DRF-340
[1-6]

RESEARCH ARTICLE Asian Journal of Dairy and Food Research

Proximate, Functional and Sensory Analysis of Quinoa and Wheat Flour Composite Cake

I.A. Olawuni[1], A.E. Uzoukwu[1], J.C. Ibeabuchi[1], A.F. Ofoedum[1], A.A. Nwakaudu[1], S.O. Alagbaoso[1], E.J. Anaeke[1], J.N. Ugwoezuonu[1]

10.18805/ajdfr.DRF-340

ABSTRACT

Background: Confectionaries are one of the major food categories that provides one of the basic nutritional needs of humans. Cake has always been made from flour, as such, has placed a heavy burden of wheat production. However, quinoa seeds have been under-utilized owing to its nutritional components and the need to produce baked products with balanced nutritional needs. The goal of this study was to develop a high-protein cake using a protein source. Quinoa flour was employed as a protein source.

Methods: The quinoa seeds were ground into flour and combined with wheat flour in the following ratios: 30:70, 40:60 and 50:50, in that order. A cake made entirely of wheat flour served as the control. Sensory analyses were conducted on the samples, as well as functional and proximate compositions, using standard analytical techniques.

Result: The research's findings revealed that moisture ranged from 33.61% to 43.99%, protein ranged from 13.60% to 18.03%, ash ranged from 0.91% to 1.211%, fiber ranged from 5.25% to 5.77%, fat ranged from 5.54% to 6.25% and carbohydrate ranged from 30.59% to 39.81%. Comparing samples of composite flour cakes to samples of wheat flour cakes revealed a difference in the amount of total protein that was statistically significant ($p<0.05$), indicating that these cakes make a great source of protein for fortified snacks.

Key words: Cake, Functional properties, Proximate analysis, Quinoa flour,Sensory evaluation, Wheat flour.

INTRODUCTION

Cakes are quick food items that are sweet and frequently baked. They are typically made from a variety of ingredients, with wheat flour, sugar, water, shortening, baking powder and eggs serving as the main ones (Cauda *et al.,* 2013). The cereal and key ingredient wheat is farmed all throughout the world, but it is imported into nations with adverse climatic conditions. Bodyfelt (2001) asserts that cakes made solely from wheat flour lack the necessary protein for cellular growth, tissue repair and growth.

Consumers are, nonetheless, gravitating more and more toward functional food items (Ofoedu *et al.,* 2021 and Ofoedum, *et al.,* 2023). This has had a big impact on the use of composite flours, which replace some of the wheat flour used in cake making with flours containing high protein seeds. In the search for a wheat alternative, flour with superior nutritional qualities to wheat would be greatly desired, especially in underdeveloped nations where hunger is pervasive (Murphey, 2015).

In order to produce products that are superior to the sum of their separate parts, composite flour is a combination of flours made from roots, tubers, cereals and legumes (Murphey, 2015). Legume flours are added to improve cereal flour, which is low in lysine but high in sulfur-containing amino acids. Cereal flour is also added to boost the nutritional value of roots and tubers, which are low in protein (FAO, 2021). Legumes and cereals are both excellent sources of protein and their amino acid profiles complement one another.

[1]Department of Food Science and Technology, School of Engineering and Engineering Technology, Federal University of Technology, Owerri, PMB 1526, Imo State, Nigeria.

Corresponding Author: A.F. Ofoedum, Department of Food Science and Technology, School of Engineering and Engineering Technology, Federal University of Technology, Owerri, PMB 1526, Imo State, Nigeria. Email: ofoedum.arizona.edu@gmail.com

How to cite this article: Olawuni, I.A., Uzoukwu, A.E., Ibeabuchi, J.C., Ofoedum, A.F., Nwakaudu, A.A., Alagbaoso, S.O., Anaeke, E.J. and Ugwoezuonu, J.N. (2023). Proximate, Functional and Sensory Analysis of Quinoa and Wheat Flour Composite Cake. Asian Journal of Dairy and Food Research. DOI: 10.18805/ajdfr.DRF-340

