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# Processing, Formulation and Acceptability of Breakfast Cereals from Wheat, Sesame, Powdered Milk and Coconut Flour

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**Abstract** The production of breakfast cereal was carried out using wheat, sesame, powdered milk and coconut flour. Five formulations of breakfast cereal were produced from the raw materials by mixing the samples in appropriate ratios designated with codes. The formulations were sample code 107: 95% wheat, 5% milk, 0% coconut, 0% sesame; sample code 302: 85% wheat, 10% milk, 1% coconut, 4% sesame; sample code 982: 75% wheat,1 5% milk, 5% coconut, 5% sesame, sample code 435: 65% wheat, 20% milk, 7% coconut, 8% sesame; and sample code 142: 55% wheat, 25% milk, 10% coconut, 10% sesame. Standard methods were used for the determination of moisture, protein, fat, ash, and carbohydrate. A 9 point hedonic scale was used to determine the sensory acceptability scores of the breakfast cereal formulations. Data generated were statistically analyzed using analysis of variance (ANOVA) and means separated using Duncan's Multiple Range Test (DMRT). The result of the proximate composition of the formulated breakfast cereal indicated significant differences among the samples. The results showed that the moisture content was generally low and ranged from 4.85 (%) to 5.52 (%).The protein content ranged from 14.50 (%) to 14.98 (%), the fat content ranged from 3.21 (%) to 4.73 (%), the result for ash content ranged from 1.38 (%) to 2.91 (%), crude fibre content ranged from 3.41 (%) to 5.23 (%) and carbohydrate content ranged from 72.56 (%) to 75.60 (%). The sensory acceptability scores obtained in this indicated that all the formulated samples were generally accepted by the panelists used. The sensory acceptability scores for colour ranged from 7.87 to 8.67, texture ranged from 7.83 to 8.74, taste ranged from 8.41 to 8.84, consistency ranged from 7.60 to 8.54 and the overall acceptability ranged from 8.43 to 8.72.

***Keywords:*** *process, wheat, sesame, coconut, formulate, Acceptability*

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## 1. Introduction

Breakfast is the most important and a nutritional foundation or the first meal of the day which varies widely with different cultures around the world. It has been shown that individuals should all be aiming to consume around 15-25% of the daily energy intake at breakfast (i.e., 300-500 calories for women and 375-625 for men [1,2]. Cereals have been endorsed as the principal source of breakfast's carbohydrates [3] and allow the consumers to vary their breakfast meal with several different cereal-based products. Breakfast cereals can also be consumed as Ready-to-eat (RTE) foods which are prevalent due to its convenience and it is readily consumed by almost all age group. It often includes a carbohydrate source such as cereal, fruits, and or vegetable, protein and sometimes dairy and beverage. Breakfast cereals are those products that are either served hot and are expected to be cooked before serving or these are fully cooked ready-to-eat meals that are rarely cooked, if ever heated, before serving [4]. Breakfast cereals are also dry cereal eaten and are by far the most important plants eaten by man, at breakfast, which has been processed into different forms by soaking, swelling, roasting, grinding, rolling, or flaking, shredding or puffing of any cereal and is eaten as breakfast [5]. The breakfast cereals have become firmly established on the breakfast tables almost all over the world. In addition to a wide variety of forms, colours and taste, breakfast cereals are expected to also meet stringent nutritional quality requirements. The positive benefits associated with ready-to-eat-breakfast-cereal (RTEBC) include their high micronutrient contents and the nutrient benefits obtained from the milk that they are commonly consumed with [6]. In addition to providing an important source of vitamins and minerals, breakfast cereals are also potentially important

sources of antioxidants [7,8,9] and phytoestrogene [10] and are one of the important sources of whole grains [11]. Several of the intervention studies showed breakfast cereal consumption to be helpful in assisting weight loss when used as snack or meal replacements [12,13,14,15,16]. Other than a good source of available carbohydrates, breakfast cereals can be an important source of micronutrients (e.g., vitamins and minerals) and fibre, such as β-glucans, which play a key role in the prevention of cardiovascular risk, but also in the improvement in appetite control and increase of satiety, Shrapnel [17,18,19,20].

