Full Length Research Paper

Effect of storage temperature on shelf life of standardized buffalo milk *Ujani basundi*

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The effects of storage of buffalo milk *Ujani basundi*, incorporated with or without potassium sorbate (0.1% w/w) and with or without cardamom (0.1% w/w) under ambient (30±1°C) and refrigerated temperature (5±1°C) over a period of 20 days were studied. The physicochemical as well as sensory quality of stored product samples were studied. The stored product samples at refrigerated and ambient temperature with potassium sorbate gave shelf life up to 20 and 10 days respectively. The product stored with cardamom gave best flavor score in both the temperature.

Key words: Shelf life, *Ujani basundi*, flavor, cardamom, refrigerated temperature.

INTRODUCTION

*Ujani basundi* is the heat desiccated indigenous dairy product of Ujani village and popular throughout the Latur district in Maharashtra state. Nowadays many researchers, that is Landge (2007), Navjeevan and Rao (2005) worked on packaging materials, to increase the shelf life of indigenous dairy products at room temperature.

Misra (1997) stated that most of the Indian milk products are sterile when fresh; it is the post manufacture contamination during storage that deteriorates their quality. Hence, it is of utmost importance from economic as well as safety point of view, to prevent any type of contamination before, during or after the preparation of the products. However, researchers Kulkarni et al. (1983), Palit and Pal (2005), and Kumar and Anand (2003) studied channa, burfi and khoa indigenous dairy products to increase their shelf life respectively.

Shelf life of dairy products can be increased by the addition of antibacterial agents like potassium sorbate and antifungal agent like cardamom. So researchers Natta et al. (2008), Mahafuz and Khalequzzaman (2007), used essential oil from cardamom in their investigation and reported that cardamom found fumigant effects on the adult *C. amaculates* and beneficial effects on such organisms.

*U. basundi* contains 28 to 35% moisture Gaikwad and Hembade (2010). It is a common knowledge that moistures food does not keep longer at room temperature. Hence, this product also does not keep longer than 4 days at room temperature. The product can remain safe number of days at refrigerator temperature, but it is a costly method of preservation, hence an attempt was therefore made to develop a technology for improving the shelf life of *U. basundi* at 30°C applicable in village conditions by employing the food grade antimycotic agents like potassium sorbate and antifungal agent like cardamom. Therefore due to beneficial effects of potassium sorbate and cardamom in present study potassium sorbate and cardamom were used to extend the shelf life of this popular desiccated milk sweet meat.

MATERIALS AND METHODS

Buffalo milk *U. basundi* was prepared according to the method standardized by Gaikwad and Hembade (2010). When the product get ready potassium sorbate and cardamom (in powder form) were added separately, as preservatives each @ 0.1% (w/w) level. *U. basundi* samples were then filled in previously cleaned and sterilized low density poly ethylene (LDPE) pouches of 100 g capacities after attaining the room temperature. Three types of

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**RESULTS AND DISCUSSION**

Effect of storage period on moisture content in buffalo milk *U. basundi* at refrigerated (5±1°C) and ambient temperature (30±1°C) at refrigerated temperature

The control sample showed low moisture (37.41%) content on 5th day and it was again reduced to 36.72, 35.18 and 33.31 on 15th, 20th day of storage respectively (Table 1). The sample T1 containing potassium sorbate showed 38.06% of moisture on 0th day which was then reduced to 37.64, 36.86, 35.39 and 34.44% on 5th, 10th, 15th and 20th day of storage respectively. The sample T2 containing cardamom did not show any different results than the control sample. This sample showed 36.06% initial moisture and reduced to 37.53, 36.75, 35.23 and 33.36% on 5th, 10th, 15th and 20th day of storage respectively.

At ambient temperature

Effect of storage period on moisture content in buffalo milk *U. basundi* at ambient temperature (30±1°C) shown in Table 2. The control sample showed low moisture (36.71%) content on 5th day as compared to T1 (37.48%) and T2 (36.84%) but these values are not significant (P>0.05). The sample T1 containing potassium sorbate showed 38.06% moisture on 0th day which was then reduced to 37.48 and 35.12% on 5th and 10th day of storage respectively. The sample T2 containing cardamom did not show any difference with control. The control sample showed 41.68% initial moisture and reduced to 36.84% on 5th day of storage. The reduced moisture contents in khoa, khoa, khoa, khoa, and burfi also reported by Kumar et al. (1975), Rao et al. (1977), Jha et al. (1977), Malhotra and Prasad (1997) and Palit and Pal (2005) respectively.

The control and T2 sample showed mold growth over the surface of experimental samples on 6th day of storage at ambient temperature (30±1°C) therefore discarded from the experiment. Sample containing potassium sorbate did not show mold growth over the surface of product till the completion of investigation. However, rancid flavor developed on 11th day of storage therefore; it was discarded from the present investigation.

