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COSUMMER ACCEPTANCE OF SENSORY SCORING PARTTERN OF INSTANT AND POUNDED WHITE YAM FUFU

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ABSTRACT

Instant yam fufu (IYF) was prepared by hot-water maceration and stirring of whole flour extracted from steamed white guinea yam (WGY) tuber in a flour-to-water (mass: volume) ratio of 3-is-to-5. The IYF was compared with its typical pounded-type fufu (PYF) counterpart. The results of the sensory textural attributes (STAs), as functions of processing method, social factors (gender and age class) and frequency of consumption, showed that PYF has overall acceptability (OA) of [illegible] which was significantly (P = 0.05) higher than 5.5 for IYF. [illegible] the highest scored STA for both PYE (6.4) and IYF (6.0) while stickiness was the least rated of the fufu samples PYF (5.5) and IYF (4.5). The male consumer panelists (MCP) ac[illegible] both [illegible] samples more than their female counterparts (FC[illegible] adults of 31 – 45 years old (YAL) preferred PYF (OA = 6.6, [illegible]s (TAG = 13 – 19 years) ac-

cepted the later "Slightly" (AO = 5.00 which was least in age class factor (ACF) comparison. Regarding frequency of consumption (FCF), both "often" (OA = 6.6) while OFT also scored IYE (OA = 5.4) above others. Results indicated that both the processing and consumers' social factor studies have placed diverse demands on the modifications of STAs of **fufu**, especially in smoothness, drawability and stickiness.

These factors are critical for the production of WGY and for both distribution and marketing of IYF flour in the "Yam Zone" and beyond.

INTRODUCTION

White guinea yam (WGY) supplies to 15.9 MJ of energy per kg of tuber (Oyenuga, 1968). The most culinary product made from WGY is **fufu** (Olurunda et al., 1977). The traditional yam **fufu** (TYF) is of two basic types: pounded-yam **fufu** (TPYF) and instant yam **fufu** TIYF) according to Course (1965). The TPYF is obtained when boiled yam cuts (chunks) are pounded in a mortar using pestle, to produce a thick (glutinous) paste. The balls of this paste are dipped in soup or stew before being eaten (Onwueme and Sinha, 1991). The TIYF is obtained by macerating with boiling water and turning the flour of dried parboiled and/or fermented yam (Onyekwere, 1977; Kordylas, 1990). The most important characteristics or quality indices of good textured **fufu** are mouldability, softness, and stickiness, interpreted as viscoelastic properties. These arise from the pounding of boiled yam chunks with pestle in mortar or the stirring of the hot-water macerated flour in a bowl (Ihekoronye and Ngoddy, 1985; Kordylas, 1990).

Preparation methods such as boiling, steaming, fermentation and drying influence the rheological properties of resultant flour (Kamenan **et al.**, 1987; Achi, 1991). TIYF does not perform well as compared to TPYF due to shrinkage and slow release of starch during drying (Chinsman and Fiagan,

1987; FAO, 1991; Martin et al., 1984; Akoroda, 1994).

The sensory textural attributes (STAs) of TYF are functions of storage temperature and cultivar (Onyia, 1986), variety and processing (Iwuoha, 1999). Study that profiled the textural attributes of WGY **fufu**, sensorily determined has been reported (Iwuoha, 1999). However, no report is available in the literature on the effect of social factors on the STAs scoring pattern. There is a need to appraise these factors on **fufu** acceptability, since it is very important menu in the "yam zone" (Nigeria, Benin, coted' Ivoire, Ghana and Togo)

The objectives of this work, were: (1) to prepare WGY **fufu** from both flour and pounding and evaluate the sensory textural attributes (STAs); and (2) to assess the influence of preparation method and social factors such as gender, age class and frequency of consumption, on the STAs scoring pattern.

METHODOLOGY

Materials: fresh yam tubers of the white guinea variety (**Dioscorea rotundata** Poir) were procured from a local farmer in Owerri, Imo State, Nigeria. Preparation and analytical facilities used in this study were from the Processing and Analytical laboratories, Department of Food Science and Technology, Federal University of Technology, Owerri (FUTO), Nigeria.

