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Effect of Storage Temperature on Microbiological Quality of Standardized Cow Milk Ujani Basundi

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ABSTRACT

It is common knowledge that moistures food cannot keep longer at room temperature. Hence, Ujani basundi product also cannot keep longer than 4 days at room temperature. The product can remain safe for number of days at refrigerator temperature but it is costly method of preservation, hence an attempt was therefore, made to develop a technology for improving the shelf life of Ujani basundi at 30°C applicable in village conditions by employing the food grade antimycotic agents like potassium sorbate and antifungal agent like cardamom. Therefore, changes in standard plate count, coliform count, yeast and mold count, flavor, body and texture, color and appearance were determined during the entire storage period. Potassium sorbate added product gave shelf life up to 20 days at refrigerated temperature whereas, 10 days at ambient temperature (30°C). Potassium sorbate added sample showed good inhibitory effect in microbiological study. The control and cardamom added samples gave the shelf life up to 15 days at refrigeration temperature and 5 days at ambient temperature (30°C). However, the flavor of cardamom added samples found superior among all the treatment during storage study. Therefore, from the present investigation it is concluded that the product can be stored at refrigerated (5±1°C) and ambient temperature (30±1°C) by the addition of potassium sorbate for 20 and 10 days, respectively with acceptable quality.

Key words: Shelf life, concentrated dairy product, Ujani basundi

INTRODUCTION

Ujani basundi is the heat desiccated indigenous dairy product of Ujani village and popular throughout the Latur district in Maharashtra state. Two families i.e. Bardapure and Dhawan are preparing this product since the beginning of 20th century. The third generation members of these families, even today run the business of Ujani basundi manufacture in this village. Special thing regarding these families and other manufacturing agents is that they do not prepare any dairy product except Ujani basundi. Ujani village is situated on the Solapur-Latur highway just near to famous religious place Tuljapur (Gaikwad and Hembade, 2011).

Shelf life is defined as the number of days a product can be stored at a certain temperature and can be consumed safely, without deterioration of sensory characteristics of taste, color and texture. The shelf life is determined by microbiological and organoleptic quality. Whichever of the two criteria manifests firsts, determines the shelf life. Shelf life of a product depends on its chemical

composition and microbiological status. Refrigeration and in some cases freezing may extend the shelf life considerably but now-a-days many researchers, i.e., Landge (2007), Navjeevan and Rao (2005) etc., worked on packaging materials, so as, to increase the shelf life of indigenous dairy products at room temperature.

Mahafuz and Khalequzzaman (2007) and Natta *et al.* (2008), used cardamom in their investigation and reported that cardamom found very well over the control sample. Ujani basundi is moistures product it contains 30-40% moisture. It is 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 for number of days at refrigerator temperature but it is costly method of preservation, hence, an attempt was therefore, made to develop a technology for improving the shelf life of Ujani basundi at 30°C applicable in village conditions by employing the food grade antimycotic agents like potassium sorbate and antifungal agent like cardamom (Gaikwad and Hembade, 2010). Therefore, in present study potassium sorbate and cardamom used to study the shelf life of this popular desiccated sweet meat.

MATERIALS AND METHODS

Cow milk Ujani 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 at 0.1% level. Ujani basundi samples then filled in previously cleaned and sterilized polystyrene containers of 100 g capacities after attaining the room temperature. Three types of Ujani basundi samples as given below were stored at 30±1°C and 5±1°C observed daily and analyzed at an interval of 5 days:

T_0 = Without preservative (control)
T_1 = With potassium sorbate
T_2 = With cardamom

The samples were analyzed for microbiological study, viz. standard plate count, yeast and mold and coliform count as per Indian Standards (1980) SP: 18- Part (XI, 1980).

