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QUALITY EVALUATION OF CAKE PRODUCED FROM WHEAT, BLENDS OF PAWPAW FRUITS AND PROCESSED AFRICAN ALMOND (TERMINALIA CATAPPA) NUT

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Abstract: *This study was aimed at evaluating the quality characteristics of cake produced from wheat, blends of pawpaw (Carica Papaya) fruit flour and processed African almond (Terinalia Catappa) nut flour. Six (6) cake samples were prepared with varying levels of substitution. Sample A:100% wheat flour(control), sample B: 60% wheat, 40% pawpaw flour, 0% almond flour, Sample C: 60% wheat flour, 30% pawpaw flour, 10% almond flour, Sample D: 60% wheat 20% pawpaw flour, 20% Almond flour, Sample E: 60% wheat, 10% pawpaw flour, 30% almond flour, Sample F 60% wheat, 0% pawpaw flour, 40% almond flour. Various cake samples were assessed for proximate composition, physical properties and sensory quality. The results revealed that the inclusion of almond and pawpaw flour significantly influenced the quality characteristic of the cake. The almond flour increased the weight and volume of the cake, which enhanced specific volume a desirable trait in baked products. The almond flour improved the protein (22.41 ±0.05) and fat (43.55 ±0.06) content of the cakes, reflecting it nutrients dense profile. Sensory evaluation showed that cakes made with almond flour had the highest scores in appearance, aroma, taste, texture and overall acceptability. This study supports the utilization of indigenous ingredients to develop nutritious and acceptable baked product.*

Key words: *pawpaw, African almond, functional cake, nutritional composition, sensory evaluation.*

1.0 INTRODUCTION

Cake are widely consumed bakery products that traditionally rely on refined wheat flour, sugar, fat and eggs (Eke *et al,* 2019). The increasing demand for heathier food option has led to interest in incorporation local and functional ingredients to improved nutritional content (Ahmed *et al;* 2019). Pawpaw (Carica papaya) is a tropical fruit rich in vitamins, antioxidants and dietary fiber (Adebayo *et al;* 2017). Pawpaw is the only fruit with all essential amino acids and it is also located with antioxidants. It contains carotenoids (B- Carotene, cryptoxanthin), energy about 163kg, carbohydrates, sugars, vitamin A and C dietary fiber and minerals such as calcium, potassium and sodium (Maboh *et al*; 2023).

African almond (*Terminalia catappa*) nut is a good source of protein healthy fats and minerals. Utilizing these ingredients in baked products could enhanced nutritional quality and support local agricultural utilization (Akinoso *et al:* 2011).

African almond, scientifically known as *Terminalia catappa* is a tropical tree native to Asia but widely found across west Africa, Central

Africa and parts of the Caribbean (Etame *et al;* 2024). It's commonly known as tropical almond, sea almond or Indian almond. African almond seeds are nutrients dense, making them suitable for food applications (Nwozo *et al;* 2015).

2.0 Materials and Methods.

2.1 Pawpaw Fruits and African almond nut were procured from Gboko main market, Benue state, Nigeria. Other baking ingredients including wheat flour, sugar, margarine, eggs and baking powder were also sourced from Gboko main market, Benue State. All these were then taken to Federal polytechnic Wannune, Science Laboratory Department where preparation, processing and analysis was carried out.

2.2 Preparation of Raw Materials.

2.2.1. Preparation of Pawpaw flour and almond nut flour.

Pawpaw and almond nut flour were produced as shown on figure 1 and 2.

2.3 Cake Formulation.

Table 1. Six (6) different formulation.

