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Evaluation of consumer acceptability of selected food products from improved maize among farmers and non-farmer groups in Oyo state

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Abstract
Quality Protein Maize (*Zea mays L.)* (QPM) and High Protein Maize varieties (HPM) are nutritionally-enhanced maize varieties with potential of improving nutritional status especially among the poor. Improved maize varieties were promoted and their acceptability as traditional diets was tested among farmers and non-farmers in Oyo state. Quality Protein Maize ART-98-SW-6-OB(QPM1) and ILE-1-OB (QPM2). Quality Protein Maize - ART-98-SW-6-OB (QPM1) and ILE-1-OB(QPM2),in comparison with ART-96-SW-1 (High Protein Maize) and SUWAN-1-SR (farmer's variety) were processed into traditional (*ogi, eko, abari*, cowpea-maize porridge) diets that the farmers were familiar with. Consumer acceptability results indicate *ogi* and *eko* from improved maize varieties were preferred to products from farmer's variety among farmers. *Ogi*,*eko* and maize-cowpea porridge from the two improved varieties had similar acceptability among farmers. *Ogi* as sifted or unsifted from HPM or QPM had high acceptability for all the qualities tested. High acceptability of the traditional products from improved maize varieties among potential consumers as farmers and non-farmers group is an indication of possibility of high adoption rate of the improved varieties. The high acceptability of the products will hence aid the popularisation of the improved varieties.

Key word: Maize, improved varieties, products, consumer acceptability, promotion

Introduction
Food consumption patterns among rural families in Nigeria have been reported to be dominantly local staple food (Maxiya-Dixon *et al.*, 2014). Among the different dominant ethnic groups in Nigeria, consumption of maize meals is common in diverse forms. It is an important source to meet daily energy requirement which can be processed into breakfast, lunch and dinner foods. In the southern part of Nigeria, among the Yorubas, it is usually prepared into *ogi*, a cooked fermented maize gruel as breakfast and as *eko*, a solid gel which is usually consumed as a light dinner meal. In the Northern part, among the Hausas, it is usually prepared as *tuwo*. Nutritionally, maize has been reported to be low in lysine and tryptophan contents (Atlin *et al.,* 2010). Consumption of maize diet as main staple without adequate source of animal protein has been responsible for malnutrition among children which was reported to account for about 40% stunted children in Nigeria (Maxiya-Dixon *et al.*, 2014). This led to research studies to breed for improved maize varieties. Quality protein maize and High protein maize are nutritionally-enhanced varieties of maize. Quality Protein Maize differs from High Protein Maize by having better quality of essential amino acid content while High Protein Maize has increased protein content in comparison with local varieties. Nutritionally-enhanced food crops have been used to address hunger and malnutrition among poor people in developing countries. The Institute of Agricultural Research and Training (I.A.R.&T.,), Ibadan Nigeria has developed Quality Protein Maize varieties which has been reported to have 3.7-3.72% lysine and

0.87% tryptophan content (Olakojo *et al.*, 2007). This variety is intended to improve the nutritional status of rural poor households in Nigeria. The QPM varieties also have the advantage that they are downy mildrew (fungal) and maizestreak (viral) tolerant varieties which are common fungal and viral diseases attacking maize in southwest Nigeria (Olakojo, 2014). This paper presents the promotion of the variety among farmers in Eruwa in Oyo state. The objective of the study was to assess consumer acceptability of traditional diets developed from improved varieties of maize at IAR&T among farmer and non-farmer groups in Oyo state.

Materials and Methods

Dissemination and demonstration of maize processing technologies

On-farm Adaptive Research (OFAR) was conducted among the farmers at Eruwa to grow QPM varieties ART-98-6-OB and ILE-1-OB and HPM Suwan-1-SR developed at I.A.R. &T, Ibadan. At maturity stage, fresh QPM and HPM varieties were harvested and processed into different maize food products that were commonly eaten among the community. The processing techniques for the products were demonstrated during a field day organised for the popularisation of the improved varieties among farmer groups in Eruwa. Sixty five farmer including male and female were present as participants. The benefits of the improved varieties were highlighted to the farmers in comparison with the farmers' local variety. The participants were trained on how to process the varieties. The female farmers assisted in the processing while the male farmers watched the processing activities involving the participation of female farmers in the community. The improved varieties were processed into traditional diets familiar to the farmers; *ogi, eko* and cowpea-maize porridge as follows:

Ogi: Previously soaked maize (fermented for 3 days) was milled. This was sifted with muslin cloth to remove the chaff and allowed to settle. The water was decanted and the slurry was mixed with boiling water with continuous stirring until it formed a gel called ogi gruel. Maize is usually consumed in sifted maize form in the communities.

