# Production and Evaluation of *Robo* Analogue from Melon Seeds *(citrullus lanatus)* and Bambara Groundnut (*vigna subterranea*) mixes

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## ABSTRACT

This study evaluated the proximate composition, microbial analysis and sensory properties of freshly produced '*Robo*'. The melon seeds and bambara groundnut were sorted, roasted and milled into paste. The *Robo* samples were produced using various proportions of melon seed and Bambara groundnut flour mixes. The proximate composition of the produced '*Robo*' varies from 15.18-25.69, 5.20-10.13, 23.18-39 .19, 6.52-6.94, 4.04-6.10, and 16.88-40.15% for protein, moisture, fat, crude fibre, total ash and carbohydrate contents, respectively. Microbial analysis of *Robo* showed that total viable count increased as substitution level with bambara groundnut increases. No growth was observed for total coliform in the samples. Sensory properties of the produced *Robo* indicated that sample B produced from 90% melon seeds and 10% bambara groundnut was comparable to sample A produced from 100% melon seeds in term of overall acceptability. The study shows that bambara nuts could be incorporated in the production of *Robo* and other snacks in order to improve their nutritional quality.

**Keywords*:*** '*Robo*', melon seeds, Bambara groundnut, proximate composition, sensory, quality.

## INTRODUCTION

*Robo* is traditionally produced from the seeds of melon, and is widely consumed in the Western part of Nigeria. Several researchers have worked and reported on the recipes for *Robo* production and processing procedures [10] [14]. Most snacks are generally considered as junk foods with little or no nutritional value and are seen as contributing little to general health and nutrition. However, *Robo* is traditionally produced from nutrient-rich legumes. It contains protein and some essential amino acids that could contribute to and complement the cereal or starch rich meals by supplying the necessarily needed protein [10]. *Robo* is a ready-to-eat traditional snacks produced from the cake obtained from oil extraction of melon. It has remained a traditional family art in homes with rudimentary utensils. The traditional process consists of roasting, sorting, cleaning, kneading/oil expression, molding, frying and packaging [10]. It is commonly consumed with high carbohydrate-rich meals such as *garri* from cassava, *ogi* and *agidi* from cereals [2].

Melon seeds, *Citrullus lanatus* (*egusi*) is the biological ancestor of water melon now found all over the world, but originated from West Africa. *Egusi* melon is a member of the *cumcurbitaceae* family [1]. Unlike the common water melon, whose flesh is sweet and red, the *egusi* melon is yellow or green and has a bitter taste. The *egusi* melon comprises of 50% oil and 35% protein, the seeds have both nutritional and cosmetic importance. The seeds contain vitamins

C and B2, minerals, riboflavin, fat, carbohydrate and protein. Melons are major food crops with several varieties which serve as major food sources [11].

Bambara groundnut is regarded as the third most important legume crop after groundnut and cowpea in Africa but due to its low status, it is seen as a snack or food supplement but not a lucrative cash crop [15]. The seeds of Bambara make a nutritious and complete food due to its sufficient quantities of protein (20.5 - 24.0%), carbohydrate -(54.5 - 69.3%), and fat (5.3 - 7.8%) with the level of essential sulphur containing amino acid higher than that found in most legumes [9]. These values are considered sufficient to make this legume a complete food.

## Materials and Methods

### Materials

Bambara groundnut, melon seeds and other ingredients such as pepper, onion, salt and vegetable oil used for the study were obtained from Sabo market, Ogbomoso, Oyo state.

### Preparation of melon seeds and bambara groundnut paste.

Bambara nut and melon seeds were sorted to remove extraneous materials and then subjected to roasting separately in an open dry pot according to the method of [12]. The seeds were turned constantly for 10-15 mins. The roasted seeds were cooled and milled into paste without adding water using the attrition mill.

### Production of *Robo*

The paste (1 Kg) of melon and Bambara groundnut were thoroughly mixed and kneaded together at various proportions (100:0, 90:10, 80:20, 70:30, 60:40) until oil was extracted and (100 g) onion (30 g) chili pepper and (a pinch) salt were added. The kneading continued until oil was extracted for about 1 h and the cake became harder and firmer. The cake was rolled into small round balls and then fried in oil extracted from the cake. The *Robo* samples were cooled down at room temperature and packaged in airtight bottles [12].

### Proximate analysis

The *'Robo'* samples were analyzed according to the method described by AOAC [4] for moisture, ash, crude fibre, protein, crude fat and carbohydrate was determined by difference

### Microbial analysis

The method described by [7] was adopted to enumerate total viable bacteria and coliform counts.

