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Proximate Analyses of Three Brands of Bread under Different Storage Conditions Available on the Ghanaian Market

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Abstract
A study was conducted to evaluate the proximate value of three brands of bread under different package conditions available on the Ghanaian market. Bread samples were analyzed at the Crops Research Institute laboratory in Kumasi for proximate composition (moisture, carbohydrate, crude protein, crude fat, crude ash and crude fibre) of the freshly baked bread and bread of 10 days storage duration. The treatment was a 3×2 factorial with three replicates. Factor A (bread types - wheat, sugar and butter); and factor B (storage condition- refrigeration and ambient). The proximate analyses showed that the raw material for baking the three bread types was composite flour and there was a significant difference between the bread types with regards to carbohydrates, crude protein, crude fibre and ash contents even though the difference in crude protein level between sugar and butter breads were not significant. There was a significant difference (P>0.05) in the crude fibre content between wheat and butter bread and ash content between wheat, sugar and butter breads. Wheat bread had the highest ash and moisture contents compared with sugar and butter types but there was no significant difference in moisture content between sugar and wheat.
Key Words: Proximate, Analysis, Wheat, Sugar, Butter, Bread

1.0 Introduction

Bread has always been one of the most popular and appealing food products due to its superior nutritional, sensorial and textural characteristics, ready to eat convenience as well as cost competitiveness. Bread is a major wheat based product, which has gained wide consumer acceptance for many years in Ghana (Tsatsu, 2009). It is an important stable food, the consumption of which is steady and increasing. It is however, relatively expensive, being made from imported wheat that is not cultivated in the tropics for climatic reasons (Edema *et al*., 2005; Olaoye *et al*., 2006). The idea of substituting part of wheat with other starchy crops is not new. Several institutions have carried out research designed to find ways of partially substituting wheat flour with other sources of flour or replacing wheat altogether (Bokanga, 1995). With the constant increasing consumption of bread and other baked products in many countries, the composite flour programme promises to save significant amount of foreign exchange, provide a traditional nutritious food to more people at lower cost and to utilize indigenous crops to a greater extent. The product is basically made of hard wheat flour, yeast, fat sugar, salt and water. Different bread types exist in Ghana; it could be butter, sugar or salt based. It could also be composite flour bread. Nonetheless, they all have wheat flour base. The consumption of bread in Ghana as a staple food has steadily been on the increase, especially with explosions in population and changing life style patterns. It is worth noting that bread is one food that knows no social stratification, as such is consumed by all and sundry irrespective of their per capita income. Bread from the wheat flour has certain desirable aesthetics due to its gluten content (Nickerson and Ronsivalli, 1980). Wheat flour is essentially imported into the country resulting in the high cost of bread and other baked products.

Bread is a highly nutritious food eaten in one form or another by nearly every person on earth. Consequently, proximate analysis provides an indication of the nutritional value of the bread we consume. As an excellent source of protein, carbohydrates, and vitamins, bread has been an essential element of human diet for centuries in all regions, (countries) except rice growing Southeast Asia (Adow, *et al*., 1991).

The simplest breads are made from grains such as wheat, oats, barley, rye, millet and corn mixed with water or milk. These ingredients are mixed into dough, shaped and cooked usually by baking. Salt, eggs, sugar and other ingredients may be added to give the bread flavor, change its texture or increase its nutritional value. A special ingredient is added often called leavening agent to make the dough rise by enlarging the air spaces in the dough, giving it a lighter texture and more volume (Adow *et al*., 1991).

1.1 Bread types: (unleavened and leavened bread)

1.1.1 Unleavened bread

Bread which does not contain leavening agent is called unleavened bread. These include matzoh- bread traditionally eaten during Jewish Passover holiday and tortill- a Latin American–style pancake made from wheat or corn; these are made only from water and flour (Adow, *et al*., 1991). During baking heat converts the water in the bread dough to steam which creates tiny bubbles that cause the bread to rise.