Submitted: 26-06-2023 **Accepted:** 25-10-2023 **Online:** 23-11-2023

Quinoa is a flowering plant in the amaranth family with the scientific name Chenopodium quinoa. It is an annual herbaceous plant cultivated largely for its palatable seeds. When used alone or together with other cereal grains, quinoa can help build dietary protein balance since it is a gluten-free whole grain carbohydrate and a whole protein, meaning it includes all nine essential amino acids (Murphey, 2015). The Incas once referred to the pseudo-cereal from the Andes as the “mother of all grains,” or quinoa. In particular, it is a tetraploid and halophytic crop that is an herbaceous plant. The quinoa species is diocotyledonous belonging to the Chenopodium genus and Chenopodiaceae family (Tanwar *et al.,* 2019). The Andes region of South America has been cultivating quinoa since 3000 BC to 5000 BC (Nwokenkwo, *et al.,* 2020). Quinoa was revered as a sacred grain throughout the Inca civilization's history. But during the Spanish colonial era, quinoa's function changed. In urban areas, quinoa production, use and consumption began to decline, although quinoa farming on communal grounds (known as "aynokas") continued. Depending on where these "aynokas" were located, this resulted in the formation of several quinoa types. Both the nutritional profiles and the aesthetic elements of these various types vary (Alarcon, 2017). Due to its high concentration of health-promoting phytochemicals such vital amino acids, fiber, polyunsaturated fatty acids, vitamins, minerals, saponins and phytoserols, among others, quinoa is currently gaining more and more attention (Murphy *et al.,* 2015).

However, the price of obtaining quinoa seeds is a significant issue in the production of quinoa and wheat flour composite cakes. This is because quinoa is underutilized in the country due to ignorance and lack of awareness of the nutritious and health benefits of quinoa; as a result, it was not available in nearly all local markets in the eastern part of the country and had to be bought from Jumia Nigeria at a high price. Producing quinoa and wheat composite flour composite cakes and assessing the near-term acceptability, functional acceptability and sensory acceptability of baked cake samples are the primary goals of this study.

The requirement to use quinoa protein for the creation of composite cake serves as justification for the study. The findings of this study will increase public awareness of the quinoa's nutritional value and health advantages, which will promote widespread use of quinoa-rich foods like cake. By using this protein source, which has low sugar levels and is gluten-free, you can boost the nutritional value for older individuals and those with dietary disorders. It can also use to help people who have food intolerances.

MATERIALS AND METHODS

Quinoa seeds used for this study were purchased from Jumia Nigeria as the seed is scarce to find around with its high cost. Wheat flour, baking powder, eggs, salt and other optional ingredients used in the cake making were purchased at Eziobodo market in Owerri. Chemicals (analytical grades) and other equipment used for the analysis were procured at the laboratory of Department of Food Science and Technology, Federal University of Technology, Owerri, Imo State.

Place and period of research

The research was carried out in the Department of Food Science and Technology Laboratory, Federal University of Technology, Owerri, Imo state Nigeria. The work was stated on September, 2022 and completed on May, 2023.

Ingredients

Wheat flour, quinoa seeds, baking powder, salt, sugar, water, Eggs, butter, nutmeg powder and milk flavor.

Equipment used

Measuring scale, bowls, grater, sieve, oven, mixer, blender, bowls, spoon, egg whisker, tray pans, baking pans (tins), cupcakes wrap.

Sample preparations

Processing of quinoa seeds into flour

Method described by Nwokenkwo *et al.* (2020) was adopted. The quinoa seeds was thoroughly rinsed with clean water after being sifted to remove foreign objects and damaged seeds. After draining the water, the quinoa seeds were sprinkled on a metal pan and heated to $185^{o}C$ for 45 minutes to dry/roast them. After roasting, the seeds were ground into powder using a blender and put through a 177-mesh sieve to create uniformly sized flour. The flow chart is shown in Fig 1.

