INTERNATIONAL JOURNAL OF WOMEN IN TECHNICAL EDUCATION AND EMPLOYMENT (IJOWITED)

International Journal of Women in Technical Education and Employment
ISSN: 2811-1567. Volume 6 – Issue 2. December 2025
https://fpiwitedjournal.federalpolyilaro.edu.ng

Micronutrient Constituents and Organoleptic Attributes of Meat Substitutes Produced from Cow Milk and Coconut Milk

Kikelomo Alaba & Olawale Ogunyemi
Department of Nutrition and Dietetics, Federal Polytechnic, Ilaro, Ogun State, Nigeria.
Department of Hospitality Management, Federal Polytechnic, Ilaro, Ogun State, Nigeria.
Kikelomo.alaba@federalpolyilaro.edu.ng ; olawale.ogunyemi@federalpolyilaro.edu.ng

ARTICLE HISTORY
Received: October 27, 2025
Revised: December 6, 2025
Accepted: December 17, 2025

Abstract
The current investigation produced meat alternatives from mixtures of cow and coconut milk and evaluated their sensory properties and nutritional value. Four coconuts were shelled, and their milk was derived using different mixture ratios. The faux meat was developed by modifying a standard methodology, and macronutrient constituent was determined using established analytical techniques. Results revealed that as the percentage of coconut milk increased, preparation time rose, while the output of the meat substitute decreased. Sample B, containing 90 % cow milk and 10 % coconut milk, produced the highest output (486 g) in the minimal duration (8 min). Mineral testing showed that Sample A had the most concentrations of calcium (4.33–5.16 mg/100 g), iron (7.20–8.14 mg/100 g), magnesium (3.99–4.66 mg/100 g), and zinc (16.37–26.45 mg/100 g), with significant differences ($p < 0.05$) among samples. Organoleptic evaluation showed no significant difference ($p < 0.05$) in color between the control and Hibiscus sabdariffa-added samples. Sample A scored significantly higher than the other samples for flavor (8.55), texture (8.20), aroma (8.45), appearance (8.15), and overall acceptability (8.50). The findings suggest that a blend of 90 % cow milk and 10 % coconut milk produces a nutritious meat alternative suitable for diverse populations. Further research on the proximate composition and microbial load of the product is recommended.

Keywords: meatless meat, organoleptic evaluation, dairy-plant-based meat, trace elements.

Citation
Alaba, K. & Ogunyemi, O. (2025). Micronutrient Constituents and Organoleptic Attributes of Meat Substitutes Produced from Cow Milk and Coconut Milk. *International Journal of Women in Technical Education and Employment,* 6(2), 61 – 72.

Introduction

Meat is a staple ingredient in many recipes and serves as the primary component of most diets worldwide. Its high protein content and overall nutritional value have attracted the interest of both omnivores and traditional vegetarians. Rich in macro- and micronutrients, meat constitutes a highly nutritious food (Bakhsh et al., 2021). Laskowski et al., (2018) stated that flesh replacements are goods that are made to look like animal food and have all the characteristics of real flesh, including flavour and texture. Despite having a somewhat different makeup, it shares most of the same structure as meat.

Meat substitutes must be made with a food product that contains protein of high biological value, such as cheese (a milk-based product), which is a reasonably priced and healthier alternative to meat, to serve the chemical attributes of meat (mainly flavour, texture, and appearance) (Singh & Sit, 2022). Numerous proteins can be found in cow milk, which can be used to make high-quality meat substitutes. Milk is used extensively in animal products, and accounts for a sizeable amount of the food sector. It contains essential elements such as protein, lipids, vitamins, calcium, phosphorus, and potassium in exceptional quality (Mode et al., 2023).

Additionally, milk contains a lot of natural antioxidants. Among the non-enzymes are glutathione peroxidase (GPx), catalase (CAT), superoxide dismutase (SOD), retinol, alpha-tocopherol, carotenoids, uric acid, ascorbic acid, vitamin A, vitamin C, and vitamin E (Mode et al., 2023). Cattle are the world's greatest milk supplier, accounting for 81 percent of global milk production (FAO, 2020). When a nursing mother is unable to provide human breast milk, cow milk can be made daily into different dairy products and utilised as a substitute (Fructuoso et al., 2021).

