

THE PRODUCTION AND HANDLING OF QUALITY MILK¹

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The dairy industry and official milk control agencies have the common objective of providing the consumer with a safe, wholesome, nutritious product of good flavor and attractive appearance and they realize that this must be done within a price range which enables the consumer to buy adequate quantities.

The term "quality" is not always uniformly defined. It is likely to mean different things to different people. However, certain basic characteristics must be considered in almost any definition that can be offered and certainly there can be no question that safety is of greatest importance.

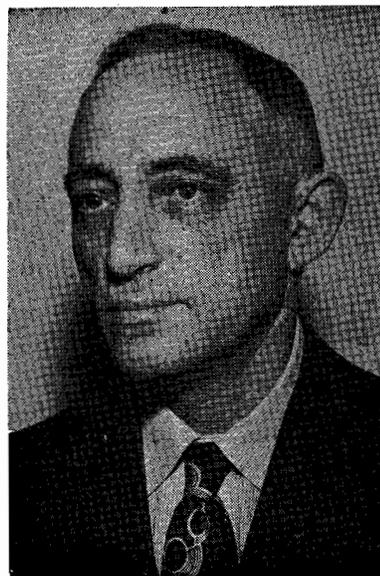
Safety reaches back to the health of the cow and of the people handling the milk. Here, we think not only in terms of freedom from bovine tuberculosis and brucellosis but also freedom from mastitis. It is recognized that it is hard to keep a herd free from infection but this difficulty should not cause us to regard the disease as inevitable and hope that pasteurization will take care of the matter.

Without minimizing the public health value of pasteurization, we still should not permit it to be used as a cover-up for deficiencies in the production and handling of milk. While pasteurization will kill the bacteria found in udder infections, there is one type of staphylococcal infection sometimes found in mastitis which produces a toxin that is not destroyed by conventional pasteurization treatment. Fortunately, we do not see too much of this illness but the possibility of milk borne gastro-enteritis should not be overlooked.

The purpose in mentioning staphylococcus toxin is to point out the need for a multi-barrier protection concept in a well rounded milk control program. It is unwise to place our complete dependence upon either farm inspection, pasteurizing plant control or post pasteurization control. All three phases should be integrated in a complete system.

The recent outbreak of paratyphoid fever in Lancaster, Pa., will probably serve as a good illustration of this point. You may recall from sketchy newspaper reports that over 200 people in the city of Lancaster, Pa., were stricken with paratyphoid fever shortly before last Christmas.

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Investigation indicated that most of the patients had one thing in common namely, the consumption of milk from a certain pasteurization plant in the city. The plant was eventually closed down pending completion of an investigation and the epidemic was finally brought under control.

The first reports on the cause of the trouble expressed the belief that two of the plant workers were paratyphoid carriers and a short time later another story was published to the effect that there was a carrier on one of the dairy farms supplying the plant.

These explanations of the cause of the epidemic leave a great many unanswered questions:

1. Did any or all of the three reputed carriers ever have an active case of paratyphoid fever or were

they completely unwitting victims? It would seem to be a great coincidence if the latter were the case.

2. If any of the three ever had an active case, was it reported to the health authorities and was their carrier status ever determined? Were they ever cautioned against working as milk or food handlers? Is the disease a reportable one in the respective state.
3. Since we know that proper pasteurization will destroy the organisms of paratyphoid fever, what went wrong either during or after pasteurization to enable the survival of enough organisms to cause over 200 cases of infection over a period of several weeks?

Since the reports seemed to have absolved the plant of blame, this inevitably would lead to the conclusion that the cases arose through post-pasteurization contamination. However, there has been no explanation of just how this came about and there are very serious doubts as to whether such an explanation can stand scientific scrutiny.

While there is no sure way of preventing contamination of milk at the point of production, certainly the employment of known carriers on a dairy farm cannot be defended and certainly a good farm inspection program involving cooperation with the State's communicable disease control program, can greatly reduce the possibility of this type of contamination. If we were to disregard farm inspection completely and depend solely upon pasteurization, it becomes obvious that a failure in the pasteurizing process could be disastrous.

It is also obvious that if both farm control and pasteurization should fail, we still have a possible deterrent to harm if post-pasteurization control is properly enforced. Here, one thinks in terms of adequate cover capping of the bottle and good refrigeration at all times to discourage bacterial growth, some of which could conceivably be pathogenic.

There is one more interesting and unfortunate sidelight to the Lancaster picture. Sixty-eight producers were unable to deliver their milk. They found themselves innocent victims of mass fear since no milk plant operator in the general area would risk accepting milk from these producers.

Brief mention was made earlier of mastitis as a factor in evaluating milk quality. In the past six or eight years, there has been a tremendous increase in the use of antibiotics for the treatment of mastitis. These new drugs are a blessing to dairymen but as very frequently happens, abuses have come into the picture. In their eagerness to expand the sale of antibiotics, drug manufacturers have made them available all over the country for home medication.