The product was evaluated by conducting sensory evaluation of panel of 6 semi-trained judges by using the nine point hedonic scale. Results were analyzed using complete randomized design to test the statistical significance as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Effect of storage period on standard plate count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: It is evident from Table 1 that the standard plate count of all the samples of Ujani basundi increased during storage except potassium sorbate treated sample (T_1). The rate of increase was faster in case of control samples. The initial count of the samples was 69×10^2 Ujani basundi treated with 0.1% potassium sorbate (T_1) and increased steadily during the early storage from an initial value of 69×10^2-5.2×10^3 on 5th day of storage and then showed a sharp increase to 85×10^5 on the 10th day of storage. The initial count of the samples was 69×10^2 Ujani basundi treated with 0.1% cardamom (T_2) and increased steadily during the early storage from an initial value of 69×10^2-5.3×10^5 on 5th day of storage. The control samples showed similar results like that of the cardamom treated samples. The count of the samples treated with 0.1% potassium sorbate (T_1) increased steadily during the early storage from an initial value of

Table 1: Effect of storage period on standard plate count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature

		Storage period (days) (CFU g^{-1})				
Treatment	Temperature	0	5	10	15	20
Control	Ambient	69×10^2	5.3×10^5	-	-	-
	Refrigerated	69×10^2	91×10^2	48×10^3	91×10^3	62×10^4
T_1	Ambient	69×10^2	5.2×10^3	85×10^5		
	Refrigerated	69×10^2	57×10^2	89×10^2	113×10^2	132×10^2
T_2	Ambient	69×10^2	5.3×10^5	-	-	-
	Refrigerated	69×10^2	88×10^2	43×10^3	83×10^3	43×10^4

T_1: Potassium sorbate, T_2: Cardamom

Table 2: Effect of storage period on yeast and mold count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature

		Storage period (days) (CFU g^{-1})				
Treatment	Temperature	0	5	10	15	20
Control	Ambient	3	21,400	-	-	-
	Refrigerated	3	31	148	1300	1960
T_1	Ambient	3	331	4100	-	-
	Refrigerated	3	6	28	73	155
T_2	Ambient	3	21,300	-	-	-
	Refrigerated	3	30	146	1289	1948

T_1: Potassium sorbate, T_2: Cardamom

69×10^2-57×10^2 on 5th day of storage and then showed a sharp increase to 132×10^2 on the 20th day of storage at refrigerated temperature. The count of the samples treated with 0.1% cardamom (T_2) increased steadily during the early storage from an initial value of 69×10^2-88×10^2 on 5th day of storage. The control samples showed the counts increased from initial value of 69×10^2-91×10^2 on 5th day of storage period. The control sample showed 48×10^3, 91×10^3 and 62×10^4 SPC whereas, sample containing the cardamom showed 43×10^3, 83×10^3 and 43×10^4 SPC contents on 10, 15 and 20th day of storage, respectively. The sample containing the potassium sorbate showed 89×10^2, 113×10^2 and 132×10^2 SPC contents on 10, 15 and 20th day of storage, respectively. The result of present investigation corroborates with that of earlier researchers (Rudreshappa and Sukumar, 1971; Jha *et al*., 1977; Rao *et al*., 1977; Ghodekar *et al*., 1978; Hossain *et al*., 2001).

Effect of storage period on yeast and mold count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: It is evident from Table 2, that the yeast and mold count of all the samples of Ujani basundi increased during storage except potassium sorbate treated sample (T_1). Mold growth is probably the most important single factor limiting shelf life of milk sweets. The initial yeast and mold count in Ujani basundi was 3 CFU g^{-1}. The presence of yeast and mold in concentrated dairy products is objectionable since they produce discoloration defects and lipolytic changes causing off flavor development in the product (Kumar *et al*., 1975). The number of yeast and mold increased progressively during storage at ambient temperature except potassium sorbate treated samples. Yeast and mold of control, cardamom and were and potassium sorbate treated samples were 21400, 21300 and 331 CFU g^{-1} on fifth day of storage, respectively.

Samples treated with potassium sorbate showed 4100 CFU g^{-1} yeast and mold count on 10th day of storage. However, control sample and cardamom treated (T_2) sample spoiled on sixth day of storage, they showed the presence of yeast and mold growth over the surface of product. The sample treated with potassium sorbate did showed the presence of yeast and mold growth over the surface of product but a rancid flavour was developed on 12th day of storage. This indicates possible inhibitory effect of potassium sorbate on yeast and mold.