Coconut milk is prized not just for its culinary applications but also for its special nutritional qualities. It has an abundance of dietary fats, primarily saturated fatty acids, particularly medium chain triglycerides (MCTs) like lauric acid, caprylic acid, and capric acid. Lauric acid, which is known to have antibacterial and antiviral properties, makes up over half of the total fat **(**Jahurul et al., 2014; Tan & Bhat, 2021**).** These medium chain triglycerides enter the body quickly and may have positive effects on immune response and energy metabolism. Trace element such as iron, magnesium, phosphorus, potassium, zinc, and trace levels of vitamins C and E can be found in coconut milk **(**Jahurul et al., 2014**)**.

However, coconut milk has comparatively low levels of calcium and vitamin D, which may require fortification when used to replace these elements in meals (Aziz et al., 2023). The coconut kernel's beneficial phytochemicals and antioxidants are still present in the milk despite the reduced fibre level caused by the extraction procedure, which may add to its wellness benefits (Ahmed et al., 2019). Consequently, this study aims to assess the nutritional constituent and sensory attributes of meat alternatives created from a mixture of coconut and cow milk.

Materials and Methods

The cow milk was bought from Kushe in Ilaro. The milk was collected aseptically and placed in a 10-liter container. The remaining materials for the study, such as coconut, coagulum (Sodom apple), pork, vegetable oil, zobo leaf (dried hibiscus flower), pepper, and spice, were purchased at Sayedero market in Ilaro, Ogun State.

Specimen Preparation

Four coconuts that had been dehusked and weighed 540g, 543g, 550g, and 555g each were split in half. To extract the meat from the shell, the split coconut was deshelled using knives. After being cleaned, the coconut meat was sliced into smaller pieces. In order to extract the coconut milk, the sliced coconut meat was grated. Three litres of warm water were added, and the mixture was filtered through a cotton cloth using the method described by (Ekanem & Ojimelukwe, 2017).

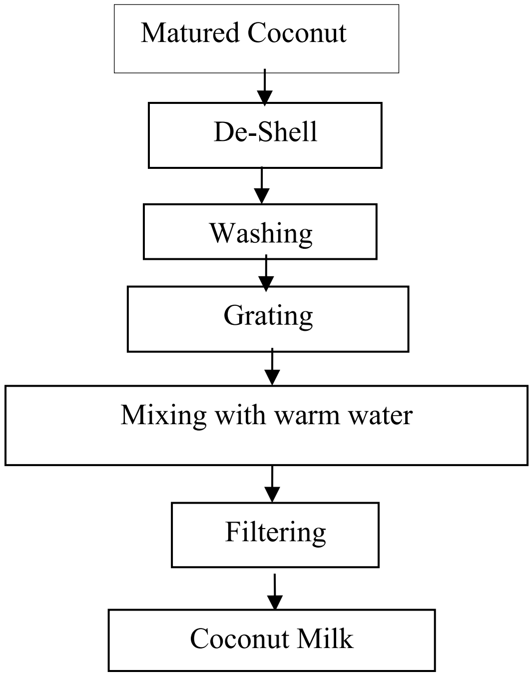

Fig.1: shows the process flow chart of coconut milk production (Ekanem & Ojimelukwe, 2017)

Proportion Ratio of Meat Substitute

The fresh portions of cow milk and coconut milk were measured according to the required ratio, while red meat was used as a sample control.

Table 1: Proportion **Ratio of Meat Substitute** %

Specimen	Red meat	Cow milk	Coconut milk
A (Control)	100%	0	0
B	0	90	10
C	0	80	20
D	0	70	30
E	0	60	40

Production of Meat Substitute

With a few adjustments, the process outlined by Ekanem et al., (2017) was modified to produce cheese as a meat substitute. Using a pestle and mortar, fresh Sodom apple leaves and stems were mashed. Label samples B, C, D, and E, respectively, in four clean pots. Each clean pot was filled with three litres of milk blend and set over low heat. The enzymes in the leaves and stem were allowed to react with the milk for one minute after 26g of crushed Sodom apple stem and 9g of crushed Sodom apple leaf were added to the heated milk. The temperature of this mixture was kept low, between 32 and 38°C.To guarantee complete mixing, the milk was swirled for approximately one minute. A distinct separation of whey and curd was visible shortly after stirring. To further separate the cheese from the whey, the curd was put through a sieve and allowed to sit for fifteen minutes. Ultimately, the curd was taken out of the sieve and put away for further examination.

