

SOME FORMS OF ADULTERATION IN DAIRY PRODUCTS¹

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In this report a type of regulatory activity which often may escape the attention of sanitarians will be discussed. Consequently, instead of confining my discussion to sanitary adulterations of dairy products, my report will recognize the analytical work of public servants across this country who are active in preventing fraud, deception and misrepresentation of dairy products before these foods get to the consumer. Misrepresentation of products must be controlled to prevent unfair competition with reputable processors who handle, manufacture and sell the majority of all dairy products.

In addition to fraud prevention, the dangers from contamination with toxic materials and with insects, insect parts, insect and rodent excreta and other forms of filth are not ignored. In the time permitted, only a few of the more common and one or two unusual violations of the Pure Food Laws and the means to detect them will be mentioned. The subsequent remarks represent personal opinions and may not conform with the opinions or policies of the Department of Agriculture and Markets of the State of New York.

ADDED WATER

Added water is universally the cheapest adulterant of fluid milk and many other dairy products. Some adulterants, like water, may be added accidentally, some intentionally, and sometimes excessive amounts of water or of other foreign residues, as judged by standards of identity, are left in manufactured products. Where standards of identity are recognized for manufactured dairy products, official methods of analysis may be used to determine the moisture content of these foods. In the absence of standards of identity, determinations to establish freedom from adulteration often depend upon a broad knowledge of the normal characteristics of the unadulterated food and the interpretive skill of the chemist and administrator.

An illustration of some of the problems of assuring uniform moisture content throughout a batch of cottage cheese and similarly a uniform moisture and fat



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content in creamed cottage cheese may be worthwhile. It is essential that the food in each package which the consumer pays for conforms in composition to minimal standards of identity for each product. Usually, it is demonstrable from the weights and composition of the materials combined by the manufacturer that he has adjusted the moisture and fat content (latter in creamed cottage cheese only) so that they meet the minimal standards for the batch. Despite this certainty, completely uniform distribution of the moisture and fat by mixing is less certain and maintenance of the distributed state is still less certain because, as the cheese is stored before sale, progressive separation of these components takes place, particularly if the temperature of the cheese is allowed to rise to that usually found in display cases from which bulk sales are made.

¹Presented at the Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., at Louisville, Kentucky, October 7-10, 1957.

Because of leaching and separation tendencies, the manufacturer may select one of two or more methods to overcome possible fat deficiencies and possible moisture excesses in the food as sold to the consumer. He may offer the food in consumer-size packages with minimal manufacturing tolerances above the composition requirements so as to escape possible violations, or he may sell the cheese in larger containers, portions from which are to be weighed into packages for the consumer by the retailer, in which case the composition tolerances must be somewhat larger in order to assure that no portion sold will be deficient in milk fat or contain moisture.

When preparing official samples for removal of test portions, it is best for the chemist to condition the entire amount purchased in order to recombine uniformly any portions which may have separated by leaching. A caution on the prolonged use of an electric blender is needed because the composition of the official sample is changed progressively by moisture losses as the temperature in the blending jar increases. To assure a uniform blend without undue scatter of portions of the sample on the cover of the jar and on the walls above the sample level, a rheostat in the line permits starting at a lower speed. After operation for 30 to 40 seconds, the speed may be increased so as to produce a uniform creamy mixture before transferring the test portions. Time limit for conditioning the sample should not exceed 2 minutes.

Added water in fluid milk at the producer level will continue to be a perennial problem. However, the amount of inescapably added water in retail milk supplies under good management conditions seldom exceed 0.2%. Despite this low figure on market supplies, there will always be a few producers who accidentally or intentionally add proportionately larger amounts of water to milk. Careless preflushing and post-flushing operations of pasteurizing and bottling equipment, and also careless cleaning methods for milking machine pipe lines, may result in milk and water mixtures where the added water content in the first ten gallons of mixture from the equipment may be as high as 15 or 20%. Such practices are both uncommon and inexcusable.

