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MILK IODINE RESIDUES AFTER A POST-MILKING IODOPHOR TEAT-DIPPING

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Résumé

CONTAMINATIONS DU LAIT PAR DE L'IODE LORS DU TREMPAGE DU TRAYON APRÈS LA TRAITE AVEC UN IODOPHORE. — Le trempage du trayon avec un iodophore après la traite induit une augmentation de 33 à 54 μg I/kg de la concentration en iode du lait quand la mamelle est lavée avant la traite. La teneur en iode des premiers jets est 1,08 à 8,27 fois supérieure à celle du lait total. Cependant, l'origine des contaminations semble être un passage transcutané de l'iode au niveau du trayon. Dans les conditions d'utilisation décrites, le trempage du trayon par un iodophore entraîne une augmentation de la teneur en iode du lait qui ne peut être considérée comme dangereuse pour la santé du consommateur en France.

Milk and dairy products have become the major sources of dietary iodine for humans in the UK (Wenlock et al 1982), in the USA (Park et al 1981, Allegrini et al 1981) and in Finland (Varo et al 1982). The most significant factor within the dairy farmer’s ability to control the iodine content of bulk tank milk is the iodine supplementation in dairy rations (Franke et al 1983, Ruegsegger et al 1983). However, the practice of post milking teat-dipping may contribute to the increase in iodine content of milk, which has been recorded in many countries (Dunsmore 1976, Hemken 1980, Bruhn and Franke 1985).

The post milking teat-dipping with an iodophor above 5 000 mg available iodine per liter (mg avl/I) is used because of their bactericidal properties against mastitis pathogens (Oshea et al 1975, Sheldrake et al 1980a, Godinho and Bramley 1980). As it can be for the ability of iodophor teat-dipping to control mammary infection (Sheldrake et al 1980a, Bray et al 1983), the amount of iodine residue in milk is greatly affected by premilking practices (Sheldrake et al 1980a, Galton et al 1984) and the available iodine concentration of the iodophor solution (Bray et al 1983, Galton et al 1984, Berg and Pagditt 1985). For these reasons, the results on iodine contaminations of dairy milk from iodophor teat-dipping are conflicting. No significant additions of iodine in milk have been recorded (Dunsmore et al 1977) whereas some authors have reported contaminations above 250 μg I/kg of milk (Iwarsson and Ekman 1974, Sheldrake et al 1980a). Conrad and Hemken (1978) have showed that a systemic transfer of iodine from the teat skin to the milk can be the major source of contaminations. However, Sheldrake et al (1980a) concluded that the bulk of iodine residue in milk has a direct teat skin origin.

The main purpose of this study is to quantify the iodine residue in milk after a post milking teat-dipping with a 5 000 mg avl/I iodophor when the udder is washed before milking.

Materials and Methods

Thirty multiparous dairy cows were assigned to two groups of 16 and 14 animals each. The group assignments were made to equalize the number of lactation, the body weight one week after calving and the milk yield of previous lactations. Cows were housed in a tie-up cowshed with cows in one row post milking dipped with 5 000 mg avl/I iodophor (Bellaiodine R – Rhône-Mérieux). The opposite row was dipped with a latex teat shield solution (Teat Shield 3M R – Rhône-Mérieux) as a control. The udders were washed before each milking with an individual towel. The cows received a maize silage and cereal-soja concentrate ration and a mineral supplement allowing a daily iodine intake of 0.8 mg I/kg dry matter (DM). The experiment was carried out from the first to the tenth week of lactation.

Milk from both daily milkings was collected in 30 ml samples in a polypropylene tube at the 4th, 6th and 8th week of lactation. Total milk was defined as the whole milk from one milking, without the first 30 ml when the first sprays of milk were discarded. At the 6th and the 8th week of lactation, the first 3 sprays of milk from each quarter were discarded before milking by handling milking. The volume discarded was equal to 30 ml. The first 3 sprays of milk were also collected for iodine analysis at the 8th week of lactation. All the samples were frozen at – 18°C and stored until analysis.
The iodine concentrations of milk were determined after alkaline ashing by the reaction of Sandell and Kolthoff (1937) according to the method of Aumont (1982).

The data were statistically analysed by analysis of variance, t test, and non-parametric tests (Snedecor and Cochran 1967).

**Results**

The milk yields per cows were respectively for iodophor dipped cows and placebo dipped cows: 27.1 ± 5.2 and 27.3 ± 3.4 kg per day (kg/d) during the first month of lactation, and 25.5 ± 3.1 kg/d and 24.9 ± 2.6 kg/d during the second month of lactation. During the period of sampling, the weighted mean of the iodine content of milk was 162 μg/kg for the placebo group allowing a daily milk iodine excretion of 4.0 mg/d/cow.