Many producers either have not realized or have

disregarded the necessity of withholding milk from treated cows for at least three days with the result that a great deal of market milk is found to contain traces of antibiotics. In 1954, the Food and Drug Administration made a limited survey throughout the country and found that about 3 percent of all samples collected contained penicillin. A wider survey was made in 1955 with 25 market milk samples taken from each of the 16 Food and Drug Stations throughout the country. This study revealed that approximately 11 percent of all samples contained penicillin or other antibiotics.

From a public health standpoint, we are concerned with this problem for two reasons:

1. Since there are generally some pathogens present in limited numbers even in the healthy human body, would the continued ingestion of milk containing penicillin build up a resistance in these organisms to such an extent that treatment with the antibiotic would be ineffective in case of a serious illness?
2. Would the continued ingestion of the antibiotic bring about a sensitivity of the person to the drug?

The Food and Drug Administration asked these questions of some of the foremost experts in the country and received a somewhat reassuring comment that, based upon the amounts found in the samples, there would probably be no harm to people except possibly in the case of those individuals who might be "exquisitely sensitive" to the drug.

A new and more intensive sampling survey has been started and we are waiting for the results with considerable interest. Even if the health risk is remote, the definition of milk in most ordinances or regulations prohibits the addition of any substance to milk unless specifically provided for in the ordinance or regulation. It is doubtful that we can remain wholly unmindful of a condition where such a large percentage of the milk contains even trace amounts of an antibiotic.

Let us look at some of the other aspects of quality which are not directly concerned with health but are related to flavor and esthetic values. Several years ago, a study was made of milk delivered by 100 dairymen in one of the northeastern states. It was revealed that 70 percent of these dairies were producing and delivering milk with off flavors. The study further indicated that 40 percent of these off-flavored samples were bad enough to cause the milk to be considered unfit. This was not a very attractive situation and it is probable that the same results could have been obtained in many other areas. The flavor defects which were involved in this particular study were the usual ones

which are some times described as grassy, barny, salty, rancid, oxidized, acid, medicinal, etc.

We know enough about these undesirable milk flavors to be able to eliminate most of them without much difficulty or expense. In most cases it means the exercise of a little more care on the part of the producer. Feed flavors can be corrected by feeding cows after milking or by withholding feed for a few hours before milking. Barny and musty flavors can be prevented by keeping the cows and stables clean and dry. Salty flavors are caused by the shipment of milk from mastitis infected animals or strippers. Rancid taste comes from stripper milk and from unnecessary agitation of warm milk. Acid or sour milk results from improper cooling, and oxidized milk arises in part from poorly tinned equipment and from unnecessary exposure of milk to the light.

Why was the condition which was found in the survey permitted to develop to such an undesirable degree? If we are honest with ourselves, we probably must all take a share in the blame. Inspectors habitually concern themselves mostly with physical conditions on the farm and although odor examinations are sometimes made, they seldom concern themselves with the taste of milk. The receiving station operator has, perhaps, been concerned only when the milk was obviously so poor as to make it unmarketable. The producer perhaps, did not care very much as long as his milk was not rejected and the Extension Service and educational groups may not have been getting their messages over where it would do the most good.

Increased attention to the detection of off flavors in milk is essential in maintaining consumption at a high level. There is need for greater education of people engaged in the procurement of milk relative to the recognition of the variety of off flavors which may occur in raw milk supplies. Some of the Extension Services are assisting in this work by holding grass-root clinics. Here producers, fieldmen, inspectors and other interested people learn how to find poor flavors and what to do about eliminating them.

The physical requisites which are basic to the production of high quality milk are generally well understood. They include such things as healthy cows kept in a clean barn, clean utensils, good refrigeration, properly equipped and well kept milk houses for the handling and storing of milk, a potable water supply and proper sewage disposal. However, since farm inspections of necessity are made infrequently and since a satisfactory farm score today provides no assurance of proper conditions a week later, it is necessary to use certain tests or techniques to more adequately evaluate the day-to-day performance of the producer.

We have been following a program of deck examination which seems to provide a good way to do a

job under the conditions which apply in our milk shed and under our budget allowance. As we practice deck inspection, it involves the examination of every can of milk delivered, in order to determine if there are abnormal odors such as those associated with mastitis, unclean utensils, improper cooling or feed flavors. Men can be trained to acquire a certain skill in recognizing these conditions by smell. A thermometer and strainer dipper are used to supplement the inspector's usual equipment and when abnormalities are detected, a direct microscopic examination is made for bacteriological evaluation. Obviously, poor milk is rejected and sent back to the producer with an explanation.

Since our limited field staff can reach only a comparatively small percentage of our receiving stations daily (we have about 400), we require operators to train a man for deck examination work which must be done on each producer's milk. The plant is required to keep an individual producer's quality control record on which are listed all adverse deck findings, all high counts, all rejections and all unsatisfactory conditions which are revealed on farm inspections.

