World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

# Production and characterization of margarine from coconut and melon oil blend

Nwafor Ihennariorochi A [1,*], Onyema Chika Rose [2] and Okeke Chibuzor O [3]

[1] *Department of Biology/Microbiology, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria.*
[2] *Department of Microbiology/Biochemistry, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria.*
[3] *Department of Chemistry/Biochemistry, Federal Polytechnic Nekede, Owerri, Imo State, Nigeria.*

World Journal of Advanced Research and Reviews, 2026, 29(01), 1447-1454

Publication history: Received on 14 December 2025; revised on 24 January 2026; accepted on 26 January 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.29.1.0184

## Abstract

This study examined the production of margarine from a blend of coconut and melon seed oils as a sustainable, non-hydrogenated alternative to traditional spreads, addressing health concerns associated with trans fats and the need for plant-based formulations. Oils were extracted from melon seeds and coconut meat using mechanical pressing methods, blended in equal ratios, and formulated into margarine with and without salt, incorporating emulsifiers, antioxidants, flavor, and skim milk powder. The products were characterized for physicochemical properties (acid value, free fatty acids, peroxide value, saponification, iodine value, density, refractive index, melting/boiling points, and cloud point), proximate composition (moisture, fat, ash, fiber, protein, and carbohydrates), and mineral content (including sodium, potassium, calcium, magnesium, zinc, iron, and trace elements) using standard analytical techniques. The results of the study revealed that unsalted margarine exhibited lower acid (4.334 %) and free fatty acid (2.169 %) values, higher saponification (174.198 mgKOH/g) and iodine (71.67) values, indicating better hydrolytic stability and unsaturation retention. Salt addition increased acidity, peroxide (16.0 meq/kg), and sodium (22.787 ppm), while proximate analysis showed low moisture (5%), moderate fat (30%), and high carbohydrates (57%). Mineral contents confirmed safety with beneficial macro/trace elements. It was concluded that the coconut-melon oil blend produces a stable, nutrient-rich margarine comparable to commercial margarine, with salt enhancing flavor but requiring moderation for dietary considerations. This study supports the use of tropical oils for eco-friendly food innovations.

**Keywords:** Production; Coconut Oil; Melon Oil; Physicochemical; Proximate; Minerals

## 1. Introduction

Margarine, a widely consumed fat-based spread, has historically been produced through the hydrogenation of vegetable oils to achieve desired consistency and stability. However, the health implications of trans fats and the environmental concerns associated with industrial hydrogenation have prompted a shift towards healthier and more sustainable alternatives (Ramalho et al., 2020). This has led to the exploration of non-hydrogenated, plant-based oils as viable substitutes in margarine production. Specifically, oils from coconuts and melons have gained attention for their potential use in food formulations due to their favorable health properties and unique fatty acid compositions (Bello et al., 2019; Okafor et al., 2021).

Recent studies have investigated various oil blends for margarine formulation. For instance, a study by Ityotagher and Terhile (2020) evaluated margarine produced from blends of melon and palm kernel oils, identifying a 70:30 ratio as optimal for desirable physicochemical and sensory properties. Similarly, research by Ezenwa et al. (2025) assessed margarine from coconut and cashew kernel oil blends, highlighting its potential as a shortening for biscuit production. These studies underscore the viability of using alternative oils in margarine production, suggesting that blending oils can enhance the functional properties of margarine (Akinmoladun et al., 2020).

* Corresponding author: Nwafor Ihennariorochi A

Despite these advancements, there remains limited research on the combined use of coconut and melon oils in margarine production. Coconut oil is known for its high saturated fat content, which contributes to its stability and spreadability, while melon oil, though less explored, offers unique fatty acid profiles that could enhance margarine characteristics (Bello et al., 2021). The synergistic effects of these oils in margarine formulation have not been extensively studied, thus presenting an opportunity for novel product development.

Therefore, this study aims to produce and characterize a novel margarine blend using coconut and melon oils. The objectives include evaluating the physicochemical properties, sensory attributes, and stability of the margarine, thereby contributing to the development of healthier and more sustainable margarine alternatives. This research will fill the gap in knowledge regarding the potential of these oils for use in margarine formulations and provide insights into their practical application in the food industry.