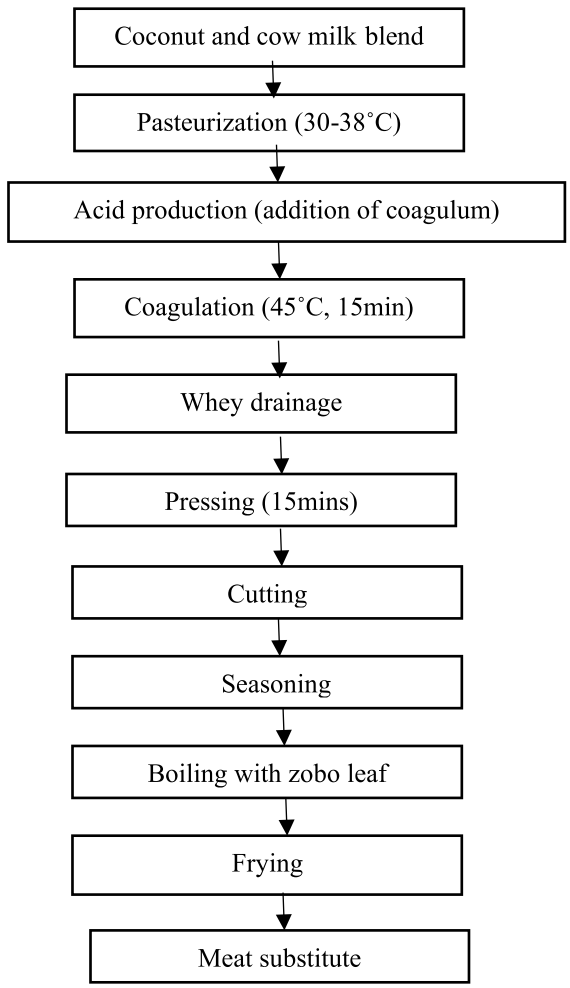

Figure 2: shows the process flow chart for Meat substitute production (Adapted from Sharma et al., (2019)

Mineral Analysis

The AOAC (2010) technique was used to analyse the samples' mineral content. Following digestion with a combination of perchloric and nitric acids, the elements iron, calcium, zinc, and magnesium were measured using an Atomic Absorption Spectrophotometer (Thermo Scientific S Series Model GE 712354). A 125 ml Erlenmeyer flask containing 0.50 g of each sample was filled with concentrated sulphuric acid (2 ml), concentrated nitric acid (25 ml), and perchloric acid (4 ml) for digestion under a fume hood. After that, the mixture was cooked gradually on a hot plate beneath the perchloric acid fume hood in a Buchi Digestion Unit K-424 using low to medium heat. The heating process went on until thick white vapours were created. Before cooling, the solution was heated aggressively for a further thirty seconds. After cooling, 50 ml of distilled water was added, and a wash bottle was used to filter the mixture into a Pyrex volumetric flask. After adding distilled water to adjust the final volume, the solution was examined with an Atomic Absorption Spectrophotometer.

Vitamin Analysis

The Achikanu et al., (2013) method was used to measure vitamins. One gramme of the material was weighed, put in a test tube with twenty millilitres of n-hexane, and centrifuged for ten minutes. After the liquid was filtered, three millilitres of the filtrate were dried in a boiling water bath and incubated twice (in triplicate) in a dry test tube. After that, 2 millilitres of 0.5 N alcoholic potassium hydroxide were added, and the mixture was heated for 30 minutes in a water bath. After adding three millilitres of n-hexane, the mixture was briskly shaken. After being moved to a different set of test tubes, the n-hexane was dried by evaporation. To the residue, two millilitres of ethanol were added. One millilitre of 0.2% ferric chloride in ethanol was added as an additional volume. After adding 1 millilitre of 0.5% 1-dipyridyl in ethanol, another millilitre of ethanol was added to bring the total to five millilitres. After mixing the solution, the absorbance was measured at 520 nm in comparison to the blank.

Organoleptic Evaluation

A panel of 20 randomly chosen, semi-trained panelists, including male and female academics, laboratory staff, and students of the department of Food Technology and Nutrition and Dietetics, evaluated the meat replacements for colour, taste, look, flavour, and overall acceptability. The eligible panelists were carefully chosen to prevent judgmental prejudice that could result from hunger or poor health. Organoleptic characteristics were evaluated using a nine-point hedonic scale, with zero representing extreme dislike and nine representing extreme liking. The samples were shown to the panelists in a randomized order. The 100% beef sample served as the reference.

Method of Data Analysis

Data obtained from the organoleptic evaluation and laboratory analysis were statistically analyzed using SPSS version 20.0. An analysis of variance (ANOVA) was applied to analyze the data, and Duncan's multiple range test was applied next to identify significantly different means.

