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Sensory Evaluation of Ogbono (Irvingia Gabonensis) Soup Formulations

Oladimeji Olusegun* Idowu-Adebayo Folake. Sanni Toibudeen. A
Department of Food Science and Technology, Federal University, Oye Ekiti, Ekiti State, Nigeria
*Address for correspondence: E-mail: segundimeji@yahoo.com

ABSTRACT
Particle size of dikanut seeds milled using attrition and hammer mills were submitted for sensory evaluation in three ogbono soup formulations. Sensory attributes of the freshly prepared ogbono soup classified by the three formulas, percent dikanut concentration and temperature of soup preparation were assessed. Consumer test showed preference for Oguntona's formula and consumer's acceptability was optimized when dikanut concentration lies between 10 – 11%. Objective measurement (consistency index) correlated well with subjective response (overall acceptability). A model was developed relating consistency index to temperature of preparation and dikanut concentration.
Keywords: Dikanut seeds, soup, sensory formulations

INTRODUCTION

Local sourcing of indigenous, tropical seeds that will meet citizen nutritional requirements are been developed and encouraged to address the issue of better nutrition in Nigeria. One of the nutritionally important seeds is the *Irvingia* kernels (dikanu seed) used as a recipe in the preparation of ogbono soup. *Irvingia gabonensis* and *irvingina wombully* are two of Non-Timber Forest Products (NTFPs) which in recent times have become very essential products; especially to rural communities.Though their pulps have different properties, the kernels have similar characteristics and are not differentiated in the market by sellers (Awe et al, 2012)

Ogbono soup is highly cherished by the consumers for its drawability; just like okro and corchorus autorins (Adeboye & Bello, 1998). Over two billion people are believed to be affected by micro nutrients of low and middle income countries of the world (Tomon et al, 2000)

Nigeria is currently addressing the issue of better nutrition for her citizen and cash generation for her national income (*Anegbeh et.al.,* 1996). Local sourcing of indigenous, tropical seeds which will meet her nutritional requirements are being encouraged and developed.

One of the nutritionally important seeds, is the dikanut seed, used as a recipe in the preparation of ogbono soup. The soup is highly cherished by the consumers for its drawability; just like okra and Corchorus Olitorius (Adeboye and Bello, 1998). The soup has remained for a long time the dish of the low-income earners in the Southwest and middle belt region of Nigeria (*Anegbeh et.al.,* 1994), but in recent time large time large restaurants are exploiting the potentials of these seeds in ogbono soup (Oguntona, 1999) as a popular Nigerian dish coupled with the recent discovery that a dietary supplement of dikanut improves the treatment of Type II diabetes (Adamson et al, 1990)

Although various formulations for the preparation of ogbono soup have been reported by different authors (Oguntona et al, 1999; Abubakar and Sopade, 1993; Fayemi, 1999), as well as different methods of preparation, a more generalized and acceptable formula of ingredients composition is required for the purpose of product development and process design. This paper reports on sensory evaluation and consumer's preference of the three different formulation developed by previous workers and the percent composition of dikanut allowable in the recipe of the preferred formulation in order to optimize consumer's acceptability.

MATERIALS AND METHODS

The ingredients used in the formulation of recipe for the preparation of the Ogbono soup were all purchased from the central market, Ile-Ife, Osun State. The dikanut seeds were cleaned and sorted out to remove unwanted adhering particles and thoroughly mixed together before milling.

Particle Size Analysis of the Milled Seeds

2kg of dikanut was milled in Corona Lander Y (Model 1199 & CIA, South Africa). Attrition mill and the same quantity were milled separately in Premier A 720 (Model A443 Hunt), Britain Hammer Mill. The milled samples were sieved using Endicott's test sieve shaker with a set of sieves of the following aperture sizes: 1.18mm, 0.85mm, 0.60mm, 0.425mm, 0.30mm, 0.212mm, 0.150mm, 0.075mm and pan after extracting the oil with petroleum ether as described by AOAC 2000. The weight retained on each sieve was expressed as a percentage of the lot.

Formulation and Preparation of Ogbono Soup

There is considerable variation in the composition of major ingredient(s) and the method of preparation noticed among ethnic and socio-class groups. However, the basic line has been drawn on regional and economic

grounds. Three formulations developed by Oguntona *et a.,l* (1999), Fayemi (1999) and Abubakar and Sopade (1993) have been adopted and expanded to widen the range of investigation of percent concentration of dikanut seed necessary for effective formulation, and these formulas represented elite/aristocratic, peasant/low income and middle income formulas respectively. These formulations are presented in Tables 1 to 3.

