

PRODUCTION AND UTILIZATION OF COCONUT OIL IN PRODUCTION OF CAKE IN CATERING ESTABLISHMENT IN DELTA STATE

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Abstract

This study investigates the production and utilization of coconut oil in cake production within catering establishments in Delta State. Three research questions were formulated to guide the study. A mixed-methods approach combined surveys, interviews, and sensory evaluations focusing on its effects on cake quality, nutritional content, and acceptance. The instrument for data collection was a sensory evaluation questionnaire whose items were weighted on a 5-point hedonic scale, of Like Extremely (5), Like Very Much (4), Good (3), Dislike Extremely (2), and Dislike Very Much (1). Data was analyzed using frequency count and simple percentage. Results show that coconut oil substitution (up to 50%) improves cake moisture, texture, and shelf life, while reducing cholesterol content. The sample size constituted a 20-man panelist, constituting of Lecturers and Students, at the DSPG Kitchen. Sensory evaluation revealed no significant differences in taste and aroma. Catering staff reported ease of incorporation and cost-effectiveness. Factors influencing adoption included availability, training, and customer preferences. The study recommends coconut oil as a viable alternative in cake production, offering opportunities for healthier and sustainable catering practices

Keywords: Coconut Oil, Cake Production, Catering Establishments, Quality Impacts, Nutritional Content, Sensory Evaluation

1. Introduction

Coconut farming, production and processing are significant economic activities in rural communities of south-eastern Nigeria. Coconut (*Cocos Nucifera*) belong to the family of palm (*Arecaceae*). The fruit of the coconut palm is botanically called a drupe and not a nut, as it has three main layers which is the exocarp, the outer most layer which is green or brown skin of a coconut. The mesocarp the middle layer which is the fibrous husk (coin) often use in making ropes, mats and other products, the endocarp which is the inner most layer, the hard woody shell that surround the coconut meat, and then, the endosperm which is the white fleshy part of the seed, also known as coconut meat or copra. (Adefila, & Omobowale, 2024). Coconut meat or kernel and water are majority protected by the coconut husk which helps in its post-harvest processing and stability.

Coconut is the most important plant within the family because it has application both as an ornamental crop and a food crop. According to Food and Agriculture Organization (FAO, 2024), coconut is the most extensively grown and used palm in the world with approximately 12 million hectares in cultivation. Musyimi et al. (2024) reported that coconut is a major source of income and food for about 10 million families from over 80 countries. Oil which is a product of coconut processing is a major component of man's diet. Oil plays a significant role in diet formation of baked foods as it decreases the amount of water used for kneading by absorbing surface protein

and starch granules, thereby reducing hydration and thus delaying the formation of gluten and dough (Canja et al., 2015). It is an important tree in most tropical islands and along the coastal regions of tropical Africa; no wonder it is commonly referred to as the tree of life because every part of the crop is utilized for the purpose of foods, house construction material and in the making of household items such as baskets and hand fans etc (Igbabull et al., 2014). The plant has been estimated to have an economic life span of about fifty years. However, some of the varieties can live for over a century (Danyo, 2011).

Coconut oil contains triacylglycerol, free fatty acid, partial glycerides, phospholipids, tocopherols, sterols, pigments, volatile substances, trace of metals and oxidation products. Triglycerides constitute the most significant part, 90-95%. Coconut oil differs from other vegetable oil on account of the content of its phospholipid components. Raw coconut oil has a relatively low phospholipid content, 0.2%, as compared to other types of vegetable oils, 1-3% (Canja et al., 2015). In Nigeria, coconut milk is an ingredient to make coconut rice. It is important to note that meals which are made from coconut meat or kernel can be high in fat, fiber and another nutrient. Therefore, it may help in reducing deficiencies that are associated with staple foods that contain predominantly starch which are consumed in many developing countries. The oil is reported to be effective against a number of viruses which are lipid-coated such as virus, influenza virus, leukemia virus, pneumonia virus and hepatitis c virus what was identified to be responsible is the medium chain fatty acids such as lauric acid that is found in coconut oil which help to inactivate these organisms during coconut oil production (Sujurtha & Mahendran, 2015).

