CLEAN MILK PRODUCTION

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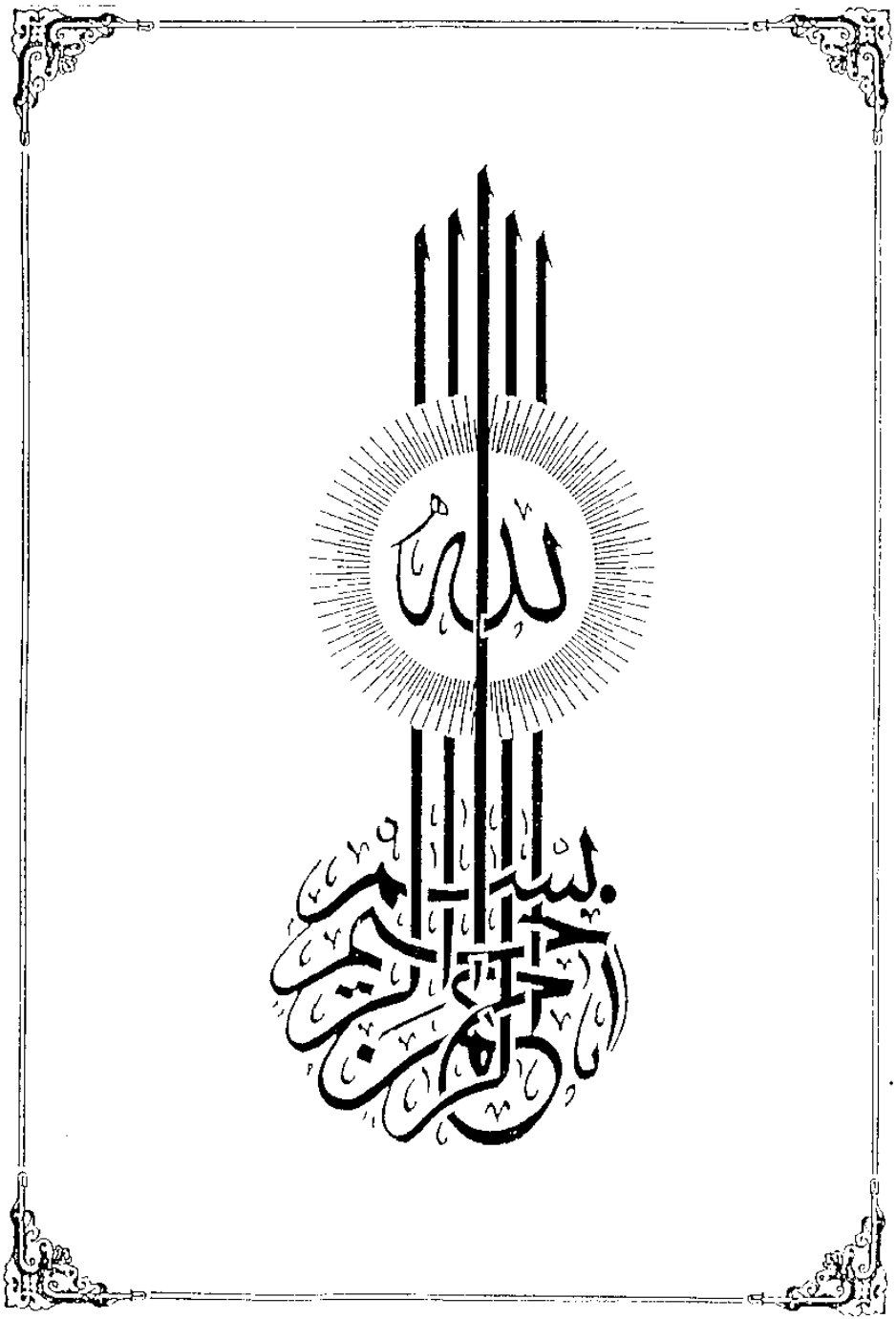

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INTRODUCTION

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Clean and hygienic milk may be defined as raw whole milk from healthy cattle, which has a minimum number of bacteria and which is capable of keeping in well condition for a reasonable length of time, at least two days, whatever variations in temperature occur (Hill, 1952).

It is not possible to exclude all bacteria from milk, but it is possible to reduce to a minimum the number which may gain access.

The keeping quality is entirely dependent upon the cleanliness of the milk, which in turn depends upon the methods used in its production and distribution.

Two methods of milking are in use, hand milking and machine milking. A milker should be in a neat health, clean and should appreciate the importance of suitable methods in handling materials intended for human consumption. Clean hands add fewer organisms than dirty ones.

A managed milking program should be designed to remove all of the milk obtainable after milk ejection, prevent that milk from being contaminated with dirt or other foreign materials, avoid irritation and injury to the teats and udder, prevent the spread of pathogenes from infected to non-infected glands, and do these things efficiently. Milkers should have their work organized so that they do not have other jobs to look after during milking. Good milking requires devoting [illegible] of the milkers' time and concentration to that job. Milkers' hands and the milking equipment should be cleaned and sanitized.

