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Comparative Studies on Proximate Composition of Cowpea, Maize and Soft Wheat Flours In Ghana

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Abstract

The proximate composition of flours are critical factors in product development and food formulation trials in the food industry. The present study was carried out to study the proximate composition of different flours, that is maize, cowpea and soft wheat flour. The flours under study had crude protein content ranging between 10.40% to 24.53%. The percentage of crude protein of Asomdwee cowpea was significantly ($P < 0.05$) higher than that of soft wheat flour and Abontem maize. The same trend was observed in terms of crude fibre, moisture and ash content. Abontem maize flour tended to have the highest fat content (2.83%) with the lowest (1.00%) coming from Asomdwee cowpea flour. Soft wheat flour also had the highest carbohydrate content (83.60%) whereas Asomdwee cowpea flour had the lowest (57.35%). The findings obtained from this study supports and demonstrate the utilization of legumes and cereals as a nutritional constituent in the food industry.

Keywords: *Cowpea; Soft wheat flour; Maize; Proximate Composition*

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Introduction

Legumes and cereals are nutritionally complementary and are excellent source of energy due to their relatively high content of carbohydrates and proteins (Haard and Chism, 1996). Cowpea (*Vigna unguiculata* (L.) Walp), like other grain legume is an important foodstuff in tropical and subtropical countries. It provides essential nutrients and high level of protein making it extremely valuable where many people cannot afford protein foods such as meat and fish (Akpapunam and Sefa-Dedeh, 1997). Maize (*Zea mays* L., Poaceae) is the most important cereal in the world after wheat and rice with regard to cultivation areas and total production (Osagie and Eka, 1998). Maize has an average chemical composition of 10.3% protein, 60.5% starch, 1.2% sugar, 2.5% crude fibre and other substances (Addo-Quaye., *et al*. 2011). Wheat flour approximately consists of 72% carbohydrates, 8 to 13% protein, 12 to 13% moisture, 2.5% sugar and 1.5% fat, 1.0% soluble protein and 0.5% minerals salts (Oberoi., *et al*. 2007). Soft wheat flour is used in cakes, pastries, cookies, crackers and oriental noodles.

As there is continuous awareness that health may be improved through balance diet, it has been a challenge for food scientists in finding more nutritious and healthy substitutes in the food industry. The high level of malnutrition in developing countries is of great importance not only to food scientists but also for concerned citizens and governments as well (Olsen, 1975). The rapid increase in population and inadequate supply of protein has inadvertently increased the occurrence of malnutrition in developing countries (Siddhuraju, 1996). Recent studies have shown that malnutrition among children in developing countries is mainly due to the consumption of cereal based porridge which is bulky, low in energy and high in anti-nutrients (Michaelsen and Henrik, 1998).

The output of this research involves the collation of data on the proximate composition of soft wheat, maize and cowpea flours. This would provide useful information to food scientist and others alike on the subsequent incorporation of soft wheat flour, maize and cowpea flours into food products to produce natural, cheap and adaptable functional foods. The objective of this study, therefore, was to evaluate the proximate composition of cowpea, maize and soft wheat flour.

Materials and Methods

Experimental Location

The Proximate composition was carried out at the Department of Animal Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Sample Collection and Preparation

Cowpea (Asomdwee variety) and maize (Abontem variety) seeds were obtained from the Crop Research Institute of the Council for Scientific and Industrial Research at Fumesua, Kumasi Ghana. The commercially available soft wheat flour was purchased from local suppliers at Kajetia market in Kumasi.

Flour Preparation

The samples were cleaned of foreign materials and milled into flour in a hammer mill and sieved through 75 µm. The flours were packaged in air-tight plastic containers and stored under laboratory condition until further analyses.

Proximate Composition

The proximate analysis of samples for moisture content, crude protein, ash and crude fiber was carried out on the flours using the standard methods described by (AOAC, 2002). Crude fat was extracted using the Soxhlet procedure with petroleum ether (60-80°C). Carbohydrate content was determined by difference.

