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Production of White Cheese (*Gibna bayda*) in Zalingei Area West Darfur (Sudan)

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Abstract: This study was conducted to evaluate the production methods, chemical composition and proteolysis properties of white cheese *Gibna Bayda*. The Sudan like other countries in the tropics enjoys a hot dry climate, which is not suitable for the storage of hard cheese. Therefore, the most popular type of cheese produced is the white cheese locally known as *Gibna Bayda*. It is generally consumed fresh or matured for a period of several months. Cheese is not produced domestically, although there are a few small-scale commercial cheese manufacturers in the rural areas of south Darfur who use milk from pastoral herds. Twenty-four Sudanese *Gibna Bayda* samples manufactured in Zalingei area; were examined in duplicates during the period from September 2004 to January 2005. The production method, chemical composition and proteolysis of *Gibna Bayda* was investigated. *Gibna Bayda* contained 45.17-58.17 total solids, 19.27-23.83 fat, 19.70-29.73 TN, 0.26-1.28, WSN, 1.87-7.80, ash, 2.27-8.77, salt, 0.36-1.80 TA, VFA 2.77-5.07 mg/100gm, 131.00-277.50 mg/100gm tryptophane, 6.63-146.80 mg/100 gm, tyrosine, respectively. The values obtained for ripening indices were, 12.33-18.33 and 93.00-133.33 for FRI and SRI of cheese respectively.

Key words: Sudanese white cheese, Sudanese *Gibna Bayda*, chemical composition, proteolysis, volatile fatty acids, Zalingei.

INTRODUCTION

Cheese making is a major milk preservation method in Sudan (Ibrahim, 1971). The major traditional cheese types that produced in Sudan are *Gibna Bayda* (Osman, 1987a); *Gibna Mudaffra* (Abdel-Razig, 2000) and *Mish Cheese* (Osman, 1987b). They are varying in composition, texture, color, taste and flavor, due to composition of milk, production methods, microbial flora, type of package, microbial activity during ripening and ripening conditions.

Cheese production in the Sudan has been started by the foreign families migrated to the Sudan, and settled mainly at Ed Dueim, in the Blue Nile Province. (El Tayeb, 1986).

In Sudan cheese is produced throughout the country especially in El Doeim, White Nile Province, El Obeid, North Kordofan Province Nyala, South Darfur, Darfur Province and other localities in the country.

Gibna Bayda is produced in four areas in South and West Darfur States. In Darfur *Gibna Bayda* is produced throughout the year and the highest production is during the rainy season.

Milk produced in rural areas is always converted into other products which withstand longer storage periods such as fermented milk, ghee, cheese and sour milk (Payne, 1990). The making of *Gibna Bayda* in Darfur varies from one place to the other. The variation is due to the method of processing, salting before or after renneting or during moulding. Also due to the way of treating the whey.

Sudanese *Gibna Bayda* is unique among cheese varieties in that high concentrations of table salt (Sodium Chloride) is added to the milk before processing (Osman, 2005). It is manufactured from raw or heated milk (Ibrahim, 2003). During processing under tropical conditions cheese deteriorates rapidly before it ripens thus salting before renneting becomes essential for its preservation (Alla Gabo, 1986).

During the seasons when milk is relatively plentiful, Baggara women process part of the milk extracted from their cows into buttermilk (*roob*) and clarified butter or ghee *(semin*). The existence of seasonally surplus

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milk at low prices has promted several entrepreneurial merchants to set up small-scale rural cheese-making plants which offer women higher prices for whole milk than they could otherwise obtain fore buttermilk (Kerven 1987).

The aim of this study was to review the production technique, chemical composition, proteolysis, and other ripening properties of Sudanese *Gibna Bayda* manufactured in small-scale dairies in Zalingei area West Darfur (Sudan).

MATERIALS AND METHODS

The study was performed to investgate the production methods, chemical composition and ripening properties of *Gibna Bayda* in the late rainy and dry seasons between September 2004 to January 2005.

Cheese making was attended in the eight small-scale commercial factories. *Gibna Bayda* samples used in this study were purchased from the Gibna Bayda manufacturers in and around Zalingei area, West Darfur.

