

## Proximate Composition and Anti-nutrient Properties of Breakfast Cereal Made from Blends of Local Rice, Soybeans and Defatted Coconut Flours

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### Abstract

Five samples of breakfast cereal were produced by mixing the flours (white rice-Soybean composites with graded levels of defatted coconut flour) at ratio 100:0, 95:5, 90:10, 85:15, 80:20, in order to generate dry convenience food products. The proximate composition and the anti-nutrient properties (Oxalate and tannin) were determined. The proximate composition ranged from 10.20-11.00% moisture, 22.38-30.30% protein, 14.08-18.13% fat, 2.11-3.30% crude fiber, 1.05-2.40% Ash and 39.74-42.60% carbohydrates. While the oxalate and tannin compositions have the range of 0.47-1.47 mg/100 g and 0.07-1.87 mg/100 g respectively. It was discovered that the inclusion of soybeans and defatted coconut flours improved the nutritional quality of breakfast cereal significantly and the anti-nutrient composition were found to be less than the recommended safe level.

**Keywords:** Breakfast cereal; Chemical composition; Anti-nutrient local rice; Soybean; Defatted coconut

### Introduction

Breakfast cereal is defined as any food obtained by the swelling, roasting, grinding, rolling or flaking of any cereal. It is a grain food, usually pre-cooked or ready-to-eat that is customarily eaten with milk or cream for breakfast in the United States or elsewhere, often eaten with sugar, syrup or fruit [1].

Eating breakfast is a vital to our body and mind because after 8-12 hours without food, the brain and muscles will be short of caloric energy to function [2]. Thus Breakfast helps us kick off the day both mentally and physically sound. It is meant to break the fasting period between dinners, the night before and lunch the following day. Omission of breakfast or consumption of an inadequate breakfast is a factor contributing to poor school performance and dietary inadequacies that are rarely compensated for in other meals of the day [3].

Individuals who consume breakfast report higher morning subjective mood than those who do not [4]. It is possible that an inadequate breakfast contributes to making of poor food choices over the rest of the day and in long term to an increased risk of obesity [5].

This research seek to produce and evaluate a breakfast meal made from cereals and to improve the nutritional quality of these cereal foods, by fortifying with cheap plant sources such as Soya beans since animal protein sources are too expensive for an average Nigerian. Also, defatted coconut was added to serves as a nutritious and healthy source of dietary fiber [6]. The development of breakfast cereal from blends of local rice, defatted coconut and soy powder is useful in the creation of novel food products.

The diet of an average Nigerian consists of food that are mostly carbohydrate based. There is therefore the need for strategic use of

inexpensive high protein sources that complement the amino acid profile of the staple diet in order to enhance nutritive value.

This study is useful in the improvement of the nutritional quality of cereals by complementing their limiting amino acids with legumes. The data obtained from this study can play an important role as reference material for researchers, health and nutrition policy makers, dietary counselors as well as households.

### Materials and Methods

#### Source of raw materials

Sound Soya bean (*Glycine max*) and coconut (*Cocos nucifera*) were obtained from Anyigba main market in Kogi state, Nigeria (Lat. 07°47'N, Long. 06°45'E), while the local rice (*Oryza japonica*) was obtained from Muslim market in Lagos state, Nigeria (06°25'N, Long. 03°27'E).

#### Preparation of defatted coconut flour

The defatted coconut flour was prepared using the method described by Okafor [7]. The coconut was manually cracked and detached from the pericarp using a sharp kitchen knife. The endocarp was manually scraped to remove dark covering then milled to a smooth paste using a roller hammer mill. The liquid component of the endocarp was extracted, and the residue was rinsed thoroughly with hot water several times using a muslin cloth so as to reduce the fat content. The obtained residue was oven-dried. The dried coconut flour was re-milled to remove lumps and then packed in an air tight plastic container at room temperature until used.

#### Preparation of soya bean flour

The Soybeans seeds were sorted and washed to remove dirt and contaminants. The seeds were then soaked in water for 8 hours then placed in a colander to drain off the water. The beans were boiled for

20 minutes to inactivate enzymes activity and also to facilitate dehulling. The beans were then dehulled and solar dried in glass house at a temperature of 60°C for about 3 days followed by roasting at 120°C for 30 minutes. The roasted beans were then milled into flour and stored in an air tight container till used.

