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Changing of pH and Quantity of Major Chemical Components of Dabar and Fetarita Flours during Fermentation.

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ABSTRACT

Two varieties of sorghum samples Dabar and Feterita were perched from the food research center at Chambat, The starters were collected from different house holds in Omdurman, Khartoum north, Khartoum state. They were milled into flour and fermented into dough forms and then kisra was made of them. Chemical analysis before and after fermentation was conducted. And then the effect of fermentation on quantity of protein, carbohydrate of the two varieties was determined, while the chemical analysis before fermentation showed that moisture content was 6.8% and 6.5% in Dabar and Feterita flours, while protein content was found to be 11% in Feterita and 10% in Dabar the fat, fiber ash and carbohydrates for Dabar and Feterita were found to be (3.5%-3.0%), (1.7%-1.4%), and (75.6-76%) respectively also.

Keywords: fermentation, flour, dough, kisra, dabar, feterita.

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INTRODUCTION

Fermentation has been known by man as a naturally occurring process for thousands of years. Man has succeeded in utilizing this natural phenomenon for his benefit, particularly in food production. Fermentation is known to affect the nutritive value of food by increasing or decreasing the levels of some of its contents.

Sudan is rich in fermented foods, among which Kisra forms the staple food for the majority of Sudanese people. Kisra is a pancake like bread made in a form of thin sheets from sorghum or millet flour. The process of its production falls into three phases: Milling, Fermentation and Baking [1].

In the past limiting factor in Kisra production in the Sudan was the milling capacity. Traditional milling is tedious and time consuming. However, this problem was solved through the introduction of modern mechanical mills which are now common in the Sudan. The development of cities, changes in the food habits, education and movement of women to work outside their houses forced many Sudanese people to shift to the consumption of bread made from wheat. Regardless of the progress made in solving the problem of sorghum milling, fermentation and baking processes still constitute the bottlenecks in Kisra production. A lot of work is needed to improve starter culture production and baking so that people can shift back towards Kisra consumption [2].

Women in villages have no problem concerning starter culture production because they utilize the remnants of the previous fermented batch, and if this starter is lost for any reason or another, they can get it easily from the neighbors for no charge. However, during the winter season fermentation may get delayed.

This may necessitate the production of improved starter, capable of carrying the process under low temperature. During summer, the dough may have bitter taste due to over fermentation.

Some people say that this bitter Kisra cause some abdominal troubles. In the urban areas Kisra production is not always practiced at home, Thus urban women face the problem of lack of starter.

MATERIALS AND METHODS

Materials

Flour:

The flour used in this study was prepared from the sorghum verities locally called Dabar and Fetirita it were perched from the food research center at Shambat and they were kept in a sterilized bottle in the refrigerator.

Collection of Starter Sample:

Starters were collected from different households in:

- Omdurman.
- Khartoum North.
- Khartoum.

Preparation of the Dough:

Fermented dough (Ajien) was prepared according to the traditional methods used in homes. Sorghum flour was mixed with water in ratio of about 1:2 (w/v), then a starter was added to the dough. At a rate of about 10% of the dough. The fermentation was usually completed of in 6-12 hours depending on the temperature and the amount of starter added.

Methods

Determination of pH, moisture content, crude fiber, crude protein, ash content of the fermented dough were carried out at 3 hour intervals.

pH:

Ten grams of sample were shaken into 90 ml distilled water, left to stand for twenty minutes and then the pH of the suspension was measured using a pH meter model 7020 [3].

Ash content:

Total ash content was determined by the AACC method [3]. Constant weight was obtained after igniting the sample in an electric muffle furnace. The crude ash content was calculated using the following equation:

$$\text{Crude ash\%} = \frac{W_2 - W_1}{\text{sample weight}} \times 100$$

Where:
$W_1 =$ The weight of the empty crucible.
$W_2 =$ The weight of the crucible + sample after ashing.

