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PROXIMATE AND FIBER FRACTION COMPOSITIONS OF WHEAT-CASHEW APPLE FLOUR BLENDS

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ABSTRACT

Dietary fibre has been recognized in the preparation of food with high nutritional quality in maintaining human overall physical well-being.Cashew apples were washed, cut into pieces before juice extraction. The cashew apples residues were conditioned in water at ratio 1:2, pH 4.5 at 35°C for 15minutes, oven dried at 55°C and milled to obtain flour. Six composite flours were made from wheat flour supplemented with cashew apple flour at different proportions of 5, 10, 15, 20, 25, 30% and wheat flour as control. The inclusion of cashew apples showed gradual increase in moisture (11.13-12.58%), fat (1.48-2.11%) and fiber (0.99-3.85%) with concomitant decrease in ash (2.49-1.95%), protein (11.15-10.11%), and carbohydrate (72.76-69.30%).The neutral detergent soluble (NDS) ranged from 53.67-74.67% while control flour was higher in NDS (78.67%) and hemicellulose (16.57%). The range of values obtained for neutral detergent fibre and acid detergent fibre were: 21.27%-32.20% and 8.97%-21.33% respectively. Most of the fiber fractions were significantly different ($p<0.05$) at different levels of inclusion of cashew apple flour. This study recommended wheat and cashew apple flour blends as rich sources of digestible fibres when compared with control as an advantage to consumers.

Keywords: Wheat, Cashew apple, composite flour, proximate, fibre fraction.

INTRODUCTION

Food is one of the most important basic needs of humans and animals; since life processes depend on nutrients. Nigeria is one of the largest producers of cashew fruit while over 30% are lost annually due to poor processing, handling, storage and value addition that can support all year availability of the products. Cashew kernel is of high food value containing about 40-57% oil and 21% crude protein. Cashew apples contain astringent and acid components which produce an unpleasant biting sensation on the tongue and throat when eaten. The residue has a dark yellow color, a fibrous aspect, and a typical astringent aroma due to the presence of tannins which could be a limiting factor. Research has shown that the fiber can be used for production of natural colorant; while the milled fiber could be incorporated with cereals flour for production of bread and meat-like produce(Saxena and Raja, 2014).Several researches has shown numerous health benefits of consuming both soluble and insoluble dietary fibers among which are: reduced absorption of soluble and total blood sugars which may in turns lower the risk of gallstone, kidney stone, diverticulitis and hemorrhoids, lower risk of heart disease and stroke. Dietary fiber has been suggested as a possible food stuff that may enhance weight loss among the obese as a result of feeling of fullness. Therefore, this study is designed to assess the proximate and fibre fraction composition of wheat-cashew apple composite flour.

MATERIALS AND METHODS

Sources of cashew fruits

Matured and fully ripped fresh cashew fruits were obtained from the Federal University of Agriculture, Abeokuta plantation farm (DUFARM). One hundred kilogram (100kg) of the fresh cashew fruits were carefully harvested and packaged into four different plastic buckets containing 25kg each of the cashew fruits. The cashew fruits were taken to the Food processing laboratory for further processing at the Department of Food Science and Technology, College

of Food Science and Human Ecology, Federal University of Agriculture, Abeokuta.

Production of cashew apple fibre

Fresh cashew fruits were manually sorted; the apples were separated from the nut, washed in cold water and cut into small pieces of between 0.3-1.0cm before the juice was extracted with the aid of a juice extractor. The residue was conditioned at a ratio of cashew apple with water 1:2at pH of 4.5 and temperature at 35°C (hot water treatment) and later drained. The drained cashew apple residues were oven dried at 55°C and milled with a milling machine to obtain a fine cashew fibre.

Mixing proportions of cashew apple fiber with wheat flour

A total of seven treatments were used in this study. Six composite flour treatments were made by supplementing wheat flour with the finely milled cashew apple fibre at different proportions of 5, 10, 15, 20, 25 and 30%. Wheat flour without the addition of the cashew apple fiber was used as control experiment. The composition of the experimental composite flours is presented in Table 1.

Determination of proximate and fibre fractions of the flour blends

The moisture content (oven dried), total ash (muffle furnace), crude protein (Kjedahl), crude fat (Soxhlet) were determined according to Cullison (1982) and AOAC (2000), while dry matter was calculated and expressed in percentage as described by AOAC (2000). The Van-Soest(1982)method of forage evaluation was used for the determination of fibre fractions.

Statistical data analysis

All analyses with mean and standard deviations were determined in three replicates. Means was separated using Duncan's multiple range test (DMRT) using the statistical package for social sciences (SPSS) version 21.0 (SPSS incorporation Chicago, IL) Significant differences were established at $P \leq 0.05$. Data was analyzed using the Analysis of Variance (ANOVA) statistical method IBM SPSS Statistics 21 [h33t] [ku92].