Company fieldman are required to visit farms when poor results are found on deck examination and to see if the cause can be ascertained and eliminated. Our field staff make comparisons of their own deck findings with those of the plant and we expect to find some degree of correlation. Failure to find some comparability, calls for an explanation by the operator and his field inspector.

When farm holding tanks came into the picture in our area, it became necessary to substitute other control measures since the ability to make deck examinations on individual cans brought in by producers, no longer was possible. The other controls which we have applied are as follows:

1. A requirement for a quarterly veterinary examination in place of the annual one to serve as an aid in the control of mastitis.
2. A requirement for a monthly farm inspection by the company fieldman in place of the yearly one required for conventional dairies.
3. A requirement for the plant operator to make a weekly standard plate count and thermoduric determination of each producer in lieu of the monthly total count required in the case of conventional dairies.
4. A more rigid bacteria standard for the farm tank dairies (50,000 per ml. as against a count of 150,000 per ml. for the conventional dairies).

These substitute requirements may not be completely equivalent to the deck examination procedure which we follow but we think they have merit in the maintenance of good quality.

It is now necessary for us to look at the processing end of the fluid milk industry for further consideration of the factors which affect milk quality. Proper pasteurization, of course, is the keystone in the whole structure of milk quality considerations. Without this, there is no safety and where safety is lacking, other refinements of quality would be purely academic.

Plant operators simply cannot afford to be satisfied with anything less than the most careful adherence to all the details which will give complete pasteurization. No time saving or money saving shortcut can possibly be worth the risk of disaster which would surely follow a milkborne outbreak.

No detail in the checking of equipment and its operation is so unimportant that it can be overlooked with impunity by control agencies. One can never be sure when a plant sewer pipe may develop a leak — so they cannot be tolerated over a milk vat. One can never be sure when a plant well may become contaminated — so we do not want it interconnected with the regular water supply. One never knows when a plug valve may start to leak — so inlet and outlet valves of vat pasteurizers should be properly leak protected. Flow diversion valves and thermal limit controllers must be checked frequently to see that they function properly. Short-time units must be tested regularly to see that holding times are adequate. Coolers sometimes develop leaks through which contaminated water may enter the milk and the same thing may happen in case of spray vats used for pre-cooling.

This list of possibilities is by no means a complete list of items to which the inspector and the plant operator must be alerted. They are merely illustrations of the myriad of details which enter into the maintenance of proper pasteurization procedure.

Pasteurization cannot convert poor milk into good milk. If one wishes to finish with a good product, he must start with good raw material. Bacteriological measurements are still highly regarded as a means of evaluating sanitary quality, and good control dictates the making of standard plate counts on raw supplies. However, it is well to know something about the types of organisms present, for example, thermophilic types. The presence of an excessive number of this type in raw milk will make it difficult to obtain low counts in pasteurized milk. Thermophilic bacteria are routinely detected by making laboratory pasteurized counts. Plate and coliform determinations on the pasteurized product should complete the bacteriological

examinations for all practical purposes.

In any discussion of milk quality, some mention should be made of chemical control procedures. It is safe to say that the days of gross and crude adulterations are, for the most part, passed. Nevertheless every well run plant and every regulatory agency must make at least the basic determinations to see that the butterfat and total solids contents are up to standard. The cryoscope, of course, is of great value in determining whether water has been added to milk.

For his own protection, the plant operator should make phosphatase determinations and keep a careful record of his findings. If vat pasteurization is used, a phosphatase test of every batch should be made and if the short-time method is used, several samples taken at different periods of the run should be tested. Time does not permit a complete discussion of the numerous other things which demand continuous attention.

A person uninformed of the details and intricacies of the modern American milk industry is likely to ask whether all this detailed care is necessary, but a brief examination of the way in which milk is handled after it leaves the dealer will soon bring the necessary enlightenment. No other food product of comparable perishability gets as much abuse as milk. How unusual is it for milk to be left on the doorstep for two or three hours of a hot summer Sunday morning while the family is catching up on its sleep? Do stores handling large volumes of milk have sufficient refrigerating capacity to keep their peak volumes properly cooled? Do all storekeepers carefully control their inventory of milk so that old milk does not accumulate in the back corner of the refrigerator? Have any of you noticed milk warming up on the table an hour or more after the meal is finished? These are some of the abuses to which milk is subjected during its distribution. For these reasons and for others the plant must provide milk with those necessary quality factors which will enable the milk to withstand to some extent the abuse to which it is frequently subjected.

The production of milk of good sanitary quality is not something that just happens. The producer, the processor and the distributor must recognize the fundamental things that relate to quality and must work at the job of providing them all of the time. The consumer's confidence in the milk supply is in direct ratio to the quality of the product. Increased milk consumption can be obtained by taking positive steps to eliminate inferior milk.