# Development and Quality Assessment of Artificial Meat from Soya Beans and Peanuts

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## Abstract

Plant-based meats are rapidly becoming popular due to being low in fat and high in protein in today's food markets. Soya-based artificial meat possesses a broad spectrum of functionality and is now a key component of many processed meat products. It has many features like higher nutritional value than animal meat, is more homogeneous, long-lasting and free from cholesterol and bad fat, and contains a high content of heart and friendly unsaturated fatty acids. In current research, a small portion of peanut milk has been blended with soya milk to overcome the beany flavour of soya in the final product, which is often disliked. The physico-chemical and sensory evaluation of the artificial soya-based meat was a significant part of this research. This activity aimed to improve the final characteristics, particularly sensory attributes of soya-based meat. The artificial meat from soybeans and peanuts can be a source of essential amino acids and minerals.

**Keywords:** artificial meat, soybeans, peanuts, plant protein, animal proteins.

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**Highlight:**

- Meat substitutes with comparable physicochemical and sensory characteristics to beef meat.
- A good choice for health-conscious people searching for alternate healthy options for animal protein.
- Artificial meat was prepared by precipitating soya beans and peanut milk.
- Physico-chemical and sensory evaluation of the artificial soya-based meat was determined.
- The artificial meat from soybeans and peanuts can be a source of essential amino acids and minerals for vegetarians.

## 1.    Introduction

There has been an increasing trend of shifting from animal to plant protein, widely applied in the food industry to formulate different healthy diets for nutritional purposes (Rizzo & Baroni, 2018). Alternative protein foods derived from vegetable protein, such as beans, are more affordable than meat. Switching from animal to vegetable protein has many advantages because it is cheaper, improves taste, and has many other applications. Soybean is a good vegetable protein for lowering blood cholesterol. High soybean fibre also helps control high blood sugar levels and protects the body from cardiovascular diseases (Sui et al., 2021).

Artificial meat has several features, such as it can be produced to have higher nutritional value than the original meat. In addition, it can be made without animal fat or cholesterol and has a high content of unsaturated fatty acids, which is cheaper and non-hazardous to health (Bakara & Sihotang, 2018). The diversification of food processing through processed, artificial meat is strategic in supporting food security, especially in promoting various aspects of food availability, overcoming the problem of nutrition, and empowering the poor community in Pakistan. One such effort has been made by preparing soya and peanut-based artificial meat. The role of protein is significant in the development of the human body. In other words, proteins are essential to human health (Fukushima, 2011). People are now preferring plant protein over animal protein, as this method has been considered to be the primary dietary protein source for a long time. Due to awareness of the goodness of plant protein, a dietary consumption pattern has now been changed from animal protein to plant protein. As a result, plant protein production in the food industry is increasing (Afroz et al., 2016; Qin et al., 2022).

Diversified plant sources of protein are the key subjects of researchers to replace conventional animal-based proteins with healthy and environmentally friendly plant-based proteins (Greenfield & Southgate 2003). Soy protein is a high-quality protein close to some of the proteins from animal sources, such as meat and dairy. Due to their high protein content and versatility in developing food products, soy proteins are the primary supply of plant-based proteins and are widely consumed by diverse populations worldwide (Afroz et al. 2016). One of the drawbacks to soya-based products is their typical beany taste. Current research has been done to produce soya-based artificial meat free from the typical beany taste. Peanut milk has been used in a particular ratio for this purpose.

## 2.    Materials and Methods

The soybeans and peanuts were purchased from the local market in Lahore, Pakistan, and experiments on meat production were performed at FBRC and PCSIR Laboratories Complex in Lahore, Pakistan. Roasted peanuts were used for milk production. Soybeans and peanuts were soaked overnight in water to prepare soy, and milk was extracted from soybeans and peanuts according to the method described by Afroz et al. (2016).

First, soybeans and peanuts were cleaned and sorted to remove insect-damaged and discoloured seeds. Soy and peanut kernels were then rinsed and soaked separately in the water. The soaked seeds were parboiled in water for five minutes. After that, the boiled seeds were cooled, de-husked, peeled, and washed out with drinking water. Both seeds were ground one by one in a pin grinder using filtered water to form milk. A blend of soy and peanut milk with a proportion of 80:20, respectively, was prepared (Fig. 1).

**Figure 1: Flow Chart of Processing Vegetable Meat**

Cleaning and Sorting of seeds ⟹ Soaking in water ⟹ Washing ⟹ Grinding ⟹ Filtration ⟹ Blending of Soy and Peanut Milk ⟹ Addition of food additives ⟹ Boiling and precipitation ⟹ Filtration & Spinning ⟹ Drying ⟹ Packing

The food-grade colour raspberry red, salt and preservative potassium sorbate were added to the milk. Milk was precipitated with a saturated solution of citric acid during boiling. The whey from precipitated milk was filtered and turned through a centrifuge spinner to separate the whey from precipitated milk.

Coagulated protein was then shaped and dried at 50 $^0$C for 10 hrs to keep the moisture content under 8 % before packing. The meat substitute was analyzed for physical and chemical tests, such as total protein, fat, moisture, carbohydrates, and ash content. Protein was determined by the Kjeldahl method, fat by the Soxhlet apparatus, carbohydrates by difference, moisture content and ash contents as per the method given in (AOAC).

