Evaluation of Cookies produced from blends of Wheat, Soybean and Corn Flours

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ABSTRACT

Nutritional related diseases are known to abound in many developing countries. In this study, suitability of wheat, soybean and corn composite was investigated for the development of cookies. Wheat, soybean and corn were blended into various proportions to produce cookies. The cookies were analyzed for proximate and minerals compositions. The proximate composition of the cookies varied from 2.03-3.27, 6.13-17.07, 15.37-18.3, 0.98-2.73, 3.50-5.50 and 54.78-66.76%, for moisture, protein, fat, crude fibre, ash and carbohydrate contents, respectively. The mineral contents ranged from 5.45-12.43, 6.67-20.19, 10.33-16.35, 0.047-0.096, and 5.21-8.11 mg/100g for potassium, calcium, iron, zinc and magnesium, respectively. Therefore, consumption of cookies from wheat, corn and soyflour should be encouraged to prevent nutritional related diseases.

Keywords: Cookies, corn, mineral composition, proximate composite, quality, soybean, wheat,

INTRODUCTION

Cookies are among the snack products relatively well-known [10]. They are usually nutritive quick snacks produced from array of recipes including the use of unpalatable dough transformed into appetizing product using heat application in an oven [17]. A cookie can be wheat based and part of the wheat can also be substituted with other starchy foods. Different levels of success have also been recorded with the use of flours from legume, cereals, roots and tubers in baked goods [5] [7] [15]. Wheat (*Triticum aestivum*) is one of the most useful and valuable crops grown around the world and it is considered as almost first among cereals largely due to the fact that its grain contains protein having unique chemical and physical properties including other vital nutrients [12]. Wheat is the ideal flour suitable for baking. The high level of its utilization has resulted in an overdependence on wheat flour for baked goods especially in developing countries like Nigeria.

Soy bean (*Glycine max*) is an edible legume highly famed for being nutritious; as they are rich in protein, calcium, fiber, iron, magnesium, and other enriching vitamins and minerals [1]. It can be cooked, fermented, dried, and converted into products like milk, flour, and tofu. Soy beans

contain significant amounts of phytic acid, dietary minerals and B vitamins. Soy vegetable oil, used in food and industrial applications from soybean crop.

Maize (*Zea mays*) corn is a cereal crop that is grown widely throughout the world in a range of agro-ecological environments. It is the most important cereal in the world after wheat and rice [19]. It has been discovered that maize is nutritionally superior to other cereals in many ways, except in protein value. Maize is low in two essential amino acids, lysine and tryptophan. The addition of soybeans which are rich in lysine and tryptophan was meant to enhance the nutritional capacity of the composite flour. The objective of this work was to determine the nutritional composition of cookies from wheat, soybean and corn flours.

MATERIALS AND METHODS

Materials

Wheat, soy beans, yellow corn and other major ingredients like flavour, milk, eggs, salt, margarine, sugar and baking powder used were purchased from Wazo market Ogbomoso, Oyo State, Nigeria. The equipment and reagents used were obtained from the Department of Food Science, Ladoke Akintola University of Technology, Ogbomoso, Oyo State

Production of wheat, soybean and corn flours

Dried wheat and yellow corn grains were manually sorted and cleaned to remove unwholesome materials. The sorted grains were milled and sieved to produce whole wheat and yellow corn flours. The flours were packaged and stored in air tight container until further needed. Soybean seeds were sorted, washed and soaked in water for 6 h. It was boiled in pressure cooker for 5 min, dehulled and dried in a locally fabricated cabinet dryer at 50 °C for 24 h, then milled and sieved to produce soybean flour that was stored in a dry air tight container.

Production of cookies

Seven blends of flour recipe were prepared by mixing different proportions of wheat flour (WF), soybean flour (SF) and corn flour (CF) and 100% WF served as control (Table 1).

Table 1: Formulation of whole wheat, corn and soy flour mixes

Formulations	A	B	C	D	E	F	G
Whole wheat flour, %	100	90	80	70	60	50	0
Corn flour, %	0	5	10	15	20	25	50
Soy flour, %	0	5	10	15	20	25	50

Cookies were prepared using the method described by [11]. The ingredients (wheat flour, corn and soybean flour) were measured into a bowl. All the samples of cookies contained 30g sugar, 25g fat, 1.5g baking powder, 4g vanilla flavor, 0.5g salt 30g whole egg and small quantity of water. Using the rubbing method, fat, milk and salt were added and rubbed for 30 min. In a

separate bowl, egg and water was mixed and added to the flour-based mixture, then kneaded to make dough. The dough was rolled and flattened into a uniform thickness of about 3.5 mm before cutting out to shapes using biscuit cutter. The cut-out dough was baked in the oven at 150°C for 10-15 min. After baking, the cookies were cooled to room temperature, packed in low density polyethylene (LDPE) bags and sealed in a plastic transparent container.