Methods:

Preparation of instant yam fufu (IYF):

White yam tubers were cleaned, washed, pared off and cut into chunks (2.5 cm thickness), soaked in water containing 1% ($^{m}/m$) sodium metabisuphite for 1min as per Kordylas (1990) recommendation. The steep liquor was drained off and the chunks washed with clean water and placed inside bowls with 1-cm mesh bottom and steamed using Fisher's water bath for 30min at 1 atm and 100^{0}c. The steamed chunks were then withdrawn and cut into slices (2.5 – 3.0mm thickness), dried in a forced-draught oven (50^{0}c for 24h), cooled and milled into flour with a Wiley Mill (Thomas Wiley Laboratory Mill, Model 4, Arthur H. Thomas Co., Philadelphia, PA) equipped with a 0.5mm screen

(IYF flour).

Flour (300g DMB) from steamed yam tuber (IYF flour) was mixed with 500ml water in a pot, followed with gentle heating and continuous turning/stirring with wooden paddle until **fufu** of desirable consistency was obtained as reported by Onyia (1986).

Preparation of pounded-yam fufu (PYF)

Washed chunks (2.5 thickness) of pared off yam tubers were boiled in water (100^0C) of PH = 6.26 at loading rate of 1kg yam per litre water for 30min, withdrawn and pounded hot in mortar using pestle until a mash of desired consistency was obtained.

Sensory textural assessment:

A 25-member trained tactile panel, selected from the National Root Crops Research Institute, Umudike, (NRCRI) assessed the sensory textural attributes (STAs) of the instant yam fufu (IYF), side by side with the pounded yam fufu (PYF), Drawability, smooth, softness, stickiness and overall acceptability attributes of IYF and PYF were descriptively evaluated on a 7-point Hedonic scale. A sore of "1" indicated "dislike extremely" while "7" indicated "like extremely". The panel was trained as a group, but made to conduct the evaluation in sets of 5 persons at one time. The two **fufu** samples were served while hot (50^0C) and evaluated in one session by each member of the panel with unbiased coding of samples, adequate lighting, and space (Watts **et al**., 1989). The panel was in addition required to respond individually to gender, age class as well as frequency of consumption factors section in the questionnaire.

Sensory textural data analyses:

The data from tactile panel evaluation were subjected to four categories of computations for means and standard deviations of each STA with respect to the components of all the design (study) variables such as processing method factor (PMF), consumers' gender factor (CGF), consumers' age class factor (ACF) and frequency of **fufu** consumption factor (FCF).

Two-way analysis of variance (ANOVA) technique was applied to PMF, while Fisher's Multiple comparison test was used to separate the means due

to PYF and IYF for each STA according to Roessler (1984) procedures.

In order to demonstrate the variations in scoring pattern, the influence of CGF, ACF and FCF were computed and reported in the form of each factor component versus PYF and IYF mean scores.

RESULT AND DISCUSSION

Preparation Method Factor (PMF)

Results of mean sensory textural attributes (STAs) evaluations showed that the panel observed statistical changes ($P = 0.05$) due to PMF effect in all the STAs (Table 1).

The overall acceptability (OA) scores indicated and confirmed the preference of the typical pounded yam **fufu** (PMF) over modern instant yam flour **fufu** (IYF). In earlier studies, **fufus** from yam flour have been reported as having "draw quality" that were not equivalent to those of PYF (Ene, 1992; Axtell and Adams, 1993; Akoroda, 1994). The inferior visco-elastic qualities (STAs) of the IYF were attributed to shrinkage due to chips drying which in turn results in structural rearrangment in the yam tissues. That condition would hinder release of free starch and eventually lead to a poor

Table 1. Mean Scores for Sensory Textural Attributes of Pounded *Fufu* and Instant *Fufu* Prepared form White Guinea Yam.

