DEVELOPMENT of a DEHYDRATED FERMENTED MAIZE MEAL.

PROGRESS REPORT # 1

Chemical and Organoleptic Characteristics of Traditionally Fermented Market Samples of Corn - Dough.

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1. INTRODUCTION

1.1 PROBLEM

Maize is one of the most widely used cereals in Ghana where it is utilised by almost every ethnic group for various products which form part of the main diet of the people. Although different methods are employed, most of these products are similar and, in fact, common intermediate products can be identified. Fermented maize dough is one very common intermediate product which forms the basis for a large variety of foods derived from maize.

However, the traditional methods employed for the preparation of this fermented maize dough are unstandardised and involve a lengthy process resulting in an unstable product. It would therefore be a laudable idea to develop a standard method of producing a stable and readily available dehydrated fermented maize meal suitable for the intended food uses. In this exercise, a thorough appraisal of the processing effects on the nutrient composition and organoleptic properties; and the various chemical changes that will take place will be required with a view to maintaining the desired quality of the final product.

1.2 OBJECTIVES

The ultimate objective of the whole project is to produce an acceptable dehydrated fermented maize meal with good keeping quality and suitable for the intended food uses.

In line with this objective, this preliminary study aims at investigating the level of acidity and other chemical properties in relation to the acceptability of the traditional fermented corn dough as is available in the markets in order to establish the acceptable limits of these properties in fermented corn dough.

1.3 METHODOLOGY

Samples of traditionally fermented corn dough were purchased from four corn dough sellers randomly selected from each of five markets in Accra. In the course of the sampling the processors (who are in most cases the sellers) were interviewed to obtain the various methods employed for corn dough production.

To prevent further fermentation, all samples were frozen immediately after purchasing and kept in that condition until the time of analysis. While the chemical analysis for total acidity and proximate composition was in progress, representative samples from each market sample were simultaneously assessed for their organoleptic properties and general consumer acceptability. This determination was done by exposing trained/ untrained (unscreened) taste panelists to samples of "AKASA" - a common fermented corn dough poridge-to assess their flavor, taste, appearance and acceptability. A standardised method was used in the preparation of the "AKASA" to avoid any possible variations in the quality of the various samples due to differences in methods of preperation.

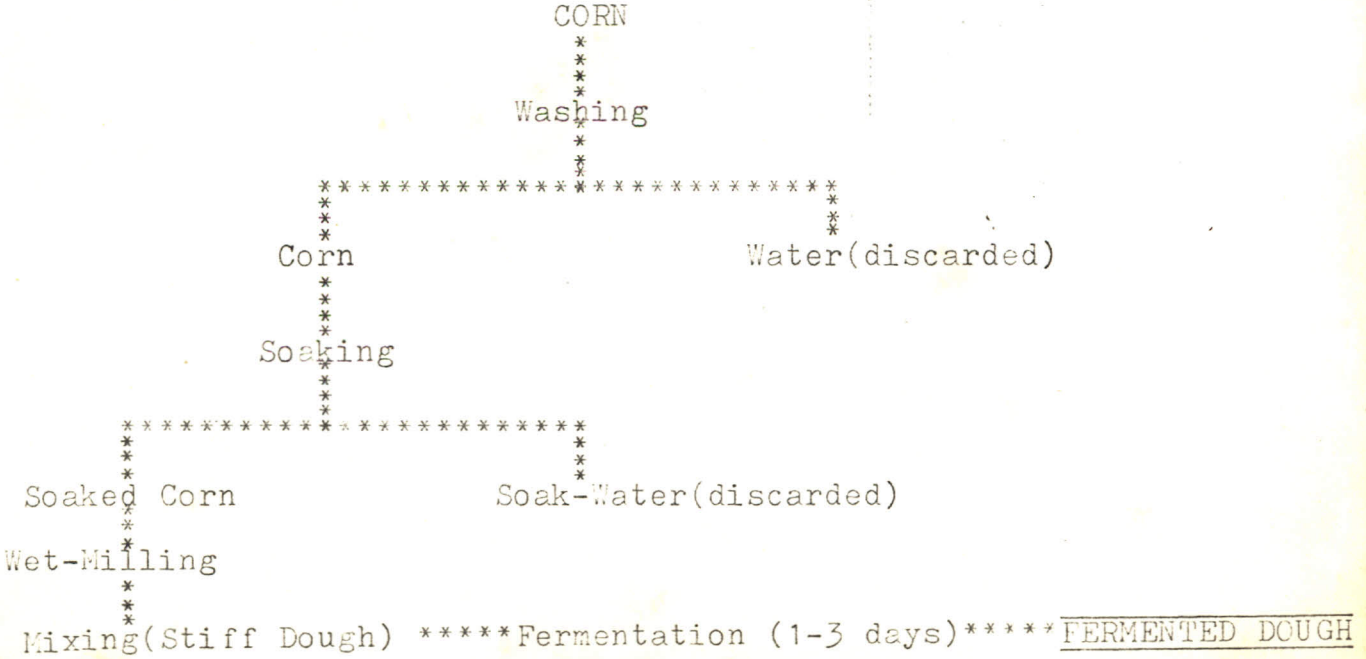
2. TRADITIONAL METHODS OF CORN DOUGH PROCESSING.

