
**EFFECT OF DIFFERENT METAL CONTAINING VESSELS ON CURD
FERMENTATION BY LACTIC ACID BACTERIA****Kagne S.R.**Badrinarayan Barwale Mahavidyalaya, Jalna, Maharashtra,
431213 (India).kagne_suresh@rediffmail.com**Abstract**

Curd is produced by lactic acid bacteria (LAB). Bacteria involved in curd formation from milk are *Lactobacillus debrueckii* Subspecies *belgaricus*, *Brevibacillus brevis*, *Bifidobacterium*, *Leuconostoc*, *Lactococcus*, *Enterococcus*, *Aerococcus* etc., are the diverse of microorganism associates with plants, meat, and dairy products. The source of milk used for curd formation in was collected from domestic buffalo, cow and goat separately, while inoculum was spontaneously added as a whey after pasteurization and sufficient cooling of milk and incubated at room temperature. In present study the fermentation was carried in different metals like stainless steel, aluminium, and clay pot. The presence of LAB in whey ferment the milk to produce lactic acid, which work as preservative agents and gives flavour to the product. Good fermentation is detected by its texture and is because of polysaccharide produce by LAB.

Key words: Lactic acid bacteria, Inoculum, Fermentation and Flavour.**1. Introduction**

Lactic acid bacteria (LAB) belongs to family Lactobacillaceae. They act as potential microorganisms and have been widely used in fermented food worldwide because of their well-known status as generally recognised as safe (GRAS) microorganisms (Yantyati, *et al.*, 2014). These microorganisms are also recognised for their fermentative ability and thus enhancing food safety, enriching nutrients and increasing health benefits (Panesar, 2011). Milk and dairy products play an important role in the nutrition of people in all the countries of the world. It has been shown that milk is an ideal medium used for the growth of microorganisms, because it is rich in protein, carbohydrate, mineral, vitamin and water, these ingredients plays significant role for bacteria (Shan-na Liu

et al., 2011). Because of richness in nutrients, storage of milk for longer period under low temperature has also resulted in new problem in dairy industry arising out of the growth of wild microorganism (Jonghe, *et al.*, 2011), to resolve this problem and economical loss fermentation of milk come in to use.

Curd is an important fermented milk product used in India as a refreshing beverage. It has mild pleasant flavour, with a slight acidic taste, a creamy white colour with a smooth, glossy texture and layer of cream on surface. The mass of curd is expected to be soft and firm, free from gas holes (Srinivasan, 2011). On prolonged storage or fermentation curd becomes highly acidic, making it unpalatable for human consumption for human being, hence restriction in the



growth of spoilage causing microorganisms should be undertaken. Research carried at NDRI (National dairy research institute), Bangalore showed that bottled curd of long keeping quality can be prepared by using selective strains of lactic acid bacteria (Ganguly, 2001). These microorganism shows antimicrobial activity against pathogenic microorganisms and spoilage causing microorganisms (UshaKiran, *et al.*, 2012). LAB have a multifunctional role in dairy industry. They produce lactic acid by fermenting lactose sugar present in milk. It is disaccharide linked by β -1, 4 glycosidic linkage between glucose and galactose. *Lactobacillus* ferment this sugar which impart sour taste to curd (Ledenbach, 2009). Lactose is responsible to develop the characteristic texture and overall flavour of the fermented milk and enhance preservation (Hati, *et al.*, 2013).

Curd is popular and mostly consumed by all the peoples particularly from rural areas of India which possess great history and is prepared by inoculating starter culture in pasteurized milk.

Curd was favourite fermented dairy product of Lord Shri Krishna from India. In south Asian countries like India, Shri Lanka, Pakistan and Nepal, curd is an ordinarily consumed food as a dessert (Liyanage, *et al.*, 2014). Curd is also made by curdling or coagulating the milk, this can be done by mixing edible acidic substances in to the milk e.g. lemon juice or vinegar. These substances curdle the milk and separate into two part i.e. liquid part is whey, and solid milk is curd (Anil Kumar, *et al.*, 2017). The whey contains whey protein of milk, while curds contain milk protean or casein. LAB are wide spread in nature. Indonesian fermented food are mostly produced traditionally by

spontaneous fermentation (Wardanai, *et al.*, 2017). *Lactobacillus* plays most important role in Indonesian fermented food followed by *Pediococcus*, *Streptococcus*, *Leuconostoc*, *Enterococcus*. In our study milk fermentation was carried out by using LAB from whey for curd formation.

2. Material and Methods

Preparation of curd is very easy process which has been used since ancient time and has passed from one generation to other generation. A good quality of curd can be prepared by using few steps, that a majority of people learn though their experience or as they were taught by grandmother. Milk which contain high level of fat are used for making curd, which adds nutritional quality to its texture being a high fat food.

Three different sources of milk were used in present study i.e. goat milk, buffalo milk and cow milk, because these animals are pet of farmers or peoples who live in rural area. Fresh milk from these pets were collected separately. This milk was collected by proper washing of udders of animals and drawn to farmers home.