The previously cleaned and milled dikanut seeds and ground crayfish were blended together into a fine powder. The bitter leaves were shredded, washed and squeezed to remove the bitter taste with the aid of salt. The ground mixture of dikanut and dry fish (which had been previously washed with warm water) was then added to the heated palm-oil while stirring to avoid lumps. Hot water was gradually added while mixing. The ground pepper, bouillon cube and chopped okra were then added and allowed to cook at 70oc for 20mins. Other cooking temperatures (50 and 90oc) were employed with other recipe samples. The bitter leaf was later added and was allowed to cook for another 3mins. Finally the salt was added to taste.

Experimental Design

Combinations of dikanut, moisture content and other ingredients at various levels with a deviation to the left and right of the prescribed quantity as reported by previous workers are shown in Tables 1 to 3. Preliminary experiments (Sanni, 2001) had indicated that percent dikanut concentration in the formulations should not be greater than 14% if the soup were to be given the minimum acceptability by consumers. These ingredient levels were chosen to fit a simplex-lattice mixture design (Cornell, 1981). Mathematical Models were fitted to data collected on each treatment to predict values for consistency index score. The experimental model included the following:

$K = a+bT+cY+dTY$……..(1)

Where K = Constituency Index

T = Temperature, deg. C

Y = Percent Concentration of Dikanut Seed

The coefficient values when estimated indicate the effects of various ingredients combinations on the response. Two statistical methods were used to test the model. A t-test was performed on the individual terms in the model using the ratio of the estimated coefficient value and its standard error. The second test was performed to determine the value of the model's adjusted multiple correlation coefficients. The closer the adjusted multiple correlation coefficients is to 1 line the better the model.

Response Measurement

The viscosity of the soup at 50, 70, and 90˚c were obtained using Brookfield Engineering Laboratories Inc. viscometer Model RV (Stoughton, Massachusetts). The consistency index

Table 1: Ogbono soup formulation

Mix A = Water 75.4%

Ingredients	**Quantity(%) w/w**				
	A1	**A2**	**A3**	**A4**	**A5**
Ground Ogbonno	9.64	10.94	12.24	13.54	14.80
Water (distilled)	75.40	75.40	75.40	75.40	75.40
Palm Oil	4.52	4.13	3.74	3.34	2.95
Dry Fish	3.60	3.30	2.91	2.64	2.36
Salt and Bitter Leaf	2.81	2.60	2.40	2.14	1.89
Dry Ground Pepper	1.21	1.10	1.00	0.89	0.79
Ground Cray Fish	0.60	0.55	0.50	0.45	0.35
Maggi Cubes and Okra (Abenuscos esculentia L.)	0.22	1.98	1.80	1.60	1.42

Source:Oguntona *et al* (1999)

Table 2: Ogbono soup formulation
Mix B = Water (70.0%)

Ingredients	Quantity(%) w/w				
	B1	B2	B3	B4	B5
Ground Ogbonno	15.40	16.70	18.00	19.30	20.60
Water (distilled)	70.00	70.00	70.00	70.00	70.00
Palm Oil	6.20	5.65	5.10	4.50	4.00
Dry Fish	2.90	2.65	2.40	2.12	1.90
Salt	1.56	1.40	1.30	1.12	0.99
Ground Pepper	0.23	0.20	0.19	0.17	0.15
Ground Tomatoes	0.47	0.43	0.38	0.34	0.30
Maggi Cubes and Okra	0.77	0.69	0.62	0.57	0.49

Source:Abubakar and Sopade (1993)

Table 3: Ogbono soup formulation
Mix C = Water (62.40%)

Ingredients	Quantity(%) w/w				
	C1	C2	C3	C4	C5
Ground Ogbonno	20.00	21.30	22.60	23.90	25.20
Water (distilled)	62.40	62.40	62.40	62.40	62.40
Palm Oil	6.20	5.65	5.10	4.50	4.00
Dry Fish	2.90	2.65	2.40	2.12	1.90
Salt	1.56	1.40	1.30	1.12	0.99
Ground Pepper	0.23	0.20	0.19	0.17	0.15
Okra	3.00	3.00	3.00	3.00	3.00
Ground Cray Fish	0.47	0.43	0.38	0.34	0.30
Maggi Cubes	0.77	0.69	0.62	0.57	0.49

Source:Fayemi (1999)

was calculated and was used to develop the model described in equation 1 as a function of temperature and dikanut concentration.

Sensory Evaluation
Two different panels were used for sensory evaluations. A panel consisting of 10assessors was used for the sensory profile evaluation and a panel consisting of 100habitual consumers of ogbono soup was used for the preference test (Palgliarini et al; 2001).

