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Original Article

Proximate composition, B-vitamin content and sensory properties of cookies produced from wheat–Egusi (*Citrullus colocynthis*) flour blends

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ABSTRACT

This study evaluated the proximate composition, vitamins (B1 and B2), and sensory attributes of cookies produced from wheat and egusi (Citrullus colocynthis) flour blends. Egusi seeds were dehulled, washed, oven-dried, and milled into flour, which was subsequently blended with all-purpose wheat flour in varying proportions (100:0, 95:5, 90:10, 85:15, and 80:20) to produce cookies. The formulated cookies were analyzed for proximate composition and micronutrient content using standard methods. Sensory evaluation was conducted using a structured nine-point hedonic scale, with the control sample (W100E0) included for comparison. The ash content increased from 1.33% to 1.81%, and protein (17.63 - 19.99%), fat (14.10 - 24.00%), and carbohydrate rose from 35.59% to 54.52%, compared to the control (W100E0) values, which were 1.25%, 12.36%, 21.41%, and 43.04%, respectively. A slight reduction was observed in moisture content (10.46 - 16.30%) and fiber content (1.28 - 1.91%) relative to the control. Sensory evaluation revealed that all the cookie samples were generally acceptable to the panelists, with the 100:0 (W100E0) and 90:10 (W90E10) formulations receiving the highest preference scores. The findings suggest that the inclusion of egusi flour in cookie production enhances nutritional quality while maintaining good sensory attributes, making it a viable ingredient for cookie fortification.

KEYWORDS: *Cookie, Micronutrient profiling, Protein enrichment, Seed flour composites*

INTRODUCTION

The term cookies, or biscuits as they are called in many parts of the world, refers to a baked product that contains three major ingredients flour, sugar and fat, which are mixed together with other minor ingredients to form dough (Panghal *et al*., 2011; Ibe *et al.,* 2025). In Nigeria, cookies are one of the versatile food products, which makes it an excellent choice for adding a new functional product, because they are easy to prepare, have long shelf life and widespread popularity with consumers (Almeida *et al*., 2018).

Cookies are one of the best-known quick snack products. Olaoye *et al*. (2007) defined cookies as nutritious snacks made from unappetizing dough that is transformed into a delicious product through baking. These baked goods are popular examples of ready-to-eat bakery products with numerous appealing qualities, such as extensive consumption, convenience, extended shelf life, and the ability to deliver essential nutrients (Ajibola *et al*., 2015). Cookies are leavened through a combination of mechanical, chemical, and physical processes that create and trap gases for lift and texture (Dhal *et al*., 2023). Mechanical leavening occurs during creaming of fat (like butter) and sugar, incorporating air bubbles that expand in the oven (Meza *et al*., 2021). Chemical leavening uses agents such as baking soda (sodium bicarbonate, activated by acids like brown sugar or yogurt) or baking powder (which

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includes its own acid for a double-acting rise when wet and heated), producing carbon dioxide gas (Hanan, 2013).

Traditionally prepared cookies provide a significant source of energy through carbohydrates but are relatively low in protein, dietary fiber, essential micronutrients, and certain bioactive compounds (Brown, *et al* 2021; Giwa and Akanbi, 2020). This nutritional limitation has prompted extensive research into the development of composite flours, where wheat is partially substituted with locally available, nutrient-dense ingredients such as legumes, oilseeds, tubers, or pseudocereals. Such substitutions not only enhance the overall proximate composition-including higher protein, fat, fiber, and mineral contents but also contribute to improved amino acid balance, antioxidant potential, and functional properties while addressing food security concerns through reduced dependence on imported wheat. In this research, egusi melon seed (*Citrullus colocynthis*), a protein and oil-rich oilseed widely cultivated in West Africa, emerges as a promising complementary raw material for enriching wheat-based bakery formulations. *Citrullus colocynthis* is high in good-quality protein (approximately 28–37% on dry basis), unsaturated fatty acids, essential amino acids, B-vitamins, and minerals, egusi flour offers a cost-effective and culturally relevant means to fortify cookies, potentially improving their nutritional profile without substantially compromising acceptable sensory qualities when used at appropriate substitution levels Akansha, *et al*. (2023). The present study therefore investigates the effects of incorporating varying proportions of egusi melon seed flour into wheat flour on the proximate composition, B-vitamin content, and sensory properties of the resulting cookies, with the aim of developing a more nutritious and acceptable baked product.

