds.

Step 3- dicing of almonds.

Step 4- Mixing of all ingredients in a large number as per used compositions. And sprinkle 2-2.5% of olive oil.

Step 5- Add seasonings.

FLOW PROCESS

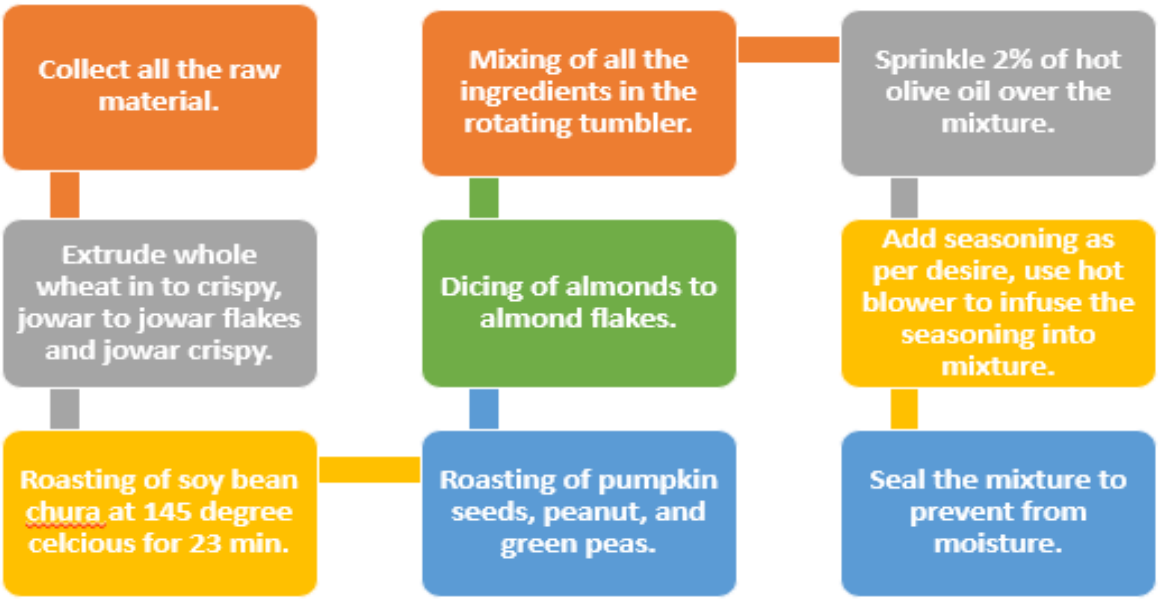

Fig. 2. Flow Process for Mixture Preparations.

Result & Discussion-

With is millet-based protein rich snacks is prepared by using extrusion and roasting. Image of the product is attached in this for reference and hence this helps in creating a healthy snack without frying in oil to keep this trans-fat free.

Fig.2. Image of Mixture.

For checking the nutritional attributes of millet-based snacks, here are the results of various parameters.

	Nutritional Info.		Serving Size-80g
	Per 100g	**RDA per serving**	**Methods**
Energy	407.79kcal	16.31%	FL/SOP/FC-02
Protein	18.87g	26.97%	IS-7219
Total carbohydrates	62.85g	66.10%	IS-1656
Total Sugars	7.35g		FSSAI Manual 4, 2015
Added sugars	3.96g	9.60%	FSSAI Manual 4, 2015
Total fat	8.99g	28,48%	IS-4684
Saturated fat	1.48g	5.92%	AOAC 996.06
Trans fat	0.3g		AOAC 996.06
Sodium	177.9mg	7.12%	FL/SOP/AAS-10
Dietary fibre	3.98g	10.56%	FL/SOP/FC-185

Fig. 4. Nutrition Attributes of the Mixture.

Conclusion-

This wholesome snack is thoughtfully developed to combine nutrition, taste, and modern healthy eating preferences in one balanced product. It contains **17% jowar millet, soy, and whole wheat**, bringing together the natural benefits of traditional grains known for sustained energy and digestive support. The addition of **almonds and pumpkin seeds** enhances the snack with essential healthy fats, minerals, and micronutrients, making it both nourishing and satisfying.

