

# Soy Polpetta

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**Abstract:** Nowadays, consumers are more health conscious. Consuming meals high in saturated fat, such as red meat, can boost cholesterol levels since meat and dairy products are significant sources of saturated fat. Therefore, this innovation aims to reduce the amount of red meat by adding second-class protein (tempeh) and to enhance tempeh's market potential by incorporating it in meatballs. Other ingredients used include breadcrumbs, cheese, onion, garlic, various types of herbs, and spices. The process of making Soy Polpetta starts with accurately weighing and mixing all the ingredients before the mixture is marinated, rested, shaped, and baked at desired temperature and time. Tempeh is an excellent red meat alternative due to its high protein content and excellent processing quality. In addition, they also contain various biologically active substances, such as isoflavone, saponin, and lecithin, which can positively affect the human body. Sensory evaluation was conducted among 60 panels to evaluate customer preferences towards 3 variations of the sample. The first variation is 100% tempeh (V1), the second variation is 50% tempeh and 50% mincemeat (V2) and the third variation is 20% marinated banana peel and 80% tempeh (V3). The finding shows that the beef Soy Polpetta (V2) is preferred by 41.7% of panelists, demonstrating the highest overall acceptability. As a result, in addition to promoting a healthier alternative with a distinct flavor, this product appears to have commercial potential and may offer new product offerings to the market.

*Keywords:* health conscious; soy; substitute; tempeh; Soy Polpetta.



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## 1. INTRODUCTION

The development of meat-based diet products has increased in the global food manufacturing industries (You et al., 2020). It is because the meat is a protein source for human beings. Protein is rich in essential amino acids such as histidine, lysine, and methionine which are essential for humans (Park et al., 2020). Moreover, the rising number of urban populations and dual income has changed the demand for more convenient, healthy, complete diets and affordable products (Muhammad et al., 2013).

In Malaysia, meatballs, known as "bebola daging", have become the most popular frozen meat-based products. However, the perception of the concern that excessive meat consumption can lead to metabolic diseases such as cardiovascular disease among consumers cannot be denied (Argel et al., 2020). Thus, meatball with plant-based protein such as fermented soy cake or "tempeh" is developed, as an alternative to animal protein suitable for all consumers without worrying about the consequences.

According to Kang et al. (2022) the nutrients and dietary fibres from vegetable protein and meat products will increase the nutritional value and quality. Moreover, plant-based proteins can prevent vascular diseases, be anti-cancerous, and provide antioxidant effects. Soybeans are the most common vegetable protein used due to their high protein content and excellent processing quality (Kouakou et al., 2019). In addition, they also contain various biologically active substances, such as isoflavone, saponin, and lecithin, which can positively affect the human body. Therefore, this food innovation suits with health-conscious society, especially cardiovascular disease patients.

## 2. METHOD & MATERIAL

### 2.1 Materials

The ingredients for Soy Polpetta were readily accessible at local supermarkets and regular grocery stores. Due to the product's commercial market worth, this product innovation is preferable for mass production. Table 1 displays the ingredients and proportions required to produce Soy Polpetta.

**Table 1.** Formulation of Soy Polpetta.

<b>Ingredients</b>	<b>Measurement (gram)</b>
Black Pepper	1.2
Dried Basil	2.5
Dried Oregano	2.5
Dried Chili Flakes	2.5
Fresh Parsley	2.5
Salt	2.5
Chicken Stock	2.5
Garlic	5.0
TVP	10
Flaxseed	15
Parmesan Cheese	83
Onion	125
Breadcrumbs	125
Mincemeat	100
Tempeh	100
<b>Total</b>	<b>579.2</b>

Variations:

1. Variation 1 – 100% tempeh
2. Variation 2 – 50% mincemeat, 50% tempeh
3. Variation 3 – 20% bacon-flavoured banana peel, 80% tempeh