## 2. Materials and Methods

### 2.1. Sample collection

Melon seeds, coconut fruit, salt, skim milk powder and emulsifier were purchased from Nkwo-Ukwu market, Ihiagwa, Owerri-West, L.G.A., Imo State.

### 2.2. Preparation of melon oil

The method described by Akubuenyi and Odey (2022) in the preparation of melon seed. The procured egusi melon seeds will be sorted and washed to remove dirt and other extraneous materials such as sands, sticks, leaves and debris. The sorted and washed melon seeds was oven dried and then roasted in a dry pot until they became very brown. After cooling, the seeds was milled into paste without the addition of water using a wet miller. The paste was pressed with clean hands continuously. Little water was added at intervals during pressing and the extracted oil was collected. The oil was filtered using a double layer of cheese cloth to remove solid particles present in it. The moisture was removed by oven drying at 105 °C for one hour and then stored at 8 °C until use.

### 2.3. Extraction of oil from the coconut

The method described by Ityotagher and Terhile (2020) in the preparation of coconut was used. The fresh coconut meat was grated and allowed to dry under the sun for some days. Thereafter, the coconut meat was ground using sterile mechanical grinder and the oil extracted by pressing it through sterile white handkerchief. The oil was labeled and stored for further use.

### 2.4. Blend formulation

The method described by Ityotagher and Terhile (2020) was adopted in the blend formulation of coconut oil and melon. Two different blends was formulated based on addition of salt and without salt.

### 2.5. Production of Butter from blends of melon and coconut oil

The method described by Ityotagher and Terhile (2020) was used in the production of butter from blends of melon and coconut oil. Butter was produced from of melon and coconut oil. Butter produced from 125 ml of melon oil and 125 ml of coconut oil. A basic recipe that include five (5) spoons of oil blend, 500 ml emulsifier, five (5) spoons of water, pinch of spoon salt, ten (10) spoons of skim milk powder, half spoon of flavour, 50 pieces of antioxidant was used for butter production. Emulsifier, antioxidant and flavour was dissolved in the heat oil phase. Salt and skim milk powder were dissolved in the water phase. The water phase was added gradually to the oil phase while agitating it to form a nice emulsion. For the solidification of butter, the emulsion was stirred for 10 minutes and then cooled in ice bath containing 10 % sodium chloride (NaCl). The emulsion was then mixed and solidified at a temperature of 11 °C. The butter samples was labelled and stored in a refrigerator at 4 °C.

### 2.6. Determination of mineral contents of the produced from blend of coconut oil and melon oil

The method described by Imo et al. (2018) was adopted in the determination of mineral contents of the produced from blend of coconut oil and melon. The concentration of minerals determine were; sodium, magnesium, potassium, calcium, zinc, copper, iron, lead, manganese, chromium, cadmium, arsenic, cobalt, mercury, silver, selenium and aluminium.

*2.6.1. Calcium*

The calcium content was determined based on the method of Perkin Elmer Corporation, USA. A 1.0g sample was treated with 10ml of concentrated HNO 3 and 4ml of 70 % HClO 4 . The resulting solution was evaporated to a smaller volume (7 ml) by careful heating and transferred to 50 ml volumetric flask. One millilitre (1 ml) of SrCl 2 .6H 2 O was added and made up to volume with distilled water. The solution was The solution was sprayed into atomic absorption spectrophotometer (Perkin Elmer, model 5100 PCAAS, USA) at 422.7 nm to determine the concentration of calcium. The calcium standards used were 0 ppm, 5 ppm, 10 ppm, 20 ppm and 30 ppm.

*2.6.2. Iron*

The iron content was determined based on the method described by Perkin Elmer Corporation. Ten milliliters (10 ml) of concentrated HNO 3 was added to 1 g of the sample and left overnight. The sample was carefully heated until the production of red nitrogen dioxide fumes ceased. The sample was cooled and 4 ml of 70 % HClO 4 was added and evaporated to a smaller volume (7 ml) by careful heating. The resulting solution was quantitatively transferred into 50 ml volumetric flask and diluted to the mark with distilled water. The solution was sprayed into an atomic absorption spectrophotometer (Perkin Elmer, model 5100 PCAAS, USA) at 248.3 nm to determine the concentration of iron. The iron standards used were 0 ppm, 1 ppm, 2 ppm, 3 ppm and 4 ppm.

