Robo from melon seeds and groundnut

E. A. Akande, O. W. Alawode*, O. T. Owopetu and O. O. Oyesiji

Department of Food Science, Ladoke Akintola University of Technology Ogbomoso, Oyo State, Nigeria

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% were evaluated for proximate composition, physicochemical/functional and sensory attributes. The results showed an increase in crude protein (38.56 - 42.8 d), crude value, and unhealthy snacks consumption are associated with the risk of developing non-communicable diseases. Thus, improved Robo will increase consumer’s nutrients intake and prevent health problems associated with snack intake.

Keywords: Melon seeds; Groundnut; Robo; Proximate composition; Functional properties

Introduction

‘Robo’ is ready to eat snacks produced from the residue or cake obtained from the oil extraction of melon and groundnut. Melon (Citrullus colocynthis) 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, grainsuch as corn, sunflower seed and nuts such as oil palm seed, coconuts which are technologically grown to produce oil for consumption. The filtrates were usually used as a protein source for animal feeds, excluding tin 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 (Collens 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 Shirvastava, 2011). Melon is grown and cultivated all over Nigeria. Melon seed is called “Ogili” (Ibo), “Dende” (Fulani), “Egusi” (Yoruba), and “Iguana Agushi” (Hausa) (Ojiej 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 (Adeye et al., 2020). Melon seeds can be used for culinary purposes; they have anti-inflammatory anti-diabetic properties due to Citrullus colocynthis (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 (Ojiej 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,
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).
Table I. Formulation of Robo from melon seeds and groundnut

<table>
<thead>
<tr>
<th>Sample</th>
<th>Melon (%)</th>
<th>Groundnut (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain melon Robo</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>20% Melon-groundnut Robo</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>30% Melon-groundnut Robo</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>40% Melon-groundnut Robo</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>50% Melon-groundnut Robo</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

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 (40.25a, 40.28b, 42.8c, 38.56e, 42.04d) from samples A, B, C, D and E, respectively, with sample C having the highest value of protein (42.8%). 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±0.01d) than other samples (7.03a, 8.04b, 13.21c, 9.01e) while the crude fibre in sample A (100% of melon seeds) was found to be the lowest (7.03) 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 35.20a, 31.42d, 22.03a, 22.40b, and 27.21c, respec-
It was thoroughly kneaded until oil was extracted, Ladoke Akintola University of Technology, Ogbomoso, Oyo state. The oil used for making Robo was procured from a local market in Ogbomoso, Oyo state. The oil used for making Robo was procured from a local market in Ogbomoso, Oyo state. The oil used for making Robo was procured from a local market in Ogbomoso, Oyo state.

**Materials and methods**

Therefore, this study produced Robo using a blend of children and adolescents daily over 30 years. Likewise, it is usually stored in polyethene films or airtight containers. Adeyeye et al., 2020. Globally, snaking is a common practice. Sample D Robo (60% melon and 40% groundnut seeds) were the most acceptable in terms of flavour, crispness, taste and overall acceptability. According to San and Umar, 2004. Sample D Robo (60% melon and 40% groundnut seeds) were the most acceptable in terms of flavour, crispness, taste and overall acceptability. According to San and Umar, 2004.

**Physicochemical/functional analysis**

The total plate count and coliform count were done using Brilliance Agar media, and incubation was carried out at the temperature of 34–36°C for 48 hours. Official methods of analysis were used for the physical characteristics of Robo: proteins, leaf starch, moisture, and ash contents. Fats have been shown to enhance the taste and facilitate the absorption of fat-soluble vitamins. The fat content (%) of the samples from A, B, C, D and E were 40.25±0.014\textsubscript{b}, 40.28±0.014\textsubscript{b}, 42.8±0.014\textsubscript{d}, 38.56±0.014\textsubscript{a}, and 42.04±0.014\textsubscript{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 keep the quality of the products.

The ash content (%) were 18.0\textsubscript{e}, 8.12\textsubscript{a}, 6.12\textsubscript{c}, 5.43\textsubscript{c}, and 5.33\textsubscript{c} for samples A, B, C, D and E. Robo from melon had the highest value (18.02\textsubscript{c}), 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.

**Results and discussion**

The percentage of groundnut in the sample. According to Hassan and Umar, 2004. High protein contents can be attributed to the increase in protein contents of Robo from sample C could complete the percentage of groundnut in the sample. According to Hassan and Umar, 2004. The high crude fibre from melon and melon seeds have a significant impact on the body. The high crude fibre from melon and melon seeds have a significant impact on the body. The high crude fibre from melon and melon seeds have a significant impact on the body.

The result of the moisture content (%) for samples A, B, C, D and E were 2.43\textsubscript{a}, 3.30\textsubscript{c}, 2.51\textsubscript{b}, 3.24\textsubscript{d}, and 3.21\textsubscript{c}, respectively. 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\textsubscript{e}) compared to others.

