Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.33, 2014

Effect of Drying on the Physicochemical Properties of Ready-To-Cook Ogbono Mix (*Irvingia gabonensis*)

Eunice Moriyike Ogunbusola[1*], Stephen Olanrewaju Arinola[2] and Habibat A. Adubiaro.[3]
[1]Department of Food Science and Technology, Federal University Oye – Ekiti, Nigeria.
[2]Department of Food Technology, Federal Polytechnic, Ado – Ekiti, Nigeria.
[3]Department of Industrial Chemistry, Federal University Oye – Ekiti, Nigeria.
*E-mail: riikebusola@yahoo.com

Abstract
Ogbono (*Irvingia gabonensis*) seeds were dried in the laboratory using different drying methods. Ready – to – cook *Irvingia gabonensis* mixes were prepared by mixing with dried crayfish, stockfish, pepper, bitter leaf andlocal spices. The physicochemical and sensory properties of ready – to – cook *Irvingia gabonensis* mixes were evaluated. The proximate composition (g/100g sample) of the mixes revealed protein; 7.17, 7.51, 7.28 and 7.32; ash 0.6, 0.8, 0.6, and 0.9; carbohydrate 3.47, 3.46, 3.49 and 3.47; crude fibre 2.5, 2.0, 2.6 and 2.4; moisture content 6.0, 6.0, 7.5 and 8.0; and fat 71.14, 70.95, 71.09 and 71.12 for tray dried, oven dried, sun dried and fresh mixes respectively. The functional properties showed that the oven dried mixes was significantly higher in water absorption capacity (675% g/g) than fresh and other dried mixes. The sensory evaluation conducted on cooked mixes revealed that tray dried *Irvingia gabonensis* mix was significantly ($P \leq 0.05$) superior in drawability and overall acceptability to other dried and fresh mixes. Tray drying at 60^0C is recommended for drying *Irvingia gabonensis* seeds to produce ready – to – cook mix.
Keywords: *Irvingia gabonensis*, Physicochemical, sensory properties, ready-to-cook oghono.

1. Introduction

Ogbono (*Irvingia gabonensis*) is a commercial and indigenous fruit tree of West and central Africa which has been identified as the most important tree for domestication (Nangue et al., 2011; Dienagha and Miebi, 2011). Ogbono fruits, commonly called African mango or wild mango is an indigenous forest tree belonging to the group of plants classified as non timber forest products. The seeds constitute very important soup condiment used in thickening and flavouring soups in Nigeria. Its high nutritional and socio-economic potential makes it stand-out amongst other food crops in Nigeria.

Fresh ogbono seeds have relatively high moisture content (about 65% moisture) and high fat content (Ezeanya et al., 2012), which easily enhance mould growth and thus there is need for proper drying before storage. Being a seasonal crop, storage is inevitable, drying therefore enhance storage and ensures their availability during off season. Improper drying favours mould growth on the seeds, high relative humidity of tropical environment contribute to greater fungal growth and thus lowers storability of the seeds of *irvingia gabonensis*. Aboloma and Ogunbusola (2012) isolated fungi of the group micromycetes from seeds of *irvingia gabonensis.*Drying and preservation of ogbono seeds are traditionally achieved in many parts of Nigeria through sun drying and drying over heat from the fire place in the kitchen. These traditional methods produce low quality products, they are time consuming and the products are easily exposed to the attack of rodents, insects and dust. Apart from the traditional methods of drying, many researchers have used various mechanical device to dry ogbono seeds (Ezeanya et al., 2012; Akusu and Kiin-Kabari, 2013; Awolu and Oluwafemi 2013). Previous work on *irvingia gabonensis* have focused on enhancing the storability of dried ogbono seed and to the best of our knowledge no work has been reported on ogbono mixed with other ingredients (ready-to-cookogbono mix). Packaging ogbono mixed with other ingredients will further enhance the exploitation of ogbono and facilitate wider distribution especially to other countries. Study on the functionality of dried ogbono mix is thus inevitable. This work is therefore aimed at investigating the effects of different drying methods on the functional and sensory properties of ready-to-cook ogbono mix.

2. MaterialsandMethods

2.1. Collection and Preparation of Samples.

Fresh ogbono seeds were purchased from Effurum market at Warri, Delta State Nigeria while other ingredients such as crayfish, stockfish, pepper, bitter leaf and fermented locust bean were purchased at Oja Oba market in Ado-Ekiti, Ekiti State, Nigeria. The ogbono seeds were divided into four portions; a portion was tray dried at

60^0C, a portion was oven dried at 60^0C, another portion was sun dried and the remaining portion was wrapped in polythene bag and kept in the freezer as control. The different dried ogbono was separately milled using a Brabender blender and mixed with equal portions of other ingredients (crayfish, stockfish, pepper, bitter leaf and fermented locust bean) to produce various batches of ready-to-cook ogbono mix. Table 1 shows the mixing proportion.