### Sensory evaluation

The sensory evaluation was carried out by twenty-five semi-trained panelists comprised of staff and students of Department of Food Science, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. Each panelist was served with *Robo* samples to assess the organoleptic attributes such as colour, taste, texture, flavour, appearance, crunchiness and overall acceptability using the 9-point hedonic scale with 1 dislike extremely and 9 like extremely.

### Statistical Analysis

Data obtained were subjected to analysis of variance (ANOVA) and the means were separated with the use of Duncan's multiple range test to detect significant difference ($p<0.05$) among the samples.

## RESULTS AND DISCUSSION

### Proximate composition of the *Robo* analogue

The result showed that the moisture content of '*Robo*' samples ranged from 5.2-10.13%. Sample E had the highest moisture content of 10.13% while sample A had the lowest moisture content of 5.20%. The result is quite comparable to the value of 7.36% reported by Adeyeye et al. [1] on production and evaluation of *robo* from watermelon seeds. The low moisture content could be as a result of deep frying of the snack and could help in keeping quality of the products.

The protein content of '*Robo*' ranged from 15.18- 25.69% indicating that the products are good sources of protein. Sample A had the highest protein content of 25.69% while sample E had the lowest 15.18%. However, the protein content reduced significantly due to the addition of Bambara groundnuts and similar trends were observed by Aletor and Ojelabi [3], Makinde and Ibim [12] in the nutritive attributes of kulikuli and *robo*, respectively. According to [12], the high protein content of '*Robo*' from the melon seed and bambara groundnut mixes could be used to complement high carbohydrate and starchy foods from developing countries especially in Nigeria where '*Robo*' is a common traditional snack.

The fat content ranged from 23.18 to 39.19%. Sample A had the highest value of 39.19% while sample E had the lowest of 23.18%. The values of the study were higher as melon is an oil seed Jimoh and Adedokun [10], Makinde and Ibim [12]. Deep frying of '*Robo*' could also be a contributing factor to the high fat contents. Fats have been shown to enhance the taste and acceptability of foods. However, high fat content could predispose '*Robo*' to rancidity under high relative humidity and high ambient temperature [12].

The crude fibre ranged from 6.52 to 6.94%. Sample A had the highest value of 6.94% and sample E had the lowest of 6.52%. The samples were significantly different at ($p\leq0.05$). The crude fibre values of '*Robo*' in this study are comparable to value of 7.04% reported by Makinde and Ibim [12] on the nutritive attributes of *robo* produced from melon seeds. The high crude fibre could be of great health benefit to consumers as consumption of vegetable fibre has been found to reduce serum cholesterol, risk of coronary heart disease, colon and stomach cancer and hypertension; enhance glucose tolerance and increase insulin sensitivity [8], [12].

**Table 1: Proximate Composition of *Robo* analogue produced from melon seed and Bambara groundnut mixes**

| Samples | Moisture Content (%) | Protein (%) | Fat (%) | Crude Fibre (%) | Ash (%) | CHO |
|---|---|---|---|---|---|---|
| A | $5.20^{c}$ | $25.69^{a}$ | $39.19^{a}$ | $6.94^{e}$ | $6.10^{a}$ | $16.88^{e}$ |
| B | $8.00^{b}$ | $24.32^{a}$ | $31.73^{b}$ | $6.83^{b}$ | $4.74^{b}$ | $24.38^{d}$ |
| C | $8.40^{b}$ | $22.73^{b}$ | $29.98^{c}$ | $6.64^{c}$ | $4.46^{c}$ | $27.79^{c}$ |
| D | $10.00^{a}$ | $19.10^{c}$ | $27.94^{d}$ | $6.59^{d}$ | $4.13^{d}$ | $32.24^{b}$ |
| E | $10.13^{a}$ | $15.18^{d}$ | $23.18^{e}$ | $6.52^{e}$ | $4.04^{d}$ | $40.15^{a}$ |

Values represent means of triplicate reading, follow by different lowercase letter. Means within the same row with different superscripts are significantly different ($p\leq0.05$)
Sample A – 100% melon seed

Sample B – 90% melon seed + 10% Bambara groundnut
Sample C – 80% melon seed + 20% Bambara groundnut
Sample D – 70% melon seed + 30% Bambara groundnut
Sample E – 60% melon seed + 40% Bambara groundnut

The ash contents ranged from 4.04 to 6.10%. Sample A had the highest ash content of 6.1% while sample C had the lowest value of 4.04%. The samples were significantly different from each other except for Samples D and E at ($p \leq 0.05$). The decreasing trend observed in ash content could be traced to increase in Bambara groundnut substitution. The values obtained could be compared with 5.82% reported by Adeyeye *et al.* [1] on *Robo* production.