Processing	Sensory Textural Attributes					
Factor (PMF)	Mouldability	Smoothness	Softness	Drawability	Stickiness	Overall Acceptability
PYF	$6.4^{a} \pm 0.3$	$6.0^{a} \pm 0.2$	$6.4^{a} \pm 0.2$	$6.0^{a} \pm 0.7$	$5.5^{a} \pm 0.8$	$6.4^{a} \pm 0.1$
IYF	$5.4^{b} \pm 0.6$	$5.0^{b} \pm 0.8$	$6.0^{b} \pm 0.6$	$5.1^{b} \pm 1.1$	$4.8^{b} \pm 1.2$	$5.5^{b} \pm 1.0$

PYF = Typical or traditionally pounded – yam fufu; IYF = Modern instant yam fufu obtained from flour *Superscripts common along columns indicate no significant difference among samples means at P = 0.05 in Fisher's multiple comparison test.

"gluten-like" network (Ngoddy and Onuoha, 1985; Chinasman and Fiagan, 1987; FAO, 1991).

Softness was the highest scored STA for both PYF (6.4) and IYF (6.0) while stickiness was the least rated of the two *fufu* samples, PYF (5.5) and IYF (4.8). The cases of softness and stickiness might be due to their uniqueness in yam *fufu* as traditional quality indices (Ihekoronye and Ngoddy, 1985; Kordylas, 1990; Iwuoha, 1999).

Consumers' Gender Factor (CGF)

The influence of CGF on the STAs scoring pattern for WGY *fufu* are shown in Table 2.

Table 2: Mean Scores for Sensory Textural Attributes of White Guinea as Yam *Fufu* and Instant *Fufu* as Affected by Consumer Gender Factor (CGF).

	CGF	Sensory Textural Attributes (STAs)					
		Mouldability	Smoothness	Softness	Drawability	Stickiness	Overall Acceptability
PYF	MCP	$6.5^{a} \pm 0.3$	$5.8^{a} \pm 0.8$	$6.5^{a} \pm 0.7$	$6.9^{a} \pm 0.4$	$6.0^{a} \pm 0.6$	$6.5^{a} \pm 0.5$
	FCP	$6.2^{a} \pm 0.9$	$6.1^{b} \pm 1.3$	$6.2^{b} \pm 1.1$	$5.9^{b} \pm 1.3$	$4.9^{b} \pm 1.5$	$6.3^{b} \pm 1.0$
IYF	MCP	$5.8^{a} \pm 0.8$	$5.5^{a} \pm 0.7$	$6.5^{a} \pm 0.6$	$6.1^{a} \pm 0.5$	$5.9^{a} \pm 0.7$	$6.2^{a} \pm 0.8$
	FCP	$5.0^{a} \pm 1.3$	$4.4^{a} \pm 1.9$	$5.4^{a} \pm 0.7$	$4.0^{a} \pm 0.8$	$3.6^{a} \pm 1.4$	$4.8^{a} \pm 1.2$

Means for each PMF among STAs with uncommon superscripts differ stastistically (P=0.05) while overall for PYF differ at P = 0.10. PMF = Processing method factor. CGF is oen of th eSocial Factors. NCP Male consumer panelists. FCP = Female consumer panelists PYF = Pounded yam fufu. IYF = Instant – yam fufu.

The male consumer panelists (MCP) rated the STAs of the two fufu samples more than their female counterparts (FCP) except for smoothness of PYF. It is noteworthy that on the overall acceptability, MCP scored the IYF much higher (6.2) than FCP (4.8).

These observations indicate that MCP appreciated the STAs of WGY fufu than the FCP. With reference to IYF, the FCP scored "indifference" (3.0-4.4) for smoothness, drawability and stickiness which indicated that the females (FCP) desired some further modifications on the visco-elasticity of the *fufu*. This is critical if this product is to be developed for market in a community with larger proportion of female because gender factor has been reported to be very decisive and influential in consumer appreciation of food (Briz and de-Felipe, 1997; Gath and V Alvensleben, 1998).

Consumers' Age Class Factor (ACF)

The results in Table 3 show that differences exist among panel's age classes' (TAG-

Table 3. Mean Scores for Sensory Textural Attributes of White Guinea Yam Fufu as Affected by Age Class Factor (ACF)*.

