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NUTRITIONAL QUALITY OF SORIT BREAD IN RELATION TO WHEAT, RICE AND SOYBEAN

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Abstract
This research was carried out to compare the nutritional quality of SORIT bread (bread made from the composite flours of wheat (70%), local rice(15%), and soybean(15%)) with bread made from whole wheat flour (100%), whole local rice flour (100%), and whole soybean flour (100%). Wheat, local rice and soybeans grains were processed into flour for bread production. Four samples of bread were produced from the flour namely wheat bread, local rice bread, soybean bread and SORIT bread. The proximate composition of the loaves of bread were determined and the result showed the composition of the breads as: wheat (protein: 23.91±0.36, carbohydrate: 67.41±0.43, lipids: 0.90±0.05, fibre: 2.78±0.02, ash: 0.92±0.02 and moisture: 4.06±0.11), local rice (protein: 12.59±0.13, carbohydrate: 77.18±0.11, lipids: 0.78±0.07, fibre: 5.13±0.03, ash: 0.56±0.03 and moisture: 3.74±0.04), soybean (protein: 31.16±0.14, carbohydrate: 58.45±0.11, lipids: 2.26±0.14, fibre: 2.12±0.07, ash: 1.07±0.04 and moisture: 4.93±0.03) and SORIT (protein: 26.01±0.05, carbohydrate: 63.99±0.07, lipids: 1.64±0.08. fibre: 3.24±0.08, ash: 0.82±0.02 and moisture: 0.82±0.02). This result shows that SORIT bread was significantly ($p<0.05$) comparable to wheat bread which is the conventional bread not only in Nigeria but in other parts of the world. The result also suggests that SORIT bread will be healthier for diabetic patients, people suffering from hypoproteinemia (protein deficiency), constipation, indigestion and people with hormonal imbalance. Also, SORIT bread will be a good source of energy because of its high content of lipids as lipids are broken down it yields large amounts of energy.

Keywords: Nutritional quality, bread, wheat, rice, soybean, flour, composite.

Introduction
SORIT bread is bread made from the composite of wheat flour, local rice flour, and soybean flour (SO= soybean; RI= rice; T= wheat). Composite flour is a combination of flours, starches, and other ingredients that can totally or partially replace wheat flour in bakery and pastry products (Milligan et al., 2015). Shittu et al. (2017) agreed with this since the composite flours used were binary or ternary mixtures of flours from other crops with or without wheat flour. For developing nations like Malaysia, using composite flours has various advantages, such as: (i) a greater supply of protein for human nutrition; (ii) an improvement in the nutritional value and overall standard of bakery items; (iii) the promotion of high-yielding native plant species; (iv) the preservation of foreign currency; (v) the prevention of degenerative diseases linked to modern lifestyles; (vi) the promotion of native plant species and better overall use of domestic agriculture production (Berghofer, 2010; Bugusu et al., 2011; Chillo et al., 2018). Wheat is increasingly being substituted with local raw materials due to the growing demand for confectioneries (Noor-Aziah & Komathi, 2019). As a result, a number of developing countries have backed the launch of programs to determine whether utilizing alternative locally accessible flour as a replacement for wheat flour is feasible (Abdelghafor et al., 2011). Additionally, the FAO established the concept of composite technology to lower the cost of assistance for temperate countries by encouraging the use of native crops such as cassava, yam, maize, and others in partial substitution for wheat flour (Satin, 2013). Wheat has poor nutritional value because, although being a large source of calories and other nutrients, grain proteins lack essential amino acids like lysine and threonine (Dhingra & Jood, 2011; Dhingra & Jood, 2012). As a result, increasing the nutritional value of wheat products will be achieved by mixing wheat flour with inexpensive staples like grains and pulses (Sharma et al., 2010). One of the most consumed and accepted staple foods in every region of the world is bread, which is widely acknowledged on a global scale as a very practical form of food that is essential for all people

(Ijah et al., 2014). Additionally, it can be employed as a carrier for beneficial nutrients (Akhtar et al., 2015). It also has a lot of nutrients, including protein and fibre, as well as complex carbohydrates, which give energy from starch (Eduardo et al., 2013). People who prefer wholemeal wheat bread should be able to get bread that satisfies their needs from bread made from a combination of flour from locally cultivated crops and wholemeal wheat flour. Examples of such flour include rice and soybean flour. A sizable number of the nutrients needed for development, health maintenance, and overall well-being are found in bread. It is a great source of fibre, complex carbohydrates, vitamins, minerals, and proteins. It has a minimal fat and cholesterol content. Because bread is so substantial, it takes longer to digest, making it more fulfilling and less fattening than typically overindulged fats, sweets, and alcoholic beverages.