The iodine concentrations of milk from the iodophor-dipped cow were 33 to 54 μg/kg of milk higher than those from teat shield dipped cows (P<0.01, table 1). The iodine concentrations in milk from morning milkings were higher than those from evening milkings for both groups of cows (P<0.01, table 1). The iodine concentrations of milk were not affected by discarding the first 3 sprays of milk from each quarter (table 1). However, for iodophor-dipped cows, the ratio of iodine content of total milk/iodine content of the first sprays of milk ranged between 1.08 to 8.27. The iodine content of the first three sprays of milk was significantly higher than the iodine content of the total milk (table 2).

**Discussion**

The amount of iodine excreted in milk is independent of the volume of milk (Miller *et al* 1975). The dilution of iodine by milk is probably the reason for the differences which have been recorded between iodine concentrations in morning milk and evening milk. As might be expected from the animal assignment, any difference in milk yield have been recorded between the two cows groups. Thus, the iodine concentration of milk from both groups of cows could be compared.

The total iodine excreted via milk was equal to 34 % of the total daily iodine intake, ie 12 mg I/cow. This result is three times higher than those reported by many authors in experiments involving daily radioactive iodide doses as tracers (Miller *et al* 1964, 1965, Moss *et al* 1972, Miller and Swan-son 1973). Apart from the discrepancies between the different methods, these conflicting results are probably due to different dietary iodine levels. As a matter of fact, with an ovine model, it has been shown that the ratio of milk iodine/plasma inorganic iodine increased with the dietary iodine intake, from an height limit level onward (unpublished results).

The 5 000 mg avl/l concentration has been used because it is the most common formula dealt out in France. The effect of iodophor post milking teat-dipping on iodine content is largely affected by premilking practice (Sheldrake *et al* 1980b, Galton *et al* 1984). However, the slight but significant increase of iodine concentration of milk that we have recorded is in agreement with the results of Dunsmore *et al* (1977) using a teat dip with the same concentration. On the other hand, these data are conflicting with those of Sheldrake *et al* (1980) and Iwarsson and Ekman (1974).

**Table 1. – Effects of discarding the first jets of milk from each quarter on iodine content of milk after post milking iodophor teat-dipping.**

<table>
<thead>
<tr>
<th></th>
<th>Iodophor dipped cows (b)</th>
<th>Test shield dipped cows (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morning</td>
<td>Evening</td>
</tr>
<tr>
<td>Total milk</td>
<td>200 ± 35 (ac)</td>
<td>237 ± 41 (b)</td>
</tr>
<tr>
<td>Total milk without the 3 first jets</td>
<td>188 ± 38 (ac)</td>
<td>244 ± 49 (b)</td>
</tr>
</tbody>
</table>

a: Values are expressed as mean ± SD. Means with different letters are statistically different to 1 % risk (t test and t paired data test)
b: number of samples for each mean (iodophor dipped cows): 16
c: number of samples for each mean (teat shield dipped cows): 14

The iodine concentrations of milk were determined after alkaline ashing by the reaction of Sandell and Kolthoff (1937) according to the method of Aumont (1982).
In this experiment, the direct skin iodine residue seemed to be the major source of contamination because the udders were washed before milking. Small amounts of iodophor solution persisted for 12 hours in the teat canal. The first three jets of milk from each quarter represented only 30 ml of volume. From the data on the iodine content of the first sprays of milk, the persistent residue in the teat canal cannot be considered as the major source of iodine contaminations of milk. This experiment confirms the results of Unsi-Rauva et al. (1974) and Conrad and Hemken (1978) who have shown that the transfer of iodine from the teat skin to the blood or the milk could be the origin of iodine residue in milk. Thus, discarding the first sprays of milk does not significantly change the amount of iodine residue in milk. Cleaning the udder before milking is the best way of decreasing the level of iodine contaminations in milk after a post milking teat-dipping with an iodophor as it was shown by Sheldrake et al. (1980b).

In France, the iodine contents of the greater part of dairy raw milks are markedly below the 500 µg I/kg (Aumont et al. 1987), the upper limit which cannot be exceeded for safe and wholesome dairy products. Thus a proper use of iodophors for post milking teat-dipping cannot be a threat to public health.

Abstract

When udders were washed before milking, a post milking teat-dipping with a 5 000 mg available iodine/I iodophor induced an iodine residue of 33 to 54 µg I/kg in milk. The iodine contents of the first jets of milk were 1.08 to 8.27 times higher than those of average milk. However, the bulk of iodine residues in milk seemed to be an iodine transfer across teat skin to milk. From these data, iodophor teat-dipping cannot be considered as a threat for public health in France.

References


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