SURVEY OF TRACE METALS IN TURKISH KES CHEESE

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ABSTRACT

Kes cheese, a traditional Turkish dairy product, is commonly made around Ordu, Giresun and other cities in Blacksea region of Turkey. The different heavy metals were determined in commercial Turkish Kes cheese by Flame Atomic Absorption Spectrometer (FAAS). The concentration ranges in the samples were determined to be 4.30-37.30, 7.10-22.30, 5.90-47.80, 0.23-1.92, 0.04-0.75, 0.03-0.26, 0.04-0.44 and 2.31-7.25 μg/g, dry weight for zinc, iron, cupper, manganese, lead, cadmium, cobalt and chromium, respectively. The results were compared with those reported in recent years. The metal levels were compared with previous data for different cheeses. Fe, Cu and Cr mean concentrations were found to be higher. The overall mean concentrations of Zn, Mn, Pb, Cd and Co levels were in agreement with the values of other cheeses.

Keywords: Turkish Kes cheese, trace metal, food pollution, FAAS.

INTRODUCTION

Kes cheese, a traditional Turkish dairy product, is commonly made around Ordu and other cities in Blacksea region of Turkey. In some regions, Kes cheese is known as kurut. A close relative of çökelek is kurut, dried bricks of yoghurt made of low-fat milk or of Kes cheese made from buttermilk. Since it has a lower fat content it keeps well. Some of the best known regional varieties are the kurut of Kars and Bitlis, the sürk cheese of Hatay, the Kes of Mengen, Giresun, Ordu and the dried çökelek of Aydın. Traditional producing method has been modified, but generally cow's milk is used in production and in the case of sheep or buffalo's milk being available, these milks mixed with cow's milk are used. Production is carried out in summer months /1/. For production of Kes cheese, milk is firstly filtered through a cheese-cloth prior to heat treatment to remove unwanted materials. After clarification, it is cooled to 40-45°C and inoculated with yoghurt culture (2–3 %). The inoculated milk is filled into big containers and incubated. The yoghurt is then churned into the butter and Ayran (buttermilk). Ayran is heated to 90–100 °C for about 10 min until a white coagulum floats on the surface; the curd is transferred into a cheese cloth and some weight is placed on it to drain water off until the desired solids level is reached. The curd is salted 2-3 % with dry salt and filled into cotton bags. The bags are hung up in a warm room for 2-3 days. The bags are occasionally turned over for homogeneous dryness. The cheeses reach up to 60 to 70 % total solids content after being stored in a cool place for 4-5 months, and can then be marketed. Kes cheese is commonly produced in small family businesses for their needs and also by small dairy processing plants for commercial purposes. In recent years, 20-30 % white cheese curd has been added to the curd of Kes cheese in order to make the product more attractive, resulting in a mosaic-like structure in the final product /2,3/.

Milk and milk products are important compounds of the human diet. Cheese being one of the basic dairy products is rich in protein, fat, calcium, riboflavin and other vitamins. (Yuzbasıoglu *et al.* 2003). The heavy metal content of cheese is variable due to factors such as differences between species, geographical area, characteristics of the manufacturing practices and possible contamination from the equipment during the process /4,5/. The levels of trace elements important for nutritional and/or toxicological properties, in some traditional and innovative dairy products, contribute to

the characterization of the quality and adequacy of the Turkish diet /5,6/. The heavy metals enter the human body though inhalation and ingestion. The intake via ingestion depends upon food habits. It is well established that Pb and Cd are toxic and children are more sensitive to these metals than are adults. The metals, namely Cu and Zn, are essential micro nutrients and have a variety of biochemical functions in all living organisms. While Cu and Zn are essential, they can be toxic when taken in excess; both toxicity and necessity vary from element to element /5,7/. However, researches on Kes cheese are very limited and are not determined heavy metal contents. The aim of this research was to examine some mineral and trace metals contents of Kes cheese.

MATERIALS AND METHODS

Forty one samples of Kes cheese were purchased in local markets in Ordu. The Kes cheese samples were transported to the laboratory and kept at approximately 4 °C until they were analyzed. Ash content in cheese was determined using a gravimetric method after thermal treatment (550 °C for 24 h) in a muffle furnace /8/. For determination of mineral contents, 5 g of cheese samples were ashed in a porcelain crucible, solubilized with 10 ml of 6 N HCl, quantitatively transferred into 50 ml volumetric flasks, and diluted to volume with double-deionized water and filtered after 5-6 hours with blue-band filter paper and again regulated to 50 ml /9/. Concentrations of Zn, Fe, Cu, Mn, Pb, Cd, Co and Cr mineral elements were measured by Flame Atomic Absorption Spectrometer (Unicam, 929). All the analyses were performed in duplicate and the results reported are the mean values. In this study, the statistical calculations were performed, and the obtained values are presented as mean ± standard deviation.

