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Full Length Research Paper

Utilization of cashew kernel meals in the nutritional enrichment of biscuit

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A study was carried out on the utilization of cashew kernel meals (CKM) in the nutritional enrichment of biscuit. The biscuits were prepared from blends of soft wheat flour (SWF) and cashew kernel meals (CKM). The different ratios of SWF to CKM used were (A) 100: 0, (B) 90:10, (C) 85:15, (D) 75:25 and (E) 50:50 respectively. The digestive biscuit (DB) bought at the open market served as reference sample. The different biscuits produced were nutritionally analyzed. It was observed that all the samples contained desirable proportions of protein (14.3 - 28.6%), fat (16.21 - 29.62%) and digestible carbohydrates (33.48 - 64.66%). Protein contents, fat, ash and crude fibers increased with increase in CKM. Sensory evaluation results indicated that all the biscuits had high sensory ratings for all the attributes evaluated. There were significant differences among all the samples and the reference biscuit (DB) at $p < 0.05$ in taste, colour and flavour while samples A and B were not significantly different in terms of crispness and texture from the reference digestive biscuit (DB). The general acceptability showed DB > B > A > C > D > E.

Key words: Biscuit, cashew kernel meal, nutritional enrichment, utilization.

INTRODUCTION

Snack foods including biscuits, frequently receive criticisms due to their high levels of salt, sugar and fat, which render them nutritionally damaging when eaten regularly in place of traditional food (Ferrando, 1981; Fellows, 1997). However, they can be very nutritious when made from fruits, pulses or cereals (Coultate, 1984). It should also be pointed out that the consumption of snack foods does not necessarily lead to health problems such as obesity but the cause is rather an unbalanced diet with excess fat, sugar and salt with little protein (Ekpeyong et al., 1977) or due to passive over consumption of dietary fat which has been known to cause excessive weight increase or as a result of reduced thermo genetic response to fat ingestion. To alleviate the problems of malnutrition as a result of an unbalanced diet in a developing country like Nigeria, there is a need for a cheap and available protein source as food fortifier since animal protein is very expensive and beyond the reach of the common man.

Cashew kernel meal has been reported to be highly rich in proteins (Holland et al., 1989; Lee and Nieman, 1993; Latham, 1997). It is a moderate source of iron, riboflavin and thiamine (FAO, 1997, Ekpeyong et al., 1997, Fellows and Hampton, 1992; Fellows and Hampton, 1997). The meal obtained from cashew kernel meal after oil extraction is a white solid material that can be ground into any degree of fineness. It contained about 45% crude protein, 2% crude fiber and 6% ash (Ekpeyong et al., 1997). It is also known that cashew kernel meal is rich in essential amino acid that are normally lacking in common plants, for example, lysine and the sulphur containing amino acids methionine (Ekpeyong et al., 1997). These attributes of cashew kernel meal could therefore be exploited to upgrade a carbohydrate rich snack food like biscuit. Since there is dearth of knowledge on the effect of cashew nut meal on the nutritional and sensory changes of biscuits, further studies to bridge the gap in knowledge became imperative. The objectives of this study were to prepare biscuits from cashew kernel meal (CKM) and soft wheat flour (SWF:CKM) ratios, evaluate the chemical and sensory characteristics of the biscuit and to determine the

Table 1. Mean compositions of cashew kernel, and soft wheat flours.

Components	Cashew kernel	Cashew kernel meal	Soft wheat flour
Protein %	18.60	39.90	12.10
Fat %	48.30	4.10	2.00
Ash %	2.10	2.60	1.80
Moisture %	7.50	5.40	13.40
Crude fiber %	0.56	2.10	1.90
Carbohydrate %	22.84	12.15	69.80
Calorifric value (Kcal/100 gcal)	600.46	204.90	345.60

most acceptable products to consumers.

MATERIALS AND METHODS

Source of raw materials

Cashew kernel meal was obtained from Cocoa Research Institute of Nigeria, Idi-Ayunre, Ibadan, Nigeria. The kernel was roasted in oven (Gallenkamp, BS model 250, size 2, UK) at about 70 - 80°C for 1 h 30 min, cooled and milled using a Moulinex blender. The blended flour was mixed with water using 4 parts of water to 1 part of the flour. The mixture was brought to boil and the oil in water mixture was boiled again until the water was finally evaporated. The residue (meal) was then dried at 100°C for 1 h to obtain the meals (Fellows and Hampton, 1997).