Coconut (*Cocus nucifera*) belongs to the palm family. The coconut flesh is highly nutritious and rich in fibre, vitamins (vitamin C, vitamin E, vitamin B1, vitamin B3, vitamin B5, vitamin B6) and minerals (iron selenium and sodium, magnesium, phosphorus). The parts of its fruit like coconut kernel and tender coconut water have numerous medicinal properties such as antibacterial, antifungal, antiviral, antiparasitic, antidermatophytic, antioxidant, hypoglycemic, hepatoprotective, immunostimulant [21]. Coconut flour is off-white to cream in colour with a slight nutty flavor. Coconut flour is used in baking and confectioneries industries for various baked products. It can also be blended with wheat flour to produce bread, cake, biscuits, to increase the protein and fibre content [22]. Coconut flour have been proven to contain soluble and insoluble dietary fibre which reduces the total LDL cholesterols in humans. It can be used as fiber food to help in preventing constipation, and for patients with diabetes.

Sesame (*Sesamum indicum* L .) is an ancient oil crop supplying seeds for confectionery purposes, edible oil, paste, cake and flour [23]. They are also used as to flavor and garnish various foods, particularly breads and other baked products. The seeds are also high in protein and are also rich in thiamine and vitamin B6.

Ready to eat breakfast cereals are increasingly gaining acceptance in most developing countries, and gradually displacing the traditional diets that usually serve as breakfast due to convenience, nutritional values, improved income, status symbols and job demands especially in urban areas. In centaury, due to the efforts to reduce the amount of in-home preparation time, breakfast technology has evolved from the simple procedure of milling grains for cereal products that require cooking; to the manufacturing of highly sophisticated ready-to-eat products that are convenient and can be quickly prepared [24]. The objective of the study was to produce a breakfast cereal from wheat, powdered milk, sesame and coconut flour blends and evaluate the proximate composition and sensory quality of the formulated breakfast cereals.

# 2. Materials and Methods

## 2.1. Materials

The samples used for this study included wheat, sesame, and coconut flour. The Wheat sample used was Atilla Gan Atilla which was obtained from Lake Chad Research Institute, Maiduguri. The coconut, powdered milk and sesame used were obtained from Maiduguri Monday Market.

## 2.2. Methods

Standard methods of [25] were used for the determination of moisture, protein, fat, ash, and carbohydrate. 9 point hedonic scale was used to determine the sensory evaluation studies Larmond [26], while ANOVA using Duncan's Multiple Range Test (DMRT) was used for the statistical analysis [27].

### 2.2.1. Preliminary Processing of Raw Materials

The wheat is cleaned to remove foreign particles or contamination and then dehulled to remove the bran. The dehulled wheat is winnowed, washed, strained and then steam cooked for 30 minutes. The wheat is then spread out to dry and then roasted lightly until slightly browned. The wheat was then broken into coarse particles in a commercial attrition mill. The coarse milled wheat is sieved to remove the soft particles and then stored in a clean, covered, container at room temperature.

Coconut is washed, cleaned and broken to expose the liquid content. The fleshy part of the coconut is removed with the aid of a sharp pointed knife. The brown part of the coconut is scraped off with the aid of the knife. The coconut is washed to remove the remaining brown particles. The coconut flesh is grated using a manual grater and then expressed into a clean muslin cloth and squeezed to remove the coconut milk. The remaining residue obtained is then dried at 60°C for 10 hours in a hot air oven, milled into fine powder and subsequently sieved to remove the coarse particles. This is then packaged in a clean polythene bag and sealed and stored at room temperature until used.

Sesame is sorted, cleaned, washed and dehulled to remove the outer layer. It is then dried, and toasted in an electric oven until golden brown. The toasted sesame is cooled, milled into flour and sieved to remove the coarse particles and then finally packaged in a clean polythene bag and sealed and stored at room temperature until used.

