AFTER REVIEW

Proximate composition of cowpea / fermented African oil bean seed flour blends and sensory properties of steamed paste (moimoi) prepared from the blends.

ABSTRACT

This research work studied the use of cowpea flour and fermented African oil bean seed flour for the production of moimoi and assessment of the proximate properties of the flour blends and the sensory properties of the steamed paste (moimoi). A completely randomized design (CRD) was used in the design of experiment. A total of 7 samples of the composite flour and one control (100 % cowpea flour) were obtained and used for the production of the steamed paste (moimoi). The blends as well as the control sample were analyzed for the proximate properties of the flours and sensory attributes of the steamed paste (moimoi). Result of the proximate analysis showed that the samples differed significantly ($p < 0.05$) and had values that ranged between 17.46-36.31%, 5.63 -7.83%, 2.83-16.58%, 2.81-4.99%, 2.88-6.95% and 27.35-67.75% for protein, moisture, fat, ash, crude fibre and carbohydrate respectively. Sensory evaluation carried out on the moi-moi samples showed that the moimoi samples differed significantly ($p<0.05$) in terms of colour, taste, texture, aroma, mouthfeel and overall acceptability. It was observed from the study that moimoi produced from blends of 95:5 (cowpea: ugba) and 90:10 (cowpea: ugba) had the best acceptability rating as well as the control sample (100:0).This implies that moimoi with good acceptability can be produced from blends of 95:5 and 90:10. The study shows that the incorporation of fermented African oil bean flour into cowpea will effect better nutrition to meet the demand for nutrient balance among the populace.

1. INTRODUCTION

Moi-moi (cowpea pudding) is a pudding produced by heating slurry made from dehulled, wet-milled cowpea (*Vigna unguiculata* walp) with added ingredients such as vegetable oil, spices e.t.c. which further solidifies on cooling [1]. It is a typical Nigerian food also pronounced as *moin-moin, mai-mai, moy-moy*, e.t.c., and can be eaten as snacks or as a full time meal. Moi-moi can also be prepared from dehulled ground cowpea flour. [2] prepared akara and moin-moin from cowpea flour alone. [3] prepared moi-moi from blends of cowpea and maize flour. However, there was decrease in acceptability of the moi- moi by consumers when the maize flour substitution in the blends was increased beyond 35%.

Cowpea is a leguminous plant belonging to the *Fabaceae/Papilionaceae* family [4]. Cowpea originated from Africa and is now widely grown in Africa, Latin America, and Southeast Asia and in the Southern United States [5]. Cowpea provides food for millions of people mainly in developing countries with an annual worldwide production of about 4.5 million metric tons [6]. Nigeria is a major producer of cowpea. Beans as cowpea is popularly called by Nigerians remains the greatest supplier of protein which play a significant role in our diet as a major protein source in the absence of sufficient animal protein for the populace [7].

Nutritionally, cowpea grain is more or less the same as other pulses, with a relatively low-fat content and high total protein concentration. Cowpea is considered as a nutrient dense food with low energy density. An average cowpea grain contains 23–32% protein,50–60% carbohydrate and about 1% fat on dry basis [8]. The total protein content of cowpea is approximately two to four times higher than cereal and tuber crops [9]. Moreover, compared with cereal grains, cowpea protein is a rich source of the amino acid lysine and is used as a natural complimentary food with cereals. However, it is deficient in methionine and cysteine compared to animal proteins [10]. Cowpea is considered as an incredible source of many other health-promoting components, such as soluble and insoluble dietary fiber, phenolic compounds, minerals, and many other functional compounds, including B group vitamins [11]. According to [12], Cowpea also contain an appreciable quantity of micronutrients such as vitamin A, iron and calcium. The polyphenolic compounds found in cowpea interact with proteins and reduce their digestibility, as well as alter organoleptic and functional properties of the seed flour [13]. Polyphenolic compounds also have beneficial effects due to their antioxidant activity which is fundamental to life [14].

Major limiting factors of consumption of cowpea in day-to-day diet include poor digestibility, deficiency of sulphur containing amino acids such as methionine and presence of antinutritional factors such as trypsin inhibitors, oligosaccharides and phenolic compounds. Nevertheless, adequate processing methods can be used to destroy those antinutritional factors and improve their bioavailability levels especially when it is used as a food [15]. Production of cowpea flour with good functional and reconstitutional properties has the potential for a large market since it can be incorporated in many recipes.

