A Research Note

Iodine in Cow’s Milk Produced in the USA in 1980-1981

JOHN C. BRUHN and ANTOINE A. FRANKE

Cooperative Extension and Department of Food Science and Technology, University of California, Davis, California 95616

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ABSTRACT

In 378 samples of milk collected from farms and silos outside California, iodine varied from 30 to 3484 μg/kg and averaged 499 μg/kg. In a previously reported study, iodine in 1021 samples of milk collected from farms in California varied from 22 to 4048 μg/kg and averaged 328 μg/kg. Of samples collected outside California, 68.0% were below 500 μg/kg; of samples collected in California 83.4% were below. Volume weighted averages were calculated for both sets of samples. The volume weighted average outside California was 438 μg/kg and inside California was 316 μg/kg. While some farms do produce milk containing high (more than 500 μg/kg) concentrations of iodine, dilution of that milk with milk lower in iodine results in finished fluid and manufactured products low in iodine; thus it is unlikely that any population group purchasing processed dairy foods at the retail level in the USA will be exposed to excessive concentrations of iodine in the dairy products they consume. However, it is possible that some farm families using only the milk produced on their farms might be at risk.

Iodine occurs naturally in most foods and is a required nutrient for animals, including man (15,30). The recommended daily dietary allowance varies from 35 μg for infants, six months and less, to 150 μg for lactating women (24). Since iodization of salt became common in the USA, enlarged goiter, a symptom of an iodine-deficient diet, is seldom seen. A small proportion of the population, however, can be subject to iodine toxicity syndrome. In 1975, the USPHS became concerned that perhaps the USA diet contained more iodine than was required, or possibly safe, for nutrition. Since then, several market-basket studies have demonstrated that the major sources of iodine in the USA diet have been bread and dairy products (28); bread’s contribution has been declining in recent years while that of dairy products has been increasing (9). We have been monitoring the iodine concentration of dairy products in California since 1978 (5).

Sources of iodine in cow’s milk are many and varied. Lactating cows require a small amount of iodine in their diet. In 1978, the NRC established the requirement to be no more than 50 μg/kg of feed (25), except in those instances where other dietary constituents made the iodine in the diet less available. Any iodine the cow consumes in excess of her needs is excreted or secreted into the milk (1,3,7,14-17,21). At some farms the milking claw and attached milk hoses are backflushed with iodophor-containing solutions between cows. These systems when used properly will usually add no more than 50 μg of iodine to each kg of milk, but they must be adequately maintained and the iodophor solution should be routinely monitored to see that it does not exceed the recommended strength (25 ppm) of active iodine (5,7,13,18). Iodophors are also used to treat infections that may affect the cow. When used topically, these compounds enter the bloodstream and hence the milk of lactating cows (8,11-13,17,18).

To determine the iodine concentrations of farm milks in other states, we arranged to have samples of the raw milk produced in those states shipped to us for analysis. This research note reports our findings.

MATERIALS AND METHODS

Raw milk samples were collected either from farm holding tanks or from factory silos in 250- or 500-ml bottles and frozen. The frozen samples were air-expressed to Davis in insulated packers and stored at -18°C until analyzed.

The frozen samples were thawed in warm water (ca. 37°C) and their iodine content was measured using a selective ion electrode (Orion model 94-53A) (4,22,32) and a double junction reference electrode (Graphic Controls part number PHE 54473). The ionic strength adjuster used was 2 M nickel nitrate (20). Iodine concentrations were measured by the method of standard additions (27).
Data were analyzed statistically using the Frequencies subroutine of the SPSS package available on the UC-Davis computer (26).

RESULTS

The states from which we received samples are listed in Table 1. California data previously published (5) are included for purposes of comparison. Iodine concentrations in all the samples collected outside California varied from 30 to 3484 μg/kg; the average for the 378 samples was 499 μg/kg. To ensure that a small dairy producing milk with a high iodine concentration did not bias the average higher than was truly representative, volume weighted averages were calculated. They were lower than the simple means by 12 μg/kg for California and 61 μg/kg for all other states, differences that were statistically insignificant.

Frequency distributions for iodine concentrations measured inside and outside California are shown in Fig. 1. In California, at the time of this study, 40.5% of samples were below 200 μg/kg, whereas outside California 14.0% were below. The greatest fraction (32.0%) of samples in California was between 101 and 200 μg/kg. For samples collected outside California, the greatest fraction (25.0%) was between 301 and 400 μg/kg.

DISCUSSION

Of the 27 states outside California from which raw milk samples were received, only 11 (Colorado, Idaho, Illinois, Minnesota, Montana, Ohio, Oregon, Pennsylvania, South Dakota, Utah, and Washington) had average iodine concentrations greater than 500 μg/kg, the maximum limit established by legal statutes in Switzerland and Australia. We hasten to point out, however, that the number of samples taken from each of these states really is not sufficient to make general conclusions as to the average iodine concentration in all of that state’s producer milk. In each State, more samples should be collected to determine the average iodine concentration of the raw milk produced there more precisely.

Some other workers have been measuring the iodine concentration of farm milk produced in their states. In samples from 2500 farms in New York, more than 90% had less than 500 μg/kg. About 62% had less than 200 μg/kg (9). In samples from 175 herds in Wisconsin, 64.6% were below 500 μg/kg and 33.8% were below 250 μg/kg (23, 29).

Historically, the concentration of iodine in milk has been considered to average around 40 μg/kg (24, 29). Before 1970, reported concentrations were generally less than 100 μg/kg and the highest reported value was 165 μg/kg. That the concentration of iodine in milk at the farm has increased in the last decade has been demonstrated indisputably in many parts of the world (5, 6, 10, 19). The question we must address is whether the increase in milk iodine concentrations is a threat to the health of the milk-drinking population. If we had to draw a conclusion from the data presented here, we would have to agree with Binnerts (2); the iodine content of

### TABLE 1. Iodine content of raw milk.

<table>
<thead>
<tr>
<th>State</th>
<th>Samples</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Weighted mean</th>
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milk is not a health concern unless a person consumes milk from a single source that is excessively high in iodine. Since we have the means to control milk iodine concentration (5,7,33), it should not be a concern in the future if all involved in production of dairy products monitor the levels of iodine in the raw milk supply wherever we are and, if high levels are found, eliminate the excess iodine at its source. Special effort should be directed toward educating those farm families that consume only the dairy foods they produce, to the importance of adopting management practices that will ensure that they are not exposed to dangerously high levels of iodine.

REFERENCES

Results of this survey show that egg noodle samples contained all the defects more frequently than the macaroni product samples, with wider ranges of defect counts and higher defect means.

ACKNOWLEDGMENTS

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REFERENCES


Bruhn and Franke, con't. from p. 399