PMF	ACF	Sensory Textural Attributes (STAs)					
		Mouldability	Smothness	Softness	Drawability	Stickiness	Overall Acceptability
PYF	TAG	$6.2^{ab} \pm 0.8$	$6.6^{a} \pm 0.5$	$6.6^{ab} \pm 0.6$	$5.2^{a} \pm 0.7$	$4.8^{a} \pm 1.1$	$6.4^{a} \pm 0.5$
	YTH	$6.3^{b} \pm 0.7$	$5.7^{b} \pm 1.5$	$5.9^{c} \pm 1.2$	$5.9^{c} \pm 1.4$	$5.6^{b} \pm 1.7$	$6.2^{ab} \pm 0.9$
	YAL	$6.7^{c} \pm 0.5$	$5.8^{b} \pm 0.8$	$6.7^{a} \pm 0.5$	$6.8^{b} \pm 0.4$	$5.7^{b} \pm 1.0$	$6.8^{c} \pm 0.4$
	MAL	$6.0^{a} \pm 1.4$	$6.2^{c} \pm 1.2$	$6.4^{b} \pm 0.9$	$6.6^{b} \pm 0.5$	$5.4^{c} \pm 1.5$	$6.0^{b} \pm 1.2$
IYF	TAG	$5.2^{x} \pm 1.6$	$4.2^{x} \pm 2.2$	$5.2^{x} \pm 0.7$	$4.0^{x} \pm 2.1$	$5.0^{x} \pm 1.3$	$5.0^{x} \pm 1.4$
	YTH	$5.2^{x} \pm 1.0$	$4.9^{y} \pm 1.7$	$5.9^{y} \pm 1.8$	$5.0^{y} \pm 1.2$	$4.1^{z} \pm 1.9$	$5.6^{y} \pm 1.3$
	YAL	$5.2^{x} \pm 0.9$	$5.0^{y} \pm 0.8$	$5.7^{y} \pm 1.5$	$5.2^{z} \pm 1.0$	$5.2^{y} \pm 1.2$	$5.0^{x} \pm 1.1$
	MAL	$6.0^{y} \pm 1.2$	$5.4^{z} \pm 1.1$	$6.8^{z} \pm 0.4$	$5.4^{n} \pm 1.5$	$4.6^{n} \pm 1.9$	$6.0^{z} \pm 1.7$

*ACF is one of the Social Factors. TAG=Teenagers (13-19 years old)

teenagers, 13-19 years old; YTH-=Youths, 20-30 years YAL=Younger adults, 31-45 years, MAL=Maturer (Older) adults, 46-65 years) scoring pattern for STAs of both PYF and IYF samples overall acceptability these observations indicted clearly that age class is a factor (ACF) that influence STAs scoring pattern of WGY *fufu*. Elsewhere, age cal has been reported to affect both acceptance and marketability of foods (Briz and de-Felipe, 1997).

STA means for each fufu sample among the ACF with uncommon superscripts differ significantly at $P \leq 0.05$ The YAL has an "extreme" overall acceptability (OA=6.8) of the PYF much higher than both the panel's overall mean score (Table 1) and other age

Table 4. Mean Scores for Sensory Textural Attributes of White Guinea Yam Fufu as Affected Consumer's Frequency of Consumption Eaction (FCF).

