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Tuwo Consumption and Preferences in Cosmopolitan Cities of Nigeria: A Consumer Response Survey

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ABSTRACT

Tuwo is the most common food prepared from sorghum, millets, maize etc., with several variations in the details of preparation and preferences in various localities. The wide differences in the properties of *tuwo* and the wide cultural/regional differences in the preferences of the product impose great difficulties in the adoption of standard quality, which in turn, impose difficulties in raw material specification, process design and in finished product quality control. Consumer response survey to identify common quality preferences and consumption pattern is the starting point to reduce such difficulties and pave way for *tuwo* standardisation, mechanisation and possible industrialisation. It was found that there was no significant difference ($p > 0.05$) in the quality perception of *tuwo* between native consumers, frequent consumers and casual consumers. Maize is the most preferred grain among the three grains studied followed by sorghum and millet in that order, which were generally obtained from the local markets. *Tuwo* consumption as a family diet ranged from three times a day to two or three times a week depending on the consumer status. Majority of the respondents indicated preferences for soft textured *tuwo* (soft 40%, very soft 23.4%, $n=290$) and white coloured *tuwo* (51%, $n=290$), while taste of *tuwo* do not seem to matter for the majority (55.9%, $n=290$).

Keywords: Cereal *tuwo*, sorghum, maize, millet, consumer perception, quality preference

1.0 INTRODUCTION

Stiff porridge in the form of *tuwo* is the most common and simplest food prepared from sorghum, millets, maize and rice. Stiff porridges are normally "solid" and can be eaten with the hand. They are an important part of daily meals and are consumed at least one or two times a day (Rooney and Murty, 1982). The basic procedure for the preparation of stiff porridges involve adding flour in boiling water in small increments accompanied by vigorous stirring. The flour is cooked until it forms a thick, homogenous and well gelatinized mass devoid of lumps. Flour is normally obtained from decorticated grains, although whole grains, fermented or roasted grains are also used in some regions. Flour particle size can vary from very fine flour to coarse grits depending on the grain milling procedure used and the desired consistency of the product. However, there are several variations in the details of production procedures adopted in various regions. A form of *tuwo* is prepared by cooking sorghum flour in water in which tamarind extract or lemon juice is added, which results in an acidic product called *tô* (Da *et al*, 1982). In other cases, leachates from wood ashes or potash are added to the water before

preparation, thus producing an alkaline product (Sheuring *et al*, 1982), while in most cases ordinary water without addition of any ingredients is used in the preparation of thick porridge which possess neutral pH. In yet some other cases, the flour is soured by fermentation for at least 18 hours before cooking, resulting in a fermented porridge called "*tuwon tsari*". In Uganda, Tanzania and Kenya, brown sorghum grains are mixed with small quantities of dry cassava, finger millet or maize, and the mixture is ground to flour to make a form of *tuwo* called "*ugali*" (Mukuru *et al*, 1982). Thick porridges are sometimes moulded or shaped in to balls. In Bauchi, Kaduna and Plateau states of Nigeria whole meal from fonio is used in the preparation of "*tuwon acha*" (Jediani, 2012).

A good quality *tuwo* must not contain lumps and must be well cooked without burning. To obtain good *tuwo* colour from millet or sorghum sometimes it requires steeping the dehulled grain in *kadal* (spent liquor from ndaleyi or ogi production) overnight (Nkama, 1993). The thickness of *tuwo* depends on the choice of individuals and families. Some people prefer

their *tuwo* very thick while others prefer it light. Most people prefer *tuwo* that draws (cohesive and elastic) (Nkama, 1990). *Tuwo* is served with vegetable soups and stews.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) West African trials of the International Sorghum Food Quality Trials found four important quality criteria for *tuwo* to include taste, colour, texture and overnight keeping quality (Scheuring *et al.*, 1982). However, consumption temperature and aroma/flavor are equally considered as quality factors, as the product is normally served immediately after preparation as hot as it were, though it may be allowed to stay in the open dish or plate for some minutes under the prevailing ambient condition for the temperature to drop enough to be comfortably cut with the bare hand. This cooling process, as insignificant as it may seem, is an important aspect of consideration in *tuwo* processing as it determines the final eating texture of the product. Upon cooling the gelatinized starch of the *tuwo* undergo retrogradation and also losses moisture which reduce the stickiness of the product and increase the *tuwo* hardness. The desired final *tuwo* hardness determines the water: flour ratio to be mixed during production. *Tuwo* texture preference depends to a large extent on individual choice and community practice. However, people generally tend to prefer non-sticky *tuwo* with moderate hardness. The gel should be stiff, but not dense. A person should be able to dip in his fingers, scoop out a piece and readily manipulate the piece with the forefingers and thump without the gel adhering to the fingers (Scheuring, 1982). The colour of *tuwo* is normally the colour of the grain and the method adopted for preparing the flour. In some practices, spent steep water is used to improve the white colour appearance by soaking the grains overnight. The taste of *tuwo*, like its colour, depends on the grain from which it is prepared and the method of flour preparation. Knowledge of traits preferred by consumers is valuable for crop improvement programs and provides valuable signals for food processors (Ndjeunga and Nelson, 2003). Fermented grains tend to produce sour taste while *tuwo* prepared with added ash leachate gives characteristic tardy taste. *Tuwo* aroma is an important consideration in the processing. In some cases the formed gel is allowed to stay on fire until it starts caking from the bottom of the pot. The