With a high **protein content of 18.87% per 100g**, this snack supports muscle health, daily energy needs, and active lifestyles, making it suitable for children, working professionals, fitness enthusiasts, and the elderly alike. Being **rich in dietary fibre**, it promotes better digestion, improved gut health, and longer-lasting satiety, helping to reduce unhealthy snacking between meals.

Unlike conventional snacks, this product is made using a **no-frying process**, ensuring it remains light, clean, and easier to digest while avoiding excess oil and unnecessary calories. This makes it a guilt-free option for regular consumption without compromising on flavour or crunch.

Overall, this snack represents a smart shift toward mindful eating. By blending ancient grains with plant-based protein and nutrient-dense seeds, it offers a **healthy snack for everyone**—one that aligns with today's wellness-focused lifestyles while delivering real nutrition in every bite.

Reference-

Alam, M. S., Kaur, J., Khaira, H., & Gupta, K. (2016). Extrusion and extruded products: changes in quality attributes as affected by extrusion process parameters: a review. Critical reviews in food science and nutrition, 56(3), 445-473.

Altan, A., McCarthy, K. L., & Maskan, M. (2008). Evaluation of snack foods from barley–tomato pomace blends by extrusion processing. *Journal of Food Engineering*, *84*(2), 231-242.

Chakraborty, S. K., Singh, D. S., & Chakraborty, S. (2009). Extrusion: a novel technology for manufacture of nutritious snack foods. *Journal of Beverage and Food World*, *42*, 23-26.

Cheftel, J. C. (1986). Nutritional effects of extrusion-cooking. *Food chemistry*, *20*(4), 263-283.

Desikachar, H. S. R. (1977). Processing of sorghum and millets for versatile food uses in India. In *Proceedings of symposium on sorghum and millets for human food* (pp. 41-46). Tropical Products Institute.

Devi, P. B., Vijayabharathi, R., Sathyabama, S., Malleshi, N. G., & Priyadarisini, V. B. (2014). Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fiber: a review. *Journal of food science and technology*, *51*(6), 1021-1040.

Filli, K. B., Kama, I. N., Abubakar, U., & Jideani, V. (2006). Optimization and end use characteristics of extruded millet fortified with soybean for the manufacture of FURA: a Nigerian traditional food. *Britsh Food Journal*, *109*, 68-80.

Giovanni, M. (1983). Response surface methodology and product optimization. Food technology (Chicago), 37(11), 41-83.

Nath, A., & Chattopadhyay, P. K. (2007). Optimization of oven toasting for improving crispness and other quality attributes of ready to eat potato-soy snack using response surface methodology. *Journal of Food Engineering*, *80*(4), 1282-1292.

Seth, D., & Rajamanickam, G. (2012). Development of extruded snacks using soy, sorghum, millet and rice blend–A response surface methodology approach. *International Journal of Food Science and Technology*, *47*(7), 1526-1531.

Singh, S., Gamlath, S., & Wakeling, L. (2007). Nutritional aspects of food extrusion: a review. International journal of food science and technology, 42(8), 916-929.

Sumathi, A., Ushakumari, S. R., & Malleshi, N. G. (2007). Physico-chemical characteristics, nutritional quality and shelf-life of pearl millet-based extrusion cooked supplementary foods. *International journal of food sciences and nutrition*, *58*(5), 350-362.

Taylor, J., & Shewry, P. (2006). Preface to sorghum and millets reviews. *Journal of Cereal Science*, *44*(3), 223-223.

Taylor, J. R. N. (2016). Grain production and consumption: Africa. Encyclopedia of Food Grains, 4, 359-366.

Thakur, S., & Saxena, D. C. (2000). Formulation of extruded snack food (gum-based cereal–pulse blend): optimization of ingredients levels using response surface methodology. *LWT-Food Science and Technology*, *33*(5), 354-361.

Toft, G. (1979). Snack foods: Continuous processing techniques. *Cereal Foods World*, *24*(4), 142-143.