The carbohydrate contents ranged from 16.88 to 40.15%. C. Sample E had the highest carbohydrate content of 40.15% and sample A had the lowest value of 16.88%. All the samples were significantly different at ($p \leq 0.05$). The result is contrary to the values of carbohydrate reported by Adeyeye *et al.* [1] on production and evaluation of *robo* from watermelon seeds.

**Microbial analysis of '*Robo*' analogue**

Table 2 shows the microbial analysis of '*Robo*' samples produced from melon seeds and Bambara groundnut. The total viable bacteria count ranged from 1.01- 1.68 x $10^5$ cfu/g. Total viable count increased as the substitution level of bambara groundnut increased. The increasing trend could be due to milling process, addition of blended ingredients and the manual unit operations involved in the preparation of *Robo* analogue. Also, the high fat content of *Robo* could increase the survival of microbes which invariably affect the shelf stability and sensory quality of most snack [5]. The values obtained are similar to the study of Olanipekun *et al.* [13] and Ba1a *et al.* [16] in biscuit and fried bean cake, respectively

There was no growth of coliform in all the samples, which is pointer to good production and handling practice. This result is comparable to the production of cookies as reported by Ezeama [5].



**Table 2: Microbial Analysis of *Robo* analogue**

| Samples | Bacteria Count × $10^5$ (cfu/g) | Coliform Count (cfu/g) |
|---|---|---|
| A | $1.01^d$ | NG |
| B | $1.23^c$ | NG |
| C | $1.39^c$ | NG |
| D | $1.50^b$ | NG |
| E | $1.68^a$ | NG |

Values represent means of triplicate reading, follow by different lowercase letter. Means within the same row with different superscripts are significantly different ($p \leq 0.05$)

Sample A – 100% melon seed
Sample B - 90% melon seed + 10% Bambara groundnut
Sample C – 80% melon seed + 20% Bambara groundnut
Sample D – 70% melon seed + 30% Bambara groundnut
Sample E – 60% melon seed + 40% Bambara groundnut
NG - No Growth

## Sensory evaluation

Table 3 shows the result of the sensory analysis of '*Robo*' samples produced from melon seeds and Bambara groundnut. The attributes investigated include colour, appearance, taste, aroma, crunchiness, aroma, texture and overall acceptability. The panelists showed preference for samples A and followed by samples C, D and E in terms of colour, appearance, taste, aroma, crunchiness, aroma and texture except for colour in sample B. The overall acceptability showed that sample B had the highest rating compared to sample A. This indicated that it could compete favourably with sample A. Therefore, the substitution level of Bambara groundnut should not exceed 10%.

**Table 3: Sensory Analysis of *Robo* analogue**

| Samples | Colour | Appearance | Aroma | Taste | Crunchiness | Texture | Overall acceptability |
|---|---|---|---|---|---|---|---|
| A | 8.400 $^{a}$ | 8.133$^{a}$ | 8.266$^{a}$ | 8.400$^{a}$ | 8.200$^{a}$ | 8.000$^{a}$ | 8.566$^{a}$ |
| B | 8.167$^{a}$ | 8.000$^{a}$ | 7.767$^{b}$ | 7.937$^{a}$ | 7.867$^{a}$ | 7.800$^{a}$ | 8.167$^{a}$ |
| C | 6.833$^{b}$ | 6.600$^{b}$ | 6.700$^{cd}$ | 6.633$^{b}$ | 6.766$^{b}$ | 7.033$^{b}$ | 7.133$^{b}$ |
| D | 7.100$^{b}$ | 6.900$^{b}$ | 6.766$^{c}$ | 6.866$^{b}$ | 6.767$^{b}$ | 6.933$^{b}$ | 7.133$^{b}$ |
| E | 6.333$^{c}$ | 6.533$^{b}$ | 6.267$^{d}$ | 6.533$^{b}$ | 6.333$^{b}$ | 6.767$^{b}$ | 6.733$^{c}$ |

Values represent means of triplicate reading, follow by different lowercase letter. Means within the same row with different superscripts are significantly different ($p \leq 0.05$)
Sample A – 100% melon seed
Sample B – 90% melon seed + 10% Bambara groundnut
Sample C – 80% melon seed + 20% Bambara groundnut
Sample D – 70% melon seed + 30% Bambara groundnut
Sample E – 60% melon seed + 40% Bambara groundnut



## CONCLUSION

The *Robo* analogue produced had relatively high protein, fat, ash, crude fibre and carbohydrate contents desirable for good health and wellbeing of the consumers. It could serve as a nutritious snack used to complement starchy or carbohydrate based foods. Sensory evaluation of the *robo* showed that 0-10% inclusion with bambara groundnut gave the highest ratings in terms of colour, appearance, taste, aroma, texture, crunchiness and overall acceptability which compared favourably with the control (100% melon seed).