Wheat (*Triticum aestivum*), a member of the Poaceae family, ranks among the world's most important cereal crops, alongside maize and rice, collectively providing over half of global caloric and protein requirements. Refined wheat flour serves as the primary ingredient in cookie production due to its unique gluten-forming proteins, which contribute to desirable texture, structure, and volume in baked goods. However, the refining process removes the nutrient-rich bran and germ layers, resulting in substantial losses of dietary fiber (often >90%), essential minerals (e.g., iron, zinc, magnesium), B-vitamins, and other micronutrients, while leaving a product dominated by starch with limited protein quality and overall nutritional density (Chakanova *et al*., 2022; Suanno *et al*., 2025).

To address these limitations and enhance the nutritional profile of bakery products, the use of **composite flours**-blends of wheat with non-wheat ingredients-has gained considerable attention as a strategy for incorporating locally available, nutrient-dense materials (Noorfarahzilah *et al*., 2014). Such formulations can improve protein content, dietary fiber, essential amino acids, minerals, and bioactive compounds, while reducing reliance on imported wheat and promoting food security. In this research, **egusi melon seed** (*Citrullus colocynthis*), an oilseed indigenous to West Africa with approximately 28–37% protein and 45–52% oil (predominantly unsaturated fatty acids), represents a promising complementary ingredient. When incorporated into wheat flour at appropriate levels, egusi enhances the amino acid balance (notably lysine and methionine), increases healthy lipid content, and contributes additional micronutrients, potentially yielding cookies with superior nutritional value and acceptable sensory attributes. The present study evaluates the proximate composition, B-vitamin content, and sensory properties of cookies formulated from wheat–egusi composite flours to assess their potential as a more nutritious alternative to conventional products.

MATERIAL AND METHODS

Purchase of raw material

Shelled seeds of Egusi (*Citrullus colocynthis*) bought from Ojoo, Akinyele Local Government area of Ibadan, Oyo State, Nigeria were packed in plastic bags, and then placed in a closed box and transported to Food Science and Technology laboratory, NAU Awka, Nigeria. The seeds were kept at room temperature (30℃) until required for processing and laboratory analyses.

Experimental Design

This experiment was designed in constant mixture (D-Optimal) using Design Expert version 12 as shown in Table 1.

Table 1: Design Key

Mixture	Name	Low	High
A	Wheat	80	100
B	Egusi	0	20

Table 2: Design matrix

S/N	Sample code	Wheat flour (%)	Egusi flour (%)
1	W100E0	100	0
2	W95E5	95	5
3	W90E10	90	10
4	W85E15	85	15
5	W80E20	80	20

Preparation of *Egusi* Flour

The melon seeds were shelled and sorted, washed and dried in an oven at 60°C for 6 h. The dried seeds were milled with laboratory blender (BLG – 403), to produce the Melon flour.

The cookie was produced using the traditional creaming method outlined by (Chinma et al. 2011) using the recipe in Table 3. The fat and sugar were combined in a Kenwood mixer (HM 430) and beaten until the mixture achieved a fluffy texture. Subsequently, eggs and milk were added to the mixture. Additional ingredients were included and the mixing process continued. Baking powder, ground nutmeg, composite flour, and salt were incorporated into the mixture to create a soft dough. The dough was taken out of the bowl and kneaded on a flat surface until it achieved a consistent blend. The kneaded dough was then flattened into sheets using a rolling pin and shaped according to preference using a cutter. The cut dough was placed onto a baking tray that had been greased. Baking took place at a temperature of 200°C for a duration of 20 min. As a comparison, a cookie was made entirely from wheat flour and served as the control sample (W100E0).

Table 3: Recipe for cookies

Ingredient	Quantity
Egusi Flour Composite	250 g
Fat	63 g
Sugar	63 g
Powdered Milk	5 g
Whole Egg	20 mL
Nutmeg	1.5 g
Salt	1 g
Baking Powder	1 g
Water	100 ml

Source: Onabanjo and Ghere, 2014

The processing method was described in Figure 1.

