Journal of Food Technology 3 (3): 353-355, 2005

Effect of Drying Methods on Composition, Sensory Evaluation and Rheological Value of Pupuru (Fermented Cassava Product)

Osundahunsi and Oluwatooyin Faramade
Department of od Science and Technology, Federal University of Technology,
PMB 704, Akure, Nigeria

Abstract: The effects of oven, solar cabinet and smoke drying methods on the composition, physicochemical, sensory and pasting characteristics of Pupuru, fermented cassava flour were evaluated. Irrespective of the drying method, there was no appreciable change in the proximate composition. Oven and solar cabinet-dried Pupuru had moisture contents of 12.2 and 12.1%, respectively while smoke-dried had 12.9% moisture content. The cyanide content appreciably reduced in the fermented-dried samples in comparison to fresh cassava tubers. Results obtained from pasting characteristics showed that solar cabinet-dried Pupuru had the highest peak viscosity (2250 BU) while smoke-dried sample had the least (1570 BU) peak viscosity. Oven dried sample was shown to be most stable in terms of the gelatinization temperature. Oven-dried sample had -100BU retrogradation value (Set-back) and 520BU gel values. Sensory evaluation revealed that Pupuru dried with smoke was rated significantly ($P<0.05$) higher than the solar-cabinet and oven-dried samples in terms of aroma, but least in colour, although taste and overall acceptability were not affected.

Key words: Rheological value, pupuru, solar cabinet, physicochemical

INTRODUCTION

An estimated fifty million people in African derive more than 500 kcal per day from cassava m [1]. Out of the total world production of 175 million tons, Nigeria is the first on the list with about 34 million tons production per year [2]. At least as many as 4-6 million people in Nigeria and more in other African countries eat Pupuru a fermented product from cassava (*Manihot esculenta*) [3]. Pupuru is different from other fermented cassava products like gari, fufu, lafun and akpu based on the processing method. Ogunsua and Adedeji [4] and Ayankunbi *et al.*, [5] reported that processing method affect chemical composition of cassava products. Odetokun *et al.*, [3] improved the nutritive value of pupuru by adding Soybean to the product. This study aims at evaluating the effect of different drying methods on Pupuru.

MATERIALS AND METHODS

Freshly harvested cassava roots 11-12 months old were obtained locally from a farm in Akure. Fresh roots for Pupuru production were washed, peeled manually, cut into cylindrical pieces about 8cm long and steeped in water for 4 days. The fermented pieces were mashed with hand and dewatered by squeezing. Portions of mash were prepared traditionally by moulding into small-sized balls and smoke dried. The smoking chamber is usually constructed to contain live coal as the source of heat at a lower layer while Pupuru balls were arranged at the upper layer. Moderate heating was applied for 36 h for the product to get dried until a constant weight is achieved. A second batch was dried in the hot air oven (Gallenkamp Model Ov- 160) at 60°C. Temperature was taken by a thermometer. For the third batch, solar cabinet dryer with black-painted base was used. The dryer's surface was covered with glass. The sun's rays were concentrated by tilting at 7° towards the rays' direction from 9am to 6pm daily. Drying was done until a constant weight was attained. The drying time was 36, 11 and 14 h for smoke, oven and solar cabinet dryers, respectively.

Proximate composition was determined on the dried products by AOAC [6] method and Carbohydrate by difference. The energy values were calculated by Atwater factors of 4, 9 and 4, respectively for protein, fat and carbohydrate contents. The method of Medcalf and Gillies [7] was used to determined Water-binding capacity. Total titratable acidity (TTA, as % lactic acid) was determined using AOAC [6]. pH was determined on a standardised digital pH meter. Samples were analysed for hydrogen cyanide content by alkaline titration method.

Corresponding Author: Osundahunsi, Department of od Science and Technology, Federal University of Technology, PMB 704, Akure, Nigeria

Table 1: Proximate composition of Pupuru dried by different methods

Parameter	Smoke-dried	Oven-dried	Solar cabinet-dried
Protein (%)	1.68±0.05	1.53±0.01	1.78±0.02
Carbohydrate (%)	80.99±0.01	82.79±0.01	81.76±0.01
Ash (%)	1.20±0.02	1.08±0.02	0.90±0.01
Fat (%)	0.46±0.01	0.46±0.01	0.48±0.01
Crude fibre (%)	2.77±0.01	1.93±0.02	2.95±0.00
Moisture (%)	12.90±0.01	12.21±0.00	12.13±0.02
Energy (Kcal)	334.82	341.42	338.48