Analyses

The proximate composition of the cookies samples were determined according to the method described by [3] for moisture, ash, crude fibre, protein, crude fat and carbohydrate by difference. Calcium, potassium, magnesium, iron and zinc were determine using the dry-ash techniques according to [13]. The data obtained were statistically analysed using the Statistical Analysis Software (SAS) package (version 11 of SAS Institute, Inc.).

RESULTS AND DISCUSSIONS

The results of the proximate analysis of the cookies produced from whole wheat, soybean and corn flour mixes are shown in Table 2. The moisture contents of the cookies ranged from 2.03 to 3.27%. The moisture level increased as the substitution levels increased. Sample A (control) had the highest value of 3.27% while sample B had the lowest value of 2.03%. The moisture content of the cookies is similar to the result obtained by [13] in which the moisture content ranged from 3.34 to 4.06%. Moisture content is very essential for shelf-life maintenance and also determine the way food may be processed [2]. It has also been used as a measure of stability and susceptibility to microbial contamination. There was no significant difference in samples C, D and E at $P<0.05$.

Table 2: Proximate composition of cookies

Samples	Moisture Content (%)	Protein (%)	Fat (%)	Crude Fibre (%)	Ash (%)	Carbohydrate (%)
A	3.27^{a}	6.13^{g}	15.38^{c}	0.98^{g}	3.67^{d}	70.57^{a}
B	2.03^{c}	10.51^{f}	15.67^{c}	1.68^{f}	3.73^{cd}	66.38^{a}
C	2.43^{bc}	11.82^{e}	16.00^{bc}	1.89^{e}	3.93^{bcd}	63.93^{b}
D	2.47^{bc}	13.13^{d}	16.07^{bc}	2.10^{d}	4.50^{cd}	61.73^{c}
E	2.50^{bc}	14.01^{c}	16.22^{bc}	2.24^{c}	4.53^{bc}	60.50^{d}
F	3.03^{ab}	15.76^{b}	16.78^{b}	2.52^{b}	4.67^{ab}	57.24^{e}
G	3.13^{a}	17.07^{a}	18.37^{a}	2.73^{a}	5.50^{a}	53.20^{f}

Values are means of three determinations. Value with the same subscript in the column are not significantly different ($p<0.05$)

Whole wheat flour: WF

Soybean flour: SF

Corn flour: CF

C: 80 % WF: 10% SF:10 % CF

D: 70 % WF: 15% SF:15 % CF

E: 60 % WF: 20 % SF: 20 % CF

A: 100 % WF: 0% SF:0 % CF F: 50 % WF: 25% SF:25 % CF

B: 90 % WF: 5% SF: 5 % CF G: 0 % WF: 50% SF: 50 % CF

There was increased in protein content of the cookies as the soybean flour substitution level increased. The protein content ranged from 6.13 to 17.07%. Sample G had the highest value of 17.07% while sample A (control) had the lowest value of 6.13%. The value obtained in this research work is in accordance with a range of 14.65 to 18.31% reported by Tanko *et al*. [22], in the quality characteristics of biscuits produced from composite flour of sweet potato and cashew nut flour blends. The highest protein was obtained with the highest substitution level of soybean flour which might be due to the protein content of soybean flour.

The fat content of the cookies ranged from 15.38 to 18.37% in the cookies samples. Sample G had the highest value of 18.37% while sample A had the lowest value of 15.38%. The results may be due to the variations of the samples and the processing method adopted. Soybean (an oil seed) from which the soy-flour was produced must have contributed most of its oil content to the product. The high oil content of the cookies will affect the shelf stability [20].