2.1 METHODS

The traditional preparation of maize dough as described by W.F.K. Christian (1970) is uncontrolled and involves spontaneous fermentation. According to the method, the grains are washed and soaked for twelve (12hrs.) to twenty-four (24hrs.) hours, wet-milled into a meal and made into a stiff dough which is then allowed to undergo spontaneous fermentation for one to three days before use.

The description of the various methods employed by the traditional processors interviewed was found to follow this same procedure described by Christian. Soaking time and fermentation periods were the only unit operations found to differ from processor to processor. According to them, the soaking time depends on the hardness of the corn and the fermentation period is determined by the individual processor's preference but should always be within the acceptable limits of the consumer community. Soaking time in all cases however, does not exceed 48 hours as it is likely to develop a bad odor when kept too long in the soak - water. This odor remains in the dough even after fermentation and affects the organoleptic properties of the final product.

FLOW DIAGRAM FOR TRADITIONAL CORN-DOUGH PROCESSING.



2.2 PRODUCT APPLICATION AND PROPERTY REQUIREMENTS

An extensive survey work undertaken by F. E. Dovlo(1970) has established various uses of maize for food in Ghana. The work, which serves as a criterion for the characterisation and definition of maize foods, has been able to classify the various types into three main intermediate products from which liquidised, semi-solid, and solid or caky maize products such as "Akasa", "Akple", "Banku", "Abolo", "Kenkey", and "Fonfom", can be obtained.

Apart from the Northern and Upper Regions of Ghana where other cereals are used as a substitute for maize to prepare similar products, all other ethnic groups in Ghana have at least one of these products forming part of their main diet. All the products require corn dough with a suitable degree of fermentation which has not yet been established. It is, however, hoped that this project will eventually come out with a standardised process from which an intermediate product, acceptable for all these final products, will be obtained.

3. PROPERTIES OF TRADITIONALLY PROCESSED CORN-DOUGH SAMPLES

All the twenty different samples of corn-dough collected from various markets in Accra were analysed for their proximate composition (ie. Protein, Fat, Moisture, and Starch), titratable acidity, and organoleptic characteristics. The results from these determinations were analysed and presented in terms of consumer preference in relation to the acidity of the samples.

3.1. PROXIMATE COMPOSITION

The methods used for most of the determinations are given by the American Assocition of Cereal Chemists (1962) and the Association of Official Agricultural Chemists (1970). Total nitrogen was determined on about 2g sample by micro-Kjeldahl method and percentage protein calculated as (Nx6.25) whilst the crude fat content was determined by extraction in a Soxhlet unit with

petroleum ether for about five hours (A. A. C. C. 1962). The Lintners method of starch determination (Pearson, 1970) was used to obtain the starch content of the samples; and for moisture, the Oven drying method was used. The Lintners method involves acid dispersion of the starch followed by its polarimetric estimation.

TABLE 1

Proximate Composition of Market Samples of Fermented Corn-Dough.