1.1.2 Leavened bread

Leavened bread on the other hand uses the physical action of steam to create the rise; but also receives an additional lift from the leavening agents such as baking soda, baking powder or yeast. Leavening agents produce carbon dioxide, a harmless gas to life which enlarges air bubbles inside the dough (Adow *et al*., 1991). Bread is also leavened with chemical agent such as baking powder or baking soda instead of yeast and this bread type is called quick bread**,** for, this can be mixed together and baked without having to let the dough rise. Quick bread relies on chemical reactions between ingredients that produce carbon dioxide e.g. baking soda (Na_2CO_3) a harmless, tasteless leavening agent that reacts with acidic ingredients such as lactic acid in milk causing quick bread to rise (Adow, *et al*., 1991).

1.2 Justification for the Study

According to Boateng, *(*2011) in International Journal of Home Economics Research, bread is noted to be consumed by a wide spectrum of people for its high nutritional value. In Ghana bread is baked in almost every city/town and is widely eaten by consumers sometimes instantly from the point of purchase by women, men and even children without extra heating or toasting. It is therefore, imperative to evaluate the proximate composition of the bread we consume in Ghana from the main bakeries and distribution points under different package and storage condition and know the raw material used for the production and its nutritional value for quality improvements.

1.3 Objective

The main objective was to conduct the proximate analysis of the three types of bread in storage and compare the nutritional values of the different samples as components of diet.

1.4 Methodology

1.4.1 The Study Area and Target Population.

A preliminary survey was conducted at Koforidua and Nkawkaw based on the two areas largely

involved in the production and distribution of bread to other consumers in Ghanaian markets using a questionnaire to track responses on socio-economic and demographic characteristics of the people summarized as follows. The Koforidua Metropolis is the regional capital of the Eastern Region of Ghana and is located 85 kilometers from Accra and 245 kilometers from Asante Mampong through Kumasi. It is one of the most commercialized cities in Ghana. It is made up of traders, drivers, teachers, students, health workers etc. and more than 90% of the people consume bread. It has over 15 commercial bakeries with numerous retail outlets and the most popular ones are B Foster, Jofa and Jamous and these factories feed the people of Koforidua and its environs and even the towns along the main Kumasi-Accra high way, all the way to Kumasi itself. Visitors purchase them to their various destinations all over Ghana. Nkawkaw which is located about 127 kilometers from Accra, 96 kilometers from Kumasi and 147 kilimeters from Asante Mampong via Kumasi with a population of about 12000, made up of Kwahu tribes mostly is a commercial town along the main Kumasi-Accra road. The people hawk along the main road with few of them operating shops with their male counterparts along the high way as a means of making livelihood. Nkawkaw has about 80 bakeries (the most popular ones being- Nyamebekyere, Nkwabodoo, and O A T), with several retail outlets. The retailers are mostly along the Kumasi-Accra high way and feed the travelers from Kumasi-Accra and villages and towns along the road. They also sell to the people of Nkawkaw and its environs in addition to visitors and passerby.

1.4.2 Sampling of Bread Types

Three types of bread (wheat, butter and sugar) were purchased from the three sources in Koforidua and Nkawkaw in the Eastern region of Ghana. Samples were sent to the Crops Research Institute laboratory in Kumasi for storage, microbiological and proximate analysis. The sample size was fifty (50) for each town making a total of one hundred (100) samples.

1.4.2 Proximate Analysis

Proximate composition of the freshly baked bread samples were analyzed for its moisture, carbohydrate, crude protein, crude fat, crude ash, and crude fibre contents. Samples of the bread types were analyzed again in 10 days from storage.