Table 2: Physicochemical properties of Pupuru dried by different methods

Sample	pH	Titratable Acidity (%)	Cynanide content (mg HCN/100g)	Water binding capacity (%)
Fresh roots	6.01±1.20	0.09±0.14	14.58±0.02	100.4±0.05
Smoke-dried	4.69±0.17	0.15±0.09	0.25±0.10	110.8±0.01
Oven-dried	5.40±0.31	0.13±0.12	0.49±0.05	114.6±0.02
Solar cabinet -dried	5.45±0.40	0.12±0.10	0.19±0.04	124.2±0.01

Brabender amylograph was used on flour-water mixture (10%w/v) to determine the pasting properties. Colour, aroma, texture, taste and overall acceptability of the cooked (i.e.made into paste) pupuru were assessed by ten trained panellists using a nine-point hedonic scale and analysis of variance was used in the calculation and means were separated by Duncan multiple range.

RESULTS AND DISCUSSION

The proximate composition of the dried samples (Table 1) showed that Pupuru dried with smoke has moisture content (12.90%) while oven-dried and cabinet-dried, had 12.21 and 12.13%, respectively. There was no appreciable difference in all the parameters. Odetokun *et al.*,[3] reported 9.86 and 10.20% in traditionally prepared Pupuru. The result is similar to the results of Sanni *et al.*, [8] on Lafun another fermented cassava product. The values ranged between 12.40-12.60%. The moisture content gives an insight to the shelf life of the product. Lower moisture content provides better storage stability. Solar-cabinet dryer also reduced the moisture content of Pupuru to a level that can enhance long storage period in agreement with Aboua [9] who reported that moist cassava products have short shelf-life. Sun drying usually takes longer time due to low drying temperature (32°C) and contamination do occur. However, such problems can be eliminated by the use of solar cabinet dryer. The inside part was painted black to enhance heat absorption.

The titratable acidity (Table 2) increased from 0.09 to 0.15 with corresponding decrease in pH revealing increase in acidity, which could be as a result of acids produced during fermentation. Reduction in cyanide

Table 3: Pasting characteristics of Pupuru dried by different methods

Parameter	Smoke-dried	Oven-dried	Solar cabinet-dried
Pasting temperature (°C)	68.75	72.5	68.75
Gelatinization time Mg (min)	15.5	17.0	15.5
Tp at Peak Viscosity (°C)	83.75	95	88.13
Peak Viscosity (Vp) BU	1570	1260	2550
Time to reach Vpi Mn (Min)	21.5	28.0	23.25
Viscosity at 95°C BU	12.30	1080	2380
30 minutes hold at 95°C (Vr) BU	620	640	940
Cooled to 50°C (Ve) BU	940	1160	1040
Ease of cooking (Mn-Mg) min	6	11	7.75
Stability (Vp-Vr) BU	950	620	1610
Set-back (Ve-Vp) BU	-630	-100	-1510
Gel index (Ve-Vr)	320	520	100

concentration is observed in the processing of Pupuru from 14.58mg/100g to 0.49mg/100g or less with the lowest value for solar cabinet-dried Pupuru. The guide given for cyanide toxicity may be adopted as following: less than 5mg HCN/100g is considered innocuous, 5-10mg HCN/100g is moderately poisonous and more than 10mg HCN/100 is dangerously poisonous[10]. For gari, 3.0mg HCN/100g was regarded as safe by Akinrele *et al.*,[11]. However, a lower limit of 2.0mg HCN/100g is recommended by the Standards Organization of Nigeria (SON, 1983). Suggested limits for other cassava products like pupuru, lafun and akpu are not available. Pupuru made by any of these methods would be safe for consumption. The reduction in cyanide content could be attributed to synergistic effect of loss by hydrolysis into the steeping water during fermentation[13] and evaporation of HCN during drying[8,14].