Fermented African oil bean seed (*Pentaclethra macrophylla* Benth*)*, known as ugba in Igbo is a leguminous woody plant belonging to the family leguminosae and sub family mimosoideae with no varietal characterization. It is consumed by an estimated 15 million people in eastern Nigeria majority of who are 'Igbos' [16]. It is popularly known by several names such as 'Apara' in Yoruba, 'Ukana' in Efik and the most prominent 'Ugba'/ 'Ukpaka' in South Eastern Nigeria. Ugba is a popular Igbo condiment and delicacy made from traditional household solid state fermentation of African oil bean seed. The processing of these large brown glossy seed of African oil bean seed to obtain ugba is usually by natural fermentation, a process that involves microbiological and biochemical changes caused by hydrolysis and proteolysis. With successive processing steps during the fermentation, there is progressive softening of the cotyledons, reduced astringency and increased palatability and enhanced meaty flavour. The fermentation is a mixed culture alkaline process involving a variety of microorganisms [17]. The microbial enzymes from the fermenting organism aid in hydrolysis of the seed macromolecules [18].

The traditionally prepared Ugba consumed as snack or used as condiment in soup preparation and local porridge is produced by hydrothermal treatment of the seeds, dehulling the seeds to remove the hard coat, slicing the cotyledons, boiling and fermenting [19]. The fermentation of the raw seed is known to produce nutritionally better product than the raw seeds [20]. Well fermented seeds are added to soups and used as flavouring [21].

As an important nutritional item Ugba is very rich in protein (36.2-43.89%) with all essential amino acids; and essential fatty acid that make up 10% of the fatty acids in the oil [20].The oil bean seeds contain 4-17% carbohydrate, 44-47% oil which has been found to be rich in oleic acid and linoleic acid [22]. It is also reported that the oil bean seed contains about 75% saturated

fatty acid and 25% unsaturated fatty acid. The major unsaturated fatty acid in the seed is linoleic acid constituting 42.8%. Oleic acid is also present in appreciable amounts (29.0%). However the sulphur containing amino acid content is much lower than those found in other plant proteins [23].The high content of other essential amino acids makes the seeds a potential source of protein [24]. It also contains several nutrients and minerals such as potassium, calcium, magnesium, iron and other minerals in its raw form when it has not undergone any processing operation and these minerals are significantly reduced by some long and uncontrollable processing technique. It is also an excellent source of phytonutrients such as tannins, alkaloids, flavonoids, glycosides and saponin. These components are crucial to the nutritional health of human beings and these seeds contain and provide a lot of these needs. 'Ugba' can also serve as a protein substitute for low income earners and can reduce the protein-calorie malnutrition and essential fatty acid deficiencies [25]. The fermentation of the African oil bean seed effects better nutrient availability and digestibility with significant softening of the cotyledons [26].

To ascertain other potential food uses of cowpea and fermented African oil bean seed and expand their uses, they can be prepared into flour and explored in food fortification and confectionaries. it is also important to know the physico-functional properties of these flours for subsequent use in food formulations such as production of moi-moi. The present research aims to explore the proximate properties of cowpea and African oil bean seed flour blends for steamed paste production.

INTRODUCTION IS GOOD, STRONG/DEEP EXPLANATION, AND REFERENCE

2. MATERIALS AND METHODS

2.1 Materials and Sample Collection

Fermented African oil bean seed (*Pentaclethramacrophylla*Benth) was bought from a local producer in Umuahia, Ohekelem Community of Ngor-Okpala L.G.A, Imo State, cowpea and other ingredients were purchased from Eke Awka Market, Anambra State, Nigeria.

2.2 **Preparation of Fermented African Oil Bean Seed Flour (ugba flour)**

Five hundred grams of the fermented African oil bean seed (Ugba) was weighed using top loader weighing balance. The weighed sample was sent to the already preheated hot air oven (model 10-D1390) set at 60^0C for a duration of 6 hours. The dried sample was cooled and ground using a hammer mill and stored in an air tight container prior to subsequent analysis.

