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Changes in proteolysis of preserved raw milk through pseudostem juices of banana tree

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Abstract

The present study we are using a potential preservatives pseudostem juices of banana tree (PJBT) at three different concentrations (0.1%, 0.2% and 0.3%) for preservation of raw milk at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ and refrigerated temperature (RT) at $7\pm 1^{\circ}\text{C}$ for extending the shelf life of milk. Tyrosine value (TV) as an index of proteolysis was determined for control and three different levels of pseudostem juices of banana tree 0.1%, 0.2% and 0.3% concentration preservatives for cow and buffalo milk for up to 6 hrs. preservations at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$. The mean value for Tyrosine value (TV) of fresh cow and buffalo milk were found to be 0.138 mg/ml and 0.152 mg/ml respectively at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ and refrigerated temperature (RT) at $7\pm 1^{\circ}\text{C}$. The change in Tyrosine Value was slower in higher of 0.3% concentration of pseudostem juices of banana tree-treated cow and buffalo milk sample during 6 hrs. storage of 0.147 ± 0.05 mg/ml and 0.161 ± 0.02 mg/ml respectively at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$. Similarly, after 6 days of storage TV of preserved cow and buffalo milk samples were 0.138 ± 0.02 mg/ml and 0.152 ± 0.04 mg/ml to 0.144 ± 0.02 mg/ml and 0.163 ± 0.03 mg/ml respectively at 0.3% concentrations of pseudostem juices of banana tree (PJBT) on refrigerated temperature (RT) at $7\pm 1^{\circ}\text{C}$.

Keywords: preservative, proteolysis, cow milk, buffalo milk, pseudostem juices, banana tree

Introduction

Milk is highly perishable food and it is also a good medium for growth various micro-organisms which makes it unsuitable for processing and consumption. So, it is adversely affected the shelf life of milk. Milk production in tropical countries is hindered by accelerated milk spoilage due to poor production, transportation facilities and high ambient temperatures (Meyer *et al.*, 1999; Imele *et al.*, 2000) [9, 6]. The growth of micro-organisms will result in loss of freshness and spoilage of milk. So generally physical and chemical methods of milk preservation are used to prevent microbial growth of raw milk. The present study we are using a potential preservatives pseudostem juices of banana tree (PJBT) at three different concentrations (0.1%, 0.2% and 0.3%) for preservation of raw milk for extending the shelf life of milk. Pseudostem juices of banana trees (PJBT) are easily available in rural area and as well as urban area. It is buffer in nature and most economical. A higher proteolysis activity was observed in buffalo milk samples treated with low level of formalin preservatives. Raw buffalo milk preserved with potassium dichromate gave marginally higher proteolysis activity. Preserved buffalo milk with formalin or Potassium dichromate and noticed a steady increase in the tyrosine value (TV) till the end of the storage period. The increase in tyrosine value was higher at lower concentration irrespective of preservative used (Karmakar and Ghatak, 1995) [11]. Banana pseudostem juice contain tannic acid as a main constituent and which have antimicrobial property (Scalbert, 1991; Chung *et al.*, 1998) [12, 5]. Calvo *et al.* (1990) [4] reported that CO_2 has a proteolytic effect on heat components of milk during heat treatment. In agriculture, it was suggested that pseudostem could be enriched with nitrogen as well as phosphorus to be used as substrate for growing ferns (Pacheco, 2010) [10].

Materials and Methods

The experiment "Changes in proteolysis of preserved raw milk through pseudostem juices of banana tree" was carried out in Dairy Chemistry laboratory, Mohanpur campus, West Bengal University of Animal & Fishery Sciences, West Bengal.

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Procurement of ingredients

Milk

Fresh cow and buffalo milk samples were collected from the nearby village of Mohanpur, Nadia (West Bengal) and some other khatalis situated nearby Haringhata, Nadia (West Bengal).

Preservatives

Pseudostem juices of banana tree (PJBT) is used as a preservative in raw milk. Banana tree were collected nearby village of Mohanpur, Nadia, West Bengal. Banana Pseudostem juice (BPJ) was obtained following the procedure described by Bharti (2005) [1]. First cut pseudostem of banana tree in a small piece and then put in a mixer or grinder for juices extraction and then filtered it. There are three different concentration of pseudostem juices 0.1%, 0.2% and 0.3% were prepared in the present studies.

