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RESEARCH ARTICLE

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Studies on effect of preservatives on keeping quality of Khoa

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ABSTRACT

The khoa was preserved by addition of various plant essential oils as rosemary (1.0, 0.1%), garlic oil (0.25, 0.1%) and sage oil (1.0, 0.1%) and by potassium sorbate (0.02%) and shelf-life was studied at ambient and refrigerated temperatures. These samples were observed periodically for physico-chemical and microbial quality characteristics. The study revealed that khoa prepared by using sage oil was found distinctly superior ($p<0.05$) in physico-chemical and microbial characteristics than rosemary and garlic oil.

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Key words : Khoa, Essential oil, Shelf-life, Refrigerated temperature, Microbial characteristics

INTRODUCTION

It has been estimated that about 50-55% of milk produced in India is being converted into variety of traditional Indian dairy products of which 6.5% of milk is used for manufacture of khoa, mostly in private and unorganized sector. Khoa is partially dehydrated product prepared by continuous heating in a pan over direct fire while constant stirring-cum-scrapping by using stirrer till it reaches semi-solid consistency (Bhadania *et al*., 2004). Khoa obtained by traditional method as well as using khoa making machine has a limited shelf-life of less than a week under ambient conditions. The loss of moisture due to desiccation, development of rancidity and surface mould growth are the main forms of quality deterioration that can occur.

Attempts to increase the shelf-life of khoa based on wrapping in butter paper, storage under refrigeration, addition of sugar and incorporation of preservatives have been reported by Goyal and Srinivasan (1988). The incorporation of plant essential oil in foods is found effective for inhibiting the growth of *Staphylococcus aureus* (Burt and Reinders, 2002; Hili *et al.*, 1996). Being plant natural foodstuffs, spices appeal to consumers who tend to question the safety of synthetic additives. Antimicrobial activity of spices depends on several factors which include kind of spice, composition, concentration, and microbial species and their occurrence level, substrate composition, processing and storage conditions (Smith-palmer *et al*., 1997).

Therefore, the attempts were made in the present investigation to study the effect of plant essential oils on keeping quality of khoa at ambient and refrigerated storage conditions.

MATERIALS AND METHODS

Fresh, clean and pure buffalo milk was purchased from the local market and stored at 4^0C temperature until use. Plant essential oils extracted by using solvent extraction method, were also obtained from local Ayurvedalaya and stored at 4^0C temperature until use. Baird Parker agar and Plate count agar were used for the development of *Staphylococcus aureus*. The supplements such as 1% potassium tellurite and egg yolk emulsion were used with Baird Parker agar (Jha *et al.*, 1977).

Preparation of khoa:

The khoa was prepared as per the standard methods. Then 0.02% potassium sorbate, 0.1 and 1.0% sage oil, 0.1 and 1.0% rosemary oil, 0.25 and 0.1 % garlic oil were added separately in hot khoa. It was then shaped into large circular pats and allowed to cool on the floor at room temperature. The prepared buffalo milk khoa was then

stored at ambient (27 ± 2^0C) and refrigerated (5 ± 2^0C) conditions. One sample was stored without any preservatives at both storage conditions. The samples were evaluated periodically at an interval of 3 days up to 9 days at ambient and refrigerated conditions for moisture, total soluble solids (TSS), acidity and ash content and total microbial count expressed as colony forming units (cfu) as per standard methods of AOAC (2002).

RESULTS AND DISCUSSION

The data presented in Table 1 reveal that khoa preserved with potassium sorbate was more stable with respect to physico-chemical changes at ambient condition. There were no marked differences in TSS, acidity and ash in khoa preserved for 3 days at ambient temperature without any preservative (control) and the one preserved with any of the preservative irrespective of their concentration. However, the moisture content was found increased after addition of preservatives at all concentrations. The microbial count was found decreased on addition of preservatives, being the least with 0.25% garlic oil and nil with 0.1% and 1.0% each of rosemary oil and sage oil. As the storage period increased beyond 3 days to 6 days, the khoa stored without any preservative (control) and with preservatives such as rosemary oil, sage oil each at 0.1 and 1.0% and garlic at 0.25% was found unfit for consumption due to developed acidity and therefore discarded. The khoa preserved with potassium sorbate and garlic oil at 0.02 and 0.1%, respectively was still found fit for consumption due to no increase in acidity.

The data on physico-chemical and microbial qualities (Table 2) of khoa stored at refrigerated condition showed that khoa could be stored up to 9 days on addition of any of the preservatives at all concentrations. Potassium sorbate appeared more effective in inhibiting the growth of selected yeast and molds in khoa at 7^0C temperature. Addition of 0.02 % potassium sorbate to hot khoa increased the shelf-life from 6 to 14 days at 7^0C and at 37^0C from 2 to 4 days. Potassium sorbate (0.075-0.15%) was found less effective.