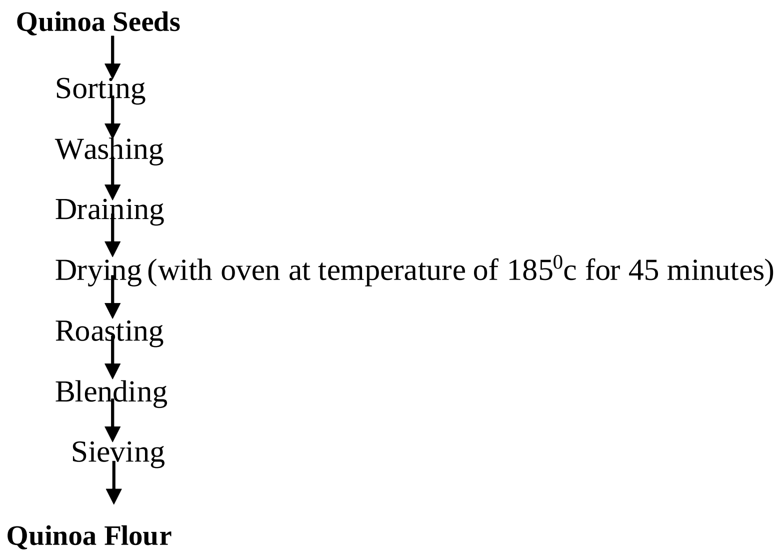

Fig 1: Flow chart for the productions of quinoa flour.

Preparation of the cake

This preparation followed the Olawuni *et al.* (2019) method with a few minor modifications. However, the cakes were made by combining wheat flour and quinoa flour at three distinct amounts or proportions (30, 40 and 50%) that were designated as A, B and C. The dry components were combined in a bowl with another bowel (flour, salt, whole milk powder, nutmeg powder, baking powder). The intended fat was continually beaten or stirred until it was smooth and light and then the granulated sugar was combined and agitated with the intended fat. The eggs were properly whipped up till fluffy. At regular intervals, the combined dry ingredients and whisked eggs were incorporated into the beaten fat and sugar and swirled clockwise as the fat and sugar until a dropping consistency was achieved. A tidy toothpick was used to check for doneness in the center after the batter had been spooned into the baking tins. The poked came out neatly indicating doneness. The cupcakes were allowed to cool for two hours at room temperature before being wrapped. The production step is given in Fig 2.

Proximate composition of cake

For the proximate analysis of fat, ash, crude fiber, crude protein and moisture content, the protocols given by the association of official analytical chemists (AOAC., 2006) were followed in determining all the parameters.

Functional properties of the quinoa flour

The different functional properties determined in this work were done according to a method described by AOAC, (2006). The parameters analyzed include the following: Bulk density, Wetness, Fluidity, Foam capacity and Stability, Emulsion capacity, Water/Oil absorption capacity and swelling index.

Sensory evaluation

The panelists were twenty semi-trained cake consumers (10 males and 10 females). Flavor, taste, appearance, texture, mouth feel and general acceptability were tested on a 9-point hedonic scale (Alagbaoso, *et al.,* 2019).

Statistical evaluation

The generated data was subjected to one way ANOVA using Microsoft Excel 2007 software and means were separated using Fisher's least significant difference (LSD) at P>0.05.

RESULTS AND DISCUSSION

Proximate composition of cake samples

Moisture content

Moisture content was found to increase as the incorporation of the quinoa composite increased. It ranged from 33.61% (sample A) to 43.99% (Sample C). Wheat starch flour (control) had the least moisture content of 29.5% which conveys quinoa starch granules have higher rate of absorption capacity when compared to wheat starch flour (Ahamed, 2000). Low moisture content is known to improve the storage stability and higher keeping quality. By implication sample C might not have a long shelf life.

Ash content

The ash content of flour indicates its mineral content (Cauda, *et al.,* 2013). The ash content of the cake samples increased significantly from 0.89% to 1.21% (See Table 1). There was no significant difference (pe”0.05) between samples A, B