Collections were from three; seven days old; *Gibna Bayda* batches, each batch served as a replicate of the experiment. After purchase, the samples were kept in whey in dry clean sterilized large moused jars, placed directly into cool boxes and transported to Nyala Regional Veteriary Laboratory and were examined in duplictes within 24 hours.

Chemical Analysis:

The cheese samples were analyzed for titratable acidity, total solids, crude protein and ash contents according to AOAC (1990). Fat contents were determined according to Foley *et al* (1974). Soluble protein was determined according to Ling (1963). Salt content was determined according to Breene and Price (1961). Volatile fatty acids were determined according to Kosikowski (1982). Tyrosine and tryptophane contents were determined according to Vakaleris and Price (1959).

Statistical Analysis:

Statistical analysis was done using Statistical Package for Social Studies Software SPSS (1998) Complete Randomized Design was used to estimate the chemical composition and the ripening properties of *Gibna Bayda* in Zalingeni Area.

RESULTS AND DISCUSSION

Cheese Manufacture:

Cheese manufacturers purchase fresh raw cow's milk from the milk producers; in rural areas in Zalingei, West Darfur, State; who brought milk in plastic containers on donkeys. The milk was strained with a piece of cloth in plastic (Plate 1) or iron barrels. Rennet tablets were added to the milk at the rate of 2 – 4 tablets per barrel (120-200 litres respectively). The milk was left for coagulation for about 1 to 2 hours. The curd was then cut by a clean wood for whey drainage. The cut curd was poured into wooden molds lined with clean cloth (Plate 2). Suitable weights were put on the molds cover for about 6 hours. The drained whey was collected into a clean pan, then boiled for 15 minutes, the fats and coagulated whey proteins were removed from the boiled whey, starter from previous fermented milk was added to the removed fat and coagulated whey proteins and left overnight to ferment for use as an additional product. Next day the cheese (*Gibna*) was removed from the molds and cut into small cubes 10x10x10 cm. The boiled whey was salted at the rate of 3 – 9% and the cut *Gibna Bayda* preserved into it and packed in plastic containers of about 80 Kg cheese (*Gibna*) capacity and stored at the room (35-37°C) temperature until marketing (Plate 3). The fermented parts of the whey were poured into local churners gourd (*bokhsa*) (Plate 4) for separation of traditional butter *(Fursa*) which used in Ghee production and the remaining sold as sour milk (*roob).* Collection of *Gibna Bayda* samples were from three processing batches and from each batch two samples were taken, samples served as a replicate of the experiment. Samples were kept in whey and subsequent chemical and proteolytic properties were carried out.

Chemical Composition of Cheese:

Mean percent of TS, fat, crude protein, WSP, ash, TA, and salt were 52.77, 22.80, 22.50, 0.77, 4.87, 108 and 5.72 respectively (Table 1).

The TS content of *Gibna Bayda* ranged from 45.17-58.17%, the average content was 52.34. Similar values were reported by Babiker (1987) but they were in contrast with those of Warsama *et al*. (2006). The variation in TS content might be due to the lack of standard procedure followed by the producers.

