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Robo from melon seeds and groundnut

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Abstract

Robo is a widely consumed Nigeria snack made from local food ingredients. Snacks are often subjectively classified as junk food, possibly because they naturally have little or no nutritional value, and unhealthy snacks consumption are associated with the risk of developing non-communicable diseases. The effects of producing Robo from melon and groundnut seeds at different ratios from 20 to 50% wereevaluated for proximate composition, physicochemical/functional and sensory attributes. The results showed an increase in crude protein (38.56_a - 42.8_d), crude fiber($15.01\pm0.014_d$), fat content (35.20_e) and ash content (18.02_e), but decreased in moisture content (2.43_a - 3.30_e). Hardness properties decrease from (240_a- 720_e). Robo from blends of melon and groundnut seeds have improved sensory attributes in terms of flavour, crispness, taste and overall acceptability, particularly at supplementation of 60% melon and 40% groundnut seeds. Thus, improved Robo will increase consumer's nutrients intake and prevent health problems associated with snack intake.

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Introduction

'Robo' is ready to eat snacks produced from the residue or cake obtained from the oil extraction of melon and groundnut. Melon (*Citrulluscolocynthis*) and Groundnut (*Arachis hypogea*) seeds are among the most commonly consumed oil plant seed foods (Makinde and Ibim, 2015). The numerous oil seeds include legumes such as soya seed, groundnut seed, grainssuch as corn, sunflower seed and nuts such as oil palm seed, coconuts which are technologicallygrown to produce oil for consumption. The filtrates were usually used as a protein source for animal feeds, excluding ting nuts and castor beans that are toxic but used as fertilizer (Wang *et al.*, 2018). Both melon and groundnut seeds are prepared and processed differently by cultural groups in Nigeria (Collons *et al.*, 1989).

Melon belongs to the family of Cucurbitaceae and originated from Africa, but it is available in other continents of the world (Ingale and Shrivastava, 2011). Melon is grown and cultivated all over Nigeria. Melon seed is called "Ogili" (Ibo), "Dende" (Fulani), "Egusi" (Yoruba), and "Iguana Agushi" (Hausa) (Ojieh *et al.,* 2008). Melon seeds nutrients include about 53% oil, 28.4% protein (60% in defatted flour), 2.7% fiber, 3.6% ash and 8.2% carbohydrate (Adeyeye *et al.,* 2020). Melon seeds can be used for culinary purposes; they have anti-inflammatory anti-diabetic properties due to *Citrulluscolocynthis* (Templeton *et al.,* 2005).

Groundnut crops originated from South America and are widely known globally because almost every part of the plant has commercial value (Ojieh *et al.,* 2008). The nutrients present in groundnut seed include 44-56% oil and 22-30% protein with minerals and vitamins (Savage and Keenan, 1994). Groundnut serves as functional food owning Coenzyme Q10 that protects the heart during the lack of oxygen (Anderson *et al.,* 2009). It has antioxidant minerals (selenium, copper and manganese) and antioxidant compounds such as resveratrol and flavonoids (Bellise, 2014; Anderson *et al.,* 2009). Hence, this study aimed to develop and evaluate the quality of Robo produced from blends of melon and groundnut seeds. Generally, after the preparation of Robo,

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it is usually stored in polyethene films or airtight containers to maintain the quality and prevent rancidity (Adeyeye *et al.,* 2020). Globally, snaking is a common practice among people. Bellisle (2014) indicates an increase of over 20% consumption of snacks among children and adolescents daily over 30 years. Likewise, a study revealed that 84% of United States young adults consume snacks at least once in two days (Wokoma and Aziagba, 2001).

However, snacking may result in excess energy intake and a low nutrient-dense diet (Otles and Ozgoz, 2014). Therefore, this study produced Robo using a blend of groundnut and melon seeds to address the challenges mentioned above. The two materials are nutrient-rich legumes containing some essential amino acids and protein in the right proportion that complement starchy or cereals foods.

Materials and methods

Materials

Shelled melon seeds (*Citrulluscolocynthis*) and groundnut seeds (*Arachus hypogea*) were procured from a local market in Ogbomoso, Oyo state. The oil used for frying was extracted from the melon and groundnut seeds. Robo preparation and experimental analyses were done at Ibrahim Owodunni Food Processing Laboratory of the Department of Food Science and Engineering, LadokeAkintola University of Technology, Ogbomoso, Oyo State, using the method of Ejohand Ketiku, 2013. All reagents used were of analytical grade.

