Volume 2, Issue 4

Innovation Series Quarterly

https://journal.academicapress.org/aps/index.php/isq

Research Article

Development of Prototype Kolagena Mee Kit: Utilization of Chicken Feet Collagen into an Innovative Meal

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Keywords:
Chicken feet collagen
Food product development
Functional food
Sustainable food innovation
Convenience meal

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Abstract: *The increasing demand for convenient, nutritious, and sustainable food products has encouraged the development of innovative functional foods using underutilised food resources. Chicken feet has opportunities to increase the commercial value from underutilised part of poultry to value added food innovation. This study aimed to develop a prototype of Kolagena Mee Kit, a chilled ready-to-prepare noodle meal incorporating collagen-rich broth derived from chicken feet, and to evaluate its sensory acceptability, packaging suitability, and preliminary commercial potential. The prototype of product development process involved ingredient selection, formulation trials, preservation method comparisons, sensory evaluation, and production cost analysis. Three formulation trials were conducted to optimise noodle texture and structural stability. Consumer acceptance was assessed using a nine-point hedonic scale and descriptive sensory evaluation focusing on appearance, aroma, texture, taste, and overall acceptability. Findings indicated that the final noodle formulation incorporating wheat flour, tapioca flour, rice flour, and xanthan gum improved noodle elasticity and structural stability during chilled storage. Sensory findings indicated generally positive consumer acceptance, with most reported ratings ranging from 7 (like moderately) to 9 (like extremely). Overall, the prototype of Kolagena Mee Kit demonstrates preliminary potential as a value-added convenience food that integrates culinary innovation, consumer convenience, and underutilised food resource.*

1. INTRODUCTION

The food industry is experiencing increasing demand for innovative products that combine convenience, nutritional value, and sustainability. Modern consumers are seeking food options that require minimal preparation while maintaining desirable sensory qualities and offering potential nutritional benefits. This trend has encouraged food manufacturers to explore functional ingredients and alternative food resources that can be incorporated into familiar products (Granato et al., 2020).

Collagen has gained attention in food product development because of its structural and functional properties, including water-binding, gel formation, emulsification, and stabilisation. Its applications extend across different food categories, making it a potentially valuable ingredient for functional food innovation (Liu et al., 2015). Nevertheless, collagen-containing consumer products are commonly associated with supplements, powders, and beverages, presenting an opportunity to explore collagen incorporation into everyday convenience meals.

Chicken feet represent a potentially valuable source of collagen due to their connective tissues, tendons, skin, and cartilage. Their utilisation as a source of functional ingredients offers opportunities to increase the commercial value of poultry products (Oechsle et al., 2016). Furthermore, the conversion of underutilised food resources into value-added products supports broader approaches to reducing food loss and improving resource utilisation (Food and Agriculture Organization of the United Nations, 2019).

In response to these opportunities, Kolagena Mee Kit was developed as a chilled ready to prepare meal comprising collagen noodles, chicken feet collagen soup paste, chilli oil, and dried vegetables. The product was designed to provide a convenient meal preparation experience while utilising chicken feet in a more consumer-friendly format.

The objectives of this study were to develop and optimise a collagen-based noodle meal kit, evaluate its sensory acceptability, identify suitable packaging and preservation methods, and assess its preliminary commercialisation potential.

2. LITERATURE REVIEW

2.1 Chicken Feet as an Underutilised Food Resource

In Malayia, chicken is a source of protein that preferred by Malaysian because of the availability, taste and affordability (Marni et al., 2024). In many countries, chicken feet are considered waste, however they are containing essential nutrients and offer health benefit (Santana et al., 2020). Chicken feet containing a skin, bone, muscle and connective tissue, with composition of collagen that approximately 30 – 35% (Nassar, 2026). Thus, it is making chicken feet a potential source of collagen and gelatin. The utilisation of poultry by-products for food ingredient development also creates opportunities to increase raw material value and improve resource efficiency (Liu et al., 2015).