Data Analysis

All data collected on the proximate composition was analyzed using Statistix 9 statistical Package. Mean separation was done using LSD at 1% confidence intervals.

Results and Discussion

Moisture Content

Significant differences ($P<0.01$) were observed among the flours in terms of the moisture content. The highest moisture content of (10.90%) was recorded by Asomdwee Cowpea flour. Soft wheat flour had the least moisture content (3.33%). The moisture content of Asomdwee cowpea was the highest and was significantly ($P < 0.01$) different from the others. The moisture content of abontem maize flour from this research (7.03%) was higher than (6.78%) reported by Owiah, (2013). The value of moisture content in this study for cowpea was higher than the (9.20%) for cowpea flours in Nigeria by (Arawande and Borokini, 2010). The moisture content of wheat flour was lower than the (11.60%) and (13.29%) recorded for buckwheat flour and refined wheat flours (Baljeet., *et al*. 2010) as well as (13.3%) for wheat flour as reported by (Ahmed and Campbell, 2012).

Moisture content of foods is influenced by type, variety and storage condition (Enwere, 1998). The moisture content of wheat and maize was within the acceptable limit of not more than 10% for long term storage of flour (Onimawo and Akubor, 2012). The low moisture content of wheat and maize flour would enhance its storage stability by avoiding mould growth and other biochemical reactions (Onimawo and Akubor, 2012). Shittu., *et al*. (2012) reported moisture content of (7.75%) for wheat flour which was quite higher than the moisture content in the soft wheat flour in this research. This assertion explains why they have longer shelf life and also confirms their used in both noodles and bakery products.

Ash Content

Ash content of (3.00%) was recorded by Asomdwee Cowpea flour and this represents the highest ash content of all the three samples. The least ash content value was (1.00%) and was recorded by soft wheat flour but there was no significant difference ($p>0.01$) between soft wheat and abontem maize flour. Cowpea flour recorded the highest ash content value (3.00%). The ash content of soft wheat flour (1.00%) was higher than the 0.89% reported by Dewi (2010).

In contrast, the ash content for maize and wheat flours in this study was lower than the 2.53% for mung bean flour and (2.53%) for chickpea flour reported by Aziah., *et al*. (2012) as well as (6.51%), (4.58%), (4.73%) and (3.25%) for Jack bean, Pigeon pea, cowpea and mucuna bean flour respectively (Arawande and Borokini, 2010; Omohimi., *et al*. 2013). Ash content is an indication of mineral content of a food. This therefore suggests that Asomdwee cowpea flour could be an important source of minerals.

Fat Content

It was observed that there was no significant difference ($p > 0.01$) between wheat and cowpea flours. Abontem maize had the highest crude fat content (2.83%) whereas cowpea flour had (1.00%) representing the lowest fat content. The fat content for abontem maize flour was within the range (2.2–5.7 %) recommended for fat content of maize from several publications (Cortez and Wild-Altamirano, 1972). Fat content of (2.83%) for Abontem maize flour in this research was similar to (2.30%) reported for maize flour by Oladunmoye., *et al*. (2010). Arawande., *et al*. (2010) also reported fat content of (4.37%) for cowpea seed flours found in Nigeria. These values were higher than the value obtained for asomdwee cowpea in this research. However, in this study fat content of Asomdwee cowpea was (1.00%).

The differences in fat content may be due to location and varietal differences (Moorthy., *et al.* 1996). Diets with high fat content contribute significantly to the energy requirement for humans. High fat content of Abontem maize would make it a better source of fat than the others. High fat flours are also good for flavor enhancers and useful in improving palability of foods in which it is incorporated (Aiyesanmi and Oguntokun, 1996).

Crude Fibre Content

There were significant differences ($P < 0.01$) between the three flours. Asomdwee cowpea flour recorded the highest crude fibre content (3.21%). The least crude fibre content was recorded by soft wheat flour (0.51%). Asomdwee cowpea flour had the highest crude fibre content (3.21%). Butt and Batool (2010) reported crude fiber content of (8.19%) for pigeon pea, (9.58%) cowpea, (4.61%) mungbean and (6.83%) for peas flour.