Statement of the problem

A major difficulty with food is nutritional deficiency, which leads to poor nutrition and health issues like marasmus and kwashiorkor. More than 840 million people lack access to enough food to meet their daily needs, and over one-third of children worldwide have stunted growth as a result of inadequate diets in terms of both quantity and quality (Bankole et al., 2013). By increasing the protein level of bread, this research will address the issue of the low nutritional quality of bread. It will also help to lower the high price of bread that results from the importation of wheat by substituting locally grown crops for some of the wheat flour. This will reduce dependency on wheat and will save costs.

Aim and Objectives of the study

This study was aimed at analysing the nutritional quality of SORIT bread as compared to other loaves of bread. The objective was to:

1. analyse SORIT bread for its proximate composition
2. compare the proximate composition of SORIT bread with the other types of bread

Materials and Methods

Sample collection: Wheat, local rice, and soybean grains were purchased from Rumuomasi market in Port Harcourt. They were milled, sieved and four different samples of bread were produced from their flours, which were (1) 100% wheat bread, which served as the control because wheat flour is the normal major raw material for bread production; (2) 100% local rice bread, (3) 100% soybean bread; and (4) SORIT bread (70% wheat flour, 15% local rice flour and 15% soybean flour).

Bread Production: The different loaves of bread were produced under the same conditions. The loaves were made in the following order: (1) sugar was dissolved in warm water in a big mixing bowl, and then yeast was added. They were left to proof for 7 minutes until the yeast resembled a creamy froth. The yeast was combined with salt and oil. One cup of flour was added to the yeast at a time. (2) After kneading the dough for 7 minutes, they were put in well-oiled bowls. The bowls were covered with a moist towel and let to rise for 1 hour until it doubled in size. (3) The doughs were pounded down and kneaded for another minute before being shaped into loaves and put in oiled loaf pans. After that, they were given 30 minutes to rise. (4) They were baked for 30 minutes at 350 degrees F (175 degrees C).

Determination of proximate compositions of the loaves of bread

The loaves of bread were allowed to cool for two hours after baking before being examined for their proximate composition.

Moisture Content

The moisture content was evaluated using the Association of Official Analytical Chemists, AOAC, (2016) hot air oven technique. Two grammes (2g) of the material were put into an empty crucible, which was weighed. This was placed in a hot air oven and dried at 100°C for 24 hours. After cooling in the desiccator, the crucible and its contents were weighed.

The moisture content was calculated from the weight loss and represented as:

$$\% \text{ Moisture} = \frac{\text{Loss in weight}}{\text{Weight of sample}} \times \frac{100}{1}$$

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Ash Content

The AOAC (2016) technique was used to determine the ash content. Each sample was weighed five grammes (5g) in triplicate into crucibles, then burned at 550°C in a muffle furnace until a steady weight was attained. The sample was then dried in a desiccator to prevent moisture absorption and weighed to determine the ash content. Thus:

$$\% \text{ Ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times \frac{100}{1}$$

Crude Fibre

The AOAC (2016) technique was used to calculate crude fibre. In a 500 mL Erlenmeyer flask, five grammes of each sample were weighed, and 100 mL of Trichloroacetic acid (TCA), the digesting reagent, was added. It was then brought to a boil and then refrigerated for 40 minutes, beginning from the commencement of the boiling process. The flask was taken off the heater, and let to cool somewhat before being filtered using a 15.0 cm Whatman number 4 filter paper. The leftovers were cleaned in hot water and placed on a porcelain dish. The sample was then dried at 105°C for 24 hours before being transferred to a desiccator and weighed (W_1). It was then burned for 6 hours at 500°C in a muffle furnace, cooled, and reweighed (W_2). The percentage of crude fibre was determined as follows:

