A STATEWIDE SURVEY OF FREEZING POINTS OF AUTHENTIC MILK SAMPLES

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SUMMARY

Eighty-three authentic samples were taken from the mixed herd milk of dairies located in eight areas of the State of Mississippi during an eight-month period. The range of freezing points observed was wider than expected based on the recognized upper limit of $-0.530\,^{\circ}C$. Eleven percent of the samples would have been termed adulterated based on this accepted standard. The mean freezing point was $-0.536\,^{\circ}C$ and the standard deviation $-0.006\,^{\circ}C$. The data showed a moderately acceptable normal curve fit. But the true distribution appeared somewhat skewed, indicating that factors other than normal differences between animals tend to force the freezing point up. Variation between laboratories was small. The mean test deviation was slightly more than 0.001 $^{\circ}C$.

In 1958 the Mississippi State Board of Health established a standard of $-0.530\,^{\circ}C$ as the maximum freezing point for producer milk. White (6) stated that the freezing point distribution curve for milk shows that something less than one in a thousand herd samples could normally fall above this figure. However, the possibility that this standard is too low for the applicable area has been often suggested by producers and processors. Official laboratory analyses on 4,777 producer samples during 1963 and 1964 showed that 10.3% froze at temperatures higher than $-0.530\,^{\circ}C$.

Custer (1, unpublished data) ran freezing point determinations on unauthenticated samples from 631 Mississippi herds. The freezing point range was $-0.550$ to $-0.471\,^{\circ}C$ with an average of $-0.536\,^{\circ}C$. Variance within the one regulatory and two private laboratories was $\pm 0.003\,^{\circ}C$.

Several workers have concluded that freezing point values vary geographically (2, 3, 4, 5). Robertson (5) suggested that "regional or area freezing point values be established based on local data and research."

These considerations led to the experiments reported herein.

EXPERIMENTAL PROCEDURES

Sample Collection.

The State of Mississippi was divided into eight areas based on concentration of dairy herds, topography and meteorological conditions. Two milk sanitarians were selected from each area and trained to take authentic samples and to make essential observations. One sample was taken from each area every two weeks.

Aseptically collected samples were iced in fiberglass shipping containers and shipped via bus express to the Mississippi State Board of Health Central Milk Laboratory where the samples were split. One sample was held for testing and the other shipped in the same manner to the University of Missouri Milk Analysis Laboratory. Samples were normally tested within 52 hr of collection.

The following were criteria of sampling: (a) random sampling based on the number of dairies within the area; (b) bulk tanks empty at the beginning of the evening milking; and (c) milking operations observation and control to prevent adulteration. The latter included inspection of the milking equipment to assure the complete drainage of water before milking. Where teat cup rinsing was practiced, the operator was cautioned to insure that all valves were closed during the rinsing operation.


Freezing Point Determinations.

Determinations were made in both the Mississippi State Board of Health and the University of Missouri Milk Analysis laboratories using Fiske Milk Cryoscopes (Model J). Each instrument was calibrated with 7 and 10% sucrose equivalent solutions. Daily calibration checks were made using a standard solution with a true freezing point of $-0.530\,^{\circ}C$. Comparative tests of the two instruments using this standard demonstrated variation which never exceeded $\pm 0.002\,^{\circ}C$. Technician variation between samples run on the same instrument ranged up to $\pm 0.003\,^{\circ}C$.

RESULTS AND DISCUSSION

Eighty-three authentic samples were tested in each of the two laboratories. The arithmetic mean freezing point and the standard deviation were the same for both laboratories, the former being $-0.536\,^{\circ}C$ and the latter $0.006\,^{\circ}C$. The average difference on paired samples between the two laboratories was

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Surveys of Freezing Points

Feeding practices and animal conditions were possible influencing factors. About 20% of the 31 samples from herds which were "poorly fed" and/or in "fair to poor condition" produced high freezing points. Less than 6% of the 52 herds classed "good" under these categories produced milk high in freezing point. The mean freezing points were -0.537 C and -0.535 C for the herds classed "good" or "fair to poor", respectively, as to condition and feeding practices. While the difference between the means was only large enough to approach significance at the 10% probability level, it is our opinion that they were at least related to influential factors. It has been our observation that poorly managed herds often show a high incidence of mastitis. However, relation of mastitis to freezing points was not studied.

Certainly, these data indicate a much broaded distribution of freezing points than suggested by White (6). Furthermore, they indicate an unexpected number of high freezing points.

No significant differences in mean freezing points between areas could be demonstrated. The highest mean was -0.535 C and the lowest -0.539 C. At least one sample of milk from each of the eight areas froze above -0.530 C.

High freezing points occurred in samples from three of 39 herds milked with pipeline equipment and six of 44 herds milked with conventional equipment. These results verify the sanitarian's observations that pipelines were well-drained prior to milking.

Freezing points did not vary from month to month as evidenced by the uniformity of distribution within months. Freezing points of -0.524 C or higher were observed during each month of the experiment.

References

1. Custer, E. W. Personnel communication of unpublished data. Dairy Department, Mississippi State University.