From a sustainability perspective, transforming underutilised food resources into value-added products aligns with broader food loss and waste reduction strategies. The Food and Agriculture Organization of the United Nations (FAO, 2019) emphasised the importance of improving resource utilisation throughout the food supply chain. Reducing food loss and waste is essential for improving resource efficiency, food security and environmental

sustainability (Djekic et al., 2021). Therefore, incorporating chicken feet as ingredients into food formulations offers a potential approach to sustainable culinary innovation.

2.2 Collagen as a Functional Food Ingredients

Collagen is one of the most abundant structural proteins in animals and plays a vital role in maintaining strength and serving as connective tissue, including in skin, bones, cartilage and tendons. According to Liu et al. (2015), collagen and its derivatives have garnered significant attention in the food industry due to their functional properties, such as water-binding capacity, gel formation, emulsification, and stabilization, which be able to influence the texture, consistency, and overall quality of food products. These characteristics are important in food product development, particularly for products that require desirable texture and consistency (Romero-Pérez et al., 2024).

The function of collagen is closely related to its molecular structure as well as the processing conditions employed during extraction. When collagen is exposed to heat, its triple-helical structure undergoes denaturation, which can lead to the formation of gelatin (Al Hajj et al., 2024).

In the development of the 'Kolagena Mee Kit', a collagen-rich broth has been incorporated into both the noodle and soup paste formulations. This application demonstrates the potential of collagen base ingredients in the creation of common convenience meals, extending their use beyond conventional applications. Consequently, the inclusion of collagen-rich ingredients in the prototype of Kolagena Mee Kit presents opportunities for functional food innovation, while highlighting the importance of formulation optimization and scientific validation.

3. METHODOLOGY

This study employed an experimental food product development approach involving idea generation, ingredient research, formulation development, sensory evaluation, packaging selection, and preliminary costing analysis.

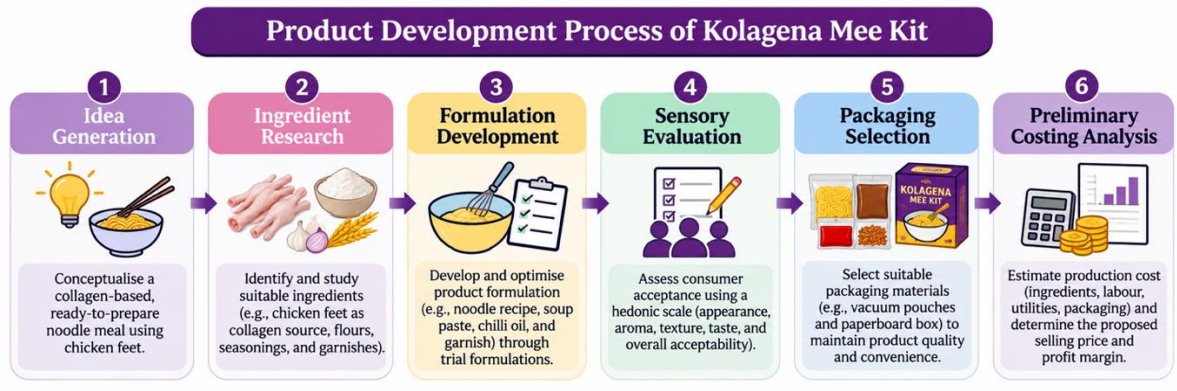


Figure 1. Product Development Process of Kolagena Mee Kit. (Source: authors)

3.1 Idea Generation

The idea for Kolagena Mee Kit originated from an observation of the underutilisation of chicken feet in the catering industry. During routine food preparation, large quantities of chicken feet were generated and stored without being fully utilised, highlighting an opportunity to transform this poultry by-product into a value-added food product. Chicken feet were identified as a potential source

of natural collagen, although their physical appearance and texture may limit consumer preferences for direct consumption.

During the brainstorming stage, several product concepts were considered before final product has been selected. These concepts were evaluated based on their innovation potential, practicality, market suitability, and ability to utilise underused food resources. Following discussions and preliminary assessment, the team selected the development of a collagen-based noodle meal kit. The final concept, known as Kolagena Mee Kit, was designed as a chilled ready-to-prepare meal incorporating natural chicken feet collagen, combining convenience, functional food innovation, and the value-added utilisation of poultry by-products.