Sample Code	Source	Moisture %	Starch %D.M.B.	Fat %D.M.B.	Protein %D.M.B.
FD/MTA/459	Mal'Ata Market	48.7	76.0	4.1	11.6
FD/MTA/669	"	53.3	86.0	3.0	7.6
FD/MTA/619	"	50.4	76.4	3.9	11.6
FD/MTA/349	"	50.7	81.3	3.6	10.4
FD/MPB/349	Mamprobi Market	49.5	70.4	4.1	11.6
FD/MPB/244	"	50.4	69.6	4.0	11.1
FD/MPB/459	"	50.1	82.5	3.9	9.9
FD/MPB/619	"	50.1	68.3	2.7	9.2
FD/KNS/349	Kaneshi Market	50.7	68.3	3.5	11.5
FD/KNS/619	"	48.8	81.3	4.1	12.6
FD/KNS/459	"	50.8	73.9	3.5	11.2
FD/KNS/669	"	46.5	76.2	3.8	10.4
FD/OSU/349	Osu Market	53.8	88.3	3.5	8.9
FD/OSU/459	"	49.5	86.8	3.9	11.6
FD/OSU/619	"	48.6	78.5	3.5	10.3
FD/OSU/244	"	53.2	70.9	3.9	10.9
FD/MKL/349	Makola Market	51.6	68.9	4.3	11.5
FD/MKL/669	"	51.8	80.7	3.9	12.0
FD/MKL/619	"	63.6	63.6	3.8	11.4
FD/MKL/244	"	47.3	68.3	4.1	12.9

As shown in Table 1, the moisture levels in the samples range from 46.5 to 53.8 per cent. On dry matter basis the protein, fat, and starch content were found to have the following ranges respectively:

7.6% to 12.9%, 2.7 to 4.1 percent, and 63.6 to 88.3 percent.

3.2 TITRATABLE ACIDITY AND CONSUMER ACCEPTABILITY

The titratable acidity was measured for all samples by titrating extracts against 0.1N NaOH and the results expressed as g NaOH per 100g sample. A wide range of acidity was observed in the samples examined; the minimum being 0.6g NaOH/100g sample (DMB) and 1.7g NaOH/100g sample (DMB) as the highest. Sensory evaluation results also indicate consumer preference for the samples with lower acidity (mainly 0.6-0.8g NaOH/100g DMB, but average of about 0.9gNaOH per 100g dry sample) while most of the samples rejected by the taste panel were those with acidity of well over 1.0gNaOH/100g sample.

TABLE 2

Consumer Preference in Relation to the Acidity of Market Samples of Fermented Corn-Dough.

LIKE EXTREMELY		LIKE MODERATELY		DISLIKE MODERATELY		DISLIKE EXTREMELY	
Sample Code	Acidity gNaOH/100g	Sample Code	Acidity gNaOH/100g	Sample Code	Acidity gNaOH/100g	Sample Code	Acidity gNaOH/100g
MTA/459	0.96	MPB/619	0.84	MPB/349	0.69	MTA/669	0.90
KNS/349	0.62	OSU/349	0.67	KNS/669	1.35	KNS/619	1.11
OSU/244	0.66	MPB/244	0.94	MKL/619	1.47	MKL/669	1.21
OSU/619	0.82	MPB/459	1.08	MTA/619	1.51	OSU/459	1.43
MKL/344	0.92	MTA/349	1.55				
MKL/244	1.17						
KNS/459	1.75						
Average	0.98		1.02		1.25		1.16

Apart from the few isolated cases (figures underlined in Table 2) where a sample with high acidity is extremely prefered and a low - acid sample is rejected, the general trend as reflected by the overall averages tend to favor a consumer preference for samples with low acid levels.

4. GENERAL DISCUSSIONS

The main indication from the results is the fact that titratable acidity plays an important role in the consumer acceptability of the final product. This is a fermentation product and although no clear-cut limits were obtained for acceptable levels, higher acidity than 1.0g NaOH/100g sample which usually results from long fermentation periods, were found to be associated with low consumer acceptability. The main question this raises is whether the high acid level specifically impacts the adverse organoleptic properties to the product , or whether it is only an indication of a procedure giving rise to unacceptable flavor compounds, the development of which goes simultaneously with rise in acid levels in the fermented product.

The results of this preliminary study could not give satisfactory answers to these questions, neither could any standards be developed. The only valuable information obtained here is that fermentation is necessary to give the desired textural and organoleptic characteristics of the final product ; but fermentation procedures resulting in high acidity can make the product unacceptable.

To confirm this and be able to set standards for the fermentation of corn dough for food uses in Ghana, it would be necessary to investigate the biochemical changes during the traditional preparation of corn dough from the steeping stage, through fermentation to the final product. This is the main objective of the immediate follow-up to this study. This will be followed by the analysis of pure culture fermented samples to determine any changes in the rate of the components being examined.