RESULTS AND DISCUSSION

Proximate composition of the composite flour obtained from wheat and cashew apple fibre is presented in Table 2.As the inclusion of cashew apple fibre in the composite flour samples increased; there was gradual increase in moisture content (11.13-12.58%), crude fat (1.48-2.11%) and crude fiber (0.99-3.85%) with concomitant decrease in values obtained for the total ash (2.49-1.95%), crude protein (11.15-10.11%), and total carbohydrate (72.76-69.30%).There exist significant differences ($p<0.05$) in the proximate parameters measured among all the treatment means except the moisture content (11.13%) and total carbohydrate constituents(72.76%) of sample 5WCF when compared with the moisture (11.11%) and carbohydrate content (73.02%) of the control sample (WTF). The range of moisture revealed in the flour blends indicated an acceptable level for prolonged shelf life and less exposure to microbial attack (Aremuet al., 2006). Flour with moisture content greater than 14.5% has been shown to attract moulds and bacteria which often cause deterioration during storage, while flour containing low moisture content especially below 13.0% has been reported to be more stable during storage (AACC, 2000). The enhancement of moisture content of the composite flour can be attributed to the high content of cellulose, hemicellulose and lignin of the cashew apple;thus making the cashew apple based samples to require and entrap more water than the control. The levels of fat recorded for the composite flour samples and control practically suggests that the flour could be processed into baked products like the cake.

The increase in fibre constituents of the samples can be attributed to high composition of the cellulose, hemicellulose and lignin content of cashew apple fibre. The increased total ash with increased inclusion of cashew apple fibre in the composite flour indicated an increase in mineral content of the samples. Total ash has been used for the estimation of mineral content of flour and the degree of endosperm separation from bran during milling (Calvelet al., 2001).The crude protein of the cashew apple based samples and control are comparable to the claims of proteins in wheat or its composite flour in previous works of some authors like Ahmed (1993), which ranged from 11.99 to 13.80% and which also ranged from 11.86 to 11.95%. On the contrary, the values were observed to be relatively higher when compared the protein content (3.30%)ofwheat flour reported by Kiin-Kabari and Giami (2015).The increased cashew apple substitution in the flour blends, which showed significant effect ($p<0.05$) on the protein content of the composite flour is attributable majorly to low protein constituents of cashew apple fibre. Protein content has been described as the best single test that can be applied to determine the quality of flour, because of its direct correlation with

baking quality (Matz, 1996; Stone and Savin, 1999).Despite the lower carbohydrate obtained in this study, the range of values obtained for the cashew apple based samples (69.39% - 72.76%) and control (73.02%) were still comparable to recent claims of Kiin-Kabari and Giami (2015).Qarooni, (1996)attributed the main causes of differences in flour quality to the inherit properties of wheat grains, tempering conditions, and milling practices which often leads to deviations from previous reports.

Results obtained for the fiber fractions of composite flour made from wheat and cashew apple blends is shown in Table 3. The level of substitution of wheat flour with cashew apple fibre significantly($p<0.05$) lower the solubility of the flour in neutral detergent reagent with increase in cashew apple fibre. The Neutral Detergent Soluble (NDS) shows the amount of composite wheat and cashew apple fiber that can dissolve in neutral detergent reagent. The values recorded for NDS of the composite flour ranged from 53.67% (30WCF) to 74.67% (5WCF). The control sample (WTF) was higher in NDS (78.67%) and hemicellulose (16.57%) than the composite flour samples; while significantly lower ($p<0.05$) in other fibre fraction parameters as indicated in Table 2. As the cashew apple substitution is increased in the composite flour, the range of values obtained for the Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF);which shows the percentage of fibre in the flour that dissolved in acidic detergent were: 21.27%-32.20% and 8.97%-21.33%respectively.

The NDF, which indicated the bulk of the constituents and thus feed intake showed a higher value with increase in cashew apple and consequently, the ADF which has been described by (Van-Soest, 1982) as good indicator of digestibility was higher with increased cashew apples. This shows that the cashew apple based flour may have greater potential for better digestibility in a neutral and acidic medium compared with control sample as it is higher in NDF and ADF values. Other fibre fraction parameters that were evaluated in the samples includes; Acid Detergent Lignin (ADL) which ranged from 7.07% (5WCF) to 14.62% (30WCF), silica rangedfrom1.21%(5WCF) to 2.70% (30WCF), and cellulose ranged from 0.69%(5WCF) to 4.01% (30WCF). Most of the parameters measured as fibre fractions were significantly different ($p<0.05$) at the different levels of inclusion of the cashew apple fibre in the composite flours.

CONCLUSION

Results obtained from this study suggested that substituting wheat flour with cashew apple fibre flour was fibre fractions. The results indicated that the higher level fibre fractions in the cashew apple based samples could be advantageous to the consumers of baked products when compared with control. In addition, cashew apple fibre could be a useful ingredient in the production of value-added, nutritious and convenient foods for the populace who consume baked products as it may increase digestibility due to its digestible fibre constituents such as the NDS, NDF and ADF. Therefore, it could be recommended that wheat and cashew apple flour blends could be incorporated into wheat flour as rich sources of digestible fibre.