**Table 1. The Ratio of the Raw Samples Used in the Study**

| s/n | Sample Code | Wheat (AtillaGanAtilla) | Powdered Milk | Defatted Coconut | Sesame |
|---|---|---|---|---|---|
| 1. | 107 | 95 | 5 | 0 | 0 |
| 2. | 302 | 85 | 10 | 1 | 4 |
| 3. | 982 | 75 | 15 | 5 | 5 |
| 4. | 435 | 65 | 20 | 7 | 8 |
| 5. | 142 | 55 | 25 | 10 | 10 |

#### 2.2.2. Formulation of the Breakfast Cereal

The breakfast cereal produced from the raw materials is the produced from mixing the samples in appropriate ratios as shown in Table 1. Five samples were used for the formulation of breakfast cereals from wheat, defatted coconut, sesame and powdered milk.

The breakfast cereal is produced by mixing it with clean cold water to form smooth slurry mixture. Water is allowed to boil and then the slurry is added gradually while stirring to the boiling water. This is then allowed to cook for 2 minutes, cooled and served either sweetened or unsweetened. The ratios of the samples used are shown in Table 1.

## 3. Results and Discussion

### 3.1. Proximate Composition

The energy value of the breakfast cereal indicated that there was significant difference among the samples which ranged from 370.89Kcal to 378.45Kcal. The sample codes 435 had the lowest energy value while sample code 982 had the highest energy value. The result of proximate composition for the breakfast cereal samples are presented and shown in Table 2. The results indicated significant differences ($P<0.05$) among the samples. The result showed that the moisture content is generally low which ranged from 4.85 (%) to 5.52 (%). Sample code 142 had the lowest moisture content of 4.85%, followed by sample code 982 with 4.99 % moisture, sample code 107 with moisture content of 5.32 % and then followed by sample code 302 with moisture content of 5.29 % while sample code435 had the highest moisture content of 5.52%. High moisture products usually have poor shelf life stability compared to lower moisture contents food products [28]. Product moisture content is therefore one of the important determinants of the shelf stability of foods [4].

The protein content indicated significant differences among the samples. The protein content ranged from 14.50 (%) to 14.98 (%). Sample code 107 had the least protein content of 14.50% while sample code142 had the highest protein 14.98%. Sample code 982, 302 and sample code 435 had the protein contents of 14.77%, 14.62% and 14.86% respectively. The increase in protein could also be attributed to the addition of milk in the breakfast cereals as the protein content is observed to increase with increase in milk quantity which in turn improves the overall protein quality of the breakfast cereal.

The fat content indicated that there was no significant difference among sample codes 982, 435, and 142;and also no significant differences among sample code 302 and sample code 107.The fat content ranged from 3.21 (%) to 4.73 (%). Sample code 107 had the lowest fat content of 3.21%, then sample code 302 with a fat content of 3.46 %, followed by sample code 982 with fat content of 4.21%, sample code 435 with 4.49% while sample code 142 had the highest fat content of 4.73%. The increase in fat content could be attributed to the increase in the addition of milk and coconut flour.

The ash content indicated significant difference among samples. The result for ash ranged from 1.38 (%) to 2.91 (%).Sample code 107 had the lowest ash content of 1.38%, sample code 302 had an ash content of 1.90%, sample code 435 had an ash content of 2.54%, sample code 982 with ash content of 1.67 %while sample code 142 had the highest ash content of 2.91%. Ash content is an indication of the amount of mineral in a food material or product and the increase in ash content could be attributed to the increase in the addition of milk and coconut flour. The increased milk intake would contribute significantly to the higher daily calcium and riboflavin intakes [29]. In both Australia and the United States, approximately one-quarter of all milk consumed by children and adolescents is added to breakfast cereal [30,31].