Preparation of cashew kernel meal/soft wheat biscuits

The preparation of the biscuits involved the replacement of part of the soft wheat flour (SWF) with 10, 15, 25 and 50% cashew kernel meal (CKM). The 100% soft wheat biscuit served as the control. All the biscuits contained 30% sugar, 38% margarine, 0.5% baking powder, 1% dried vanilla flavour, 1% salt and 25% water. Flour, sugar, margarine and salt were mixed together manually for 3 - 5 min to get a creamy dough. The other ingredients, except water, were then incorporated. The measured amount of water was added gradually using continuous mixing until a good textured, slightly firm dough was obtained. The dough was kneaded on a fat clean stainless metal table for four minutes. It was manually rolled into sheets and cut into shapes using the stamp cutting methods. The cut dough pieces were transferred into fluid fat greased pans and baked at 180°C for 15 - 20 min in a baking oven (F1 Foem, Model 4BF, Germany).

Chemical analyses

Moisture content (hot air oven method), fat (soxhlet extraction method) and crude fiber determined as described by Pearson method (Pearson, 1990). The AOAC, 1990 Methods, 14.085 and 14.086, were used for the determination of ash and crude protein contents respectively. The digestible carbohydrates content was determined by simple difference and calorie value was estimated by multiplying the proportions of protein, fat and digestible carbohydrates by their respective physiological fuel values of 4, 9 and 4 kcal/g respectively and taking the sums of the products.

Organoleptic evaluation of biscuits produced from cashew kernel and soft - wheat flour

A trained fifteen member panel was used for the sensory evaluation. The panel was made up of staff of Cocoa Research Institute of Nigeria, Baden. The panelists were provided with clean tap water to rinse their mouth after tasting each of the five biscuits. The sixth biscuit was the reference NASCO digestive biscuit labeled DB (not disclosed to the panelists). Biscuits were evaluated using a 9-point hedonic scale (1- dislike extremely to 9-like extremely).

Statistical analysis

All data generated were subjected to analysis of variance (Ihekonronye, 1985). Significance was accepted at $p < 0.05$ level and means were separated using Duncan's Multiple Range Test.

RESULTS

The mean chemical compositions of soft wheat flour as evidenced in this study, cashew kernel, and cashew kernel meal after oil extraction are shown in Table 1. The percentage protein content of the kernel meal was 39.9%, kernel 18.6% and the SWF had the lowest protein content of 12.1%. The cashew kernel had a higher fat content than both the soft wheat flour and the meal produced from cashew kernels (cashew kernel, 46.30; cashew kernel meal 4.10 and; SWF 2.0.). The moisture contents obtained in SWF was higher than the ones observed in both the cashew kernel and the meal. The cashew kernel had a higher value in crude fiber (7.5%) than both the kernel meal and the soft wheat flour. Carbohydrates were highest in soft wheat flour when compared to the cashew kernel meal and cashew kernel. According to Table 2, the mean chemical composition of the biscuit made by adding cashew kernel meal varied according to the quantity of the CKM added. Apart from moisture content, carbohydrate and energy values, all

Table 2. Mean chemical composition of biscuits produced from SWF/C KM blends.

Biscuits	Components (%)						
SWF:CKM	Moisture	Protein	Fat	Ash	Crude fiber	Carbohydrate	EnergyKcal/100g
100:0 (A)	1.83^{a}	14.30^{e}	16.21^{e}	1.10^{d}	1.90^{d}	64.66^{a}	461.73
90:10 (B)	1.80^{a}	17.70^{d}	21.40^{d}	1.30^{d}	2.50^{c}	52.80^{b}	487.44
85:15 (C)	1.79^{b}	23.10^{c}	28.40^{c}	1.94^{c}	2.81^{c}	41.96^{c}	512.84
75:25 (D)	1.77^{b}	27.80^{b}	29.32^{b}	2.00^{b}	3.30^{b}	36.20^{d}	519.88
50:50 (E)	1.76^{b}	28.60^{a}	29.62^{a}	2.54^{a}	4.00^{a}	33.48^{e}	514.90

a, b, c, d, e: along the same vertical columns with different superscripts are significantly different at $p < 0.05$.

Table 3. Mean sensory scores for SWF/CKM blend biscuit.

