EFFECT OF DIFFERENT CASSAVA VARIETIES AND PROCESSING METHODS ON SOME CHARACTERISTICS OF 'KUDEME' - AN INOCULANT FOR 'AGBELIMA' PRODUCTION

N.T. Dziedoave
Food Research Institute (CSIR),
Accra.

W.O. Ellis
K. Boakye
Department of Biochemistry,
University of Science and Technology, Kumasi.

B.K. Simpson
J.P. Smith
Department of Food Science and
Agricultural Chemistry,
McGill University, Montreal, Canada.

ABSTRACT

Kudeme is a traditional inoculant used in fermenting cassava for the production of agbelima (fermented cassava dough), a traditional Ghanaian fermented cassava food. It helps to improve the texture, colour and flavour of the agbelima. The effect of different cassava varieties and processing methods on some chemical and microbiological characteristics of kudeme were studied. Significant differences ($p<0.01$) were observed in the chemical characteristics of kudemes prepared by the different processing methods. No significant differences were observed in microbial load of the kudemes. Differences in cassava variety significantly affected the pH, total acidity, Chroma (C^*) ($p<0.01$) and Value (L^*) ($p<0.05$) of the kudemes but had no significant effect on the Hue angle (H°) and the microbial load. The interaction between cassava variety and processing method significantly ($p<0.01$) affected the parameters monitored with the exception of microbial load. These observations may have effects on the quality of agbelima produced from the different 'kudeme' types.

Keywords: Cassava, Agbelima, Kudeme, traditional inoculate.

INTRODUCTION

Agbelima is a traditional fermented cassava food product widely consumed in most parts of Ghana. Agbelima is of prime importance in Ghana because it is used in the preparation of a wide range of traditional meals but given less attention with respect to improvement and standardisation in terms of quality and processing. Unlike most fermented cassava products, the fermentation process is usually enhanced by the addition of an inoculant locally called 'kudeme'. Kudeme is a product of microbial and biochemical disintegration of the cassava tissue (Sefa-Dedeh, 1989). The primary function of kudeme is to impart a smooth texture to agbelima and to improve the flavour and colour of agbelima (Budu, 1991; Al-Hassan, 1991; Lartey, 1993).

Kudeme processing varies from locality to locality and from processor to processor. About four to six different methods have been identified in the processing of kudeme (Budu, 1991; Lartey, 1993). Since agbelima is produced from any available cassava variety, the kudeme is likewise prepared from any cassava variety. Since different cassava varieties differ in quality and characteristics, the interaction between cassava variety and the method of kudeme preparation may affect the physicochemical characteristics of the kudeme, which may thus affect the performance of the kudeme, and consequently the quality of the agbelima produced. Therefore, an understanding of the effect of the interactions between cassava variety and processing method on the characteristics of the inoculum (kudeme) will greatly aid in the optimisation of the production process of agbelima.

The objective of this study was to investigate the effect cassava variety and processing method have on selected physicochemical and microbiological characteristics of kudeme.

MATERIALS AND METHODS

Experimental Design

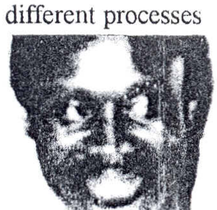
A two factor completely randomised design involving three cassava varieties and three processing methods were used in this study. All determinations were carried out in triplicate.

Source of Raw Materials

Fresh cassava tubers were obtained from farms in and around Pokuase, a suburb of Accra in Ghana. The cassava varieties selected comprised two local varieties namely, 'Bosomensia' (BN), and 'Biafra' (BF) and an improved variety, TMS-30572 ™ locally called GlemoDuade introduced into the country from the International Institute of Tropical Agriculture (IITA).

Kudeme Preparation

The harvested cassava tubers of each variety were used for kudeme processing as in Figure 1. The tubers were knife-peeled, washed and cut into pieces of 50gm each and processed using three processing methods namely, soaking in water, toasting and blanching. These three different processes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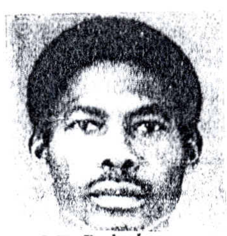
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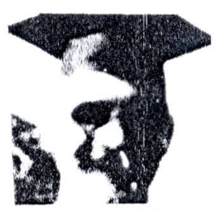
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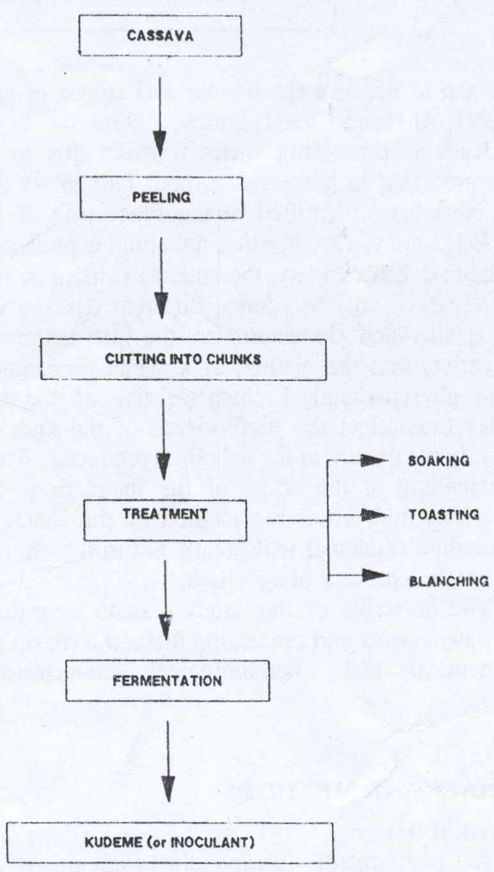

