

Evaluating the Acceptability of Maize Pap and Solid Gel Produced from Fermented Flour of Quality Protein Maize

Dorcas L. Alabi

Department of Agricultural Extension and Rural Development,
Faculty of Agriculture, Obafemi Awolowo University, Ile-Ife, Nigeria

Abstract: The study aimed at promoting the utilization of Quality Protein Maize (QPM), thereby increasing the protein intake of the majority of rural households (who subsist more on maize pap and solid gel) in the study area. It specifically utilized fermented flour of QPM, wet paste of QPM and wet paste of local maize to prepare pap and solid gel (two common maize diets in the study area). Six replicates were conducted at 2 per each of the three agricultural zones of Osun State, Southwest, Nigeria. A- 10 member taste panel familiar with the products was selected per replicate to assess the products for appearance, colour, taste, flavor, preference and acceptability using 3 point hedonic scale. The results revealed that for all the parameters tested, significant difference was observed in the prepared from fermented flour of QPM and those of the other two treatments, whereas, there was no significant difference in the two products prepared from the wet forms of QPM and local maize pastes as they were both acceptable. The study concluded that acceptable pap and solid gel could be produced from the wet paste of QPM, while the low acceptability of the products from fermented flour of QPM may be due to the fact that panel members were not familiar with this innovation. Based on the findings, the study recommended replacement of local maize paste with QPM among processors and consumers of maize paste because of its poor nutritive value. It also suggested further investigation into how to make the fermented flour form of maize paste more acceptable to enhance the product's durability, portability and overall value addition.

Key words: Maize paste flour • Fermented • Quality protein maize • Pap • Solid gel • Sensory evaluation

INTRODUCTION

Maize is an important cereal crop which supplies many macro and micro-nutrients necessary for human metabolic needs. It is grossly produced in Nigeria and serves as a good source of food for all and sundry. Most importantly, babies are fed with maize-based diets such as pap (locally called akamu in Southwestern Nigeria) and solid gel (locally called eko or agidi) as weaning foods. Nursing mothers also consume plenty of pap to induce profuse lactation. In addition, a good number of women derive their livelihood from the production and sales of raw maize paste, pap and solid gel. However, it has been ascertained that local maize-based diet threatens to impoverish the bodies of people who predominantly subsist on it because of its poor nutritive value as it lacks B vitamins and contain low content of lysine and

tryptophan which are essential amino acids required for growth and development. Also, the white varieties of local maize lack vitamin A which is essential for immunity, growth and eyesight [1].

On the other hand, research has revealed that QPM contains about twice the levels of lysine and tryptophan of the normal maize and high level of these two essential amino acids not only enhance manufacturing of complete proteins in the body but also offers 90% of the nutritional value of skim milk, thereby alleviating malnutrition [2, 3]. Olakojo *et al.* [2], specifically recommended that ART-98-SW6-OB variety with lysine level of 3.67% and tryptophan level of 0.87% and ILE-1-OB variety with lysine level of 3.72% and tryptophan level of 0.87% are good QPM that can alleviate protein deficiency in Nigeria. Hence, QPM consumers stand to benefit more nutritionally than local maize consumers [4, 5].

Fermentation is one of the processing strategies for boosting dietary qualities of maize and other cereals. It is achieved by soaking cereals in water for between 2-3 days to stimulate the growth of edible microorganisms resulting in flavor, aromas and textures that are pleasant and attractive to consumers. The process improves nutrient density by increasing bio-availability of nutrients (National Programme for Food Security) [6].

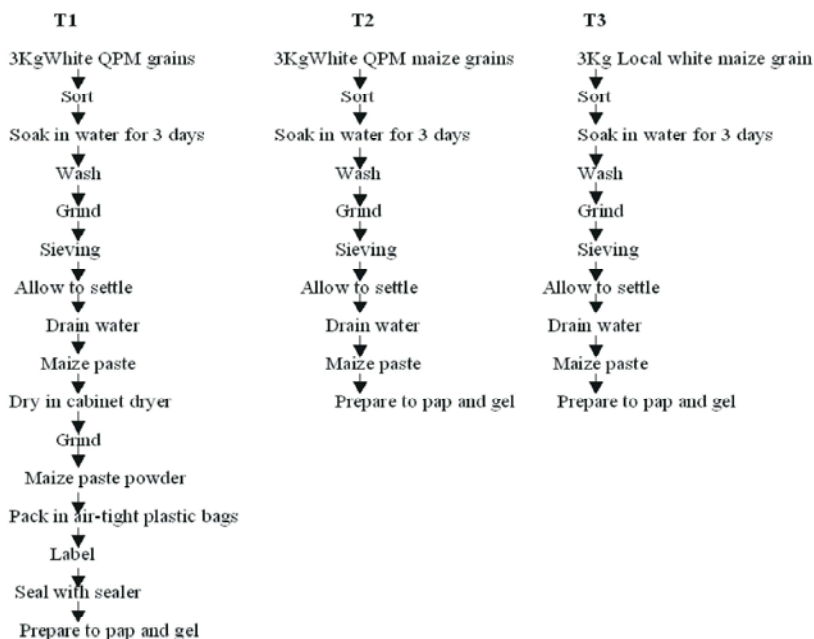
Different varieties of QPM seed and grain are readily available in Nigeria research institutes like Institute of Agricultural Research & Training (IAR&T), Ibadan and Obafemi Awolowo University, Ile-Ife. Despite its availability, many are yet to adopt the cultivation and utilization of this crop, whereas, there is the need to promote the replacement of the local maize based diets with QPM for the benefits of the babies, nursing mothers and the general populace. In addition, traditionally, in Nigeria, maize paste is usually produced in the wet form and this encourages quick deterioration and spoilage of the paste. It then becomes necessary to improve on the quality of maize paste through appropriate value addition that can increase its shelf life. This study was conducted to determine the acceptability of two maize-based products (pap and solid gel) popularly consumed by all