Table 1: Preparation of Ready-to-cook Ogbono mix

Ingredient	Amount (g)
Ogbono flour	50.00
Crayfish	20.00
Stockfish	20.00
Pepper	6.00
Bitter leaf	2.00
Locust bean	2.00

2.2. Determination of Proximate Composition

Ready-to-cook Ogbono mix batches were analyzed for their proximate composition (crude fat, total ash, moisture and crude fibre) according to the standard method of AOAC (2005). The Nitrogen content was determined as described by Kirk and Sawyer (1991) and the Nitrogen content was converted to protein by multiplying by 6.25. Carbohydrate was obtained by difference.

2.3. Determination of Functional Properties.

2.3.1. Water and oil absorption capacity: The WAC of Ready-to-cook Ogbono mix was determined using the procedure of Sathe et al. (1982). The OAC was determined by replacing the distilled water with Executive chef vegetable oil (Density, 0.92g/ml) obtained from Jof Ideal family farm, Owo, Ondo State. The water / oil absorbed in the seed flours were expressed in percentage g/g.

2.3.2. Bulk Density: The bulk density (g/ml) was determined according to the procedure of Narayana and Narasinga Rao (1984) using a 10ml graduated measuring cylinder.

2.3.3. Emulsion Capacity: The emulsion capacity was determined using the modified procedure of Beuchat (1977) as described by Fagbemi (1999). Two grams of Ready-to-cook Ogbono mix were dispersed in 40ml distilled water in a beaker using a magnetic stirrer (Armfield MM 2A) at 500rpm for 30 minutes. Ten millitres of executive chef vegetable oil were added over a period of 10 minutes with continuous stirring. The mixture was transferred into a calibrated centrifuge tube and water bathed at 85^0C for 15 minutes. The tubes were removed, cooled to 25^0C and centrifuged at 4500rpm until the volume of oil separated from the emulsion was constant. Results are expressed as the percentage volume of oil emulsified per gram of the flour used.

2.3.4. Least gelation concentration: The LGC of Ready-to-cook Ogbono mixwas determined using the method of Coffman and Garcia (1977) with slight modification. Sample suspensions of 2-20%m/v were prepared in 5ml distilled water. The test tube containing there suspensions were then heated for one hour in a boiling water bath followed by rapid cooling under running cold water and further cooling at 4^0C for 2 hours. The LGC was determined as the concentration when the sample from the inverted test tube did not slip or fall.

2.4. Preparation of Ogbono soup

Ogbono soup is prepared by adding red palm oil into cooking pot, heat is applied to the oil for about two minutes, onion is then added and water is added and allowed to boil for 3minutes. Ready-to-cook Ogbono mix is then added with continuous stirring to facilitate thorough mixing. The mixture is allowed to boil for 15minutes, maggi and salt is then added to taste and boiled for additional 5minutes.

2.5. Sensory evaluation of Ogbono soup

A twenty-man member panelist (semi trained) consisting of staff and students of Federal Polytechnic, Ado-Ekiti, Nigeria was selected based on experience and familiarity with ogbono soup for sensory evaluation of taste,

aroma, drawability and the overall acceptability using on a 9-point Hedonic scale (Iwe, 2002) from like extremely to dislike extremely.

2.6. Statistical analysis

Determinations were carried out in triplicates, errors were recorded as standard deviation from the mean. Data were subjected to analysis of variance using SPSS 15 computer programme, while means were separated using Duncan multiple range test. Significance was accepted at 5% level of probability.

3. Results and Discussion

Table 2 depicts the proximate composition of ready-to-cook Ogbono (*Irvingia gabonensis*) mixes obtained by different drying methods. The moisture content ranged from 6.00 to 8.00g/100g sample in tray dried and raw ogbono mixes respectively. It was observed that there was no significant difference in the moisture content of tray dried and oven dried mixes, however they were significantly lower than both sun dried and raw ogbono mixes. The range in values of the moisture content was higher than the range of values from 2.49 to 3.48% and 2.55 to 6.41% moisture reported for raw and defatted ogbono flour (Ogungbenle, 2014 and Ogunsina et al., 2012 respectively). The crude protein, crude fat and ash content of ready-to-cook ogbono mixes ranged from 7.17 to 7.51g/100g; 70.95 to 71.14g/100g and 0.60 to 0.90g/100g respectively. This shows that ready-to-cook ogbono mix is a rich source of edible fat. The range of value of fat content of ogbono mixes compared favourably with 68.4g/100g and 65.46% fat reported for ogbono flour (Ogunsina et al., 2012 and Onimawo et al., 2003). The range is however higher than 54.7% fat reported for African mango (*Irvingia gabonensis*) flour (Ogungbenle, 2014). The variation may be due to the effect of other ingredients added to ready-to-cook ogbono mixes.

