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Effect of Heating on Chemical Characteristics and Acceptability of Sudanese White Cheese made from Goat's Milk

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Introduction

Goats are considered to be very important for their contribution to the development of rural zones and people. Moreover their production is generally home-consumed, given to the neighborhood or sold within the villages (DUBEUF ET AL., 2004). However the increasing demand for goat milk cheeses during the last decade, coupled with a much higher price for raw goat milk compared to cow milk, has resulted in new interest in predicting cheese yield from milk composition parameters due to the chemical differences between the milk of the two species (ZENG ET AL., 2007).

The high levels of native lactic acid bacteria present in raw milk are a major drawback in cheeses manufactured from raw milk (BUCHIN ET AL. 1998). Yet, most cheeses are produced from pasteurized milk, rather than raw milk, to eliminate pathogens (TRUJILLO ET AL., 1999). ZENG ET AL. (2007) found the overall means of concentrations of fat, total protein and total solids in the goat soft cheese cheeses were $3.6\pm 0.7\%$, $3.2\pm 0.6\%$ and $11.8\pm 1.5\%$, respectively. The total solids of goat cheese made from pasteurized milk revealed value of $67.41\pm 1.55\%$ (TRUJILLO ET AL., 1999). There were no significant differences in flavor, body and texture, and total sensory scores of goat cheese during aging times and goat cheese yield was highly correlated with milk total solids content (FEKADU ET AL., 2005). They obtained for the semi hard cheese fat, protein and moisture of $24.59\pm 2.40\%$, $18.05\pm 2.63\%$ and $45.69\pm 3.95\%$, respectively.

NOUR EL DIAM AND EL ZUBEIR (2007) reported that there are two main types of cheeses in Sudan namely Sudanese white cheese (Gibna bayda) and braided semi hard cheese (Mudaffarra). Traditional cheese methods need to be encouraged and improved by hygienic handling and appropriate methods of processing in order to utilize the surplus milk in rural areas (ELKHIDER ET AL., 2011). Sudanese white cheese is usually made from cows', ewe's and goat's milk or their mixtures (ELKHIDER ET AL., 2012). However cheese from goat milk alone was not produced. Hence the objectives of this study are to evaluate the compositional content and acceptability of goat milk cheese and to study the effect of heat treatment on its properties.

Material and Methods

Sources of milk

Fresh raw cow's milk was brought from Kuku Dairy Project for goat improvement (18 liters). The cheese was made at the processing laboratory of the Dairy Production, Faculty of Animal Production, University of Khartoum. The milk was analyzed first using the Lactoscan 90 (Aple Industries services—La Roche Sur Foron, France).

Cheese processing

The milk was divided into 2 equal portions; one part was heated at 72° C for 15 seconds using on stainless steel vessel and allowed to cool to 45° C, while the raw was worm to 45° C. Then both types of milk (heat treated and the raw were used for preparation of the Sudanese white cheese. The rennet tablets (Chr. Hansen's, Denmark); two tables/ 100 kg milk; were dissolved in little amount of milk and mixed with the rest of milk, stirred for five minutes by spatula and the mixture was left to stand for 2 hours to allow the milk to coagulate. The coagulated mixture was transferred into a wooden moulds lined with cotton cloth, placed in a sloping wooden rack where it was left for 2 hours to allow drainage of whey. The cheese was weighed and then the salt was added to the whey at a rate of 6%. The prepared cheeses were cut into small cubes with a stainless steel knife and then packed into glass containers. Then the containers were tightly covered and the cheese samples were stored at room temperature for 8 weeks.

Chemical analysis of cheeses

Total solids, protein, fat and ash content and the titratable acidity were determined according to modified method of AOAC (2003).

Sensory evaluation

Fifteen untrained panelists, however are familiar with cheeses were asked to judge on the quality goat cheese using a sensory evaluation sheet.

Statistical analysis

Data generated was subjected to Statistical analysis system (SAS). The figures were plotted using Microsoft excel program.

Results and Discussion

The composition of the cheese made from heated and raw milk revealed 46.81% and 46.31% total solids, 22.13% and 21.85% fat, 15.02% and 13.73% protein and 2.44% and 2.25% ash, respectively. Higher recovery from milk constituents was found in goat cheese made after heating the milk compared to the cheese made from raw milk (Figure 1). The higher total solids, protein, fat and ash obtained for the heat treated cheese supported TRUJILLO ET AL. (1999) and ZENG ET AL. (2007). The significant differences ($P < 0.05$) reported between the raw and heat treated cheese could be due to that the cheese made from raw milk tends to develop stronger flavors and to ripen more quickly than cheese from pasteurized milk (TRUJILLO ET AL., 1999). The highly significant variations ($P < 0.001$) found for both cheeses during the storage supported NOUR EL DIAM AND EL ZUBEIR (2010) and ELKHIDER ET AL. (2011) who reported more or less similar overall composition for cow milk cheese.