2.3 **Preparation of Cowpea Flour**

The cowpea flour was prepared using the method described by [27] with slight modification. The cowpea seeds was carefully cleaned, sorted to remove defective ones from the lot and weighed (1 kg). The cleaned seeds were then soaked in water for 30 minutes to soften the hulls and ease removal for the production of dehulled cowpea flour. The hulls were lossened by repeated rubbing between the palms and the hulls removed by floatation in water leaving behind dehulled seeds. The seeds were drained and dried at 60^0C for 6 hours using hot air oven (model 10-D1390). The dried seeds were cooled, milled using a hammer mill and sieved to obtain fine flour using a 70mm mesh screen. The resulting flour was stored at room temperature (28-30^0C) in polyvinyl chloride bags prior to use and analysis.

2.4 **Research Design**

The research design is Completely Randomized design (CRD). Two different flours (cowpea and fermented African oil bean flours) were mixed at different proportions to give 100g composite.

Table 1: Formulation of cowpea/fermented African oil bean seed flour blends for steamed paste production.

Sample Code	Cowpea Flour (%)	Ugba Flour (%)
CSC	100	-
CUP	95	5
MAT	90	10
ZLA	85	15
IMO	80	20
DPP	75	25
MPH	70	30

FAG	60	40

2.5 Preparation of steamed paste (Moi- Moi)

The steamed paste (moi-moi) was prepared from blends of cowpea and ugba flour using the method of [28]. Cowpea flour was partially replaced with a certain percentage of the ugba flour according to the design of experiment a shown in Table 1. The flour blends were mixed in a bowl using a wooden spatula with the addition of other ingredients such as pepper, onions, tomato, tatashe, salt, magi cube, vegetable oil and warm water at 70^0C until a smooth paste was formed. The paste was dispensed into aluminium foil, packaged and steamed for 1 h. The moi-moi samples were cooled and evaluated for sensory properties.

2.6 Proximate Analysis

The crude protein content, crude fibre content, moisture content, fat content and Ash content of the flours were determined in duplicate using established analytical procedures of [29]. The carbohydrate content was estimated by difference from 100% after accounting for moisture, protein, fibre, ash, and fat.

2.7 Sensory Evaluation of the steamed paste (Moi- Moi)

The method described by [2] was used for sensory evaluation of the moi-moi samples. This involves a panel of twenty members consisting of students and lecturers in the Department of Food Science and Technology, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria who are familiar and regular consumers of cowpea based moi-moi. Moi-moiproduced from each flour blend, along with the control sample was presented in coded form in white disposable plates and presented randomly to the panellists at the department laboratory. The assessors were also provided with portable water for rinsing the mouth between evaluations. The laboratory wherein the evaluation was carried out was brightly illuminated with white fluorescent bulb. The quality attributes (colour, taste, texture, flavour, mouth feel and overall acceptability) of the moi-moi were evaluated and rated by the panelists on a 9-point hedonic scale of 1 to 9 with 1 as disliked extremely while 9 as liked extremely.

2.8 Statistical Analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 23. Analysis of variance (ANOVA) was done to detect significant differences ($p<0.05$) among the sample means. This was followed by the application of Duncan Multiple Range Test (DMRT) for the separation of the significant means.

3. RESULTS AND DISCUSSION

3.1Proximate Composition of African Oil Bean and Cowpea Flour Blends

The proximate composition of the flour samples was displayed in Table 2, from the results it was shown that the proximate composition of the flour blends varied with response to the variation in the blends.

The protein content of the samples ranged between 17.46 and 36.31% with sample 60:40 (cowpea:ugba) having the highest value (36.31%) and the control sample (100% cowpea) having the least value (17.46%). The analysis of variance shows that there is a Significant difference ($p<0.05$) between the samples with increasing ugba in the flour blends or pre-mix. This is expected as fermented African oil bean seed has more protein than cowpea. The value obtained for the control sample (100% cowpea) is lower than 25.6% reported by [30] for decorticated cowpea grain but comparable with 20.8-21.8% reported by [31].This can be due to many factors which may include the processing methods used during sample preparation and the variety of cowpea used during the study. The high protein content of the samples could be attributed to the fact that water has been removed from the sample thus making it concentrated.

The increase in the protein content of the samples could also be attributed to the incorporation of fermented African oil bean seed flour to the blend, as *ugba* (African oil bean seed) has been reported to be rich in protein [32]. It was observed that *ugba* played a positive role in increasing the protein content of the flour blends because as the quantity of the fermented African oil bean seed flour increases the protein content also increases. The increase in protein content of the flour blend for moi- moi production makes it an important and cheap source of protein to people whose staple foods are deficient in protein.