By skillfully using the lactometer and a record of the usual fat composition of each producer's milk, it is possible for an inspector on the milk receiving deck to identify nearly all individual supplies which contain detectable amounts of added water and/or from which milk fat has been removed. Each year in New

York State routine inspections at milk receiving plants reveal the identity of producers who deliver watered and/or skimmed milk. Tests at the laboratory usually confirm the field records. We are not proud of this situation, and no doubt other states and cities have records which they prefer to conceal.

Wherever it is possible to compare the composition of a producer's sample taken at the farm, usually collected within an interval of a week after taking a delivery sample, with the composition of the latter suspected of adulteration, it is not difficult to detect whether the milk has been watered, skimmed, or both. Where no comparison samples are available, such forms of adulteration are more difficult to detect. In such cases, minimal composition standards for fat and total solids in fluid milk are among the remaining guides available to the milk sanitarian.

Comment on the freezing point method for the objective determination of the presence of added water in fluid milk and cream is appropriate. The need for the recent survey on milk cryoscopy was created by reports which tended to undermine the value of this official test which has been recognized for nearly 40 years. Admittedly the directions for performing the test needed some clarification and revision, but the major difficulty centered around misinterpretation and misuse of the results, particularly by a few less well informed regulatory officials. Interpretation of freezing point data will continue to be a problem because of unpredictable conditions in individual herds at the time milk samples are taken. The new data should restore confidence in the method and should show the ultra need for interpretive caution in those cases where a marginal degree of adulteration is suspected.

BUTTERFAT TESTS

That fat tests by the routine Babcock method do not always agree with tests using the ether extraction Rose-Gottlieb method is not a new revelation. Experience shows that fat tests on fluid milk by the Babcock method are apt to average from 0.02 to 0.03 percent above tests by the Roese-Gottlieb method. On composite samples the trend is in the opposite direction by a similar amount. Because of these opposing tendencies, a modification of the Babcock technique would cause the results on either the preserved or the non-preserved samples to be more divergent from those by the Roese-Gottlieb method than they are. For this reason it would seem best not to change the present Babcock technique unless a modification is proposed which will eliminate almost com-

pletely the major source or sources of error. One of these is the wide tolerance for graduations on the necks of test bottles. It is estimated that about 500,000 tests on composite milk samples are made in New York State annually and that an equal number of tests are made on non-preserved fluid milk samples. Some have hoped that one or more of the recently proposed detergent type modifications of the Babcock method could be substituted for the recognized Babcock test procedure. Because recent information discloses that the detergent type modification is not applicable to composite samples, it seems doubtful that much interest can be aroused in this type of modification. However, a current need is for recognition of an acid digest type of method suitable for determining the fat content in homogenized products. There is reason to believe that the Association of Official Agricultural Chemists will encourage a properly organized comparison using one or more promising methods for fat determinations in homogenized fluid milk and cream and in frozen desserts. It would be well to include the Gerber method in such a comparative study. The first step in organizing such a study is to appoint a referee who is sufficiently interested in the work to complete the necessary investigations.

DETECTION OF RECONSTITUTED MILK

The ability to detect reconstituted milk when mixed in small amounts with whole milk is not as encouraging as the sponsors of the method reported it to be originally. The claim was that from 2 to 5 percent of added reconstituted milk could be detected. Comparative tests on mixtures of known composition show that this figure must be raised to about 15 percent. If portions from the same container of powder reconstituted by the chemist and serial dilutions of the reconstituted product are added to an authenticated sample of whole milk from the suspect source, it may be possible to establish the presence of added reconstituted milk when the amount added is substantially less than 15 percent.

BACTERIAL GROWTH INHIBITORS

For about ten years attention has been directed to different bacterial growth inhibitors in milk which appeared to prevent the subsequent normal growth of cheese cultures. In the latest edition of *Standard Methods for the Examination of Dairy Products*, types of these inhibitors were classed as follows:

1. Residues from chemical sanitizers, applied to farm and plant milk-handling equipment.
2. Residues from "sulfa" drugs, used therapeutically.
3. Residues from antibiotics, used therapeutically.

4. Bacteriophages, multiple and miscellaneous.
5. Other unidentified inhibitors.

Our referees selected methods which seemed applicable to the detection of antibiotics, especially penicillin. The increasing demand now is for a selective method to distinguish phage inhibitors from other types. In other words, cheese manufacturers are reluctant to believe that their cultures can become contaminated.

