

PLANT-BASED MEAT ANALOGUES

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Plant-based meat analogues (PBMA) have experienced rapid global growth in recent years, driven by increasing consumer demand for food that is healthier, more affordable and environmentally sustainable (Singh et al., 2021; United Nations, 2019). Despite this growing popularity, many PBMA products currently available in the market remain relatively expensive and less accessible to the wider population. One of the key contributing factors is the reliance on imported liquid vegetable oils such as soybean, sunflower and canola oils, which are subject to price volatility and regional supply limitations (Yu et al., 2023).

In addition, the production of PBMA often depends on high-cost processing technologies and specialised equipment, creating significant barriers for small and medium-sized enterprises (SMEs) and limiting large-scale adoption (Chen et al., 2025; Ozturk & Hamaker, 2023). Another critical challenge lies in maintaining product stability during storage and distribution. The inherent oxidative stability and functional properties of palm oil make it suitable for maintaining product quality during processing, storage and distribution. These advantages position palm oil as a promising ingredient for the development of cost-effective, stable and scalable plant-based meat alternatives using conventional processing technologies.

THE TECHNOLOGY

The technology for producing PBMA using palm-based innovation is a simplified and cost-effective approach that utilises palm oil fractions as functional lipid components to mimic animal fat in plant-based formulations. The system is designed to deliver desirable texture while maintaining product stability during processing and storage. The technology being offered serves as a flexible platform that allows the base formulation to be adapted into various PBMA products such as sausages, patties, meatballs and other processed formats, catering to diverse consumer preferences and market needs. The image of the PBMA developed is shown in *Figure 1*.

NOVELTY OF THE PRODUCT/ TECHNOLOGY

The novelty of this technology lies in the development of a PBMA platform that strategically positions palm oil fractions as functional lipid systems within plant-based formulations, addressing a key gap in current PBMA study and industry practice. Unlike conventional approaches that rely heavily on imported oils and advanced processing technologies, this technology demonstrates that desirable fibrous texture, meat-like mouthfeel

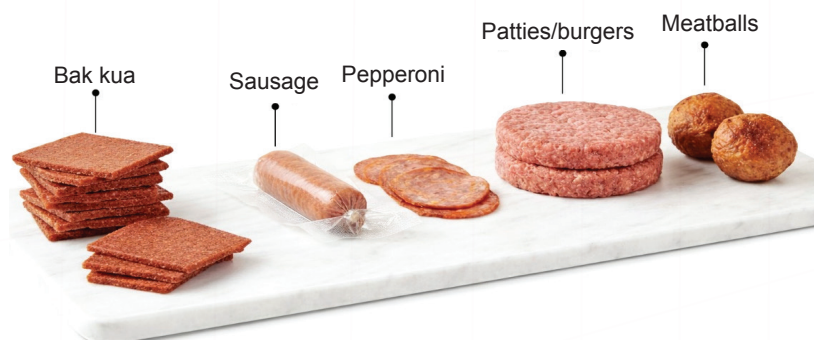


Figure 1. Plant-based meat analogues (PBMA).

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and product stability can be achieved using a simplified and scalable processing system. In addition, the formulation exhibits strong stability under repeated freeze-thaw cycles and extended frozen storage, overcoming a common limitation in plant-based meat products. The integration of locally available ingredients further enhances its potential as a cost-effective and adaptable solution for broader commercial applications.

BENEFITS AND ADVANTAGES

- 100% plant-based (vegan), suitable for multiple consumer segments.
- High protein (~29 g/100 g) and dietary fibre (~4 g/100 g).
- No trans-fat and no cholesterol.
- Good freeze-thaw stability.
- Stable texture and quality during six months of frozen storage.
- Flexible product formats for wider market applications.
- Cost-effective and simple processing, compatible with existing facilities.

ECONOMIC ANALYSIS

The raw material cost for the plant-based meat analogue, based on a serving size of 40 g × 5 pieces per pack, is estimated at approximately RM2.50–RM2.60, covering ingredient costs. When additional costs, including packaging and processing costs (labour and utilities) are considered, the total estimated production cost is approximately RM5.00–RM5.50 per pack, based on small-scale production (~1,000 patties per batch). The estimated retail price for the product is around RM10.00–RM12.00 per pack, which is comparatively lower than existing commercial plant-based patties priced at approximately RM17.00 for 40 g × 5 pieces. This indicates a cost-competitive advantage, with sufficient margin to cover overheads and profit, demonstrating good economic feasibility.

IMPACT

This technology supports the broader use of palm oil in food applications. For manufacturers, it offers a more cost-effective production approach without sacrificing product quality. It also contributes to the development of more affordable protein

alternatives, which is increasingly relevant given current pressures on global food security and the gradual shift in consumer diets.

CONCLUSION

The development of PBMA with palm-based innovation demonstrates the potential of palm oil as a functional and cost-effective ingredient in PBMA formulations. The optimised vegan meat analogue formulation achieved desirable physicochemical properties, acceptable sensory characteristics and stability under freeze-thaw and storage conditions. This technology provides a practical pathway for producing affordable and scalable plant-based meat alternatives using locally available resources, supporting both industry innovation and the expansion of plant-based food applications.

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