Sensory Profiling
A panel of 10 judges (all of whom were regular consumers of the test product and unaware of the research topic) were selected from a pool of volunteers for the sensory profiling. Each of the selected judges evaluated the 15treatments (described in Tables 1-3) on a scale from 1 (extreme dislike) to 9 (extreme like) for appearance, colour, taste, drawability, dikanut flavor, and overall acceptability. All the 15treatments were evaluated three times by each panelist for each of the sensory attributes scored treatment.

Consumer Test
100 consumers (54 females and 46 males) were used for the preference test. Three samples were presented per session and were requested to express their preference based on the overall sensory characteristics perceived and to rate each sample using 9point hedonic scale. The design was balanced for order and carry over effects (Mactie et al, 1989).

Data Analysis
The sensory data for each attribute were submitted to Analysis of Variance with judges, treatments and their interactions as effects. The significance of these effects was tested with F-tests. Differences between treatments were examined and the statistical significance was determined by application of the Turkey HSD Test (O' Mahony, 1986).

RESULTS AND DISCUSSION

The plot of the cumulative undersize against sieve aperture of defatted dikanut powders for different milling methods is shown in Fig.1. Hammer Mill produces particles whose average size (0.18mm) is not significantly different ($p<0.05$) from that obtained for attrition mill (0.17mm). however, while small particles (<0.08mm) and large particles (>0.43mm) account for about 87% of the aggregate particles in hammer mill, these same grade of particles account for about 37% of the aggregate particles in attrition mill. Preference test carried out

on soup formulated from particles from the two milling methods show consumer's preference for hammer mill particles (Table 4).

Response Measurement

The average value of the responses to different formulation of ogbono soup employing various concentration of dikanut and different temperature of preparation are listed in Table 5. Simple correlation coefficients (r's) between each of the specified responses are listed in Table 6. Consistency index (K) and sensory panel drawability scores were highly correlated ($p<0.01$) suggesting that the objective measurement might be used with confidence as a predictor of the subjective response. Rockower, et al (1983) found that an objective breaking force measurement was a useful tool in predicting sensory firmness sources of minced fish patties. Drawability and overall acceptability scores were significantly ($p<0.05$) correlated. This indicates that drawability though served as a better predictor of overall acceptability, this does not preclude taste, colour and appearance from being major factors in ogbono soup overall acceptability.

Sensory Evaluation

The results of the sensory attributes of freshly prepared ogbono soup classified by formula, percent concentration of dikanut and temperature of preparation are presented in Table 7-9. Fayemi's formula was less preferred on account of high viscosity resulting from high temperature dikanut content of soup. In drawability, there is significant difference ($p<0.05$) between Oguntona's, Fayemi's and Abubakar and Sopade's formulas. However, Oguntona's formular was preferred to the other formulas possibly because of increased flavor constituents in the soup recipe and the absence of onion (viscosity reducing ingredient). Generally, percent dikanut concentration between 10-11% appeared to meet consumers' overall acceptability.

Table 10 lists the model terms, standard errors associated with each term, and the adjusted correlation coefficients and the modeled response. A predictive model that describes the relationship between Consistency Index (K), percent dikanut concentration (A), and temperature (T) of preparation of the soup is given by Equation 2.

$K = 3.671 + 0.552A - 0.105T$……(2)

The adjusted correlation coefficient showed that temperature and dikanut percent concentration accounted for 78% of the variation in consistency of the coup. While 23% of this variation was due to dikanut concentration, 55% of the variation arose from temperature variation.

Table 4: Panel Means for Evaluation of Milling Methods

Treatment	Appearance	Taste	Flavour	First Impression in the Mouth	Hedonic
Hammer	3.96a	5.51b	7.14a	5.35c	5.63a
Attrition	3.90a	5.40b	6.06b	4.78d	5.02c
SEM	0.12	0.17	0.23	0.35	0.41

Means in the same column that bear different letters are significantly different ($P<0.05$) using ANOVA/Tukey HSD test

SEM – Standard Error of the Mean

Table 5: Average Response Values for 15 Treatments of Dikanut Seed and at Various Temperature of Preparation (Oguntona's Formular)