$$\% \text{ Crude Fibre} = \frac{W_1 - W_2}{W_0} \times \frac{100}{1}$$

W_1=Weight of crucible + fibre + ash

W_2=Weight of crucible + ash

W_0=Dry weight of food sample

Fat Content

The fat content of the samples was determined using the soxhlet extraction technique defined by AOAC (2016). The weight of the flat bottom flask was obtained with the extractor installed on it, and two grammes (2g) of the sample were weighed. After that, 40ml of petroleum ether was used to extract the material. The solvent was removed by evaporation on a water bath after the extraction, which lasted 4 hours, and the residual half of the flask was dried at 80°C for 30 minutes in an air oven and then chilled in a desiccator. The flask was reweighed, and the percentage fat content was estimated as follows:

$$\% \text{ Fat} = \frac{\text{Weight of loss}}{\text{Weight of sample}} \times \frac{100}{1}$$

Protein Content

The crude protein was determined using the micro Kjedal technique, as specified by AOAC (2016). In the digestion flask, two grammes (2 g) of the sample were weighed. The digesting flask also included ten grammes (10 g) of copper sulphate and sodium sulphate (catalyst) in a 5:1 ratio, as well as 25 mL of concentrated sulphuric acid. The flask was put in the fume cupboard's digesting block and heated until the foaming stopped, yielding a clear and light blue-green colouration. The mixture was then allowed to cool before being diluted to a level of 250ml with distilled water. The distillation apparatus was attached, and 10 mL of the mixture was put into the receiver of the apparatus, along with 10 mL of 40% sodium hydroxide. The ammonia generated by boric acid was treated with 0.02 molar (M) hydrochloric acid until the colour changed from green to purple. Using the formula:

$$\% \text{ Nitrogen} = \frac{(\text{Titre-Blank}) \times \text{Normality}}{\text{Weight of sample}} \times \frac{100}{1}$$

% Crude protein = % Nitrogen x 6.25 (conversion constant)

Carbohydrate Content

The carbohydrate content was calculated using the difference method (AOAC, 2016).

(percentage protein + percentage fat + percentage ash + percentage crude fibre + percentage moisture) = 100 percent carbohydrate

Statistical Analysis

All analytical procedures were carried out in multiples. The standard deviations and means were determined. The data were submitted to ANOVA using the Statistical Package for the Social Sciences (SPSS) at a significant level of ($p<0.05$).

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Results

Table 1: Proximate Composition of the different loaves of bread

Bread	Moisture	Ash	Fibre	Protein	Lipid	Carbohydrate
Wheat	4.06±0.11[b]	0.92±0.02[c]	2.78±0.02[b]	23.91±0.36[b]	0.90±0.05[b]	67.41±0.43[c]
Local rice	3.74±0.04[a]	0.56±0.03[a]	5.13±0.03[d]	12.59±0.13[a]	0.78±0.07[a]	77.18±0.11[d]
Soybean	4.93±0.03[d]	1.07±0.04[d]	2.12±0.07[a]	31.16±0.14[d]	2.26±0.14[d]	58.45±0.11[a]
SORIT	4.27±0.03[c]	0.82±0.02[b]	3.24±0.08[c]	26.01±0.05[c]	1.64±0.08[c]	63.99±0.07[b]
F-cal.	57.495	48.488	503.415	1398.090	54.753	1128.367
p-value	.000	.000	.000	.000	.000	.000

**Sample means with the same alphabets attached along the rows are significantly different from each other at 5% levels.*