Result

Table 1 shows the outcomes of the meat alternative yield employing blends of cow and coconut milk. As the percentage of coconut milk rose and the preparation time increased, the production of the meat substitute gradually declined, as the table makes clear. Sample B yielded the most meat substitute (486g) in the shortest amount of time (8 minutes) and contained 2700 ml of cow milk and 300 ml of coconut milk. A steady decrease in product yield (439g, 330g, and 315g) and a gradual rise in preparation time (15, 17, and 20 minutes) were the results of increasing the amount of coconut milk in Samples C, D, and E from 400 ml to 500 ml and 600 ml, respectively. This implies that adding more coconut milk lowers the yield of the final product and lengthens the processing time, perhaps as a result of the physicochemical characteristics of coconut milk and cow milk differing.

Table 1: Meat Substitute Yield

Samples	Meat	Cow Milk (Milliter)	Coconut Milk (Milliter)	Total milk used (Milliter)	Yield of product (g)	Time used in preparation
A	100%	0	0	0	0	0
B	0	2700 mil	300 mil	3000 mil	486g	8 min
C	0	2600 mil	400 mil	3000 mil	439g	15 min
D	0	2500 mil	500 mil	3000 mil	330g	17 min
E	0	2400 mil	600 mil	3000 mil	315g	20 min

Key

Specimen A = 100% meat
Specimen B = 90% cow milk, 10% coconut milk
Specimen C = 80% cow milk, 20% coconut milk
Specimen = 70% cow milk, 30% coconut milk
Specimen E = 60% cow milk, 40% coconut milk

The results of the samples' vitamin makeup are displayed in Table 2. The levels varied from 0.03 to 0.01 for vitamin A, 2.95 to 2.16 for vitamin B12, 0.40 to 0.20 for vitamin B6, and 0.10 to 0.02 for vitamin D. Specimens A and B had the highest content of vitamin A, whereas specimens D and E had the lowest (0.01). The values for vitamin B12 and B6 were highest in specimen A (2.95), (0.44), followed closely by specimen B (2.74), (0.35), and lowest in specimen E (2.16), and (0.20). Specimens A (0.02) and D and E (0.10) exhibited the lowest and highest values of vitamin D, respectively. Each sample showed a significant difference (p<0.05).

Table 2: Vitamin Composition of Fried Meat Alternatives Samples

Specimen	A (µg/100g)	B12 (µg /100g)	B6 (mg/100g)	D (µg/100g)
A	0.03 ± 0.001^{a}	2.95 ± 0.02^{a}	0.44 ± 0.04^{a}	0.02 ± 0.02^{b}
B	0.03 ± 0.001^{b}	2.74 ± 0.03^{b}	0.35 ± 0.03^{b}	0.05 ± 0.02^{ab}
C	0.02 ± 0.001^{c}	2.45 ± 0.03^{c}	0.33 ± 0.04^{cd}	0.05 ± 0.04^{ab}
D	0.01 ± 0.001^{d}	2.31 ± 0.04^{d}	0.26 ± 0.02^{cd}	0.10 ± 0.01^{a}
E	0.01 ± 0.001^{e}	2.16 ± 0.03^{e}	0.20 ± 0.02^{e}	0.10 ± 0.02^{a}

Data shown as mean ± SD (duplicate measurements). Significant differences ($p < 0.05$) are indicated by different superscripts within rows.

The results of the mineral content of the meat substitute samples are displayed in Table 3. These values varied from 5.16 to 4.33 mg/100g for calcium, 8.14 to 7.20 mg/100g for iron, 4.66 to 3.99 mg/100g for magnesium, and 26.45 to

-16.37 mg/100g for zinc. Out of all the mineral content examined, specimen A had the greatest value, followed by specimen B. There was a significant difference (p<0.05) in each sample.

Table 3. Mineral Composition of Fried Meat Alternative Samples

Sample	Iron (mg/100g)	Calcium (mg/100g)	Zinc (mg/100g)	Magnesium (mg/100g)
A	5.16 ± 0.04^a	8.14 ± 0.03^a	4.64 ± 0.06^a	26.45 ± 0.06^a
B	4.93 ± 0.04^b	7.84 ± 0.08^b	4.45 ± 0.04^b	24.86 ± 0.03^b
C	4.74 ± 0.04^c	7.55 ± 0.03^c	4.23 ± 0.03^c	21.07 ± 0.03^c
D	4.55 ± 0.04^d	7.24 ± 0.04^d	4.21 ± 0.06^c	18.10 ± 0.04^d
E	4.33 ± 0.05^e	7.20 ± 0.04^d	3.99 ± 0.06^d	16.37 ± 0.05^e

Data shown as mean ± SD (duplicate measurements). Significant differences ($p < 0.05$) are indicated by different superscripts within rows.