The moisture content of the samples ranged between 5.63 and 7.83% with sample CSC (100% cowpea flour) having the least value (5.63%) and sample 60:40 (cowpea: ugba) having the highest value (7.83%). This is slightly higher than the values (2.97-3.66%) reported by [33] for three varieties of dehulled cowpea flour but lower than 9.19-9.99 reported by [34] for three varieties of cowpea flour. The analysis of variance shows that the moisture content of the samples differed significantly ($p<0.05$). It was observed that increase in the substitution of the cowpea flour with fermented African oil bean seed flour resulted in increase in moisture content. This is an indication that fermented African oil bean seed flour has more moisture than the cowpea flour, thus the blending result in higher moisture with increasing quantity of the fermented African oil bean seed flour in the blend.

Moisture content in a food sample gives an indication of its total solid content and water activity and is used as a measure of storage stability and susceptibility to microbial contamination [35]. The low moisture content of the flour blends is an indication that they will keep well if stored under good conditions as it will discourage the absorption of moisture which encourages the growth of spoilage microorganisms prior to use for the production of Moi Moi.

The fat content of the samples ranged between 2.83-16.58% with the control sample (100:0; cowpea: ugba) having the least value (2.83%) and sample (60:40; cowpea: ugba) having the highest value (16.58%). The analysis of variance shows that the fat content of the samples differed significantly ($p<0.05$) as shown in Table 2. The value obtained is higher than 1.6% reported by [31] for decorticated cowpea grains.. It was observed from the study that as the proportion of the fermented African oil bean seed increases, the fat content of the blend increases. The increase in percent fat of the samples could be attributed to the high fat content of African oil bean seed as the later has more fat than cowpea. This substantiated the report by [20] on African oil bean.

Furthermore the analysis of variance showed that the ash content of the samples differed significantly ($p<0.05$). The values ranged between 2.81 and 4.99% with the control sample (100:0; cowpea: ugba) having the least value (2.81%) and sample (60:40; cowpea: ugba) having the highest value 4.99%). The value obtained for the control sample 100% cowpea (2.18%) is

comparable with 2.0% reported by [31] but lower than 3.75% reported by [30] for decorticated cowpea.

Ash is the inorganic residue left after removing water and inorganic matter by burning the food sample [36]. It gives an indication of the mineral matter in food. It was observed that the addition of the fermented African oil bean flour to the blend played a positive role in improving the ash content. This increase in ash content is expected to also improve the nutrient content of the steamed paste (moimoi).

The crude fibre content of the samples ranged between 2.88 and 6.95% with the control sample 100:0 (100% cowpea) having the least value (2.88%) and sample (60:40: cowpea: ugba) having the highest value (6.95%). The analysis of variance showed that the fibre content of the samples differed significantly ($p<0.05$) from one another as shown in Table 2. In addition the crude fibre content of the flour blend increased with increase in the quantity of fermented African oil been flour in the blend. Crude fibre is the indigestible matter left in food after successive digestion with ether, acids and alkalis and subtraction of ash. Since fibre aids in digestion, the result suggests that sample 60:40 (cowpea: ugba) would be more easily digestible compared to the control sample when used for moimoi production. This fiber also confers functionality to the moi-moi as it serves as free radical scavenger in human nutrition.

The carbohydrate content of the samples ranged between 27.35 and 67.75% and the analysis of variance showed that the samples differed significantly ($p<0.05$) from each other. The control sample (100:0; cowpea: ugba) had the highest value (67.75%) while sample 60:40 (cowpea: ugba) had the least value of (27.35%). This value is higher than 57.9% reported by [31] but lower than 78.9% reported by [30] for decorticated cowpea grains. The high carbohydrate content of the control sample indicates that it is a good source of carbohydrate and can supply most of the body's energy requirement.