Crude Fiber:

The percent crude fiber content was determined according to the AACC method [3]. The crude fiber content was estimated using the following equation:

$$\text{Crude Fiber\%} = \frac{W_2 - W_1}{\text{sample weight}} \times 100$$

Where:
$W_1 =$ The weight of the oven dry sample after treatment by H_2SO_4 and KOH.
$W_2 =$ The weight of the sample after ashing.

Crude Fat:

Crude fat was determined as described by AACC [3]. The result was calculated on dry weight basis using the following equation:

$$\text{Crude Fat\%} = \frac{W_2 - W_1}{\text{sample weight}}$$

Where:
$W_1 =$ The weight of the empty extraction flask.
$W_2 =$ The weight of the extraction flask after the extraction process.

Crude Protein:

This was done according to the method described by AACC [3] and the micro-kjeldahl method of AOAC [4]. The protein content was calculated as follows:

$$\text{Nitrogen\%} = \frac{\text{ml HCL} - \text{ml HCL blank} \times 0.02 \times 14 \times 100}{\text{sample weight} \times 100}$$

Where:
$0.02 =$ Normality of HCL.
$14 =$ Nitrogen molecular weight.
$1000 =$ To convert from ml equivalent to gram
Therefore: protein% = Nitrogen (%) $\times$ 6.25

Moisture Content:

The moisture content of the sample was determined by using the air oven method of AOAC [4]. The moister content was calculated follows:

$$\text{Moisture\%} = \frac{W_1 - W_2}{W_2} \times 100$$

Where:
$W_1 =$ Original weight of sample.
$W_2 =$ Weight of sample after drying.

RESULTS AND DISCUSSION

Chemical Composition of Dabar and Fetirita Flours:

The chemical composition of Dabar and Fetirita flours were determined as described in material and method.

The results are shown in table (1). The pH of Dabar and Fetirita flours has the same value of 6.2. This is in agreement with values reported by Hamad *et al*. [5], Ahmed [6], Dirar [1], El Sharif [7] and El Tinay *et al* [8] who found that the pH of Dabar and Fetirita flours ranged between 6.2 and 5.6.

The moisture content was 6.8% and 6.5% in Dabar and Fetirita flours, respectively. This is not very different from results obtained by Yousif and Magboul [9] who found 6.1% as the average moisture content of 15 varieties of sorghum grown in Sudan. However results reported by [1] and [7] show that the moisture content of Dabar flour ranges between 5.7% and 10.5% with 7.4% as a mean. According to Ahmed [9] the moisture content of Dabar flours is 6.9% El Tinay *et al*. [8] reported that the moisture content of Fetirita was 6.5%.

The protein content of Fetirita was 11.0% and that of Dabar was 10.0% Feterita has a slightly higher protein content that Dabar. This result agree with results reported by Yousif and Magboul [10], Badi *et al* [11], El Hidai [12], Dirar [1], [9] and Eggum *et al*. [13] who found that the protein content of Dabar and Fetirita flour ranged between 6.9% and 13.8% and 6.5% and 13.8% respectively.

Deyoer and Shellenberger [14] found the highest protein level in 30 samples of different sorghum varieties to be 12.8% and the lowest to be 6.6%.

The fat content of Dabar was 3.5% and that of Fetirita was 3.0%. Reports in the literature show that the fat content of Dabar ranged between 5.1 % to 3.5% ([1];[10] & [11]). El Hidai [12] found the fat content of Fetirita to be 3.0%.

The fiber content of Dabar and Fetirita was 1.7% and 1.4% respectively. These results agree with results reported by Yousif and Magboul [10],[11],[12]&[1].

Dabar and Fetirita have a similar ash content of approximately 1.7%. These results agree with results reported by Dirar [1] and El Hidi [12].

The carbohydrate contents of Dabar and Fetirita were 75.6% and 76.1%, respectively. Reports in the literature show that the content of carbohydrate in Fetirita is higher than in Dabar. This result agrees with results reported by Dirar [1] and El Hidai [12].