resulting caramel flavour of the caramelized starch adds to the aroma of the *tuwo*.

The wide differences in the properties of *tuwo* and the wide cultural/regional differences in the preferences of the product impose great difficulties in the identification and adoption of standard qualities for *tuwo*. In turn, lack of standard quality for *tuwo* imposes difficulties in raw material specification, process design and in finished product quality control. To reduce such difficulties and pave way for *tuwo* standardisation and mechanisation for mass production and possible industrialisation, consumer response survey to identify common quality preferences and consumption pattern must be the starting point. The main aim of this work is therefore to conduct *tuwo* consumption survey in cosmopolitan cities of Nigeria as cultural melting points where regional/cultural biases in *tuwo* preference are minimal while the possibility of accepting universal standard is highest.

2.0 MATERIALS AND METHODS

As the research is aimed at the exploration of *tuwo* consumers' preferences, a descriptive research approach was adopted using structured mode of enquiry with written questionnaires (Kumar, R., 2011) and personal observation methods of data collection. These were employed to generate primary demographic data of the respondents and their *tuwo* consumption preferences including their main grain sources. Random sampling method was used to select the sample population from across the six (6) cities (Yola, Jalingo, Gombe, Bauchi, Damaturu and Maiduguri) of the North-East region of Nigeria. The questionnaire was designed and validated by a simulation test with 5 senior academics generally familiar with questionnaire method of data collection. The questionnaire was divided into four sections. Section 'A' covers demographic data of the respondents; section 'B' covers the consumers' grain sources and their order of preference; section 'C' covers the *tuwo* consumption pattern and quality preference, while section 'D' covers *tuwo* production constraints perceived by the consumer.

The respondents were categorized into three based on their familiarity with *tuwo* and their consumption pattern. 'Native Consumers' comprised of those respondents to whom *tuwo* consumption is part of their culture and thus

consume *tuwo* as their regular staple diet. 'Frequent Consumers' comprised of those respondents whose cosmopolitan nature of socialization introduced them to different cuisines and dishes such that their eating habit also became cosmopolitan. 'Casual Consumers' comprised of those respondents to whom *tuwo* eating is an acquired habit not known to their cultural and/or ethnic extraction. After the validation, a total of 400 questionnaires were administered and recorded 60% retrieval. Personal observation was conducted by the researchers in different places across the study area.

2.1 Statistical Analyses

Respondents' demographic data and their responses on their grain sources, their *tuwo* preferences and their perceived *tuwo* production constraints were each analysed by Kruskalwallis One-way Anova, a nonparametric version of statistics using MATLAB statistical software [MATLAB 7.12.0 (R2011a)]

3.0 RESULTS AND DISCUSSION

3.1 Personal Observation

It was observed that in *tuwo* preparation from any cereal grain, the cereal flour is generally obtained through decortication, grinding and sieving. The first two operations are accomplished by small scale motor driven dehulling machines and various milling machines such as disk attrition or hammer mills. The decorticated grains may be washed and dried under the sun before milling and can be milled directly after decortication. In some instances whole grains may be milled without decortication and the flour thus obtained is called "*datsa*", and *tuwo* from such flour called "*tuwon datsa*" which is normally regarded as inferior. Cereal flour for *tuwo* preparation is separated into coarse grits known as "*tsaki*" and fine flour called "*laushi*".