Organisms multiply rapidly on milkers' hands, especially if the hands are chapped or cracked, and can be spread from animal to animal. Milk from healthy animals is a high-quality product. To keep it in this condition, clean, sanitized milking equipment is necessary.

The objective of the milk quality-control program on a dairy farm is to produce high-quality milk, that is, milk characterized by: (1) composition that meets or exceeds minimum legal standards (3.0 % fat and 8.5 % solids-not-fat) for cow's milk, while (5.5 % fat and 8.75 % solids-not-fat) for buffalo's milk, (2) good flavor and odor (a bland but slightly sweet taste and no odor), (3) freedom from all pathogenic bacteria, (4) a low bacteria content (less than 10 to 15,000/ml. in raw milk), (5) a low content of somatic cells or leucocytes (less than 0.5 million/ml), (6) freedom from all drug and pesticide residues and other adulterants, and (7) freedom from foreign or extraneous materials. The production of high-quality milk requires healthy, normal animals, clean animals and sanitary milking practices, clean milking equipment, rapid cooling, discarding milk of animals that have been treated with drugs or that have consumed feeds that contain pesticides.

Chemical sanitizers of many types are available. These include compounds bearing iodine, quaternary amonium compounds, and acid wetting agent sanitizers. Each has advantages and disadvantages, but compounds bearing chlorine and iodine are most widely used. Sodium hypochlorite (NaOCl) releases chlorine, which reacts with water to form hypochlorous acid. Sodium hypochlorite is the sanitizer most widely used in the dairy industry. It is economical, readily

soluble, unaffected by minerals in hard water, and highly efficacious. Iodophor is a complex compound consisting of combinations of iodine and synthetic detergents, the detergent acting as the iodine carrier giving increased stability to the product. This compound is a very effective bactericide and also has good detergent properties. The use of iodophors as sanitizing agents for udders, milking utensils, and dairy and food plant equipment is increasing rapidly. Stability when compared with chlorine, negligible odor, and the dual-purpose property of detergent and bactericidal action are major advantages.

Cooling is the only acceptable means available to the producer for controlling the growth of bacteria in milk. The value of adequate cooling, as well as of proper sanitation, has become more important with less frequent deliveries to the processing plant. The effectiveness of cooling in minimizing bacterial development in raw milk depends upon the types of micro-organisms present. The contamination of milk by unclean utensils, rinse water, and manure with types such as coliforms, pseudomonas , and certain streptococci, however, limits the effectiveness of cooling, for many of such bacteria are relatively psychrophilic in nature. In order to impede sufficiently the growth of these types, temperatures closer to 5°C are required, particularly when milk is to be stored for extended period.

In Arab Republic of Egypt, it is known that milking is done mostly by hand-methods at dairy farms either small or big herds. This is due to the fact that mechanical milking is designed to be in farms of modern stables for cattle breeding which are found in

few places. Milking at normal stables conditions lacks most sanitary conditions.

The object of the present work, therefore, is to investigate:

1. The effect of some disinfectants used as sanitizers with hand milking, on the quality of buffaloes' raw milk.

2. The effect of such disinfectants under storage conditions at different temperatures, on the quality of buffaloes' raw milk.

summer than in winter, though milk produced under extremely good hygienic conditions may have a slightly higher thermoduric organisms content in winter than in summer.

Buchanan and Nelson (1960) observed that the predominant bacteria in milk with a thermoduric count of < 1,500 ml were generally sporeformers while streptococci and micrococci predominated in samples with a high thermoduric count. Mycobacteria, actinomycetes and unidentified Gram-positive rods constituted < 10 % of the total thermoduric flora.

Hoff *et al* (1963) reported that the incidence of thermoduric bacteria seemed to be largely present in counts as high as 10,000-100,000 organism per ml of milk. They added also that efficient cleaning and sterilization system for dairy farm and marketing utensils should be put in force.

Hifi and Foda (1964) found that market raw samples which they examined were found to be contaminated with coliform organisms with milk dilutions as high as 10^{-4}. Most of the samples vary from from coliforms in one dilution or another in winter and summer seasons.

Nakanishi and Hyogi (1964) studied the seasonal variation in numbers and types of thermoduric bacteria in bulk raw milk. Thermophilic counts were found to be at a minimum in January and the highest between July and September. The samples heat-treated at 63° for 30 min. contained predominately *Microbacterium lacticum* in summer

and *Streptococcus bovis* in winter, with small numbers of *Str. thermophilus*, *Micrococcus conglomeratus* and *Alcaligenes tolerans* occurring frequently. Counts of *Bacillus cereus* were higher in the warmer months, whereas *B. subtilis* and *B. licheniformis* occurred more often in colder periods. Samples tested for thermophilic organisms in May were found to contain predominatly *B. calidolactis* and *B. stearothermophilus*.

Manzullo and Estévez (1965), examined 250 samples of raw milk in a zone of Buenos Aires, and found that *Escherichia coli* were only detected in 17 samples but neither *Shigella* nor *Salmonella* spp. were found.

Pal (1968) mentioned that microflora of raw milk depend upon incidence, types and significance of organisms present, and their bearing on changing farm practices that was considered. Average standard plate count was 78000/ml, with 16 % of samples exceeding the standard of 100,000/ml. Yearly averages for various types of organisms (% total population) were : alkaline formers, 59; proteolytic bacteria, 41; acid formers, 31; penicillin resistant, 3; lipolytic, 15; *B. haemolytic*, 1; staphylococci, 2; coliforms, 2; sporeformes, 1. The latter 3 groups of organisms were consistently present in raw milk samples. 97 % of bacteria were destroyed by pasteurization, varying from 93.5 % of acid-formers to 99.9 % of *B. haemolytic* organisms. It is suggested that predominance of alkaline forming organisms in raw milk is due to suppression of growth of acid formers by rapid cooling and not to a change in contaminating flora originally present.

Yano *et al* (1968) reported that mesophilic aerobic spore counts and total bacterial counts of raw milk samples obtained from 5 dairy farms in Chiba between July 1962 and February 1963 varied from 10 to 150/ml and from 26 x 10^2 to 77 x 10^5/ml respectively. There was no significant variation in spore counts due to season or producer. Of 169 isolates, 108 were *Bacillus cereus* spp., 27 were *B. brevis*, 19 *B. megaterium* and 15 *B. subtilis*. Spores of *B. subtilis* were most resistant and those of *B. megaterium* and *B. cereus* var. *mycoides* least resistant to heat treatment at 100°C for 30 min.

Skrebbyukov (1969) reported that pathogenic serotypes of *E. coli* were cultured from various objects of a milk farm as well as from the hands of dairy workers and the udders of cows. In the majority of cases, 15.2 to 37.3 % of the cultures were positive. The smallest number of positive cultures were obtained from the milk flasks, while 37.3 % of the cultures of unwashed udders were positive. Following washing, 24 % of udder cultures were positive for pathogenic *E. coli* strains. Seventeen and two-tenths of the cultures obtained from the hands of dairy workers were also positive. The data show that the dissemination of pathogenic strains of *E. coli* on a milk farm is widespread and, consequently, the highest standards of sanitary practice should be adhered to in the processing of milk.

Wrobek (1970) observed that counts of various bacterial groups could be related to milk cooling methods but not to quality grading or evaluation of plant cleanliness.

Pal and Heuper (1970) mentioned that in a 1-yr study (1966-67) to determine the nature of the microflora in a grade A milk supply of a medium-sized milk-processing plant, a total of 320 raw milk samples from 16 producers were analysed bacteriologically. Average counts /1 ml were as follows : total bacteria 77966, coliforms 1545, sporeformers 67, acid-formers 25216, alkali-formers 46047, neutral bacteria 931, proteolytic bacteria 30872 , lipolytic bacteria 11677, and penicillin-resistant bacteria 23851. Season had a significant effect on numbers of sporeformers, acid formers and neutral bacteria ($P < 0.01$) and on alkali-formers ($P < 0.05$), sporeformers and acid-formers were highest in winter, alkali-formers were highest in autumn and spring, and neutral bacteria were highest in autumn. Counts of all organisms except sporeformers were directly correlated with standard plate count, sporeformers were independent of all other groups except lipolytic organisms.

Tsaregradskaya (1970) reported that counts of (i) total, (ii) lactic acid and (iii) proteolytic bacteria were made at 1.5 - 2 months intervals through out 1-yr on raw milk from 25 suppliers and 2 dairy factories. The results are presented as a log graph, which shows max. for (i) and (ii) in May-June, and max. for (iii) in March and min. in May-Oct. *Bacillus cereus*, *B. mesentericus* and *B. mycoides* predominated among (iii) in winter and spring, and coliforms and *Proteus vulgatis* in summer and autumn.

Ghazvinian et al (1971) reported that samples (1000 l) of raw milk from 120 farms producing milk for the Tehran (Iran) pasteurizing

plant were studied for total coliform counts with special reference to coagulase-positive staphylococci. In 86 % of samples from the 120 farms, no coagulase positive staphylococci were found but in 45 samples from farms equipped with cooling apparatus the percentage of positive cases is 23.1 %. This must be due to the influence of the growth of other microorganisms and lactic acid bacteria on the staphylococcal strains.

Mrozek (1972) examined the bacterial flora of 1546 summer and winter milks drawn from various areas of Germany for evidence of relationship to conditions of production as revealed in producers replies to a questionnaire. Low total counts were often associated with the larger herds and high coli counts with the use of machine milking. But in general correlation between bacterial counts and production factors, e.g. cooling facilities and cleaning equipment, was poor. Certain very erratic results in individual cases may have arisen from operational errors. General improvement in milk quality would appear to require the introduction of a programmed cleaning apparatus, a situation dependent, however, on the provision of adequate inducement to the farmers.

Naguib and Shouman (1972) mentioned that three species of clostridia were isolated from samples of raw cow and buffalo milk obtained near Cairo (Egypt). Of 150 isolates of anaerobes, 108 were *Clostridium perfringens*, 30 were *C. butyricum* and 12 were *C. sporogenes*. The *C. perfringens* isolates comprised 100 nonhemolytic and 8 pathogenic hemolytic strains. The latter strains typed by neutralization tests, were of type A. Fifteen of the nonhemolytic