Effect of Bamboo leaf (*Bambusa vulgaris*) on the keeping quality of raw milk

M. A. S. Khan, A. K. M. A. A. Biswas, M. A. H. Sarker and M. N. Islam, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh, Bangladesh, Email: maskhands@gmail.com

Abstract

Bamboo leaf has been used in raw milk during transportation over long distance for a long time in Bangladesh under village condition by milk man (middleman). Till now, no information we have, on the effect of bamboo leaf on the keeping quality of raw milk. Accordingly, a study was carried out to find out the effect on the keeping quality of raw milk. The collected milk was stored with bamboo leaves up to spoilage time. Physical, chemical and microbiological studies of the stored milk with bamboo leaves was conducted and agitation/shaking effect on the milk was monitored. Results showed that acidity increased faster in bamboo leaf treated milk than untreated milk but just after treatment acidity decreased and took 4 to 5 hours to return back to previous level. Faster increase of acidity may be due to higher milk temperature (87.4^0F). Treated milk showed positive Clot-on-boiling test at 12 to 14 hours, acceptable flavor, taste and texture up to 13 to 14 hours, 14 hours and 15 to 16 hours. It was interesting that at the time of acceptable shelf life in above mentioned respect acidity was higher than normal. No change was observed in color. Microbial population was always lower than untreated milk. Just after adding bamboo leaf microbial population decreased and it took 4-5 hours to return back to previous position. This interesting phenomena might be due to some sort of chemical composition of bamboo leaves. Every one hour interval agitation or shaking was done for 30 seconds and result showed that bamboo leaf acts as defoaming and bumping protecting agent in milk which results the reduction of lipolysis during transportation. From the above findings, it can be suggested that bamboo leaf can be used as a short time cost effective milk preservative under village conditions.

Introduction

Milk and milk products are considered to be most important ingredients for human diet. For the newly born infant or animal, milk is an almost complete and well balanced food. The main constituents of milk are fat: 3.8 %, protein: 3.5%, carbohydrate (lactose): 4.8% and minerals: 0.65% (Eckles et al. 1951). Milk also contains considerable amount of water and fat soluble vitamins. Milk contains all the nutrients essential for normal functioning of the body system in adequate amount and of superior quality. Due to the presence of all nutrients, milk is also a suitable media for growth of large variety of bacteria. The spoilage of milk may result in the microbial and chemical changes, and the volatile compounds of the milk (Reinheimer et al., 1993). About 95% of milk in Bangladesh is produced by villagers. In Bangladesh milk is mainly marketed on the basis of volume and not on the basis of fat or solids-not- fat content or not on the basis of its microbial status. Usually, milk is being supplied to the consumers from the urban and rural areas by the middlemen. They collect milk from different small farmers as well as from the local market. Middlemen collect milk from the small farmers and before selling to the consumers. There is a long interval time for carrying milk till distribution among the consumers. So, now, to maintain the good physical, chemical and microbiological condition of raw collected milk, it is very difficult to preserve the milk from morning to evening or evening to morning without applying any technique. Limited works have been done for inventing the traditional preservation of raw milk in Bangladesh. So, to produce and distribute high quality milk, it is important to find out a suitable low-cost-short-time and easy milk preservation system at the village or field condition. Bacterial growth, protease activities, lipase activities, protein degradation and acidities of skimmed and whole milk were retarded using different materials including banana and bamboo leaf (Tatik Khusniati and Yantyati 2008). Using of 0.03 to 0.04% H_2O_2 with raw milk is enough to

preserve raw milk for up to 22 to 24 hours (Saha *et al*. 2003). Extensive research in this field is essential to develop preservation system for quality control of market milk and to observe whether bamboo leaf has any effect on the keeping quality of milk or not.

Materials and Methods

The experiment was conducted at the Dairy Technology and Dairy Microbiology Laboratory of The Department of Dairy Science, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh. In this experiment in every trial two types of raw milk samples - one from BAU Dairy Farm, Mymensingh and other either from the surrounding villages of Trishal or Bhaluka Upazila were taken where bamboo leaves were placed in the milk during transport. The following tests were made at both BAU Dairy Farm and market milk sample: physical tests {milk temperature, color, taste, flavour, clot-on-boiling (COB), texture}, chemical tests {fat test, solids-not-fat (SNF), total solids (TS), acidity, water percentage) and microbiological test (Standard Plate Count). Experiments were performed to check the effect of bamboo leaves on acidity, COB, microbiological and agitation/shaking.

Statistical analysis of the experimental data was performed by using the statistical package M-STAT. Anova test was done to find out the difference between treatments. In case of significant difference Duncan's Multiple Range Test was carried out to find out significant differences between the means.