Preservatives used on milk

The milk samples after being collected were divided into two parts. On part was kept aside as control sample and other parts were added pseudostem juices of banana tree (PJBT). The pseudostem juices (PJ) were added in raw milk at three different concentrations each and one control samples also kept for analytical purpose. After the initial observations the sample preserved with 0.1%, 0.2% and 0.3% of pseudostem juices (PJ) were kept in ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ and refrigerated temperature (RT) at $7\pm 1^{\circ}\text{C}$.

Estimation of proteolysis in milk

The extent of proteolysis in milk was estimated by the method described by Juffs (1973) [7].

Reagents

- Folin-ciocaeteu reagent, 0.57 N.
- 1% CuSO_4 in 2% sodium potassium tartarate.
- 2% NO_2CO_3 in 0.1 N NaoH.
- One part of (b) and 49 parts of solution (c) were mixed to constitute of 50 ml of alkali reagents.
- 24% TCA solution.

Procedure

5 ml of milk sample was taken in a test tube. 5 ml of 24% TCA solution was added and shaken vigorously. The mixture was allowed to held at room temperature for 15 minutes and then filtered, 0.2 ml of TCA filtrate was transferred to a test tube and 4 ml of alkali reagents was added. After 15 minutes, 0.2 ml of 0.67 N Folin-ciocalteu reagent was added rapidly to the mixture and mixed immediately. The mixture was kept for 5 minutes for colour development. The developed colour was measured at 650 nm in colorimeter. The standard curve was prepared by determining the optical density at 650 nm for TCA sample mixture containing 0 to 250 μg tyrosin per ml.

Results and Discussion

Pseudostem juices of banana tree (PJBT) was used in raw milk as preservatives to increase the shelf life of milk. Pseudostem juices at three different concentrations (0.1%, 0.2% and 0.3%) were used in the present study. The use of banana pseudostem juice in fishery and agriculture as a very

good antimicrobial agent (Biswas, 2004) [3]. Present studies have been carried out of reveal the changes in proteolysis of cow and buffalo milk preserved with pseudostem juices of banana tree (PJBT) at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ and refrigerated temperature (RT) at $7\pm 1^{\circ}\text{C}$.

Changes in proteolysis of preserved raw milk by pseudostem juices of banana tree

Milk contains fat, proteins, lactose, vitamins, mineral etc. It is well known that the milk protein undergoes proteolysis by psychrotrophs bacteria during cold storage. The proteinases enzyme either indigenous or bacterial origin are of great important in the context of changes in physico-chemical properties of preserved milk during storage. Bharti (2013) [3] reported the use of banana pseudostem juice in preservation of raw milk. Hence a study was carried out on the effect of pseudostem juices of banana tree (PJBT) on proteolysis of raw cow and buffalo milk. Tyrosine value (TV) as an index of proteolysis was determined for control and three different levels of pseudostem juices of banana tree 0.1%, 0.2% and 0.3% concentration preservatives for cow and buffalo milk for up to 6 hrs. Preservations at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ and the results are presented in Table-1.

Table 1: Proteolysis (mg of tyrosine/ml) of cow and buffalo milk during stored at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$ of added preservatives pseudostem juices of banana tree (PJBT)

Species	Concentration (%)	Duration of storage (Hrs.)			
		0	2	4	6
Cow milk	Control	0.138 \pm 0.02	0.154 \pm 0.06	0.165 \pm 0.04	0.176 \pm 0.04
	0.1	0.138 \pm 0.01	0.146 \pm 0.07	0.153 \pm 0.04	0.160 \pm 0.03
	0.2	0.138 \pm 0.02	0.143 \pm 0.03	0.148 \pm 0.04	0.155 \pm 0.04
	0.3	0.138 \pm 0.01	0.140 \pm 0.04	0.143 \pm 0.03	0.147 \pm 0.05
Buffalo milk	Control	0.152 \pm 0.04	0.162 \pm 0.04	0.173 \pm 0.04	0.183 \pm 0.05
	0.1	0.152 \pm 0.06	0.157 \pm 0.04	0.164 \pm 0.03	0.173 \pm 0.03
	0.2	0.152 \pm 0.04	0.155 \pm 0.03	0.159 \pm 0.02	0.165 \pm 0.04
	0.3	0.152 \pm 0.03	0.154 \pm 0.04	0.158 \pm 0.03	0.161 \pm 0.02

