

Camel Milk: Pasteurization to preserve the wonder

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Allah (SWT) has revealed milk to us, saying, “Rivers of milk the taste whereof does not change” (*Qur’an 47:15*). And again He said, “Pure milk, easy and agreeable to swallow for those who drink” (*Qur’an 16:66*). The Prophet Muhammad (PBUH) is said to have remarked that milk is irreplaceable and that he himself loved milk.

Sir Churchill said “There is no finer investment for any community than putting **milk** into babies. Healthy citizens are the greatest asset any country can have” (*Lord Randolph Henry Spencer Churchill Speech on BBC radio, 21 Mar*). A group of Israeli physicians reported during their case studies on the child studying in USA that the child returning home after 2 weeks of drinking milk had no allergic reaction to camel milk and able to eat food to which she had previously been allergic. Treatment was halted because camel milk could not be imported to America. It appeared that she remained healthy and stable after returning home. The 4 month old infant suffered from ear infections with oozing pus 2 months after ceasing to drink camel milk. No treatment was effective, including a number of surgical interventions. After drinking camel milk again, the child was healed within 48 hours. The child of osteoporotic women who drink the milk of camel showed a rapid increase in bone calcium. In another observation a young girl, who showed severe reactions to cow milk, even in minute amounts, consumed the camel milk without problems. The camel milk has been used as remedy for the treatment of the diabetic patients.

The camel milk is unique in composition (Table 1) and has limited shelf life. It is domineering to preserve the quality of milk. It is even more vital if milk is produced by the camel in deserts where the life faces austerity. In the deserts, the milk has less chances of contamination as it is preserved in the natural sanctuary, the udder. The milk could be drained out any time because the animal has multiple milking frequencies (6times/day). However, the task of preserving the milk from contamination starts after milking and is foremost important to improve the shelf life of milk so that it can be marketed from distant areas to more demanding areas.

Table 1. Composition of camel milk during first six months of lactation

Month	(%)		(%)			
	Acidity	Specific gravity	Protein	Fat	TS	SNF
1	0.20 ± 0.008	1.032 ± 0.0009	2.91 ± 0.078	3.47 ± 0.148	12.5 ± 0.31	9.18 ± 0.22
2	0.19 ± 0.008	1.031 ± 0.008	2.80 ± 0.06	3.58 ± 0.16	12.38 ± 0.29	8.82 ± 0.27
3	0.21 ± 0.009	1.030 ± 0.0008	2.64 ± 0.085	3.54 ± 0.13	12.22 ± 0.23	8.67 ± 0.213
4	0.19 ± 0.005	1.032 ± 0.007	2.86 ± 0.063	3.58 ± 0.13	12.59 ± 0.29	8.93 ± 0.25
5	0.20 ± 0.005	1.030 ± 0.006	2.98 ± 0.08	3.68 ± 0.14	12.28 ± 0.3	8.57 ± 0.34
6	0.20 ± 0.005	1.029 ± 0.0009	2.96 ± 0.06	3.51 ± 0.096	11.89 ± 0.28	8.35 ± 0.27

Adopted from Arshad et al., 2011

Microbiological quality of camel milk along the market chain and its correlation with foodborne illness among children and young adults in Isiolo, Kenya was studied by Kaindi (2009). Microbiological assessment involved enumeration of total bacterial count (TBC), presumptive Streptococcal/ Enterococcal count (PSEC), Yeast and Mold count (YMC), Enterobacteriaceae count (ESe), and presumptive Staphylococcal count (PSC). Determination of the shelf life of pasteurized camel milk stored at 4-7°C, 25°C, and at 30°C was also investigated. Raw camel milk was pasteurized at 65°C for 30 minutes in a water bath. Further, a cross sectional study was carried out by interviewing 993 randomly selected households in peri-urban zone of Isiolo town to assess risk factors in symptoms of food-borne illnesses with special attention given to the consumption of camel milk, cow milk and goat milk. Results indicate that microbial counts were increasing along the marketing chain. Since un-hygienically handled raw camel milk was associated with food-borne illnesses, consumers of camel milk should be sensitized either to boil or consume processed camel milk. This study recommended for urgent development and adaptation of feasible and sustainable interventions to improve the camel milk hygiene and safety in Kenya and to mitigate food-borne related diseases in the agro-pastoralist regions.

