

# STUDIES ON COMPOSITE BREAD - CORN BREAD

By

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## ABSTRACT

Bread was prepared with composite flour containing 20% maize meal or maize flour. Maize meal with particle size  $\angle 439\mu$  gave heavy loaves with specific volume of 2.5. Maize flour with much finer particles  $\angle 129\mu$  however, gave acceptable loaves with 3.5cc/g specific volume.

The effect of various additives on the quality of corn bread was studied. 0.5% diastatic malt flour was found to improve the volume and other characteristics extensively (sp. vol. 4.3cc/g). Both soya flour and Agushie flour, which are vegetable protein sources, depressed the volume slightly. 1.0% Emplex (Sodium Stearoyl - 2 - Lactylate) had a marked effect on the quality of corn bread. The volume was comparable to that of 100% wheat bread (sp. Vol. 5.0cc/g). This emulsifier also improved the colour and texture of corn bread.

It was observed that corn bread became stale after 30 hours. This resulted in the bread becoming dry and very crumbly despite the addition of 2% hardened fat. Here again, the use of 1.0% Emplex in place of hardened fat improved the quality of bread by retarding staleness and thus suppressing crumbliness.

## INTRODUCTION

Wheat flour protein forms with water an elastic substance called gluten. Wheat gluten strength is of importance in conventional bread-making systems because it has the power of retaining the gas generated by yeast, thus giving volume to the loaf. However, various workers (3, 6, 7, 8 & 12) have demonstrated that it is possible to make bread from gluten-free flours by using other substances which have the power to bind starch particles together into a cohesive structure.

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Bread from blends of wheat and non-wheat materials has been known in various parts of the world since ancient times.<sup>(2)</sup> In Ghana, however, 'corn bread' made from blends of wheat and maize flours was introduced during the Second World War.

A number of papers have been published on the making of bread from blends of wheat and non-wheat materials of tropical origin. Avazzi and Graff 1939<sup>1</sup> described bread made from blends of wheat and sorghum or maize and found that 10-15% of the diluent gave poor looking loaves. Littlewood 1964<sup>4</sup> recommended the use of good strong Canadian wheat flour to provide the lift and stability in corn bread. Rasperova et al 1967<sup>5</sup> found that without the use of additives, blends of 30% non-wheat flour (from Ghanaian starchy materials) and strong wheat flour gave passable bread.

Various binding agents of swelling nature and certain emulsifiers have been found to improve the quality of bread from composite flours<sup>9,10 & 11</sup>.

Some workers have found it necessary to raise protein content in composite flour bread to levels similar to all wheat bread. This has been achieved by the addition of protein concentrates both of plant and animal origin.<sup>7, 8, 9, 10 & 11</sup>

This paper describes work on breadmaking from blends of wheat flour and maize meal or maize flour with 20% of the diluent. The effect of additives such as diastatic malt flour, soya flour, 'agushie' flour (*Cucumeropsis edulis*) and the emulsifier sodium stearoyl - 2 - lactylate on 'corn bread' was studied.

#### MATERIALS AND METHODS

##### A. Ingredients

flour

1. Canadian strong wheat<sup>1</sup> of about 72% extraction was used in these experiments.

##### 2. Maize meal and maize flour

Maize meal and maize flour were prepared using a laboratory mill (70% extraction). The through of sieve with aperture size 439 u were designated maize meal and the throughs of mesh size 129 u were taken as maize flour.

3. Soya flour

Arkasoy 50 manufactured by the British Arkady Company was used in this work. This is a defatted soya flour with a protein content of 50%.

4. "Agushie" flour

Defatted flour of Cucumeropsis edulis with protein content of 70%. This is a raw product which had not been heat treated.

5. Malt flour

Diastatic malt flour 65<sup>o</sup> Lintner.

6. Emplex

Emplex is the brand name for the emulsifier sodium stearoyl-2-lactylate.

TABLE I

B. Formula

Wheat flour	480g	(80%)
Maize flour (meal)	120g	(20%)
Salt	8g	
Sugar	16g	
Yeast	10g	
Margarine	12g	
Water	Variable	

Maize meal was used initially but subsequent work was carried out with maize flour.