When the desired flour is obtained, thin slurry of the flour in water is first made, which is then added into a pot of boiling water with gentle stirring to make thin gruel known as "*talge*". The *talge* is brought to boil by a process of "*bararraka*" until the starch is well gelatinized. *Bararraka* is a heating process with regular, gentle stirring to control expansion and avoid spilling of the "*talge*" over the brim of the pot. Small quantities of flour are then added incrementally with continuous stirring until a stiff mass is obtained. The burning firewood is

then removed and the *tuwo* is allowed to cook on the glowing charcoal long enough to ensure complete gelatinisation. This stage is critical to avoid incomplete starch modification which leads to "*danyen tuwo*". In some cases, small quantities of the *talge* is kept aside until when the *tuwo* is done, it is then added back on to the *tuwo* and mixed again. This practice facilitates smooth appearance and also increases the moisture content should the *tuwo* be too stiff. A good quality *tuwo* must not contain lumps and must be well cooked without burning.

However, this observation was slightly different from the account of Bolade *et al.*, (2009) in their studies on the traditional methods of the production of maize *tuwo* in which they reported that the commercial preparation procedure for maize *tuwo* involved initial slurry preparation by mixing appropriate quantities of maize flour and water which was then poured into an appropriate quantity of boiling water and stirred properly to form a pap-like consistency (the *talge* noted by this researcher). This was followed by addition of an appropriate quantity of maize flour to the pap-like consistency coupled with vigorous stirring to form a gel-like consistency, then addition of small quantity of water to the gel-like consistency (not observed by this researcher), leaving of the gel to cook for 5-7 min with the cooking pot covered and without stirring, after which a final stirring was made to obtain hot maize *tuwo*. Such minor difference is obvious due to the numerous regional and cultural variations in the details of *tuwo* preparation as noted earlier (Da *et al*, 1982, Sheuring *et al*, 1982).

3.2 Demographic Data of the Respondents

Table 1 shows the demographic data analysis of the respondents. The total male to female ratio is 41:59 with no significant difference ($p > 0.05$) indicating that both genders were drawn from the same population such that their responses are representative of the same larger society. Such representation reflects the social disposition of women as those who are closely associated with *tuwo* preparation, and are thus more inclined to answer questions and give information about the product. Similar pattern was equally observed by (Bolade and Adeyemi, 2013) in their survey of the commercialisation of maize *tuwo* in which they reported that females constituted the majority in all the categories of food processors in their sample population (n=151) which they attributed to the fact that it is generally believed

in Nigeria that any food-related activity is an exclusive domain of the females. Of the native consumers the highest percentage (42.1 %) are aged between 35 – 44 of age while age 55 years and above constitute the least percentage (6.3), and Likewise in the total population. These age groups represent those that are most likely to have settled down and more involved in supporting families, and thus make most major food decisions in the family. Their perception of *tuwo* will most likely reflect societal and cultural habits. On the overall however, Ndjeunga and Nelson, working towards understanding preference for consumption characteristics of millet varieties in western Niger Republic reported that the demographic data they analyses indicated that consumers' ratings of all traits of millet *tuwo* did not differ by gender, level of education, age, household size or daily consumption frequency of *tuwo*, but all the traits except colour significantly differed by ethnic groups between the Zarma and the Hausa ethnic groups of Niger republic (Ndjeunga and Nelson, 2003).

It was observed that those respondents with secondary education and those with informal/primary education formed the bulk of the respondents in this work with 30% and 29.3% respectively, and these two groups mainly represented the native consumers of *tuwo* who have little options in food choices either due to poverty or lack of exposure to more cosmopolitan varieties. These groups of consumers are the primary target of high protein flour for *tuwo* to increase their general protein intake. Majority of those respondents with Graduate/postgraduate level of education

are casual consumers of *tuwo* indicating their cosmopolitan nature leading to diverse food choices and taste thus making *tuwo* an occasional option. This group may be targeted for *tuwo* flour with improved functionality and superior sensory properties that can appeal to their more sophisticated taste for continental cuisines.

Marital Status determines to a large extent the choice of *tuwo* and preference of quality parameters. 53 % of the respondents are married while 37 % are single. Divorced persons form 9 % of the respondents. Those with family size from 1 – 5 form half of the total respondents followed by those with family members from 6 – 10 (34.8 %). Income category of respondents and their contribution to family feeding predispose them to food decision making in the family. Their perception of *tuwo* will therefore reflect the general *tuwo* preference in the family. Of the native consumers of *tuwo*, those with annual income less than N100, 000 formed 51.6 %. This group may be targeted for high protein *tuwo* flour to improve their general protein intake that may be affected by their low income status. The same group accounted for the highest percentages in all the three consumer status. Those who contributed 75 – 100% to family feeding are most likely to control the food choices in the family. Their perception on *tuwo* is therefore most likely to represent the family eating habit. Of the total native *tuwo* consumers, 40.5% contributed 75 – 100% to family feeding. Similar high percentages are observed in the other two consumer status. This is an indication that the responses obtained are representative of the general family eating habit.