*2.6.3. Magnesium*

Magnesium was determined by Atomic Absorption Spectrophotometry (AOAC, 1990). One gram (1 g) of the sample was dry ashed in a muffle furnace (Muffle furnace size 2, England) at 550 ˚C for 5 hours until a white residue of constant weight was obtained. The minerals were extracted from the ash by adding 20.0 ml of 2.5 % HCl, heated to reduce the volume to 7.0 ml, and this was transferred quantitatively to a 50 ml volumetric flask. It was diluted to the mark (50 ml) with distilled water, stored in clean polyethylene bottles and magnesium content determined using atomic absorption spectrophotometer (Perkin Elmer model 5100 PCAAS, USA) at 285.2nm. Magnesium standards of 0 ppm, 0.5 ppm, 1 ppm, 1.5, and 2 ppm were used.

*2.6.4. Zinc*

Zinc was determined after digestion of sample (about 2.0 g) by Atomic Absorption Spectropho-tometer (AAS) at 213.8 nm using air-acetylene as a source of flame for atomization. Zinc level was then estimated from standard calibration curve (0.5 - 3.0 µg Zn/ml) prepared from ZnO.

*2.6.5. Sodium*

The sodium determination was done based on the method of AOAC (2015). Two grams of the sample was ashed in muffle furnace (Muffle furnace size 2, England) preheated to 600˚C for 2 hours. The ash was dissolved in 5 ml of 5 M H 2 SO 4 . Four millilitres (4 ml) of 2% ascorbic acid and 4 ml of 4% ammonium molybdate were added to the resulting solution and shaken for uniform mixing. The absorbance of each sample was determined with a UV spectrophotometer (UNICAM 929 AA Spectrophotometer, UK) at 420 nm.

**2.7. Determination of proximate composition of the produced from blend of coconut oil and melon**

The method described by Association of Official Analytical Chemist (AOAC, 2015) was adopted in the determination of the proximate composition. The following parameters: ash content, protein content, crude fibre content, crude fat content, moisture content and carbohydrate content.

*2.7.1. Ash content determination*

Two grams (2.0g) of the sample was weighed out using digital electronic balance in a crucible which was washed and dried in an oven, cooled and weighed. The porcelain crucible containing the sample was heated on a Bunsen flame inside a furnace cupboard until no fume was observed. The crucible with the residue was transferred to a preheated mantle furnace at 600 ℃ for 2 hours until complete ashing and constant weights were achieved with intermittent cooling and weighing. The percentage of the ash was calculated.

*2.7.2. Nitrogen and crude protein determination*

Two grams (2.0 g) of the sample was weighed into a Kjelhadh flask. Five gram of anhydrous sodium sulphate and one gram of Copper sulphate was added (as catalyst). Then 25 milliliters of concentrated H 2 SO 4 was added to the sample and moved into a furnace cupboard and heated for 1 hour using Thermo regulated heating mantle at temperature of 25 0 C with intermittent shaking till green color emerged. It was filtered to remove impurities. The filtrate was reheated

gently until green color disappeared and was allowed to cool. The digest was transferred with several washings into a 250 milliliters volumetric flask and made up to the mark with distilled water. It was distilled using distillation apparatus. 100 milliliters capacity conical flask containing 5milliliter of boric indicator was placed under the liquid. 10 milliliters of the digest was measured and transferred to the cap of the Kjeldah distiller, followed by addition of 10 milliliters of 40% 0.1 mole NaOH solutions. The solution was shaken thoroughly for 15 minutes to collect enough ammonium sulphate, evidenced by colorless solution. The receiving flask was removed and the tip of the condenser was washed down into the flask. The solution was titrated in the receiving flask using 0.01 ml HCL until blue colour appeared.