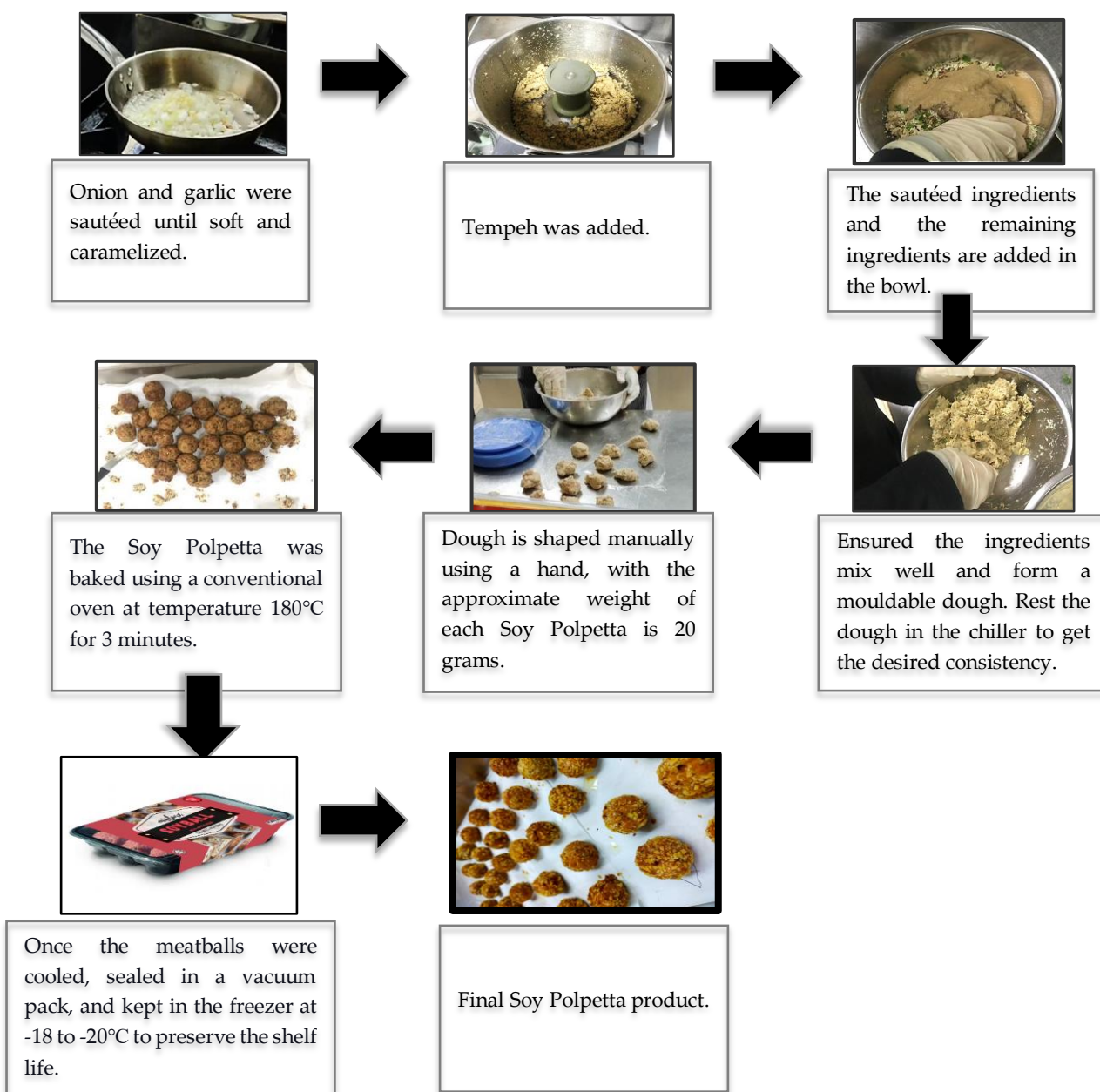
2.1.1 Banana Peel Marination

Table 2. Formulation of Banana Peel Marinade.

Ingredients	Measurement
Soy Sauce	3 tablespoons
Maple Syrup	2 tablespoons
Garlic Powder	½ teaspoon
Smoked Paprika	3 teaspoons
Liquid Smoke	4 teaspoons
BBQ Powder	1 teaspoon

All the ingredients are accurately weighed and mixed well before marinating. Marinating took 30 minutes to ensure the desired flavour was achieved.