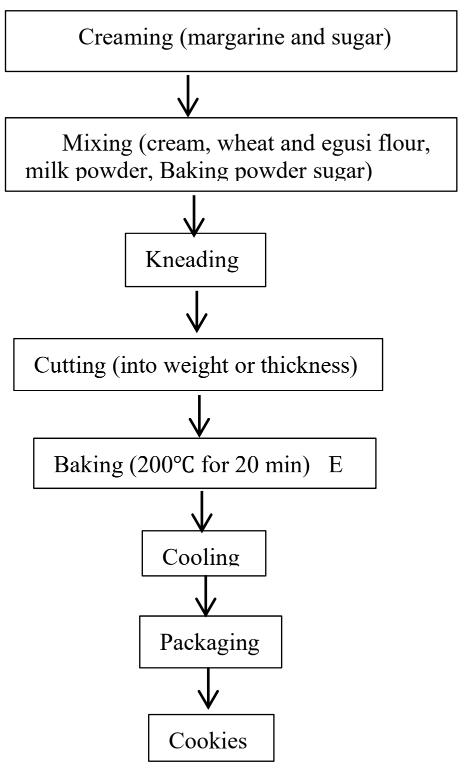

Figure 1: Production of cookies

Source: Okpala *et al.* (2019)

Proximate Analysis

Proximate analysis (moisture, ash, crude fibre, fat and crude protein) was determined as described by Onwuka (2018). The total carbohydrate content was determined by difference.

Determination of moisture content

Ten grams (10 g) of the sample was put into a previously weighed moisture can (W_1). The sample in the can (W_2) was dried in the oven at 105°C for 3 h. It was cooled in desiccators and weighed. It was returned to the oven for further drying after which it was left to cool and weighed repeatedly at an hour interval until a constant weight was obtained (W_3). The final dry weight was recorded and used to calculate the percentage moisture content of the sample as shown below:

$$\%\text{Moisture} = \frac{W2-W3}{W2-W1} x \frac{100}{1} \qquad (1)$$

Where; W_1 = initial weight of empty can, W_2 = weight of can + sample before drying, W_3 = weight of can + sample after drying

Determination of Crude Protein Content

The Kjeldahl method was used (AOAC, 2016). This method was divided into three (3) stages: the digestion stage, the distillation stage and titration stage.

a. Digestion: Two grams (2 g) of the samples were added into Kjeldahl flask and 5 g of anhydrous Sodium sulphate was added. One (1) gram of copper sulphate ($CuSO_4$) and one tablet of Kjeldahl catalyst were added into the mixture; 25 ml concentrated sulphuric acid (H_2SO_4) and 5 glass beads were added. The samples were heated gently in the fume cupboard and then increasing heat with occasional shaking, until solution assumes a green colour. The samples were distilled using Markham distillation apparatus.

b. The Markham distillation apparatus was steamed for 15 min before use. Under the condenser, 100 ml conical flask containing 5 ml of boric acid (indicator) was placed, such that the condenser tip was under the liquid. Five (5 ml) of the digests were added into the body of the apparatus via the small funnel aperture and were washed down with distilled water, followed by 5 ml of 60% NaOH solution. The mixture was steamed for 5-7 min to collect enough ammonium sulphate $(NH_4)_2 SO_4$). The collected solution in the receiving flask was titrated using 0.01N hydrochloric acid. The Nitrogen and protein content were calculated using the formula.

$$\%Nitroge = \text{Vs} - \text{V}_\text{B} \times \frac{\text{N(acid)}\times 0.01401}{\text{Weight of sample used}} \times \frac{100}{1} \qquad (2)$$

%Crude protein = %Nitrogen x 6.25

Where: w = weight of sample, N = normality of titrant (0.02 H_2SO_4), Vt = total digest volume (100 m/s), Va = volume of digest analysed (10 mL), T = titre value of sample, B = titre value of blank

Determination of Ash

The ash content was determined using the furnace incineration gravimetric method (AOAC, 2016). A measured weight (5 g) of each sample was put in a previously weighed porcelain crucible (W_1). The sample in the crucible (W_2) was put in a muffle furnace set at 600°C and allowed to burn for 2 h (until) the sample becomes white or light gray ash). The sample in the crucible was very carefully removed from the furnace (taking care not to allow air to blow the ash away) and cooled in a desiccator, and reweighed (W_3).

