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# EFFECT OF SOMATOTROPIN HORMONE TREATMENT OF EGYPTIAN BUFFALOES ON MANUFACTURING PROPERTIES AND QUALITY OF SOFT CHEESE

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## ABSTRACT

Cheese was made from individual milk samples taken from six buffaloes on day 50 post-partum just before the start of their treatment with bovine somatotrorpin bst (control) and on day 70 after they received two bi-weekly injections of bst to study the effect of bst treatment on milk composition and manufacturing properties, chemical composition and organoleptic properties of soft cheese.

Cheese samples were stored at 4°C for 4 weeks and analyzed as fresh and after 4 week storage period .Results indicated that the use of bst did not affect milk composition, or its manufacturing properties in terms of rennet coagulation time (RCT), curdling time (CT), cheese yield and fat loss in whey. Also the use of bst did not influence cheese composition and did not interfere with ripening indices of the manufactured soft cheese .Furthermore, the results showed that the use of milk from buffaloes supplemented with bst did not nip-up the organoleptic properties of soft cheese.

## INTRODUCTION

Many investigations were carried out to enhance milk yield from ruminants using various chemical as hormones, minerals, vitamins or feed additives.

Numerous factors, such as feed-stuff, breed, level of milk production, and stage of lactation and season of the year influence milk composition and chemical characteristics of milk fat and protein, which have effects on the properties and quality of the dairy products (Barbano& Lynch, 1989).

In the past decade, recombinant somatotrorpin (bst) has been used as an exogenous hormonal treatment to increase milk production in commercial dairy herds. bst is a protein hormone which makes milk produced from bst treated animals safe for human consumption (Huber *et al.*, 1997 and Miller *et al.*, 1999).

Composition of milk protein has been examined in many studies for the impact on functional properties of milk used in the manufacturing of dairy products. The administration of bst did not cause major changes in milk fat, protein and lactose concentration (Chilliard, 1989; Phipps *et al.*, 1990; Kubasa, 1992; Jenny *et al.*, 1992; Barbano *et al.*, 1992 and Huber *et al.*, 1997).

The results of many investigations carried out on dairy cattle indicated that total protein, non casein protein and non protein nitrogen contents of milk were not affected by the administration on bst (Barbano and Lynch, 1989 and Van den Berg, 1989).

In contrast, some researches reported that bst could perhaps have increased the protein (Hansen *et al.*, 1993 and Piccolic *et al.*, 1992).

Composition of milk lipid is of particular importance because of its impact on nutritive value, flavour characterist and manufacturing properties. Studies have demonstrated that fatty acid composition and cholesterol content of milk were not altered by bst (Barbano and Lynch, 1989). The use of bst increased the proportion of long-chain and decreased the proportion of short-chain fatty acids (Bitman *et al.*, 1984 and Eppard *et al.*, 1985).The changes were small and were considered unlikely to affect the quality of manufactured dairy .The effects of bst on milk fat were variable; some studies showed a trend for decreased milk fat (Huber *et al.*, 1997), whereas other studies showed no differences between treated and control (Eppard *et al.*, 1991;Kubasa,1992 and Hansen *et al.*,1993). Contrary to these studies, Piccolic *et al.*, (1992) observed higher milk fat content from bst-treated cows when subcutaneous injections of (640 mg/28d) were used.

Studies in USA showed that bst did not affect clotting time of milk (Marshall and Cartledge, 1989). Also, studies in France and Holland indicated that manufacturing properties and the quality of Camembert and Gouda cheeses were not affected when milk from bst treated cows was used (Van den Berg, 1989; Desnouveaux,*et al.*, 1988 and Auberger *et al.*, 1988 ). In England, the study of Phipps *et al.* (1990) revealed that the administration of bst did not alter the composition of milk or its manufacturing characteristics.

Research on the use of bst in buffaloes is scarce and was limited to its effects on milk yield, whereas its effects on milk manufacturing properties have not been reported previously.

Therefore, this work was devoted to study the effect of using milk produced by bst-treated buffaloes on the composition of milk and resultant soft cheese.

## MATERIALS AND METHODS

**Material:**

Fresh buffalo milk samples from morning milking obtained from 6 buffaloes on day 50 post-partum, before the start of their treatment with bst and were considered as control and after bst treatment (day 70 post-partum) to determine the gross composition of milk and its manufacturing properties.

Bovine Somatotropin (bst): On days 50 and 70 post-partum, each buffalo received 500 mg bovine somatotropin (Somatech ) injected subcutaneously. Calf-rennet powder (HALA) from Hansen's Denmark and dry coarse table salt obtained from El-Nasr Company at Alex. Egypt, were used for cheese manufacturing.