Table 2: Proximate Composition of Cowpea and African Oil Bean Flour Blends

Sample	Description Cowpea: Ugba	Moisture	Protein	Fibre	Ash	Fat	Carbohydrate
CSC	100:0	6.25^{d} ±1.0	17.45^{h} ±1.0	2.88^{h} ± 1.0	2.81^{h} ± 1.0	2.83^{h} ±1.0	67.75^{a} ±1.0

CUP	95:5	6.44^{b}±1.0	19.05^{g}±1.0	3.24^{g} ±1.0	3.05^{g} ±1.0	4.13^{g} ±1.0	64.10^{b} ±1.0
MAT	90:10	6.35^{c}±1.0	21.47^{f}±1.0	3.96^{f} ± 1.0	3 22^{f} ±1.0	6.27^{f} ±1.0	58.74^{c} ±1.0
ZLA	85:15	6.14^{e}±1.0	24.47^{e}±1.0	4.55^{e} ± 1.0	3.48^{e} ±1.0	8.06^{e} ±1.0	53.42^{d} ±1.0
IMO	80:20	5.63^{h}±1.0	26.02^{d}±1.0	4.88^{d} ±1.0	3.81^{d} ±1.0	10.55^{d} ±1.0	49.12^{e} ±1.0
DPP	75:25	5.70^{g}±1.0	29.13^{e}±1.0	5.88^{c} ± 1.0	4.05^{c} ±1.0	11.87^{c} ±1.0	43.36^{f} ±1.0
MPH	70:30	5.76^{f} ±1.0	31.63^{b}±1.0	6.52^{b} ± 1.0	4.35^{b} ±1.0	12.65^{b} ±1.0	39.10^{g} ±1.0
FAG	60:40	7.83^{a}±1.0	36.31^{a}±1.0	6.95^{a} ± 1.0	4.99^{a} ±1.0	16.58^{a} ±1.0	27.35^{h} ±1.0

Values are mean scores ± standard deviation of triplicate determination. Data in the same column bearing different superscripts differ significantly ($p<0.05$).

3.2 **Sensory evaluation of steamed paste (moi-moi) prepared from blends of cowpea and fermented African oil bean Flour.**

The result of sensory evaluation carried out on the steamed paste (moimoi) samples are presented as mean ± standard deviation in Table 3. The sensory properties tested are colour, taste, texture, aroma, mouth feel and overall acceptability.

It was observed that an increase in the quantity of fermented African oil bean flour added to cowpea flour affected the rating of all the sensory parameters studied. Generally the control sample 100:0 (100% cowpea flour) did not significantly differ from samples 95:5 and 90:10 for all the parameters studied.

The colour rating of the samples range from 3.60 and 8.25 with control sample 100:0 (100% cowpea) having the highest value (8.25) and sample 60:40 (cowpea: ugba) having the least value (3.60). From the analysis of variance it was observed that there was no significant difference between samples 100:0 (100% cowpea), 95:5 (cowpea: ugba) and 90:10 (cowpea: ugba) but they differed significantly ($p<0.05$) from other samples. It was observed that increasing the quantity of the fermented African oil bean flour in the blends reduced the colour rating of the moimoi samples.

Furthermore, the preference for taste of the samples range between 4.30 and 8.15 with control sample100:0 having the highest value (8.15) and sample 60:40(cowpea: ugba) having the least value (4.30). The analysis of variance shows there was no significant difference between samples 100:0, 95:5 (cowpea: ugba) and 90:10(cowpea: ugba) but they differed significantly ($p<0.05$) from other samples. This suggests that increasing the quantity of fermented African oil bean flour substituted in the blend beyond 10% affected the taste perception of the moi-moi samples by the panelists.

The preference for texture of the samples differed significantly ($p<0.05$) with sample 95:5 (cowpea: ugba) having the highest value (8.00) and sample 75:25and 60:40having the least value of (4.60) respectively. From the analysis of variance it was observed that sample 95:5 (cowpea: ugba) differed significantly from other samples but there was no significant difference in texture between the other samples.

The aroma of the samples ranged from 4.35 – 7.65 with sample 90:10 (cowpea: ugba) having the highest value and sample 75: 25 having the least value (4.35). The analysis of variance showed that there was significant difference ($p<0.05$) between some samples. It was observed that there was no significant difference in aroma between the control sample 100:0, 95:5 and 90:10 but they differed significantly from other samples.

The mouthfeel of the moimoi samples is characteristic of both the texture and consistency of the product. The mouthfeel of the samples ranged between 4.95 and 7.75 with sample 80:20 having the least value (4.95) and sample 95:5 having the highest value (7.75). The analysis of variance showed there was no significant difference between the control sample 100:0, 95: 5 and 90:10 but their preference for mouthfeel differed significantly ($p<0.05$) from other samples.