Sample A:	100% Wheat flour		
Sample B:	60% Wheat flour	40% pawpaw flour	0% almond
Sample C:	60% Wheat flour	30% pawpaw flour	10% almond
Sample D:	60% Wheat flour	20% pawpaw flour	20% almond
Sample E:	60% Wheat flour	10% pawpaw flour	30% almond
Sample F:	60% Wheat flour	0% pawpaw flour	40% almond

2.4 Cake Production.

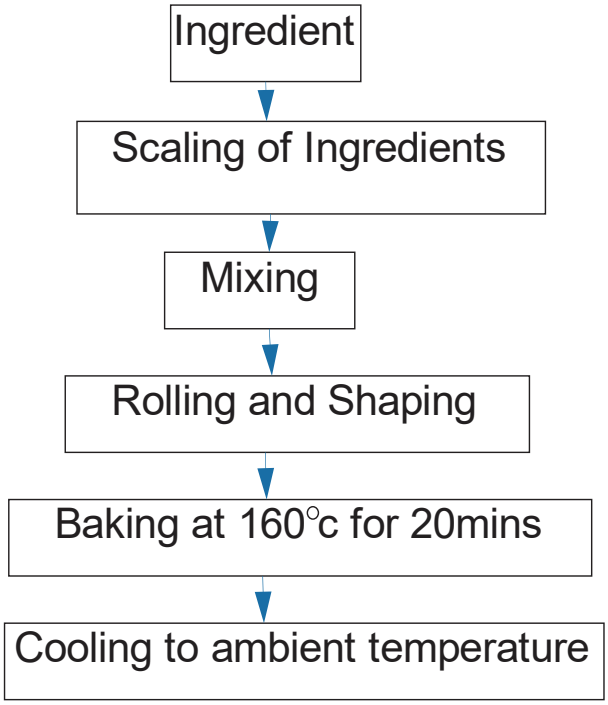

Fig. 1 Flow diagram for the production to cake.

Pawpaw fruits

Washing

Peeling

Slicing

Grating

Blanching (95^0c for 5mins)

Cooling

Oven dry at 50 – 60^0c

Sieving (0.5mm pore size)

Pawpaw flour

Fig. 2 Chart for the production of pawpaw flour.

Almond Nuts

Sorting

Washing

Drying (at 60^0c for 2hrs)

Grinding

Sieving (0.5mm pore size)

Almond flour.

Fig. 3 Flow chart for the production of Almond flour.

2.5 Analytical Methods.

2.5.1 Proximate Composition.

Moisture, protein, fat, Ash, crude fiber and carbohydrate contents were determined using AOAC (2019) Standard procedures.

2.5.2 Physical Properties.

Cake weight, volume and specific volume were measured following standard baking analysis method.

2.5.3 Sensory Evaluation:

Twenty (20) semi-trained panelists evaluated the cakes for appearance, texture, taste, aroma and overall acceptability using a 9-point hedonic scale (1 = dislike extremely; 9 = like extremely).

2.5.4 Statistical Analysis.

Statistical Package for social science (spss) v26 computer software was used to analyze raw data. Mean and standard deviation was calculated where appropriate. Analysis of variance (one way ANOVA) was equally used to determined treatment different from others in the various parameters to be tested. Duncan's multiple range test was performed to determine the difference of mean. Differences were considered at 95% ($p<0.05$) significant level.

3. 0 RESULTS AND DISCUSSION.

3.1 Proximate composition of cakes from wheat, almond and pawpaw flour blends

Table 2. Shows the proximate composition of the cake samples. The results of moisture, ash, fat, fiber, protein carbohydrate and energy showed a significant difference between samples. The result revealed that moisture content ranged from 5.17% to 8.75% with sample B (High in pawpaw flour) having the highest value. This aligns with findings by Ocheme *et al* (2018), who reported increased moisture in composite flour products when fruit-based moisture in composite flour products when fruit-based flours were introduced. The high moisture content in pawpaw-rich cake is attributed to the fruit inherent water-binding capacity, while almond-rich samples (E and F) had moderately low moisture (Ocheme *et al*. 2018). Fat content increased significantly with almond flour substitution, ranging from 13.96% in the Sample A (100% Wheat) to 44.75% in sample F (40% almond flour). This is consistent with results by Oyeyinka and Afolayan (2020), who noted that almond flour is rich in healthy oils, contributing to higher fat levels in baked products. Protein content improved with increased almond flour, ranging from 9.13% to 22.51%. Almonds are known to be protein – rich and similar results were reported by Adeola and Ohizua (2018) in cake formulations using nut-based flours. Conversely, carbohydrate content decreased with increasing almond and pawpaw inclusion, since these ingredients dilute the starch-rich wheat flour.