*2.7.3. Crude fibre determination*

Two grams (2.0 g) of the sample was weighed out using digital electronic balance and boiled with 200ml of 1.25% H 2 SO 4 for 30 minutes in a flask using water bath. It was filtered using Whatmann 54 filter paper through a funnel. The residue was washed with hot water to remove acid

from it. The residue was transferred to another beaker and boiled for 30 minutes in a water bath using 200 ml of 1.25% NaOH. It was filtered again and progressively washed with boiled water. The residue was also transferred to a crucible and dried in the oven to a constant mass. It was at this stage incinerated using mantle furnace, cooled and reweighed. The percentage of the fibre wascalculated.

*2.7.4. Crude fat determination*

The wet samples were dissolved in the methanol to give a single phase, miscible with water. Additionally, chloroform was added to give a separation of the phases and then centrifuged to separate the solvents. The residue left behind after the chloroform layer containing the dissolved fat was removed and reweighed. The percentage of the fat was calculated.

*2.7.5. Determination of moisture content*

A crucible was properly washed and allowed to dry in an air oven at 110 ℃ for 10 minutes to a constant weight. Then the crucible was allowed to cool in desiccators for 30 minutes and was labelled and weighed (W1). 2.0g of the sample was accurately weighed (W2). The crucible containing the sample was placed in an oven maintained at 103 ℃ for 14 hours. It was then be removed and allowed in the desiccator then finally weighed (W3). The percentage moisture content was calculated.

*2.7.6. Determination of carbohydrate*

The total carbohydrate content was determined by difference method. The sum of the percentage moisture, ash, crude lipid, crude protein and crude fibre was subtracted from 100%. Carbohydrate = 100- (% moisture + % ash + % protein + % lipids + % fibre).

**2.8. Determination of the physicochemical properties of the produced butter**

The method described by Association of Official Analytical Chemists (AOAC) (2015) was adopted in the determination of the physicochemical properties of the samples.

*2.8.1. Acid value*

Twenty five millilitres (25 ml) of diethyl ether was mixed with 25 ml alcohol and 1 ml of 1 % phenolphthalein and was carefully neutralized with 0.1 M NaOH. Thereafter, 5 g of the oil was melted in neutral solvent and was titrated with 0.1M aqueous NaOH by shaking constantly until a persistent pink colour was obtained within 15 seconds. The acid value was calculated using the formular;

$$\text{Acid value} = \frac{\text{Titre (ml) x 5.61}}{\text{Weight of sample used}}$$

where; The FFA figure is usually calculated as oleic acid (1ml 0.1M sodium hydroxide = 0.0282g oleic acid), in which case the acid value = 2x FFA. For most oils acidity begins to be noticeable to the palate when the FFA calculated as oleic acid is about 0.5- 1.5 %.

*2.8.2. Iodine value*

The butter was added into small beaker and a small rod was added and weighed out into a suitable quantity of the sample. Thereafter, 10 ml of carbon tetrachloride was added to dissolve. 20 ml of Wiji's solution was added and stoppered and allowed to stand in the dark for 30 minutes. 15 ml of potassium iodine solution and 100 ml of water was

added and titrated with 0.1M thiosulphate solution using starch as indicator. A blank was carried out at the same time commencing with 10 ml of carbon tetrachloride (titration = bml) and calculated.

$$\text{Iodine value} = \frac{(b - a)}{\text{Weight of sample}} \text{x } 1.269$$

*2.8.3. Specific gravity/density*

A 50 ml pycometer bottle was washed thoroughly with detergent, water and petroleum ether, dried and weighed using weighing balance. The bottle was filled with water and weighed. Thereafter, the bottle was dried and filled with oil sample and weighed. Specific gravity was calculated;

$$\text{Specific gravity} = \frac{\text{Weight of Xml of oil}}{\text{Weight of Xml of water}}$$

$$\text{Density} = \frac{\text{Weight of oil}}{\text{Weight of water}}$$

*2.8.4. Refractive index*

The Abbe's refractometer was reset with a light compensator (water at 20 ℃). The oil was smeared on the lower prism of the instrument and closed. A light was passed by means of angled mirror which appeared in a form of a dark background. Using the fine adjustment, the telescope tubes were moved until the black shadow appeared in the cross wire indicator. The reading on the refractive index was recorded.

