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Full Length Research Paper

Protein quality and sensory evaluation of moin-moin prepared from cowpea/maize flour blends

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The proximate composition, acceptability and nutritional evaluation of moin-moin prepared from cowpea/maize flour blends in the ratio 100:0 (sample A, control), 80:15 (sample B); 75:25 (sample C), 65:35 (sample D), 50:50 (sample E), 40:60 (sample F) and 30:70 (sample G), respectively were investigated. Protein quality was evaluated by feeding 28 days-old weaning albino rats with 10% protein diets formulated with sample A to G, with casein as control diet. The crude protein, fat and moisture content of sample A were 21.89, 15.25, 44.12, 15.40, 9.85 and 36.10% but decreased to 15.40, 9.85 and 36.10%, respectively as the level of maize flour in the blend increased to 70%. Up to 35% of maize flour substitution in the blend produced acceptable moin-moin with sensory properties similar to the traditionally prepared moin-moin. There was no significant (P>0.05) difference for protein efficiency ratio, net protein ratio, apparent and true digestibility of moin-moin at 70% level of maize substitution when fed to rats suggesting an improvement in protein quality of moin-moin prepared from cowpea/maize (30:70 W/w) flour blend but the moin-moin was unacceptable.

Key words: Moin-moin, cowpea/maize, flour, protein quality, sensory evaluation.

INTRODUCTION

Protein malnutrition coupled with calorie deficiency is widespread in many developing countries. The legumes including pulses and beans are important dietary foodstuff. Unfortunately, the legumes are deficient in certain amino acids particularly the sulphur containing amino acids. This makes them individually inferior compared to proteins of animal origin. The protein quality of legumes can be improved by complementing with that of cereals. Protein quality of a diet is a measure of its ability to promote growth in animal. Akpapunam (1985) prepared moin-moin from blends of cowpea/maize flour. Ngoddy et al. (1986) prepared akara and moin-moin from cowpea flour alone. Achinewhu (1987) reported that the nutritive value of food protein does not depend only on the quantity of the protein but also in the quality of the protein. Moin–moin is a gel produced by heating slurries containing cowpea solids of 15% and above. Cowpea paste is obtained by wet milling of the dehaulled bean or by mixing cowpea flour with water and small amounts of vegetable oil and other ingredients to form a homogeneous slurry or paste. On heating the slurry in punches made from leaves or aluminum foil cooked in boiling water or steam; it solidify into an irreversible gel between 73 to 87°C (Okechukwu et al., 1992).

Cereal such as maize is known to be deficient in the essential amino acids such as lysine and tryptophane. Maize diet can provide sufficient calories, but cannot provide adequate source of protein for infants. Baptist (1956) reported that a combination of cereal and legumes gave a product of a higher protein value than either alone. Attempts have been made to process cowpea and maize into local Nigerian foods in which nutrients are more readily available and optimally utilized. The formulation of a popular local dish called “Egbo” (Yoruba) using maize and cowpea was reported by Ochema and Alashi (2007). Presently, the Nigerian consumers are not familiar with moin-moin produced from blends of

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cowpea/maize. The beneficial effects of adding cereal ingredients to a legume based food such as moin-moin cannot be at the expense of sensory quality if the product is to be acceptable by the consumers. This study therefore was aimed at addressing the issue of improvement of the nutritional quality of moin-moin by using cowpea/maize flour blends to develop product that will be nutritious and acceptable to the Nigerian consumers.

MATERIALS AND METHODS

'Blackeye' variety of cowpea (*Vigna unguiculata* L. Walp) white maize (*Zea mays*), vegetable oil and other ingredients used in this work were purchased from a local market in Port – Harcourt Nigeria. All reagents used were of analytical grades (BDH chemicals U.K). Weaning male albino rats, vitamin and mineral premixes were obtained from the University of Port- Harcourt Nigeria.

Preparation of flour samples

The procedure described by Odum et al. (1981) was used for the preparation of cowpea/maize flour. Whole-seed samples (1kg each) of cowpea and maize were separately soaked at room temperature (28±1°C) in tap water at a bean or grain ratio of 1:5 for 12 h. Pre-soaked cowpeas manually dehaulled and maize grains were separately autoclaved at 121°C for 15 min, oven-dried at 60°C for 24 h in a hot air fan oven (model QUB 3050/OG. Gallenkamp, U.K), ground using a laboratory mill (Numex pep grinding mill, India) and screened through a 0.25 mm British standard sieve (model BS 410, Endecotts, Limited, U.K) to obtain flour samples.