**Effect of storage period on fat content in buffalo milk *Ujani basundi* at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)**

Initially the fat content in control, T1 and T2 sample was 18.34, which increased to 18.53, 18.36 and 18.51% on 5th day of storage respectively (Table 1 and 2). The control sample showed 18.71, 18.88 and 19.71% whereas sample containing the cardamom showed 18.67, 18.84 and 19.76% fat contents on 10th, 15th and 20th day of storage respectively. The sample containing the potassium sorbate showed 18.51, 18.59 and 19.63% fat contents on 10th, 15th and 20th day of storage respectively. The control sample showed the higher percentage of fat content on 5th day whereas potassium sorbate treated sample showed the lowest fat content as compared to control and T2 sample and these values are not statistically significant (P<0.05).

The fat content in control, T1 and T2 sample at ambient temperature (30±1°C) increased to 18.68, 18.51 and 18.66% on 5th day of storage respectively from the initial value of 18.34%. The increase in fat content on 5th day of storage might be observed due to loss of moisture. Therefore, fat contents increased. The control sample showed the higher loss of moisture therefore it showed higher (18.68) percentage of fat content on 5th day whereas potassium sorbate treated sample showed the lowest fat than the control and T2 sample but that values are not statistically significant (P<0.05). The similar findings in present investigation were also reported by Kumar et al. (1975), Rao et al. (1977), Jha et al. (1977), Malhotra and Prasad (1997) and Palit and Pal (2005).

**Effect of storage period on sucrose content in buffalo milk *U. basundi* at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)**

Initially the sucrose content in control, T1 and T2 sample was 18.24 which increased to 18.29, 18.26 and 18.30 on 5th day of storage at refrigerated temperature respectively (Tables 1 and 2). The control sample showed showed 18.36, 18.48 and 18.69% of sucrose whereas
Table 1. Effect of storage temperature on physicochemical properties of *Ujani basundi* stored at refrigerated temperature (5±1°C).

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The sample containing the cardamom showed 18.35, 18.44 and 19.68% of sucrose contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 18.30, 18.39 and 19.48% of sucrose contents on 10, 15 and 20th day of storage respectively. The increase in sucrose content during storage period might be observed due to decrease in moisture contents.
The sucrose content in control, \(T_1\) and \(T_2\) sample increased to 18.39, 18.33 and 18.36 on 5th day of storage at ambient temperature (30±1°C) respectively. The increase in sucrose content on 5th day of storage might be observed due to loss of moisture contents. The control sample showed the higher (18.39) percentage of sucrose content on 5th day whereas potassium sorbate treated sample showed the lowest (18.33) fat content as compared to control (18.39) and \(T_2\) (18.36) sample. The sample treated with potassium sorbate showed the 19.12% of sucrose contents on 10th day of storage period.

Effect of storage period on lactose content in buffalo milk \(U. \text{basundi}\) at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

Initially the lactose content in control, \(T_1\) and \(T_2\) sample was 13.65, decreased to 13.56, 13.61 and 13.58 on 5th day of storage respectively (Tables 1 and 2). The control sample showed 13.51, 13.42 and 13.26% of lactose whereas sample containing the cardamom showed 13.54, 13.44 and 13.29% of lactose contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 13.60, 13.56 and 13.48% of lactose contents on 10, 15 and 20th day of storage respectively.

A steady decrease in lactose content in control and cardamom treated samples during the storage period might be observed due to microbial growth which resulted in decreased lactose contents. The lactose content in control, \(T_1\) and \(T_2\) samples at ambient temperature (30±1°C) decreased to 13.22, 13.44 and 13.20 on 5th day of storage respectively. Potassium sorbate treated sample showed the highest lactose content as compared to control and \(T_2\) sample it might be due to microbial resistance power of potassium sorbate added which is considered effective antimicrobial agents (Hossain et al., 2001). The microbial resistance power potassium sorbate was also reported by researchers Jha et al. (1977), Rao et al. (1977), Rudreshappa and De (1971), Ghodekar et al. (1978) and Sachdeva and Singh (1990a, b). Despite slow but steady decrease in lactose contents in control and \(T_2\) these values are not statistically significant (P<0.05).

Effect of storage period on protein content in buffalo milk \(U. \text{basundi}\) at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

Variations in the protein contents of \(U. \text{basundi}\) stored for 20 days were observed at refrigerated temperature (5±1°C). The \(T_1\) sample showed low protein (11.79%) content on 5th day as compared to \(T_2\) (11.81%) and control (11.83%) (Tables 1 and 2). However, the fresh sample showed the (11.76%) protein content. The control sample showed 11.91, 11.96 and 12.63% protein whereas sample containing the cardamom showed 11.90, 11.97 and 12.58% of protein contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 11.84, 11.90 and 12.41% of protein contents on 10, 15 and 20th day of storage respectively.