1.4.3 Moisture Content Determination

Moisture was determined by the method of AOAC, (1990). Two grams of bread sample was weighed into a pre-dried and weighed crucible and placed in thermostatically regulated hot-air oven (MIDO/3/SS/F, U.K.) at 105 °C for 8 hours. The crucible was removed cooled in a desiccator and weighed. The process was repeated until a constant weight was obtained. Moisture content was calculated and expressed as a percentage of initial weight of the flour.

$$\text{Moisture} = \frac{\text{Initial mass of sample - Mass after drying}}{\text{Initial mass of sample used}} \times 100$$

1.4.4 Crude Fat Determination (Soxhlet Method)

Crude fat was measured by the method of AOAC, (1990). Two grams of dry bread sample was weighed into a cellulose thimble and plugged with glass wool. The extraction was carried out in a soxhlet apparatus for 16 hours with 150 ml of petroleum ether. The flask was removed and the solvent evaporated on steam bath in a hood. The flask and its contents were dried in the hot air oven at 103 °C for 30 minutes, cooled in a desiccator and weighed. The weight of crude fat extracted was measured and the percentage fat calculated.

$$\% \text{ Crude fat} = \frac{\text{Mass of fat obtained}}{\text{Dry mass of sample used}} \times 100$$

1.4.5 Crude Fibre Determination

Determination of crude fibre was by method of AOAC (1990). Two grams of defatted bread sample was transferred into a 750 ml Erlenmeyer flask and 0.5 g asbestos added. Two hundred millilitres of boiling 1.25 % H_2SO_4 was added to the flask and the flask was connected to cold finger condenser, and immediately brought to boil on a hot plate for 30 minutes. The flask was removed and the content filtered through a linen cloth in a funnel and washed with boiling water until no longer acidic. The charge and asbestos was washed back into the flask with 200 ml of boiling 1.25 % NaOH solution. The flask was again connected to a condenser, boiled for 30 min, filtered through linen cloth and thoroughly washed with boiling water. The residue was transferred into a gooch crucible, washed with 15ml of 95 % ethanol and dried at 100 °C in the oven for 1 hr. The flask was cooled in a desiccator weighed and ignited in a pre-heated muffle furnace (Gallenkamp muffle furnance, England) at 600 °C for 30 minutes. The flask was again cooled and reweighed. The weight difference was recorded and percent crude fibre content calculated.

$$\% \text{ Crude fibre} = \frac{\text{Mass of fiber}}{\text{Dry mass of sample used}} \times 100$$

1.4.6 Ash Determination

Ash determination was by method of AOAC (1990). Two grams of bread sample was weighed into a previously ignited and weighed crucible. The crucible and content were ignited in a pre-heated furnace to 600 °C for 2 hours. The crucible was cooled in a desiccator, weighed, and percent ash content calculated.

$$\% \text{ Ash} = \frac{\text{Mass of ash}}{\text{Dry mass of sample used}} \times 100$$

1.4.7 Nitrogen Determination

Nitrogen determination was by Kjeldahl method of AOAC (1990). Two grams of bread sample was weighed into a Kjedahl digestion flask and 25 ml of 98 % H_2SO4 added and a mixture of $Cu_2SO_4.5H_2O$ and K_2SO_4 added. The mixture was digested until a clear solution was obtained. The digest was transferred into 100 ml volumetric flask and diluted with distilled water to the mark. Ten millilitres aliquot of the digest was measured into the decomposition chamber of the distillation apparatus. Fifteen millilitres of 40 % NaOH was added and the ammonia released was trapped into 20 ml of 2 % boric acid solution containing mixed indicator. A colour change from pink to green was observed as the ammonia was trapped. Distillation was continued for 5 minutes and the boric acid-ammonia solution so obtained titrated against 0.1 N HCl and the percentage protein calculated by using the formula below.

$$\% \text{ Nitrogen} = \frac{(V_S - V_B) \times N_A \times 0.01401 \times 100}{W}$$

V_S = Volume of acid used in titration, N_A = Normality of acid V_B = Volume of base and
W =Mass of sample used.