Microbiological analyses were done according to the American Public Health Association APHA (1992). The physicochemical and sensory characteristics of the prepared meat substitute were found to be very comparable to the beef meat. Sensory attributes of soya meat were also evaluated, and beef was used as a reference. The product was served to a panel of 6 judges. The average scores of five sensory parameters, colour, taste, aroma, cooking quality and overall acceptability, were evaluated as described by Sindumathi & Amutha (2014).

## 3.0 Results and Discussion

A nutritious analysis of both soy and peanuts was conducted to determine the nutritional composition, as shown in Table (1). Unlike other leguminous crops, soy and peanuts are rich in nutrition, as Messina (1999) reported. The contents of protein in soy and peanuts are as high as 36.2 and 24.6 %, and oil contents in soya and peanuts are 18.2 and 43.7 %, respectively, as shown in Table (1) compared to the reported by Messina et al. (2022) indicate the effectiveness of vegetable meat.

**Table 1. Nutritional Analysis Soybeans, Peanuts and Soy Peanut Milk**

| S.No. | Parameters | Nutritional Analysis of Soybean | Nutritional Analysis of Peanut | Nutritional Analysis of Soy Peanut Milk |
|---|---|---|---|---|
| 1. | Moisture % | 9.7 | 4.4 | 89.71 |
| 2. | Protein % | 36.2 | 24.6 | 3.74 |
| 3. | Fat % | 18.2 | 43.7 | 3.45 |
| 4. | Carbohydrates % | 27.40 | 23.4 | 3.02 |
| 5. | Crude Fiber% | 4.1 | 2.0 | 0.02 |
| 6. | Ash% | 4.4 | 1.9 | 0.06 |
| 7. | **Energy** | **411** | **581** | **58** |

The final product, artificial meat, was analyzed for nutritional, microbiological and sensory attributes, and results are reported in Table (2). Soya and peanut meat are vegetable-based, high-protein products similar in taste and texture to minced meat (Andreani et al.,2023).

**Table 2. Nutritional, Microbiological and Sensory Analysis of Artificial Meat**

| | Nutritional Analysis | | Microbiological analysis (CFU/ml) | | Sensory evaluation* | |
|---|---|---|---|---|---|---|
| 1. | Moisture | 7.37 % | TPC | <1000 | Colour | 7 |
| 2. | Protein | 57.83% | Yeast& Mold | < 10 | Taste | 6 |
| 3. | Fat | 18.2% | Coliforms | Not detected | Aroma | 6 |
| 4. | Carbohydrates | 13.40% | Salmonella / 25 gm | Not detected | Cooking Quality | 7 |
| 5. | Crude Fiber | Nil | - | - | Overall acceptability | 6 |

It contains about 57.83 % protein and is enriched with 18.2% good fat. It also provides 13.40 % carbohydrates and contains 7.37 % moisture content. It was observed that the total protein and fat content were very close to the animal meat. It is ideal

for those people who can't eat meat, especially beef because it's very nutritious and health-friendly. These are less expensive and hence more cost-effective. Every plant-based protein is deficient in essential amino acids, so peanut protein was used to make the product more nutritive. The product was also accepted overall in sensory evaluation. Adding peanuts with soybean made the product more palatable by masking the typical beany flavour of soybeans. It's a wonderful product for vegetarians, providing positive health effects and more excellent food safety than animal meat. It may replace animal meat in different food dishes (Imran & Liyan, 2023; Greenfield & Southgate, 2003). Microbiological results were also satisfactory, as shown in Table (2). The total bacterial count was less than 1000 cfu/gm, yeasts and moulds were less than 10 cfu per gram, and coliform and salmonella bacteria were found absent in the final product, ensuring the product was safe to consume.

The organoleptic evaluation of the product was also accepted overall in terms of taste, colour, and texture. Sensory evaluation was conducted for the prepared meat using a nine-point scale, and results are given in Table (2). The plant-based protein meat offers high nutritional content, texture, and flavour similar to regular meat (Sui et al., 2021; Shurtleff & Aoyagi, 2013). It may be used in burgers, steak, and sliced meat alternatives that are cholesterol-free and low in saturated fat. Alamu and Busie (2019) also worked on soy protein and found the same results explored in current research. It's a good choice for health-conscious people searching for alternate healthy options for animal protein.

Outcomes of the present search suggest that plant-based diets may replace animal-derived foods, like meat, and recommended that more searches on this significant artificial diet replacement should be undertaken as it may be a potential alternative to facilitate the transition toward sustainable and nutritionally adequate diets.

## 4. Conclusion

It was concluded that soya-based artificial meat, particularly when blended with peanut milk, offers a promising substitute for traditional meat products (beef meat). It comprises high nutritional value with improved sensory attributes, making it a feasible and health-conscious option for consumers. Continued research and development in this field could further enhance the appeal and functionality of plant-based meats. The product resembles dried minced meat, which, after hydration and cooking, possesses similar characteristics to animal meat.

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### Conflict of interests

There is no conflict of interest among authors.

### Consent for publication

This is original research work and has not been submitted and published elsewhere.

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