FCF	Sensory Textural Attributes (STAs)				
	Mouldability	Smoothness	Softness	Drawability	Stickiness	Overall Acceptability
PYF	OF	6.6a ± 0.5	6.0a ± 0.9	6.5[a] ± 0.8	6.6[a] ± 0.5	5.5[a] ± 1.1	6.6[a] ± 0.3
	OAW	5.9[b] ± 0.9	5.8[a] ± 1.4	6.5[a] ± 1.1	5.8[b] ± 1.3	5.5[a] ± 1.3	6.1[b] ± 1.0
	NAL	6.8[a] ± 0.4	6.4[b] ± 0.5	6.6[a] ± 0.5	5.6[b] ± 1.0	5.0[b] ± 1.8	6.6[a] ± 0.8
IYF	OF	5.4[a] ± 1.0	5.1[a] ± 1.1	6.6[a] ± 0.7	5.4[a] ± 1.1	4.9[a] ± 1.5	5.4[a] ± 1.1
	OAW	5.3[a] ± 1.3	4.8[a] ± 1.5	5.5[a] ± 1.8	4.6[a] ± 1.4	4.3[a] ± 1.8	5.0[a] ± 1.4
	NAL	5.4[a] ± 1.0	4.6[a] ± 2.0	5.6[a] ± 0.8	5.4[a] ± 1.7	5.2[a] ± 1.3	5.0[a] ± 1.7

ACF is one of the Social Factors. TAG=Teenagers (13-19 years old) YTH=Youth (20-30 years) YAL = Younger adults (31-45y) MAL=Matured-adults (46-65y) PYF = Pounded = yam fufu IYF = Instant-yam fufu. Gath and V. Alvensleben 1998; Briz and deFelipe 1999).

classes. In terms of sales output, the population with a greater proportion of YAL will attract more market returns for PYF of WGY than from other age classes. With respect to IYF, MAL accepted it "moderately" (6.0) while TAG accepted it "slightly" (OA=5.0) which was least in comparison. It means that pilot-scale and/or commercial-scale production of IYF will benefit processor/ marketer in population predominated by MAL (46-65 years old persons). It means that pilot-scale and/or commercial-scale production of IYF will benefit processor/ marketer in population predominated by MAL (46-65 years old persons). On the other-hand the predominance of teenagers (TAG) will not help the IYF in its present preparation condition/ technique.

The TAG scoring pattern on both smoothness and drawability are expressions of demand for improvements or modification to suit their class. It is noteworthy that MAL, on the overall, accepted both PYF and IYF equally (OA=6.0).

Frequency of (Fufu) Consumption Factor (FCF)

The FCF influences ht scoring pattern for STAs of WGY *fufu* (Tables 1 and 4).

With respect tot eh panel's overall mean score (OA=6.4, Table 4), the OFT (often) and MAL (not-at-all) consumer-members of panel accepted PYF "extremely", on the overall (OA=6.6, Table 4), more than others. On the IYF, OAW (once-a-while) panelists overrated their overall acceptability (OA=5.6) by 14.25%, of which AMS (arithmetic mean score) is put at 4.90. in view of these, the highest acceptance was from OFT (OA=5.4). It means that both OFT and NAL influence greatly the IYF overall mean (OA=5.5, Table 1). It implies that any further modifications or preparations of this WGY fufu must be done taking into account the STAs reactions of the FCF, especially OFT and secondly, NAL. In other areas of study on measurements of consumer attitudes, frequency of consumption was reported as influential factor in hedonic judgments (Schifferstein, 1999).

CONCLUSIONS

The data form this study have shown that processing method

(PMF), gender (CGF), age class (ACF) and frequency of consumption (FCF) are all critical STAs factors that determine the magnitude and degree of acceptability of WGY **fufu**. The STA with highest queries was stickiness for both PYF and IYF, followed by smoothness and drawability for IYF only. The greatest overall acceptability (OA) of the WGY ***fufu*** was by YAL for PYF (6.8, Table 3) while the least was 4.8 by FCP for IYF (Table 2). This work has attempted providing better and a more-encompassing profile for the psycho-archeological appraisal of WGY ***fufu*** than has been done hithertoSTA means for each fufu sample among the FCF with uncommon superscripts differ significantly at $P \leq 0.05$

PMF = Processing method factor; PYF = Pounded-yam fufu; IYF = Instant – yam ***fufu***,

OFT = FCF = Often; OAW = FCF = Once-a-while; NAL = FCF = Not-at-all. The OA score was what used to be rated as "texture" score in organileptic assessment of food. In the present work, however, the STAs have been employed to bring out the components of what is known as "texture" to help the processor or designer appreciate exact areas the assessor or consumer demands for modifications.

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