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

<table>
<thead>
<tr>
<th>Samples</th>
<th>Crude protein (g/100g)</th>
<th>Crude fiber (g/100g)</th>
<th>Ether extract (g/100g)</th>
<th>Moisture (%)</th>
<th>Ash (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40.25±0.014\textsubscript{b}</td>
<td>7.03±0.000\textsubscript{a}</td>
<td>35.20±0.141\textsubscript{e}</td>
<td>2.43±0.000\textsubscript{a}</td>
<td>18.02±0.014\textsubscript{e}</td>
</tr>
<tr>
<td>B</td>
<td>40.28±0.014\textsubscript{b}</td>
<td>15.01±0.014\textsubscript{d}</td>
<td>31.42±0.014\textsubscript{d}</td>
<td>3.30±0.010\textsubscript{e}</td>
<td>8.12±0.000\textsubscript{d}</td>
</tr>
<tr>
<td>C</td>
<td>42.8±0.014\textsubscript{d}</td>
<td>8.04±0.014\textsubscript{ab}</td>
<td>22.03±0.000\textsubscript{a}</td>
<td>2.51±0.000\textsubscript{b}</td>
<td>6.12±0.000\textsubscript{c}</td>
</tr>
<tr>
<td>D</td>
<td>38.56±0.014\textsubscript{a}</td>
<td>13.21±0.000\textsubscript{c}</td>
<td>22.40±0.141\textsubscript{b}</td>
<td>3.24±0.000\textsubscript{d}</td>
<td>5.43±0.014\textsubscript{b}</td>
</tr>
<tr>
<td>E</td>
<td>42.04±0.014\textsubscript{c}</td>
<td>9.01±0.414\textsubscript{b}</td>
<td>27.21±0.000\textsubscript{c}</td>
<td>3.21±0.010\textsubscript{c}</td>
<td>5.33±0.014\textsubscript{a}</td>
</tr>
</tbody>
</table>

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

**Table III. Physiochemical Analysis of ‘Robo’ produced from melon seeds and groundnut seeds**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Hardness (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>720±0.414\textsubscript{e}</td>
</tr>
<tr>
<td>B</td>
<td>504±0.414\textsubscript{c}</td>
</tr>
<tr>
<td>C</td>
<td>644±0.414\textsubscript{d}</td>
</tr>
<tr>
<td>D</td>
<td>340±0.414\textsubscript{b}</td>
</tr>
<tr>
<td>E</td>
<td>240±0.414\textsubscript{a}</td>
</tr>
</tbody>
</table>

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

Mean values along the same column with different superscripts are significantly different (p<0.05)
kneaded together, the cake was rolled into small round minutes). The cooled roasted seeds with chilli pepper

The shelled seeds (groundnut and melon) were sorted, LadokeAkintola University of Technology, Ogbo-

Citrullus colocynthis Materials and methods

legumes containing some essential amino acids and mentioned above. The two materials are nutrient-rich
groundnut and melon seeds to address the challenges

Aziagba, 2001). – consume snacks at least once in two days (Wokoma and

children and adolescents daily over 30 years. Likewise,

practice among people. Bellisle (2014) indicates an

containers to maintain the quality and prevent rancidity

it is usually stored in polyethene films or airtight

San and Umar, 2004). Sample D Robo (60% melon and

samples test was conducted in obedience to LAUTECH

Technology (LAUTECH) who usually eat Robo. The

Sensory evaluation of five different samples of Robo

Flavor, crispness, taste and overall acceptability.

Overall acceptability scores were 5.19 a, 5.82 ab,

For crispness; 6.27 a, 6.95 a, 7.09 a, 7.55 aand 6.96 a respec-

The results showed in Table III the hardness properties

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.), while sample E (50% of

melon and 50% of groundnut seeds) had the lowest

value (240.).

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.

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.), while sample E (50% of melon and 50% of groundnut seeds) had the lowest value (240.).

Microbial analyses of Robo samples produced from melon and groundnut seeds

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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.

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

<table>
<thead>
<tr>
<th>Sample (10^4)</th>
<th>E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Nil</td>
</tr>
<tr>
<td>B</td>
<td>Nil</td>
</tr>
<tr>
<td>C</td>
<td>Nil</td>
</tr>
<tr>
<td>D</td>
<td>Nil</td>
</tr>
<tr>
<td>E</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Nil – not detected

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

<table>
<thead>
<tr>
<th>Samples</th>
<th>Colour</th>
<th>Flavour</th>
<th>Crispness</th>
<th>Taste</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.87±1.096a</td>
<td>5.36±0.127a</td>
<td>6.27±1.160a</td>
<td>4.41±0.707a</td>
<td>5.19±0.643a</td>
</tr>
<tr>
<td>B</td>
<td>7.37±0.771a</td>
<td>6.12±1.124ab</td>
<td>6.95±0.707a</td>
<td>5.32±0.962ab</td>
<td>5.82±1.032ab</td>
</tr>
<tr>
<td>C</td>
<td>7.60±0.636a</td>
<td>6.87±0.445ab</td>
<td>7.09±0.382a</td>
<td>6.46±0.134bc</td>
<td>6.96±0.191ab</td>
</tr>
<tr>
<td>D</td>
<td>7.41±0.325a</td>
<td>7.28±0.389b</td>
<td>7.55±0.262a</td>
<td>7.37±0.262a</td>
<td>7.68±0.453b</td>
</tr>
<tr>
<td>E</td>
<td>7.55±0.643a</td>
<td>6.46±0.516ab</td>
<td>6.96±0.064a</td>
<td>6.09±0.905ab</td>
<td>7.09±0.905ab</td>
</tr>
</tbody>
</table>

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

**Acknowledgement**

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