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Heating in Pasteurization Process Reduce Milk Iodine Concentration

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Abstract: In study that was conducted for investigation of relationships between iodine intake by lactating Holstein cows and iodine concentrations in milk, 6 Holstein dairy cows with the average live body weight of 652±43 and daily milk yield of 32.9±2.4 kg allocated to 4 treatments in a complete randomized design with 4 replications to evaluate the effect of heating in pasteurization process on milk iodine content. The treatments were basal diet (without Potassium Iodide) as the control diet, 2, 3 and 4, the basal diet plus 2.5, 5 and 7.5 mg kg^{-1} diet DM Potassium Iodide, respectively. Iodine contents in raw and pasteurized milk were significantly ($p<0.01$) affected by the iodine supplementation. Pasteurization of milk by HTST method result in average decrease of iodine 27.15±7.13%. The amounts of iodine were 142.61, 430.86, 545.43, 593.32 and 67.43, 306.94, 367.56, 466.88 μg L^{-1} for raw and pasteurized milk and different treatments, respectivley. High amount of iodine in free form in milk cause to decrease of iodine content after heating in pasteurization process.

Key words: Iodine, heating, pasteurization process, dairy cow milk

INTRODUCTION

Adequate dietary iodine intake is essential for the production of thyroid hormones. Milk has become a major source of dietary iodine for humans. Iodine content of milk has been investigated extensively (Alderman and Suanks, 1967; Berg *et al*., 1988; Bruhn and Franke, 1985; Conrad and Hemken, 1978; Hemken *et al*., 1972) but relatively little definitive information on the effect of heat proceessing on iodine content in milk is available (Magee and Glennie, 1928). Therefore, this study was conducted for determination of the effect of heating during pasteurization process of milk on iodine concentration.

MATERIALS AND METHODS

This research is a part of study that was conducted in Ferowsi University of Mashhad, Iran for survay of relationship between of iodine content in diet and milk. In this study 16 Holstein cows, with an average daily milk yield of 32.9±2.4 kg and 189±27 days in milk, were assigned to 4 treatments in a completely randomized design. The experimental diets were the control, the control diet plus 2.5, 5 and 7.5 mg Potassium Iodide kg^{-1} diet DM. The experiment lasted after 8 weeks. Diets were formulated accordance to NRC 2001 recommendations. The content of iodine in basal diet was 0.534 mg kg^{-1} DM and other treatments included basal diet plus different levels of iodine supplementation (Table 1). The iodine content of raw and pasteurized milk was determined. In the end of any week, 10 mL of samples saved in 4°C until send to laboratory. Milk pasteurized by HTST (High Temperature, Short Time) method. Iodine content determined after acid digestion with use of Sandell-Kolthoff reactions (Endocrine Research Center, Shaheed Beheshti University of Medical Sciences, Tehran, Iran). Data were statistically analyzed by repeated measurement procedure with mixed model of SAS software.

Table 1: Treatments and iodine content of experimental diets

	Diets			
Content	Control	2	3	4
Iodine Supplement* (mg kg^{-1} DM)	0.000	2.500	5.000	7.500
Diet Iodine** (mg kg^{-1} DM)	0.534	3.034	5.534	8.034

*Iodine Supplement was Potassium Iodide; **The iodine content of each diet was including iodine Diet, Water and Iodine supplementation

RESULTS AND DISCUSSION

Milk iodine affect by treatment significantly ($p<0.01$) and increased (Table 2). Milk is an important way for

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Table 2: Least square mean of iodine concentration raw and pasteurized milk

	Diet					Effect	
Item	1	2	3	4	SEM	Diet	Period
Raw milk iodine (μg L^{-1})	142.61[a]	430.86[b]	545.43[c]	593.32[c]	15.38	<0.01	<0.01
Pasteurized milk Iodine (μgL^{-1})	67.43[a]	306.94[b]	367.56[b]	466.88[c]	26.47	<0.01	<0.01

excretion of additive iodine in body and increase of iodine intake cause to increase in excretion via milk. Results of 17 studies with radioisotope iodine were shown that the excretion ratio of iodine via milk is 8-12% of iodine intake (Swanson *et al*., 1990). Decrease of iodine content in all treatments after pasteurization were significant ($p<0.01$). Average decrease of iodine after pasteurization was 27.15±7.13% (Table 2 and Fig. 1).

Magee and Glennie (1928) found 20 and 26% decrease of iodine content of milk in pasteurization and boil point, respectively.

The reason of decrease of iodine concentration after heat processing is sublimation characteristic of iodine element. Iodine in milk includes tow forms, Protein Binding Iodine (PBI) and free. Magee and Glennie (1928) reported that free form of iodine in milk is 83%. High amount of iodine in free form in milk cause to decrease of iodine content after heating.

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