The weight of ash was obtained in the percentage by the formula.

$$\%\text{Ash} = \frac{W3-W1}{W2-W1} x \frac{100}{1} \quad (3)$$

Where: W1 = weight of empty crucibleW2 = weight of crucible + food before drying or ashing, W3= weight of crucible + ash

Determination of fat content

The method described by AOAC (2016) was used. Five (5 g) of samples were weighed into filter paper, wrapped carefully and put in the sample holder of the soxhlet extraction apparatus. A clean dried and weighed soxhlet flask was half-filled with diethyl ether and the whole apparatus was assembled together and the flask placed on a heating mantle and allowed to heat at 80°C. The fat was extracted for 3 h and the sample holder was disconnected and the extraction flask removed. The equipment was re-assembled with only the extraction flask and its oil content. The flask was then heated at 34°C and solvent evaporated, leaving the oil in the flask. The oil was dried in a moisture extraction oven in other to remove the solvent residue in the oil. The dried sample was cooled in a desiccator and re-weighed. The drying, cooling and re-weighing of the oil samples were repeated until a constant weight was obtained.

The percentage fat content was determined using the formula below;

$$\%\, crudefat = \frac{(\text{Weight of flask+oil})-(\text{Weight of empty flask})}{\text{Initial weight of sample}} \times \frac{100}{1} \quad (4)$$

Determination of crude fibre

Two (2 g) grams of each sample were digested with 200 mL of 1.25% H_2SO_4 solution under reflux for 30 min boiling. The digest was allowed to cool and then filtered with Buckner funnel equipped with muslin cloth. The residue was washed thrice with hot water, scooped into a conical flask and digested with 200 mL of 1.25% NaOH solution under reflux for 30 min boiling.

The digest was cooled, filtered and washed thrice with distilled water. The residue was drained and scooped into a previously dried and weighed crucible and then put into the oven to dry at 105°C to a constant mass. The dish with its content was reweighed after drying and then placed in the muffle furnace to ash at temperature of 550°C for 3 h. The ash was withdrawn at the end and put in a bell jar and reweighed. The weight of fibre was calculated as a percentage of weight of sample analysed. It was given by the expression in equation (5):

$$\%\text{ crude fibre}= \frac{w2-w3 \times 100}{weight\ of\ sample} \quad (5)$$

Where: W2= weight of crucible + sample after boiling, washing and drying

Determination of carbohydrates

The carbohydrate content of the sample was determined by estimation using the arithmetic difference method described by Onwuka (2018). The carbohydrate was calculated as shown below:

$$\%\text{ CHO} = 100 - \%\ (a+b+c+d+e) \quad (6)$$

a= protein content, b= fat content, c= ash content, d = crude fibre content, e= moisture content

Determination of Vitamins B_1 and B_2

Vitamin B_1

Vitamin B_1 content was determined according to AOAC (2016). One (1 g) gram of sample was dissolved in a beaker with 50 ml of distilled water for 5 min and filtered. Two (2 ml) millilitres of the filtrate were added to 2 ml of (1% Potassium ferricyanide and 10% sodium hydroxide in the ratio of 1:9. After 1min, 15 ml of isobutyl alcohol were added and shaken vigorously for 2 min. Thereafter, the Isobutyl layer was collected and dried by passing it through a spatula tip of anhydrous Sodium sulphate, shaken and the absorbance read at 367 nm wavelength with Isobutyl alcohol as blank. The vitamin B_1 was calculated using the equation from the calibration curve; $y = 0.072x$

$$x = \frac{y}{0.072} \quad (7)$$

Where; y = absorbance, x = concentration

Vitamin B_2

Vitamin B_2 content was determined according to AOAC (2010). Five grammes of the sample was mixed with 50 ml of distilled water and allowed to shake in a rotary shaker for 3 h. The whole solution was filtered and 2 ml of the filtrate was collected into a test tube. Exactly 6.5 ml of distilled water was added and 2 ml of degass reagent was added. Degass reagent was prepared by mixing 1 g of mercury II oxide and 10 ml of sulphuric acid and made to the mark in 100 ml volumetric flask using distilled water. The sample was read against the blank at 525 nm.