Fibre in food and food products is known to reduce constipation, bloating, digestive discomfort, and ease of bowel movement. The result for crude fibre content indicated that there was no significant difference between sample code 302 and sample code 982; and there was also no significant difference between sample code 435 and sample code 142 except for sample code 107. The result for crude fibre ranged from 3.41 (%) to 5.23 (%). Sample code 107 had the lowest crude fibre content of 3.41%, sample code 302 had a fibre content of 3.94%, sample code 982 had an ash content of 4.01%, sample code 435 with ash content of 4.82 % while sample code 142 had the highest ash content of 5.23%. The increase in fibre content could be attributed to the increase in the addition of coconut flour. Breakfast cereals provide 8-12% of the dietary fiber in adult diets in the United States, the United Kingdom, and Australia [32,33,34] and therefore have an important role in supporting healthy laxation, but clearly this varies depending on the type of breakfast cereal and its fiber content. Dietary fiber could also decrease colorectal cancer risk by increasing stool bulk, diluting fecal carcinogens, and decreasing transit time, [35].

There was significant difference for carbohydrate among samples. The result for carbohydrate ranged from 72.56 (%) to 75.60 (%) which indicates that sample with code number 142 had the lowest carbohydrate content of 72.56%, sample code 435 had an ash content of 72.58%, sample code 982 had a carbohydrate content of 74.38%, sample code 302 had an ash content of 74.72%, while sample code 107 had the highest carbohydrate content of 75.60%. The decrease in carbohydrate content could be attributed to the increase in fat, protein and fibre as a result of the addition of milk and coconut flour.

**Table 2. Proximate Composition of the Samples Used in the Study[1]**

| Sample Code | Moisture (%) | Protein (%) | Fat (%) | Ash (%) | Crude Fibre(%) | Carbohydrate (%) | Energy (Kcal) |
|---|---|---|---|---|---|---|---|
| 107 | 5.32ab | 14.50c | 3.21b | 1.38d | 3.41c | 72.19a | 375.65ab |
| 302 | 5.29ab | 14.62bc | 3.46b | 1.90c | 3.94c | 70.78b | 372.71ab |
| 982 | 4.99b | 14.77abc | 4.21a | 1.67cd | 4.01b | 70.37b | 378.45a |
| 435 | 5.52a | 14.86ab | 4.49a | 2.54b | 4.82b | 67.76c | 370.89b |
| 142 | 4.85b | 14.98a | 4.73a | 2.91a | 5.23a | 67.33c | 371.81b |

[1]Mean of duplicate determinations and triple replications
[a-d]Means with each column not followed by the same superscript are significantly different ($P<0.05$).

**Table 3. Sensory scores of break fast cereal formulations**

| s/n | Sample Code | Colour | Texture | Taste | Consistency | Overall acceptability |
|---|---|---|---|---|---|---|
| 1. | 107 | 8.32ab | 8.72ab | 8.78ab | 8.40a | 8.71a |
| 2. | 302 | 8.29ab | 7.83c | 8.57bc | 7.60c | 8.63a |
| 3. | 982 | 7.87bc | 8.48ab | 8.41c | 7.77bc | 8.72a |
| 4. | 435 | 8.67a | 8.74a | 8.84a | 8.54a | 8.67a |
| 5. | 142 | 7.87bc | 8.43b | 8.79ab | 7.88b | 8.43a |

[1]Mean scores of twenty (20) panelists and triple replications
[a-d]Means with each column not followed by the same superscript are significantly different (P<0.05).

### 3.2. Sensory Scores

The sensory scores of panelists indicated that all samples were generally accepted. The values for colour ranged from 7.87 to 8.67 with sample code 435 having the highest rating for colour. The values for texture ranged from 7.83 to 8.74 with sample code 435 having the highest rate for texture. The taste ranged from 8.41 to 8.84 with sample code 435 having the highest score. The value for consistency ranged from 7.60 to 8.54 with sample code 435 having the highest score. The overall acceptability showed that all the samples were rated high with the values ranging from 8.43 to 8.72 with sample code 982 having the highest score.

## 4. Conclusion

This study was to add value to the Nigerian grown wheat so as to increase its production and utilization by producing a breakfast cereal from Nigerian grown wheat, powdered milk, sesame and coconut flour. The proximate composition showed an increase in protein and fibre content of the breakfast cereal with the addition of milk and coconut. The sensory quality of the breakfast cereals formulated indicated that all the samples were generally accepted by the panels and the sample with code 435 had the highest rating for the formulated product.

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