Preparation of moin-moin

The preparation of moin-moin involves the replacement of a part of the cowpea flour (CF) with 0% (blend A, control), 15% (blend B), 25% (blend C), 35% (blend D), 50% (blend E), 60% (blend F) and 70% (blend G) maize flour (MF) by gradually mixing MF and CF in a mixing bowl using a wooden spatula. A modified recipe (Table 1) of Ngoddy et al. (1986) and the procedures outlined by Akpapunam (1985) were used for moin-moin preparation. 300 g of the blended cowpea/maize flour and the control (A to G) were each mixed with all other ingredients as shown in Table 1. 900 ml of warm water (70°C) was then added in a mixing bowl using a wooden handle to form a smooth paste. The paste was allowed to stand for 3 min and mixed thoroughly. Then 300 ml of the paste was each dispensed into aluminum foil packaged and steamed for 1 h. The product was cooled and evaluated organoleptically. The moin-moin wraps were divided into four lots and oven dried at 50°C, for 24 h, ground and stored at 0°C in a freezer until one lot was used for proximate analysis, while the other three lots was used for rat bioassay. Proximate analyses of moin-moin involving percentages of crude protein (N x 6.25), moisture, ether extract, total ash and crude fiber contents of the moin-moin were determined by AOAC (1995) standard methods as 2.057, 14.0047, 7.062, 14.006 and 7.070, respectively. Carbohydrate was calculated by difference and energy value was calculated using the Atwater energy factors.

Sensory evaluation

A thirty-member panel consisting of staff and students of the Rivers State University of Science and Technology Port Harcourt, Nigeria was selected based on experience and familiarity with moin-moin for sensory evaluation. At each session, two wraps of moin-moin samples per flour blend of similar size were served plain on white saucers coded with 3 digit numbers; fresh water was provided to rinse the mouth between evaluations. Moin-moin prepared from the cowpea/maize flour blends were compared to those from traditional (100% cowpea flour) and evaluated for surface colour, sogginess, structure, texture, flavor and overall acceptability. Each attribute was rated on a 9-point hedonic scale of 1 to 9 using the sensory scale described by Ngoddy et al. (1986). The sensory scores were subjected to statistical analysis using the analysis of variance (ANOVA).

Table 1. Ingredients for moin-moin preparation.

Ingredient	Amounts
Cowpea/maize flour blend	300(g)
Tatashe pepper (ground)	60(g)
Onions	60(g)
Salt	40 g
Hot water (70°C)	900ml
Magi cube	10 g
Vegetable oil	140 ml

Table 2. Composition of basal diet.

Ingredient	Amount (%)
Protein	10
Corn oil	8
Salt mixture	2
Vitamin mixture	1
Cellulose	1
Cassava starch	To make up 100

Source: Achinewhu and Isiechei (1990). 1. Salt mixture (composition 100 g) calcium (0.69); chloride (0.5 g) copper (1.0 mg); iodine (0.2 mg) phosphorus (0.5 g); Potassium (0.5 g) sodium (0.5 g); zinc (1.8 mg).2. Vitamins mixture (composite 100 g) vitamin A (700: iu); vitamin D (30 iu) vitamin E (6 iu); vitamin K (0.29 mg).

Protein quality evaluation

Protein quality of moin-moin prepared from cowpea/maize flour blends as well as the control was evaluated using a rat bioassay. A based diet was prepared based on the formulation of Achinewhu and Isichei (1990). The composition is shown in Table 2. Moin-moin was oven-dried at 70°C for 24 h in a hot-air fan oven and milled to pass through a 0.25 mm sieve. Flours obtained were defatted by solvent extraction in a soxhlet apparatus (Tecator Inc. Colorado, U.S.A.) for 8 h using n-hexane. Seven experimental diets were prepared by incorporating the defatted flours from moin-moin samples (A to G) into the basal diet at the expense of cassava starch such that provided 10% crude protein in the final diets. Seventy-two (72) weaning male albino rats, 28 days old weighing between 34 and 36 g were grouped by a randomized block statistical design into nine groups of rats so that the average weight of the group differed by not more than ±0.5 g. Each group of eight rats were fed with nitrogen-free diet, which consisted entirely on the

Table 3. Proximate composition of moin-moin from cowpea/ maize flour blends.