The crude fibre content of the cookies increased in the range of 0.98 to 2.73% as the percentage of soybean and corn flour mixes increased. Sample G had the highest value of 2.73% while sample A had the lowest value of 0.98%. Fibre is essential in human diet as it improves the stool bulk by acting as a vehicle for faecal fluid. It improves the health of the gastro-intestinal system and metabolic system in human [4]. The increased fibre and lower carbohydrate contents of cookies have several health benefits, as it will aid digestion in the colon and reduce constipation often associated with products from refined grain flours [8] [21]. The crude fibre content of the cookies was within the recommended range of not more than 6 g dietary fibre and other non-absorbable carbohydrates per 100 g dry matter [20].

The ash content of the cookies increased from 3.67 to 5.50% as the substitution levels increased. Sample G had the highest value of 5.50% while sample A had the lowest value of 3.67%. Atobatele and Afolabi [4] also observed that there was an increase in the ash content of cookies with increasing level of soy-flour in the flour blends. Ash content is a representation of mineral content, samples with high ash content are expected to have a relatively high mineral content [18].

The carbohydrate content of the cookies ranged from 53.20 to 70.57%. Sample A (control) had the highest carbohydrate value of 70.57% while sample G had the lowest carbohydrate value of 53.20%. This implies that the snacks are good sources of energy needed for normal body metabolism. The significant variation ($p<0.05$) in carbohydrate content may be attributed to alterations in other constituents. The cookies can be used as energy-based snacks [4].

Mineral composition of the cookies

The results of mineral composition of cookies samples are as shown in Table 3. The values ranged from 5.45-12.43, 14.79 -20.19, 10.33-16.35, 0.05-0.010 and 5.21-8.11 mg/100g for potassium, calcium, iron, zinc and magnesium, respectively. The increase in mineral content of cookies could be due to increase in substitution levels of soy beans flour and corn flour compared to whole wheat flour. Maize flour contains high levels of important minerals such as potassium, phosphorus, zinc, calcium and iron [23]. The mineral content of the cookies increased as the soy-flour substitution increased for all the minerals analyzed, except for zinc. Sample A (control) had

the highest content of zinc (0.10 mg/100g) while sample D had the lowest value of 0.05 mg/100g. The results may be due to the variations of the samples and the processing method adopted. Calcium content increased significantly with increase in soybean supplement levels. Other researchers have also reported an increase in calcium content of composites with an increase in soybean supplementation Adelakun *et al.* [1], Bolarinwa *et al.* [6]. Thus, these flours could be substituted with wheat flour to improve nutritional quality of resultant food products. Minerals are important in the diet because of their various functions in the body.

Table 3: Mineral composition of the cookies

Samples	K (mg/100g)	Ca (mg/100g)	Fe (mg/100g)	Zn (mg/100g)	Mg (mg/100g)
A	10.68^{c}	14.79^{g}	10.33^{g}	0.07^{cd}	5.21^{g}
B	5.45^{f}	15.23^{f}	12.79^{f}	0.05^{d}	6.98^{f}
C	6.64^{e}	16.67^{e}	12.93^{e}	0.07^{c}	7.20^{e}
D	9.22^{d}	17.49^{d}	14.22^{d}	0.07^{c}	7.44^{d}
E	10.88^{b}	18.66^{c}	14.99^{c}	0.08^{b}	7.55^{c}
F	11.76^{b}	19.12^{b}	15.54^{b}	0.08^{b}	7.58^{b}
G	12.43^{a}	20.19^{a}	16.35^{a}	0.10^{a}	8.11^{a}

Values are means of three determinations. Value with the same subscript in the column are not significantly different ($p<0.05$)
Whole wheat flour: WF
Soybean flour: SF
Corn flour: CF
A: 100 % WF: 0% SF:0 % CF
B: 90 % WF: 5% SF: 5 % CF
C: 80 % WF: 10% SF:10 % CF
D: 70 % WF: 15% SF:15 % CF
E: 60 % WF: 20 % SF: 20 % CF
F: 50 % WF: 25% SF:25 % CF
G: 0 % WF: 50% SF: 50 % CF

They are vital for normal growth, maintenance, effective immune system and prevention of cell damage [20]. The results from the mineral analysis showed that the composite flour would contribute substantially to the recommended dietary requirements for minerals.

CONCLUSION

The findings from this study showed that supplementing whole wheat flour with corn and soybean flour in the cookies production resulted to increase in fat, protein, crude fibre and ash contents of the cookies. The cookies samples also indicated presence of the essential minerals. Hence, incorporation of the flour mixes could eradicate malnutrition among populace in the developing countries.

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