	Biscuit samples					
Sensory attributes	(A) 100SWF:0CKM	(B) 90SWF:10CKM	(C) 85SWF:15CKM	(D) 75SWF:25CKM	(E) 50SWF:50CKM	Digestive Biscuit (DB)
Taste	6.77^{b}	7.54^{a}	5.54^{c}	5.62^{d}	3.62^{d}	7.4^{a}
Colour	7.85^{b}	8.00^{a}	6.46^{d}	5.69^{e}	4.23^{f}	8.2^{a}
Flavour	6.62^{b}	6.85^{b}	6.00^{c}	6.08^{c}	4.35^{d}	8.0^{a}
Crispness	6.31^{a}	6.31^{a}	6.00^{b}	6.00^{b}	4.77^{c}	6.24^{a}
Texture	5.81^{a}	5.62^{a}	5.37^{b}	4.77^{c}	3.55^{d}	5.6^{a}
General acceptability	6.29^{b}	7.50^{a}	5.53^{d}	5.26^{e}	3.68^{f}	7.7^{a}

a, b, c, d, e and f: means along same rows with same superscripts are not significantly different at $p < 0.05$.

other chemical components like protein, fat, ash and crude fiber increased with increase in CKM in the blends.

Sensory evaluation

The results obtained in Table 3 show high sensory ratings for all the selected attributes evaluated except sample E that scored the lowest. Comparing the biscuits A, B-C, D to the reference sample DB, it was observed that at 5% significance level, there were no significant differences in attributes of taste, flavour and colour while samples A and B were not significantly different in crispness and texture from DB. Generally, sample E was lowest in all the evaluated attributes. In terms of general acceptability, DB was the most preferred and the overall trend was found to be DB > B > A > C > D > E. Further more, samples B- SWF/CKM 90:10 was considered to be closest to the reference DB currently available in the market. The panelists also had their reservations for sweetness which could be improved, although lowering of sugar content could also minimize hardness or undesirable texture of the biscuits.

DISCUSSIONS

According to the proximate composition shown in Table 1, the protein value for the defatted cashew kernel meal was higher (about 39.9%) than that of SWF (12.1%). The result obtained for the CKM protein did not agree with that reported by (Ekpeyong et al., 1997) which was 45% crude protein. However, the percentage protein recorded was favourably comparable to the one reported by (Singh, 1990). The fat content as shown was 4.1% for the CKM, which was in agreement with the work of (Madamba, 1991).

The moisture content of SWF was higher than the one for CKM while the percentage ash content of the latter compared favourably well with the value quoted by (Pearson, 1990) who stated that ash contents of nuts and its meals should be less than 3% in conformity with the results obtained in Table 1 for cashew kernels and its meals respectively. The protein content of CKM complemented the lower protein for SWF. Since SWF : CKM blend is a good source of gluten-forming protein, fat was used as shortening agent. This shortening agent imparted desirable flavor characteristics to the end products.

Chemical composition of biscuit produced from SWF/CKM blends

The chemical analysis of the five biscuit samples shown in Table 2 indicated that all the biscuits contained desirable proportions of protein, fat, ash and digestible carbohydrates. The control biscuit, sample A, has the

lowest fat content of 16.2%. This was probably due to non-inclusion of CKM in the blend which is richer in both protein and fat than SWF. All the biscuit samples produced had an increasing value for fat as the amount of CKM in the blend increased. This result was in conformity with the report of (Latham, 1997). According to Table 2, the greater the percentage inclusion of CKM in the blend the higher the percentage of ash. This is an indication that with increase in CKM, there is possibility of increase in macronutrients. Crude fibers of blends also followed an increasing order in magnitude with increase in CKM in the mix. This has a health implication because diets low in fiber content with a low consumption of fruits and vegetables and a high consumption of red meat and milk products result in high incidence of colon cancer and other neoplastic conditions. The fiber content of SWF/CKM 100/0 and 90/10 fell within recommended limits of 0 and 2.66% (Latham, 1997). This is a desirable value because high fiber contents may inhibit iron absorption and reduce the digestibility of protein in foods. (Latham, 1997). The type of biscuits produced is called Digestive biscuit since it involved the use of soft wheat flour. The moisture content for all the biscuit samples according to Table 2 fell between 1.09 - 2.54%, which was desirable in combating mould growth.

Conclusion

The inclusion of CKM in the making of biscuit increased the protein content of the biscuits as the CKM increased but the consumer's acceptance increased up to 10% inclusion and subsequently decreased.

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