The mean score for the overall acceptability of the samples ranged between 4.65 and 8.20 with samples 75:25 (cowpea: ugba) and 60:40 (cowpea: ugba) having the least value of (4.65) respectively and sample 95:5 having the highest value (8.20). This implies that moimoi with good acceptability can be produced from blends of 95% cowpea and 5% fermented African oil bean flours. The analysis of variance showed there was no significant difference between the control sample 100:0, 95:5 and 90:10 for overall acceptability but they differed significantly ($p<0.05$) from other samples.

Generally it was observed from the sensory evaluation that blends with not more than 10% substitution with fermented African oil bean flour was not significantly different ($p<0.05$) from the control sample. Hence, the limit for substitution with ugba is 10%. Substitution with 15-20% ugba gave moi-moi that is moderately liked.

Table 3. Sensory evaluation scores of moimoi samples prepared from blends of cowpea and fermented African oil bean flours.

Sample	Description Cowpea: Ugba(g)	Colour	Taste	Texture	Aroma	Mouthfeel	Overall accept
CSC	100:0	8.25^{a} ±0.06	7.25^{a} ±0.10	7.45^{b} ± 0.82	7.50^{a} ± 0.82	7.40^{a} ±0.46	8.10^{a} ±0.50
CUP	95:5	7.20^{a} ±0.06	8.15^{a} ±0.10	8.00^{a} ±1.0	7.50^{a} ±0.82	7.75^{a} ±0.46	8.20^{a} ±0.50
MAT	90:10	7.15^{a} ±0.06	7.55^{a}±0.10	7.35^{b} ± 0.30	7.65^{a} ±0.82	7.25^{a} ±0.46	7.80^{a} ±0.50
ZLA	85:15	5.90^{b} ±0.25	5.90^{b} ±0.12	6.20^{b} ±0.30	5.80^{b} ±0.06	5.60^{b} ±0.34	6.30^{b} ±0.27
IMO	80:20	5.25^{bc} ±0.23	5.70^{b} ±0.12	4.95^{b} ±0.30	5.90^{b} ±0.06	4.95^{b} ±0.34	6.00^{b} ±0.27
DPP	75:25	4.30^{cd} ±0.11	4.45^{b} ±0.12	4.60^{b} ± 0.30	4.35^{c} ±0.06	5.00^{b} ±0.34	4.64^{c} ±0.09
MPH	70:30	4.60^{cd} ±0.11	4.90^{b} ±0.12	5.0^{b} ± 0.30	5.40^{bc} ±0.06	5.15^{b} ±0.34	5.65^{c} ±0.27
FAG	60:40	3.60^{d} ± 0.95	4.30^{b} ± 0.12	4.60^{b} ±0.30	4.60^{bc} ± 0.06	4.95^{b} ±0.34	4.65^{c} ±0.09

Values are mean scores ± standard deviation of triplicate determination. Data in the same column bearing different superscripts differ significantly ($p<0.05$) from one another.

4. Conclusion

This research work studied the proximate properties of cowpea and fermented African oil bean seed flour blends and the sensory attributes of the steamed paste (moimoi). The blends had higher levels of protein, fat, ash and fibre compared to the control sample which consisted of 100% cowpea flour. This research has established that the incorporation of African oil bean seed

into cowpea for the production of moimoi influenced the proximate and sensory property of the moimoi positively. It may be concluded from the study that fermented African oil bean flour can be incorporated into cowpea flour for moimoi production up to 10% to yield moimoi with improved nutritional quality and acceptable sensory attributes. Hence, the development and utilization of such (moimoi) will improve the nutritional status of the populace. Furthermoremoimoi produced from blends of 95:5(cowpea: ugba) and 90:10 (cowpea: ugba) had the best acceptability rating as well as the control sample.

From the results obtained in this research, it is recommended that fermented African oil bean seed flour be incorporated in cowpea flour for the production of moimoi to boost its nutritional profile and effect better nutrition to meet the demand for nutrient balance among the populace. Moi moi produced from blends of African oil bean seed and cowpea flour could help reduce protein energy malnutrition prevalent in developing countries such as Nigeria.

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