Eko: Previously soaked maize (fermented for 3 days) was milled. This was sifted to remove the chaff and allowed to settle. The water was decanted and the slurry was mixed with boiling water and cooked on heat in a pot with continuous stirring until it formed a gel. The gel was allowed to cool for about 2 hours to form a thick gel called *eko*.

Cowpea-maize porridges: Cowpea (beans) was cooked separately in a pot until it became soft. The HPM and QPM were also cooked separately until they were soft. The beans were divided into two portions. One portion was mixed with HPM and the other part with QPM in separate cooking pots while still boiling. Vegetable oil (palm oil), pepper, onion and salt were added to the portions to form porridges.

Testing of consumer acceptability of improved maize varieties

***Farmers' consumer acceptability testing*:** Sensory evaluation of maize products *ogi, eko* and cowpea-maize porridges processed during the field day was evaluated using the farmers as the panelists to have their feedback on the maize varieties. Sensory

evaluation was carried out to assess the acceptability of the products using the method of Iwe (2002). The evaluation was carried out by forty (40) farmers. The parameters tested were appearance, colour, flavour, texture, taste and overall acceptability.Products were presented as random coded samples. The samples were independently evaluated using a nine-point hedonic scale to determine the preference of each panelist. Ratings were: 1 = "extremely dislike", 2= "dislike very much", 3= "dislike moderately", 4= "dislike slightly", 5= "neither like or dislike", 6= "like slightly", 7= "like moderately", 8= "like very much" and 9 = "extremely like" (Iwe, 2003). The assessors were allowed to drink water in between product testing. The data were statistically analysed using analysis of variance (ANOVA) and means were separated by Duncan's multiple range test. ANOVA of SAS, (1995).

Non-farmers' consumer acceptability testing: Another group of thirteen (13) non-farmers within the I.A.R. &T., Ibadan were also asked to assess the sifted *ogi* and unsifted *ogi* from the QPM and HPM varieties.

Sifted maize *ogi*: is processed as *ogi* as previously reported.

Whole maize *ogi:* Previously soaked maize (fermented for 3 days) was milled as processed by Fasoyiro *et al.* (2013). The water was decanted and the slurry was mixed with boiling water with continuous stirring until it formed a gel called *ogi* gruel (Unsifted/ whole *ogi* is nutritionally better in terms of protein and fibre quality than sifted maize from previous report).
Randomly coded products were also evaluated for colour, flavour, texture, taste and overall acceptability. Products were also analysed as earlier reported.

Results and Discussion

Table 1 shows farmers' sensory scores for *ogi* pap and *eko* from HPM, QPM compared with farmers' variety (FV). HPM and QPM *eko* were rated better than FV for all the attributes tested. HPM and QPM Eko were not significantly different in all the attributes tested at $P<0.05$. HPM *ogi* was rated highest for colour, appearance and overall acceptability. HPM *ogi* pap was not significantly different from QPM in flavour, taste and texture. Farmers' variety (FV) *ogi* pap was rated least among the samples for all the attributes tested. This shows that the improved maize varieties were highly accepted among the farmers' community compared to the local varieties which were used.

Table 2 shows farmers' sensory acceptability of cowpea-maize porridges from QPM and HPM varieties. In all the attributes assessed- colour, flavour, taste and texture, all the samples were highly rated and acceptable to the farmers. On a rating scale of 1-9 with 9 as highest for acceptability, none of the QPM and HPM products were rated less than 8 showing very high acceptability. High acceptability of HPM and QPM informs of cowpea-maize porridge in the communities will not only aid the popularisation and adoption of these new improved varieties among the farmers but will aid its spread and popularisation among the neighbouring communities.

Table 3 shows the non-farmers' sensory acceptability of sifted and whole *ogi* from QPM and HPM varieties. Products from unsifted whole QPM: Q-S7 had the

Table 1: Farmers' group consumer acceptability of *ogi* pap and *eko*from high protein maize (HPM) and quality protein maize(QPM) in comparison with farmers' variety (FV)

Samples	Colour	Appearance	Flavour	Taste	Texture	Overall acceptability
Eko (solid gel)						
HPM	8.42a	8.50a	8.58a	8.58a	8.58a	8.58a
QPM	8.25a	8.33a	8.50a	8.41a	8.50a	8.50a
FV	7.47b	7.58b	7.33b	67.25b	6.83b	7.17b
Standard error	0.159	0.155	0.149	0.162	0.140	0.151
Ogi (maize gruel)						
HPM	8.67a	8.67a	8.25a	8.83a	8.75a	8.75a
QPM	8.08b	8.33a	8.08a	8.42a	8.25a	8.25b
FV	7.17c	7.33b	7.08b	7.08b	7.17b	7.50c
Standard error	0.141	0.147	0153	0.158	0.149	0.154

Mean values of each column with different alphabet is significantly different at $p<0.05$

Table 2: Farmers' group consumer acceptability of comparing cowpea-maize porridge from quality protein maize (QPM)with high protein maize (HPM)