These counts indicated that yeasts do not play a significant role in Kisra fermentation although they are present in most of this fermentation.

Chemical composition of fermented dough of Dabar and Fetirita:

The chemical composition of fermented dough of Dabar and Fetirita was determined as described in materials and methods. The results are shown in Figures 1, 2, 3, 4, 5 and 6. The pH dropped during the fermentation from 5.8 to 3.6 in 15 hours (Fig. 1). This is a relatively slow drop in pH. Hamad *et al*. [2] found that the pH in Kisra fermentation dropped from about 5.4 to 3.4 in about 10 hours. Achi [15] reported about a drop in the pH of obiolor from 6.8 to 4.9 in 24 hours.

The protein content of the fermented dough increased slightly from 10.0% at zero time to 11.4% at the end of an 18 hours fermentation for Dabar and from 11.0% to 12.1% for Fetirita (Fig. 2). Some workers reported about increases in the protein content of fermenting sorghum doughs ([16]; [17] & [6]). Other workers found no significant increases in the protein content ([2]; [18] & [19]).

Hamad [20] attributed the apparent increase in the protein content to losses in other dough components such as starches and water.

During the fermentation the fat content decreased slightly from 3.5% to 3.1% and from 3.0% to 2.6% in Dabar and Fetirita respectively. These results agree with reports made by El Hidai [12] who found a decrease in the fat content of Dabar and Fetirita doughs from 3.5% to 3.2% and from 3.0% to 2.7% respectively (Fig. 3).

The fiber content of the fermented dough's of the two sorghum types increased with time by 18 hrs. Of fermentation Dabar fermented dough had 3% crude fiber which is double the amount in Dabar flour. Fetirita dough had 2.7% crude fiber, which is 50% more than that in flour found by El Hidai [12] (Fig.4). The ash content of the two dough did not change during the fermentation process (Fig. 5). The moisture content of fermented dough increased slightly from 6.8% at zero time to 7.2% at the end of an 18 hours fermentation for Dabar and from 6.5% to 7.1% for Fetirita (Fig. 6).

From the obtained results, we can conclude to that, nutritive value of the fermented dough is slightly increased quantitively and mechanically because the fermentation Kisra could be easily digested and absorbed, then fermentation is a primary stage of digestion which increases the nutritive value of flour.

Table (1): Chemical Composition of Dabar and Fetirita flours (On dry matter basis)

Components	Dabar	Fetirita
pH	6.2	6.2
Moisture%	6.8	6.5
Crude protein%	10	11
Crude fat%	3.5	3
Crude fiber%	1.7	1.4
Ash%	1.71	1.7
Carbohydrate%	75.6	76.1