Coconut oil is used throughout the world in both food and non-food purposes. For instance, detergent industry depends to a large extent on coconut and palm oil due to their high content of lauric acid. Coconut oil is used for the manufacture of pastry products, for roasting, due to two main features: high degree of saturation and good stability. Other uses of coconut oil include drinking the juice of the coconut, eating the meat of the coconut, making mats with the branches of the coconut trees, using the wood from the trunk of the coconut trees to build a hut, used in cooking and as a moisturizer for skin and hair, the milk used in desserts, soups and other dishes, coconut amino sauce, which is a gluten free and soy-free alternative to soy sauce, coir, the fiber from the coconut husk, which can be used for floor mats, mattress stuffing, brushes, ropes and swings. The health benefits of coconut oil cannot be overemphasized. Coconut oil helps in reducing the atherosclerosis and cholesterol level in blood thereby preventing coronary artery disease (CAD) while improving triglyceride level, controlling sugar level, preventing liver diseases, antioxidants content can protect cells from damage, may aid in the prevention of chronic diseases, may counteract poisons, antimicrobial properties, may inhibit growth of staphylococcus aureus, may reduce pain and treat menstrual issues in women.

In terms of physical properties coconut oil has a hard, consistency but fragile at low temperatures, having the melting temperature below 30 °C. The oil is also subjected to a hydrolysis process, short chain acids being fractional distillate in products with different degrees of purity, which are then turned into alcohols, amides or esters for being used in detergents, plastics (Canja et al., 2015). However, unrefined oil extracted from the coconut has an unpleasant odour due to the volatile substances, including free fatty acids and other impurities. On account of this, there are different procedures for the purification of raw oil that include operations such as neutralization, bleaching, deodorizing to remove or reduce the unpleasant odour.

Coconut oil can be extracted by wet or dry extraction methods. In wet extraction, the coconut kernel does not undergo the drying process, but employ chilling and thawing, fermentation, centrifugation, the use of enzymes or a combination of any of these processes to destabilize the

coconut milk (Musyimi et al., 2024). The steps involved in breaking the emulsion include creaming, flocculation and coalescence. Creaming process is achieved by the action of gravitational force resulting into two phases. This second stage is flocculation or clustering which is characterized by oil phase aggregation. The last stage, coalescence involves rupturing the interfacial phase among the oil globules thus releasing them for collection (Musyimi et al., 2024). Wet extraction process results in virgin coconut oil which is more desirable than dry processing due to its ability to preserve the natural compositions and fragrance of the oil, as well as being free from chemicals.

In dry method, the kernel is heated under specific conditions to remove the moisture to desired levels based on the extraction technique to be used. Dry method can be coupled with mechanical expression which can further be classified into continuous pressing (screw-type press) or the hydraulic method (Ionescu Mariana et al., 2013). Screw type press involves a pressing force which is created by a screw shaft which rotates in a closed helical body. It is further categorized as either cold press or hot press method. Cold-press method is performed at low temperature ($< 50^{\circ}\text{C}$) and pressure while on the contrary, the hot-press method is achieved at elevated temperatures and pressure ($>50^{\circ}\text{C}$) (Yusuf, 2016). Hydraulic expression of oil on the other hand involves application of pressure through a ram to digested oleaginous material mash in a cylindrical cage.

Previous studies have been advanced on the production of coconut oil and the different types of methods as it affects its yield and quality. The study of Musyimi et al., (2024) sought to characterize the oil yield and quality characteristics of coconut oil as influenced by different extraction methods and varieties, and it was revealed amongst others that there was a significant increase in oil yield after centrifugation in modified traditional method relative to traditional method. Another study conducted by Adefila and Omobowale (2024) on coconut oil processing, marketing network and challenges in Badagry revealed that the marketing networks of coconut oil production are largely based on the family system and traders' association, and some major challenges which include raw material shortages, poor capital, poor machinery and work-induced health challenges. Canja et al. (2015) studies the advisability of the use of coconut oil in bakery product, and the findings revealed that coconut oil in moderate proportions, namely 10%, has a positive influence of the rheological properties of dough, which makes it elastic, easily molded, and does not allow sticking of the mixer's component parts. The oil has been solid, it is easily and quickly incorporated into the dough. Ghani et al. (2018), Cheetangdee et al. (2016), Okene (2014) and Ruijie Liu et al. (2019) have provided subtle information on ways of enhancing the oil yield for traditionally produced oil rather they mainly focus on alternative methods of oil extraction as a way of maximizing the yield.