Samples	Colour	Appearance	Flavour	Taste	Texture
Cowpea-maize Porridge HPM	8.74a	8.59ab	8.59a	8.59a	8.35ab
Cowpea-maize porridge QPM	8.41a	8.88a	8.88a	8.88a	8.65ab
Standard error	0.406	0.381	0.381	0.381	0.387

Mean values of each column with different alphabet is significantly different at $p<0.05$

highest acceptability for colour and texture while Q-S5 was most acceptable for flavour but it was not significantly different from the rest of the Q-S samples. Q-S5, Q-S7 and Q-S 8 were not significantly different in taste. Products from unsifted whole QPM: Q-US3 was the most acceptable in terms of colour. All the Q-US products were not significantly different in appearance, flavor, taste and texture. Products from unsifted whole HPM: H-US9 and H-US10 were rated highest for colour, H-U13 for appearance. All the samples were not significantly different in flavour, taste and texture. Products from sifted ogi H-S16 were rated highest for colour, H-S13 for appearance and H-S15 for texture. All the samples were not significantly different in taste. Among the QPM and HPM samples, Q-US3 was the most acceptable for colour, H-US14 for appearance, Q-S7 and H-S15 for texture. Most of the samples were highly rated for taste. This study shows using QPM and HPM as unsifted *ogi* will help to further retain the amino acids lysine and tryptophan in whole *ogi* than in the sifted *ogi*. Most families in Nigeria consume *ogi* in form of sifted *ogi* which they are familiar with. Acceptance of *ogi* in the whole form will hence improve nutritional status especially

Table 3: Non-farmers' consumers' acceptability of *ogi* from quality protein maize(QPM) and high protein maize (HPM)

Samples	Colour	Appearance	Flavour	Taste	Texture
Q-US1	6.54def	6.45ab	6.4ab	6.27a	6.82ab
Q-US2	7.00cde	7.36ab	7.00ab	6.82a	7.00ab
Q-US3	8.36a	7.63ab	7.00ab	7.90a	7.63ab
Q-US4	7.73cdef	6.81b	7.09ab	6.64a	6.36ab
Q-S5	7.27bcde	7.00ab	7.45a	7.36a	6.64ab
Q-S6	6.9cdef	709ab	7.09ab	7.09ab	7.00ab
Q-S7	7.55abcd	7.63ab	7.27ab	7.36a	7.63a
Q-S8	6.91cdef	6.90ab	7.27ab	6.72a	6.72ab
H-US9	7.63abc	7.63ab	7.09ab	6.54a	6.91ab
H-US10	6.54def	6.27b	6.27b	6.27a	6.63ab
H-US11	6.40ef	6.80ab	6.80ab	6.80ab	6.9ab
H-US12	7.00cde	7.36ab	7.00ab	6.82a	7.00ab
HS-S13	7.63abc	7.90a	6.30b	6.90a	6.82ab
H-S14	7.18bcde	7.27ab	6.64ab	7.27a	6.82ab
H-S15	7.45abcde	7.45ab	7.09ab	7.00a	7.62a
H-S16	8.18ab	7.63ab	7.00ab	7.90a	7.69ab
Standard error	0.974	0.815	0.091	0.954	0.852

Mean values of each column with different alphabet is significantly different at $p<0.05$

Key: QU-S1- quality protein maizesoy-*ogi* unsieved, QU-S2- quality protein maize*ogi* unsieved, QU-S3- quality protein maize*eko* unsieved, QU-S4- quality protein maizesoy-*eko* unsieved, Q-S5-quality protein maize soy-*ogi* sieved, Q-S6-quality protein maize-*ogi* sieved, Q-S7-quality protein maize *eko* sieved, Q-S8, quality protein maize soy-*eko* sieved, H-US9- high protein maize soy-*ogi* unsieved, H-US10- high maize *ogi* unsieved,H-US11-high protein maize *eko* unsieved, H-US12- high protein maize soy-*eko*, H-S13- high protein maizesoy-*ogi* sieved. H-S14- high protein maize*ogi* sieved, HS-15 high protein maize eko sieved,H-S16- highprotein maize soy *eko*sieved.

when improved maize varieties are utilised.

Conclusion

Products of improved maize varieties disseminated for popularisation among the farmers and non-farmers as potential consumers were well accepted. Acceptability of improved maize varieties QPM and HPM among farmers and non-farmers show that the varieties will not only impact the nutritional status of various communities both in the rural and urban areas, but will also encourage farmers to adopt the varieties. The various forms to which the products are processed will also serve as good avenues for income generation among the rural poor communities especially the women group. It is therefore recommended that the QPM and HPM maize be consumed in form of traditional diets especially as unsifted *ogi*, *eko* and cowpea-maize porridges and popularized.

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