

Use of Jiben Seeds Extract to Manufacture Soft White Cheese

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Abstract: Rennet substitute was applied for preparation of white cheese with Jiben (*Solanum dubium* seeds extract). Time effect 0, 15, 30, 45, 60, 75, 90, 120 and 150 days was studied at 30°C on the prepared cheese, kept at room temperature as well as in the refrigerator at 5±1°C. Cheese analysis includes pH and the percentage content of moisture, salt, fat and protein. Use of Rennet to manufacture white cheese was served as a control. Results and statistical analysis indicated that, cheese prepared using Jiben Extract has high quality with a very small variations as well as it has a long storage time. Thus, *Solanum dubium* is a suitable extract for preparation of white cheeses with a long storage time in the refrigerator 5°C as well as at room temperature 30°C.

Key words: Soft cheese, *Solanum dubium*, preparation, chemical properties

INTRODUCTION

The contributions of cheese as source of proteins, calories, minerals and some vitamins^[1] are vital to the development of a good health. White pickled cheese is a soft white cheese made in Sudan and is similar to Domiati Cheese^[2]. It is usually made from raw milk containing 6-20% NaCl^[3,4,5]. A number of developments take place in other parts of the world to reach the farm level cheese producers in many parts of Africa. Coagulants such as rennet are still not available in rural areas of Chad, where most of the cheese is produced. Rennet is the most desirable enzyme for coagulation milk to manufacture cheese as well as, it is important in the formation of the casein network during coagulation^[6]. A shortage of this enzyme has occurred as the decrease in general availability of sucking calves as they are left for beef, thus decreasing the rennet availability and increasing its cost^[7]. This prompted us to use Jiben seed extract in the production of white pickled cheese. Also, storage period effect on cheese analyses at different intervals was done for 150 days.

MATERIALS AND METHODS

All chemical used were of BDH grade and re-distilled water used for the preparation of all solutions. Glassware was soaked in 10% (v/v) HNO₃ 24 h and rinsed three times with distilled water and then re-

distilled water before used. All solutions were prepared by dissolving the appropriate weight for each in re-distilled water and standardized according to standard methods^[9].

Source of milk: Milk was obtained from herds of white Fulani and red Bororo in Ndjamena, Chad and Bauchi, Nigeria. Milk was collected using 20 liter capacity plastic containers and transported to the laboratory.

Source of Jiben seeds: The dried seeds of Jiben were collected from the surrounding bushes of Ndjamena during the month of January threshed, decorticated manually and stored in the refrigerator until required^[10].

Extraction of Jiben Seeds^[10]:

- Extraction with water: 15.0 g of *Solanum dubium* seeds and 8.0 g sodium chloride were dipped in 250 ml flask containing 100 ml re-distilled water for two days at room temperature.
- Extraction with Buffer Solutions: 15.0 g *Solanum dubium* seeds were extracted in 100 mL of citrate phosphate buffer^[11] (pH's 3.6, 4.6, 5.6 and 6.6) containing 8.0 g sodium chloride. Extracts were stirred using continuous automatic shaker at 25°C with speed of 150 rotator min⁻¹ for 3 h. The resulting solutions centrifuged at 3000 rotator

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min⁻¹ for 5 min and the precipitate removed. The resulting filtrates divided into 150 ml portions in dark brown bottles and stored at both room temperature and in the refrigerator until required.

Production of White Pickled Cheese: The cheese was produced according to the following procedure^[12].

- 20 kg of fresh cow milk was heated at 61°C for 30 min and then cooled to 45°C
- At the rate of 2.0% w/v, starter culture of lactobacillus lactic was added and left for 30 min to develop acidity
- Extraction of 15g, Jiben seeds in 100 ml water containing 8 g NaCl were added to the milk at the rate of 2 ml kg⁻¹ (Rennet was used as a control)
- The milk was mixed and left to coagulate for 45 min
- The curd was cut vertically and horizontally into 1 cm³ with a sharp knife.
- The whey obtained from the cheese curd was drained and curd was added into small cylindrical moulds lined with cloth and pressed lightly overnight
- The curd was cut into cups of 3×3×3 cm³ and placed in glass Jars, then filled with whey containing 15% NaCl (w/v) and sealed.

Cheese Analysis:

Hydrogen ion concentration, pH: pH values were measured with a Fischer (Pittsburgh, PA) Digital pH Meter Model 810.

Moisture: Mortelli^[13] suggested that moisture in cheese was measured by Karl Fischer method.

Salt, fat and protein: Salt: (Mohr method) and fat (Babcock method) were determined according to standard methods^[14]. The Kjeldahl method^[15] was used for protein determination as described in the Association of Official Analytical Chemists (AOAC)^[16] with the modifications^[17]. One gram of sample was used and 15 ml H₂SO₄ were added followed by two tablets (Kjeltabs-175 mg HgO and 3.5 g K₂SO₄ in each tablet). The mixture was digested for 45 min. using a Kjeltac digester (Tecator 1015 digester. Fisher Scientific Pittsburgh PA). After the sample was cooled, 10 ml of sodium thiosulfate (80 g in 1 L re-distilled water) were added. Boric acid (25 ml) was used to receive the distillate which was then titrated with 0.1 N HCl. Protein (%) was calculated using a conversion factor of 6.38.