Sample	Moisture %	Crude protein %	Ether extract %	Crude fibre %	Ash %	Carbohydrate by difference	Energy value K cal.
A	44.12^{b}	21.89^{a}	15.25^{a}	1.48^{c}	1.39^{c}	15.87^{c}	292.1^{d}
B	40.23^{b}	20.25^{a}	14.75^{a}	1.38^{d}	1.70^{b}	21.39^{d}	304.7^{a}
C	38.50^{c}	19.25^{b}	13.55^{b}	1.40^{d}	1.80^{b}	25.50^{c}	305.5^{a}
D	37.90^{c}	18.34^{c}	12.34^{c}	1.44^{e}	1.85^{a}	28.13^{b}	301.5^{b}
E	37.05^{c}	17.47^{d}	11.25^{d}	1.50^{c}	1.87^{a}	30.86^{a}	299.4^{b}
F	36.80^{d}	16.50^{d}	10.60^{d}	1.65^{b}	1.90^{a}	32.55^{a}	296.5^{a}
G	36.10^{d}	15.40^{e}	9.98^{e}	1.85^{a}	1.95^{a}	34.72^{a}	295.5^{c}

Samples were prepared from cowpea/maize flour blends as follows A= 100:0; B= 85:15; C=75:25; D= 65: 35; E=50; 50; F= 40:60, G = 30: 70. ^{abc} means with the same superscript within the same row do not differ (p≤0.05).

Table 4. Mean sensory scores of moin-moin prepared form cowpea/maize flour blends.

Organoleptic attributes	A	B	C	D	E	F	G
Surface colour	8.4^{a}	8.2^{a}	8.0^{a}	7.9^{a}	6.8^{c}	6.0^{c}	4.0^{d}
Sogginess	8.3^{a}	8.1^{a}	8.0^{a}	7.5^{b}	7.0^{b}	6.5^{c}	4.2^{d}
Structure	8.4^{a}	8.2^{a}	7.6^{b}	7.2^{b}	6.8^{c}	6.3^{c}	5.4^{d}
Texture	8.5^{a}	8.3^{a}	8.0^{a}	7.8^{b}	7.0^{c}	6.5^{c}	4.5^{d}
Flavour	8.4^{a}	8.1^{a}	8.0^{a}	7.8^{b}	7.5^{c}	7.0^{c}	4.3^{d}
Overall acceptability	8.6^{a}	8.4^{a}	7.9^{b}	7.5^{b}	6.8^{c}	6.1^{c}	5.6^{d}

^{Abc} means with the same superscript within the same row do not differ DMRT (P≤0.05).

basal diet; another group was fed on casein diet (H) while the remaining seven (7) groups of rats were fed on the experimental diet of moin-moin (A to G). The rats were given the diet with drinking water *al*- labium for 28 days; throughout the duration of the experiment for the protein efficiency ratio study. The digestibility study was started on the 14th day of the PER study and lasted for 7 days, while the net protein ratio (NPR) determination was done on the 10th day of the PER study. Daily records on weight gained, food and protein intakes and feacal output by the rats were kept and used in calculating the PER, NPR and apparent and true digestibilities using standard procedure (Pellet and Young 1980).

Statistical analyses

All experiments and analyses were carried out in triplicates and the mean calculated. Data were subjected to analysis of variance (ANOVA) using a general linear model Wahua (1999). Duncan multiple range test was used to separate means where significant differences existed (Wahua, 1999; Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of moin-moin prepared from the cowpea/maize flour blends are shown in Table 3. Moin-moin prepared from 100% cowpea flour (sample A, control) had a crude protein content of 21.89%. The crude protein decreased to 15.40% as the level of maize substitution increases from 0 to 70% whereas the carbohydrate content increases from 15.87 to 34.72% as the level of maize substitution increases from 0 to 70%. There was no significant (P>0.05) difference in fat, ash and fibre contents. These compositional values of the blends were typical for cowpea/maize flour blends and they are in line with the finding of Akpapunam (1985), Akubor and Onimawo (2003) and Banigo and Akpapunam (1987). Table 4 shows the sensory characteristics of moin-moin prepared from cowpea/ maize flour blends. There was no significant (p<0.05) difference in texture, sogginess, flavor, surface appearance and overall acceptability of moin-moin prepared form 100% cowpea flour and the blends containing up to 35% maize flour. However there was a significant (p < 0.05) decrease in the above sensory attributes when the maize flour in the blend was increased beyond 35%.