Table 1: Demographic Data of Respondents

Question	Consumer Status				P-Value
	Native Consumer n = 126	Frequent Consumer n = 103	Casual Consumer n = 61	Total n = 290	
1. Sex					
(a) Male	50 (39.7)	42 (40.8)	27 (44.3)	119 (41.0)	
(b) Female	76 (60.3)	61 (59.2)	34 (55.7)	171 (59.0)	
Total	126	103	61	290	0.1038
2. Age Bracket					
(a) 15 - 24	25 (19.8)	21 (20.4)	10 (16.4)	56 (19.3)	
(b) 25 – 34	17 (13.5)	26 (25.2)	19 (31.2)	62 (21.4)	
(c) 35 - 44	53 (42.1)	36 (35.0)	21 (34.4)	110 (37.9)	
(d) 45 - 54	23 (18.3)	13 (12.6)	11(18.0)	47 (16.2)	
(e) 55 and above	8 (6.3)	7	0 (0)	15 (5.2)	
Total	126	103	61	290	0.0577

Question	Consumer Status				P-Value
	Native Consumer n = 126	Frequent Consumer n = 103	Casual Consumer n = 61	Total n = 290	
3. Level of Education					
(a) Informal/Primary	45 (35.7)	29 (28.2)	11 (18.0)	85 (29.3)	
(b) Secondary	36 (28.6)	36 (35.9)	15 (24.6)	87 (30.0)	
(c) Diploma/NCE	29 (23.0)	25 (24.3)	19 (31.1)	73 (25.2)	
(d) Graduate/Postgraduate	16 (12.7)	13 (12.6)	16 (26.2)	45 (15.5)	
Total	126	103	61	290	0.0129
4. Marital Status					
(a) Single	43 (34.1)	42 (40.8)	23 (37.7)	108 (37.2)	
(b) Married	71 (56.3)	53 (51.5)	31 (50.8)	155 (53.4)	
(c) Divorced	12 (9.5)	8 (7.8)	7 (11.5)	27 (9.3)	
Total	126	103	61	290	0.2815
5. Family Size					
(a) 1 to 5	57 (45.2)	53 (51.5)	35 (57.4)	145 (50.0)	
(b) 6 to 10	41 (32.5)	37 (35.9)	23 (37.7)	101 (34.8)	
(c) More than 10	28 (22.2)	13 (12.6)	3 (4.9)	44 (15.2)	
Total	126	103	61	290	0.0922
6. Income (NGN per annum)					
(a) < 100 000	65 (51.6)	43 (41.7)	17 (27.9)	125 (43.1)	
(b) 100 000 - 200 000	26 (20.6)	22 (21.4)	11 (18.0)	59 (20.3)	
(c) 200 000 - 300 000	21 (16.7)	19 (18.4)	12 (19.7)	52 (17.9)	
(d) 300 000 - 400 000	11 (8.7)	11 (10.7)	7 (11.5)	29 (10.0)	
(e) 500 000 and above	3 (2.4)	8 (7.8)	14 (22.9)	25 (8.6)	
Total	126	103	61	290	0.0409
7. Contribution to Family Feeding					
(a) 0 - 24%	5 (3.9)	9 (8.7)	11 (18.0)	25 (8.6)	
(b) 25 - 49%	13 (10.3)	12 (11.7)	8 (13.1)	33 (11.4)	
(c) 50 - 74%	57 (45.2)	37 (35.9)	23 (37.7)	117 (40.3)	
(d) 75 - 100%	51 (40.5)	45 (43.7)	19 (31.1)	115 (39.7)	
Total	126	103	61	290	0.1881

Figures in parenthesis are percentages

3.3 Grain Sources and Preference

Table 2 shows the responses of the respondents on their sources of grain and their order of preference of maize sorghum and millet which are the target grains in this work. Kruskalwallis test of the three groups of consumers showed no significant difference ($p > 0.05$) among the median ranks of the groups in all the measured parameters. 50 % of the native consumers of *tuwo* cultivate their grains themselves while

85.2% of casual consumers buy their grains from the local markets. Only 13.8 % of the respondents obtain grains from local farmers, while 19% purchased from government reserves. Local markets is therefore the major grain source of the consumers indicating that if improved *tuwo* flours are placed in the markets, it will be made available in the very source of grains for most *tuwo* consumers.