*Results of average of six samples

The mean value for Tyrosine value (TV) of fresh cow and buffalo milk were found to be 0.138 mg/ml and 0.152 mg/ml respectively. Upon subsequent storage at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$, there are marginal changes in tyrosine value were observed up to 6 hrs preservation in all samples of control and pseudostem juices of banana tree-treated cow and buffalo milk samples. The Tyrosine value of cow and buffalo milk were found to be 0.143 \pm 0.03 mg/ml and 0.158 \pm 0.03 mg/ml respectfully up to 4 hrs. preservation of 0.3% concentration of preservation. The change in Tyrosine Value was slower in higher of 0.3% concentration of pseudostem juices of banana tree-treated cow and buffalo milk sample during 6 hrs. storage of 0.147 \pm 0.05 mg/ml and 0.161 \pm 0.02 mg/ml respectively at ambient temperature (AT) at $30\pm 1^{\circ}\text{C}$. Increase in Tyrosine Value was 0.005% and 0.009% respectively for cow and buffalo milk samples at higher of 0.3% concentration of pseudostem juices of banana tree (PJBT). Hence cow milk treated preservation has more keeping quality to buffalo milk treated preservatives. This finding agrees very well at higher concentration 0.3% with that reported by Ray (2013).

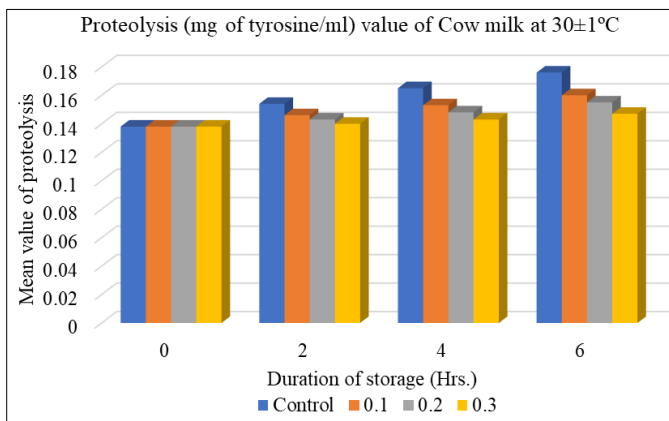


Fig 1: Graphical representation of proteolysis (mg of tyrosine/ml) value of cow milk during stored at ambient temperature (AT) at 30±1°C of added preservatives pseudostem juices of banana tree (PJBST)

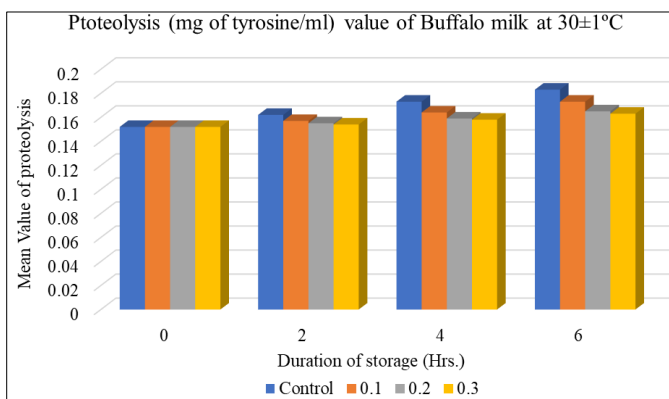


Fig 2: Graphical representation of proteolysis (mg of tyrosine/ml) value of buffalo milk during stored at ambient temperature (AT) at 30±1°C of added preservatives pseudostem juices of banana tree (PJBST)

samples were 0.138±0.02 mg/ml and 0.152±0.04 mg/ml to 0.144±0.02 mg/ml and 0.163±0.03 mg/ml respectively at 0.3% concentrations of pseudostem juices of banana tree (PJBST). Increase in TV was 0.006% and 0.011% respectively for cow and buffalo milk samples at 0.3% concentration of Pseudostem juices of banana tree (PJBST). Hence cow milk treated preservation has more keeping quality to buffalo milk treated preservatives. The increase in TV of cow and buffalo milk was mainly due to proteolytic activity of psychrotrophic bacteria and that are produced during storage of milk under refrigerated condition because increase in TV is always associated with increase in these micro-organisms.