Sample preparation

The shelled seeds (groundnut and melon) were sorted separately to remove extraneous materials. Sorted melon and groundnut seeds were roasted separately in an open dry pot until they became brown (10-15 minutes). The cooled roasted seeds with chilli pepper (*Capsicum annum*) were milled separately into a paste using a hammer mill without adding water shown in Figure 1. A pinch of salt was added into each of the pastes, and it was thoroughly kneaded until oil was coming out for almost one hour; it was then weighed in a ratio of 100:0 (control sample), 80:20, 70:30, 60:40 and 50:50 (melon and groundnut) (Table I), and then kneaded together, the cake was rolled into small round balls and fried in oil extracted. The 'Robo' samples were cooled down at room temperature and packaged in airtight nylons (Figure 2).

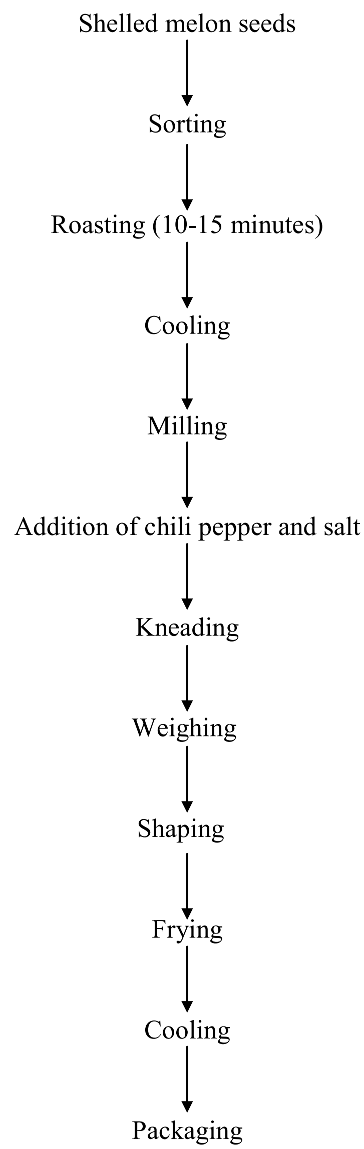

Fig. 1. Flow chart for the production of melon Robo (Makinde and Ibim, 2015)

Table I. Formulation of Robo from melon seeds and groundnut

Sample	Melon (%)	Groundnut (%)
Plain melon Robo	100	0
20% Melon-groundnut Robo	80	20
30% Melon-groundnut Robo	70	30
40% Melon-groundnut Robo	60	40
50% Melon-groundnut Robo	50	50