Idris and Alhassan (2010) also reported that the total bacterial viable count was significantly ($p<0.05$) affected by storage temperature, the highest value was at room temperature, yeast, molds, coliforms and *E. coli* counts were not significantly ($p<0.05$) affected while studying the effect of packaging material on microbiological properties of Sudanese white cheese. Yeast and mold of control, cardamom and potassium sorbate treated samples were 31, 30 and 6 CFU g^{-1} on fifth day of storage at refrigerated temperature, respectively. The control sample showed 148, 1300 and 1960 CFU g^{-1} yeast and mold whereas sample containing the cardamom showed 146, 1289 and 1948 CFU g^{-1} yeast and mold contents on 10, 15 and 20th day of storage, respectively. The sample containing the potassium sorbate showed 28, 73 and 155 CFU g^{-1} yeast and mold contents on 10, 15 and 20th day of storage, respectively. The researchers Hossain *et al.* (2001) also reported the inhibitory effect of potassium sorbate in dairy product.

Effect of storage period on coliform count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: Table 3, shows the changes in coliform of Ujani basundi samples during storage. The initial level of coliform counts of control was zero and it reached to 19 CFU g^{-1} on 5th day, similar results were also observed in cardamom treated samples in which coliform increased to 18 CFU g^{-1} on 5th day of storage. There was no coliform count found in entire storage period of Ujani basundi samples containing 0.1% potassium sorbate. This indicates that potassium sorbate is quite effective in reducing initial counts and has an inhibitory effect on the microorganisms during storage. Earlier researchers (Rudreshappa and Sukumar, 1971; Jha *et al.*, 1977; Rao *et al.*, 1977; Sachdeva and Singh, 1990a, b; Hossain *et al.*, 2001) also reported similar trend of inhibitory effect of potassium sorbate on coliform counts of stored dairy products.

The initial level of coliform counts of control was zero and it increased slowly during storage and reached to 9 CFU g^{-1} on 5th day, similar results were also showed by cardamom treated samples in which coliform increased to 8 CFU g^{-1} on 5th day of storage at refrigerated temperature. There was no coliform count found in entire storage period of Ujani basundi samples containing 0.1% potassium sorbate. This indicates that potassium sorbate is quite effective in reducing initial counts

Table 3: Effect of storage period on coliform count in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature

		Storage period (days) (CFU g^{-1})				
Treatment	Temperature	0	5	10	15	20
Control	Ambient	0	19	-	-	-
	Refrigerated	0	9	51	104	1.4×10^2
T_1	Ambient	0	0	0	-	-
	Refrigerated	0	0	0	0	0
T_2	Ambient	-	18	-	-	-
	Refrigerated	0	8	45	98	1.2×10^2

T_1: Potassium sorbate, T_2: Cardamom

and has an inhibitory effect on the microorganisms during storage. The control sample showed 51, 104 and 1.4×10^2 coliform counts whereas, sample containing the cardamom showed 45, 98 and 1.2×10^2 of coliform counts on 10, 15 and 20th day of storage, respectively.

Alalade and Adeneye (2006) also reported Coliform Bacterial Count (CBC) 472.75 $\times10^5$ CFU g^{-1} while studying the effect of storage period on the chemical composition and coliform microflora of wara cheese. No colonies of *E. coli* were detectable in any of the Ujani basundi samples either initially or during the storage of Ujani basundi samples. This might be due to high heat treatment during preparation of this concentrated product and no post manufacture contamination.