**Experimental Procedure:**

Cheeses were made from the twelve individual milk samples, six samples from untreated buffaloes (control) and six from the same buffaloes after treatment with bovine somatotropin (bst). Milk was salted by 5% NaCl, and then heated at 73°C for 1 min, cooled immediately to 35°C and renneted.

The soft cheese was made by the conventional method of making Domiati cheese (Fahmi and Sharara, 1950).Cheese was packed in plastic cups, filled with whey, and stored in refrigerator for 4weeks.

**Methods of Analysis:**

Milk samples were analysed for their fat, protein and lactose contents using the methods described by A.O.A.C. (1990). Cheese samples were analysed when fresh and after 4 weeks of ripening. Moisture content, acidity, totals and soluble nitrogen and fat were determined as described by A.O.A.C. (1990). Total volatile fatty acids (TVFA) were assessed according to Kosikowski (1982).Cheese rennet coagulation time (RCT) and curdling time (CT) were determined according to Al-Swaf (1977).Weight of fresh curd was taken as cheese yield.

Organoleptic properties of cheeses were evaluated by 15 panelists from the staff of the Dairy Technology Department and Buffalo Research Department, Animal Production Res. Inst. Fifty points were allocated for flavour, 40 points for body& texture and 10 points for appearance. All the experiments were carried out in triplicates.

**Statistical analysis:**

Least squares one-way analysis of variance was performed using the General Linear Models procedure of SAS. (SAS, 1990).

## RESULTS AND DISCUSSION

As indicated in table (1),bst treatment did not have significant ($p \geq o.o5$) effect on the gross composition of milk (fat ,protein and lactose contents).These results are in agreement with Barbano& lynch (1989), Van den Berg (1989) and Eppard *et al.*(1991). Fat percentages was almost similar in milk samples taken before (7.07%) or after (7.04%) treatment with bst. This results are in agreement with those of most other studies where milk fat content was not affected by bst treatment (Eppard *et al.*, 1991; Kbasa, 1992; Hansen *et al.*, 1993 and Huber *et al.*, 1997). In contrast, some studies indicated a trend for increased milk fat (Piccolic *et al.*, 1992). A slight and insignificant ($p \geq 0.05$) increase was noticed in milk protein content after bst treatment buffalo (3.64 v 3.87 %).These results are in agreement with Hansen *et al.* (1993), who reported that the cows treated with bst had higher in protein content (3.23%) than control (3.11%).Similary, a slight and insignificant increase in lactose content was observed after bst treatment compared with that obtained before start of treatment (4.71 v.4.61), (table1). Barbano *et al.* (1992) and Huber *et al.*(1997) indicated that contents of protein and lactose in milk of bst-treated cows was similar to those in control cow.

**Table (1): Effect of bovine somatotropin injection on milk chemical composition.**

| Item | Control M ±SE | Treatment M ± SE |
|---|---|---|
| Fat % | 7.07 ± 0.13 | 7.04 ± 0.12 |
| Protein % | 3.64 ± 0.04 | 3.87 ± 0.03 |
| Lactose % | 4.61 ± 0.03 | 4.71 ± 0.07 |

Table (2) shows the manufacturing properties of milk from untreated buffalo (control) and that taken after treatment with somatotropin (bst) .The use of milk from buffaloes supplemented with bst did not affect rennet coagulation time (RCT) and curdling time (CT) while manufacturing soft cheese, 93.8 and 93.3 Sec for RCT and 172.5 and 1723 min for CT for control and treated groups, respectively. These results are in agreement with Desnouveaux *et* al. (1988) and Van den Berg (1989) for Cammbert and Gouda cheese. Phipps *et al*, (1990) reported that the use of milk from cows supplemented with bst did not affect renneting properties in manufacturing Cheddar, Wensleydale and Cheshire cheeses. They stated that slightly longer time from rennet to milling for the Cheddar cheese made from the control milk might have been due to a small variation in the activity of the starter.Concerning fat lost in whey, the results indicated that there were no appreciable differences in fat lost in whey, as the values obtained were 0.28 % for control and 0.26 % for treatment groups. These results are in agreement with those of Phipps *et al*. (1990).

As illustrated in Table 2, there was only slight and insignificant ($p \geq 0.01$) difference between the control and treated groups in the cheese yield, being 28.61 ± 0.15 % for control and 28.78 ± 0.19 % for treatment.