At ambient temperature (30±1°C) the \(T_1\) sample showed low protein (11.86%) content on 5th day as compared to \(T_2\) (11.89%) and control (11.91%). The sample \(T_2\) containing cardamom did not show any different results than the control sample. The sample \(T_1\) containing potassium sorbate showed 12.16% protein on 10th day of storage.

Effect of storage period on ash content in buffalo milk \(U. \text{basundi}\) at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

The ash contents of \(U. \text{basundi}\) stored for 20 days were observed at refrigerated temperature (Table 1 and 2). The \(T_1\), \(T_2\) and control showed similar percentage of ash contents on 5th day of storage might be due to loss of moisture contents. The increased in ash content on 5th day of storage respectively. The sample containing the potassium sorbate showed 1.97% of protein on 10th day as compared to \(T_2\) (1.96%) and control (1.98%). The fresh sample of \(U. \text{basundi}\) showed the (1.96%) ash content. The control sample showed 2.03, 2.07 and 2.11% of ash whereas sample containing the cardamom showed 2.03, 2.06 and 2.10% of ash contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 1.98, 2.01 and 2.06% of ash contents on 10, 15 and 20th day of storage respectively.

Variations in the ash contents of \(U. \text{basundi}\) stored for 10 days were observed. The \(T_1\) sample showed low as (1.96%) content on 5th day as compared to \(T_2\) (1.97%) and control (1.98%). However, the fresh sample of \(U. \text{basundi}\) showed the (1.96%) ash content. The sample \(T_2\) containing cardamom did not show any different results than the control sample. The sample \(T_1\) containing potassium sorbate showed 1.97% of protein on 10th day of storage.

Effect of storage period on free fatty acid content in buffalo milk \(U. \text{basundi}\) at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

Free fatty acidity (per cent oleic acid) was measured to quantify hydrolytic changes during storage (Table 1). The initial FFA found (0.54%) and these increased slowly during storage, however, the rate of increase of FFA in potassium sorbate \(T_2\) was very low as compared to control \(T_0\) and cardamom \(T_2\) treated samples. The control sample showed 0.59, 0.63 and 0.66% of free fatty
acid whereas sample containing the cardamom showed 0.59, 0.61 and 0.64% of free fatty acid contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 0.55, 0.57 and 0.60% of FFA contents on 10, 15 and 20th day of storage respectively.

The initial FFA found (0.54%) and these increased slowly during storage, however, the rate of increase of FFA in potassium sorbate (T_1) was very low as compared to control (T_0) and cardamom (T_2) treated samples. Therefore present investigation reports that storage at low temperature with potassium sorbate retards the increase in FFA (Tables 2).

Changes in the FFA were recorded low in the samples with potassium sorbate, indicating that the release of FFA was controlled by this preservative. The same result was also observed by Hossain et al. (2001). Increased level of FFA during storage indicating lipolytic and proteolytic changes Singh et al. (2007), Chavan et al. (2009), Suresh and Jha (1994). This indicates that potassium sorbate is beneficial in reducing the initial level of FFA of Ujani basundi samples and subsequently checking the proteolytic and lipolytic changes during storage.

Effect of storage period on acidity content in buffalo milk U. basundi at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

The initial titratable acidity (0.53%) in the control U. basundi samples gradually increased and approached to 0.57% on the 5th day of storage (Table 1). Titratable acidity of U. basundi samples remain unchanged in potassium sorbate treated sample (T_1) from the day of preparation to 5th day of storage however it reached 0.71% (% lactic acid) on 20th day of storage period. Titratable acidity of U. basundi increased from 0.53 to 0.96% (%lactic acid) in cardamom treated sample (T_2) from the day of preparation to 20th day of storage. The control sample showed 0.64, 0.77 and 0.96% of acidity whereas sample containing the cardamom showed 0.64, 0.74 and 0.96% of acidity contents on 10, 15 and 20th day of storage respectively. The sample containing the potassium sorbate showed 0.56, 0.65 and 0.71% of acidity contents on 10, 15 and 20th day of storage respectively.

Effect of storage period on acidity content in cow milk U. basundi at ambient temperature (30±1°C) are given in table. The initial titratable acidity (0.53%) in the control U. basundi samples gradually increased and approached 0.71% on the 5th day of storage. Titratable acidity of U. basundi increased from 0.50 to 0.58% (%lactic acid) in potassium sorbate treated sample (T_1) from the day of preparation to 5th day of storage however it reached 0.64% (% lactic acid) on 10th day of storage period. Titratable acidity of U. basundi increased from 0.50 to 0.67% (% lactic acid) in cardamom treated sample (T_2) from the day of preparation to 5th day of storage.