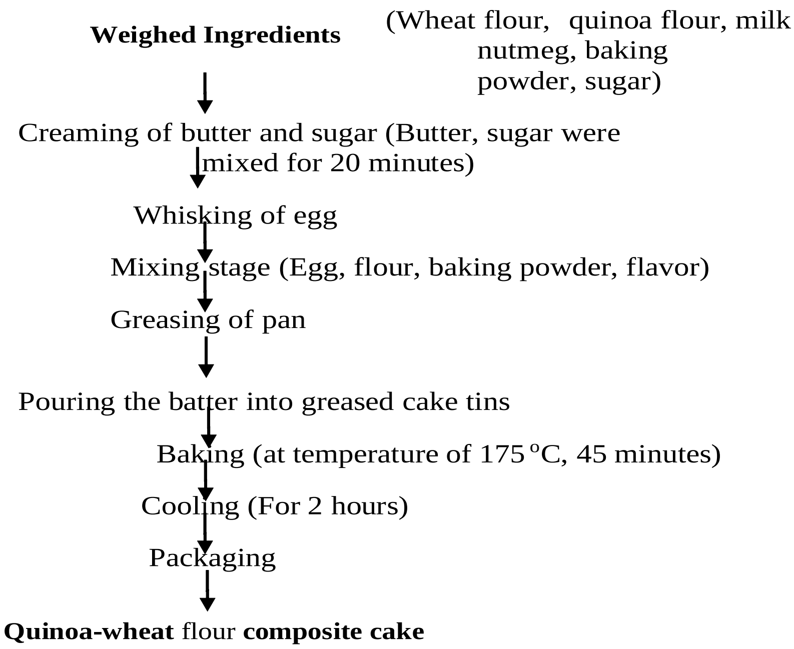

Fig 2: Flow chart for the production of quinoa wheat flour composite cake.

and C, with sample C having the highest ash content. The ash content of the supplemented cake samples increased as the level of substitution of quinoa flour increased, compared to 0.89% for the control. The high ash content of sample C indicated that the sample contained more minerals, which represented the total mineral contents in food, making it an important tool for nutrient evaluation.

Protein content

Table 1 shows that the protein content of the samples differed significantly (p<0.05) from one another, ranging from 13.5 to 18.02 mean score. The wheat flour cake (control) had the lowest value of 13.40 and the sample with 50% quinoa substitution had the highest (sample C). Because of the rich essential amino acids present in quinoa, as well as the highly nutritive and easily digestible albumins and globulins protein, the protein content of the cake samples increased as the amino flour content increased which was also stated by Odimegwu *et al.* (2020). Sample C's high protein content suggests that it has the potential to alleviate chronic protein syndromes, which are common in developing countries such as Nigeria.

The fiber content

The fibre content of the cake samples increased from 5.25% to 5.77% from A to C, with sample C having the highest fibre content of 5.77%, which could be attributed to an increase in quinoa flour incorporation in the cake sample. As a result of the amount of indigestible starch in the wheat, Sample D (control) had the lowest fibre content. The high fiber content of the flour samples indicates that quinoa is high in fiber and can be used to make high fiber snacks for people with indigestion or food intolerance diseases (Abugoch *et al.,* 2009).

Fat content

Fat is the level of substitution increased fat content increased significantly (p<0.05) from 5.54 to 6.25, as the sample with 50% quinoa substitution (sample C) had the highest fat content of 6.25 due to quinoa flour's higher lipid content. Because there was a significant difference (p<0.05) between sample D and the other samples, the wheat flour cake (sample D) had the lowest fat content of 5.04.

Carbohydrate composition

The carbohydrate content decreased from 39.81% (sample A) to 30.59% (samples B and C). This decrease with increasing quinoa substitution may be due to differences in the quantitative distribution of protein fraction and physiochemical properties of wheat flour and quinoa flour. The nitrogen-free extract (NFE), also known as the carbohydrate content of the wheat flour cake sample, was found to be 40.86%, which was higher than that of the quinoa composite cake samples.

Sensory analysis

Sensory evaluation is an important parameter for determining the quality of quinoa cake in order to meet consumer expectations. The results are based on a 9-point hedonic scale that measures sensory characteristics of cake such as color, taste, flavor, texture, mouth feel and overall product acceptability. The mean score is shown in Table 2.

Colour

The mean score for cake color increased with 30% quinoa substitution and then decreased with 40% and 50% quinoa substitution. The highest mean score was recorded for sample

Table 1: Proximate composition of quinoa and wheat flour composite cake.