The results of the meat substitute samples' sensory qualities are displayed in Table 4. The meat substitute specimen's colour ranged from 7.80 to 7.00, with specimen A (control) having the highest mean value. The colour of the specimen did not differ substantially (p<0.05) from the other samples under investigation. The mean values of specimen A's taste (8.55-6.35), texture (8.20-6.85), scent (8.45-7.05), appearance (8.15-7.10), and overall acceptability (8.50-7.35) were higher than those of the other samples. Specimen B's mean value was closely behind specimen A's. Appearance and general appeal, with the exception of hue, which did not change significantly (p<0.05). According to the results of these sensory qualities, sample A (100% meat) was the most favoured and differed considerably from samples B, C, D, and E. These sensory attributes results reveal that sample A (100% meat) was significantly different from Samples B, C, D, and E, and was the most preferred.

Table 4: Organoleptic Attributes of Fried Meat Alternatives Samples

Sample	Color	Taste	Texture	Aroma	Appearance	Overall Acceptability
A	7.80 ± 1.06^a	8.55 ± 0.69^a	8.20 ± 0.95^a	8.45 ± 0.51^a	8.15 ± 0.81^a	8.50 ± 0.61^a
B	7.30 ± 1.34^a	7.50 ± 1.43^b	7.55 ± 1.32^{ab}	7.35 ± 1.14^b	7.65 ± 1.04^{ab}	8.10 ± 0.79^{ab}
C	7.00 ± 1.17^a	6.35 ± 1.42^c	6.70 ± 1.53^b	7.05 ± 1.05^b	7.25 ± 1.16^b	7.35 ± 1.04^c
D	7.05 ± 1.23^a	7.20 ± 1.64^{bc}	7.30 ± 1.53^b	7.40 ± 1.10^b	7.30 ± 1.13^b	7.65 ± 0.99^{bc}
E	7.20 ± 1.24^a	6.90 ± 1.33^{bc}	6.85 ± 1.39^b	7.10 ± 1.17^b	7.10 ± 1.37^b	7.45 ± 1.00^c

Data shown as mean ± SD (duplicate measurements). Significant differences ($p < 0.05$) are indicated by different superscripts within rows.

Discussion

The weight of the coagulated milk product (in grams) was used to calculate the yield of the meat substitute product. The meat substitute was created through the coagulation of proteins from cow and coconut milk, as shown in Table 1. As can be observed in Sample B (2700 mL: 300 mL), adding 300 mL of coconut milk raised the cow milk content, as indicated in the table. Conversely, adding 400 mL to 600 mL of coconut milk led to a decrease in the production of the faux meat. This suggest a direct link between a higher protein concentration and a higher final product yield (Amar et al., 2024**).** Sample B (2700 mL cow milk: 300 mL coconut milk) yielded 486g, which is substantially larger than Sample E's (315g) yield (2400 mL cow milk: 600 mL coconut milk**).** The higher proportion of cow milk in Sample B directly accounted for its higher yield of meat substitute, which is consistent with Halim et al. (2022). They reported that in a study of coconut-milk cheese production and its sensory characteristics, the product yield decreased from 37.96 % to 31.38 % as the amount of coconut milk increased. The reduction in cheese output with increased coconut milk content may have been caused by the low protein content and poor functional qualities of coconut milk (Amar et al., 2024). Furthermore, the table shows that the longer the coagulation time, the more coconut milk is .

The differences between the animal-based samples of beef and the plant-based samples of coconut milk are shown by the vitamin makeup of the meat substitutes. Vitamin A, vitamin B12, vitamin B6, and vitamin D showed significant differences ($p < 0.05$). All of the samples had low vitamin A contents (0.01–0.03 µg/100g), which is consistent with the findings of Fulgoni & Quann (2012) and, that milk and beef only contain trace levels of vitamin A unless supplemented.