The milk was not inoculated with extra water or extraneous addition of water, because it is common practice of milkman to increase the quantity of milk for marketing purpose. After drawing the milk into home, milk was gently and separately heated in different pots or utensil. Three different types of pots were used for fermentations are, steel pot, aluminium pot and clay pot. Separate pots were used for goat milk, buffalo milk and cow milk fermentation. Pot were filled by milk upto $\frac{3}{4}$ level and subjected for gentle heating using traditional fuel i.e. dried cow dung. After heating till to boil, all the pots containing milk were subjected for cooling to room temperature or just above the

room temperature i.e. 37⁰C – 40⁰C. After cooling of milk form all pots, they were inoculated with sufficient quantity of inoculums (5-10%), inoculums used was whey (Previously fermented milk or preformed curd).

After addition of inoculums, all the pots were covered by using clean cloth or dish. Then pots were incubated for overnight. The experiment was laid down in triplicates i.e. three pots for goat milk, three pots for buffalo milk, and three pots for cow milk. After overnight fermentation of milk, curd formation was observed early in the morning at sunrise. The changes in pH, and texture was observed every 6 hours (h) of incubation after overnight fermentation.

3. Result and Discussion

Three different milk samples were collected separately in different pots, they were separately heated for removal of

unwanted microorganism, and kept for fermentation as shown in table No.1.

After completion of fermentation for overnight (12 h) curd formation was observed. From all the three milk samples, goat milk shows excellent fermentation in clay pot, while very good fermentation in steel and aluminium pot. Buffalo milk show very good fermentation in clay pot while moderate in metal pots. Cow milk shows good fermentation in clay pot, whereas fair fermentation in steel pot and aluminium pot. It was observed that, there is variation in the quality and texture of product reported when fermentation equipment was changed. In all the milk samples from all the sources, the fermentation carried in clay pot showed best fermentations as compare to the metal pots. Chemical changes, like change in pH was noticed after completion of overnight (12 h) fermentation and thereafter 6 h intervals and is depicted in table No. 2.

Table No. 1. Fermentation of milk sample, inoculum used, pot used and quality of fermentation

Sr. No.	Milk sample	Inoculum used	Pot used	Fermentation quality
1	Goat milk	Preformed curd/ whey (5%)	Stainless steel	Very good
2	Goat milk	Preformed curd/ whey (5%)	Aluminium	Very good
3	Goat milk	Preformed curd/ whey (5%)	Clay	Excellent
4	Buffalo milk	Preformed curd/ whey (5%)	Stainless steel	Moderate
5	Buffalo milk	Preformed curd/ whey (5%)	Aluminium	Moderate
6	Buffalo milk	Preformed curd/ whey (5%)	Clay	Very good
7	Cow milk	Preformed curd/ whey (5%)	Stainless steel	Fair
8	Cow milk	Preformed curd/ whey (5%)	Aluminium	Fair
9	Cow milk	Preformed curd/ whey (5%)	Clay	Good

In all the milk samples in all fermentations, acidic pH was detected, that was in the range of 6.25 to 4.55, it was also observed that as the incubation of fermentation increases, acid formation by LAB was increased. After long incubation, change in flavour was noticed. Yantyatiet *al.*, (2014) reported texture of ferment is

supported by production of exopolysaccharide (EPS), as viscosifying agent produced by LAB. He also supported that, it is contributed by coagulation as a result of neutralization of negative charges on the milk protein. EPS is produced by some LAB, depending on strain (Yang, *et al.*, 2014). Result of our

study reveal that, traditional or Indigenous method used for fermentation of milk to produce curd is the best method, the inoculum used it was also the best, because no spoilage in any batch or pot

was reported. Among use of pots, clay pot was the best for good fermentation, where excellent quality and texture of curd was reported.

Table No. 2. Change in pH of fermented milk sample of different pots after 12 h, 18 h, and 24 h.

Sr. No.	Milk sample	Pot used	Fermentation quality	pH		
				After 12 h	After 18 h	After 24 h
1	Goat milk	Stainless steel	Very good	6.25	5.81	5.91
2	Goat milk	Aluminium	Very good	6.20	5.73	5.34
3	Goat milk	Clay	Excellent	6.12	5.62	5.21
4	Buffalo milk	Stainless steel	Moderate	6.22	5.84	5.40
5	Buffalo milk	Aluminium	Moderate	6.17	5.65	5.34
6	Buffalo milk	Clay	Very good	6.00	5.44	5.22
7	Cow milk	Stainless steel	Fair	6.15	5.50	4.95
8	Cow milk	Aluminium	Fair	6.10	5.45	4.82
9	Cow milk	Clay	Good	5.90	5.15	4.55

4. Conclusion

The excellent quality of fermentation was observed with milk sample collected from Goat and fermentation carried in clay pot followed by good fermentation of curd in steel and aluminium pot. The overall good quality and texture of curd was reported from the fermentation carried in clay pot, therefore researcher may suggests use of clay pot for excellent quality of fermentation.

5. References

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