Effect of storage period on flavour in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: Organoleptic quality of Ujani basundi presented in Table 1 Fig. 1, representing the rate of flavor deterioration during storage for each type of treatment at ambient (30±1°C) and refrigerated (5±1°C) temperature storage temperature. As expected, rate of flavor deterioration in all treatments except T_1 was greater as storage temperature increased. Also, 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 (Pal and Gupta, 1985). That defect seemed not to be objectionable at storage condition. On 0th day all the treatments got nearly equal score except cardamom it might be due to flavour of cardamom. When the storage increased the flavor score also decreased on 5th day of storage in all treatments ambient (30±1°C) temperature. The cardamom treated sample got highest score than the rest of two treatments and it might be due to flavor of cardamom. After 5th day of storage declined the flavour score at temperature it might be due to sharp increase in FFA value, same findings are also reported by Prasad *et al.* (1989), Adhikari and Singhal (1992) and Chavan *et al.* (2009). The cardamom treated sample got highest score than the rest of two treatments, it might be due to flavor of cardamom. But flavor score of all the treatments was not significant ($p<0.05$). After 15th day of storage declined the flavor score at refrigerated temperature it might be due to sharp increase in FFA value.

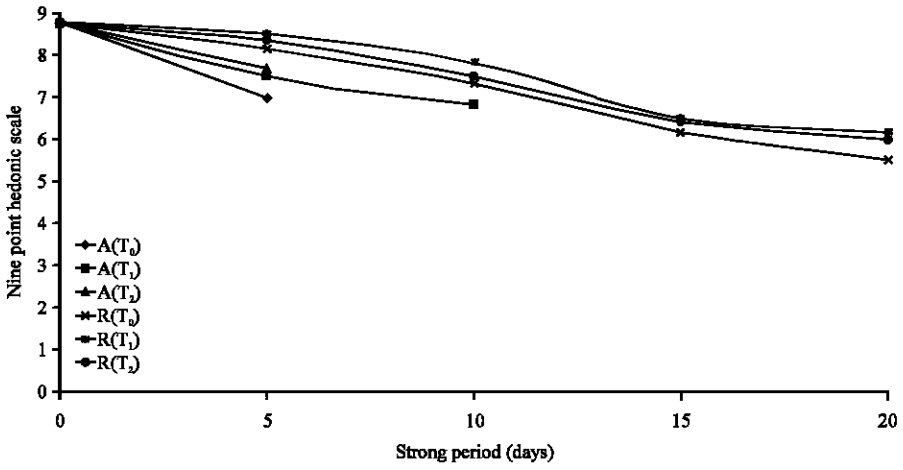

Fig. 1: Effect of temperature, potassium sorbate and cardamom on flavor score, T_0: Control T_1: Potassium sorbate T_2: Cardamom, A: Ambient 30°C and R: Refrigerated 5°C

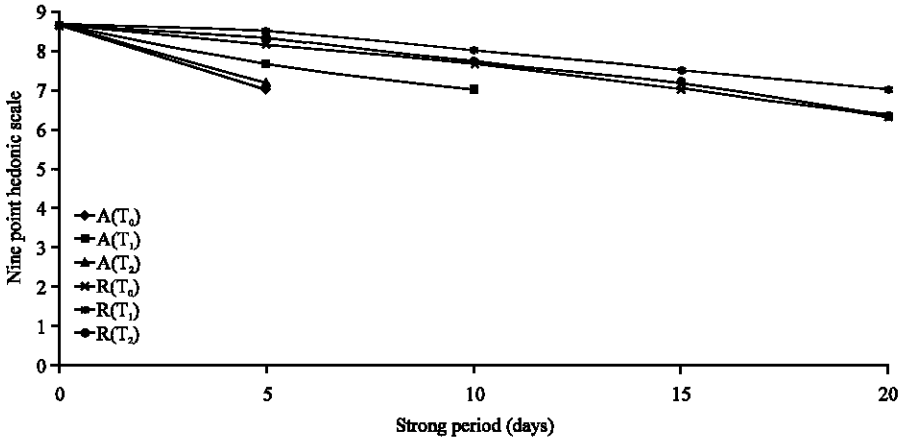

Fig. 2: Effect of temperature, potassium sorbate and cardamom on body and texture score, T_0: Control, T_1: Potassium sorbate, T_2: Cardamom, A: Ambient 30°C and R: Refrigerated 5°C

Effect of storage period on body and texture in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: Body and texture of Ujani basundi presented in Fig. 2, representing their rate of decreasing during storage for each type of treatment at ambient (30±1°C) and refrigerated (5±1°C) storage. The body and texture of samples of samples of Ujani basundi during storage at 30°C significantly ($p<0.05$) affected. 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. Present findings are in agreement with Prajapati *et al.* (1986), Usha *et al.* (2005) and Geetha and Rao (2008). The body and texture of samples of samples of Ujani basundi during storage at 5±1°C significantly ($p<0.05$) affected. 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.