3.2 Ingredient Research

Ingredient research was conducted to identify suitable raw materials, processing techniques, and product components for the development of Kolagena Mee Kit. Chicken feet were selected as the primary ingredient because of their natural collagen content, affordability, accessibility, and potential for value-added utilisation. Previous studies have highlighted the functional properties of collagen, including its water-binding, gel-forming, and stabilising characteristics, which support its application in food product development (Liu et al., 2015).

3.3 Product Formulation and Development

Chicken feet were selected as the primary collagen source. The extraction process involved simmering chicken feet with garlic, ginger, onion, celery, salt, white pepper, and water for approximately five hours to produce a collagen-rich broth. This broth was subsequently incorporated into the development of the soup paste and noodle components.



Figure 2. Ingredients used in the development of Kolagena Mee Kit. (Source: authors)

Three formulation trials were conducted to optimise noodle quality. The initial formulation utilised wheat flour as the primary ingredient. The second formulation incorporated tapioca flour, rice flour, and eggs to improve texture. In the third trial, a balanced combination of wheat flour, tapioca flour, and rice flour was used with xanthan gum to improve dough elasticity and structural integrity. The complete meal kit was assembled using four separately prepared components: collagen noodles, collagen soup paste, chilli oil, and dried garnish.

3.4 Preservation and Packaging Evaluation

Three preservation approaches were assessed: drying, retort processing, and vacuum packaging with chilled storage. The drying process was evaluated based on its effects on noodle texture and eating quality. Retort processing was conducted at approximately 121°C for 30 minutes, while vacuum packaging combined with refrigerated storage was evaluated as an alternative preservation approach.

3.5 Sensory Evaluation

Sensory evaluation was conducted with participants from different backgrounds, including academic staff, competition judges, university students, classmates, and working adults. A nine-point hedonic scale was used to assess five sensory attributes: appearance, aroma, texture, taste, and overall acceptability. Additionally, descriptive sensory evaluation forms were used to collect qualitative feedback relating to flavour, texture, consistency, and suggestions for product improvement.

Consumer responses were also collected through a sticker voting activity during the Culinary Innovation Showcase 2026. The findings were interpreted descriptively to identify general consumer acceptance and areas for product refinement.

3.6 Production Cost and Commercial Potential

A preliminary cost analysis was conducted based on a production batch of ten packets. The calculation included ingredient costs, labour, utilities, equipment usage, and packaging. A proposed selling price was subsequently determined based on production costs and the product's intended market positioning.

4. RESULTS AND DISCUSSION

4.1 Optimisation of Collagen Noodle Formulation

The formulation trials demonstrated progressive improvements in noodle quality. During the first trial, noodles produced primarily from wheat flour, which resulted an undesirable flour aftertaste and unsatisfactory texture. The second formulation improved softness and chewiness through the incorporation of tapioca flour, rice flour, and eggs. However, the noodles became fragile and broke easily after refrigerated storage, indicating insufficient structural stability. The third formulation, incorporating a balanced flour combination and xanthan gum, produced noodles with improved firmness, elasticity, and resistance to breakage during chilled storage. The flour aftertaste was also reduced, resulting in improved overall eating quality.

The research also examined suitable chicken feet's collagen extraction techniques. After considering different methods, slow simmering for approximately five hours was selected as a practical and cost-effective approach to producing collagen-rich broth while retaining its natural flavour and aroma. The broth was subsequently incorporated into the development of collagen soup paste and noodles.

For the noodle formulation, wheat flour, tapioca flour, rice flour, eggs, and xanthan gum were selected based on their contributions to noodle structure, texture, and elasticity. Additional components, including chilli oil and dried garnish, were incorporated to enhance sensory appeal and

allow consumers to customise the final flavour. A preliminary market survey was also conducted to examine existing collagen based products in Malaysia. The researchers identified an opportunity to introduce collagen in a chilled noodle meal kit rather than in conventional supplement, beverage, or snack formats. These findings provided the foundation for subsequent formulation development and product trials.

These findings highlight the importance of ingredient functionality and formulation optimisation in developing chilled convenience meals. The ability to maintain a desirable noodle texture is particularly important because consumers expect convenience foods to provide satisfactory eating quality alongside minimal preparation requirements (Costa et al., 2007).

