Nutritional and Organoleptic Evaluation of Cookies Produced from Wheat Flour and African Walnut (*Tetracarpidium conophorum*) flour blends.

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**ABSTRACT**
Cookies were made from wheat and walnut flour *Tetracarpidium conophorum*. Wheat flour was mixed with walnut flour at the ratio of 100:0% (control), 90:10%, 80:20%, 70:30% and 60:40% to produce cookies and were labeled X, A, B, C, D and E respectively. Sample X served as control. The cookies were evaluated for proximate composition, anti-nutrients (oxalates, phytate and protease inhibitor), phyto-chemicals (tannins, flavonoids, alkaloids, terpenoids, saponins, and Oxygen Radical Absorbance Capacity (ORAC) and sensory evaluation. The protein and phytate contents of sample X (16.3±0.10 and 11.3±0.10) were significantly different from all other samples. Tannins, flavonoids, and terpenoids were undetected in sample X. Alkaloids were undetected in sample X and A while ORAC level of sample X (3.4±0.11) was significantly lower compared to all other samples. Organoleptic panelists preferred sample X to all other samples followed by sample A.

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**Introduction**
Much of wheat consumed by humans is in the form of bread, snacks, semolina etc which occurs in a vast range of forms in different cultures. In addition, a range of types of noodles are made from bread wheat, durum wheat (pasta), and other baked products like cookie, cakes, chin-chin etc. it is important to maintain the quality for end use when attempts are made to improve or maintain the quality of wheat, if not done, it will not be accepted by consumers irrespective of any improvement in enhancing the nutritional quality. Wheat is the most important stable food crop for more than one third of the world population and contributes more calories and protein to the world diet than any other cereal crops. It is nutritious, easy to store and transport and can be processed into various types of food. Wheat is considered to be a good source of protein, B-group vitamins, minerals, carbohydrate, and dietary fiber (45,).

The walnut kernels are rich source of carbohydrate, protein, vitamins, minerals, phenolic acids, antioxidants and anti-microbial properties (Anderson et al., 2001; Li et al., 2006). The delicious walnut is a very good source of omega-3 essential fatty acids including cis-linoleic and alfa-linoleic, a special type of protective fat the body cannot manufacture (Sofowora, 1993). Walnuts are a good source of copper and manganese, two minerals that are essential cofactors in a number of enzymes important in antioxidant defenses; it also possesses many potential health benefits including cardiovascular protection, promotion of better cognitive function, anti-inflammatory benefits helpful in asthma, rheumatoid arthritis, and inflammatory skin diseases such as eczema and psoriasis (Edem et al., 2009). Walnuts also contain an antioxidant compound called ellagic acid, which blocks the metabolic pathways that can lead to cancer. Ellagic acid not only helps protect healthy cells from free radical damage, but also helps detoxify potential cancer-causing substances and helps prevent cancer cells from replicating. There are 16 polyphenols in walnut with antioxidants activity which can be described as “remarkable” (Pratt et al., 1997).

Cookies are snacks that are popular and widely consumed all over the world by people of all ages. They are traditionally made from soft wheat, a cereal, which is cultivated in many countries. Cookies have become one of the most desirable snacks for both young and old due to their low moisture content, long shelf-life and ability to serve as a vehicle for important nutrient (Akubor, 2003; Honda and Jood, 2005).

In the quests for wheat substitute, flour with better nutritional quality than wheat would be highly desirable especially in developing countries where malnutrition is prevalent.

The objective of this study is to determine the physico-chemical properties of cookie produced from wheat-walnut flour blends in order to determine the nutritional value and acceptability.

**Materials And Methods**
Whole walnut and wheat flour were purchased from a local market in Ibadan. Other ingredients used for baking were obtained from the same source.

**Preparation of walnut flour**
Walnut flour was prepared using the method described by Okaka (15). The nut was sorted to remove the bad ones, boiled for 45 minutes, cooled and de-shelled. The de-shelled nuts were air dried to reduce the moisture content and milled in a Marlex blender. The flour was sieved to pass through 40-mesh sieve (British standard) and packaged in an airtight container until needed. Wheat was purchased as already milled flour. The packaged flour samples were kept in airtight containers until needed for analysis.

**Flour blending**
Wheat flour was mixed with walnut flour blends at the ratios of 100:0, 90:10, 80:20, 70:30, and 60:40 respectively, in a Kenwood blender. The blends were not kept in plastic airtight containers at room temperature pending their use.

**Cookies formulation and preparation**
The basic formulation for the cookie was 100g flour, 25g fat, 5g sugar, 0.1g salt and (14) whole eggs. Wheat flour was used whole as a standard for comparison.
After mixing, the dough was kneaded to a uniform thickness of 0.25cm and cut to a diameter of 4.6cm using cookie cutter. Cookies were baked for 15 mins on aluminum sheets at 185°C in an oven, cooled, packaged in polyethylene bags and stored at room temperature prior to analysis (AACC method, 2010).

**Proximate Analysis**

The samples (cookies) were subjected to proximate analysis using official methods of Analysis (7).

**Anti-nutritional Analysis**

Tannin content was determined by the method described by Pearson (8) while Phytate was determined by Oberlease (9) with a slight modification.

**Sensory Evaluation**

The samples were subjected to sensory evaluation using the nine-point hedonic scale which ranges from ‘Liked extremely’ as 9 to ‘disliked extremely’ as 1. The 11 man panelists were randomly served with the coded samples and asked to assess the samples based on colour, aroma, taste, appearance, crispiness etc are almost the same.

**Statistical Analysis**

The data generated from analysis and taste panelists were subjected to one way ANOVA at (p≤0.05).

**Result**

**Discussion**

Proximate analysis of the cookies showed a significant increase in the protein content of all samples fortified with walnut flour compared to X (control). This is expected since walnut itself is not less than 25% protein on dry basis (Awe et al., 2015). The carbohydrate content of the control 52.4±0.15 is significantly higher than all other samples. Significant difference in fat was observed in samples B and D compared with X while the fibre contents of sample D (90% wheat flour, 10% walnut flour) and X (100% wheat flour) were not significantly different.

The phytate content of X was significantly reduced compared to all other samples while oxalates and protease inhibitors were absent in all samples. This is also expected since the wheat flour has passed through processing and the walnut had been boiled before milling into the flour that was used. i.e. heat reduces anti-nutrients (Soetan and Oyewole, 2009., Awe et al., 2015). Phytochemical profile of the samples that tannin, flavonoids and alkaloids were not detected in sample X. Oxygen radical absorbance capacity was significantly reduced in sample X compared to all other samples

Sensory evaluation showed that the panelists preferred sample X followed by sample A (90% wheat flour, 10% walnut flour). This may be because the two samples are close in terms of constituents and therefore the organoleptic properties like taste, aroma, crispiness etc are almost the same.

**References**