**Table (2): Manufacturing properties of milk taken from buffaloes before treatment (control) and after treated with bovine somatotropin (bst).**

| Properties | Control (M ± SE ) | Treatment (M ± SE ) |
|---|---|---|
| RCT (Sec) * | 93.8 ± 0.87 | 93.3 ± 0.61 |
| **CT (min) | 172.5 ± .92 | 172.3 ± 0. 66 |
| Cheese yield % | 28.6 ± 0.15 | 28.8 ± 0.19 |
| Fat loss in whey % | 0.28 ± 0.03 | 0.26 ± 0.03 |

***RCT = Rennet coagulation time** ****CT = Curdling time**

Table (3) shows the gross composition of soft cheese made from untreated buffaloes and that cheese made from the milk obtained from the same buffaloes after they were treated with bovine somatotropin (bst). It could be concluded that the fat content on dry matter (DM) basis did not show detectable change between the two groups either fresh and after 4 weeks of storage. Fat content of cheese of both treatments increased during ripening. This increase could be attributed to the decrease in moisture and solid non fat contents due to partial degradation of proteins and fermentation of lactose (El-Koussy, 1966 and Salem and Abeid, 1997).Also, the average of total protein as percent per dry matter decreased in both treatments with the progress of ripening, that probably due to protein degradation and formation of soluble nitrogenous compounds. Similar trend was reported by Kebary *et al*. (1996) and Salem and Abeid (1997). However, the attained results revealed that using bst did not result in noticeable effect on the total protein and total protein on DM basis of chesses due to bst treatments. The same trend was observed with the advanced of ripening in both treatments. Barbano and Lynch (1989) and Van den Berg (1989) examined the effect of bst treatment on the composition of milk proteins. They reported that casein content and composition (α casein, beta casein and k- casein) were not altered by bst injection. It was concluded that the gross composition of cheese in terms of dry matter, fat, protein, F/DM and TP/DM fresh and after 4 weeks were not affected by the administration of bst. Meanwhile, the general trend of these results is in accordance to those reported by Barbano and Lynch (1989), Van den Berg (1989), Phipps *et al.* (1990) and Eppard *et al.* (1991).

**Table (3): Gross composition of soft cheese from milk taken from buffaloes before and after their treatment with bovine somatotropin (bst).**

| Items | Storage period week | Control M ± SE | Treatment M ± SE |
|---|---|---|---|
| Moisture | Fresh<br>4 week | 61.34± 0.14<br>57.80± 0.11 | 61.48 ± 0.10<br>57.85± 0.11 |
| Fat % | Fresh<br>4 week | 19.60 ± 0.14<br>21.93 ± 0.13 | 19.63 ±0.12<br>21.96 ±0.11 |
| Protein %(TP ) | Fresh<br>4 week | 12.05 ±0.01<br>12.03 ±0.01 | 12.06 ± 0.02<br>12.02±0.01 |
| Fat/DM* | Fresh<br>4 week | 50.74 ± 0.2<br>51.98 ±0.23 | 50.99 ±0.22<br>52.11 ±0.02 |
| TP/DM | Fresh<br>4 week | 31.24± 0.14<br>28.52 ± 0.11 | 31.31±0.09<br>28.52 ±0.08 |

*DM = Dry matter

Titratable acidity was almost similar in two groups and increased with the advanced of ripening in both treatments (Table 4). These results are in agreement with Phipps *et al.* (1990), who reported that the use of milk from cows supplemented with bst did not affect titratable acidity in Chaddar, Wenslleydale and Cheshire cheeses. Similarly, soluble nitrogen of cheese was similar in the two groups indicating no effect of bst treatment in this trail (Table 4).Soluble nitrogen content of cheeses increased by over the 4 week storage period, and both groups showed similar rate of increase in soluble nitrogen content over the storage period (Table 4).

**Table (4): Effect of bovine somatotropin (bst) treatment of buffaloes on ripening indices of cheese made of buffalo milk during storage at 4°C.**

| Properties | Storage period week | Control M±SE | Treatment M± SE |
|---|---|---|---|
| Acidity % | Fresh<br>4 week | 0.22 ± 0.007<br>0.74 ± 0.006 | 0.21 ± 0.008<br>0.74 ± 0.008 |
| Soluble nitrogen % | Fresh<br>4 week | 0.22 ± 0.004<br>0.59 ± 0.007 | 0.22 ± 0.003<br>0.58 ± 0.013 |
| *TVFA ml 0.1NaOH/gm cheese | Fresh<br>4week | 2.66 ± 0.055<br>10.66 ± 0.15 | 2.55 ± 0.022<br>10.63 ± 0.16 |

*TVFA =total volatile fatty acids

Similarly, total volatile fatty acid (TVFA) increased three folds (about 300 %) in cheeses during ripening in both groups. There was no significant difference in TVFA content between cheeses made from milk collected before or after buffaloes were treated with bst, indicating no effect of bst treatment on TVFA content of soft cheese.