Table 2: Grain Sources and Preference

Question	Consumer Status				P-Value
	Native Consumer n = 126	Frequent Consumer n = 103	Casual Consumer n = 61	Total n = 290	
1. Grain Source	63 (50)	11 (10.7)	0 (0)	74 (25.5)	

(a) Self Cultivation					
(b) Local Farmers	25 (19.8)	15 (14.6)	0 (0)	40 (13.8)	
(c) Local Markets	38 (30.2)	67 (65.0)	52 (85.2)	157 (54.1)	
(d) Government Reserves	0 (0)	10 (9.7)	9 (14.8)	19 (6.6)	
Total	126	103	61	290	0.1675
2. Grain Preference					
(a) Maize > Sorghum > Millet	53 (42.1)	43 (41.7)	24 (39.3)	120 (41.4)	
(b) Maize > Millet > Sorghum	38 (30.2)	28 (27.2)	13 (21.3)	79 (27.2)	
(c) Sorghum > Maize > Millet	23 (18.1)	17 (16.5)	6 (9.8)	46 (15.9)	
(d) Sorghum > Millet > Maize	6 (4.8)	7 (6.8)	7 (11.5)	20 (6.9)	
(e) Millet > Sorghum > Maize	3 (2.4)	4 (3.9)	5 (8.1)	12 (4.1)	
(f) Millet > Maize > Sorghum	3 (2.4)	4 (3.9)	6 (9.8)	13 (4.5)	
Total	126	103	61	290	0.2000
3. Reasons for Preference					
(a) Personal Preference	76 (60.3)	77 (74.8)	57 (93.4)	210 (72.4)	
(b) Availability	37 (29.4)	21 (20.4)	2 (3.3)	60 (20.7)	
(c) Cost	7 (5.6)	0 (0)	0 (0)	7 (2.4)	
(d) Other Reasons	6 (4.8)	5 (4.9)	2 (3.3)	13 (4.5)	
Total	126	103	61	290	0.2865

Figures in parenthesis are percentages

Most of the respondents (41.4 %) indicated that they prefer maize for their *tuwo* preparation followed by sorghum and then millet in their order of preference. The reason generally given for such preference is personal preference (72.4 %) and availability (20.7 %). This observation is consistent with the findings of Bolade and Adeyemi who reported that the number of households in which maize *tuwo* is consumed increased with an increase in the family size. Households with a family size of 10 and above had the highest consumption level (49.6%) of maize *tuwo* while households with a family size of 1-3 members had the lowest consumption level (10.6%), implying that maize *tuwo* is a very important daily dietary calorie source for households with a large family size particularly in *tuwo*-consuming communities in Nigeria (Bolade and Adeyemi, 2013).

3.4 *Tuwo* Consumption Pattern and Quality Preference

Table 3 shows the responses of the sample population on *tuwo* consumption pattern and preferences tested by the nonparametric version of the classical one-way ANOVA, which showed that the median ranks of the three consumer groups are not significantly different ($p > 0.05$). The result revealed that consumption pattern of *tuwo* depends on the consumer status. Native consumers seem to have *tuwo* as the only staple diet creating variety only by the grain type and the nature of flour (either grits or fine flour). This may be due to the fact that the number of households in which *tuwo* is consumed increased with an increase in the family size, as *tuwo* is a very important daily dietary calorie source for households with a large family size particularly in *tuwo*-consuming communities in Nigeria (Bolade and Adeyemi, 2013)

Table 3: *Tuwo* Consumption Pattern and Preference

Question	Consumer Status			Total n = 290	P-Value
	Native Consumer n = 126	Frequent Consumer n = 103	Casual Consumer n = 61		
1. Consumption Frequency					
(a) Thrice a day	76 (60.3)	0 (0)	0 (0)	76 (26.2)	
(b) Twice a day	37 (29.4)	0 (0)	0 (0)	37 (12.8)	
(c) Once a day	7 (5.6)	0 (0)	0 (0)	7 (2.4)	
(d) Five times a week	6 (4.8)	5 (4.9)	2 (3.3)	13 (4.5)	
(e) Three times a week	0 (0)	77 (74.8)	38 (62.3)	115 (39.7)	