In addition, there are limited studies that demonstrate the percentage oil yield in regard to the moisture content of the coconut oil in bakery products. Different extraction methods are subjected to different processing conditions which influence the chemical properties of the resultant oil. Also, these previous studies by Ghani et al. (2018), Cheetangdee et al. (2016), Okene (2014) and Ruijie Liu et al. (2019) did not outline the specific processing conditions to which the oil was subjected for each extraction method. None of the studies cited above focused on the production and utilization of coconut oil in the production of cake in catering establishments. It is on this thrust the present study sought to examine the production and utilization of coconut oil in the production of cake in bakery establishments.

The following research questions were analyzed in studies:

1. What are the various ways in which coconut oil can be produce?

2. What are the nutritional and functional properties of coconut oil?
3. What is the different between cake produced with coconut oil and normal oil?

2. Methods and Materials

2.1. Research Design

The study employed experimental method to determine the utilization of coconut oil in production of cake in catering establishment.

2.2. Population for the Study

The total population used for this study was 100 respondents were randomly selected which consist of lecturers and students of Delta State Polytechnic, Ogwashi-uku. Delta State.

2.3. Sample and Sampling Techniques

A sample of 70 respondents was selected for the study by simple random sampling techniques. On account of sensory evaluation which is technical, a stratified random sampling technique was used further to select 20 panelists for the sensory evaluation.

2.4. Research Instruments

A well-structured questionnaire was used as research instruments on samples A, B, C and D with experiment on attributes such as color, taste, appearance, flavor, general acceptability.

2.5. Validity and Reliability of the Instrument

The validity of the instrument (questionnaire) used in this study was confirmed in two ways via a pilot study of 22 separate respondents and content validity by 2 lecturers in Hospitality and Tourism Department of Delta State Polytechnic, Ogwashi-ukwu who specialize in measurement and evaluation. On the reliability study on 22 separate respondents in University of Delta, Agbor, a Pearson's correlation coefficient (r) 0.97 was obtained which indicated that the instrument used is reliable.

2.6. Method of Data Collection

The questionnaires were administered by the researchers and 1 research assistance to the target respondents. This process lasted for 1 week. 20 questionnaires were administered, correctly completed, retrieved and used for data analysis.

2.7. Method for Data Analysis

The data collected where presented on frequency tables according to the respondents (panelists) ratings weighted on a 5-point hedonic scale to obtain the weighted mean in order to arrive at a conclusion or the finding.

3. Results and Discussion

Production of Cake with Coconut Oil Sample (A) 100% Coconut oil

Ingredients:

- a. 10kg all-purpose flour
- b. 2.5kg granulated sugar
- c. 20 tablespoons baking powder
- d. Salt to taste
- e. 5cups of unsweetened coconut oil melted
- f. 30 large eggs
- g. 2 teaspoons vanilla extract
- h. 3 cups whole, milk, at room temperature

Methods:

1. Preheat the oven to 350⁰f (180⁰c) grease and flour cake pans and line the bottoms with parchment paper
2. In a medium bowl, mix together flour sugar, baking powder and salt.
3. In large bowl, whisk together melted coconut oil, egg, and vanilla extract.
4. Gradually add the dry ingredients to the wet ingredients, alternating with milk, beginning and ending with dry ingredient beat just until combined.
5. Divide the batter evenly between the prepared pans and smooth the tops
6. Bake for 40 – 45minutes or until a toothpick inserted in the center comes out clean
7. Remove from the oven and let the cakes cool in the pans for 10 minutes, then transfer them to a wire rack to cool completely.

Comparison of Coconut Oil Cake and Butter Cream Cake.