Calculation:

$$\text{Vit. } B_2\text{ (mg/100g)} = \frac{\text{Absorbance} \times \text{volume of extract} \times \text{dilution Factor}}{1000 \times \text{mass of sample}} \quad (8)$$

Sensory Evaluation

The cooled cookies samples were randomly presented to twenty (20) semi trained panellists. The coded samples will be presented on a disposable plate with disposable spoons. The attributes that will be assessed are; appearance, aroma, taste, mouth feel/texture and general acceptability on a nine-point Hedonic scale where 1 represents dislike extremely and 9 liked extremely, 5 neither liked nor disliked. Sachet water will be provided for mouth gaggling before proceeding to the next sample. The control provided will be the template or reference point for the evaluation of other samples.

Statistical Analysis

The analysis was made in triplicates and subjected to analysis of variance (ANOVA) using Statistical Package for Service solution (SPSS) version 23.0 at $p>0.05$ level of significance. Mean values were separated using Duncan multiple range test where significant differences existed.

RESULTS AND DISCUSSION

The Proximate Composition of cookie Produced from Wheat Flour and Different Levels of Egusi Flour

Table 4 shows the proximate composition of cookie made from wheat-egusi flour blends. The results in the table shows that the moisture content ranged from 10.46 - 17.19% with the least value at W85E15 and the highest value at W100E0. This suggests that adding egusi flour significantly affects the moisture content. The moisture content is an indicator of shelf-life stability. The moisture content exceeded the 14% threshold recommended for long-term storage (Adeleke and Odedeji, 2010; Ogunlakin *et al*., 2012), indicating that the cookies may exhibit limited shelf stability.

The ash content of the cookie ranged from 1.25 - 1.81% with the least value at W100E0 and the highest value at W80E20, indicating that the incorporation of Egusi flour into the cookie significantly ($p<0.05$) affects the mineral content of the cookies.

The protein content of the cookie ranged from 12.36 - 19.99% with the least at W100E0 and the highest value at W80E20. This suggests that the incorporation of egusi flour affect the cookie significantly. The results showed that the higher the level of egusi flour, the higher the protein content. Protein is essential for growth, tissue repair, and body maintenance, while also serving as a carrier for nutrients such as lipids, vitamin A, sodium, and potassium. This role aligns with findings from studies on composite flours, such as those blending wheat with legume crops like pigeon pea (*Cajanus cajan*), which enhance protein content and nutrient transport in baked goods like bread (*Haji et al*., 2024). Similarly, watermelon seed flour, rich in oils and proteins, has been used in wheat composites to improve mineral profiles and sensory qualities without compromising functionality, as demonstrated in this research.

The fat content of the cookie ranged from 14.10 - 30.16% with the lowest at W90E10 and the highest at W85E15. This suggests that the incorporation of egusi flour into the cookie significantly affects the fat content of the cookie. This is due to the high level of fat contained in egusi (47-52%). Fat improves the flavor and mouth feel in foods making it a significant factor in cookie formulation (Nugraheni, *et al.,* 2019).

The fibre content of the cookie ranged from 1.28 - 4.74% with the lowest at W95E5 and the highest at W100E0. This suggests that the incorporation of egusi into the cookie significantly affects the fibre content in the cookie. From W95E5 to W80E20 it is observed that the fibre content increased as the proportion of egusi flour increased. High fibre content is important for digestion, hormone production and cardiovascular health (Poudel, 2021).

Finally, the carbohydrate content of the cookie ranged from 35.39 - 54.52% with the lowest at W90E10 and the highest at W85E15. This suggests that the incorporation of Egusi flour significantly affects the carbohydrate content of the cookie. From the results, it was observed that W85E15 (85% of wheat flour and 15% of egusi flour) had the highest percentage of carbohydrates. The fluctuation in the observed results might be caused by other ingredients used in the cookie production.