4.2 Selection of Preservation and Packaging Methods

Preservation trials revealed important differences in product quality. Drying resulted in hard, brittle, and slightly oily noodles, while retort processing at 121°C for approximately 30 minutes produced excessively soft and fragile noodles. In comparison, vacuum packaging with chilled storage maintained better noodle texture and structural stability during the development trials. Consequently, the product concept was modified from an initially proposed shelf-stable meal kit to a chilled ready-to-prepare meal. Each product component was individually packed using suitable food-grade materials to support product organisation, handling, and quality preservation.

Table 1. Comparison of Preservation Methods of Kolagena Noodle are Evaluated During Product Development

Preservation Method	Observation	Decision
Drying	The noodles became hard, brittle, and slightly oily after dehydration. The flour aftertaste also became more noticeable after preparation.	Rejected
Retort Processing	The high-temperature retort process (121°C for approximately 30 minutes) caused the noodles to become overly soft and fragile, resulting in poor texture and poor quality.	Rejected
Vacuum Packaging with Chilled Storage	The noodles maintained their texture, freshness, and structural stability without the use of added preservatives.	**Selected**

Packaging plays an essential role in protecting food from contamination and physical deterioration while communicating information to consumers (Marsh & Bugusu, 2007). The individual packaging concept also allows consumers to adjust the quantity of chilli oil and garnish according to their preferences.

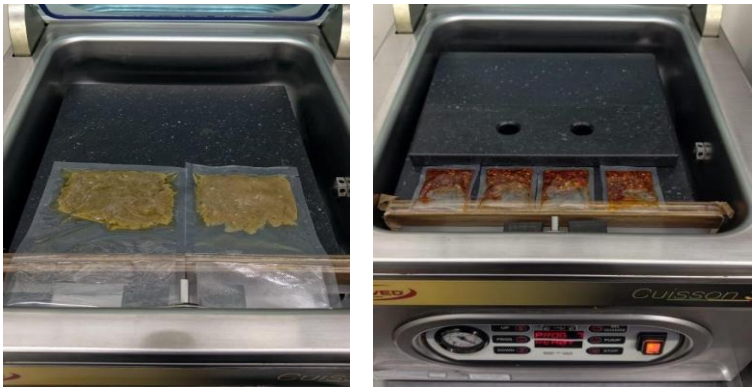


Figure 3. Vacuum sealing process of the collagen soup pastes and chili oil during the packaging development of Kolagena Mee Kit. (Source: authors)

The final packaging system consisted of individual food-grade vacuum-sealed pouches for each component, assembled inside a laminated paperboard box. The outer packaging was designed not only to protect the product during storage and transportation but also to create an attractive appearance suitable for commercialisation. The compact box design allows all product components to be organised neatly while enhancing the overall presentation of the product (Figure 4).



Figure 4. Individual packaged components of Kolagena Mee Kit. (Source: authors)

The refrigerated storage of Kolagena Mee Kit must keep at approximately 0 – 4°C, with an estimated shelf life of up to three weeks. However, this shelf-life estimate requires validation through microbiological and physicochemical testing before commercial application.

4.3 Sensory Acceptability of Kolagena Mee Kit

The sensory evaluation indicated generally positive acceptance of Kolagena Mee Kit. Most reported hedonic ratings ranged from 7 (like moderately) to 9 (like extremely) across appearance, aroma, texture, taste, and overall acceptability. Descriptive feedback indicated that participants appreciated the attractive product presentation, pleasant aroma, chewy noodle texture, and balanced flavour. The noodles were frequently described as firm, springy, and pleasant to consume, supporting the improvements achieved during formulation trials.

The hedonic evaluation of Kolagena Mee Kit was analysed using descriptive statistics based on five documented panelists (n = 5). The results indicated positive sensory acceptance across all five evaluated attributes. Aroma and overall acceptance recorded the highest mean scores (M = 8.40), followed by appearance and texture (M = 8.20), while taste received a mean score of 8.00. All mean scores were within the positive acceptance range of the nine-point hedonic scale, suggesting that Kolagena Mee Kit was generally well received by the evaluated panellists. Nevertheless, the limited sample size warrants further sensory evaluation involving a larger consumer sample to establish broader acceptability (as in Figure 5).