### Preparation of cooked rice flour

Local rice grains (*Oryza japonica*) were sorted to remove chaffs and dirt. It was then washed in clean water to remove stones from the rice grain by gravity separation. The washed rice was then spread on a tray in a thin layer and solar dried at the temperature of 60°C for 3 days after which the dried rice was milled and then properly package in an air tight container at room temperature till used.

Parameters	AAA	BBB	CCC	DDD	EEE
Moisture (%)	10.55 ± 0.07 <sup>b</sup>	11.00 ± 0.0 <sup>a</sup>	10.20 ± 0.14 <sup>c</sup>	10.45 ± 0.07 <sup>b</sup>	10.50 ± 0.00 <sup>b</sup>
Ash (%)	1.05 ± 0.07 <sup>c</sup>	1.98 ± 0.04 <sup>b</sup>	2.03 ± 0.04 <sup>b</sup>	2.40 ± 0.14 <sup>a</sup>	2.05 ± 0.07 <sup>c</sup>
Crude Fiber (%)	2.11 ± 0.167 <sup>b</sup>	2.45 ± 0.07 <sup>bc</sup>	2.85 ± 0.07 <sup>b</sup>	3.30 ± 0.42 <sup>a</sup>	2.55 ± 0.07 <sup>b</sup>
Crude Protein (%)	29.10 ± 0.30 <sup>b</sup>	27.50 ± 0.09 <sup>c</sup>	25.93 ± 0.0 <sup>d</sup>	30.30 ± 0.16 <sup>b</sup>	22.38 ± 0.21 <sup>c</sup>
Carbohydrate (%)	40.85 ± 0.53 <sup>a</sup>	40.56 ± 0.03 <sup>a</sup>	40.87 ± 0.37 <sup>a</sup>	39.74 ± 0.30 <sup>a</sup>	42.61 ± 3.76 <sup>a</sup>
Crude fat (%)	16.35 ± 0.21 <sup>c</sup>	16.52 ± 0.03 <sup>c</sup>	18.13 ± 0.18 <sup>a</sup>	14.00 ± 0.011 <sup>d</sup>	17.05 ± 0.07 <sup>b</sup>

**Table 1:** Proximate Composition of Breakfast Cereal. Values are means ± standard deviations of triplicate determinations. Values on the same row having the same superscript letters are not significantly different (P>0.05). Sample Code: Composite Flour: Defatted Coconut, AAA=100:0, BBB=95:5, CCC=90:10, DDD=85:15, EEE=80:20.

The moisture content of the samples ranged from 10.20 ± 0.14 to 11.00 ± 0.00% with sample BBB and CCC having the highest and lowest moisture content respectively. The samples generally had low moisture content which implied that the samples could have an extended shelf life in their raw form; since the moisture content of a food affects its stability and overall quality [8].

The ash content which is the residue remaining after destroying combustible organic matter ranged from 1.05 ± 0.07 to 2.40 ± 0.14% with sample DDD and AAA having the highest and lowest value respectively. The ash content of the sample BBB and CCC were not significantly different (p>0.05) from each other, however they differed significantly (p<0.05) from sample AAA, DDD and EEE. The difference in the ash content of the samples may be due to difference in formulation of the samples. The value for ash obtained is comparable to the value of 1.97 to 2.05 reported by Okafor [7]. The ash content gives an overall estimate of the total mineral elements present in the food.

The crude fibre content ranged from 2.11 ± 0.16 to 3.30 ± 0.42% with sample AAA having the lowest crude fibre content and sample DDD having the highest value. The crude fibre content of the sample BBB and EEE did not differ significantly (p>0.05) from each other, but differed significantly (p<0.05) from that of sample AAA, CCC and DDD. The fiber content of the sample increased with increase in the quantity of defatted coconut in the formulation. Trinidad reported that coconut flour contains 60.9% total dietary fibre consisting of 66% insoluble and 3.8% soluble fibre. Fibre is important for the removal of waste from the body thereby preventing constipation and many health disorders. Consumption of vegetable fibre has been shown reduce the

### Formulation of product

Composite flour containing soy to rice flour at ratio 50:50 was developed; five samples were formulated using different ratios of the composite flour (CF) and the defatted coconut flour (DCF).

### Results and Discussion

#### Proximate compositions of the raw flour samples

The mean value of the proximate composition of the breakfast cereal is presented in Table 1.

cholesterol level, risk of coronary heart diseases, colon and breast cancers and hypertension; enhance glucose tolerance and increase insulin sensitivity [8].