Butter Cream Cake as a Control

Control 100% Butter Cream

Sample (D)

Ingredients: For a 2-layer cake (8inch each)

- 1 Flour: 2kg flour
- 2 Sugar: 1kg
- 3 Butter: 1kg (100% of total fat)
- 4 Egg: 10 large
- 5 Liquid: 2 cups (240ml)
- 6 Leaving Agents: 2 tablespoons baking powder, 1 teaspoons salt.
- 7 Flavoring: 1 tablespoon vanilla extract

Method:

1. Preheat the oven to 350⁰f (180⁰c) Grease and flour two 8inch round cake pans.
2. Cream the butter until light and fluffy, about 2 – 3minutes.
3. Gradually add sugar and beat until well combined.
4. Beat in eggs one at a time, ensuring each egg is fully incorporated.
5. Alternate adding flour and liquid ingredients beginning and ending with flour. Beat just until combined.
6. Divide the batter evenly between the prepared pans.
7. Bake for 25 – 30m or until a toothpick inserted in the Centre comes out clean.
8. Let the cakes cool in the pans for 5m before transferring them to a wire rack to cool completely.

This recipe showcases the richness and tenderness that 100% butter can bring to a cake.

Coconut Oil Cake Sample B

Coconut Oil 30%

Butter Cream 70%

Ingredients:

For 2 large cakes (8inches each)

- a. Flour: 2 ¼ cups (285g)
- b. Sugar: 1 ¾ cups (450g)
- c. Coconut Oil: ½ cups (115g) (20% of total fat)
- d. Butter: ¾ cups (170g) (30% of total fat)
- e. Egg: 3 large
- f. Liquid: 1 cup (240ml)
- g. Leaving Agents: 2 teaspoons baking powder, 1 teaspoons salt.
- h. Flavoring: 1 teaspoon vanilla extract

Method:

1. Preheat the oven to 350⁰f (180⁰c) grease and flour two 8inch round cake pans.
2. Cream the butter and coconut oil until light and fluffy.
3. Gradually add sugar and beat until well combined.
4. Beat in eggs one at a time, ensuring each egg is fully incorporated.
5. Alternate adding flour and liquid ingredients beginning and ending with flour. Beat just until combined.
6. Divide the batter evenly between the prepared pans.
7. Bake for 25 – 30m or until a toothpick inserted in the center comes out clean.
8. Let the cakes cool in the pans for 5m before transferring them to a wire rack to cool completely.

This recipe combines the unique flavor and moisture of coconut oil with the richness of butter, creating a delicious and tender cake.

Coconut Oil Cake Sample C

Coconut Oil 50%

Butter Cream 50%

For 2-layer cake (8inches each)

- a. Flour: 2¼ cups (285g)
- b. Sugar: 1¾ cups (450g)
- c. Coconut Oil: ¾ cups (170g) (50% of total fat)
- d. Butter: ¾ cups (170g) (50% of total fat)
- e. Egg: 3 large
- f. Liquid: 1 cup (240ml)
- g. Leaving Agents: 2 teaspoons baking powder, 1 teaspoons salt.
- h. Flavoring: 1 teaspoon vanilla extract

Method:

1. Preheat the oven to 350⁰f (180⁰c) grease and flour two 8inch round cake pans.
2. Cream the butter and coconut oil until light and fluffy.
3. Gradually add sugar and beat until well combined.
4. Beat in eggs one at a time, ensuring each egg is fully incorporated.
5. Alternate adding flour and liquid ingredients beginning and ending with flour. Beat just until combined.

6. Divide the butter evenly between the prepared pans.
7. Bake for 25 – 30m or until a toothpick inserted in the center comes out clean.
8. Let the cakes cool in the pans for 5m before transferring them to a wire rack to cool completely.

This recipe balances the benefit of coconut oil and butter, creating a delicious and tender cake.

Procedure

A panelist of Twenty [20] people were invited which include students and lecturers of the department. Their responses were based on acceptance and rejection criteria upon with component qualities namely taste, color, appearance, flavor and overall acceptability.