Base formulation

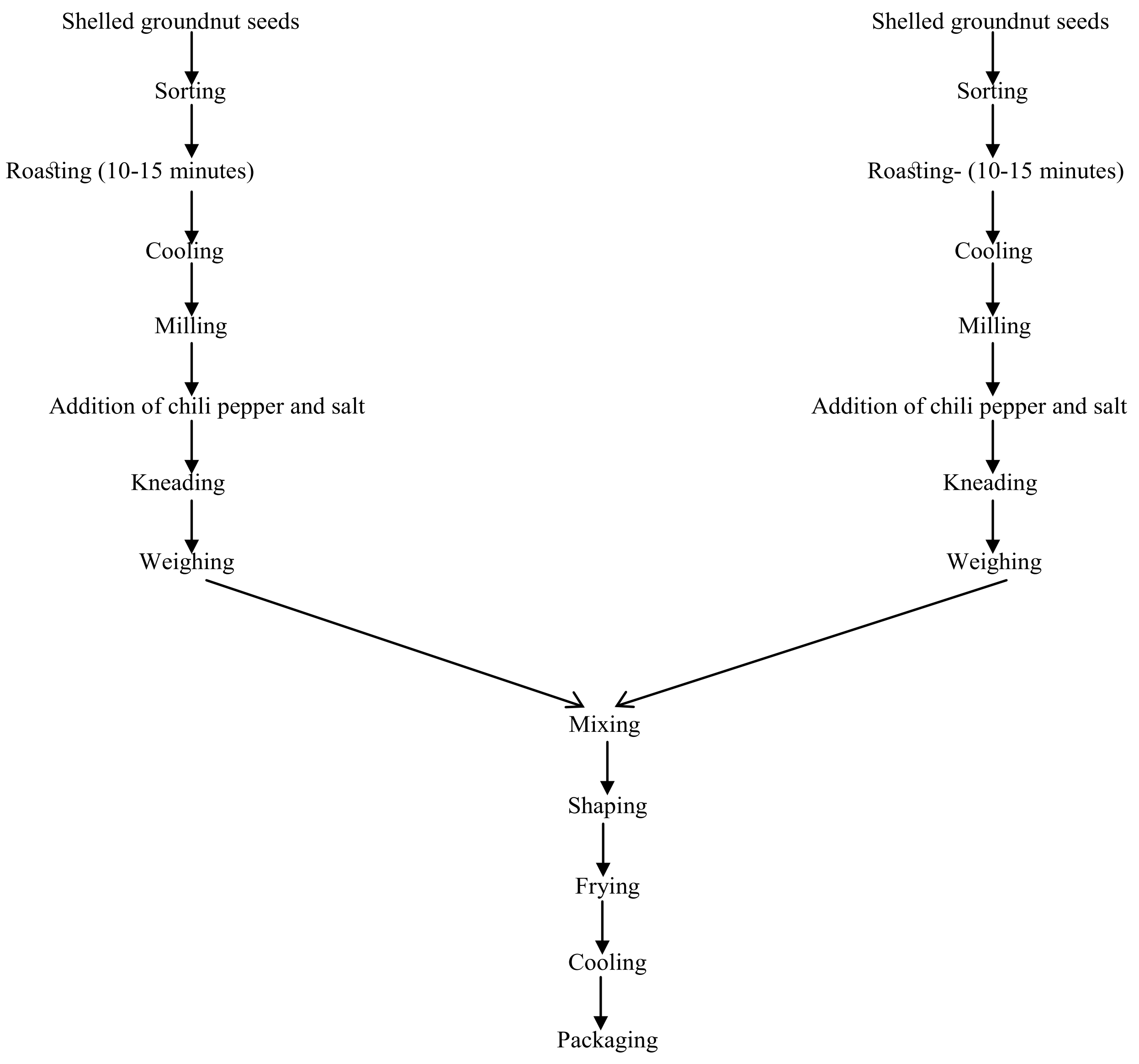

Fig 2. Flow chart for the production of melon and groundnut Robo (Makinde and Ibim, 2015).

Methods of analysis

All the experiment parameters were conducted under an ambient temperature and were repeated three times. The nutritional composition (moisture, ash, crude fat, protein and crude fibre) of Robo were estimated using AOAC methods (AOAC, 2005).

Physicochemical/functional analysis

Hardness

Official method of analysis was used for the physical hardness determination of the samples.

Microbial analysis

Total plate count and the coliform count was done using serial dilution and pour plate methods. The dilution was carried out using buffered peptone water (BPW) with a sample ratio to BPW of 1: 9. Robo samples and BPW were homogenized using a stomacher at 230 rpm for 2 minutes. The Coliform plating was carried out using Brilliance Agar media, and incubation was carried out at 37°C for 24 hours. Plating for TPC calculation was done using Plate Count Agar (PCA) media, and incubation was done at the temperature of 34–36°C for 48 hours (Bellise, 2014).

Sensory analysis

The sensory evaluation of five different samples of Robo was carried out using the preference tests. The samples were served to 25 semi-trained panelists comprising of interested students of LadokeAkintola University of Technology (LAUTECH) who usually eat Robo. The samples test was conducted in obedience to LAUTECH ethical guidelines. The aim of the study was explained to the panelists through written information on the form and orally. The panelists signed the informed consent form to participate in the study, and the forms were submitted to the researcher. Robo samples were randomly labeled and served to the panelists. After testing each sample, the panelists evaluated the samples on appearance, color, flavor, taste, and overall acceptability through eating and rinsed their mouths with water. A 9-point hedonic scale (9 - Like extremely; 8 - Like very much; 7 - Like moderately; 6 - Like slightly; 5 - Neither like nor dislike; 4 - Dislike slightly; 3 - Dislike moderately; 2 - Dislike very much; 1 - Dislike extremely) were used to measure the degree of preference for the Robo snack samples.