categories of Nigerians especially in the Southwest zone from the wet and flour form of fermented QPM.

MATERIALS AND METHODS

The Quality Protein Maize (ART98-SW6-0B variety) and the local maize used for this study were obtained from Institute of Agricultural Research and Training (IAR&T), Ibadan, Oyo State and open market in Ile-Ife Osun State, Nigeria, respectively. Three treatments were employed and three kilograms of grains was used for each treatment (T). The steps involved in producing the fermented flour and the wet pastes were highlighted in the production chart below. To produce pap from each of the 3 treatments, 2 litres of water was put to boil and 3 cups of slurry made from each treatment was added to the boiling water on fire, stirred continuously with wooden stick to prevent lumps and cooked for 5minutes before serving. To prepare solid gel, 5 cups of slurry was added to 2 litres of boiling water for each treatment and cooked for 15 minutes before wrapping in leaves and allowed to solidify before serving. Six replicates were carried out at the rate of two per each of the three agricultural zones of Osun State.

Production Flow Chart for Fermented Maize Paste and Flour



T1- Flour form of QPM paste

T2- Wet form of QPM paste

T3- Wet form of Local maize paste

Sensory Evaluation: For each replicate, the organoleptic properties of the pap and gel such as appearance (i.e. attractiveness), texture, taste, smell, preference and overall acceptability were assessed by a – 10 member taste panel familiar with these maize-based diets. The scores were ranked based on 3 points hedonic scale with 1 representing extreme dislike and 3 equals extreme like, analysis of variance (ANOVA) was used to determine the difference while Duncan multiple range test was used to separate the means where there was significant difference.

RESULTS AND DISCUSSIONS

Sensory Evaluation of Pap and Solid Gel for the Three Treatments: Tables 1 and 2 show that at $P \leq 0.05$ there was no significant difference in the texture of the pap and solid gel produced from the three treatments but a significant difference was observed in the other parameters namely: Appearance, smell, taste, preference

and overall acceptability of pap and solid gel from the flour form of quality protein maize and the other two treatments (i.e. pap and solid gel from the wet paste of QPM and local maize). Also, there was no significant difference in all the parameters for pap and solid gel from QPM wet paste and local maize wet paste showing that both treatments were equally acceptable. The observation may be due to the fact that traditionally, the panel members were used to the taste, smell and appearance of pap and solid gel made from wet maize paste despite the disadvantages of quick deterioration and possible loss of nutrients associated with wet paste; therefore they perceived the powder form as not compatible with their culture, except for the smooth texture. The implication of the finding is that more demonstrations on processing of fermented maize paste into flour form with emphasis on replacement of local maize with QPM should be carried out at the household level especially in the rural communities where the majority subsists on pap and solid gel.

Table 1: Sensory evaluation of pap for the three treatments

Samples	Appearance	Texture	Smell	Taste	Preference	Overall Acceptability
Sample A	1.86 ^b	1.87 ^a	1.78 ^b	1.77 ^b	1.76 ^b	1.78 ^b
Sample B	2.04 ^a	2.05 ^a	2.09 ^a	2.13 ^a	2.12 ^a	2.15 ^a
Sample C	2.12 ^a	2.06 ^a	2.19 ^a	2.15 ^a	2.14 ^a	2.19 ^a
SEM	0.042	0.048	0.048	0.045	0.049	0.049

Means in the same column followed by the same letter are not significantly different from each other at $p \leq 0.05$