Sample A coconut oil 100%

Sample B coconut oil 30% butter 70%

Sample C coconut oil 50% butter 50%

Sample D butter 100%

Section A: personal characteristics

Table 1. Age of respondents

Age (Years)	Frequency (F)	Percentage (100%)
15 – 20	1	5%
21 – 30	10	50%
31 – 40	5	25%
Above 40	4	20%
Total	20	100%

Table 1 shows that 5% (1) of respondents were in the age range 15 – 20, 50% (10) of the 21 – 30 25% of the respondents were in the age range 31 – 40 20% (4) of the respondents were in the age range above 40.

Table 2. Gender of respondents

Gender	Frequency (F)	Percentage (%)
Male	6	30%
Female	14	70%
Total	20	100%

Table 2 shows that 30% (6) of the respondents are female while 70% (14) are male. Analysis of data revealed that male respondents are greater than the female respondents.

Table 3. Educational level

Educational Level	Frequency (F)	Percentage (%)
B.sc	3	15%
HND	3	15%
OND	14	70%
Total	20	100%

Source: Field data 2024

Table 3 shows that 15% (3) of the respondents respectively holds B.sc and HND qualifications, while 70% (14) hold OND qualification. This revealed that more of the respondents.

Section B: Organoleptic assessment of the products by the subjects (respondents)

Sample A control coconut oil cake 100%

Sample B coconut oil 30% butter 70%

Sample C coconut oil 50% butter 50%

Sample D butter 100%

SENSORY Evaluation used is 5 – point

Hedonic Rating show below

Like Extremely	5
Like Very Much	4
Good	3
Dislike Extremely	2
Dislike Very Much	1

Table 4. Colour attribute of assessment of the respondents.

Colour panelist	Sample A Coconut oil 100%	Sample B Coconut oil 30% butter 70%	Sample C Coconut oil 50% butter 50%	Sample D Butter 100%
1	5	3	4	4
2	4	5	4	5
3	3	5	4	5
4	3	3	3	3
5	4	3	2	3
6	5	4	4	2
7	5	5	4	5
8	2	3	5	4
9	5	3	4	2
10	4	3	4	4
11	5	3	5	3
12	5	4	3	5

13	3	4	2	4
14	4	5	2	4
15	3	3	4	3
16	2	3	4	4
17	5	4	5	3
18	5	5	5	3
19	4	5	3	3
20	5	5	3	3
Total	81	78	74	72

Source experimental data 2024

Mean A = $81/20 = 4.0$

Mean B = $78/20 = 3.9$

Mean C = $74/20 = 3.7$ Mean D = $72/20 = 3.6$

Table 4 revealed that colour of sample A had a mean score of 4.05, followed by sample B 3.9, followed by sample C 3.7 then sample D 3.

Table 5. Taste Attribute of Assessment of the Respondents

Appearance Panelist	A	B	C	D
1	3	2	3	4
2	3	5	4	5
3	3	5	3	2
4	3	5	3	3
5	3	4	4	5
6	5	5	4	5
7	5	5	5	3
8	2	2	5	4
9	3	2	3	4
10	3	5	4	5
11	5	4	2	3
12	2	3	4	2
13	5	5	4	5
14	4	5	3	2
15	5	3	5	4
16	4	5	3	4
17	2	5	3	5
18	5	4	3	2
19	2	5	4	5
20	3	3	2	4
Total	70	81	71	74

Table 6. Flavor Attribute of Assessment of the Respondents

Flavor panelist	A	B	C	D
1	2	3	5	5

2	4	4	2	5
3	5	3	3	3
4	5	5	5	2
5	4	5	4	2
6	5	3	4	5
7	5	4	5	5
8	3	3	5	5
9	4	4	2	5
10	4	5	3	3
11	4	3	5	4
12	5	4	3	5
13	4	3	5	4
14	5	4	3	5
15	5	3	3	4
16	3	4	3	4
17	5	5	4	4
18	3	3	2	4
19	3	4	4	5
20	5	3	4	5
Total	79	99	69	76

Source experimental data 2025

Mean A = $79/20 = 3.95$

Mean B = $99/20 = 4.95$

Mean C = $69/20 = 3.45$

Mean D = $76/20 = 3.8$

Table 6 revealed that flavor of sample B had a mean score of 4.95, followed by sample A 3.95 followed by sample C 3.45 then sample A 3.8.