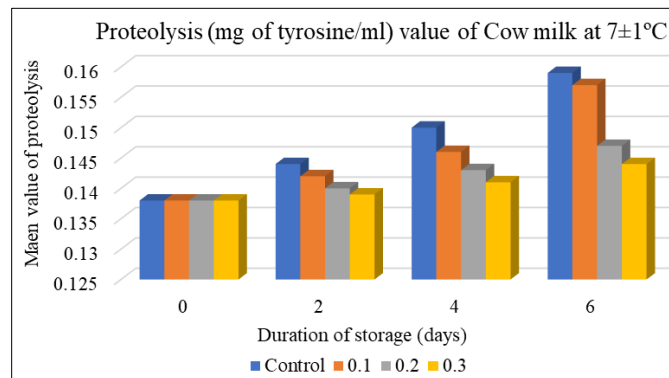


Fig 3: Graphical representation of proteolysis (mg of tyrosine/ml) value of cow milk during stored at refrigerated temperature (AT) at 7±1°C of added preservatives pseudostem juices of banana tree (PJBST)

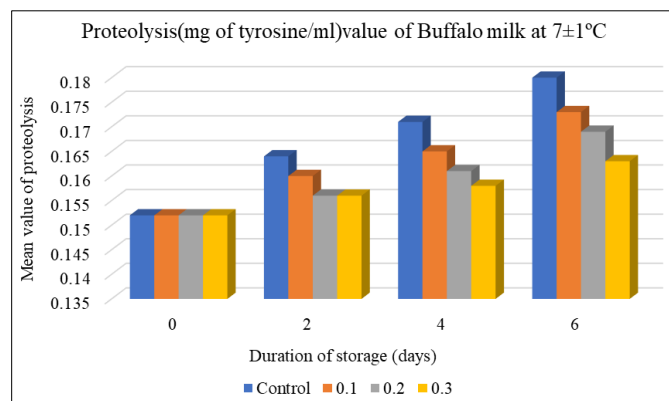


Fig 4: Graphical representation of proteolysis (mg of tyrosine/ml) value of buffalo milk during stored at refrigerated temperature (AT) at 7±1°C of added preservatives pseudostem juices of banana tree (PJBST)

Tyrosine value (TV) as an index of proteolysis was determined for cow and buffalo milk preserved with pseudostem juices of banana tree (PJBST) at refrigerated temperature (RT) at (7±1°C) and the results are presented in Table-2.

Table 2: Proteolysis (mg of tyrosine/ml) value of cow and buffalo milk during stored at refrigerated temperature (RT) at 7±1°C of added preservatives pseudostem juices of banana tree (PJBST)

Species	Concentration (%)	Duration of storage (days)			
		0	2	4	6
Cow milk	Control	0.138±0.02	0.144±0.02	0.150±0.04	0.159±0.04
	0.1	0.138±0.01	0.142±0.03	0.146±0.04	0.157±0.05
	0.2	0.138±0.02	0.140±0.02	0.143±0.04	0.147±0.06
	0.3	0.138±0.01	0.139±0.02	0.141±0.03	0.144±0.02
Buffalo milk	Control	0.152±0.04	0.164±0.03	0.171±0.04	0.180±0.05
	0.1	0.152±0.02	0.160±0.04	0.165±0.03	0.173±0.02
	0.2	0.152±0.04	0.156±0.03	0.161±0.03	0.169±0.04
	0.3	0.152±0.03	0.156±0.01	0.158±0.03	0.163±0.03

*Results of average of six samples

The mean value for Tyrosine value of fresh cow and buffalo milk were found to be 0.138 mg/ml and 0.152 mg/ml respectively. It is observed that cow and buffalo milk treated with pseudostem juices of banana tree remained almost constant over first 2 days, but thereafter it went on marginal increase till the end of the storage period for 6 days. After 6 days of storage TV of preserved cow and buffalo milk

Conclusion

The proteolysis changes in cow and buffalo milk samples as influenced by the addition of preservatives pseudostem juices of banana tree (PJBST) at ambient temperature (AT) at 30±1°C for 6 hrs. and refrigerated temperature (7±1°C) for 6 days were studied. It was concluded that the initial tyrosine value (TV) of cow and buffalo milk were found to be 0.138 mg/ml and 0.152 mg/ml respectively. The changes in tyrosine value (TV) was slower in maximum concentration (0.3%) of pseudostem juices of banana-treated both cow and buffalo milk samples during storage condition. Less proteolysis observed in treated cow and buffalo milk samples than untreated cow and buffalo milk samples. So, there was a marginal increase in the TV in milk samples preserved milk pseudostem juices of banana tree (PJBST) during storage at ambient temperature (AT) 30±1°C for 6 hrs. and refrigerated temperature (7±1°C) for 6 days.

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