Statistical analysis: Statistical analysis involving Standard Error (SE), level of significance (LS) and Least Significant Difference (LSD) were performed using statistical analysis system (SAS)^[8].

RESULTS AND DISCUSSION

The measurement of pH is very important in many aspects of chemical analysis^[18]. A specially designed voltammeter called a pH meter. The pH meter was standardized (calibrated) with the use of buffer solutions with pH values of 4.0 and 7.0 standardization. Then pH of each sample solution was determined. pH values at 30°C of prepared cheese by Jiben seeds extract and rennet extract kept at 30°C or in refrigerator are presented in Table 1. These values were between 4.3-6.0 indicating all cheese samples were slightly acidic. The average value of pH decreased during the first month, then increased during the second month. After two months decreased slightly and mainly kept constant after four months. The decrease in pH can be attributed to microorganisms that possibly survived for a few weeks in the centre of the cheese and cause a slight variation of pH over the first two weeks^[5]. The slightly decrease in pH values may be attributed to slightly acidic effect produced from decomposition of some fat and protein to fatty acids and amino acids respectively, as shown in Table 1.

Moisture: The results of moisture indicate that, the moisture contents of cheeses made with Jiben seeds extract are less than that made with rennet extract kept at room temperature or at refrigerator. The average percentage of the moisture contents were in the range of 4.25-5.57 and 5.13-5.92 respectively as shown in Fig. 1 and 2, curves a₁ and a₂ respectively (SE =1.29).

Curves indicate that, moisture content of both cheese samples decreased rapidly from the first two weeks of pickling period, then decreased gradually as pickling period advanced up 75 days of pickling period, finally, slight decrease was noticed during the last two months of pickling period. These results are in agreement with those reported^[19-21]. The decrease of moisture content during pickling period might attributed to the contraction of cheese curd as a result of developing acidity throughout the pickling period, which helps to expel the whey from cheese curd and the effect of osmotic pressure on brine solution.

Salt: The salt concentration and its distribution in the cheese mass are important parameters affecting quality and acceptability of the product. The changes of salt content at different days are listed in Table 1 and shown

Table 1: Time effect on the cheese properties made with Jiben seeds extract and rennet extract during storage at 30°C or 5°C

| Enz. Type | pH | | | | Salt (%) | | | | Fat (%) | | | | Protein (%) | | | |
|-----------|------------------|--------|----------------|--------|------------------|--------|----------------|--------|------------------|--------|----------------|--------|------------------|--------|----------------|--------|
| | J. seeds extract | | Rennet extract | | J. seeds extract | | Rennet extract | | J. seeds extract | | Rennet extract | | J. seeds extract | | Rennet extract | |
| | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C | at 30 | at 5°C |
| 0.0 | 5.100 | 5.1 | 5.4 | 5.4 | 0.000 | 0.0 | 0.0 | 0.0 | 18.000 | 18.0 | 18.0 | 18.0 | 13.900 | 13.9 | 13.2 | 13.2 |
| 15 | 5.000 | 5.0 | 5.2 | 5.2 | 10.00 | 9.5 | 10.0 | 9.4 | 16.300 | 17.2 | 16.2 | 16.6 | 13.000 | 12.8 | 12.3 | 12.7 |
| 30 | 5.000 | 5.0 | 5.0 | 5.3 | 7.800 | 7.6 | 8.1 | 7.9 | 15.200 | 16.4 | 15.0 | 15.7 | 12.000 | 12.0 | 11.5 | 12.4 |
| 45 | 5.100 | 5.8 | 5.3 | 5.3 | 6.100 | 6.4 | 6.2 | 6.4 | 15.400 | 16.5 | 15.5 | 15.8 | 11.900 | 12.0 | 11.3 | 12.0 |
| 60 | 5.300 | 5.9 | 5.8 | 6.0 | 5.000 | 5.3 | 5.1 | 5.4 | 15.700 | 16.6 | 15.8 | 15.9 | 11.200 | 11.6 | 11.3 | 12.1 |
| 75 | 5.000 | 5.7 | 5.9 | 5.5 | 4.500 | 5.0 | 4.2 | 4.9 | 16.000 | 16.6 | 16.1 | 16.0 | 11.000 | 11.5 | 11.0 | 12.0 |
| 90 | 5.000 | 5.7 | 4.8 | 5.6 | 3.900 | 4.4 | 3.9 | 4.6 | 16.300 | 16.6 | 16.4 | 16.3 | 10.800 | 11.5 | 10.9 | 11.9 |
| 120 | 4.400 | 5.6 | 4.7 | 5.6 | 3.900 | 4.4 | 3.5 | 4.3 | 16.500 | 16.9 | 16.6 | 16.6 | 10.600 | 11.4 | 10.7 | 11.8 |
| 150 | 4.300 | 5.5 | 4.8 | 5.8 | 2.900 | 3.3 | 3.1 | 3.5 | 16.600 | 17.0 | 16.6 | 16.7 | 10.500 | 11.3 | 10.6 | 11.8 |
| SE | 0.780 | | | | 1.700 | | | | 0.630 | | | | 0.315 | | | |
| LS | - | | | | NS | | | | NS | | | | NS | | | |
| LSD | 1.9 | | | | - | | | | - | | | | - | | | |