It is however said that, the rate and the net increase in acidity of potassium sorbate treated samples of U. basundi over control and T_2 during storage is lower indicating the inhibitory effect of added potassium sorbate on the microbial activity in the product. Palit and Pal (2005) also reported the inhibitory effect of potassium sorbate on dairy products. U. basundi samples containing 0.1% potassium sorbate showed practically no change in the titratable acidity up to 5 days of storage and then slowly increased. Increase in acidity is an indication of spoilage in dairy products (Bajwa et al., 2005). Earlier researchers Jha et al. (1977), Rao et al. (1977), Rudreshappa and De (1971) and Sachdeva and Singh (1990a, b) also reported similar trend of increase in acidity of stored dairy products.

Effect of storage period on flavour in buffalo milk U. basundi at refrigerated temperature (5±1°C) and ambient temperature (30±1°C)

Organoleptic quality of U. basundi presented in Tables 3 and 4, representing rate of flavor deterioration during storage for each type of treatment at each storage temperature. As expected, rate of flavor deterioration in all treatments except T_1 was greater. The flavor deteriorated with length of storage, except in T_1 treated with potassium sorbate and cardamom treated samples (T_2). During storage a slight rancid flavor was observed in control sample. Rancidity results from the hydrolysis of the fat due to lipase enzyme secreted by bacteria. That defect seemed not to be objectionable at storage condition. On 0th day all the treatments secured nearly equal score except cardamom it might be due to pleasant flavor of cardamom. But the score was not significant (P<0.05). But when the storage increased the flavor score also decreased on 5th day of storage in all treatments. The cardamom treated sample got highest score than the rest of two treatments it might be due to flavor of cardamom. But yet flavor score of all treated samples was not significant (P<0.05). After 15th day of storage declined the flavor score at this temperature it might be due to sharp increase in FFA value, same findings also reported by Adhikari and Singh (1992), Prasad et al. (1989), Chavan et al. (2009).

Effect of storage period on body and texture in buffalo milk U. basundi at refrigerated (5±1°C) and ambient temperature (30±1°C)

The body and texture of samples of U. basundi during storage at 5±1°C significantly (P<0.05) affected (Tables 3 and 4). The highest value of body and texture was obtained in potassium sorbate treated samples. The control and cardamom treated samples got lowest score
than the potassium sorbate treated samples. This may be
due to high moisture loss during storage. Due to moisture
loss the product became slightly thicker; however body
and texture scores were not much influenced with
increase in storage period. The scores remained around
liked very much to liked slightly range throughout the
storage period of 20 days for control sample whereas it
also remained same for cardamom and potassium
treated samples. Indicating thereby the products were
sensorial acceptable when stored at 5°C for 20 days. Our
findings are in agreement with Geetha and Rao (2005),
Bajwa et al. (2005) and Prajapati et al. (1986). However
in ambient temperature body and texture score reduced
greatly.

Effect of storage period on color and appearance in
buffalo milk *U. basundi* at refrigerated temperature
(5±1°C) and ambient temperature (30±1°C)

The color and appearance of samples of *U. basundi*
during storage at 5°C were not significantly (P<0.05)
affected therefore no changes were observed in scores
awarded by the panelists (Tables 3 and 4). The control
and cardamom treated samples got lower score than the
potassium sorbate treated samples. This may be due to
the fact that these samples were more affected in this
storage period. Sample added potassium sorbate did not
much effect to color. It might be due to potassium sorbate
which retarded biochemical as well the microbial changes
during storage. Due to microbial as well as biochemical
changes in control and cardamom treated samples the
product became slightly brown therefore it scored lower
during storage, however color and appearance scores of
cardamom treated samples scored slightly higher than
the control samples. The scores remained around liker
moderately to liked extremely range throughout the
storage period of 20 days. Indicating thereby the products
were sensorial acceptable when stored at 5°C for 20
days. Our findings are in agreement with Geetha and
Rao (2005), Bajwa et al. (2005) and Prajapati et al.
(1986).

Conclusion

Potassium sorbate added product gave shelf life up to 20
days at refrigerated temperature whereas 10 days at
ambient temperature (30±1°C). However, the control and
cardamom added and control samples gave the shelf life
up to 15 days at refrigeration temperature (5±1°C) and 5
days at ambient temperature (30±1°C). However, the
flavor of cardamom added samples found superior
among all the treatment during storage study. Therefore,
it is concluded from the present investigation that the
product can be stored at refrigerated temperature
(5±1°C) by the addition of potassium sorbate for long
time with acceptable quality. The potassium sorbate
added samples showed great resistant power against
microbial growth. It retarded the microbial and chemical
changes at refrigerated as well as ambient temperature.
Therefore, from the present investigation it is concluded
that the product at village level at ambient conditions
(30±1°C) with potassium sorbate may be used to
increase the shelf life.

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