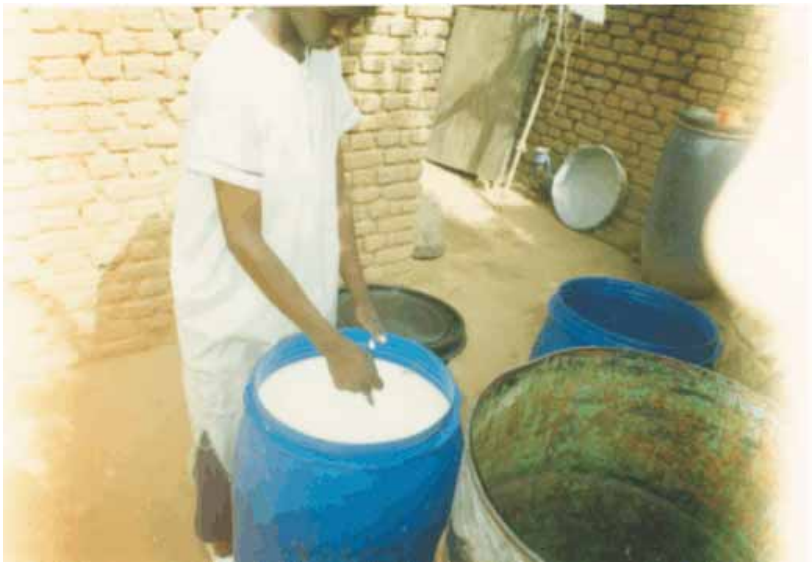

Plate 1: Coagulation of milk in plastic containers. Zalingei, West Darfur State, Sudan

Plate 2: Curd in sack of cloth in the mould ready for pressing, Zalingei, West Darfur State, Sudan

Table 1: Chemical composition of *Gibna Bayda* samples from Zalingei area, West Darfur.State, Sudan

Cheese producer No.	TS (%)	Fat (%)	C.P. (%)	W.S.P. (%)	Ash (%)	TA (%)	Salt (%)
1	54.17^{bc}	23.83^{abc}	21.97^{abcde}	0.59^{bc}	5.10^{bcde}	0.98^{cd}	3.17^{cd}
2	58.17^{ab}	23.17^{abc}	29.73^{a}	0.27^{d}	6.27^{abc}	0.69^{cd}	4.83^{bc}
3	48.33^{cde}	19.83^{c}	25.53^{abc}	0.62^{b}	3.27^{de}	1.80^{a}	2.67^{d}
4	54.17^{bc}	22.67^{abc}	26.57^{ab}	0.31^{cd}	3.40^{de}	0.83^{bcd}	3.27^{cd}
5	53.17^{bc}	23.33^{abc}	24.13^{abc}	0.26^{d}	7.80^{a}	0.97^{bcd}	8.77^{a}
6	52.33^{bcd}	21.03^{bc}	25.67^{abc}	0.50^{bcd}	2.90^{de}	0.36^{d}	3.87^{bcd}
7	53.17^{bc}	23.17^{abc}	19.70^{def}	0.45^{bcd}	2.83+de	0.98^{cd}	3.77^{bcd}
8	45.17^{de}	19.27^{c}	23.03^{abcd}	1.28^{a}	1.87^{c}	0.83^{bcd}	2.27^{d}
Average	52.77	22.80	22.50	0.77	4.87	1.08	5.72
Level of sign.	***	**	***	***	***	***	***

Means within the column bearing different superscripts are significantly different (P< 0.01).
**= Means highly significant at (p<.05)
*** Means highly significant at (P< 0.001) TS = Total solids
C.P = Crude protein
W.S.P = Soluble protein
TA= Titratable aidity

Plate 3: Plastic barrels with (*Gibna Bayda*) in salted whey stored at room temperature, Zalingei, West Darfur State, Sudan

Plate 4: Gourd (*bokhsa*) (Local churner) used for churning fermented milk, Zalingei, West Darfur State, Sudan.

The average fat content of cheese samples was 22.80% (Table 1), and the fat ranged between 19.17-23.83%. The fat content values were higher than those reported by Aly and Galal (2002) and Khalid and El Owni (1991) who reported fat values of 12.80 and 11.70, respectively. The high average fat contents in this study could be due to high fat content in milk of Baggara cattle (zebu cattle) used for cheese making.

The protein content of cheese samples ranged between 19.70 to 29.73% with an average of 22.50%. Theses results agreed with Nuser (2001) who reported protein values of 23.26% (Table 1) for fresh cheese.

The results in this study were different from those reported by Ceylan *et al*. (2003) who reported 16.00-22.71% for Orgu cheese.

The values for WSP contents were 0.77% and 0.26 and 1.28% for average, minimum and maximum values respectively (Table 1). These results were in line with those of Tarakci and Kucukoner (2006) who reported water soluble nitrogen values ranging from 0.43±0.01 to 0.88±0.005%.