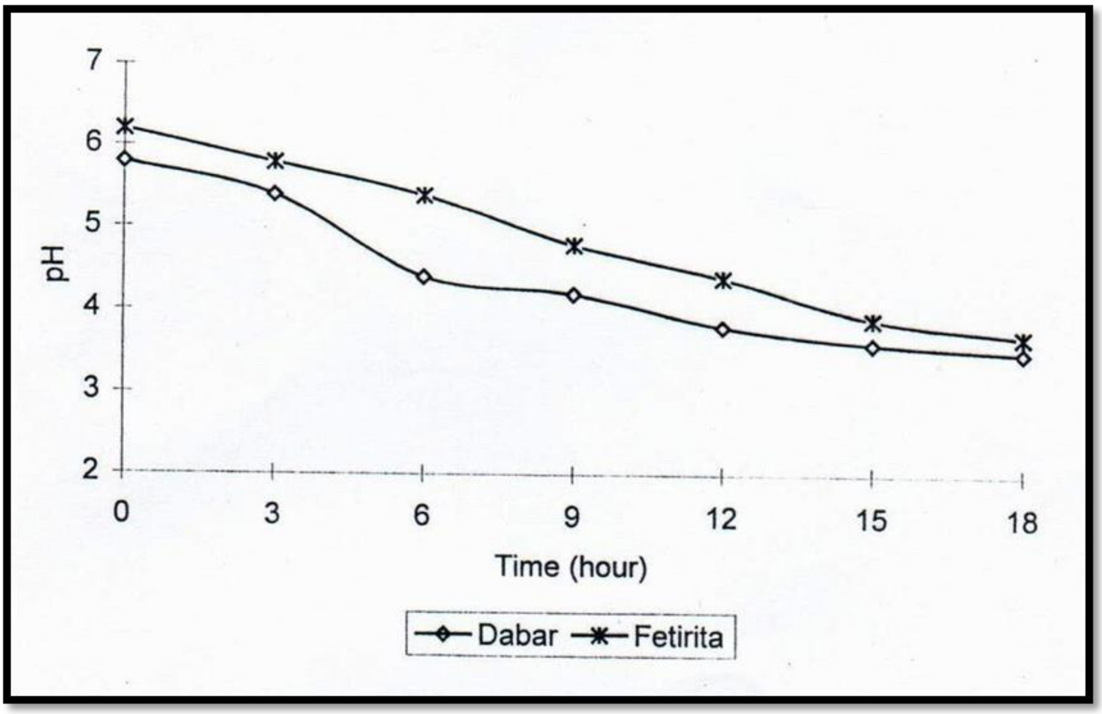

Fig. 1: pH

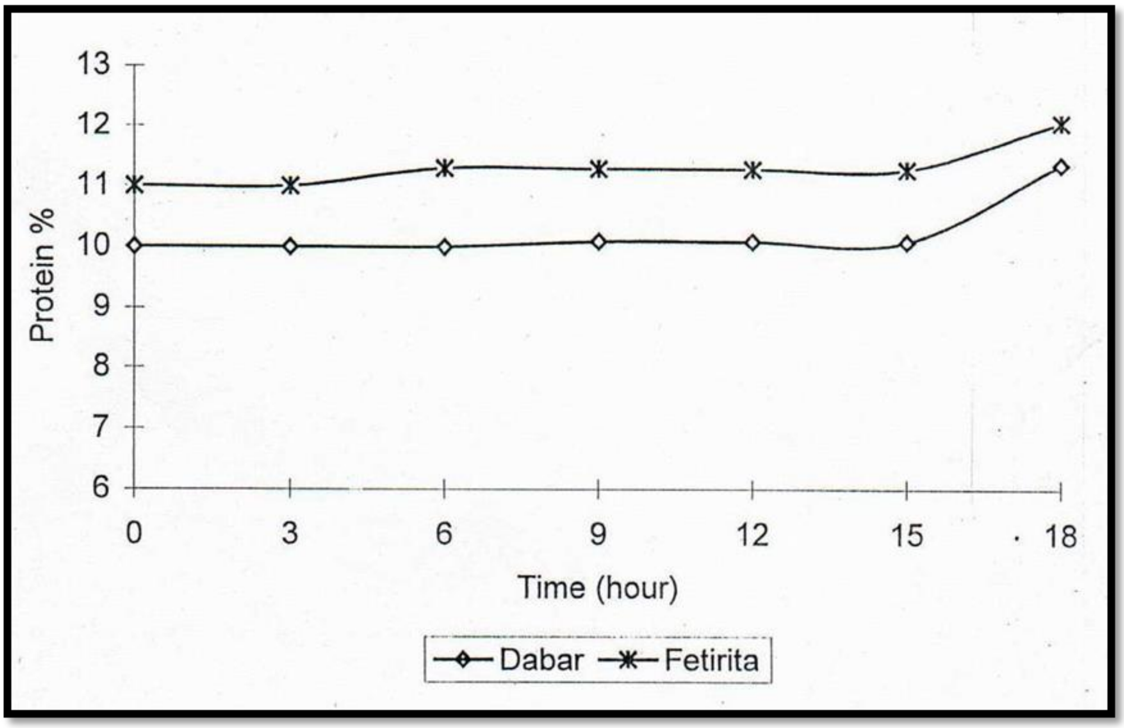

Fig. 2: Protein content of Dabar and Fetirita doughs during fermentation