(f) Once or twice a week	0 (0)	21 (20.4)	2 (3.3)	23 (7.9)	
(g) Only when desired	0 (0)	0 (0)	19 (31.1)	19 (6.6)	
Total	126	103	61	290	0.0573
2. Preparation Responsibility					
(a) Self	69 (54.8)	61 (59.2)	6 (9.8)	136 (46.9)	
(b) Spouse	44 (34.9)	22 (19.4)	18 (29.5)	84 (29.0)	
(c) House-help	7 (5.6)	11 (10.7)	12 (19.7)	30 (10.3)	
(d) Eat outside	6 (4.7)	9 (8.7)	25 (41.0)	40 (13.8)	
Total	126	103	61	290	0.1640
3. Grain Type					
(a) Maize	79 (62.7)	47 (45.6)	14 (23.0)	140 (48.3)	
(b) Sorghum	26 (20.6)	22 (21.4)	9 (14.8)	57 (19.7)	
(c) Millet	10 (7.9)	11 (10.7)	7 (11.5)	28 (9.7)	
(d) Rice	11 (8.7)	23 (22.3)	31 (50.8)	65 (22.4)	
Total	126	103	61	290	0.0694
4. Nature of Flour					
(a) Very fine	44 (34.9)	39 (37.9)	29 (47.5)	112 (38.6)	
(b) Fine	52 (41.3)	32 (31.1)	22 (36.1)	106 (36.6)	
(c) Not so fine	23 (18.3)	19 (18.4)	7 (11.5)	49 (16.9)	
(d) Grits	7 (5.6)	13 (12.6)	3 (4.9)	23 (7.9)	
Total	126	103	61	290	0.0993
5. Tuwo Texture					
(a) Very soft	18 (14.3)	31 (30.1)	19 (31.1)	68 (23.4)	
(b) Soft	64 (50.8)	36 (35.0)	16 (26.2)	116 (40.0)	
(c) Not so soft	25 (19.8)	21 (20.4)	7 (11.5)	53 (18.3)	
(d) Somewhat Hard	10 (7.9)	9 (8.7)	6 (9.8)	25 (8.6)	
(e) Hard	6 (4.7)	4 (3.9)	11 (18.0)	21 (7.2)	
(f) Very hard	3 (2.4)	2 (1.9)	2 (3.3)	7 (2.4)	
Total	126	103	61	290	0.1235
6. Colour					
(a) White	74 (58.7)	43 (41.7)	31 (50.8)	148 (51.0)	
(b) Yellow	15 (11.9)	18 (17.5)	7 (11.5)	40 (13.8)	
(c) Red	6 (4.7)	5 (4.9)	0 (0)	11 (3.8)	
(d) Does not matter	31 (24.6)	37 (35.9)	23 (37.7)	91 (31.4)	
Total	126	103	61	290	0.3004
7. Taste					
(a) Bland	50 (39.7)	46 (44.7)	20 (32.7)	116 (40.0)	
(b) Sour	5 (4.0)	6 (5.8)	1 (1.6)	12 (4.1)	
(c) Does not matter	71 (56.3)	51 (49.5)	40 (65.6)	162 (55.9)	0.4077

Figures in parenthesis are percentages

Of the native consumers, 60.3 % indicated that they can eat *tuwo* thrice a day, while majority of the frequent and casual consumers eat *tuwo* three times a week (74.8 % and 62.3 % respectively). Generally the frequency of *tuwo* consumption among the sample population ranged from two or three times a day (12.8 % and 26.2 % respectively) to three times a week (39.7 %) with only 6.6% eats *tuwo* only when desired. The person directly responsible for *tuwo* preparation in the house influences the eating

habit of the family. Native consumers tend to be personally involved in *tuwo* preparation with 54.8 % of them preparing their *tuwo* themselves, while 34.9 % get their *tuwo* prepared by their spouses. Majority of the casual consumers (41%) eat outside. Generally responsibility for *tuwo* preparation is directly on individuals (46.9 % of the sample population) on spouses (29%). The data analyzed showed that the most common type of *tuwo* among the respondents is maize *tuwo* with 48.3%, 22.4% is from rice, 19.7% is

from sorghum while 28% preferred millet *tuwo*. Curiously, Bolade and Adeyemi reported that most commercial processors of *tuwo* do not include maize *tuwo* in their menu, because, according to them, maize *tuwo* attracting the lowest consumer patronage; the quality of the food product not being liked by the consumers; and consumers' preferences for other gel-like food products like 'fufu', semovita, pounded yam, rice *tuwo* and 'amala' being higher than that of maize *tuwo* (Bolade and Adeyemi, 2013). Such observations are part of the regional and cultural influence that hinders the standardisation of *tuwo* preparation.