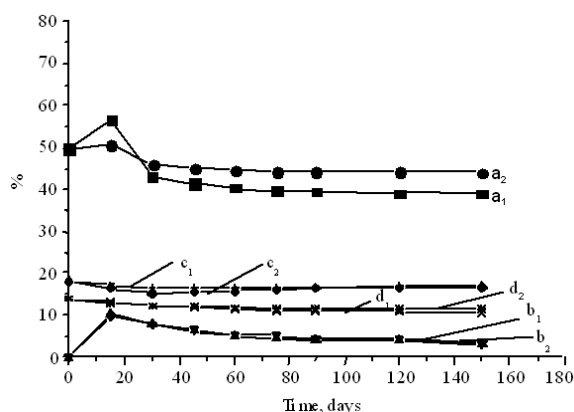


Fig. 1: Time effect on the content of moisture (a₁, a₂), salt (b₁, b₂), fat (c₁, c₂) and protein (d₁, d₂) in white cheese, prepared with Jiben Seeds extract, Kept at 30°C and in refrigerator at 5°C, respectively

in Fig. 1 and 2, curves b₁ and b₂ indicate that, the salt content of the fresh cheese made either with Jiben seeds or rennet extract at zero time was zero, but after 15 days reached 10.05 and 9.45% at room temperature and in refrigerator, respectively. Salt uptake decreased gradually with time. The final salt in white pickled cheese was targeted around 3.4 and 3.9% in cheeses made with Jiben or rennet extract respectively. The results are in agreement with those of several authors^[3,22]. They related the decrease in salt content of the cheese to the dissolution of cheese salt into the pickling whey to obtain equilibrium^[3] and they reported that^[22], the salt concentration was high near the brining surface and decreased toward the back surface, where it was low.

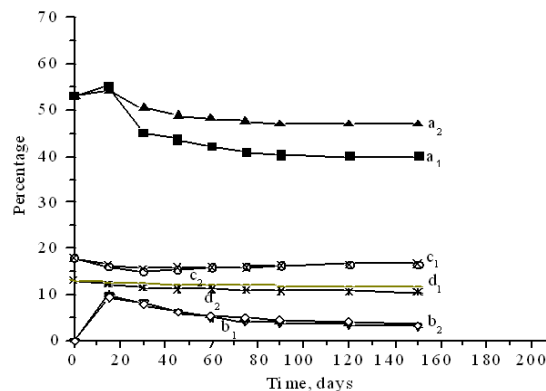


Fig. 2: Time effect on the content of moisture (a₁, a₂), salt (b₁, b₂), fat (c₁, c₂) and protein (d₁, d₂) in white cheese, prepared with Rennet extract, Kept at 30°C and in refrigerator at 5°C, respectively.

Fat: Fat contents during pickling of cheeses are presented in Table 1. The mean values of fat in cheeses, prepared with Jiben seeds and rennet extract were 18.03 and 18%, respectively.

After 30 days were 15.2 and 15%. The drop in fat contents followed by a gradual increase as shown in Fig. 1 and 2, curves c₁ and c₂. This change was attributed to the uptake of salts as well as breakdown of fat and the continuous loss of the degraded components of cheese into brine^[23]. The range of fat contents was 15-18%. This range is in agreement with that found by Prasad and Alvarez^[5]. Increase of fat contents in cheese also found by Kebary and Co-Workers^[24].

Protein: Curves d₁ and d₂ in Fig. 1 and 2, represent the change in protein contents with time. The behavior of these curves indicates that, the protein contents in all cheese samples were slightly decreased with time as

listed in Table 1. The behaviors also indicate that, the differences in Protein contents in cheeses prepared with Jiben seeds or with rennet extract, kept at room temperature or in the refrigerator were small. Our results and their statistical results, listed in Table 1 are similar to those found^[3,5,25,26]. They reported that decrease in protein content during pickling as a result of protein degradation leading to the formation of water soluble compound and some of which lost in the pickling solution leading to increase of nitrogen content in whey^[3,25,26].

CONCLUSION

In conclusion, it could be concluded that Jiben seeds extract, which used to prepare white cheese was suitable as compared with rennet extract. In addition, Jiben seeds extract is less expansive than other coagulant to manufacture white cheese.

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