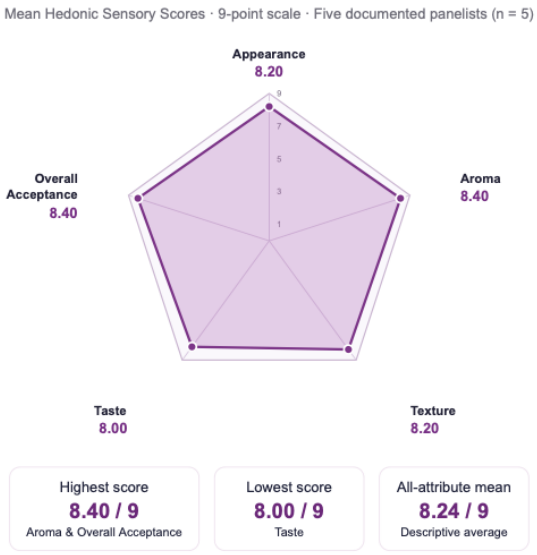


Figure 5. Mean's Hedonic Evaluation of Sensory Attribute by 5 selected panelists

Other than that, the collagen soup paste was also positively received, although some panelists suggested increasing the richness and intensity of the soup flavour. These observations provide useful directions for further product improvement for the prototypes. Additional positive responses were recorded during the Culinary Innovation Showcase 2026 at Faculty of Hotel and Tourism Management, UiTM Cawangan Selangor, Kampus Puncak Alam. The product received a Gold Medal and Innovation Product Choice Award, reflecting recognition of its innovation prototype and favourable reception during the event.

Nevertheless, the reported sensory outcomes represent preliminary descriptive findings. Further structured consumer testing with a clearly defined sample size and quantitative analysis would strengthen the evidence of market acceptance.

4.4 Commercialisation and Sustainability Potential

The preliminary costing analysis identified a total production cost of RM36.50 for ten packets, equivalent to RM3.65 per packet. The proposed retail price was RM8.90, generating an estimated gross profit of RM5.25 per packet and a gross profit margin of approximately 58.99%, based on the reported cost assumptions.



Figure 6. Product of Kolagena Mee Kit

The product was positioned towards working adults, university students, and consumers interested in convenient meals incorporating functional ingredients. Potential commercial channels identified in the report included retail distribution, e-commerce, healthcare-related food service, corporate markets, and refrigerated vending machines.

From a sustainability perspective, the utilisation of chicken feet provides an opportunity to transform a relatively low-value poultry by-product into a commercially relevant food ingredient. This approach is consistent with broader food innovation strategies that emphasise resource efficiency and value creation from underutilised materials (FAO, 2019).

The development of Kolagena Mee Kit also illustrates the importance of integrating sensory quality, convenience, packaging, and product positioning when designing functional food products. As emphasised by Granato et al. (2020), successful functional food development requires consideration of technological performance, product quality, safety, and consumer expectations.

Despite these encouraging preliminary findings, further investigations are needed to establish nutritional value, collagen concentration, validated storage stability, and commercial-scale production feasibility.

5. CONCLUSION

This study demonstrated the preliminary feasibility of developing prototype Kolagena Mee Kit, a chilled ready-to-prepare noodle meal incorporating collagen-rich broth derived from chicken feet. The product development process successfully identified a noodle formulation with improved texture and structural stability, while vacuum packaging and chilled storage were selected as the preferred approach following comparisons with drying and retort processing.

The sensory evaluation indicated positive initial acceptance across the assessed attributes, while the preliminary costing analysis suggested potential commercial viability under the reported production assumptions. The prototype product represents a practical example of culinary innovation through the value-added utilisation of an underutilised poultry by-product. It also demonstrates the potential integration of functional food concepts, convenience, and resource utilisation within a familiar noodle-based meal.

Future research should focus on laboratory quantification of collagen, nutritional analysis, microbiological safety, validated shelf-life assessment, larger-scale sensory testing, and production optimisation. These investigations are essential before making substantiated nutritional claims or progressing towards wider commercialisation.

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