Table 1: Proximate Composition (%) of Cookies produced with Wheat and different levels of Egusi flour

Treatment	Moisture	Ash	Protein	Crude fat	Fibre	Carbohydrates
W100E0	$17.19^{A}\pm0.29$	$1.25^{C}\pm0.04$	$12.36^{C}\pm0.93$	$21.41^{D}\pm0.15$	$4.74^{A}\pm0.14$	$43.04^{B}\pm0.68$
W95E5	$16.30^{A}\pm0.41$	$1.33^{BC}\pm0.04$	$18.17^{B}\pm0.53$	$22.65^{C}\pm0.21$	$1.28^{D}\pm0.08$	$40.25^{C}\pm0.79$
W90E10	$11.98^{C}\pm0.58$	$1.41^{B}\pm0.04$	$19.10^{AB}\pm0.55$	$30.46^{A}\pm0.05$	$1.65^{C}\pm0.09$	$35.39^{D}\pm1.06$
W85E15	$10.46^{D}\pm0.36$	$1.46^{B}\pm0.08$	$17.63^{B}\pm0.18$	$14.10^{E}\pm0.42$	$1.82^{BC}\pm0.03$	$54.52^{A}\pm0.17$
W80E20	$13.16^{B}\pm0.33$	$1.81^{A}\pm0.07$	$19.99^{A}\pm0.29$	$24.00^{B}\pm0.13$	$1.91^{B}\pm0.02$	$39.11^{C}\pm0.82$

Values are means ± standard deviation of duplicate determination, means with the same superscript in the same column are not significantly different ($p<0.05$).Key: W100E0 = 100% flour + 0% Egusi, W95E5 = 95% flour + 5% Egusi, W90E10 = 90% flour + 10% Egusi, W85E15 = 85% flour+ 15% egusi,W80E20 = 80% flour + 20 % egusi

The Vitamin Content of Cookies Produced from Wheat Flour and Different Level of Egusi Flour

Table 2 shows the Vitamin composition of Cookies made from wheat flour incorporated with different amounts of egusi flour. The vitamins analyzed includes; Vitamin B_1 and B_2

The results shows that the Vitamin B_1 content of the Cookies ranges from 0.61 - 0.91mg/100g with the lowest value in W80E20 and the highest value in W100E0, which indicates that the incorporation of egusi flour into the cookie significantly affects the Vitamin B_1 content of the Cookies. From the results, the control sample (W100E0) had more vitamin B_1 than the other samples.

The Vitamin B_2 content of the Cookie ranges from 0.31 to 0.45mg/100g with the lowest value in W100E0 and the highest value in W80E20, which indicates that the incorporation of egusi flour into the cookie significantly affects the Vitamin B_2 content.

Table 2: Vitamin B_1/ B_2 Content (mg/100g) of Cookies Produced from Wheat flour and Different Level of Egusi Flour

Treatment	Vitamin B_1 (mg/100g)	Vitamin B_2 (mg/100g)
W100E0	$0.91^{A} \pm 0.02$	$0.31^{C} \pm 0.00$
W95E5	$0.83^{AB} \pm 0.02$	$0.34^{BC} \pm 0.02$
W90E10	$0.80^{B} \pm 0.00$	$0.36^{B} \pm 0.00$
W85E15	$0.77^{B} \pm 0.02$	$0.39^{B} \pm 0.01$
W80E20	$0.61^{C} \pm 0.04$	$0.45^{A} \pm 0.02$

Values are means ± standard deviation of duplicate determination, means with the same superscript in the same column are not significantly different (p<0.05).Key: W100E0 = 100% flour + 0% Egusi, W95E5 = 95% flour + 5% Egusi, W90E10 = 90% flour + 10% Egusi, W85E15 = 85% flour+ 15% egusi,W80E20 = 80% flour + 20 % egusi

Sensory Analysis of the Cookies Sample

The average mean score of the sensory evaluation (Color, Texture, Appearance, Taste and the Overall Acceptability) of Cookies produced from wheat flour incorporated with Egusi flour are shown in the Table 3.