Sample	Moisture	Ash	Fibre	Protein	Fat	Carbohydrate
A	33.61^c±0.00	0.91^c±0.00	5.25^c±0.00	13.59^c±0.01	5.54^a± 0.50	39.81^b±0.00
B	35.13^b±0.00	0.97^b±0.00	5.52^b±0.02	14.19^b±0.00	6.03^b±0.02	38.76^c±0.00
C	43.99^a±0.00	1.21^a±0.00	5.77^a±0.02	18.02^a±0.01	6.25^d±0.02	30.59^d±0.00
D	29.95^d±0.00	0.89^c±0.00	4.82^d±0.02	13.40^d±0.01	5.04^c±0.51	40.86^a±0.00
LSD	0.00	0.00	0.00	0.00	0.00	0.00

Values are means ±SD of Duplicate determinations. Means with the same superscripts along a column are not significantly (Pd"0.05) different.

Table 2: Sensory properties of quinoa and wheat flour composite cake.

Sample	Colour	Taste	Flavour	Mouthfeel	Texture	General acceptability
A	7.55^a±1.42	7.50^a±1.92	7.20^a±1.74	6.75^b±0.89	6.85^a±1.42	7.45^a±1.46
B	5.45^b±1.31	5.20^b±1.22	5.90^b±1.07	5.15^c±1.91	5.25^b±0.85	5.75^b±1.73
C	5.00^c±1.14	4.95^b±1.54	5.00^c±1.23	5.05^c±1.71	4.35^c±0.91	5.40^c±1.51
D	6.80^b±1.66	7.20^a±1.92	7.15^a±1.20	7.60^a±1.24	7.20^a±1.31	7.35^a±1.40
LSD	0.34	0.37	0.36	0.38	0.36	0.26

Values are means ±SD of Duplicate determinations. Means with the same superscripts along same column are not significantly (Pd"0.05) different.

Keys: A = Cake containing 30% quinoa flour and 70% wheat flour. B = Cake containing 40% quinoa flour and 60% wheat flour. C = Cake containing 50% quinoa flour and 50% wheat flour. D = cake containing 100% wheat flour (control). LSD **=** Least Significant Difference

Table 3: Functional properties of quinoa flour.

Sample	BD	OAC(g/cm^3)	WAC(%)	SI(%)	GT(°C)	BT(°C)	FC(cm^3)	FS(Secs)
	0.714	2.19	3.10	2.00	85.00	94.00	6.00	1.00

Keys: BD= Bulk density, SI= Swelling index, GT= Gelation temperature, BT= Boiling temperature, FC= Foam capacity, FS= Foam stability at 30 minutes, OAC= Oil absorption capacity, WAC= Water absorption capacity.

A, a 30% quinoa flour composite cake, followed by sample D, a wheat flour cake (control), then 40% and 50% quinoa composite cakes, samples B and C, respectively. The slight increase in color was preferred in the 30%quinoa composite cake because the presence of quinoa changed the color to a richer slight brown color but was undesirable darker when 40% and 50% quinoa flour was added, causing the increase to drop. A small amount of quinoa was found to improve the color and appearance of baked goods as the sugar caramelizes, resulting in the dark brown color of the cake samples (Odimegwu *et al.,* 2020 and Alagbaoso *et al.,* 2019).

Taste

The flavor of the cake was also impacted by the composition of the various quinoa quantities. When compared to the control sample D, samples B and C were considerably ($p<0.05$) different, however samples A and the control sample did not differ significantly ($p<0.05$) for the taste. The highest acceptance mean score, 7.50, was obtained by Sample A. the flavor of the quinoa flour, which was subtly combined with flour to create a delicious cake, may have contributed to this.

Flavor

The flavor difference was statistically significant. As quinoa flour substitution increased, the mean flavor score dropped from 7.20 to 5.00. This was because the 40% and 50% quinoa flour samples dominated the neutral flavor produced by the 30% quinoa flour sample, giving the samples (B and C) a thick nutty flavor. The sample with the highest level of flavor acceptability is sample A (30% quinoa flour), which results from a slight increase in flavor acceptability that has an impact on the already-known flavor of the cake (Johnson and Vickers, 2003). Sample A is followed by the control sample and there is no statistically significant difference ($p>0.05$) between samples A and D. (control). Samples B and C both scored 5.90 and 5.00 respectively.