The average ash percent of cheese was 4.87%. The investigated cheese samples were in the range of 1.87 to 7.80%9 (Table 1), the variation in the ash content probably arise from different salt levels used by different producers. The cheese results obtained were not far from those reported by Ceylan *et al*. (2003) and Warsama *et* a*l*. (2006).

The average acidity of cheese samples was 1.08% with a range changing from 0.36 to 1.80% (Table 1). The variations among chemical composition and acidity of the cheese samples between different producers might be due to the lack of production process and to the variation in composition and properties of milk (Ceylan *et.al*., (2003). These results were not far from those reported by Ceylan *et al.* (2003) who reported average titratable acidity values of 1.11% with varying values ranging from 0.34 to 1.65%. Our results disagreed with Topcu and Saldamli (2006) and Aly and Galal (2002) who reported values of 0.73-1.12 gm lactic acid/100 gm of cheese and acidity of 0.20-0.73%, respectively.

The average salt content was 5.72% and it varies between 2.27 to 8.77% (Table 1). The results are not far from those reported by Alla Gabo (1988) and Ibrahim (1971) who reported salt percent of 4.20 and 4.35% for Sudanese white cheese, respectively. The results in this study were lower than those reported by Aly and Galal (2002) and Topcu and Saldamli (2006) who reported salt percent of 7.24 to 8.43% and 8.69 to 9.36%, respectively. This result was higher than the result reported by Ceylan *et.al.* (2003) who reported values of 12 and 5.03% for minimum and maximum salt content.

Formal ripening index FRI and SRI values ranged from 12.33 to 18.33 0.1 N NaOH/5 gm and from 93.00 to 139.67 0.1 N NaOH/5 gm of cheese, respectively (Table 2). The variation in ripening indices of the cheese sample was possibly due to variation in manufacturing conditions.

Table 2: Ripening indices, VFA, tyrosine and tryptophane contents of *Gibna Bayda* samples in West Darfur State, Sudan

Cheese producer No.	FRC	SRI	VFA*	Tryptoph.**	Trosine***
1	18.0^{abc}	139.67^{ab}	3.27^{b}	46.63^{g}	138.70^{g}
2	15.33^{bc}	111.33^{abc}	3.23^{b}	115.33^{d}	218.37^{d}
3	13.67^{bc}	93.00^{bc}	2.87^{b}	70.13^{e}	180.43^{e}
4	14.00^{bc}	118.93^{abc}	4.37^{b}	132.60^{b}	258.00^{ab}
5	16.69^{bc}	133.33^{abc}	4.00^{b}	127.26^{c}	244.03^{bc}
6	18.33^{abc}	131.67^{abc}	2.80^{b}	36.63^{h}	131.00^{g}
7	16.00^{bc}	113.33^{abc}	2.77^{b}	146.80^{a}	277.50^{a}
8	12.33^{bc}	108.33^{abc}	5.07^{b}	146.80^{a}	277.50^{a}
Average	18.50	116.30	9.07	108.47	200.72

Mean values bearing different superscripts within the columns are significantly different (P< 0.05).

* 0.1/VaOHml/100 1gm cheese

** mg/100 gm ch.

*** mg/100 gm cheese

The Volatile fatty acids contents average ranged between 2.77 to 5.07 mg/100 gm cheese. Similar results were reported by Abdel-Razig (1996). The high VFA values might be explained by the long storage period. The average, minimum and maximum tryptophane and tyrosine contents of cheese samples were 102.77, 36.63 and 146.80 and 215.69, 131.00 and 277.50 mg/100gm cheese, respectively (Table 2). The results disagreed with Guler (2000) who found that the average tyrosine contents of Turkish white cheese marketed was 65mg/10gm cheese. The higher tryptophane and tyrosine contents might be due to high proteolytic activities occurred in the cheese (Hayaloglu *et.al*., 2002 and Saleem *et.al*., 1978).

It is concluded that *Gibna Bayda* in Zalingei area produced by traditional methods largely in small-scale household business with slight variations in the methods. It is imperative that milk should be pasteurized, standard methods adopted to produce *Gibna Bayda* with high quality, up to the standards and safe.

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