Table 1: Cashew applefibre and wheat flour composite formulation

Samples	Cashew apple Fiber (%)	Wheat Flour (%)
5WCF	5	95
10WCF	10	90
15WCF	15	85
20WCF	20	80
25WCF	25	75
30WCF	30	70
WTF	0	100

Where: 5WCF =5% Cashew apple fibre + 95% wheat flour, 10WCF=10% Cashew apple fibre + 90% wheat flour, 15WCF=15% Cashew applefibre + 85% wheat flour, 20WCF=20% Cashew apple fibre + 80% wheat flour, 25WCF=25% Cashew applefibre + 75% wheat flour, 30WCF=30% Cashew applefibre + 70% wheat flour, WTF=100% wheat flour

Table 2: **Proximate composition of flour blends obtained from wheat and cashew apple fibre**

Flour sample	Moisture content (%)	Total ash (%)	Crude fat (%)	Crude protein (%)	Crude fiber (%)	Carbohydrate (%)
5WCF	11.13±0.06^{a}	2.49±0.03^{d}	1.48±0.03^{b}	11.15± 0.11^{e}	0.99±0.01^{b}	72.76±0.02^{d}
10WCF	11.46±0.06^{b}	2.33±0.04^{c}	1.72±0.05^{c}	10.95±0.08^{d}	1.53±0.07^{c}	72.01±0.01^{c}
15WCF	11.79±0.07^{c}	2.12±0.06^{b}	1.91±0.04^{d}	10.73±0.15^{c}	2.41±0.08^{d}	71.04±0.01^{b}
20WCF	12.18±0.03^{d}	2.04±0.07^{ab}	1.98±0.03^{e}	10.50±0.11^{b}	3.30±0.02^{e}	70.00±0.03^{a}
25WCF	12.42±0.02^{e}	2.00±0.05^{a}	2.06±0.03^{f}	10.28±0.11^{a}	3.53±0.07^{f}	69.71±0.02^{a}
30WCF	12.58±0.03^{f}	1.95±0.06^{a}	2.11±0.03^{f}	10.11±0.06^{a}	3.85±0.10^{g}	69.39±0.01^{a}
WTF	11.12±0.03^{a}	2.99±0.01^{e}	1.27±0.05^{a}	11.41±0.06^{f}	0.20±0.04^{a}	73.02±0.04^{d}

Mean values with different superscript in each column are significantly different ($p<0.05$) from each other; Values are means of triplicate. Key: 5WCF = 5% cashew apple fibre flour; 10WCF = 10% cashew apple fibre flour; 15WCF = 15% cashew apple fibre flour; 20WCF = 20% cashew apple fibre flour; 25WCF = 25% cashew apple fibre flour; 30WCF = 30% cashew apple fibre flour; WTF = 100% wheat flour (control).

Table 3: **Fibre fractions of flour blends produced from wheat and cashew apple fibre**

Flour sample	NDS (%)	NDF (%)	ADF (%)	ADL (%)	Silica (%)	Cellulose (%)	Hemi-cellulose(%)
5WCF	74.67±2.08^{f}	21.27±0.61^{b}	8.97±0.15^{b}	7.07±0.02^{b}	1.21±0.04^{b}	0.69±0.08^{b}	12.90±0.02^{d}
10WCF	66.67±1.53^{e}	23.57±0.51^{c}	10.70±0.30^{c}	7.53±0.50^{c}	1.47±0.03^{c}	1.70±0.03^{c}	12.87±0.01^{d}
15WCF	61.33±0.58^{d}	25.62±0.42^{d}	12.80±0.26^{d}	8.97±0.25^{d}	1.69±0.02^{d}	2.14±0.02^{d}	12.82±0.03^{cd}
20WCF	59.00±1.00^{c}	27.60±0.46^{e}	14.87±0.21^{e}	10.44±0.06^{e}	2.05±0.05^{e}	2.38±0.09^{e}	12.73±0.03^{c}
25WCF	56.67±0.58^{b}	28.63±0.65^{f}	17.17±0.31^{f}	12.15±0.09^{f}	2.39±0.05^{f}	2.63±0.03^{f}	11.46±0.06^{b}
30WCF	53.67±1.53^{a}	32.20±0.40^{g}	21.33±0.31^{g}	14.62±0.11^{g}	2.70±0.06^{g}	4.01±0.01^{g}	10.85±0.13^{a}
WTF	78.67±0.58^{g}	19.37±0.35^{a}	2.80±0.15^{a}	1.17±0.02^{a}	1.04±0.03^{a}	0.59±0.04^{a}	16.57±0.02^{e}

Mean values with different superscript in each column are significantly different ($p<0.05$) ; Values are means of triplicate.: **Key:** 5WCF = 5% cashew apple fibre flour; 10WCF = 10% cashew apple fibre flour; 15WCF = 15% cashew apple fibre flour; 20WCF = 20% cashew apple fibre flour; 25WCF = 25% cashew apple fibre flour; 30WCF = 30% cashew apple fibre flour; WTF = 100% wheat flour (control); NDS =Neutral detergent soluble; NDF = Neutral detergent fibre; ADF = Acid detergent fibre; ADL= Acid detergent lignin.

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