This was in agreement with the findings of Akpapunam (1985). Protein quality of a diet is usually a measure of its ability to promote growth in an animal. The result of this study (Figure 1) showed PER which is a measure of weight gained over the diet consumed by rats fed with moin-moin diet (A to D) containing 0 to 35% maize flour were similar but lower than those of rats fed diets (E to G) containing 50 to 70% maize flour, indicating that the use of high levels of maize in the formulation; increases PER in rats; this was in agreement with the findings of Giami et al. (2003). Table 5 shows that moin-moin prepared from cowpea/maize flour blend (diet G) 70% maize flour substitution, resulted in similar values for protein

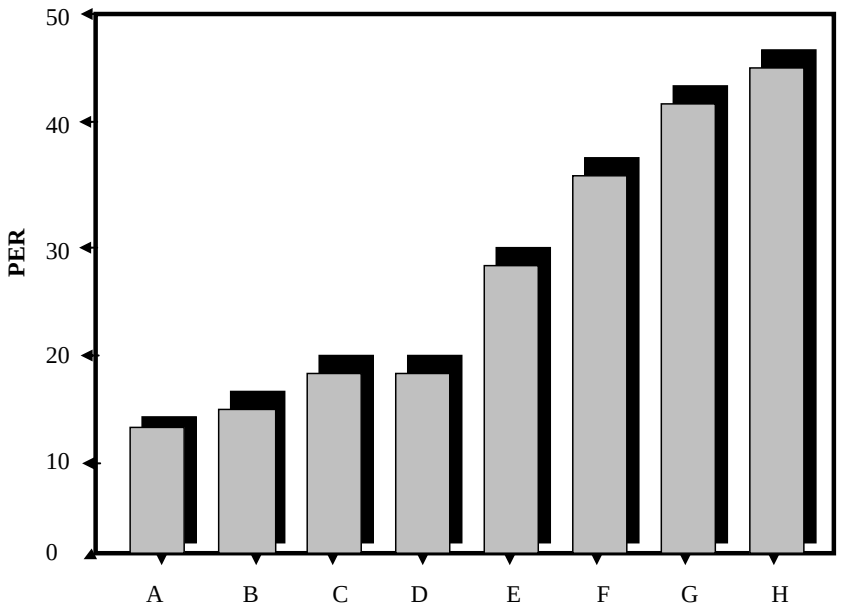

Figure 1. Experimental rat feed. Bar Chart of PER of experimental rats feed with test diet containing moin-moin prepared from cowpea/maize flour blends compared to casein cowpea: Maize flour. A = 100:0, B = 85:15, C = 75:25, D= 65:35, E = 50:50, F = 40:6 G= 30:70, H= CASEIN

Table 5. Nutritional parameters of test diets containing moin-moin prepared from cowpea/maize flour blends compared to casein.

Nutritional parameter	A	B	C	D	E	F	G	H
Food intake (g)	25.50^{d}	27.14^{d}	31.62^{d}	41.40^{c}	41.70^{c}	56.32^{b}	58.22^{b}	66.75^{a}
Protein intake (g)	6.61^{E}	6.72^{C}	7.03^{d}	8.41^{b}	8.61^{a}	9.59^{a}	9.89^{a}	10.12^{a}
Body weight gain (g)	9.25^{C}	9.42^{e}	10.83^{d}	18.60^{c}	18.60^{c}	21.40^{c}	29.67^{b}	33.70^{a}
Protein efficiency ratio (PER)	1.40^{c}	1.40^{d}	1.54^{d}	2.16^{c}	2.16^{c}	2.23^{c}	3.00^{b}	3.33^{a}
Net protein ratio	1.00^{d}	1.20^{e}	1.24^{c}	2.24^{b}	2.45^{b}	2.45^{b}	4.00^{a}	4.50^{a}
Apparent digestibility (%)	50.11^{c}	51.78^{c}	53.66^{c}	64.01^{b}	66.42^{b}	68.31^{b}	85.40^{a}	87.02^{a}
True digestibility	59.40^{c}	62.32^{c}	64.81^{c}	71.66^{b}	74.90^{b}	77.44^{b}	91.00^{a}	92.68^{a}

Prepared from cowpea flour maize flour blends was follows: =100:0; B = 85:15; C = 75:25; D = 65:35; E = 50:50; F = 40:60; G=30:70; H=casein. Only means followed by different superscript on the same row differ.

efficiency ratio, net protein utilization, apparent and true digestibility as those of the casein diet (H), indicating that the protein quality of moin-moin improved significantly ($P<0.05$) by replacing up to 70% cowpea flour with maize flour. But loss of acceptability of the moin-moin by consumers occurred when the maize flour substitution in the blend was increased beyond 35%. Again these findings were in agreement with the report of Akpapunam (1985) and Giami et al. (2003).

Conclusion

This study has shown that increasing the percentage of maize flour in cowpea/maize blends for moin-moin preparation improved the nutritional value of moin-moin, but loss of acceptability occurred when maize flour in the blends increased beyond 35%.

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