2.2 Soy Polpetta Preparation

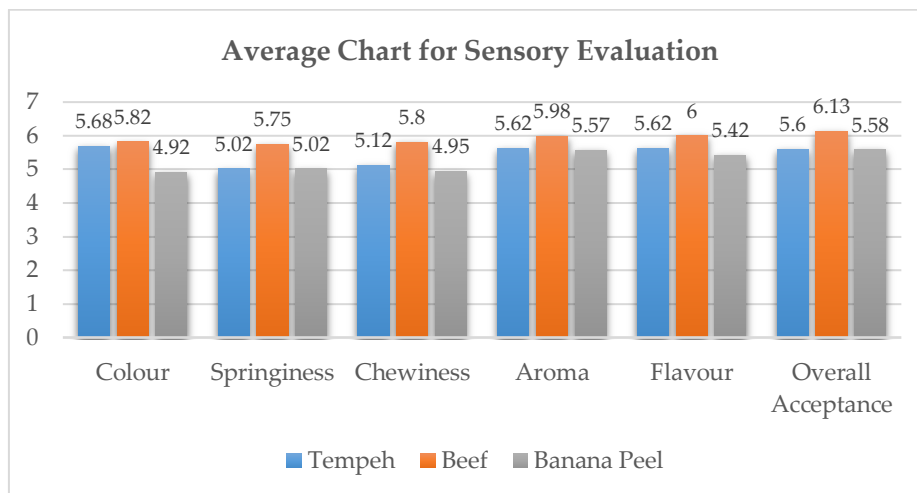


### 2.3 Score Card

A score card is used as the instrument to assess the most and least consumer preferences about the manufactured product. Within two weeks of data collection, a market survey was conducted among university students aged 18 to 21. Sixty panels from diverse study backgrounds were then recruited for the sensory evaluation, and the samples used a three-digit sample code to avoid bias. The panels were briefed on the purpose of the survey, and after tasting each product sample, they were given the sensory evaluation form with six product attributes, including appearance, springiness, chewiness, aroma, flavour, and overall acceptability. A Likert scale ranging from 0 (strongly dislike) to 7 (strongly like) was used in a Google Form score card.

### 3. FINDINGS

Sensory evaluation was conducted for three variations of product which are Soy Tempeh, Soy Polpetta and Soy Banana Peel. Six sensory attributes, including colour, springiness, chewiness, aroma, flavour, and customer acceptance, were tested on each product. The findings reveal that the most preferable variation is Soy Polpetta with the highest customer acceptance (6.13) compared to Soy Tempeh (5.60) and Soy Banana Peel (5.58) respectively (refer Figure 1). In addition, panels remark that the aroma of the ball is very aromatic.



**Figure 1.** Sensory Evaluation of The Product Attributes.

### 3.1 Product Characteristic



Figure 2. Packaging of Soy Polpetta.

The vacuum packaging was chosen as a product packaging. The method of removing air from a pack before closing it is known as vacuum packaging. It works incredibly well for fatty fish like salmon and frozen fowl like turkeys. There are vacuum packaging chamber machines that can be operated manually or semi-automatically. Coffee and dry yeast are two products that can be packaged in standard brick-shaped packaging (Farmer, 2013). This method is also used to prevent the growth of bacteria and microbes and prolong product shelf life.

## 4. DISCUSSION

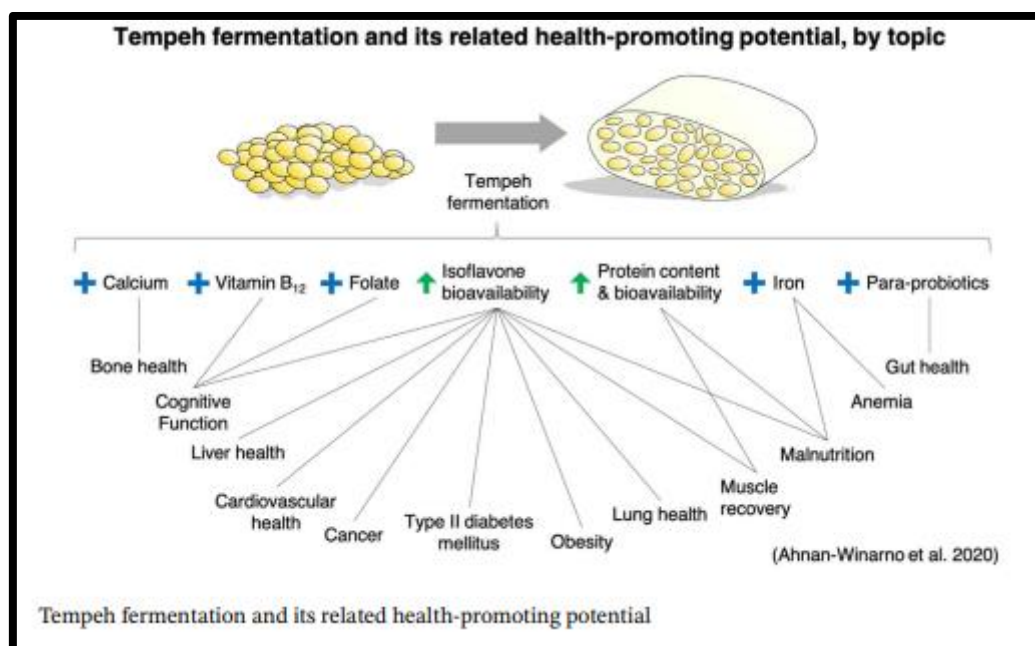
Tempeh can be a good food source because of its affordability, sustainability, and health advantages. Indonesian native food tempeh has been used as a major protein source for more than 300 years (Shurtleff & Aoyagi, 2020). Tempeh is typically created from soybeans that have been fermented with *Rhizopus spp.*, but other nuts, grains, and beans can also be used to make it (Karyadi & Lukito, 1996). Significant amounts of protein, vitamin B12, and bioactive substances can be found in tempeh (Babu et al., 2009; Nout & Kiers, 2005). Therefore, tempeh is being used in this product innovation.