Texture

The cake samples with 30% quinoa flour had the best texture. The effect could be attributed to the incorporation of quinoa flour, which reduces the formation of the gluten network, which fails to retain vapour produced; thus, the symmetry of the cake decreased linearly with increasing quinoa flour concentration. The control sample received the highest textural cake score (7.20), followed by sample A (6.85), as there was no significant difference ($p> 0.05$) between the two samples. Sample C has the lowest acceptability due to the increased incorporation of quinoa flour, which has a negative effect on the cake's textural status (Frye and Setser, 2002).

Mouth feel

The cake samples' mouth feel decreased from 6.75 for sample A to 5.05 for sample C. This was due to the cake's increased incorporation of quinoa flour. The control sample has the best mouth feel, as it differs significantly (p 0.5) from samples B and C but not significantly ($p>0.05$) from sample A (30% quinoa sample cake).

General acceptability

The overall acceptability expresses how the panelists view the product in general. Though the mean scores of samples A and D are quite close, with sample (30% quinoa flour cake) being slightly higher than sample D. (control). Since sample D was ranked as the best in terms of all sensory parameters, it appears that consumers are more likely to accept cake made from a two-component flour of 30% quinoa flour and 70% wheat flour than only wheat flour.

Functional properties of the quinoa flour

Table 3 showed the results of the functional properties of quinoa flour. These functional properties define the needs of the consumers and determine the suitability of the raw material (quinoa flour) for a specific purpose. The functional parameters of quinoa flour are as follows: bulk density of 0.7143, swelling index of 2%, gelation temperature of 85°C, boiling temperature of 94°C, foam capacity of 6 cm^3, foam stability at 30 minutes of 1, oil absorption capacity of 2.19g/cm^3, water absorption capacity of 3.10%. Quinoa flour could not be used for composite cake making due to its functional properties**.**

CONCLUSION

The study was intended to produce cake from quinoa and wheat composite flour. The study found that the total nutritive components, particularly protein, increased with increased quinoa flour incorporation. It was determined that fortification with quinoa flour can improve the protein quality of foods. However, the cake with 30% quinoa flour and 70% wheat flour was more widely accepted than the other cake samples, including the wheat flour cake sample. This revealed that the functionalities that make up the raw material can influence the overall acceptability of food. As a result, quinoa is gluten-free, indicating that the rate of food allergies in wheat flour for people allergic to gluten, celiac disease and intolerances can be reduced by including quinoa in the diet.

RECOMMENDATION

People suffering from indigestion, food intolerances and protein deficiency diseases are advised to consume more foods fortified with quinoa, as this will help to solve such problems and protein deficiencies. Furthermore, for proper growth, development and overall body metabolism, children should consume foods fortified with protein sources such as quinoa, which are high in protein, dietary fiber and essential minerals.

Contributions of the authors

All authors worked together to complete this project. The study was conceptualized and designed by authors I.A. Olawuni and A.E. Uzoukwu Authors A.F. Ofoedum, S.O. Alagbaoso and A.A. Nwakaudu wrote the Protocols and the first draft of the manuscript, as well as the statistical analysis and data interpretation. Authors J.C. Ibeabuchi, E.J. Anaeke and J.N. Ugwoezuonu conducted the literature searches, assisted in data collection and oversaw the study's analyses. The final manuscript was read and approved by all the authors.

Concurrent interest

The authors have declared that they have no competing interests and the article has not been published in any other journal and no external funding source.

REFERENCES

Abugoch, L., Castro, E., Tapia, C., Añon, M.C., Gajardo, P., Villaroel, A., (2009). Stability of quinoa flour proteins *(Chenopodium quinoa Willd.)* during storage. International Journal of Food Science and Technology. 3(2): 44.

Ahamed, N.T., Singhal, R.S., Kulkami, P.R., Palb, M., (2000). Physicochemical and functional properties of *Chenopodium quinoa* starch. International Journal of Carbohydrate Polymers. 31: 99-103.

Alagbaoso, S.O., Olawuni, I.A., Ibeabuchi, J.C., Ofoedum, A.F. and Onyeneke, E.N. (2019). Functional and sensory properties of biscuit produced from peanut butter substituted with shortening. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402, p- ISSN: 2319-2399. 13(10): Ser II 34-43 www.iosrjournals.org DOI: 10.9790/2402-1310023443.