Treatments			Responses	
Percent Concentration of Dikanut in Soup	**Temperature of Preparation (deg. C)**	**Consistency Index (K) (10^{-2})**	**Overall Acceptability**	**Correlation Coefficient (r)**
9.64	50	5236	6.6a	0.99
9.64	70	2564	6.2a	0.98
9.64	90	15	5.8a	-
10.94	50	3350	7.5ab	0.99
10.94	70	3863	7.4ab	0.99
10.94	90	2582	6.8ab	0.98
12.24	50	2884	7.6ab	0.99
12.24	70	2944	7.8ab	0.99
12.24	90	2233	6.6ab	1.00
13.54	50	2890	6.4a	0.99
13.54	70	1656	6.5a	0.99
13.54	90	1560	6.0a	1.00
14.80	50	8166	6.0a	0.97
14.80	70	2864	6.1a	0.99
14.80	90	2103	5.9a	0.99

Table 6: correlation Coefficients (r) between Consumers' Responses on Ogbono Soup Formulations

Responses	Appearance	Colour	Taste	Drawability	Overall Acceptability
Appearance	0	0.627	0.685	0.605	0.584
Colour	0.627	0	0.570	0.559	0.550
Taste	0.685	0.570	0	0.542	0.535
Drawability	0.401	0.452	0.504	0.993	0.0932
Overall Acceptability	0.584	0.550	0.535	0.951	0

Table 7 : Panel Means for Sensory Attributes of Freshly Prepared ogbono Soup Classified by Formular, Percent Dikanut Concentration in the Soup and Temperature of Soup Preparation

Formulations	% dikanut	Temp. (˚C)	Appearance	Drawability	Overall Acceptability
OG	9.64	50	4.48c	7.8a	6.6a
OG	9.64	70	4.55c	7.3a	6.2a
OG	9.64	90	4.47c	7.1a	5.8a
OG	10.94	50	4.61c	7.5a	7.5ab
OG	10.94	70	4.63c	7.7a	7.4ab
OG	10.94	90	4.53c	7.3a	6.8ab
OG	12.24	50	4.72c	7.2a	7.6ab
OG	12.24	70	4.66c	6.9a	7.8ab
OG	12.24	90	4.55c	6.8a	6.6ab
OG	13.54	50	4.45c	7.0a	6.4a
OG	13.54	70	4.50c	7.1a	6.5a
OG	13.54	90	4.42c	6.9a	6.0a
OG	14.8	50	4.38c	7.2a	6.0a
OG	14.8	70	4.40c	7.2a	6.1a
OG	14.8	90	4.32c	7.1a	5.9a

OG=Oguntona's formulation (1999)
Means in the same column with different letters are significantly different (P<0.05)

Table 8 : Panel Means for Sensory Attributes of Freshly Prepared ogbono Soup Classified by Formular, Percent Dikanut Concentration in the Soup and Temperature of Soup Preparation

Formulations	% dikanut	Temp. (˚C)	Appearance	Drawability	Overall Acceptability
AS	15.4	50	4.12c	6.5a	4.4e
AS	15.4	70	4.26c	6.4a	4.8e
AS	15.4	90	4.35c	6.6a	4.4e
AS	16.7	50	4.71c	6.7a	4.9e
AS	16.7	70	4.40c	6.4a	4.6e
AS	16.7	90	4.55c	6.7a	4.1e
AS	18.0	50	4.05c	6.1a	4.0e
AS	18.0	70	4.23c	6.2a	4.8e
AS	18.0	90	4.27c	6.0a	4.9e
AS	19.3	50	4.15c	6.2a	4.6e
AS	19.3	70	4.26c	6.0a	4.5e
AS	19.3	90	4.32c	6.4a	4.7e
AS	20.6	50	4.51c	6.2a	4.0e
AS	20.6	70	4.88c	6.1a	4.7e
AS	20.6	90	4.73c	6.5a	4.4e

AS= Abubakar & Sopade's formulation (1993)
Means in the same column with different letters are significantly different (P<0.05)

Table 9 : Panel Means for Sensory Attributes of Freshly Prepared ogbono Soup Classified by Formular, Percent Dikanut Concentration in the Soup and Temperature of Soup Preparation

Formulations	% dikanut	Temp. (˚C)	Appearance	Drawability	Overall Acceptability
FA	20.0	50	3.52d	4.7d	3.8e
FA	20.0	70	3.65d	4.1d	3.9e
FA	20.0	90	3.53d	4.0b	4.0e
FA	21.3	50	3.77d	3.7d	3.9e
FA	21.3	70	3.45d	3.4b	4.0e
FA	21.3	90	3.53d	3.9d	4.1e
FA	22.6	50	3.80d	4.1b	4.0e
FA	22.6	70	3.73d	3.5b	3.9e
FA	22.6	90	3.64d	3.4b	3.8e
FA	23.9	50	3.76d	2.6d	4.1e
FA	23.9	70	3.61d	2.9b	3.9e
FA	23.9	90	3.75d	2.7b	3.9e
FA	25.2	50	3.37d	2.1b	3.8e
FA	25.2	70	3.63d	1.7b	4.0e
FA	25.2	90	3.56d	1.9b	4.1e