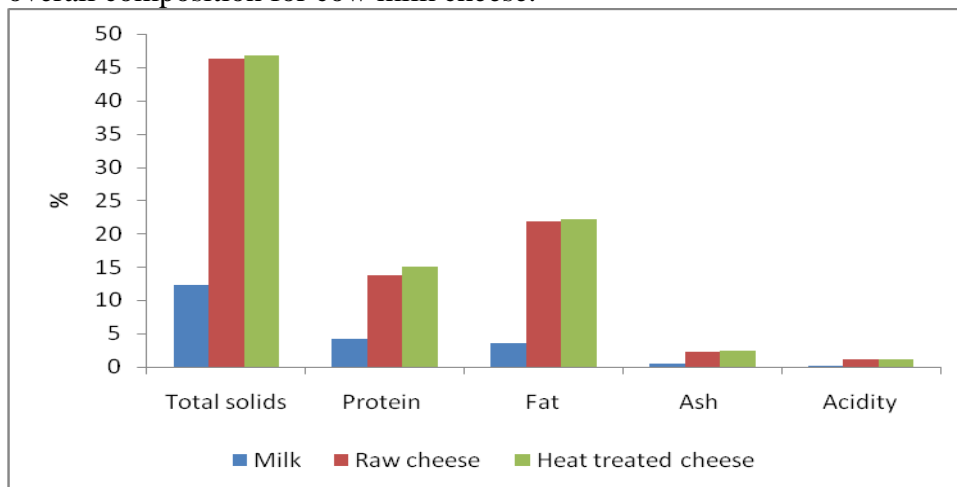


Figure 1: Comparison of chemical composition of goat milk and cheeses

Sensory evaluation

The cheese from the raw milk received higher colour score compared to that made after heating the milk (Figure 2). This supported BUFFA ET AL. (2001) who reported that colour evaluation

demonstrated significant differences between raw and pasteurized goat cheeses due to milk treatments and ripening time. Moderate salt was reported for both cheeses (Figure 2). However the heat treated cheese received higher score for the general acceptability, texture and flavour (Figure 2). The rough texture reported by some of the panelists during the storage period was in accord to VAN HEKKEN ET AL. (2004) who found that cheese texture changed significantly ($P < 0.05$) during the first 4–8 weeks of storage. Similarly BUFFA ET AL. (2001) found that cheese made from raw goat milk was firmer and less fracturable than that made after pasteurization of milk, but differences became less notable toward the end of ripening and the pasteurized cheese showed the most elastic behaviour initially. The intensive flavor of goat reported for the raw cheese could be due to the strong and characteristic of “goat” flavor, which is one of the most important quality components of French cheeses made from goat milk (GABORIT ET AL., 2001).

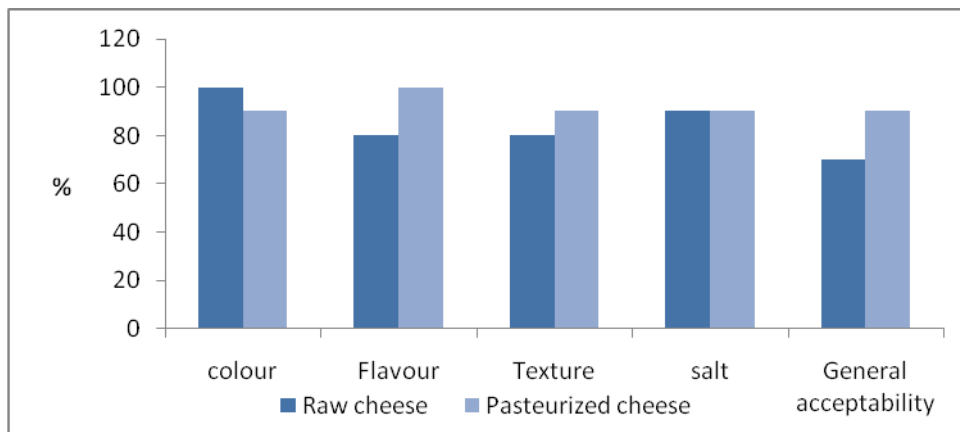


Figure 2: Comparison of sensory scores for raw and heated treated goat cheeses

The acidity was less at the beginning of the storage and it increase during storage especially in the cheese from made the raw milk (Fig. 3). This supported NOUR EL DIAM AND EL ZUBEIR (2007). ABDALLA AND AHMED (2010) reported that the high acidity of raw milk cheese could be due to the fact that storage temperature activated the natural microflora of raw milk and resulted in the development of acidity as the result of lactose fermentation.

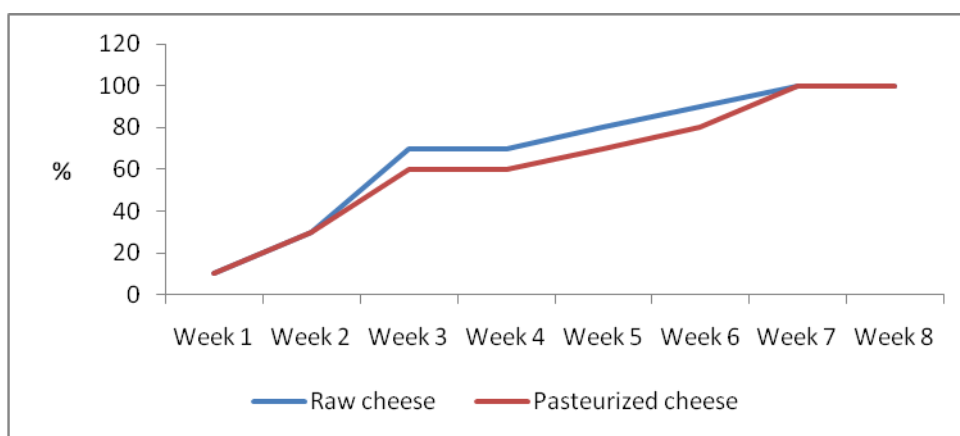


Figure 2: Acid scores during the storage of raw and heated treated goat cheeses

Conclusions and Outlook

The present study was in support to DUBEUF ET AL. (2004) who reported that goats could be a partial alternative to other production systems, if their efficiency would be improved by better

adapted research and more efficient extension service. This especially because of the economic importance of goats have real economic potentials in the future, and their present role and impact for sustainable development has been underestimated.

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