1.5 Results and Discussion

1.5.1 Proximate analysis

Table 1. Mean Values of the proximate analysis of different bread types produced in the Eastern Region of Ghana

Bread Types	Parameters					
	Carbohydrate	Crude protein	Crude fat	Crude fibre	Crude ash	Moisture content
Wheat	73.52a ± 0.09	10.49a ± 0.21	11.8± 0.02	0.41a ±0.11	2.22b ± 0.08	12.46a ± 0.24
Sugar	67.11b± 0.10	10.15ab ±0.21	9.7± 0.02	0.39a ±0.11	1.42a ± 0.08	11.84a ± 0.24
Butter	63.87c ± 0.09	9.77b ± 0.21	8.6± 0.02	0.29b ±0.11	1.2a ± 0.08	4.88b ± 0.24
LSD P>0.05)	0.6	0.7	0.1	0.1	0.3	0.8
CV %)	0.9	6.5	1.3	18.5	18.5	8.4

Figures with same letters in a column are not significantly different (P>0.05). Figures with different letters in the same column are significantly different at P>0.05

It shows that there was a significant difference between the bread types with regards to carbohydrates content. Wheat bread had the highest level of carbohydrate compared to sugar and butter bread (Table 1). There was a significant difference in the crude protein level between wheat and butter bread. There was however no significant difference in the crude protein level between sugar and butter bread (Table 1). The results further revealed higher crude fat content in wheat than butter bread. There was a significant difference (P>0.05) in the Crude fibre content between wheat and butter bread (Table 1). There was a significant difference in the ash content between wheat, sugar and butter bread types. Wheat bread had the highest ash content. As regards the moisture content, wheat bread had the highest compared to sugar and butter bread types. There was no significant difference in the moisture content between sugar and wheat (Table 1).

Table 2. Mean values of proximate Analysis of Butter Bread Stored under Two conditions (Refrigeration and Ambient).

Treatment	Parameters					
	Carbohydrate	Crude protein	Crude fibre	Crude fat	Crude ash	Moisture content
Fresh	65.12	10.44	0.46	11.99	1.97	4.67
Refrigerated	69.52	10.85	0.32	10.32	1.14	13.25
Ambient	66.48	8.96	0.30	8.21	1.41	14.64
LSD (P>0.05)	1.04	1.14	0.12	0.22	0.52	1.41
CV (%)	0.9	6.5	18.5	1.3	18.5	8.4

From the results there was an increase in the carbohydrate content with storage with a significant difference between refrigeration and the ambient. There was an interaction between treatments for all the parameters measured. The moisture content of butter bread increased with storage in refrigerator and under ambient conditions (Table 2). However, the crude fat content reduced in storage. The significant reduction in the crude fat content could be attributed to the growth of the fungal complex. The nutrient-rich characteristic of the butter bread attracted the fungi. The sources of the fungal could also be attributed to the unhygienic nature of handling bread.

Table 3. Mean values of proximate analysis of sugar bread stored under ambient and refrigerated conditions

Treatment	Parameter					
	Carbohydrate	Crude protein	Crude fibre	Crude fat	Crude ash	Moisture content
Fresh	59.76	8.64	0.30	8.49	2.78	4.04
Refrigerated	73.67	9.48	0.47	5.90	1.28	9.21
Ambient	63.87	9.61	0.21	6.77	1.39	12.74
LSD (P>0.05)	0.6	0.66	0.67	0.13	0.30	0.82
CV (%)	0.9	6.5	18.5	1.3	18.5	8.4

From the results there was an increase in the carbohydrate content with storage with a significant difference between refrigeration and the ambient. There was an interaction between treatments for all the parameters measured. There was no significant difference in the crude protein content among the storage conditions for sugar bread (Table 3). There was a reduction in the crude fat content of sugar bread in 10 days storage compared to the control. The moisture content also increased with storage (Table 3).

From the results there was an increase in the carbohydrate content with storage with a significant difference between refrigeration and the ambient. There was an interaction between treatments for all the parameters measured. There was an increase in the moisture content for the refrigerated wheat bread. The results also showed an increase in the carbohydrate content of wheat bread stored in the refrigerator. Wheat bread stored under ambient condition had a slight increase in the carbohydrate content. There was however a reduction in the crude fibre content for refrigerated wheat bread compared to the control and the ambient condition (Table 4).