The crude protein of the sample ranged from 22.38 ± 0.21% to 30.30 ± 0.61%, where the crude protein content of the sample EEE is the lowest while that of sample DDD is the highest, implying that the breakfast cereals are good sources of protein. The improved protein content could be attributed to the addition of soybeans in the formulations. The crude protein of the samples were significantly different (p<0.05) from each other. The protein plays a part in the organoleptic properties of the sample in addition to being a source of amino acids. The protein content of the samples were higher than that of ogi; a popular breakfast cereal in Nigerian, which has been reported to contain 10.92% crude protein, Folake and Bonanle [9] reported 14.16% protein content for ogi fortified with soya bean.

The fat content of the samples ranged from 14.08 ± 0.11 to 18.13 ± 0.18%, with the sample DDD having the lowest fat content and sample CCC having the highest fat content. The crude fat of the sample AAA and BBB are not significantly different p>0.05 from each other but are significantly different (p<0.05) from that of other samples. The range of crude fat detected was within the range of 13.37 to 21.50% reported by Okafor et al. [7] for that of cold extruded baked ready-to-eat snacks. Dietary fat that provides essential fatty acids has been shown to enhance the taste and acceptability of foods, slows gastric emptying and intestinal motility thereby prolonging satiety and facilitating the absorption of liquid soluble vitamins [10].

The carbohydrate content ranged from 39.74 ± 0.30 to 42.61 ± 3.76%, where sample DDD has the lowest value while sample EEE has

the highest value. The carbohydrate contents of all the samples are not significantly different ( $p > 0.05$ ). The range of carbohydrate detected was lower than  $78.3 \pm 1.64\%$  reported by Ebuchi and Oyewole [11] for that of Ofada rice. This implied that the addition of other soybean and other ingredients significantly reduced the carbohydrate content of the samples. The samples could however help in preventing protein-carbohydrate malnutrition which is wide spread in Africa.

### Antinutrient composition of the raw flour samples tannin content

The Tannin content of the samples ranges from  $0.61 \pm 0.08$  mg/100 g to  $1.87 \pm 0.00$  mg/100 g, where the tannin content of Sample BBB is the lowest while that of sample DDD is the highest. From Table 2, it can be observed that the tannin content of the samples are significantly different ( $p < 0.05$ ) from each other. It was observed that the tannin

Parameters	AAA	BBB	CCC	DDD	EEE
Tannin (mg/g)	$1.07 \pm 0.03^c$	$0.61 \pm 0.08^e$	$1.72 \pm 0.00^b$	$0.87 \pm 0.00^a$	$0.80 \pm 0.03^d$
Oxalate (mg/g)	$1.47 \pm 0.04^a$	$0.82 \pm 0.01^b$	$0.50 \pm 0.01^c$	$0.077 \pm 0.00^d$	$0.47 \pm 0.01^e$

**Table 2:** Anti-nutrient Content of the Samples. Values are means  $\pm$  standard deviations of two determinations. Values in the same row having the same superscript letters are not significantly different ( $p > 0.05$ ). Sample Code: Composite Flour: Defatted Coconut, AAA=100:0, BBB=95:5, CCC=90:10, DDD=85:15, EEE=80:20.

The recorded oxalate levels were also less than the safe levels of oxalate (4-9 mg/100 g) Siddharuji and Becker [12] and are also similar to the results recorded by Enujugba [15].

### Conclusion

This study has shown that nutritious breakfast cereal can be produced from blends of local products such as local rice, soybean and coconut flour. The low nutritional quality of cereals can be improved through supplementation with blends of coconut and Soybeans flour. It has also established the proximate composition of breakfast cereals from blends of local rice, Soya bean flour and coconut. The results obtained shows that this product can be used by both adults and children alike.

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contents of the samples were less than the safe levels of 4-9 mg/100 g as reported by Siddharuji and Becker [12-14]. The results obtained in this study is comparable with that of Enujiugha [15], where ogi, a maize instant food supplemented with African oil bean seed recorded tannin content ranging from  $0.5 \pm 0.01$  to  $0.14 \pm 0.02$  mg/100 g.

### Oxalate content

The oxalate content of the sample ranges from  $0.47 \pm 0.01$  mg/100 g to  $1.47 \pm 0.04$  mg/100 g, where the oxalate content of sample EEE is the lowest while that of sample AAA is the highest. From the table, it can be observed that the oxalate content of sample BBB and DDD are not significantly different ( $p > 0.05$ ) from each other, also the oxalate content of sample CCC and EEE are not significantly different ( $p > 0.05$ ) from each other but are significantly different ( $p < 0.05$ ) from that of sample AAA.

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