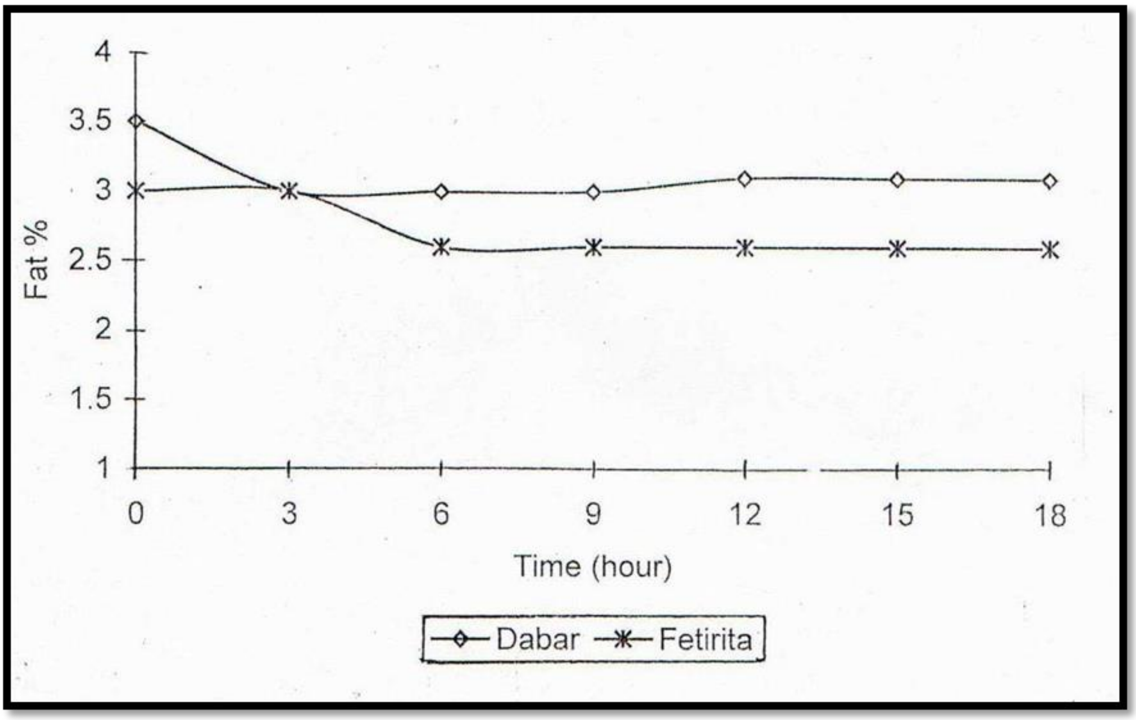

Fig. 3: Fat content of Dabar and Fetirita doughs during fermentation

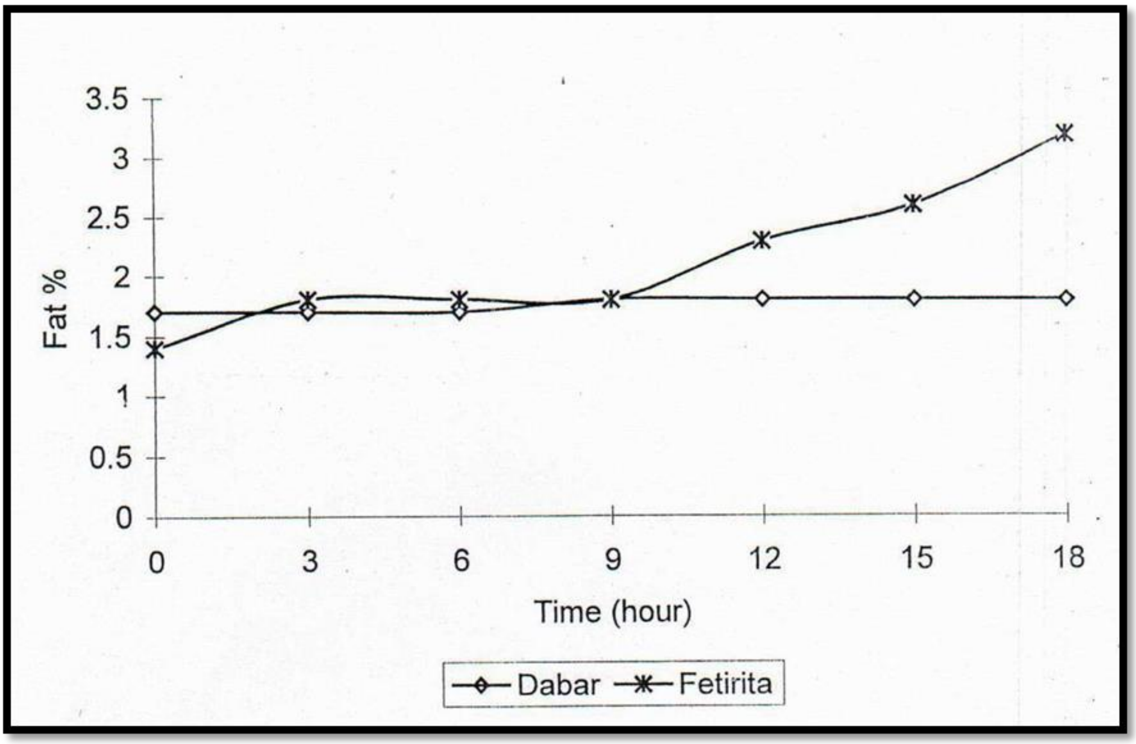