*2.8.5. Peroxide value*

One (1 ml) of oil was measured into a clean drying tube, 1 g powdered potassium iodide was added and 20 ml of solvent mixture (2 volume glacial acetic acid + 1 volume chloroform). The tube was placed in boiling water so that the liquid boils within 30 seconds and allowed to boil vigorously for not more than 30 seconds. The content was poured quickly into a flask containing 20 ml of 5% potassium iodide solution and washed out twice with 25 ml of water. The mixture was titrated with 0.002M sodium thiosulphate solution using starch indicator. The test was performed with blank at the same.

*2.8.6. Saponification value*

2 ml of the oil was measured into a conical flask and 25 ml of alcoholic potassium hydroxide. A reflux condenser was attached to the flask and heated in boiling water for 1 hour while shaking frequently. 1 ml of 1% phenolphthalein solution and titrated with hot excess alkali with 0.5M hydrochloric acid (titration = aml). The blank was carried out at the same time (titration = bml).

*2.8.7. Free fatty acids*

1000 milligram of the butter was added into 25 ml of centrifuge tube. Thereafter, 2 ml of water was added and dissolved and allowed for 15 minutes. 5 ml of internal standard of methyl tert butyl ether was added and 5 ml of 5% methanolic sodium methoxide solution. The tube was closed and vortexed for 10 seconds and after 180 seconds, 10 ml of neutralization solution was added. After 210 seconds, 10 ml of neutralization solution was added and shaken using vortex mixer. It was centrifuged at 1, 750 rpm for 5 minutes. Thereafter, 200 µL of the supernatant was added into 10 ml flask and diluted to mark with hexane.

## 3. Results and Discussion

### 3.1. Physicochemical Properties

The result of the physicochemical properties of margarine obtained from a blend of coconut and melon oils, with variations in salt addition is presented in Table 1. The result of this analysis provides the quality, stability, and nutritional profile of the produced margarine, which are important alternating potential as a food product.

The acid value and free fatty acid content functions as an indicators of hydrolytic rancidity and oil stability in fat-based products. In the unsalted margarine, these parameters were relatively low, suggesting negligible degradation and proper preservation of the oil blend's integrity during production. Salt inclusion, however, led to dignified levels, which

may reflect heightened susceptibility to water triggered breakdown or interactions between salt and the lipid matrix that increase the rate of free acid development. In spite of that, both variants exhibited values within a satisfactory ranges for edible spreads, suggesting that the coconut-melon blend offers a stable base for margarine formulation.

Peroxide value, which is a measure of oxidative stability, was moderate in both samples, with the salted version showing a slight increase. This could be attributed to salt's conceivable role as a pro-oxidant in the presence of trace metals or water, promoting the development of peroxides. The saponification value, which reflects the average molecular weight of fatty acids, was higher in the unsalted margarine, implying a greater proportion of shorter-chain fatty acids from the melon oil component. In contrast, the lower value in the salted product might come from partial esterification alterations during salting, though it remains comparable to commercial margarines derived from vegetable blends.

Specific gravity and density values were closely similar between the salted and unsalted margarine blend with 0.86 and 0.90, respectively, which indicates a consistent physical structure influenced by the semi-solid nature of the coconut-melon fat blend at ambient temperatures. The melting and boiling point value of the salted and unsalted coconut and melon oil blend of margarine were 5.8$^0$C and 6.9$^0$C and 179.2$^0$C and 173$^0$C respectively. The melting and boiling points exhibited minor differences, the unsalted blend have a slightly higher melting point than the salted blend, due to a more uniform crystal structure in the absence of salt crystals disrupting the fat lattice. The refractive index remained constant at 1.41, a demonstration for unsaturated vegetable fats, revealing the blend's high degree of unsaturation as confirmed by the iodine value.

Iodine value, indicative of unsaturation degree, was notably higher in the unsalted margarine, suggesting greater retention of double bonds from the coconut and melon oils. Salt addition reduce the iodine value due to oxidative side reactions during processing. The cloud point, representing the temperature at which the product begins to solidify, was higher in the salted blend, which might enhance its resistance to cold-induced separation, a desirable trait for refrigerated storage. Therefore, these physicochemical properties position the margarine as a viable alternative to traditional spreads, with salt influencing stability without exceeding edible oil thresholds established by food regulatory bodies.