OXIDIZED FLAVOR PREVENTATIVES

A new and unusual type of adulteration is occasioned by the proposed use of a pancreatic enzyme to prevent oxidized flavor in pasteurized fluid milk and cream. Last spring this product was available commercially as a white powder, with directions that a level tablespoonful of it be added to each 40 gallons of milk or cream. The enzyme is active during pre-heating and is inactivated by the time pasteurization is complete. Directions state "If milk is held overnight in a storage tank for short time, high temperature pasteurization, add the enzyme and agitate the mixture about 30 minutes before you start to draw from the tank. Do not add it to milk to be held overnight before pasteurization."

A sample of the enzyme preparation was submitted in an original unopened 1-lb. brown bottle to our Laboratory on May 17, 1957. The bottle was closed with a screw cap and the label bore a batch identification number. Probably the purpose of coding was related to the manufacturer's attempt to keep from use products which may be low in potency due to aging and conditions of storage. Regardless of its potential benefits to retard oxidation, our Legislature has given us no authority to permit the addition of such products to whole milk. If such additions are to be permitted, the Legislature must change the statute.

COMPOSITION OF CHEESE

From 1950 to 1954 appreciable data were collected on the composition of Mozzarella and Ricotta cheeses, both in New York and on a national basis. Based on these records, the New York State Legislature enacted definitions to identify the composition of these two products. In 1956 it was discovered that these definitions, which at one time had been endorsed by the New York State manufacturers of these Italian cheeses, failed to satisfy Mozzarella cheese manufacturers in another large cheese producing state. The latter wanted to make a drier Mozzarella cheese by adding appreciable amounts of reconstituted skim

milk powder to the milk before setting the curd. This made a product which, when sold in competition in the New York markets, failed to conform in composition to the Legislative definition for Mozzarella cheese. A vigorous effort continues among manufacturers to disguise this product by representing it under identifying name, "Pizza Cheese."

During 1956 and continuing in 1957, more than 50 samples of Mozzarella cheese, identified as Pizza cheese, have been submitted to the Laboratory. It now appears that two related Italian families in the New York metropolitan market are trying to undermine each other's business in the sale of Mozzarella cheese. One of these families is particularly interested in promoting the sale of Pizza cheese. Since the article of food is made similarly to regular Mozzarella cheese, and since to the consumer it resembles Mozzarella cheese in appearance, texture and flavor, there seems to be no need to recognize officially the coined identity, Pizza cheese, which allows proportionately more water to be sold for the original amount of fat and total solids in the milk and the substitution of the less expensive solids in skim milk powder for the more expensive solids in whole milk.

FOREIGN FATS IN DAIRY PRODUCTS

Late last year the recurrence of an old type of adulteration was discovered. In 1882 and 1884, when the first Pure Food Statutes were enacted by the Legislature in New York State, these laws contained specific prohibition on mixing oleaginous fats in cheese and in butter made from cow's milk. Evidently this form of adulteration and misrepresentation was practiced in the last half of the nineteenth century. In 1956 and continuing in 1957, two different manufacturers, one in New York City and one in Rochester, were found to be using vegetable fats by reconstituting and homogenizing them with skim milk powder before the mixture was manufactured into a product resembling cheese. The proportion of the vegetable fats was sufficient so that after getting a refractive index reading and the Reichert-Meissl and Polenski values on the extracted fat, it was possible to conclude that vegetable fat was present in the product resembling Mozzarella cheese. This year the Laboratory has examined more than 40 such samples containing vegetable fats.

Those who have watched the trend since 1952 in the sale of Mellorine type products know how disturbed some manufacturers of frozen desserts were when they wanted a simple color test for use by the plant foreman to distinguish between ice creams and

Mellorine type products. Analytical miracles to identify mixture of fats of different species origin at low concentrations have not occurred. Mellorine is here to stay and its use is spreading in some places and slowing up in others. Flavored, a good Mellorine product is indistinguishable organoleptically and in appearance from ice cream.