Fig 1. Flow Diagram for Kudeme Processing

were selected because traditional processors commonly use them.

i. Soaking Process - Three pieces of the cassava were soaked in water in a bowl for four days to ferment.
ii. Toasting Process - Three pieces of the cassava were first toasted for two minutes on charcoal fire and then wrapped in wet cheese cloth and placed in a polyethylene bag, tied securely and allowed to ferment for four days.
iii. Blanching Process - Three pieces of the cassava were blanched by dipping in boiling water for 10 minutes, then wrapped in wet cheese cloth and placed in a polyethylene bag, tied securely and allowed to ferment for four days.

These three processes were carried out on each of the three cassava varieties. The four days fermentation process was done under ambient conditions after which analyses were carried out on the fermented cassava samples termed as kudeme.

pH Determination

Five grams of each kudeme sample was taken and made into a slurry by mixing in 50ml distilled water. The pH of the slurry was determined using a Corning pH meter (model 240).

Total Titratable Acidity (TTA)

Eighteen grams of each kudeme sample (ground) was taken and made in a suspension by dissolving in 200ml of distilled water (CO_2-free) in 500ml conical flasks. The flasks were placed in a water bath at a temperature of 40°C for one hour with occasional shaking. The suspensions were filtered using Whatman's No. 1 filter paper. One hundred millitres of each filtrate was titrated with 0.2M NaOH using a phenolpthalein indicator. The total acidity was calculated as percent lactic acid.

Microbial Load determination

One gram of each kudeme sample was weighed into 9ml sterile distilled water in a test tube. The test tube and contents were shaken for 5 min. for uniform mixing. Decimal dilutions were then prepared using 0.1% sterile peptone solution as diluent to obtain the desired dilution of 10^{-5}. Microbial load was then determined using the pour plating technique and plates incubated at 28-30°C in a Gallenkamp incubator (Model IH-150) for 48 to 72hr. Colonies formed were counted using a colony counter (Gallenkamp Co. Ltd, England) and expressed as log CFU/g of kudeme.

Colour determination

The colour of each kudeme was determined on the L*C*H° colour space using a chroma meter (Model CR-200, Minolta Camera Co. Ltd, Japan). The chroma meter was calibrated with a standard white tile (L*=97.63, C*=2.17, H°=1.27).

Statistical Analysis

Analysis of variance was computed using the Statistical Analysis System (SAS, 1982).

RESULTS AND DISCUSSION

The results of this study are shown in Table 1. Toasting produced kudeme with the highest pH value while that from soaking had the lowest, with TMS 30572 having the highest pH and Bosomensia the lowest. The low pH observed for the soaked kudeme agrees with studies on foofoo production by Okafor (1984) who observed that soaking decreased the pH value of foofoo. During soaking a number of changes take place in cassava tissue due to a combination of enzyme and chemical effects (Okolie and Ugochukwu, 1988) and may account for the low pH of the soaked kudeme observed in this study. The trend in total titratable acidity (TTA) did not correspond to that of the observed pH. Kudemes produced by the blanching process gave the highest TTA value followed by that of soaking and then toasting, with Bosomensia and Biafra varieties having the highest TTA values and TMS 30572 the lowest. The difference in this trend may be due to changes in cassava variety. Generally, cassava fermentation proceeds with the production of a variety of organic acids such as lactic and formic acids thus affecting the level of total acidity (Collard and Levi, 1959; Akinrele, 1964). Both pH and total acidity were measured because the organic acids produced which are weak acids are in a system with some buffering capacity (Blanshard *et al.* 1994).