**Table 1** Physicochemical parameters of the butter produced from coconut and melon oil

| Physicochemical Parameters | Margarine with salt | Margarine without salt |
|---|---|---|
| Acid value (%) | 4.334 | 10.71 |
| Free fatty acid (%) | 2.169 | 5.356 |
| Specific gravity (%) | 0.8659 | 0.8661 |
| Peroxide value (mleq/kg) | 14.6 | 16,0 |
| Saponification value (mgKOH/kg) | 174.198 | 139.158 |
| Melting point ( $^0$ C) | 6.9 | 5.8 |
| Boiling point ( $^0$ C) | 173 | 179.2 |
| Refractive index | 1.41 | 1.41 |
| Cloud point ( $^0$ C) | 138.8 | 142.9 |
| Density ( $^0$ C) | 0.911 | 0.894 |
| Iodine value | 71.67 | 60.20 |

### 3.2. Proximate Composition

The result of the proximate composition of the cocoout-melon oil blend of margarine are presented in Table 2. The moisture content was comparably low in both blends, around 5%, which is advantageous for microbial stability and aligns with standards for low-water-activity spreads to prevent hydrolysis (Wang and Chen, 2021). Therefore the low moisture content of the sample is an indication of safety and microbial stability. The fat content of the blend with salt was 32.98% and 29.1% for blend without salt. The proximate composition of the margarine with and without salt were within the standard reported by Codex Alimentarius Commission.

**Table 2** Proximate compositions of the butter produced from coconut and melon oil

| Proximate parameters | Margarine with salt (%) | Margarine without salt (%) |
|---|---|---|
| Moisture | 4.97 | 4.84 |
| Fat | 32.98 | 29.1 |
| Ash | 2.46 | 2.01 |
| Fibre | 0.35 | 0.25 |
| Protein | 3.89 | 4.89 |
| Carbohydrate | 55.40 | 58.86 |
| Moisture | 4.97 | 4.84 |

### 3.3. Mineral content

The mineral content of the margarine formulated from a coconut and melon oil mixture are presented in Table 3. Sodium levels obtained in this study were observed to be higher in the salted margarine, reflecting the direct contribution from added salt, which enhances flavor but also elevates overall mineral density. This result is consistent with observations in commercial fat spreads where salting significantly boosts sodium content, thereby impacting dietary recommendations for low-sodium diets. Potassium content were also seen to increase with salt addition, possibly due to synergistic effects during emulsification or inherent traces in the salt used. Comparable elevations have been noted in processed vegetable butters, where potassium supports cellular functions and complements the lipid matrix. Calcium and magnesium showed modest rises in the salted variant, suggesting that salt may facilitate better retention of these bone-supporting elements from the melon oil component. Research on seed-derived oils indicates that such minerals are naturally abundant in melon varieties, contributing to the structural integrity of spreads. Overall, the macro mineral composition positions this margarine as a source of essential electrolytes, with salted versions offering amplified benefits but requiring moderation to align with health guidelines on mineral intake. Minerals like zinc, copper, iron, manganese, and selenium exhibited slight change between the two formulations. The unsalted margarine displayed higher zinc and selenium, which could come from unaltered extraction from melon seeds, known for their role in antioxidant defense and immune support. Iron levels were slightly reduced in the salted sample, potentially due to interactions during processing that affect bioavailability, though still adequate for contributing to oxygen transport. Copper and manganese, conversely, saw minor increases with salt, mirroring trends in blended oil spreads where these elements aid enzymatic activities. Cobalt and chromium were present in trace amounts, with the unsalted variant showing marginally higher cobalt, indicative of the natural variability in tropical oils.

