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Short Communication

Heat Processing and Cold Storage Effects on Vitamins B_1 and B_2 of Buffalo Milk

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Abstract. Heat processing and cold storage effects on vitamins B_1 and B_2 contents of whole and skimmed buffalo milk were investigated. Whole and skimmed buffalo milk was heated at various temperatures (90-140 °C) for different time periods (2-90 min). Losses in vitamins B_1 and B_2 occurred to various extents depending upon the temperature and time period of heating and the storage conditions. Maximum losses in vitamins B_1 and B_2 were found on heating milk at 110 °C for 90 min and 140 °C for 8 min. Maximum losses in vitamins B_1 and B_2 were found to be 32.5 and 29.9% at 110 °C and 37.5 and 32.6% at 140 °C for whole buffalo milk, 30.4 and 26.4% at 110 °C and 34.8 and 29.6% at 140 °C for skimmed buffalo milk, respectively. Similarly, after 15 days cold storage, maximum amount of vitamins B_1 and B_2 was lost from heated whole and skimmed buffalo milk. Losses in these two water soluble vitamins were comparatively higher in case of whole buffalo milk than skimmed buffalo milk after heat treatment. However, losses in vitamin B_1 were higher than vitamin B_2 contents in all samples.

Keywords: buffalo milk, vitamins B_1 and B_2, heat processing, cold storage

Shelf life of milk is very short which is usually extended by heat treatment but heating causes considerable losses of B-vitamins (B_1, B_2, B_6 and folic acid) in buffalo and cow's milks depending upon the severity of heat treatments (Sharma and Lal, 1998; Burton, 1984; Mehriz and Ganguli, 1980). Informations are available in the literature about the heat treatment on vitamins of milk (Burton, 1984; Haddad and Loewenstein, 1983; McLaughlan *et al*., 1981). Severe heat treatment of skimmed cow milk (121 °C for 20 min) destroyed all the vitamins B_{12}, about 60% of the thiamin and vitamin B_6, 70% of the ascorbic acid and about 30% of the folate (Kilshaw *et al*., 1982). Losses in vitamins C, B_1 and B_2 from goat and cow milk were observed as a result of heat treatment. However, vitamins B_6, B_{12}, thiamin and riboflavin in milk were found relatively stable to heat treatment (Lavigne *et al*., 1989; Scott and Bishop, 1986). Storage stability of nutrients including lactose, lysine and water soluble vitamins have already been studied in processed milk (Rehman, 2002; Sierra and Vidal-Valverde, 2001; Lavigne *et al*., 1989). The present work was undertaken to study the effect of heat processing and cold storage on vitamins B_1 and B_2 contents of buffalo milk.

Whole and skimmed buffalo milk was directly collected from a local dairy industry, which was heated in sealed stainless steel tubes (3.5 mL capacity) in a thermostatically controlled oil bath in a temperature range of 90° to 140 °C, with holding times ranging from 2-90 min. After heating for a specified period, tubes were placed in an ice bath to stop the reaction before carrying out the analysis of vitamins B_1 and B_2 in heated milk.

Whole and skimmed buffalo milk heated at 90°-140 °C for different time periods (2-90 min) was distributed into 50 mL flask without leaving head space. These flasks were kept refrigerated at 4.5±0.5 °C for 15 days and analysed for vitamins B_1 and B_2 contents every 5 day of cold storage. Milk sample, 10.5 mL was mixed with 1g trichloroacetic acid (TCA) in a 50 mL centrifuge tube (30 mm diameter). The mixture was thoroughly shaken for 1 min over a magnetic stirring plate and then centrifuged for 10 min at 1250 g to separate the two phases. Liquid phase was collected in 10 mL volumetric flask and the volume was filled with 4% TCA. This acid extract was filtered through a 0.45 µm filter paper prior to HPLC analysis. The analysis of vitamins was carried out on HPLC (Albala-Hurtado *et al*., 1997).

Initially, vitamin B_1 contents in whole and skimmed buffalo milk were 40 and 46 µg/100 mL, respectively, which were lost to various extends depending upon temperature and time period of heating. After heating

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at 90, 100 and 110 °C for 90 min, losses in vitamin B_1 contents were 17.5, 25.0 and 32.5% for whole buffalo milk, 17.4, 23.9 and 30.4% for skimmed buffalo milk, respectively, (Fig. 1). However, vitamin B_1 contents in whole and skimmed buffalo milk were lost by 20.0 and 21.7% at 120 °C, 32.5 and 28.3% at 130 °C and 37.5 and 34.8% at 140 °C, respectively, after heating for 8 min.

On heating at 90, 100 and 110 °C for 90 min, vitamin B_2 contents were lost by 14.4, 18.1 and 29.0% from whole buffalo milk and by 12.0, 17.6 and 26.4% from skimmed buffalo milk. As a result of heating at 120, 130 and 140 °C for 8 min, losses in vitamin B_2 contents were 15.4, 22.7, 32.6% for whole buffalo milk and 12.8, 21.6, 29.6% for skimmed buffalo milk, respectively, (Fig. 2).