Table 2: Proximate composition of Ready-to-cook Ogbono mix (g/100g)

Composition	Tray dried mix	Oven dried mix	Sun dried mix	Raw mix
Moisture content	$6.00\pm0.20_{b}$	$6.00\pm0.20_{b}$	$7.50\pm0.30_{a}$	$8.00\pm0.40_{a}$
Fat	$71.14\pm2.10_{a}$	$70.95\pm2.10_{a}$	$71.09\pm2.10_{a}$	$71.12\pm2.20_{ca}$
Protein	$7.32\pm0.02_{b}$	$7.51\pm0.10_{a}$	$7.28\pm0.06_{ab}$	$7.17\pm0.05_{c}$
Crude fibre	$2.50\pm0.04_{a}$	$2.00\pm0.04_{b}$	$2.60\pm0.06_{a}$	$2.40\pm0.04_{a}$
Ash	$0.60\pm0.05_{a}$	$0.80\pm0.04_{a}$	$0.60\pm0.06_{a}$	$0.90\pm0.05_{a}$
Carbohydrate	$3.47\pm0.40_{a}$	$3.46\pm0.20_{a}$	$3.49\pm0.50_{a}$	$3.47\pm0.20_{a}$

Values with different subscript on the same row are significant ($P \leq 0.05$)

Table 3 shows the result of the functional properties of ready-to-cook ogbono mixes. The water capacity of the mixes ranged from 450.00 to 675.00%g/g in raw and oven dried mixes respectively while the oil absorption capacity ranged from 244.00 to 312.00%g/g. These range of values were higher than 241 and 249% and 188 and 149% water and oil absorption capacities reported for raw and defatted African mango (*Irvingia gabonensis*) seeds (Ogungbenle, 2014). Oil absorption capacity of the mixes however compared favourably with the range 281-321% for cowpea flour (Olaofe et al., 1993) and 256% for African nutmeg (Ogungbenle and Adu, 2012). Water/oil absorption capacities have been very useful in food system such as soups, gravies and dough. Drying significantly enhanced the water absorption capacity, this may be due to reduction in moisture content which influences the hydrophilic activities of the dried ogbono mixes. Ogbono seed flours may be useful as thickener and binder in food system. The least gelation concentration of ogbono mixes ranged from 6.00 to 8.00%ml/g, this range is lower than 14%w/v reported by Ogungbenle (2014) for African mango seeds. The low gelation concentration of ogbono mixes shows that they may find use in production of curd or as an ingredient in food applications involving gel formation.

Table 3: Functional Properties of Ready-to-cook Ogbono mix

Functional properties	Tray dried mix	Oven dried mix	Sun dried mix	Raw mix
Water absoption capacity (%g/g)	$525.00\pm5.00_b$	$675.00\pm5.00_a$	$525.00\pm5.00_b$	$450.00\pm10.0_c$
Oil absoption capacity (%g/g)	$253.00\pm3.00_b$	$244.00\pm4.0_c$	$312.00\pm4.00_a$	$253.00\pm5.00_b$
Bulk density (g/ml)	$0.58\pm0.02_b$	$0.56\pm0.02_b$	$0.61\pm0.01_a$	$0.62\pm0.02_a$
Emulsion capacity(%ml/g)	$242.00\pm4.00_a$	$237.00\pm3.00_a$	$237.00\pm3.00_a$	$242.00\pm4.00_a$
Least gelation concentration (%g/ml)	$8.00\pm2.00_a$	$6.00\pm2.00_a$	$8.00\pm2.00_a$	$8.00\pm2.00_a$

Values with different subscript on the same row are significant ($P \leq 0.05$)

Table 4 shows the sensory evaluation of ready-to-cook ogbono mixes soup obtained by different drying methods. There was no significant difference in the taste and aroma of all the ogbono mixes soup. However, tray dried ogbono mix soup was significantly superior in drawability and overall acceptability to raw and sun dried mixes.