**Table 3** Mineral contents of the butter without salt produced from coconut and melon oil

| Mineral parameters | Margarine with Salt (ppm) | Margarine with Salt (ppm) |
|---|---|---|
| Sodium | 7.167 | 22.787 |
| Magnesium | 1.456 | 1.676 |
| Potassium | 6.356 | 10.109 |
| Calcium | 5.267 | 5.787 |
| Zinc | 0.676 | 0.566 |
| Copper | 0.466 | 0.497 |
| Iron | 2.467 | 2.109 |

## 4. Conclusion

This study demonstrated that margarine produced from a blend of coconut and melon seed oils is a viable, high-quality, plant-based alternative to conventional spreads. The physicochemical analyses revealed acceptable levels of acid value, free fatty acids, peroxide value, and other parameters in both salted and unsalted variants, confirming good oxidative and hydrolytic stability suitable for food applications. The proximate composition showed a balanced nutritional value

with moderate fat content, low moisture, and substantial carbohydrate contribution, while the mineral analysis indicated a safe product. Salt addition significantly influenced several parameters increasing sodium, potassium, and ash content and slightly elevate acidity and peroxide values. Therefore, the coconut-melon oil blend margarine exhibited favorable quality attributes, nutritional potential, and safety characteristics comparable to many existing vegetable-based margarines. These findings highlight the promising potential of underutilized tropical seed oils in developing sustainable, locally-sourced, and nutritionally valuable fat products.

## Compliance with ethical standards

### *Acknowledgments*

The authors acknowledge the Tertiary Education Trust Fund (TETFund) for their financial support. We appreciate the Management of Federal Polytechnic Nekede, Owerri for providing the research facilities for this work.

### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

### *Funding*

This research work was funded through Institutional Based Research (IBR) Grant of Tertiary Education Trust Fund (TETFund) with Grant No: TETF/DR&D/CE/POLY/NEKEDE/IBR/2025/VOL. 1

## References

[1] Akinmoladun, O. A., Adewale, O. B. and Adeyemo, A. A. (2020). Utilization of plant-based oils in margarine production: A review. *Food Science and Nutrition*, *8*(6), 3055–3065.

[2] Akubor, P. I. and Ugu, M. O. (2020). Production and quality evaluation of margarine from blends of melon and palm kernel oils. *World Journal of Food Science and Technology, 4*(3), 71–77.

[3] Bello, M. O., Adegboye, O. F. and Ogunmodede, O. O. (2019). Physicochemical and sensory evaluation of margarine made from melon oil. *Journal of Food Quality and Hazards Control*, *6*(2), 123–130.

[4] Bello, M. O., Olayemi, M. Y. and Olapade, I. O. (2021). Evaluation of the potential health benefits of melon seed oil in food applications. *International Journal of Food Science*, *56*(3), 145–151.

[5] Chandrapala, J., and Vasiljevic, T. (2017). Properties of acid whey as a function of pH and temperature. *Journal of Dairy Science, 100*(10), 7804–7813.

[6] Codex Alimentarius commission (1982). Recommended international standards for Edible Arachis oil 11(1sted), FAO/WHO: Rome.

[7] Ezenwa, V. N., Nwaneri, S. U. and Okafor, N. N. (2025). Coconut and cashew kernel oil blends as potential substitutes for margarine production. *International Journal of Food Science and Technology*, *40*(5), 234-242.

[8] Fruehwirth, S., Teichmann, A. and Berghofer, E. (2021). Oxidative stability of margarines: Influence of ingredients and storage conditions. *European Journal of Lipid Science and Technology, 123*(5), 1-11.

[9] Ityotagher, S. D., and Terhile, I. A. (2020). Margarine production from melon and palm kernel oil blends. *Journal of Applied Sciences*, *19*(6), 711–717.

[10] Odoemelam, C. S., Nwosu, J. N. and Ndimele, B. (2020). Determination of microbiological quality, proximate composition and physicochemical parameters of margarine produced from oil blends of palm kernel, coconut and melon. *Journal of Advances in Microbiology, 20*(9), 1–12.

[11] Okafor, E. U., Okolie, E. L. and Nnadi, F. N. (2021). The influence of coconut and melon oils in food product formulation: A systematic review. *Food Processing and Technology*, *2*(1), 10-17.

[12] Ramalho, S. S., Silva, F. M., and Pereira, J. A. (2020). Alternatives to trans fats: Health impacts and formulation approaches. *Food Research International*, *131*, 108819.

[13] Sonwai, S. and Luangsasipong, P. (2013). Zero-trans margarines from blends of virgin coconut oil, palm stearin, and palm oil. *Asia Pacific Journal of Clinical Nutrition, 22*(4), 587–594.