Effect of storage period on color and appearance in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature: Figure 3 represents the effect of storage period on color and appearance in cow milk Ujani basundi at ambient (30±1°C) and refrigerated (5±1°C) temperature. The color and appearance of samples of Ujani basundi during storage at 30°C were not significantly ($p<0.05$) affected therefore, no changes were observed in scores awarded by the panelists. The highest scores awarded by the panelists to potassium sorbate treated samples on 5th day storage. The control and cardamom treated samples got lowest score than the potassium sorbate treated samples. This may be due to these samples not much affected in this storage period might be due to added potassium sorbate (it retards biochemical changes) during storage. Due to

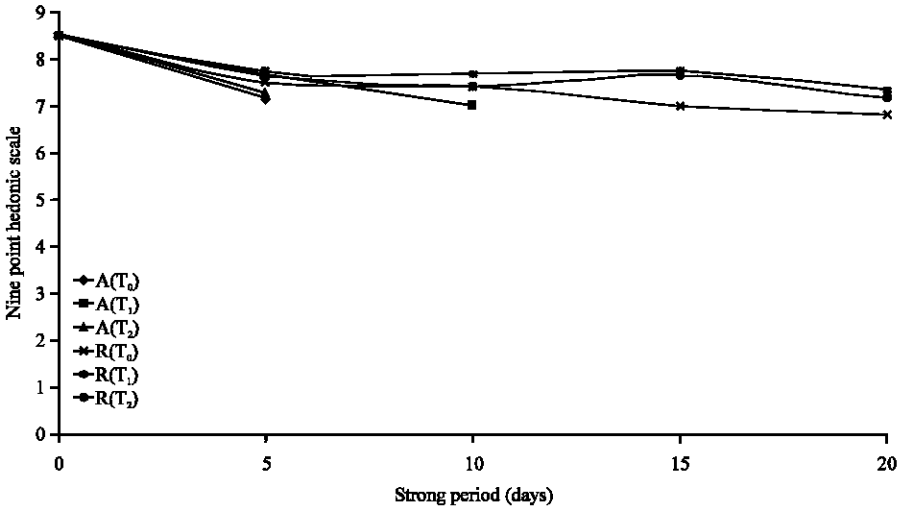

Fig. 3: Effect of temperature, potassium sorbate and cardamom on color and appearance, T_0: Control, T_1: Potassium sorbate, T_2: Cardamom, A: Ambient 30°C and R: Refrigerated 5°C

microbial as well as biochemical changes in control and cardamom treated samples the product became slightly brown therefore, it scored low during storage. However, color and appearance scores of cardamom treated samples scored slightly higher than the control samples. Present findings are in agreement with Prajapati *et al.* (1986), Usha *et al.* (2005) and Geetha and Rao (2008). The color and appearance of samples of Ujani basundi during storage at 5°C were not significantly ($p<0.05$) affected therefore, no changes were observed in scores awarded by the panelists the same findings were also reported by Osman *et al.* (2009). The control and cardamom treated samples got lowest score than the potassium sorbate treated samples. This may be due to these samples more affected in this storage period it might be due to more storage period and sample added potassium sorbate not much affected to color because 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 it might be influenced with increased in storage period. 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.

CONCLUSION

Potassium sorbate added product gave shelf life up to 20 days at refrigerated temperature whereas 10 days at ambient temperature (30°C). However, the control and cardamom added and control samples gave the shelf life up to 15 days at refrigeration temperature and 5 days at ambient temperature (30°C). The flavor of cardamom added samples found superior among all the treatment during storage study. The samples added with potassium sorbate showed inhibitory effect on microbial growth. Therefore, it is concluded from the present investigation that the product can be stored at refrigerated temperature by the addition of potassium sorbate for long time with acceptable quality.

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