Crude fibre content of (2.85% and 3.70%) were reported for chickpea and mungbean flour by Aziah., *et al*. (2012). Asomdwee cowpea flour would be a better source than wheat and maize flour since it had significantly higher crude fibre content and hence can be used in food to help relieve constipation. Islam., *et al*. (2012) reported (1.23%) for brown rice flour and 0.85% refined wheat flour. The crude fibre content of (0.51%) recorded for wheat in this research was quite close to the (0.85 %) reported by (Islam., *et al*. 2012).

Crude Protein Content

Crude protein content of the three flour samples (Asomdwee cowpea, Abontem maize and Soft wheat flour) varied between (10.23% and 24.53%) as depicted in Table 1. Asomdwee cowpea had the highest (24.53%) and was significantly different ($P < 0.01$) from the

others. Soft wheat flour recorded the least crude protein of (10.23%) but was not significantly ($p > 0.01$) different from Abontem maize flour (10.40%). The protein content of asomdwee cowpea (24.53%) was found to be between the range of (20-27%) reported by Henshaw (2008) for some cowpea varieties and also close to (21.63-25.28%) for four advanced lines of cowpea reported by Asare., *et al*. (2013). However, the crude protein content of asomdwee cowpea was lower than the (27.88%) reported for cowpea by Butt and Batool (2010).

According to Oladunmoye, (2009), wheat had protein content of (11.7%), maize (2.6%) and cowpea (19.39%). It was observed that the protein content recorded for cowpea and maize in these studies were higher compared to the values of (Oladunmoye, 2009). The crude protein content differences can be attributed to the geographical location. Since soils with high nitrogen levels can influence protein levels (Blumenthal., *et al*. 2008). Proteins are increasingly being utilized to perform functional roles in food formulations. Therefore, the protein content of the flours in this study suggests that they may be useful in incorporating into food formulation trials especially with the Asomdwee cowpea variety to help address high malnutrition levels.

Carbohydrate Content

The difference between the cowpea and maize was not statically significant ($p>0.01$). The carbohydrate content of the flours for cowpea and wheat flours was comparable to (57.17%) for cowpea, (74.22%) for wheat; reported by Ahmed and Campbell, (2012). Owiah, (2013) reported carbohydrate content of (76.54% and 77.54%) for abontem and Golden jubilee maize flours respectively.

Carbohydrate content of (50.95% to 53.98%) reported for Nhyira, Tona and Adom cowpea varieties were within the ranges recorded in this research (Appiah., *et al*. 2011). It can be observed that the flours used for these studies had higher carbohydrate content. The high carbohydrate contents of the flours under study suggest that they could be used in managing protein-energy malnutrition. The flours under study will be a good source of energy and that a high concentration of it is desirable in breakfast meals and weaning formulas.

Flour Type	Crude protein	Crude fibre	Moisture content	Ash	Fat	Carbohydrate
Wheat	10.23	0.51	3.33	1.00	1.33	83.60
Cowpea	24.53	3.21	10.90	3.00	1.00	57.35
Maize	10.40	1.06	7.03	1.06	2.83	77.61
LSD 0.01	0.75	0.42	1.06	0.20	0.71	1.28
CV	1.66	8.67	4.98	3.95	13.69	0.58

Table 1: *Proximate composition of Asomdwee cowpea, Abontem maize and soft wheat flour in Ghana (on dry basis).*

Conclusion

The high content of Asomdwee cowpea flour protein content makes it a superior quality flour than the others in complementary food products as protein-rich food for the relief of malnutrition. The findings obtained from this study supports and demonstrate the utilization of legumes and cereals in incorporation into food formulation trials in the food industry

The low (3.33%) moisture content in soft wheat flour will make it readily available for use in various food formulation trials since it has a longer shelf life and unfavorable for microbial spoilage. Also, the high fat content in maize flour will be useful in food formulations that require pleasant flavors for target consumers. The high carbohydrates content of the wheat and maize flours would make them good sources of energy in breakfast formulation trials.

Conflict of interest

The authors declares no conflict of interest

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