From the results represented in Table 4 it was concluded that the use of milk from buffaloes supplemented with bst did not interfere with the ripening indices of the manufactured soft cheese.

Results presented in Table (5) summarize the average score for organoleptic properties of cheese made from milk of buffalo before or after their treatment with bst during ripening.

Organoleptic score point results showed that the bst treatment did not affect total scores for the resultant cheese. Fresh cheese was characterized by clean flavour in both groups. However, storage improved the flavour of the cheese when ripening advanced to 4 weeks. Similarly, body and texture improved in both treatments with the advanced of ripening. It cold also be noticed that fresh and ripened cheese made from both sources had good and the same appearance 9 out of 10 score (Table 5) in all cheeses. It is clear from the results illustrated in table 5 that values of flavour, body and texture, and appearance in each of fresh or 4 week stored cheeses were almost similar in cheese made from milk taken from buffaloes before or after their treatment with bst. The present trial shows that the use of milk from buffaloes supplemented with bst did not nip-up organoleptic properties of soft cheese. These results are in agreement with those of Phipps *et al.* (1990) who reported that the values of the quality assessment trails, in terms of flavour and aroma, body and texture and colour and finish of cheeses manufactured from milk produced by cows treated with bst were indistinguishable from that of control milk.

**Table (5): Effect of bovine somatotrorpin (bst) treatment of buffaloes on organoleptic properties of cheese made of their milk, assessed as fresh or after storage at 4°C.**

| Storage period week | Items | Control M± SE | Treatment M ± SE |
|---|---|---|---|
| Fresh | Flavour (50) | 40.83 ± .04 | 40.66 ± .33 |
| | Body &texture (40) | 33.5± 0.22 | 33.5 ± 0.22 |
| | Appearance (10) | 9 ± 0 | 9 ± 0 |
| | Total (100) | 83.33 ± 0.21 | 83.16± 0.3 |
| 4 week | Flavour (50) | 45.83 ± 0.4 | 45.66 ± 0.33 |
| | Body& texture(40) | 35.50 ± 0.22 | 35.33 ± 0.21 |
| | Appearance (10) | 9 ± 0 | 9± 0 |
| | Total (100) | 90.33 ± 0.42 | 90.0 ±0.36 |

## CONCLUSION

It could be concluded that the treatment of dairy buffaloes with bst did not affect their milk composition or the manufacturing properties, chemical composition and organoleptic characteristics of soft cheese, made from their milk.

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## تاثير معاملة الجاموس المصرى بهرمون السوماتوتروبين علي تركيب اللبن وخواصة التصنيعية وعلي جودة الجبن الطرى

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***قسم تكنولوجيا الألبان و***قسم بحوث الجاموس معهد بحوث الأنتاج الحيواني- دقي- الجيزة و**قسم الا نتاج الحيوانى-كلية الزراعة -جامعة المنصورة.**

يهدف البحث الي دراسة تأثير حقن الجاموس بهرمون السوماتوتروبين علي التركيب الكيماوي للبن الناتج بعد المعاملة والخواص التصنيعية للبن كذلك تأثير الحقن بهذة الهرمون علي خواص الجبن الطرى المصنع من ألبانها ودرجة جودته.أستخدم في هذة الدراسة ٦جاموسات حلابة أخذت ألبانهاكلا علي حدا في اليوم٥٠ بعدالولادة وقبل الحقن بالهرمون (عينة المقارنة). ثم تم الحقن بالهرمون وأخذت عينات اللبن كلا علي حدا في اليوم٧٠ بعدالولادة(المعاملة).ولقد تم تصنيع الجبن من العينات المأخوذة كلا علي حدا.

**وكانت النتائج علي النحو التالي :**

-أوضحت النتائج أن أستخدام هرمون السوماتوتروبين ليس له تأثير علي التركيب الكيماوى للبن (الدهن-البروتين-اللاكتوز)

-لم يتداخل هذا الهرمون مع الخواص التصنيعية (زمن التجبن-زمن تكون الخثرة- نسبة فقد الدهن في الشرش-تصافي الجبن )

-لم يتأثر التركيب الكيماوى للجبن وخواص الجبن الحسية خلال فترة التسوية بحقن الجاموس بهذا الهرمون.