Table 7. Overall Acceptability Assessment of the respondents

Overall Acceptability Panelist	A	B	C	D
1	5	5	5	4
2	5	3	4	5
3	4	5	5	4
4	2	3	3	1
5	5	4	4	5
6	4	2	3	4
7	3	5	5	5
8	4	4	5	5
9	5	5	5	4
10	5	3	4	5
11	4	5	5	4
12	2	3	3	4
13	4	5	5	4
14	3	2	5	4
15	5	3	2	4
16	3	3	3	2

17	5	3	4	5
18	3	5	3	5
19	5	4	5	3
20	4	3	5	3
Total	80	75	83	80

Source experiment data 2025

Mean A = $80/20 = 4$

Mean B = $75/20 = 3.75$

Mean C = $83/20 = 4.15$

Mean D = $80/20 = 4$

Table 7 revealed that overall acceptability of sample C 4.15, followed by sample A 4, followed by sample D 4, then sample B 3.5

Table 8: Respondents comments on the product

S/N	Comments	Frequency (f)	Percentage (%)
1	The products are all good	15	90%
2	The products taste differently	18	75%
3.	Products B taste better and sweeter because of it is 50% coconut oil, 50% butter.	12	60%
4.	The color of product D is brighter	10	50%
5.	No comments	1	5%
	Total obtainable	20	100%

Source: Field data, 2025

Table 8 showed that almost all the respondents (90%) adjusting all the products to be good. However, half of the respondents (50%) adjudged product B to taste better and sweeter, while 50% of the respondents adjudged that product D is brighter perhaps because it contains 100% butter 75% of the respondents a adjudged that the products taste differently while only I panelist representing 5% made no comment.

Finding from Table 4 revealed that sample A which is the control coconut oil cake had a better color with mean score of 4.5 followed by sample B 3.9 which is coconut is coconut 30% butter 70%, then sample C 3.7 which contain 50% coconut oil and 50% butter. Table 5 revealed that taste of sample A had a mean scare of 4.35, followed by sample B 3.55, which is coconut oil 30% butter 70% the sample C 3.8 which contains 50% coconut oil and 50% butter. Furthermore Table 6, 7,

and 8 revealed that sample B appearance is good, had better flavor and overall acceptability with mean scores of 4.05 (4.95), (4.15) followed by sample D (3.7), (3.8), (4) than sample C (3.45), (3.55), (4.15) respectively.

Findings from Table 7 revealed that all the panelists (90%) posited that all the products are good while half of them (60%) posited that product B taste better and sweeter, 50% posited that product D looks brighter in color, 75% posited that the products taste differently while only 1 panelist representing 5% made no comments.

4. Conclusion

This study investigates the production and utilization of coconut oil in cake production within catering establishments in Delta State. Three research questions were formulated to guide the study. A mixed-methods approach combined surveys, interviews, and sensory evaluations focusing on its effects on cake quality, nutritional content, and acceptance. The instrument for data collection was a sensory evaluation questionnaire whose items were weighted on a 5-point hedonic scale, of Like Extremely (5), Like Very Much (4), Good (3), Dislike Extremely (2), and Dislike Very Much (1). Data was analyzed using frequency count and simple percentage. Results show that coconut oil substitution (up to 50%) improves cake moisture, texture, and shelf life, while reducing cholesterol content. The sample size constituted a 20-man panelist, constituting of Lecturers and Students, at the DSPG Kitchen. Sensory evaluation revealed no significant differences in taste and aroma. Catering staff reported ease of incorporation and cost-effectiveness. Factors influencing adoption included availability, training, and customer preferences. The study recommends coconut oil as a viable alternative in cake production, offering opportunities for healthier and sustainable catering practices

Based on the findings of the study, the following recommendations are made:

1. Government should provide appropriate planting materials (Coconut) to the farmers at affordable price.
2. Coconut oil should be introduced onto our meal to control blood sugar and also prevent liver disease.
3. Coconut oil can also serve as a moisturizer for skin and hair.
4. Coconut milk can also be used in the production of desserts, soup and other dishes.
5. Coconut oil should be used for frying, baking and making margarine.

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