Responses collected on the flour particle size preference for the preparation of *tuwo* indicated that 36.6% of the respondents favoured fine flour, while 38.6% prefer very fine flour. 16.9% prefer not so fine and 7.9% prefer *tuwo* from grits. This may be due to the fact that flour particle size, to a large extent, influences not only the final texture of the product but plays an important role in the overall quality characteristics of *tuwo* (Bolade, *et al.*, 2009b). This preference pattern is further strengthened by the *tuwo* texture preference observed among the sample population. *Tuwo* texture preference survey showed that 40% of the respondents prefer soft *tuwo* texture, 18.3% prefer not so soft, while 7.2% indicated preference for hard *tuwo* texture. This pattern of preference may be due to the fact that soft textured products are generally more amenable to emasculation and easy digestion than hard textured products. Also, *tuwo* made from fine flour (known as *tuwon laushi* which invariably gives a soft textured product) is generally regarded as a high quality *tuwo* and normally reserved for ceremonial purposes.

Colour preference of *tuwo* showed that 51% of the respondents prefer white coloured *tuwo*, 31.4% of the respondents indicated that colour of *tuwo* does not matter to them, while 13.8% and 3.8% prefer yellow and red coloured *tuwo* respectively. This is probably due to the general cultural preference for white coloured *tuwo*, which also reflects the general desire for dehulling of grains meant for *tuwo* preparation to improve colour despite the loss of certain nutrients associated with the removal of bran. For the taste of *tuwo*, 55.9% of the respondents indicated that taste does not matter, while 40% prefer bland *tuwo*. These observations may be mostly due to the fact that the actual taste of *tuwo* is normally masked by the taste of the soup with which it is eaten. Similarly, in their work on *tuwo* from different varieties of millet, Ndjeunga and Nelson reported that taste, colour and textural attributes are important for millet *tuwo* and that taste and colour are the first attributes that consumers use to distinguish more preferred millet food products from the less preferred ones (Ndjeunga and Nelson, 2013).

3.5 *Tuwo* Processing Constraints

Table 4 shows the results of the respondents' perception of the constraints facing *tuwo* preparation and utilisation. The most important constraints observed from the analysis are that dehulling and milling are tedious and that the former reduces nutrients. 5.5% of the respondents complained that the flour easily go bad while 27.9% says cooking is also tedious. When Bolade and Adeyemi observed that a few households do not include maize *tuwo* in their menu, the reported that part of the reasons given is that the preparation of the food product is considered cumbersome (Bolade and Adeyemi, 2013).

Table 4: *Tuwo* Processing Constraints Analysis by Kruskalwallis One-way Anova

Question	Consumer Status				P-Value
	Native Consumer n = 126	Frequent Consumer n = 103	Casual Consumer n = 61	Total n = 290	
1. Dehulling					
(a) Tedious	43 (34.1)	31 (30)	24 (39.3)	98 (33.8)	
(b) Reduces nutrients	13 (10.3)	51 (49.5)	34 (55.7)	98 (33.8)	
(c) None	70 (56.3)	21 (20.4)	3 (4.9)	94 (32.4)	
Total	126	103	61	290	0.0744
2. Milling					
(a) Tedious	43 (34.1)	31 (30)	24 (39.3)	93 (32.1)	
(b) Reduces nutrients	13 (10.3)	51 (49.5)	34 (55.7)	47 (16.2)	
(c) None	71 (56.3)	21 (20.4)	3 (4.9)	150(51.7)	

Total	126	103	61	290	0.0934
3. Flour storage					
(a) Goes bad easily	0 (0)	16 (15.5)	0 (0)	16 (5.5)	
(b) None	126 (100)	87 (84.5)	61 (100)	274(94.5)	
Total	126	103	61	290	0.7747
4. Cooking					
(a) Tedious	0 (0)	26 (25.2)	55 (90.2)	81(27.9)	
(b) None	126 (100)	77 (74.8)	6 (9.8)	209(72.1)	
Total	126	103	61	290	0.3916

Figures in parenthesis are percentages

4.0 CONCLUSION

There is no significant difference ($p > 0.05$) in the quality perception of *tuwo* between the three consumer categories due to the fact that native consumers normally set the pace that other consumers follow. Maize is the most preferred grain among the three grains studied followed by sorghum and millet in that order, which were generally obtained from the local markets. *Tuwo* consumption as a family diet ranged from three times a day to two or three times a week depending on the consumer status. Soft textured *tuwo* is considered as the standard of quality while colour does not seem to matter much though white coloured product is indicated as desirable. Similarly the taste of *tuwo* does not matter as *tuwo* is normally eaten with soup.