Refined hydrogenated, edible cottonseed and soy oils will be used in Mellorines. Some corn and peanut oil may be used in Mellorine. Certain rearranged non-lacteal fats of animal origin are often added to selected vegetable fat mixtures in such portions, usually with small amounts of milk fat, so that the resultant blends have many of the analytical constants that are indistinguishable from those of pure milk fat. Mindful of these possibilities, the Association of Official Agricultural Chemists has re-examined the older analytical tools and is searching for new ones. A method for butyric acid value to identify fats of milk origin shows the most promise as new tool. Use of this method in conjunction with other tests will permit the identification of mixtures containing vegetable fat even where the operator has attempted to disguise the vegetable fat mixture by adding commercial butyric to it. Refinements have been added to the older methods.

FUTURE TRENDS

A look into the future may be timely. American progress, demonstrated by the recently accelerated rate of commercialization to improve foods, creates a formidable task for future food chemists. The challenge involves both the identity of the new additive in trace amounts and its quantitative determination to discover whether it may be present in amounts which either may be dangerous or exceed a recognized tolerance. National thinking on food additives may be influenced to some degree by the current rate of increases in the global population, by the world-wide use of antibiotics and other miracle drugs to save lives, and by recurring visions of the Malthusian ghost of hunger. As evidence of this trend, a paragraph from a report listing nearly 1,000 food additives, by the Food Protection Committee of the National Research Council, issued in February 1956 as Publication No. 398, is quoted:

"Intentional chemical additives have been defined by the Food Protection Committee as those chemicals introduced for the purpose of imparting some desired quality to, or of serving a functional purpose in, a food product. Such materials as coloring agents, flavors, non-nutritive sweeteners, nutrients for food

fortification, preservatives, antioxidants, emulsifiers, and bleaches are all intentional additives. They are added to the food product in carefully controlled amounts during processing. No distinction is made between synthetic chemicals and those isolated from natural products."

Many are aware that food additive legislation was introduced in the 1957 Congress. While this Congress did not enact such an amendment to the 1938 Food, Drug and Cosmetic Act, no doubt a future Congress soon will do so. Legislation similar to that in the Miller Amendment for Pesticides is needed to keep dangerous chemicals from being used promiscuously by less well informed food processors.

To illustrate the potential need and how it is now being handled by a visionary group of chemists for just one item of commerce, attention is directed to the work at Syracuse University under the directorship of Dr. Ernest Reed on Migration Studies Concerning Ingredients of Paper Milk Bottle Carton Adhesives. Dr. Reed serves as Chairman of a Public Health Advisory Council on the sanitation and safety of certain types of paper packaging materials for liquid and/or wet foods. This investigation involves the use of chemicals with preserving and/or other functional properties in adhesives. Dr. Donald Lundgren and Dr. Reed, guided by suggestions from Dr. Arnold Lehman, of the Federal Food and Drug Administration, have completed many controlled ex-

periments, usually based on the amount of chemical extracted by distilled water from the adhesive as applied to the carton. Some experiments have included feeding tests with the chemical.

The pioneering work started about 5 or 6 years ago when a need for it became urgent. In some of the tests, radio-tracer techniques have been used to identify and measure the migrant in the distilled water. Among the chemicals tested to determine their migration are:

- Polyvinyl alcohol
- Polyvinyl acetate
- Dowicide A (orthophenyl phenol)
- Roccal (a quaternary)
- Cuniphen, G-4 (a chlorinated methane)
- Gulilate (Cu-8-quinolinolate)
- Arquad 12 (a quaternary)
- Tamol N (a sulfonate salt)
- Duponol ME (Na lauryl sulfate)
- Phenol
- Formaldehyde
- Darex 811 (a vinyl acetate resin)

This survey records progress to control violations of the Pure Food Laws dealing with a variety of dairy products. The type of investigation, such as that on migration of chemicals in adhesives used in paper milk bottles, is to be highly commended.

FORTY-FIFTH ANNUAL MEETING, IAMFS, Inc.

NEW YORK STATE MILK SANITARIANS ASSOCIATION

CORNELL DAIRY CONFERENCE

HOTEL NEW YORKER — N.Y.C. — SEPTEMBER 8, 9, 10, 11, 1958