FA= Fayemi's formular
Means in the same column with different letters are significantly different (P<0.05)

Table 10: Model Coefficients, their Standard Errors (in Bracket) and Adjusted Multiple Correlation (R_A^2) for Model Predicting Consistency Index (K)

Coefficient	Consistency Index
a	3.671
b	-0.105 (0.029)
c	0.552 (0.448)
d	0
R_A^2	0.782 (0.80398)

CONCLUSION

Particle size of dikanut in the ogbono soup recipe affected the consumer's acceptability of the product. Sensory profile and consumer's preference tests showed that Oguntona's formula was preferred based on the hedonic scale employed. Drawability was better correlated to overall acceptability of the product and objective

measurement (consistency index) correlated well with subjective response (overall acceptability). A predictive model was developed to generate responses for the independent variables.

REFERENCES

Abubakar, U. M. and Sopade, P. A. (1993). Rheological Characterization of Three Nigerian Traditional Soups: Ewedu *(Corchorus olitorius),* Karkashi *(Artemisia spp.)* and Ogbono *(Irvingia Gabonensis)* at different temperatures. *Nigerian Food Journal* Vol. 11: 118 – 127.

Adamson, I., Okafor, C. and Abu-Bakare, A. (1990). A supplement of dikanut *(Irvingia Gabonensis)* improves treatment of Type II diabetes. *West African Journal of Medicine*, 9: 108-115.

Adeboye, O. C. and Bello, S. A. (1998). Fruit Characteristics and Nutrient Analysis of Fifteen Accessions of *Irvingia Gabonensis Var.dulcis* of Southwest Nigeria.

Anegheh, P. O.; Jaenicke, H., Dawson, I.; Oriz, R. and Ladipo, D. (1996). Preliminary Assessment of Fruit Production of *Irvingia Gabonensis*. Published Conference Proceedings, *Horticultural Society of Nigeria* held at Ogun State University Ago-Iwoye. 1-4 April 1996, 145-14 9pp.

Anegbeh, P.O. and Ladipo, D.O. (1994). Growth of *Dacryodes edulis*. 2-7 October 1991 Douala, Cameroun. 18pp.

A.O.A.C. (Association of Official Analytical Chemists)(2000). In: Horwitz, W. (ed) Official Mehtod of Analysis, 17th edition Washington D. C. 1094pp.

Awe, F., Imoagene, E., Osadebe, C. O., Azeez, F. A. and ENiola, T.S. (2012). Evaluation of Irvningia Kernels Marketing in selected markets in Akure, Ondo State Nigeria. *International Journal of Agriculture & Forestry.* 2 (3); 113 – 116

Cornell, J. A. (1981). Experiments with Mixtures: Designs, Models, and the Analysis of Mixture Data. John Wiley and Sons, Inc., New York.

Fayemi, P.O.(1999). Nigerian Vegetables. Heinemann Educational Books (Nigeria) Plc., Ibadan, pp 12-36.

MacFie, H.J.H.; Bratchell, N.; Greenhoff, and Vallis, L. Y. (1989). Designs to balance the effect of order of presentation and first-order carry-over effects in Hall Tests. *J. Sens. Stud.*4:129.

Oguntona, C.R.B.; Odunmbaku, J.A. and Otun, B.O.(1999) Proximate Composition of Ten Standardized Dishes. *Nutrition and Food Sciences* 6: 295-302.

O'Mahony, M. (1996). Sensory Evaluation of Food. Statistical Methods and Procedures. New York: Marcel Dekker.

Pagliarini, E.; Monteleone, E. and Ratti, S. (2001), sensory profile of eight tomato cultivars (Lycopersicon esculentum) and its relationship to consumer preference. *Ital. J. Food Science*. Vol.133:285-296.

Rockower, R. K.; Deng, J.C.; Otwell, W.S. and Cornell, J.A. (1983). Effect of Soy Flour, Soy Protein concentrate and Sodium Alginate on the textural attributes of minced fish patties. *Journal of Food Science* 48: 1048-1052

Sanni, T.A. (2001). Rheological Characterization of Ogbono Soup at different ingredients levels. B.Sc. Thesis Department of Food Science and Technology, Obafemi Awolowo University, Ile-Ife, Nigeria.

Tomori, W. B. and Obijole, O. A. (2000). Mineral Composition of Some less utilized vegetables in Nigeria. *African Journal of Science and Technology*, 1: 153 – 157.

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