## References

[1] S.A.O. Adeyeye, T.O. Bolaji, T.A. Abegunde, A.O. Adebayo-Oyetoro, H.K. Tiamiyu, and F. Idowu- Adebayo, "Evaluation of nutritional composition, physico-chemical and sensory properties of 'Robo' (a Nigerian traditional snack) produced from watermelon (*Citrullus lanatus* (Thunb.) seeds*," Food Reseearch*, pp. 216-223, 2020.

[2] S.A.O. Adeyeye, O.E. Fayemi, and A.O. Adebayo-Oyetoro, "Amino acid, vitamin and mineral profiles of smoked fish as affected by smoking methods and fish types," *Journal of Culinary Science and Technology*, vol. 17, pp. 195-208, 2019.

[3] O. Aletor, and A. Ojelabi, "Comparative evaluation of the nutritive and functional attributes of some traditional Nigerian snacks and oil seed cake," *Pakistan Journal of Nutrition*, vol. 6, pp. 99-103, 2007.

[4] AOAC, Official Methods of Analysis. Association of Official Analytical Chemists, Washington, D.C, USA. 17$^{th}$ Edition; 2015.

[5] C.F. Ezeama, "Food Microbiology: Fundamentals and Applications," *Natural Prints Ltd. Lagos*, 2007

[6] S.Y. Giami, T. Amasisi, and G. Ekiyor, "Comparison of bread making properties of composite flour from kernels of roasted and boiled African breadfruit (*Treculia africana decne*) seeds," *Journal Raw Material Resources*, vol. 1, pp. 16–25, 2004.

[7] W.F. Harrigan, and M.E. McCance, "Laboratory Methods in Food and Diary Micro biology" Academic Press, New York, USA, pp. 25-29, 2006.

[8] L.G. Hassan, and K.J. Umar, "Proximate and mineral composition of seeds and pulp of *Parkia biglobosa*," *Nigerian Journal of Basic and Applied Sciences*, vol. 13, pp. 15 – 27, 2004.

[9] O.S. Ijarotimi, and T.R. Esho, "Comparison of nutritional composition and antinutrient status of fermented, germinated and roasted bambara groundnut seeds (*vigna subterranea*)," *British Food Journal*, vol. 111, pp. 376-386, 2009.

[10] K.O. Jimoh, and S.O. Adedokun, "Development and quality evaluation of defatted groundnut and melon kernel flour based ethnic product Robo," *African Journal of Food Science*, vol. 8, pp. 311-315, 2014.

[11] M.B. Mabalaha, Y.C. Mitei, and S.O. Yoboah, "A comparative study of the properties of selected melon seeds oils as potential candidates for development into commercial edible vegetable oil," *Journal of American Oil Chemists Society*, vol. 84, pp. 31-34, 2007.

[12] F.M. Makinde, and S. Ibim, "Nutritional, physico- chemical and sensory properties of Robo (A Nzcigerian traditional snack) made from sesame (*Sesamum indicum Linn*) seed," *Nigerian Food Journal*, vol. 33, pp. 88-95, 2015.

[13] B.F. Olanipekun, O.E. Adelakun, P.I. Anie, and F.O. Fajuyi, "Evaluation of biscuit produced from composition of wheat and African walnut flour," *Novel Techniques in Nutrition and Food Science*, vol. 2 pp. 1- 6,2018.

[14] O.P. Sobukola, S.O. Awonorin, M.A. Idowu, and F.O. Bamiro, "Microbial profile and critical control points during processing of 'Robo' snack from melon seed (*Citrullus lanatus Thunb*.) in Abeokuta, Nigeria. *African Journal of Biotechnology*, vol. 8, pp. 2385-2388, 2009.

[15] C.K. Tweneboah, "Modern Agriculture in the Tropics, Food crops" Co-wood Publishers; 2000.

[16] J.O. Bala, U.O.J Ijah and A.A Olayinka, Microbiological assessment production stages of fried bean cake (Akara) in Nigeria. *The IUP journal of biotechnology*, vol. v, no. 4, pp. 28-37, 2011