The properties of liquid milk that require the most attention are safety to consumer, shelf life and flavor. The milk has the natural peroxidases which help to stop the contamination of milk by the microbes. But with the passage of time the efficiency of these natural defenses in the milk decreases which causes the improvement in the bacterial counts. Most of the microbes could be destroyed by heating the milk below the boiling temperature. The heating of the milk may cause some unwanted changes. They are;

1. Loss of gasses e.g., carbon dioxide and oxygen
2. Increase in colloidal phosphate & decrease in Ca^{+2}
3. Lactose isomerization
4. Hydrolysis of casein and phosphoric esters
5. pH decrease
6. Denaturing the serum protein
7. Inactivation of enzymes as in case of mallard reaction resulting in lysine loss
8. Protein and lactose reaction because of free sulfhydryl group
9. Drop in redox potential
10. Coagulation of casein
11. Change in fat globule membranes
12. Hydrolysis of glycerides
13. Lactones and methyl ketones formation
14. Vitamins are degraded

The consequences of the above mentioned changes due to heating are;

- Color changes
- Viscosity changes
- Flavor changes
- Decrease in nutritive values
- Re-growth of bacteria in heat treated milk
- Tendency of age thickening & for heat coagulation may decreased
- The rennetability decreases
- Decrease in creaming quality of milk
- Proneness to autoxidation
- Surface layer of fat globules is affected