Results and discussion

Proximate composition of Robo produced from melon and groundnut seeds

The result of proximate analysis of Robo produced from melon and groundnut seeds are shown in Table II. The crude protein (%) content of the Robo samples varied inconsistently (40.25_b, 40.28_b, 42.8_d, 38.56_a, 42.04_c) from samples A, B, C, D and E, respectively, with sample C having the highest value of protein (42.8_d). The mean values along the same column with different superscripts are significantly different ($p<0.05$). The high protein contents can be attributed to the increase in the percentage of groundnut in the sample. According to Arya *et al.,* (2016) groundnut is a good source of protein and has high lysine content, making it a good complement for cereal protein that is low in lysine. The high protein contents of Robo from sample C could complement high carbohydrates in these snacks, especially in local areas of Nigeria where it is usually consumed(Hassan and Umar, 2004). Sample D Robo (60% melon and 40% groundnut seeds) were the most acceptable in flavour, crispness, taste and overall acceptability.

There was a significant difference in the crude fibre (%) contents of the samples. The crude fibre content of sample B (80% melon and 20% groundnut) was found to be higher ($15.01\pm0.014_d$) than other samples (7.03_a, 8.04_{ab}, 13.21_c, 9.01_b) while the crude fibre in sample A (100% of melon seeds) was found to be the lowest (7.03_c) among other samples. The value of crude fibre obtained from sample A is comparable to 7.04% reported by Ejoh and Ketiku (2013). The high crude fibre from sample B could be of great health benefit to consumers as vegetable fibre consumption has been found to reduce serum cholesterol, risk of coronary heart disease, colon and stomach cancer, and hypertension (Ingale and Shrivastava, 2011; Hassan and Umar, 2004: Ambrose, 2019). It enhances glucose tolerance and increases insulin sensitivity (Hassan and Umar, 2004).

The fat content (%) of the samples from A, B, C, D and E are 35.20_e, 31.42_d, 22.03_a, 22.40_b, and $27.21_{c;}$ respec-

Table II. Proximate composition of robo produced from melon seeds and groundnut

Samples	Crude protein	Crude fiber	Ether extract	Moisture	Ash
A	$40.25{\pm}0.014_b$	$7.03{\pm}0.000_a$	$35.20{\pm}0.141_e$	$2.43{\pm}0.000_a$	$18.02{\pm}0.014_e$
B	$40.28{\pm}0.014_b$	$15.01{\pm}0.014_d$	$31.42{\pm}0.014_d$	$3.30{\pm}0.010_e$	$8.12{\pm}0.000_d$
C	$42.8{\pm}0.014_d$	$8.04{\pm}0.014_{ab}$	$22.03{\pm}0.000_a$	$2.51{\pm}0.000_b$	$6.12{\pm}0.000_c$
D	$38.56{\pm}0.014_a$	$13.21{\pm}0.000_c$	$22.40{\pm}0.141_b$	$3.24{\pm}0.000_d$	$5.43{\pm}0.014_b$
E	$42.04{\pm}0.014_c$	$9.01{\pm}0.414_b$	$27.21{\pm}0.000_c$	$3.21{\pm}0.010_c$	$5.33{\pm}0.014_a$

Mean values along the same column with different superscripts are significantly different ($p<0.05$)
Sample A: 100% of melon seeds
Sample B: 80% of melon seeds and 20% of groundnut
Sample C: 70% of melon seeds and 30% of groundnut
Sample D: 60% of melon seeds and 40% of groundnut
Sample E: 50% of melon seeds and 50% of groundnut

Table III. Physiochemical Analysis of 'Robo' produced from melon seeds and groundnut seeds

Sample	Hardnesss (mg/l)
A	$720{\pm}0.414_e$
B	$504{\pm}0.414_c$
C	$644{\pm}0.414_d$
D	$340{\pm}0.414_b$
E	$240{\pm}0.414_a$

Mean values along the same column with different superscripts are significantly different ($p<0.05$)

tively, these values are high as a result of groundnut and melon seeds being oilseed plants. Deep frying of 'Robo'may be a contributing factor to the high-fat contents. Fats have been shown to enhance the taste and acceptability of foods. Fats could also prolong satiety and facilitate the absorption of fat-soluble vitamins. Robo sample from melon (sample A) had the highest value (35.20_e) compared to others.

The result of the moisture content (%) for samples A, B, C, D and E were 2.43_a, 3.30_e, 2.51_b, 3.24_d, and 3.21_c respectively. These values show the low moisture content in the samples, which could result from deep frying of the snack and could help maintain the product's shelf life and help keepthe quality of the products.