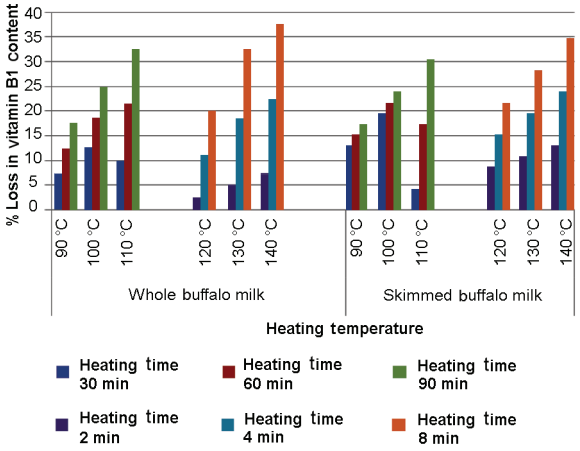

Fig. 1. Effect of heating on vitamin B_1 contents of whole and skimmed buffalo milk.

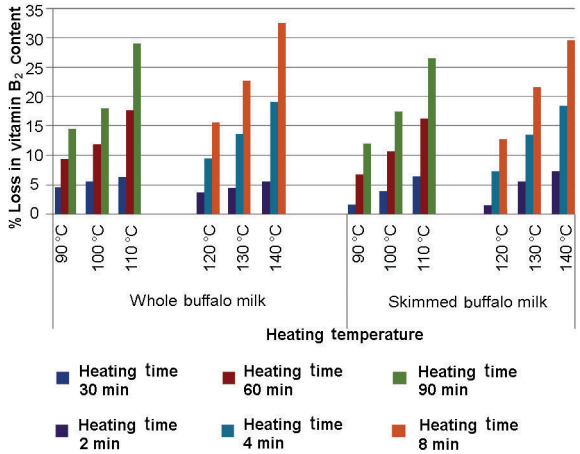

Fig. 2. Effect of heating on vitamin B_2 contents of whole and skimmed buffalo milk.

These results showed that losses in vitamin B_1 were higher than vitamin B_2 as a result of heat treatment. These results also show that loses in both, these water soluble vitamins (B_1 and B_2) were comparatively higher in case of whole buffalo milk than skimmed buffalo milk.

In fact, these results are in agreement with the observation of Lavigne *et al*. (1989). Contrary to these observations, Sierra and Vidal-Valverde (2000) found no change in vitamin B_1 contents in microwave and conventionally heated cow milk due to lower temperature and less time of heating. However, a slight decrease in vitamin B_1 by 3% was observed in heat treatment of milk at 90 °C for 30 sec. (Hartman and Dryden, 1974).

Figures 3-4 summarizes the effect of cold storage on the contents of vitamins B_1 and B_2 in heated whole and skimmed buffalo milk. During the first 5 days cold

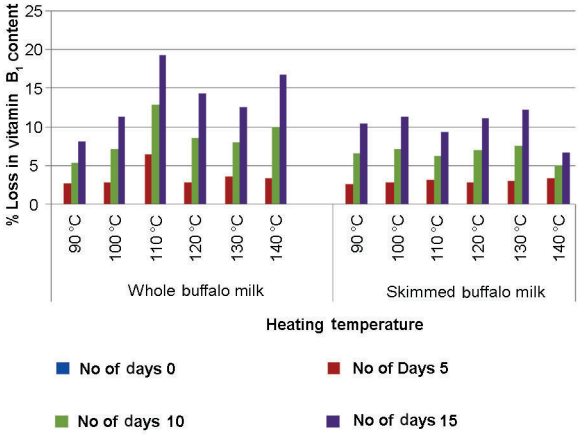

Fig. 3. Effect of cold storage on vitamin B_1 content of heated whole and skimmed buffalo Milk.

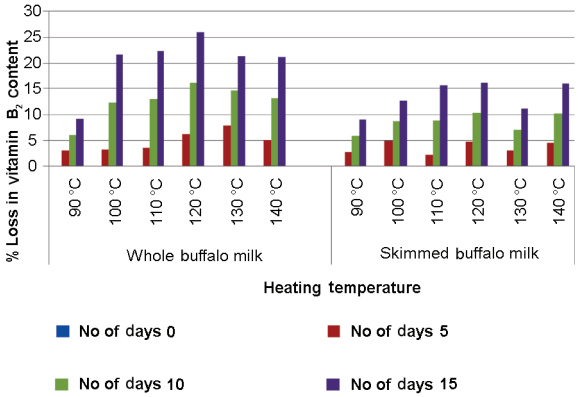

Fig. 4. Effect of cold storage on vitamin B_1 content of heated whole and skimmed buffalo milk.

storage losses in vitamins B_1 and B_2 were not significant in whole and skimmed buffalo milk but decreased thereafter, resulting losses in vitamin B_1 and vitamin B_2 by 8.1–19.23% and 9.18–26.04% for whole buffalo milk, 6.66–11.42% and 9.09–16.19% for skimmed buffalo milk, respectively, after 15 days cold storage.

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