REFERENCES

- Bello, A. B., Rooney, L. D. Waniska, R.D. (1990). Factors affecting quality of sorghum to a thick porridge. *Cereal Chemistry*, 67:1, 20-25.
- Bolade, M.K., Usman, M.A., Rasheed, A.A., Benson, E.L. and Salifou, I. (2002). Influence of hydro-thermal treatment of maize grains on the quality and acceptability of *tuwon masara* (traditional maize gel). *Food Chemistry*, 79: 479-483.
- Bolade, M.K., Adeyemi, I.A., and Ogunsua, A.O., (2009a). Studies on the traditional methods of production of maize *tuwo* (A Nigerian Non-Fermented Maize Dumpling). *African Journal of Food Agriculture Nutrition and Development*, Vol. 9, No. 7, Oct, pp. 1524-1547
- Bolade, M.K., Isaac A. Adeyemi, I.A., and Ogunsua, A.O. (2009b). Influence of particle size fractions on the physicochemical properties of maize flour and textural characteristics of a maize-based nonfermented food gel. *International Journal of Food Science and Technology* 2009, 44, 646–655
- Bolade, M.K. and Adeyemi, I.A., (2013). Successful commercialization of maize ‘*tuwo*’ preparation in Nigeria: Quality as a prerequisite consideration. *Journal of Sustainable Technology*, Vol. 4, No. 1, pp 49
- Da, S., Akingbala, J.O., Rooney, L.W. and Miller, F.R. (1982). Evaluation of to quality in sorghum breeding program. Pp 11-23 In: *Proceedings of the International Symposium on sorghum grain quality*. Rooney L.W and Murty, D.S eds. ICRISAT. India.
- Jideani, I. A. (2012). *Digitaria exilis* (acha/fonio), *Digitaria iburua* (iburu/fonio) and *Eluesine coracana* (tamba/finger millet) - non-conventional cereal grains with potentials. *Scientific Research and Essays*. Vol. 7(45) Available online at <http://www.academicjournals.org/SRE> DOI: 10.5897/SRE12.416
- Kumar, R., (2011). *Research Methodology: A step-by-step guide for beginners*. Sage Publications Ltd 1 Oliver’s Yard 55 City Road London EC1Y 1SP
- Murty, D.S., and Subramanian, V. (1982). *Sorghum Roti: traditional methods of consumption and standard procedures for evaluation*. In: Dendy, D.A.V., 1995. *Sorghum and Millets: Chemistry and Technology*. American Association of Cereal Chemists, Minnesota.
- Murty, D.S., Rooney, L.W., Path, H.D. and House, L.R. (1982). Report on the international food quality trials. In: *proceedings of the International Symposium on sorghum grain quality*. Rooney L.W and Murty, D.S eds. ICRISAT. India.
- Ndjeunga, J., and Nelson, C.H., (2005). Towards understanding preference for consumption characteristics of millet varieties: a case study from western Niger. *Agricultural Economics* 32, 151-165
- Nkama, I. (1990). Strategies for industrial development of the indigenous traditional cereal grains and grain legumes based foods of the North-Eastern states of Nigeria. The proceedings of a two day workshop on “strategies for agro based industrial raw

- material supply, processing and sanitation. Nigerian Institute of Food Science and Technology (NIFST) North-East chapter, Maiduguri. Nigeria.
- Nkama, I. (1993). Traditional methods of production of high protein energy foods from grain legumes in the north-eastern states of Nigeria. *Annals of Borno* 10: 138-148.
- Rooney, L.W. and Murty, D.S. (1982). Proceedings of the international symposium on sorghum grain quality. International Crops Research Institute of Semi-Arid Tropics (ICRISAT), Patancheru, India.
- Rooney, L.W. and McDonough, C.M. (1987). Food quality and consumer acceptance of pearl millet. Pp43–61 In: Proceedings of the International Symposium on Sorghum Grain Quality. Rooney L.W and Murty, D.S eds. ICRISAT. India.
- Sheuring, J.F., Sidibe, S. and Kante, A. (1982), Sorghum alkali t \hat{o} : quality considerations. Pp24–31. In: Proceedings of the International Symposium on Sorghum Grain Quality. Rooney L.W and Murty, D.S (eds.) ICRISAT. India.