Similarly, this result is consistent with the findings of Herrmann et al. (2024), who found that the vitamin B12 content dropped from 0.2 µg to 0.0 µg. The range of vitamin B12 is 2.16 mg/100 g to 2.95 mg/100 g, with sample A having the highest amount and sample E having the lowest. Additionally, sample A had a high level of vitamin B6 (0.44 mg/100g), but sample E had a lower level (0.20 mg/100g). Vitamin B6 likely decreased along with the protein concentration in the alternatives since, like B12, it is naturally abundant in meat and aids in protein metabolism (Ishaq et al., 2022).

The majority of the world's supply of vitamin B12, a fourth of vitamin A, and significant amounts of other B vitamins and minerals come from meat (Leroy et al., 2023). Beef had the lowest level of vitamin D (0.02 mg/100g), while milk-based products had a little rise (up to 0.10 mg/100g in Samples D and E). Every sample differs significantly from the others. Vitamins are crucial for boosting immune system performance and shielding cells from oxidative damage (Ishaq et al., 2022).

Minerals are inorganic materials that the body needs in trace amounts for a number of processes, such as the development of bones and teeth, the production of vital bodily fluids like blood and tissues, and the maintenance of the enzymatic and neurological systems (Dinda, 2019). The designed product's iron, calcium, zinc, and magnesium contents showed significant changes ($p < 0.05$). The iron level of the five samples ranged from 7.20 mg/100g to 8.14 mg/100g, with sample A having the highest, and the milk-based product generally having a declining value. In like manner, Herrmann et al. (2024) found that the iron level reduced from 3.0 mg to 1.7 mg in their study.

In accordance with Ukom et al. (2022) observation, that the calcium content of a blend of melon seed and coconut cheese hiked from 825.31 to 962.13 mg/100g, the calcium content also varied from 7.20 mg/100g to 8.14 mg/100g, with sample A having the highest even though cow milk is a proven source of calcium (Ishaq et al., 2022), calcium retention may have been impacted by the product's matrix and mixing procedure, which caused it to decrease as the amount of coconut milk increased. Additionally, the zinc composition varies between 4.64 and 3.99 mg/100; sample A had the greatest value, while sample E had the least. This outcome is consistent with that of Isaac et al. (2020), whose research revealed a notable disparity in zinc concentration from 5.12 mg/100g to 3.86 mg/100g.

Sample A had the highest magnesium levels (26.45), while Sample E had the least (16.37). Together, these findings support the knowledge that meat alternatives frequently lack essential trace elements, like iron, zinc, and vitamin B12 that are found naturally in animal flesh (Ishaq et al., 2022). To produce nutritionally complete animal alternatives, essential trace elements must be added through fortification (Ishaq et al., 2022). The highest amount of trace elements, such as calcium, zinc, and iron, was found in the meat control (Sample A). Nonetheless, the formulated samples were a rich source of protein and vital minerals, especially sample B (2700ml: 300l), which contained a higher amount of cow milk. Among the formulated samples, Sample B had the highest levels of calcium and vitamin B12, giving it a benefit over the others.

Finding the best formulated product requires careful consideration of organoleptic evaluation. Samples B, C, D, and E were made using various proportions of cow milk and coconut milk blend, whereas sample A is 100% meat and acts as a control. The samples' colour, flavour, taste, appearance, and general acceptance were all probed. The meat alternative colour ranged from 7.80 to 7.00, with Sample A having the highest colour rank (7.80), and Sample C having the least (7.00). There was a noticeable variation between the samples. When probing how well meat has been processed, colour is an important factor that shows the calibre of the raw materials used as well as the production process as a whole. (AMSA, 2015).

Sample A had the greatest flavour rating (8.55%), while Samples C and E had the least (6.35% and 6.90%, respectively). The faux meat samples' taste ratings varied from 8.55% to 6.90%. There was a notable disperity in flavour between the samples ($p < 0.05$). According to Nivetha et al., (2019), who studied the development and sensory evaluation of meat analogues, the taste results ranged from 8.66% to 6.18%. These findings aligns with the results of present study. The juiciness of the meat and the consumer's familiarity with sample A may be the reasons for its highest taste rating.

The meat samples' grades for aroma varied from 8.45 to 7.10, with Sample A having the greatest score at 8.45 and Sample C having the lowest. A significant ($p < 0.05$) difference in aroma was noticed between sample A and the formulated samples. Given that sample A is animal meat, and the formulated sample was a milk-based substitute, this is to be expected. The meat samples' appearance ranged from 8.15% to 7.10%, with Sample A having the most value at 8.15% and Sample E having the least at 7.10%. The appearance of sample A and the formulated samples varied significantly ($p < 0.05$); however, the formulated samples did not differ significantly from one another.