The ash content (%) were 18.0_e, 8.12_d, 6.12_c, 5.43_b, and 5.33_a for samples A, B, C, D and E. Robo from melon had the highest value (18.02_e), and this value decreases with an increase in the percentage of groundnut added. The importance of ash content determination is to know the amount and type of minerals in food.

Table IV. Microbial analysis of Robo produced from melon seeds and groundnut for coliform determination

Sample (10^{-1})	*E. coli*
A	Nil
B	Nil
C	Nil
D	Nil
E	Nil

Nil – not detected

Table V. Sensory evaluation of 'Robo' produced from melon seeds and groundnut

Samples	Colour	Flavour	Crispness	Taste	Overall acceptability
A	$6.87\pm1.096_a$	$5.36\pm0.127_a$	$6.27\pm1.160_a$	$4.41\pm0.707_a$	$5.19\pm0.643_a$
B	$7.37\pm0.771_a$	$6.12\pm1.124_{ab}$	$6.95\pm0.707_a$	$5.32\pm0.962_{ab}$	$5.82\pm1.032_{ab}$
C	$7.60\pm0.636_a$	$6.87\pm0.445_{ab}$	$7.09\pm0.382_a$	$6.46\pm0.134_{bc}$	$6.96\pm0.191_{ab}$
D	$7.41\pm0.325_a$	$7.28\pm0.389_b$	$7.55\pm0.262_a$	$7.37\pm0.262_a$	$7.68\pm0.453_b$
E	$7.55\pm0.643_a$	$6.46\pm0.516_{ab}$	$6.96\pm0.064_a$	$6.09\pm0.905_{ab}$	$7.09\pm0.905_{ab}$

Mean values along the same column with different superscripts are significantly different ($p<0.05$)

Physicochemical properties (hardness) of Robo produced from melon and groundnut seeds

The results showed in Table III the hardness properties of Robo produced from melon and groundnut seeds. It shows that the values decreased with an increase in the percentage of groundnut added. Sample A (100% melon seeds) had the highest value (720_e), while sample E (50% of melon and 50% of groundnut seeds) had the lowest value (240_a).

Microbial analyses of Robo samples produced from melon and groundnut seeds

The results showed in Table IV the microbiological analysis of the samples. The samples show no growth values with the Robo samples; they were free from coliforms and bacteria cells capable of causing spoilage to the Robo and rendering it unfit for consumption. Coliforms are commonly used as an indicator of the sanitary quality of foods and water, and an example of coliform includes *E.coli.* Unlike the general coliform group, *E.coli* is almost exclusively of faecal origin, and their presence is thus an effective confirmation of faecal contamination. The absence of *E.coli* indicates that the sample is fit for consumption.

Sensory evaluation of Robo from melon and groundnut seeds

Table V shows the sensory evaluation of Robo produced from melon and groundnut seeds. The results show that the score for colour varied from samples A, B, C, D and E as 6.87_a,7.37_a, 7.60_a, 7.41_a, and 7.55_a respectively. For flavor; 5.36_a,6.12_{ab}, 6.87_{ab}, 7.28_b, and 6.46_{ab} respectively. For crispness; 6.27_a, 6.95_a, 7.09_a, 7.55_a and 6.96_a respectively. While 4.41_a, 5.32_{ab}, 6.46_{bc}, 7.37_c and 6.09_{ab} were for taste. Overall acceptability scores were 5.19_a, 5.82_{ab}, 6.96_{ab}, 7.68_b and 7.09_{ab} from samples A, B, C, D and E, respectively. The results also showed that the Robo sample produced from 70% of melon and 30% of groundnut (sample C) had the highest score for colour (7.60_a), while Robo from 60% melon seeds and 40%

groundnut seeds had the highest sensory scores for flavour, crispness, taste and overall acceptability and the lowest sensory scores were from samples of Robo produced from melon seeds (sample A).

Conclusion

This study showed that the high protein content in the Robo samples could be used to supplement cereal-based products. Sample D Robo from 60% melon and 40% groundnut seeds were the most acceptable in terms of flavour, crispness, taste and overall acceptability, while Sample A with 100% melon seeds has the least value for flavour, crispness, taste and overall acceptability. Therefore, the production of Robo from melon and groundnut seeds should be in the vicinity of Sample C (70% melon and 30% groundnut seeds). These will boost the protein content of the product.

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