Table 4. Mean values of Proximate Analysis of Wheat Bread Stored under Ambient and Refrigerated Conditions

Treatment	Parameter					
	Moisture content	Carbohydrate	Crude protein	Crude fibre	Crude fat	Crude ash
Fresh	5.93	66.73	10.22	0.41	14.82	1.90
Refrigerated	13.07	77.37	11.13	0.45	12.81	1.17
Ambient	9.99	70.98	11.88	0.35	10.69	1.46
LSD (P>0.05)	0.8	0.6	0.7	0.7	0.1	0.3
CV (%)	8.4	0.9	6.5	18.5	1.3	18.5

Generally, the study has revealed that the carbohydrate content of the three bread types compared favourably with the results of Oluwamukomi *et al.,* (2011) where wheat flour was substituted by cassava flour. The results revealed a suspicion that the bakeries were using composite flour instead of refined wheat flour for the bread types. The results of the study (Table 1) corroborated very well with the study of Oluwamukomi *et al.,* (2011) in all the parameters (crude protein, crude fat, crude fibre, ash and the moisture content) assessed - showing that the flour types used in baking bread were made from composite flour.

1.5.2 Conclusion

The study revealed that the 3 bread types on the Ghanaian markets which are made from composite flour did not have the constituents on the labels as recommended by the Food and Drugs Board and the Ghana Standard Board and there was a significant difference between the bread types with regards to

carbohydrates, crude protein, crude fibre and ash contents even though the difference in crude protein level between sugar and butter breads were not significant. Wheat bread had the highest ash and moisture contents compared with sugar and butter types but there was no significant difference in moisture content between sugar and wheat. Bread storage in refrigeration was favourable than ambient condition for preservation of nutrients. However, the high cost of running a refrigerator does not present itself as a good medium. Storage of bread in a refrigerator makes the bread stale and the high nutritional level of the bread types attracts the fungi. Noticeably, the butter bread was more moistened hence the ability of the fungi to grow on it than wheat and sugar bread types when we further conducted studies on fungal growth on the same bread samples.

1.5.3 Recommendation

The Food and Drugs Board and the Ghana Standard Board should enforce measures to ensure that the various brands of bread sold and widely consumed in our local Ghanaian markets have the constituents on the labels with regards to carbohydrates, crude protein, crude fibre, and crude fat moisture and ash contents.

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References

Adow P. A. Daaku, T. Daaku, V. and Ofosu, C.T. (1991). Food and Nutrition for Senior Secondary Schools. Printed and Published by Ministry of Education.

AOAC (1990). Official Methods of Analysis, 15th Ed. Washington, D.C Association of Analytical Chemistry, p. 1546.

Boateng, O, 2011. Aflatoxins. Science with Human face.
http://www.icrisat.org/aflatoxin/health.asp

Bokanga M (1995.) Cassava: Opportunity for food, feed, and other industries in Africa. In: Agbor T, Egbe A, Brauman Griffon D, Treche S (eds.) Orstom. pp. 557-569.

Edema, M.O., l.O. Sanni and A.I. Sanni, 2005. Evaluation of maize-soybean flour blends for sour maize bread production in Nigeria. Fri. J. Biotechnol., 4: 911-918.

Nickerson, I. A and Ronsivalli, A.T. 1980. Functional and Storage properties of sorghum wheat flour blends in bread making. J. Food Sci. 42:822-833.

Oluwamukomi, M.O., I. B. Oluwalana, I.B. and O. F. Akinbowale, 2011**.** Physicochemical and sensory properties of wheat cassava composite biscuit enriched with soy flour. African Journal of Food Science Vol. 5 (2):50 – 56.

Olaoye, O.A., A.A. Onilude and O.A. Idowu, 2006. Quality characteristics of bread produced from composite flours of wheat, plantain and soybeans. Afri. J.Biotechnol., 11: 1102-1106.

Tsatsu, Tsikata, C., 2009. Utilization of soybeans in the production of bread, HND Dissertation, Cape Coast Polytechnic, Cape Coast, Ghana, 1: 4-28.

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