Table 1: Physico-chemical and microbial qualities of khoa preserved with plant essential oils at at refrigerated temperature

Khoa sample		Physico-chemical and microbial characteristics				
		Moisture (%)	TSS (%)	Acidity (%)	Ash (%)	CFU/ml
				After 3 days		
Control		17.5	67	0.5	4.25	4.7×10^3
Potassium sorbate	0.02%	21.8	67	0.48	4.42	3.6×10^3
Rosemary oil	0.1%	20.7	65	0.48	4.46	-
	1.0%	18.0	65	0.48	4.32	-
Garlic oil	0.1%	21.9	64	0.48	4.42	3.6×10^3
	0.25%	17.6	67	0.5	4.25	1.2×10^2
Sage oil	0.1%	24.0	65	0.48	4.49	-
	1.0%	22.8	67	0.48	4.51	-
				After 6 days		
Control		7.5	67	0.58	3.66	6×10^3
Potassium sorbate	0.02%	21.6	67	0.48	4.37	5.6×10^3
Rosemary oil	0.1%	20.0	65	0.51	4.13	2.3×10^3
	1.0%	17.9	65	0.48	4.05	1.2×10^3
Garlic oil	0.1%	21.6	67	0.48	4.37	5.6×10^3
	0.25%	7.5	64	0.58	3.65	3.5×10^2
Sage oil	0.1%	23.0	65	0.48	4.49	1.2×10^1
	1.0%	21.8	67	0.5	4.46	2.7×10^1
				After 9 days		
Control		-	-	-	-	-
Potassium sorbate	0.02%	20.8	67	0.48	4.16	6.7×10^3
Rosemary oil	0.1%	19.6	65	0.57	3.95	4.6×10^2
	1.0%	16.5	65	0.53	3.96	5.4×10^4
Garlic oil	0.1%	20.8	67	0.48	4.16	6.7×10^3
	0.25%	24.1	64	0.56	3.96	4.7×10^3
Sage oil	0.1%	22.0	65	0.51	4.23	2.4×10^1
	1.0%	21.3	67	0.53	4.16	3.9×10^1

Table 2 : Physico-chemical and microbial qualities of khoa preserved with plant essential oils at ambient temperature

Khoa sample		Physico-chemical and microbial characteristics				
		Moisture (%)	TSS (%)	Acidity (%)	Ash (%)	CFU/ml
		After 3 days				
Control		15.5	67	0.53	3.85	Discarded
Potassium sorbate	0.02%	22.6	67	0.48	4.02	4.9×10^3
Rosemary oil	0.1%	20.5	65	0.5	4.21	-
	1.0%	17.5	65	0.57	4.12	2.1×10^3
Garlic oil	0.1%	22.6	67	0.48	4.02	4.9×10^3
	0.25%	15.5	64	0.53	3.85	3.6×10^3
Sage oil	0.1%	24.19	65	0.457	4.57	2.3×10^1
	1.0%	22.2	67	0.48	4.26	3.7×10^1
		After 6 days				
Control		-	-	-	-	-
Potassium sorbate	0.02%	21.9	67	0.48	3.71	6.2×10^3
Rosemary oil	0.1%	-	-	-	-	-
	1.0%	-	-	-	-	-
Garlic oil	0.1%	21.9	67	0.48	3.71	6.2×10^3
	0.25%	-	-	-	-	-
Sage oil	0.1%	-	-	-	-	-
	1.0%	-	-	-	-	-
		After 9 days				
Potassium sorbate	0.02%	20.12	67	0.48	3.33	7.9×10^3
Garlic oil	0.1%	20.32	67	0.48	3.31	7.85×10^3

The micro-organisms responsible for deterioration of khoa are *Staphylococcus aureus*, *E. coli* etc. but *S. aureus* was observed as major spoilage bacterium in khoa and adversely affected the shelf-life of khoa at both ambient and low temperature storages. The result showed that the growth of *S. aureus* could be controlled by using chemical as well as natural preservatives (plant essential oils). The data of Table 1 and 2 clearly indicated the differences between the khoa prepared by using different concentration level of oils. The results obtained in this study are in conformity with the reports of Ghodekar *et al.* (1978) and Patel *et al.* (1985). It can be concluded that khoa sample prepared and preserved with addition of sage oil at different concentrations was found to be superior to rosemary and garlic oil.

Conclusion:

Use of spices as microbial growth inhibitor in foods is often limited because of flavours considerations as effective antimicrobial dose may exceed the organoleptically accepted level. Nevertheless, spices and other antimicrobial barriers could enhance the shelf-stability of foods and microbial safety even at moderate levels. Before including spices and/ or their derivatives in food conservation systems, some evaluations about microbiological quality, economic feasibility and anti-microbial effect for a long time and toxicity need to be looked into.

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