Energy values of the cakes followed a similar trend to fat and protein content, increasing with more almond flour due to its high caloric density. This supports finding from sharma *et al.* (2020). Who reported increased energy values in cakes fortified with oil-rich seeds and nuts?

Fiber content was highest in B and E (1.07 – 1.04%) compared to A (0.10%) showing improved dietary benefits with pawpaw and almond blends.

Table 2. Proximate composition of cake from wheat, almond and pawpaw blends.

%						Kcal/100g
Sample	**Moisture**	**Ash**	**Fat**	**Fibre**	**Protein**	**Carbohydrate**	**Energy**
A	5.17^{a} ±0.12	13.96^{a} ±0.01	0.10^{a} ±0.01	9.13^{a} ±0.03	68.65^{a} ±0.16	502.27^{a} ±0.32
2.21^{a} ±0.01						
B	8.75^{f} ±0.23	14.36^{d} ±0.31	1.07^{cd} ±0.02	16.24^{b} ±0.05	56.64^{e} ±0.05	420.76^{a} ±2.34
2.94^{f} ±0.01						
C	7.21^{d} ±0.11	27.31^{c} ±0.13	0.89^{a} ±0.01	16.98^{c} ±0.11	45.25^{d} ±0.16	464.71^{b} ±0.56
2.36^{b} ±0.02						
D	8.39^{e} ±0.12	31.53^{d} ±0.10	0.94^{b} ±0.04	18.31^{b} ±0.39	39.36^{c} ±0.46	510.45^{c} ±0.97
2.47^{c} ±0.00						
E	6.01^{b} ±0.14	36.15^{e} ±0.06	1.04^{d} ±0.01	21.44^{e} ±0.05	36.66^{b} ±0.32	541.75^{d} ±0.75
2.70^{d} ±0.01						
F	6.83^{c} ±0.08	44.75^{d} ±0.06	1.03^{d} ±0.00	22.5^{f} ±0.05	23.30^{a} ±0.08	574.79^{d} ±0.55
2.88^{e} ±0.02						

Values represent mean $\pm SD$ of triplicate determinations. Means in the same column with different superscripts are significantly different at P<0.05.

Key; A-100% wheat flour, B – 60% Wheat flour; 0% Almond flour; 40% pawpaw flour, C - 60% wheat flour; 10% almond flour: 30%pawpaw flour, D – 60% wheat flour: 20%Almond flour; 20% Pawpaw flour, E- 60% wheat flour: 30% Almond flour, 10% pawpaw flour, F-60% wheat flour: 40% Almond: 0% pawpaw flour.

Table 3. Physical properties of cake produced from wheat, Almond and Pawpaw sample.

Sample	Weight (g)	Volume (cm^3)	Specific Volume (g/cm^3)
A	8.96^{a} ± 0.10	396.78 ± 0.00	0.0223^{a} ± 0.00
B	10.59^{d} ± 0.01	375.40 ± 0.00	0.0279^{d} ± 0.00
C	10.15^{b} ± 0.01	384.65 ± 0.00	0.0264^{b} ± 0.00
D	10.27^{c} ± 0.01	411.02 ± 0.00	0.0250^{c} ± 0.00
E	10.17^{c} ± 0.01	375.40 ± 0.00	0.02750^{c} ± 0.00
F	10.60^{c} ± 0.00	384.30 ± 0.00	0.0276^{e} ± 0.00

Value represent mean $\pm SD$ of triplicate determination. Means in the same column with different superscripts are significantly different at P<0.05

Key; A-100% wheat flour, B – 60% Wheat flour; 0% Almond flour; 40% pawpaw flour, C - 60% wheat flour; 10% almond flour: 30%pawpaw flour, D – 60% wheat flour: 20%Almond flour; 20% Pawpaw flour, E- 60% wheat flour: 30% Almond flour, 10% pawpaw flour, F-60% wheat flour: 40% Almond: 0% pawpaw flour.

3.2 Physical properties of cake produced from wheat, almond and pawpaw flour.

In terms of physical characteristics cake weight and volume increased with higher almond flour inclusion (Sample F had the highest values), possible due to almond flour oil and protein, which improve aeration stability. This supports findings by Onabanjo and Ighere (2014), who observed improved volume and structural properties in baked goods supplemented with nuts.