Temperature of heating and duration

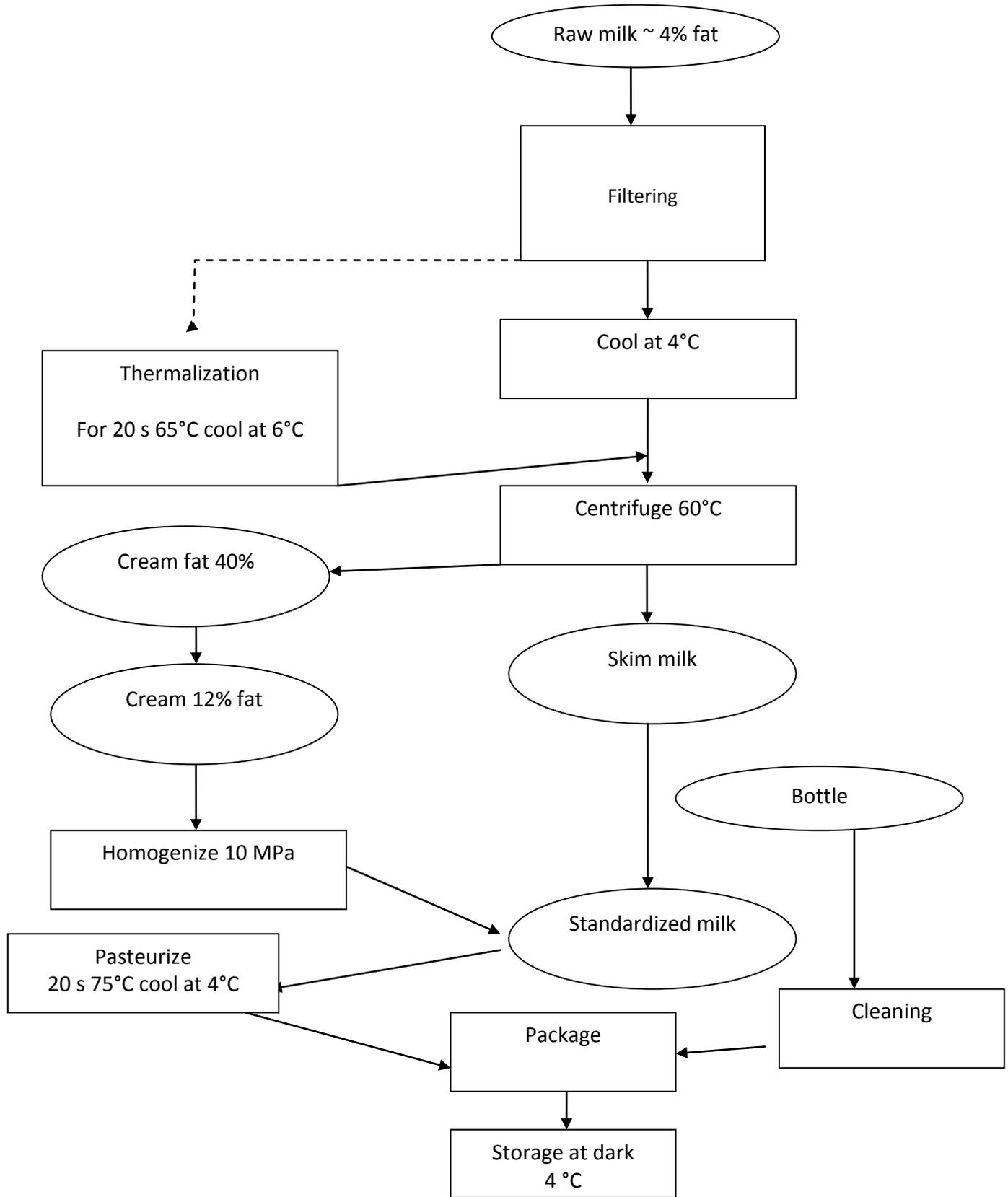
The temperature and duration of heating has interaction that affects the milk quality and wholesomeness. In the thermalization, the milk is heated at 60-69°C for 20 sec. Low pasteurization includes the heating of milk at 63°C for 30 min or at 72°C for 15 sec. The low pasteurization of milk will kill all the bacteria except some species of Mycobacterium Tuberculosis but the proteins are not denatured. This treatment is bacteriostatic. In high Pasteurization, the milk is heated at 85°C for 20 sec. This heating will result in inactivation of lactose peroxidases. If we increase the temperature and decrease the duration then it will result in killing all the bacteria but their spore will not be killed. There will be denaturation of protein, loss of vitamin C. The milk could be sterilized by heating the milk at 110°C for 30 min. All the spores could be killed but this high temperature for long duration affects the milk quality. The UHT could be the best way to sterilize the milk by heating at 130°C for 30 sec or at 145°C for one sec. One should select the heating system which results in less undesirable changes, least expensive and fit in working area.

Pasteurization may be one of the most feasible ways to improve the milk shelf life. There are many pasteurization techniques used to preserve milk. They are based on temperature, duration of heating, packaging and type of product to be pasteurized. Holder pasteurizers are used at small scale. They may be used for batch process or for packed e.g. coil vats, glass lined tanks, stainless steel tanks or spray vats etc. High temperature for short time type pasteurizers are used for commercial scales for large quantities e.g. Danish heater, drum heater, internal tubular heater or external tubular heater etc. Autoclaving is most suitable way of bottle pasteurization. The simple pasteurization flow sheet showed in figure 1.

Pasteurized camel milk brands in Pakistan

Pakistan has one of the best dairy camel breeds in the world which can produce milk from 20 to 40 liters per days. There is big potential for export of camel milk to Middle East, Europe and USA. However it requires the proper knowhow of the processing to improve the shelf life of milk. There is pasteurized bottle camel milk sold in Karachi with the brand name of wonder milk. But unluckily, no many brands are available throughout the country. Recently, we have launched the Pasteurized camel milk with the brand name **“Dachi Milk” at the EVE of WORLD CAMEL DAY, 2014.**

Figure1: Pasteurization of Bottle milk (Adopted from Walstra et al., 2006)



DACHI MILK