C. Procedure

The yeast was dissolved with 2 tablespoonfuls of sugar in some of the water. The rest of the sugar and the salt were dissolved in the remaining water. All the ingredients were then mixed together in a Hobart mixer CE100 using the dough hook at low speed for 15 minutes.

The dough was fermented for 40 minutes and then punched. It was then rested for 20 minutes before scaling (350g) and moulding with a three-roll moulder. The moulded dough was panned and proofed. Final proofing time was variable, depending on the height of dough in the pan. Fermentation was carried out in a Simon Fermentation cabinet at 30°C. The amount of water added was variable depending on the type of material incorporated in the formula. Baking was done at 230°C for 20 minutes. Loaf volumes were determined using seed displacement. Each baking test was carried out at least twice.

\*The soya and "Agushie" flours replaced part of the maize flour, for example, where 5% (by total flour weight) of either flours was used, 15% of maize flour was used instead of 20%.

! 1.0% Emplex was used in place of 2% margarine in the formula.

RESULTS AND DISCUSSION

Table II

Effect of Various Additives on Loaf  
Volume of Corn Bread:

Baking Test No.	Additive	Quantity % on Flour	Water % on Flour	Total Fermentation Time hrs.	Sp. Volume of bread cc/g
1	-	-	51	3½	2.5
2	-	-	57	3½	3.0
3	-	-	53	3½	3.5
4	Diastatic malt flour	0.5	53	3	4.3
*5	Arkasoy 50	5	52.5	3½	2.7
*6	'Agushie' (Cucumeropsis edulis)	5	52.5	3½	2.5
*7	'Agushie' + malt flour	5 + 0.5	53	3	3.1
! 8	emplex	1	53	2	5.0

In baking test No.1, maize meal was used instead of maize flour.

\* ! See under procedure.

TABLE III

Effect of Various Additives on the External and Internal Characteristics (Loaf Score)

Baking Test No.	1	2	3	4	5	6	7	8
Volume 20	10	10	15	18	10	10	15	20
Crust Colour 10	6	6	10	8 Spotty	8	6	10	10
Symmetry 10	5	5	10	10	5	5	10	10
Break & Shred 10	5	5	10	8 ragged	5	5	10	8 ragged
Grain 20	10	10	15	15 open coarse	10	10	15	20 excellent
Crumb Colour 10	8	8	10	8	8	8	10	10 excellent
Texture 20	10	10	15	15	10	10	15	20 excellent
Total Score 100	54	54	85	82	56	54	85	98

The addition of 0.5% diastatic malt flour improved the volume (Table II Nos. 3 & 4) but the product had some defects such as spotty crust, ragged break and an open coarse grain.

Both defatted soya flour and defatted 'Agushie' flour (*Cucumeropsis edulis*) individually depressed the volume (Nos. 5 & 6 on Table II & III) and thus affected other internal and external characteristics of the bread. These two products had a beany flavour which were not quite acceptable.

The addition of both 'Agushie' and diastatic malt (No.7) in corn bread gave loaves of bread with acceptable characteristics because the two additives had complementary effect on each other. The loaf score shows that this product had very acceptable qualities.

Emplex, sodium stearoyl<sup>2</sup>/lactylate, improved the qualities of corn bread namely:

1. The specific volume of corn bread was improved from 3.5 to 5cc/g (Table 2 No.8).
2. Crumb colour and texture were excellent.
3. The grain of the loaf had uniform cell structure and was found to be excellent.

The only fault found with this product was the ragged break and shred which slightly marred the outward appearance of the loaf.

#### CONCLUSION

Corn bread with no additives has very good eating qualities when it is fresh. The main fault that was detected was the rapid rate of which the bread staled after 30 hours. The addition of soya did not seem to have much influence on this by way of improvement. Sodium stearoyl-2-lactylate however had the marked effect of making corn bread very soft with very good internal characteristics.

In order to recommend the use of any texture improver, there must be the evidence of a need to store beyond 30 hours after baking.

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