The term "tempeh" as it is spelled in Bahasa Indonesia, was used as the official label for the product name in the official standard recognised by the CODEX Alimentarius Commission (Food & Agriculture Organization-World Health Organization, 2017), codified as CODEX stan 313r2013. In order to comply with English dictionaries, the term "tempeh" is utilised in this study. According to the CODEX standard, tempeh is a dense, white product in the shape of a cake that is made from dehulled, boiled soybeans using *Rhizopus spp.* Only *Rhizopus oligosporus oryzae*, and *Rhizopus stolonifer inoculants* were recognised by the standard. Tempeh can be combined as an inoculum with wheat bran, rice bran, and powdered cooked rice. When cut with a knife, the texture of tempeh should remain solid and not

crumble away too easily. Due to the establishment of *Rhizopus spp. mycelium*, which restricts the degree of natural sporulation by the inoculant, tempeh should be white in colour. The flavour of tempeh should be nutty, meaty, and mushroom-like. The smell of tempeh should be clean and free of ammonia. Tempeh should normally be free of external substances, such as other beans, husk, and small stones, as well as dietary additives. The minimum protein content of tempeh is 15% (w/w), the maximum moisture content is 65% (w/w), the minimum lipid content is 7% (w/w), and the maximum amount of crude fibre is 2.5% (w/w) (Food & Agriculture Organization-World Health Organization, 2017).

Given its high protein, high fibre, low saturated fat, mineral, and vitamin contents, tempeh can be regarded as a wholesome source of protein. Tempeh was shown to be comparable to beef in terms of protein, total fat, saturated fat, fibre, cholesterol, calcium, iron, and salt levels, and may even be better (USDA, 2019).

Evidence on the possible health advantages of tempeh for gut health, cancer, cognitive function, lung health, cardiovascular health, anaemia, liver health, bone health, type 2 diabetes mellitus, obesity, skeletal muscle recovery, and malnutrition can be found in the existing body of literature. However, the majority of tempeh's health advantages were associated with its isoflavone, protein, mineral, and probiotic content (Ahnan et al., 2019).



**Figure 3.** Tempeh Fermentation and Its Related Health-Promoting Potential.

Tempeh also contains 2/3 of calcium in 1 cup of whole milk, which means tempeh can become an alternative for lactose-intolerant people (Link, 2021). They can get their daily intake of calcium from tempeh alone. Meat can fit into many diets, while tempeh can be included in many alternative diets that are already available (Tremblay, 2018). Additionally, tempeh promotes healing after injury and healthy bones and supports brain functions. All these benefits come from manganese which can be found in tempeh. This nutrition cannot be found in regular meat (Tremblay, 2018).

Plant-based protein has its drawback to meat-based protein—usually a meat-based protein, all nine essential amino acids, also known as a protein building block. Tempeh is an exception to that rule because they contain a wide variety of all essential amino acids (White, 2020). Research from Kang et al. (2022) stated that when meat products are incorporated with plant-based protein, the value of its nutrient and dietary fibre improves. Furthermore, consuming vegetable protein has positive effects such as preventing cardiovascular disease, anti-cancerous and good source of food providing antioxidants (Chalvon-Demersay et al., 2017).

According to Molloy (2022) there are large amount of B12 and B6 vitamins, as well as the fibre, magnesium, and potassium in banana peel alone. In this innovation, it is being marinated with smoked barbeque flavour to make it more palatable for the consumer.

## 5. CONCLUSION

In conclusion, among all the variations, Soy Polpetta (V2) which contains 50% meat, and 50% tempeh, are being chosen by most of the panels. Consumers will gain benefit from the Soy Polpetta product because they have not only high protein content but also high fibre content, both of which are beneficial for the human digestive system. Thus, the objectives of this innovation have been achieved which are to reduce the amount of red meat by adding second-class protein (tempeh) and to enhance tempeh's market potential by incorporating it in meatballs.

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