Results

1. Comparative study of University Farm (UF) and Village Milk (VM) samples at initial hour before adding Bamboo leaf

Parameter	UF (Mean ± SD)	VM (Mean ± SD)	LS
Fat(g/kg)	36.7±7.2	30.5±3.2	NS
SNF(g/kg)	77.5±1.6	65.4±12.6	NS
TS(g/kg)	114.2±3.3	100.4±18.6	NS
Water(g/kg)	885.8±3.3	899.6±18.6	NS
Specific gravity	1.0283±0.001	1.023±0.005	*
Color (% of normal condition)	Normal 100% (Very slightly yellow)	Normal 100% (White)	-
Flavor (% of normal condition)	Normal 100%	Normal 100%	-
Texture (% of normal condition)	Normal 100%	85±11.83	*
Taste (% of normal condition)	Normal 100% (Slightly sweet)	Normal	-
Clot on boiling test	(-) tive	(-) tive	-
Acidity%	0.13±0.009	0.10±0.028	*
Microbial population (x 10^6/ml)	1.457±0.131	1.751±0.19	*

NS= Non significant ($p< 0.05$), * = $p< 0.05$

2. Mean effect of Source, Treatment and Time on milk % Acidity

Hour	Source and Treatment			
	UF	UFB	VM	VMB
0 hour	0.130	0.130	0.097	0.097
1st hour	0.130	0.123	0.098	0.094
2nd hour	0.133	0.123	0.100	0.095
3rd hour	0.133	0.127	0.103	0.099
4th hour	0.135	0.130	0.110	0.113
5th hour	0.138	0.137	0.117	0.123
6th hour	0.140	0.140	0.127	0.143

7th hour	0.147	0.143	0.135	0.153
8th hour	0.153	0.147	0.148	0.170
9th hour	0.160	0.167	0.169	0.210
10th hour	0.167	0.173	0.178	0.250
11th hour	0.197	0.190	0.184	0.267
12th hour	0.217	0.220	0.196	0.290
13th hour	0.233	0.253	0.230	0.333
14th hour	0.247	0.283	0.280	0.377
15th hour	0.267	0.333	0.347	0.387
16th hour	0.287	0.337	0.393	0.397
17th hour	0.307	0.343	0.467	0.410

3. Average acidity of UF, UFB, VM, and VMB

Time	Source and Treatment	Mean ± SD	Significant
0 to 17th hr.	UF	0.184±0.06	**
0 to 17th hr.	UFB	0.194±0.08	
0 to 17th hr.	VM	0.193±0.11	
0 to 17th hr.	VMB	0.224±0.118	

4. Average positive COB time of milk treated under various treatment

Hour after treatment	Treatment			
	UF	UFB	VM	VMB
0				
: : :	: : :	: : :	: : :	: : :
9	-	-	-	-
10	-	-	+	-
11	-	-	+	-
12	-	-	+	+
13	+	-	+	+
14	+	+	+	+

5. Mode of increasing microbial population of various treated milk at 4 hours time (x 10^6/ml)

Hour	Treatment			
	UF	VM	UFB	VMB
0	1.457	1.715	1.457	1.751
1	1.835	2.003	1.590	1.846
2	2.391	2.937	1.595	1.831
3	3.889	5.299	1.652	1.951
4	6.815	12.008	2.037	2.543

UF= University Farm milk without Bamboo leaf, UFB= University Farm milk with Bamboo leaf, VM= Village milk without Bamboo leaf, VMB= Village milk with Bamboo leaf.

6. Agitating/ Shaking

At the time of experiment every one hour interval agitation or shaking for 30 seconds were done and foam formation occurred. Foam breaks down during shaking with bamboo leaf treated milk. In case of control group, milk foam formed at the time of shaking and it took 15 to 30 minutes to become normal. That means bamboo leaf is a helpful source for protecting bumping and foaming of milk.

Theme: Food and Pharmaceuticals

Discussion

This study was conducted to observe the effect of bamboo leaf on keeping quality of raw milk. From the Table 1, it is said that fat, SNF, TS and water were similar for both University Farm and Village milk. Color, flavor, texture and taste were normal. Significant difference was noticed among specific gravity, acidity and microbial test of both University Farm and Village milk. From Table 2, Acidity increases with time. Acidity test was done initially and after every one hour from each milk sample to assess the quality of raw milk. After treatment with bamboo leaf acidity increased slightly faster and slowly in control milk. Just after adding bamboo leaves with milk, acidity decreased and took 2 to 3 hours to return back to previous acidity level and up to 5th hour acidity increased slowly. From Table 3, Interaction effect of treatment and source of milk were also significant. Average acidity of UF, UFB, VM, and VMB was 0.184±0.06, 0.194±0.08, 0.193±0.11 and 0.224±0.118 per cent respectively. In Table 4, in case of UF COB was positive at 13th hour but in case of UFB COB was positive at 14th hour. In VM COB was positive at 10th hour and in case of VMB COB was positive at 12th hour. COB test showed positive result in control milk than bamboo treated milk. From Table 5, it is found that at first hour in case of bamboo treated milk of both sources, microbial population increased slowly than control group. So, bamboo leaf helped to reduce microbial load on milk.

Conclusion

It can be concluded that bamboo leaf can be used for preservation of raw milk under village condition especially during transportation and where the cooling chain is not maintained. The technique is simple and cost effective.

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