Table 2: Sensory evaluation of solid gel for the three treatments

Samples	Appearance	Texture	Smell	Taste	Preference	Overall Acceptability
Sample A	1.89 ^a	1.92 ^a	1.89 ^a	1.90 ^a	1.85 ^a	1.87 ^a
Sample B	1.99 ^b	1.96 ^{ab}	2.15 ^b	1.92 ^b	2.04 ^b	2.04 ^b
Sample C	2.17 ^b	2.15 ^{ab}	1.99 ^b	2.19 ^b	2.09 ^b	2.09 ^b
SEM	0.041	0.043	0.044	0.038	0.042	0.039

Means in the same column followed by the same letter are not significantly different from each other at $p \leq 0.05$

Sample A- Product from fermented QPM paste flour

Sample B- Product from fermented QPM wet paste

Sample C- Product from fermented Local maize wet paste

Table 3: Correlation matrix showing relationships among the sensory evaluation parameters for pap

Samples	Appearance	Texture	Smell	Taste	Preference	Overall Acceptability
Appearance						
Texture	0.3170*					
Smell	0.5045*	0.4776*				
Taste	0.6095*	0.3072*	0.6110*			
Preference	0.6130*	0.5036*	0.6871*	0.6728*		
Overall Acceptability	0.5262*	0.2371	0.6391*	0.6694*	0.7047*	

* Significant ($P \leq 0.01$)

Table 4: Correlation matrix showing relationships among sensory evaluation parameters for solid gel

Samples	Appearance	Texture	Smell	Taste	Preference	Overall Acceptability
Appearance						
Texture	0.4976*					
Smell	0.1369	0.5292*				
Taste	0.2440	0.6054*	0.2782			
Preference	0.3188*	0.5176*	0.5437*	0.5389*		
Overall Acceptability	0.3147*	0.6672*	0.6250*	0.5688*	0.7777*	

* Significant (P =0.01)

Test for Relationships among Sensory Evaluation

Parameters: Table 3 shows that for pap, at $p \leq 0.01$, appearance has significant and positive correlation with all other parameters, implying that it is the major determinant of the acceptability of the pap. It shows that for the flour form of fermented QPM paste to be well acceptable, there is the need to improve on the appearance of its pap. This can be achieved through better processing technique or by adding other attractive food composite like roasted soybean or chocolate.

Table 4 shows that for the solid gel, texture is the most important determinant of its acceptability as it has positive and significant relationship with the majority of the other parameters. It implies that since the quality of a solid gel is traditionally judged with the sense of touch (which is inherent in the texture of a product), the stronger the texture, the higher the degree of acceptability. This shows that one of the major reasons for the least acceptability of solid gel made from flour form of QPM paste may likely be due to the observation of panel members that it was not as strong as the ones made from the wet pastes of both QPM and local maize.

Conclusion and Recommendation: The results show that acceptable pap and solid gel can be made from the wet form of fermented Quality Protein Maize paste. This will serve as a good replacement for pap and solid gel produced from local maize with poor nutritive value. The economic, nutritional and health advantages of consuming QPM pap and solid gel cannot be over emphasized as it affords the low income households who dominated the rural communities of Nigeria, the opportunity of feeding on protein at cheaper cost. It could also enhance eradication of malnutrition among the little children who are mostly fed on pap and saving the cost of treating nutrition-related health issues in the study area. The study recommended further investigation into more acceptable methods of producing the fermented flour form of maize paste generally and QPM in particular, because this value addition technology could serve as good entrepreneurship opportunity if well developed.

REFERENCES

1. Nuss, E.T. and S.A. Tanumihardjo, 2010. Maize: a paramount staple crop in the context of global nutrition. *Compr Rev. Food Sci. Food Saf.*, 9: 417-36.
2. Olakojo, S.A., O. Omueti, K. Ajomale and B.A. Ogunbodede, 2007. Development of Quality Protein Maize: Biochemical and Agronomic Evaluation. *Tropical and Subtropical Agroecosystems*, 7: 97-104.
3. Upadhyay, S.R., D.B. Gurung, D.C. Paudel, K.B. Koirala, S.N. Sah, Prasad, R.C.B.B. Pokhrel, L.R. Dhaka, 2009. Evaluation of Quality Protein Maize (QPM) Genotypes under rain fed mid hill environments of Nepal, *Nepal J. Sci. Technol.*, 10: 9-14.
4. Akumao-Boateng, A., 2002. Quality Protein Maize infant feeding Trials in Ghana, pp: 1-5.
5. Giwa, E.O. and A.V. Ikujenlola, 2009. Application of Quality Protein Maize in the formulation of broiler's finisher feed. *Journal of Science, Food and Hospitality*, 1(1): 47-50.
6. National Programme for Food Security, 2006. Nutrition and Health Technical Guideline and Recipes on Complementary Feeding, for Facilitators and Extension Agents. Edited by O. oyebanji, M. Nwihim and B. M. Onoto, pp: 28-30.