The specific volume (volume per gram) was highest in samples containing more almond flour, indicating a better rise and lighter structure. Conversely, pawpaw rich samples had lower specific volumes likely due to the denser nature and moisture content of pawpaw flour as also observed by Giwa and Akinoso (2019) in their work on fruit flour enhanced baked goods.

Table 4 Sensory properties of cakes from wheat, Almond and pawpaw flour blends.

Sample	Appearance	Aroma	Taste	Texture	Overall Acceptability
A	$8.70^{b} \pm 0.50$	$6.85^{a} \pm 1.13$	$7.85^{b} \pm 0.94$	$8.16^{cd} \pm 1.09$	$8.10^{c} \pm 0.79$
B	$6.65^{a} \pm 1.34$	$7.95^{c} \pm 0.95$	$6.91^{a} \pm 6.91$	$6.60^{a} \pm 1.43$	$6.70^{a} \pm 1.42$
C	$6.65^{a} \pm 1.13$	$7.00^{b} \pm 1.13$	$7.16^{ab} \pm 1.27$	$7.05^{ab} \pm 1.40$	$7.20^{ab} \pm 0.40$
D	$7.16^{a} \pm 1.32$	$7.16^{ab} \pm 1.24$	$7.16^{ab} \pm 1.18$	$7.25^{ab} \pm 1.13$	$7.50^{bc} \pm 1.05$
E	$7.40^{a} \pm 1.33$	$7.65^{bc} \pm 7.60$	$7.60^{ab} \pm 1.05$	$7.71^{bc} \pm 1.42$	$7.80^{bc} \pm 0.96$
F	$8.80^{b} \pm 0.41$	$8.31^{c} \pm 0.74$	$8.60^{c} \pm 0.69$	$8.60^{d} \pm 0.69$	$8.80^{d} \pm 0.41$

Values are means $\pm SD$ of triplicate determination. Means in the same column with different superscripts are significantly different at P<0.05

Key; A-100% wheat flour, B – 60% Wheat flour; 0% Almond flour; 40% pawpaw flour, C - 60% wheat flour; 10% almond flour: 30%pawpaw flour, D – 60% wheat flour: 20%Almond flour; 20% Pawpaw flour, E- 60% wheat flour: 30% Almond flour, 10% pawpaw flour, F-60% wheat flour: 40% Almond: 0% pawpaw flour.

3.3 Sensory properties of cake, produced from wheat, almond, and pawpaw flour blends.

Sensory evaluation showed that sample F(with 40% almond flour consistently scored highest across all attributes, appearance, aroma, taste, texture and overall acceptability. This is attributed to the natural nuttiness, appealing colour and fat. Enhanced month feel provided by almond flour. Olaoye *et al* (2017), similarly reported improved sensory ratings in cakes enriched with almond and cashew flour. Samples with high pawpaw and no almond (e.g. sample B) had lower sensory scores, especially in texture and appearance, possibly due to the fruit flour's influence on cake density and crumb structure. Oladele and Aina (2007) observed similar trends when introducing non cereal flours to traditional baked recipes, noting a need for careful formation to maintain acceptability

4. 0 CONCLUSION

The study evaluated cake produced from blends of pawpaw fruits and processed African Almond Nut, substituting wheat flour with vary proportion of almond nut and pawpaw fruit, properties, proximate composition and sensory attributes. The results revealed that the

inclusion of almond and pawpaw flours significantly influenced the quality characteristics of the cake. Physically as almond flour increased the weight and volume of the cakes also increased which enhanced their specification volume, a desirable trait in baked goods. Nutritionally the incorporation of Almond flour improved the protein, fat and energy content of the cakes, reflecting its nutrients-dense-profile. Sensory evaluation showed that cakes made with a higher proportion of almond flour (sample F) had the highest scores in appearance, aroma, taste, texture and overall acceptability. This indicates that almond flour not only enriches the nutritional quality but also enhance the sensory appeal. Further research is recommended to assess microbial stability during storage, mineral composition, vitamin content and antioxidant activity of the cakes. This approach supports the use of local underutilized ingredients in functional food development.

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