The meat samples' overall acceptability varied from 8.50% to 7.35%. Sample A had the highest grade of 8.50%, while Sample C received the least. This implies that Sample A was preferred the most, most likely because people were familiar with it. In their study of the development and sensory evaluation of meat analogue, Nivetha et al., (2019) revealed high organoleptic scores for 100% meat, which aligns with the results obtained for the sensory evaluation of meat substitute.

Sample A rated highest on all organoleptic attributes, including colour, taste, texture, and overall acceptability, according to the sensory evaluation's outcomes. This is agrees with meat products' well-known sensory appeal (He et al., 2020; Xiong, 2023). The product with 90% cow milk was the most preferred meat substitute among the formulated items, and received the highest scores across the board. This implies that customers like the texture and flavour that a higher proportion of cow milk offers (Ekanem & Ojimelukwe, 2017). Its increased protein and fat content may be the source of its excellent ratings, since fat is important for food products' mouthfeel and palatability (Verplanken et al., 2017). Table 1 shows that the product outcome (meat substitute yield) decreased as the ratio of coconut milk in the other formulated samples grew. This suggests that the larger the amount of cow milk used, the higher the product yield.

Conclusion

This study ascertained that mixtures of coconut and cow milk, particularly sample B (90% of cow milk and 10% of coconut milk), produces the greatest quantity of vital nutrients and exhibit satisfactory organoleptic attributes. Therefore, it is appropriate as meat alternative for people who refrain from meat due to health, religious, or dental consecrations. These blend is advantageous for a variety of demographics, including children, adults, the elderly, lacto-vegetarians, and individual with dental caries.

This study suggests further investigation on the proximate composition and microbial load of the formulated product.

References

Achikanu, C. E., Eze-Steven, P. E., Ude, C. M., & Ugwuokolie, O. C. (2013). Determination of the vitamin and mineral composition of common leafy vegetables in south eastern Nigeria. International Journal of Current Microbiology and Applied Sciences, 2(11), 347-353.

Ahmed, E., Rita, R. P., Huq, S., Kabir, E., Rana, M. S., & Mazumder, M. A. R. (2019). Development of functional condensed milk from coconut milk and soy milk. Asian Food Science Journal, 6(4), 1-7. (link unavailable)

Amar, A., Sukotjo, S., Nurani, D., & Andini, D. (2024). Effect of substituting cow milk with saga bean (Adenanthera pavonina, Linn) milk during the processing of saga soft cheese. Food Research, 8(2), 8-15. (link unavailable)

AMSA (American Meat Science Association). (2015). Research Guidelines for Cookery, Sensory Evaluation, and Instrumental Tenderness Measurements of Meat.

Aziz, N. S., Chin, Z. K., Mohd Razali, N. S., Sofian-Seng, N. S., & Kasim, K. F. (2023). Development of mature coconut (Cocos nucifera L.) probiotic beverage: Physicochemical characteristics, microbial count, antioxidant activity, and sensory acceptance. International Food Research Journal, 30(1).

Bakhsh, A., Lee, S. J., Lee, E. Y., Hwang, Y. H., & Joo, S. T. (2021). Traditional plant-based meat alternatives, current, and future perspective: A review. *Journal of Agriculture & Life Science,* 55(1), 1-10. https://doi.org/10.14397/jals.2021.55.1.1

Dinda, S. C. (2019). Value of minerals for human body. Food Science & Nutrition. (link unavailable)

Ekanem, G. O., & Ojimelukwe, P. C. (2017). Potentials of coconut milk as a substitute for cow milk in cheese making. Journal of Advances in Microbiology, 4(2), 1-9. (link unavailable)

FAO. (2020). The State of Food and Agriculture 2020 – Overcoming water challenges in agriculture. Food and Agriculture Organization of the United Nations.

Fructuoso, I., Romão, B., Han, H., Raposo, A., Ariza-Montes, A., Araya-Castillo, L., & Zandonadi, R. P. (2021). An overview on nutritional aspects of plant-based beverages used as substitutes for cow's milk. Nutrients, 13(8), 2650. (link unavailable)

Fulgoni, V. L., & Quann, E. E. (2012). National trends in beverage consumption in children from birth to 5 years: Analysis of NHANES across three decades. Nutrition Journal, 11(1), 92.