Table 4: Sensory evaluation of Ready-to-cook Ogbono soup

Sensory properties	Tray dried mix	Oven dried mix	Sun dried mix	Raw mix
Taste	$8.00\pm0.94_a$	$7.40\pm1.17_a$	$8.10\pm0.88_a$	$6.90\pm1.91_a$
Aroma	$8.20\pm0.63_a$	$7.60\pm1.43_a$	$8.10\pm0.99_a$	$7.40\pm1.35_a$
Drawability	$8.00\pm1.05_a$	$6.80\pm1.32_b$	$7.10\pm0.95_b$	$6.80\pm0.92_b$
Overall acceptability	$8.50\pm0.71_a$	$7.50\pm0.99_b$	$7.40\pm1.16_b$	$7.40\pm1.17_b$

Values with different subscript on the same row are significant ($P \leq 0.05$)

4. Conclusion

Drying methods significantly influenced the properties of ready-to-cook ogbono mixes.Drying enhanced the water and oil absorption capacities and least gelation concentration of ogbono mixes. Tray dried ogbono mix is better in drawability to other dried and raw mixes. Drying using Tray dryer may enhance the functional and sensory properties of ready-to-cook ogbono mix and thus promotes food distribution and security.

References

AOAC (2005).Official method of analysis of Association of Official analytical Chemist; 18th Ed. Washington D. C.

Kirk, R.S. and Sawyer, R. (1991).Pearson's composition and Analysis of foods.9th ed. Longman Sc. and Technical.

Fagbemi, T.N. (1999). Effect of blanching and ripening on functional properties of plantain *(Musa aab)* Beuchat, L. R. (1977).Functional and eletrophoretic characteristic of succinylated peanut flour.*J. Agric Food Chem.* 25:258 – 261

Beuchat, L. R. (1977). Functional and eletrophoretic characteristic of succinylated peanut flour.*J. Agric Food Chem*. 25:258 – 261

Narayana, K. and Narasinga Rao, M. S. (1984). Functional properties of raw and heat processed winged bean (*Psophocarpus tetragonolobus*) flour. *J. Food Sci*. 40: 1534 – 1538.

Olaofe, O., Umar, Y. O. and Adediran, G.O. (1993).The effect of nematicides on the nutritive and functional properties of some oil seeds. *J. Agric. Food. Chem*. 42: 878 – 881

Sathe, S.K., Desphande, S.S. and Salunkhe, D.K. (1982). Functional properties of Lupin seed (*Lupinus mutabilis*) proteins and protein concentrates. *J. Food Sci.* 47:491-497.

Awolu, O. O. and Oluwafemi, B. A. (2013).Effect of moisture content on the mechanical properties of Dika (*Irvingia gabonensis*) fruit and nut. British J. Appl. Sci. Technol. 3(4):1569-1577.

Nangue, T. J., Womeni, H. M., Biapo, F. T., Fanni, J. and Michel, L. (2011). *Irvingia gabonensis* fat: Nutritional properties and effect of increasing amounts on the growth and lipid metabolism of young ratswistar sp. Lipids in Health and Disease. 10:43. Doi:10.1186/1476-511X-10-43.

Dienagha, A.R.S. and Miebi, T. O. (2011).Energy requirements for crakingDika (Ogbono) nuts (*Irvingia gabonensis*). European J. Scientific Res. 59(2):208-215

Ogunsina, B. S., Bhatnagar, A. S., Indira, T. N. and Radha C. (2012).The proximate composition of African Bush Mango kernels (*Irvingia gabonensis*) and characteristics of its oil. Ife J. Sci. 14(1):177-183

Onimawo, I. A., Oteno, F., Orokpo, G. and Akubor, P. (2003).Physicochemical and nutrient evaluation of African bush mango (*Irvingia gabonensis*) seeds and pulp.Plant Food for Human Nutri. 58:1-6

Ogungbenle, H. N. and Adu, T. (2012). Proximate composition and functional properties of dehulled African Nutmeg. Pak. J. Sci. Industrial Res. 55:80-85

Coffman, C. and Garcia, V. V. (1977). Functional Properties of Protein isolate from mungbean flour. J. Food Technol. 12:437-484

Ogungbenle, H. N. (2014). Chemical and amino acid composition of Raw and Defatted African Mango (*Irvingia gabonensis*) kernel. British Biotech. J. 4(3):244-253

Ezeanya, N. C., Nwaigwe, K. N. and Ugumoke, P. E. (2012).Analysis of the effect of a flat plate solar dryer geometry on drying rate of Agricultural seeds. Asian J. Agric Sci. 4(5):333-336

Aboloma, R. I. and Ogunbusola, E. M. (2012). Fungi associated with *Irvingia gabonensis* (Ogbono) and *Colocynthis citrullus* (Egusi) seeds sold in markets in Ado-Ekiti, Ekiti State, Nigeria. J. Nat. Prod. Plant Resour. 2(3):423-426

Akusu, O. M. and Kiin-Kabari D. B. (2003). Effect of storage period on selected functional, chemical stability and sensory properties of bush mango (*Irvingia gabonensis*) seed flour. African J. Food Sci. Technol. 4(6):136-140

Iwe, M. O. (2002). Handbook of sensory method and Analysis. Re-joint communications services Ltd. Enugu. 71-75.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar