DATING OF PASTEURIZED MILK AS A PUBLIC HEALTH MEASURE

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Dating of pasteurized milk, either by itself or accompanied by a limitation on the length of time it may be sold, is a provision in the regulations of some States and municipalities. In general, this provision appears most often in the regulations of those jurisdictions which were among the first to institute milk sanitation activities. Polikoff (7) stated that incorporation of dating requirements for pasteurized milk originated before World War I. Of 13 cities studied by him, six had adopted this requirement between 1912 and 1917. In this connection, the Milk Ordinance and Code recommended by the Public Health Service (6), while never containing a dating requirement as such, did in early editions, establish 60 hours for the sale of milk after pasteurization. However, this limit was removed in 1934 at the recommendation of the Public Health Service Milk Sanitation Advisory Board and has not appeared in any edition since that date.

The public health significance of dating pasteurized milk and of limiting the time for its sale can best be assessed by considering the status of technical knowledge during the first decade of the century when milk sanitation requirements were evolving, and relating it to the new information that has become available and the changes that have occurred in the production, processing, and marketing of milk.

Milk sanitation — the practice of applying sanitary measures to safeguard the consuming public from milk-borne disease — owes its origin to epidemiological studies during the last half of the 19th Century. In 1857, Dr. Michael Taylor (8) of Penrith, England, described an outbreak of typhoid fever which occurred in that community, and which appeared to be related to the consumption of milk from a small dairy. In 1867, he made a similar observation regarding an outbreak of scarlet fever. By 1881, milk had been the suspected vehicle in several recorded outbreaks in England, and a compilation of 69 milk-borne epidemics was cited by Mr. Ernest Hart (8) before the International Medical Congress in that year. During this same period, the rapidly developing science of bacteriology contributed knowledge on the etiology of communicable diseases which further confirmed the role that milk could play in their spread. By the end of the century, a considerable body of knowledge had been brought together regarding the ability of certain pathogenic microorganisms to gain access to milk, survive in it, and produce disease in humans.

Epidemiological information on the role of contaminated milk in the spread of specific diseases was and is the fundamental basis for milk sanitation activities. However, it was not necessarily the sole consideration in the formulation of milk sanitation regulations. During the latter part of the 19th Century, there evolved a legal structure of control over the dairy industry which had for its purpose regulating the composition
of milk. As stated by Prucha (1), "The prevailing idea appeared to be that changing the natural chemical composition of milk made the milk unwholesome." These laws were at times also concerned with addition of coloring materials, thickening materials, and preservatives, which might be used surreptitiously to enhance the saleability of inferior milk. Both the content and philosophy of these laws appear to have been carried over in the development of regulations to protect the public from milk-borne disease.

It had also been established that spoilage of milk was caused by the growth of bacteria, and by 1900, pasteurization was being employed in a number of the larger cities to extend keeping quality of milk. Although also advocated as a public health measure to reduce the disease risk, many officials viewed pasteurization as a questionable practice. Hammer (5) stated, "In the past, milk inspectors have sometimes maintained that the employment of pasteurization to improve keeping quality of milk is an unfair practice, and that the only legitimate use is to destroy disease-producing organisms." In other words, they would have preferred a process which destroyed pathogenic organisms but did not extend keeping quality of the product.

Pasteurization also met with opposition for other reasons. Many authorities feeling that nutritional values were impaired, regarded pasteurization as an expedient to be employed only until such time as techniques could be developed for the production of a raw milk free from disease hazards. Others were reluctant to accept the commercial pasteurization processes as being adequate to destroy all pathogenic microorganisms. There was also a belief that the heat treatment of milk by pasteurization killed benign acid-producing types and left a predominance of proteolytic types which might, in the course of their growth, produce toxins.

The last two of the above objections, together with the likelihood of pasteurized milk becoming contaminated during subsequent operations, very probably influenced the decisions that led to the incorporation of dating and time limitations for the sale of pasteurized milk, in milk regulations. It could be postulated that actions leading to prompt distribution and consumption of pasteurized milk would minimize growth of the organisms present and, hence, reduce the risk.

If these were the reasons, new knowledge and technological improvements in all phases of milk production, processing, and marketing, will have made them much less important. First, there has been continued improvement in the design and construction of pasteurization equipment since the process was first introduced. The Endicott studies (2) in 1925 showed that much equipment then available was not designed to provide prescribed conditions of time and temperature throughout the entire body of milk being pasteurized. Short-circuiting of flow between inlets and outlets of continuous-flow pasteurizers, leaking valves, dead ends, foam, and splash, were found to provide conditions whereby pathogens could survive even though the time and temperature controls appeared to indicate a satisfactory operation. The study further demonstrated that these equipment defects were correctable, and when such corrections were made, processing at 145° F. for 30 minutes would destroy all pathogenic microorganisms then considered to be significant.

The above findings, together with other equipment studies by the Office of Milk Investigations of the Public Health Service (4), were used in the development of design criteria for vat-type pasteurizers and provided the basis for developing similar standards for high-temperature, short-time equipment. It is interesting to note that the adequacy of these criteria has been recently confirmed in studies on the thermal destruction of Coxiella burnetii, the causative agent of Q fever. Both laboratory and plant level studies showed pasteurization at 143° F. for 30 minutes to permit some survival when large numbers of this organism were present, but processing at 145° F. for 30 minutes to be adequate for its destruction in milk (3). (This information, together with the finding that pasteurization at 161° F. for 15 seconds, was also adequate, for the destruction of C. burnetii, has been transmitted to all State milk sanitation authorities and to the dairy industry.)

The second major change is in the sanitary practices involved in the production, processing, and distribution of milk. Better facilities and, more important, a better understanding of the sanitation factors involved in milk quality by dairy farmers and processors, has resulted in a higher quality product. Improvements in processing equipment have not been limited to pasteurizers; they have also provided greater protection against contamination of the pasteurized product and better cleanliness. Dipped milk, with its attendant contamination, is a thing of the past, and hazards once attributable to poorly cleaned containers, have been minimized by mechanized cleaning operations and single-service containers. These improvements, coupled with proper cleaning, bactericidal treatment, and operating procedures, have significantly reduced opportunities for pasteurized milk to be contaminated with harmful microorganisms.

Although each of the above changes reduces the significance of age as a factor in the safety of pasteurized milk, the change most directly involved is, perhaps, refrigeration. Time and temperature are related factors in bacterial growth. By itself, the significance of time cannot be assessed. Accordingly, early concepts
as to the length of time pasteurized milk might be safely sold were, of necessity, conditioned by the storage temperatures then in use. The great strides that have been made in providing mechanical refrigeration on the farm, in the processing plant, and in the home, have resulted in prevailing storage temperatures for milk today, that could not have been anticipated when early regulations were adopted.

The temperature at which pasteurized milk is held would have a definite bearing on the need for limiting the period during which pasteurized milk might be sold, if the limitation was predicated on a belief that the flora which normally survive pasteurization would produce toxic substances. Whether or not it is true that these organisms can produce toxins—and there is little evidence to show that this has ever occurred under practical conditions—the lower storage temperatures that now prevail would certainly substantially extend a period of safety predicated on the storage conditions of 40 years ago. In this connection, the finding that some strains of staphylococci can produce a toxin that will withstand pasteurization even though the causative organism is destroyed, suggests a better explanation for the hazard once associated with old pasteurized milk. Several outbreaks of gastroenteritis have been reported in which the evidence pointed to a toxin of bacterial origin, and which appeared to have been produced in the milk prior to, not after, pasteurization.

The dating of milk has one other facet that merits consideration—that is the matter of consumer reaction. At present, this is believed to be the leading force in the retention of dating requirements. Freshness has always been recognized as a desirable attribute of milk and certainly, no one can contend that age makes milk better. The consumer associates off-flavors and other undesirable characteristics with old milk, and regards dating as a means of assuring a fresh product. However, freshness, in terms of age, relates to the time of production—not pasteurization. As cities have grown larger, it has been necessary to go farther and farther afield to obtain adequate supplies of milk. There are now in existence situations where milk is picked up in a bulk transport tank from a farm and transported over a thousand miles to the pasteurization plant. In fact, the problems associated with the inspection of such distant sources became so acute a few years back, that the Conference of State and Territorial Health Officers requested the Public Health Service to assist in the development of an interstate milk shipper certification plan. You may recall that this plan was discussed at your 5th Annual Meeting on January 17, 1952 (9). Since that time, the program has progressed and there are now over 500 shippers whose supplies are routinely rated by State milk sanitation rating officers, and these ratings included in quarterly lists that are used by many State and local health officers to determine the acceptability of milk they receive from other areas. The fact that milk may now be transported hundreds of miles without loss of the properties associated with freshness, is a practical manifestation of the vast improvement that has taken place in sanitation and refrigeration of milk supplies.

These improvements in sanitation and refrigeration have permitted economies in the milk industry through the use of every-other-day pick-up of milk on farms and a 5-day week for plant operations. Such improvements also provide a pasteurized product having better keeping quality, but the practice of dating the pasteurized milk tends to negate the economic advantage of a more stable product. Despite the fact that the regulations may permit sale over a longer period, most consumers will refuse to accept milk which does not bear the date of the day of purchase. Because of this, stores retailing dated milk often order minimum quantities on the regular delivery for fear of leftovers involving losses, and then order special deliveries if demands are greater than were anticipated. Such extra deliveries tend to increase the price of milk. On the other hand, when demand is less than was anticipated, returns to the milk plant are involved. Such returns must be dumped and the milk diverted into other channels, with resulting loss of the closure and, in the case of single-service containers, the container itself.

In addition to the economic aspect, dating of pasteurized milk has at times led to situations presenting public health hazards. In some instances, due to the limited time pasteurization plants are permitted to make deliveries after pasteurization, they are required to make store deliveries several hours before the stores open in the morning. The milk is set in the front doorway without protection from the heat, dogs, cats, birds, and street grime, until the store is opened and the milk put in refrigerated display cases at the leisure of the storekeeper. Where glass bottles without tamper-proof closures are involved, a very serious objection has been observed in the temptation to surreptitiously change bottle caps by hand in stores and on delivery trucks. Hand-capping under any condition may contaminate milk and must be considered a serious public health hazard.

These disadvantages are believed to be more significant than any advantage that may now be claimed for the dating of pasteurized milk, and were, in all probability, among the considerations that led the Public Health Service Milk Sanitation Advisory Board, in 1934, to conclude that requirements limiting the time of sale of pasteurized products was not of sufficient significance to merit recommending them on a nationwide basis.
REFERENCES