Alarcon, M., Santos, C., Cevallos, M., Eyzaguirre, R., Ponce, S. (2017). Study of the mechanical and energetic properties of pellets produce from agricultural biomass of quinoa, beans, oat, cattail and wheat. Waste Biomass Valorization. 8: 2881-2888.

AOAC (Association of Official Analytical Chemists) (2006). "Official Methods of Analysis. 5ed. (Gaithersborg.s.edn.). AOAC Press. Washington DC. USA. Pp. 78 - 90.

Bodyfelt, F.W. (2001). Dairy product score cards: are they consistent with principles of sensory evaluation. J. Dairy Sci. 64: 2303-2308.

Cauda, C., Micheletti, C., Minerdo, B., Scaffidi, C., Signoroni, E. (2013). Quinoa in the Kitchen; Slow Food Editore: Bra, Italy; ISBN 9788884993397, 2-6.

FAO (2011). Dietary Protein Quality Evaluation in Human Nutrition Report of an FAO Expert Consultation. Available online: http://www.fao.org/3/a-i3124e.pdf (accessed on 24 July 2021).

Frye, A.M. and Setser, C.S. (2002) Optimizing texture of reduced-calorie yellow layer cakes, Cereal Chem. 69: 338-343.

Johnson, J. and Vickers, Z. (2003) Avoiding the centering bias or range effect when determining an optimum level of sweetness in lemonade. J. Sensory Stud. 2: 283-292.

Murphy, K.S., Matanguihan, J. (2015). Quinoa: Improvement and Sustainable Production. John Wiley and Sons. ISBN 978-1-118-62805-8.

Nwokenkwo, E.C., Nwosu, J.N., Onuegbu, N.C., Olawuni, I.A. and Ofoedum, A.F. (2020). Evaluation of the Antinutrients, Amino Acid Profile and Physicochemical Properties of *Hura crepitan* Seed. Archives of Current Research International 20(5): 1-17, Article no. ACRI.55249.

Odimegwu, E.N., Akajiaku, L.O., Umelo, M.C., Ezeamaku, U.L., Ofoedum, A.F and Akujobi, C.A. (2020). Investigation on the Effectiveness of Palm Ash Infusion and Water Soaking For the Reduction of Beany Flavor in Bambara Groundnut *(Vigna Subterranea)* Flour for Cake Production. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402,p-ISSN: 2319-2399. 14(2): Ser. III, 01-10 www.iosrjournals.org DOI: 10.9790/2402-1402030110 www.iosrjournals.org

Ofoedu, C.E., Iwouno, J.O., Ofoedu E.O., Ogueke, C.C., Igwe V.S., Agunwah, I.M., Ofoedum, A.F., Chacha, J.S., Muobike, O.P., Agunbiade, A.O., Njoku, N.E, Nwakaudu, A.A., Odimegwu, N.E., Ndukauba, O.E, Ogbonna, C.U., Naibaho, J., Korus M., Okpala, C.O.R., (2021). Revisiting food-sourced vitamins for consumer diet and health needs: a perspective review, from vitamin classification, metabolic functions, absorption, utilization, to balancing nutritional requirements. PeerJ 9:e11940 DOI 10.7717/peerj.11940.

Ofoedum, A.F., Owuamanam, C.I., Ndukauba, O.E., Iroagba, L.N., Ugwoezuonu J.N., Abbah, E.C. and Anaeke, J.E. (2023). Phytochemicals from Selected Tropical Spices and Agro-Food Wastes. Utilization and Applications in Health Sectors: A Review. European Journal of Theoretical and Applied Sciences. 1(5): 1-5. DOI: 10.59324/ejtas.2023:1(5).xx

Olawuni, I.A, Uzoukwu, A.E., Agunwah, I.M., Ofoedum, A.F. and Onyeneke, E.N. (2019). Incorporation of Peanut Butter as Substitute for Shortening in Biscuit Production. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402,p- ISSN: 2319-2399. 13(10): Ser. I, 62-69.

Tanwar, B., Goyal, A., Irshaan, S., Kumar, V., Sihag, M.K., Patel, A., Kaur, I. (2019). Quinoa. In: Whole Grains and Their Bioactives; John Wiley and Sons, Ltd.: Chichester, UK, pp. 269-305. ISBN 9781119129486.