Pasting characteristics is necessary to determine the nature of Pupuru since it is usually consumed in paste form. As presented in Table 3, the temperature required to start paste formation and gelatinization time were not significantly different. The temperature indicated that the carbohydrate components will not disintegrate until a high gelling temperature is reached. The oven-dried sample is more stable than either smoke or solar-cabinet dried samples. The temperature at peak viscosity ranged between 84°C and 95°C. The highest peak viscosity (2550 BU) was recorded for solar cabinet-dried sample while smoke and oven-dried had 1570 BU and 1260 BU, respectively. However, oven-dried Pupuru recorded the highest viscosity when cooled to 50°C. Smoke and solar cabinet dried samples were easier to cook than oven-dried as reflected in the time for ease of cooking (Table 3). Similar result was reported by Sanni *et al.*, [8]. The effect of these differences indicates that Pupuru dried with solar cabinet dryer tend to be hard and cohesive in texture than the other two samples. The sensory evaluation of paste products is presented in Table 4. There was least preference for oven-dried sample in terms of aroma and overall acceptability. Traditionally before paste preparation, some of the outer layer is scrapped off. There

Table 4: Sensory evaluation of Pupuru dried by different methods

	Sensory attributes				
Sample	Colour	Aroma	Texture	Taste	Overall acceptability
Smoke-dried	5.9^{bc}	7.5^{a}	6.2^{b}	7.2^{a}	7.1^{a}
Oven-dried	6.1^{b}	4.7^{b}	7.1^{a}	7.1^{a}	6.4^{b}
Solar cabinet -dried	8.2^{a}	6.9^{a}	5.0^{c}	7.2^{a}	7.4^{a}

Superscript along same column are not significantly ($p<0.05$) different

was significant difference in the colour of the products even after pasting. The aroma of smoke-dried sample was similar to solar cabinet dried but significantly different from the hot air oven-dried. Usually during smoking, there is deposition of organic components like phenols, alcohols, aldehydes and ketones which impacts flavour and antimicrobial effect on the product. This could have enhanced acceptability. More so, panelists are more familiar with the smoke-dried product.

CONCLUSION

The three methods used were all suitable for the production of Pupuru. Processing reduced the hydrogen cyanide to level that could be considered safe.

This work evaluated the traditional preparation of pupuru and other drying methods in response to physicochemical and sensory properties. It also shows that the desired pasting attributes would not be adversely affected if such methods were adopted. It is likely that smoke deposits have antimicrobial and bactericidal effect on smoked product. Studies are currently underway to determine storage stability of the products.

REFERENCES

1. Cook, R.D., 1978. An enzymatic essay for total cyanide content of Cassava (Manihot esculenta Crantz) J. Science Food Agric., 29: 345-352.
2. Food and Agriculture Organisation, 2001. Food and Agriculture Organisation Statistic. Rome, Italy.
3. Odetokun, S.M., A.F. Aiyesanmi and K.O. Esuoso, 1998. Enhancement of the nutritive value of Pupuru, a fermented cassava product. Riv. Ital. sostanze Grasse, 75: 155-158.
4. Ogunsua, A.O. and G.T. Adedeji, 1979. Effect of processing on ascorbic acid in different varieties of cassava. J. Food Technol., 14: 69-74.
5. Ayankunbi, M.A., O.O. Keshinro and P. Egele, 1991. Effect of methods of Preparation on the nutrient composition of some cassava products: Garri (Eba) Lafun and Fufu. Food Chemistry, 41: 349-353.
6. AOAC, 1990. Official methods of analysis, 14th Edn. Washington D.C. Association of Official Analytical Chemists.
7. Medcalf, D.G. and K.A. Gillies, 1965. Wheat starches comparison of physicochemical properties. Cereal Chem., 34:141.
8. Sanni, L.O., O.B. Oyewole and D.V. Olowogbade, 1998. Effect of different drying methods on Lafun (fermented cassava flour). Trop. Sci., 38:1-4.
9. Aboua, F., 1995. Optimization of traditional fermentation of cassava. Trop. Sci., 35:68-75.
10. Bolhuis, G.G., 1954. The toxicity of cassava roots. Neth. J. Agric., 2: 176-185.
11. Akinrele, I.A., A.S. Cook and R.A. Holgae, 1962. The manufacture of gari from cassava in Nigeria. Proceeding of the First International Congress of Food Technologist. London, pp: 633-644.
13. Opadokun, J.S. and J.N. Ikeorah, 1984. Survey of Hydrogen Cyanide content of cassava products on sale in Ibadan markets. Rep. Nigerian stored Prod. Res. Inst. Technical Report No., 7: 57-61.
14. Okpokiri, A.O., B.C. Ijoma, S.O. Alozie and M.A.N. Ejiofor, 1995. Production of improved cassava Fufu. Nigerian Food J., 3: 145-148.