Fig. 4: Crude fiber content of Dabar and Fetirita dough's during fermentation

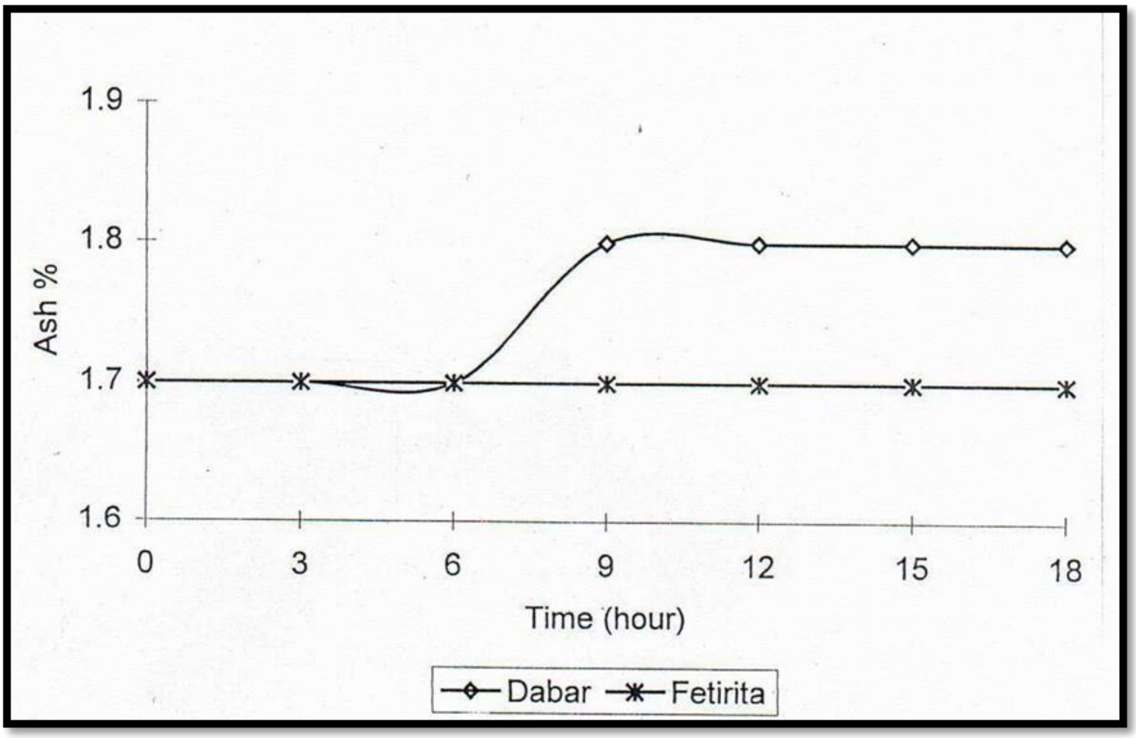

Fig. 5: Ash content of Dabar and Fetirita doughs during fermentation