Halim, J. K., Wangrimen, G. H., & Fitriani, A. (2022). Production of coconut milk cheese and its organoleptic characteristics. Journal of Agric-Food Science and Technology, 3(1), 1-9. (link unavailable)

He, J., Evans, N. M., Liu, H., & Shao, S. (2020). A review of research on plant-based meat alternatives: Driving forces, history, manufacturing, and consumer attitudes. Comprehensive Reviews in Food Science and Food Safety, 19(6), 2639-2656. (link unavailable)

Herrmann, M., Mehner, E., Egger, L., Portmann, R., Hammer, L., & Nemecek, T. (2024). A comparative nutritional life cycle assessment of processed and unprocessed soy-based meat and milk alternatives including protein quality adjustment. Frontiers in Sustainable Food Systems, 8, Article 1413802. (link unavailable)

Isaac, A., Edem, V., Ime, H., & Elijah, E. (2020). Quality attributes of cheese produced from goat's milk supplemented with coconut milk. Journal of Food Technology Research, 7(1), 100-109. (link unavailable)

Ishaq, A., Irfan, S., Sameen, A., & Khalid, N. (2022). Plant-based meat analogs: A review with reference to formulation and gastrointestinal fate. Current Research in Food Science, 5, 973–983. (link unavailable)

Jahurul, M. H. A., Ghafoor, K., & Khatib, A. (2014). Nutritional and functional properties of coconut milk. Journal of Food Science and Technology, 51(4), 761-770. (link unavailable)

Jahurul, M. H. A., Zaidul, I. S. M., Norulaini, N. A. N., Sahena, F., Jalal, K. C. A., Omar, A. K. M., & Mohd Omar, A. K. (2014). Coconut milk and its processing: A review. Food Bioscience, 5, 64–74.

Laskowski, W., Górska-Warsewicz, H., & Kulykovets, O. (2018). Meat, meat products and seafood as sources of energy and nutrients in the average Polish diet. Nutrients, 10(10), Article 1412. (link unavailable)

Leroy, F., Smith, N. W., Adesogan, A. T., Beal, T., Iannotti, L., Moughan, P. J., & Mann, N. (2023). The role of meat in the human diet: Evolutionary aspects and nutritional value. Animal Frontiers, 13(2), 12-18. (link unavailable)

Mode, A. M., Magaji, U. F., Nzon iwu, N. A., Wamakko, H. H., Ahmad, I., & Dandare, S. U. (2023). Comparative analysis of the antioxidant capacity of milk from different breeds of cow in Nigeria. International Journal of Biological and Chemical Sciences, 17(2), 600-617. (link unavailable)

Nivetha, B. R., Sudha, K., Narayanan, R., & Vimalarani, M. (2019). Development and sensory evaluation of meat analog. International Journal of Current Microbiology and Applied Sciences, 8(8), 1283-1288. (link unavailable)

Nwaeze, K. U., Ogah, C. O., Oribayo, O., Tinubu, A. O., Ezem, O. R., & Olaleye, O. O. (2020). Prevalence of some micro and macro-elements in different brands of processed cow milk in Lagos, Nigeria. J. Chem Soc. Nigeria, 45(3), 469-476.

Opeyemi, A. L. (2019). Quality, Sensory and Storage Attributes of Cheese Produced From Cowmilk Supplemented with Tigernut and Coconut Milk. [Doctoral dissertation, Federal University Oye-Ekiti].

Parmar, P. T., Singh, A. K., & Borad, S. G. (2021). Coconut (Cocos nucifera). In B. Tanwar & A. Goyal (Eds.), Oilseeds: Health attributes and food applications (pp. 163-191). Springer Nature. (link unavailable)

Sharma, P., Khanal, R. C., & Bansal, D. D. (2019). Cheese: Importance and Introduction to Basic Technologies. Journal of Food Science and Technology Nepal, 11, 14-24.

Singh, A., & Sit, N. (2022). Meat analogues: Types, methods of production and their effect on attributes of developed meat analogues. Food and Bioprocess Technology, 15(6), Article 28. (link unavailable)

Ukom, A. N., Madu, C. J., Nwanagba, L. N., & Nwachukwu, A. C. (2022). Physicochemical Composition, Antioxidant Profile and Sensorial Acceptability of Melon Seed-Coconut Milk Alternative Cheese. Nigerian Agricultural Journal, 53(3), 1-4.

Verplanken, K., Wauters, J., Vercruysse, V., Aluwé, M., & Vanhaecke, L. (2017). Sensory evaluation of boar-taint-containing minced meat, dry-cured ham and dry fermented sausage by a trained expert panel.