The colour of the kudeme was basically a combination of green, yellow and white. White (represented by L*) was dorminant with green having the least intensity. There were significant differences ($p<0.01$) in the colour of the different kudeme types. Kudemes produced by blanching

TABLE 1. VARIETAL AND PROCESSING EFFECTS ON SOME PHYSICOCHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF KUDEME

PROCESSING METHOD	CASSAVA VARIETY	KUDEME TYPE	pH **	TOTAL TITRATABLE ACIDITY **	VISUAL LIGHTNESS (L^*) **	CHROMA (C^*) **	HUE (H^o) **	Log CFU/g KUDEME ns
SOAKING	Biafra (BF)	SBF	4.49 (0.01)a	0.40 (0.00)a	90.81 (0.52)a	9.11 (1.36)a	98.80 (0.26)a	7.10 (0.61)
	Bosomensia (BN)	SBN	4.29 (0.00)b	0.56 (0.00)b	87.89 (0.94)b	9.51 (0.03)a	94.93 (0.80)bc	6.78 (0.47)
	TMS 30572 (TM)	STM	4.48 (0.02)a	0.51 (0.05)b	88.83 (1.14)b	9.53 (0.21)a	93.20 (0.20)c	6.84 (0.47)
TOASTING	Biafra (BF)	TBF	4.60 (0.02)c	0.45 (0.05)a	84.39 (0.54)c	16.86 (0.96)b	92.00 (1.76)c	7.24 (0.65)
	Bosomensia (BN)	TBN	4.70 (0.01)d	0.56 (0.00)b	86.98 (2.02)b	16.43 (1.12)b	93.80 (1.11)bc	7.15 (0.64)
	TMS 30572 (TM)	TTM	5.74 (0.00)c	0.15 (0.02)c	87.87 (1.25)b	13.43 (0.15)cd	95.70 (1.20)b	6.85 (0.61)
BLANCHING	Biafra (BF)	BBF	4.59 (0.00)c	0.67 (0.05)d	75.45 (0.86)d	14.06 (0.80)c	105.33 (1.01)d	6.80 (0.65)
	Bosomensia (BN)	BBN	4.66 (0.02)f	0.67 (0.05)d	76.52 (1.47)d	12.33 (0.62)d	104.83 (1.50)d	6.52 (0.45)
	TMS 30572 (TM)	BTM	4.21 (0.02)g	0.64 (0.00)d	79.17 (1.52)e	12.51 (0.95)d	103.73 (1.01)d	7.25 (0.50)
Lsd (0.05)			0.02	0.06	2.28	1.52	2.03	-
C.V.			0.09	0.33	0.07	0.23	0.05	0.04

Means in the same column followed by the same letter are are not significantly different.

ns - Not significant; ** - $p < 0.01$.

SBF - Soaked Biafra; SBN - Soaked Bosomensia; STM - Soaked improved variety.

TBF - Toasted Biafra; TBN - Toasted Bosomensia; TTM Toasted improved variety.

BBF - Blanched Biafra; BBN - Blanched Bosomensia; BTM Blanched improved variety.

had a lower L* value as compared to kudemes produced by soaking and toasting. The low L* value may be due to the fact that, the relatively intense initial heat treatment gelatinised the starch thereby reducing the whiteness of the product.

With respect to the C* parameter which indicates overall chroma, i.e. colour purity (McLaven, 1980; Lhl *et al.*, 1994), significant differences ($p<0.01$) existed between the kudeme types produced by the three processes with kudemes produced by toasting having the highest overall chroma and that of soaking the least. It was also observed from the analysis of data that the variety of cassava and the interaction between the variety of cassava and processing method significantly affect the visual lightness (L*) and the chroma but not the Hue angle (H°). The two local varieties on the one hand, differed from the improved variety in chroma (C*) and visual lightness (L*).

The observed data showed that the three processes produced kudemes of high microbial load. The local Biafra variety produced the highest microbial load with the improved variety, TMS 30572 producing the least. For processing methods, toasting produced kudeme with the highest microbial load and blanching, the lowest microbial load. The low microbial load observed with the blanching process in relation to the toasting method may be attributed to the fact that blanching destroys or kills some surface micro-organisms during processing (Lund, 1988) and also the variation between the duration in blanching (10 minutes) and toasting, which was three minutes. In relation to the observed data, the analysis of variance data showed that, cassava varietal difference, differences in processing method and the interaction between these two parameters did not significantly affect microbial load.

CONCLUSION

In conclusion, it is observed from this study that processing methods significantly ($P<0.01$) affect pH, total titratable acidity, and colour but not microbial load. Differences in variety of cassava however, affected significantly ($p<0.01$) the pH, total acidity and the chroma (C*) of kudeme but not the Hue Angle (H°) and the microbial load. The effect of varietal difference on the visual lightness (L*) is significant only at the 5% level. The combination between cassava varietal difference and processing method had a significant effect on all the parameters investigated except for the microbial load. The widest variation in the characteristics of the nine kudeme types was observed for total acidity (C.V.=0.33) while the smallest variation was observed for the microbial load (C.V.=0.04). Having established these differences in the characteristics of kudeme, an investigation into the effects of the observed differences during agbelima production would facilitate an understanding of the performance of each kudeme type in relation to the observed characteristics.

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