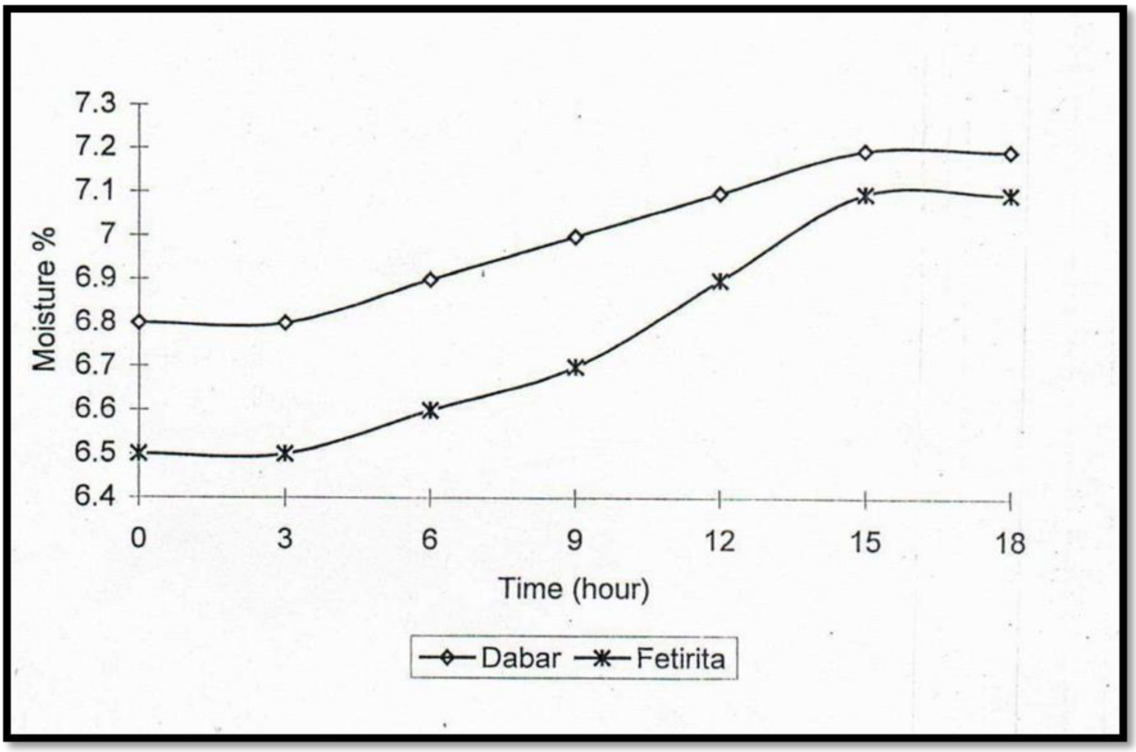

Fig. 6: Moisture content of Dabar and Fetirita doughs during fermentation

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