For color, the mean score ranged from 5.95 - 7.9, sample W80E20 has the lowest mean score while, sample W100E0 had the highest mean score, which indicated that he addition of egusi seed flour in to wheat flour affected the decision of the panellist significantly.

For texture, the mean score ranged from 5.65 - 7.40, sampleW80E20 has the lowest mean score while, sample W100E0 had the highest mean score, which indicated that he addition of egusi seed flour in to wheat flour affected the decision of the significantly.

For appearance, the mean score ranged from 6.35 - 7.65, sample W80E20 had the lowest mean score while, sample W100E0 has the highest mean score, which indicated that he addition of egusi seed flour in to wheat flour affected the decision of the panellist significantly.

For taste, the mean score ranged from 4.1 - 8.05, sample W80E20 had the lowest mean score while, sample W90E10 had the highest mean score, which indicated that he addition of egusi seed flour in to wheat flour affected the results significantly. Sample W90E10 was most liked by the panellist.

The overall acceptability mean score ranged from 4.95 - 7.95, sample W89E20 had the lowest mean score while, and sample W100E0 had the highest mean score. Which indicated that the addition of egusi into wheat flour affected the results significantly.

Table 3 Sensory Analysis of the Cookies Sample

Sample	Colour	Texture	Appearance	Taste	Overall Acceptability
W100E0	$7.90^{A} \pm 0.9$	$7.40^{A} \pm 1.23$	$7.65^{A} \pm 0.75$	$7.95^{A} \pm 0.68$	$7.95^{A} \pm 0.68$
W95E5	$7.35^{A} \pm 0.81$	$7.00^{A} \pm 0.91$	$6.90^{AB} \pm 1.11$	$7.35^{AB} \pm 1.08$	$7.20^{AB} \pm 0.95$
W90E10	$7.45^{A} \pm 0.99$	$6.60^{AB} \pm 1.42$	$6.15^{B} \pm 1.56$	$8.05^{A} \pm 1.05$	$7.75^{AB} \pm 1.06$
W85E15	$7.30^{A} \pm 1.21$	$6.45^{AB} \pm 1.39$	$6.65^{B} \pm 1.73$	$6.55^{B} \pm 1.73$	$6.95^{B} \pm 1.23$
W80E20	$5.95^{B} \pm 1.53$	$5.65^{B} \pm 2.10$	$6.35^{B} \pm 1.03$	$4.10^{C} \pm 2.07$	$4.95^{C} \pm 2.03$

Values are means ± standard deviation of duplicate determination, means with the same superscript in the same column are significantly different (p<0.05). Key: W100E0 = 100% flour + 0% Egusi, W95E5 = 95% flour + 5% Egusi, W90E10 = 90% flour + 10% Egusi, W85E15 = 85% flour+ 15% egusi,W80E20 = 80% flour + 20 % egusi

CONCLUSION AND RECOMMENDATION

In conclusion, the proximate composition, vitamin content, and sensory evaluation of cookies produced with wheat and different levels of egusi flour were analysed. The results of this study have brought about this innovative blend's potential as an advanced and improved bakery product by offering detailed knowledge about its Sensory and nutritional qualities. Examining the proximate composition revealed a nutritional profile that assures quality, as the inclusion of egusi adds substantial protein and fat content. Which enhances the protein and fat qualities, meeting consumer preferences for functional foods with enhanced health advantages. The vitamin content observed showed that egusi supplies of more of vitamin B2 than B1, further elevating the nutritional worth of the cookies.

Based on the results, it is recommended to use 10% of egusi with 90% of wheat flour to get the desired taste and general acceptability of the cookie. The study's conclusions set the stage for additional research and possible commercialization of this novel Cookie variation, which will diversify the bakery sector and provide consumers with a new and improved dietary choice.

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Authors' Contributions

KSO and UCA (drafting statement of problem, writing of manuscript, and review of manuscripts and wrote the first draft of the manuscript). GNM (managed the literature searches and material support). NMA and EON (managed the development of methodology for data analysis). KSO (reading, approved the final manuscript managed data collection and interpretation of data)

Ethical Statement

Not applicable

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