Discussion

The proximate composition of the different loaves of bread is presented in Table 1. The results showed that the loaves had the following moisture contents: wheat (4.06%), rice (3,74%), soybean (4.93%), and SORIT (4.27%). The findings of Edema et al. (2005), who noted an increase in moisture (7.42%) as the composite of maize and soybean increased, are supported by this outcome. The higher the storage stability, which also suggests the possibility of dried products having a longer shelf life, the lower the moisture level of the product to be stored (Akubor, 1997). This demonstrates that SORIT bread shouldn't be kept around for a long time to prevent spoilage. Wheat (0.9%), local rice (0.6%), soybean (1.1%), and SORIT (0.8%) was the result of ash contents. Here, the use of rice and soybean flour in place of wheat flour results in a noticeably higher ash level. This is consistent with Shaikh et al. (2017)'s findings on their composite bread (1.80%). According to Adeoye et al. (2020), the ash content of bread is just a measurement of its mineral content. This indicates that SORIT bread will have a good amount of minerals. Wheat (2.8%), local rice (5.1%), soybean (2.2%), and SORIT (3.2%) were the result for fibre content, this indicates that SORIT is beneficial for those who have constipation. Similar patterns in the results were found by Adeoye et al. (2020), who found that the fibre content of composite bread samples was 3.65%, 3.81%, 3.49%, and 3.23%. He claimed that the rise in fibre content was caused by the soybeans not being dehulled before being processed into flour.

The protein content of the loaves of different bread was: wheat (23%), local rice (12%), soybean (31%) and SORIT (26%). The increase in protein content with SORIT bread suggests that adding soy flour to wheat flour would significantly enhance the bread's protein nutritionally. This may be a result of the substantial amount of protein found in soybean seeds, of course (Asiedu, 1989; Kure et al.,1998; Basman et al., 2003; Olaoye et al., 2006). Patients with protein deficiency in most developing nations, including Nigeria, where many people find it difficult to acquire high-protein foods due to their high prices, would benefit nutritionally from SORIT bread's high protein content. Similar findings were made by Akpapunam et al. (1997) who observed an increase in the protein content with a corresponding increase in the proportion of soy flour supplementation in maize flour during the production of Agidi, a fermented cereal product, and Shaikh et al. (2017) who observed an increase in the protein content in bread when wheat flour was substituted for rice and sorghum flour in fortified bread samples. Sorghum flour was shown to have a protein value of 14.0% (Awadalkareem et al., 2008). However, Khalil et al. (1994) discovered that sorghum flour has a greater protein level, with 15.3% in white and 15.9% in reddish-white sorghum. Wheat (0.9%), local rice (0.8%), soybean (2.3%), and SORIT (1.6%) were the results for lipid content. This result implies that SORIT can be recommended to people who have indigestion and hormonal imbalance. Additionally, SORIT bread will be a wonderful source of energy because the breakdown of lipids produces significant amounts of energy. Additionally, the high content of lipids endows SORIT with enticing characteristics like colour, texture, structure, mouthfeel, etc.; this will help with the bread's sensory evaluation and acceptability. Similar findings of greater fat (lipids) content in composite bread have been observed by other studies (Olaoye et al., 2006; Kure et al., 1998; Edema et al., 2005). According to reports, soybean seeds contain a sizable amount of fat and nutrients (Ariahu et al., 1999; Onyeka and Dibia, 2002; Plahar et al., 2003). Wheat (67%), local rice (77%), soybean (58%), and SORIT (63%) were the result for carbohydrate content. After rice and wheat, SORIT has a lower value, indicating that SORIT bread can be advised to patients with diabetes. This result is consistent with that of Akpapunam et al. (1997), who found that the amount of carbohydrates in various composite loaves dropped as the quantity of soybean flour increased. This is true because soybean seeds contain fewer carbohydrates. The results obtained by Shaikh et al. (2017), who stated that the carbohydrate content of bread samples fortified with three per cent of rice increases by 56.56, 61.14, and 61.77%, are in direct opposition to this result. The substitution of wheat flour for rice flour could be the major reason for this observation due to the fact that rice flour is attributed to high contents of carbohydrates (Da Silva Torres et al., 2006).

Conclusion

A highly nutritious bread can be produced by sourcing some of the raw, materials locally. From this research, it is concluded that in terms of nutritional quality, SORIT bread is the best and should therefore be recommended to diabetic patients, patients suffering from protein malnutrition and other lack of protein-related illnesses as well as people suffering from hormonal imbalance. SORIT bread is also a good source of energy.

Recommendations

1. To further establish the nutritional quality and consumer acceptability of SORIT bread, the sensory and organoleptic qualities of SORIT bread should be evaluated by qualified panellists.
2. Pilot bakeries must be built to test customer acceptance of SORIT bread in various locations and to prepare the market for SORIT (composite flour) bread.

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