RESULTS AND DISCUSSION

Some mineral and trace metal levels were determined on a dry weight basis as μg/g and values of 41 Kes cheese samples are presented in Table 1. Zinc is one of the important metals for normal growth and development in human beings. Deficiency of zinc can result from inadequate dietary intake,

impaired absorption, excessive excretion or inherited defects in zinc metabolism /7/. The zinc content ranged from 4.30 μg/g to 37.30 μg/g, averaging 14.10±8.40 μg/g. These values are lower than the results reported by Gambelli *et al.* (1999), /10/, for Italian quark cheeses and by Prieto *et al.* (2000), /11/, for Picon Bejes-Tresviso cheeses, higher than the results reported by Mendil (2006), /5/, for White cheeses and similar to those reported by Orak *et al.* (2005), /12/, and Merdivan *et al.* (2004), /6/, for Turkish White cheeses (Table 2). The maximum iron content was found 22.30 μg/g, and as the minimum iron values 7.10 μg/g. The results are lower than the results reported by Park (2000), /13/, for USA herby cheeses and by Tarakci *et al.* (2005), /14/, for Van herby cheeses, higher than the results reported by Merdivan *et al.* (2004), /6/, in Turkish White cheeses (Table 2.). The copper values of the samples varied from 5.9 μg/g to 47.8 μg/g and these values are higher than those reported earlier /10,15,12,5/, (Gambelli *et al.* 1999; Kilicel *et al.* 2004; Orak *et al.* 2005; Mendil 2006). Manganese activates numerous essential enzymes. Food contains trace amounts of manganese /7/, (Divrikli *et al.* 2006). Mean manganese concentrations of the samples varied from 0.23 μg/g to 1.92 μg/g, and in the literature, low manganese concentrations have been reported /5,6,11/, (Mendil 2006; Merdivan *et al.* 2004; Pirieto *et al.* 2000).

Table 1

Trace metal concentrations in Kes cheeses (dry weight basis as μg/g).

	Zn	Fe	Cu	Mn	Pb	Cd	Co	Cr
Mean	14.10	15.70	20.00	0.81	0.25	0.12	0.15	4.00
SD (±)	8.40	4.50	11.60	0.35	0.18	0.06	0.10	1.55
Min	4.30	7.10	5.90	0.23	0.04	0.03	0.04	2.31
Max	37.30	22.30	47.80	1.92	0.75	0.26	0.44	7.25
n	41	41	41	41	41	41	41	41

SD : Standard Deviation.

n : number of samples.

Table 2

Trace metals concentrations of expressed in literatures as µg/g.

Cheese species	Zn	Fe	Cu	Mn	Pb	Cd	Co	Cr	Ref.
White cheese	15.57±5.24	3.61±2.16	0.62±0.25	---	0.41±0.15	0.12±0.04	0.47±0.16	0.13±0.06	Orak *et al*. 2005
White cheese	12.63±0.75	1.98±0.30	0 430.13±	0.052±0 03	---	---	0 02±0 05	0 58±0.03	Merdivan *et al* 2004
Tokat cheese	11.9±1.2	5.9±0.4	0.11±0.01	0.28±0.03	0.61±0.05	---	---	0.16±0.01	Mendıl, 2006
Van herby cheese	31.93±5.68	46.07±7.86	5.95±0.85	2.18±0.69	---	0 22±0.11	0.29±0.18	0.23±0.17	Tarakci *et al*. 2005
Herby for cheese	29.19±3.45	74.77±13.5	8.18±1.32	6.93±0.83	---	0 20±0 08	0 29±0.13	0.25±0.15	Kilicel *et al*.. 2004

Table 2, continued ...

White cheese	---	---	---	---	0.26±0.51	0.02±0.17	---	---	Demirozu-Erdinc and Saldamlı 2000
Italian Ricotta cheese	33.7-51.8	0.8-2.1	---	---	---	---	0.002-0.008	0.014-0.065	Gambelli *et al.* 1999
Picon Bejes-Tresviso cheese	58.6±19.2	2.0±0.4	1.20±0.60	0.20±0.04	---	---	---	---	Prieto *et al.* 2000
Kasar cheese	26.5-63.0	1.0-14.1	0.3-1.6	--	0.01-0.421	0.0003-0.0083	--	---	Yuzbası *et al.* 2003
USA herby cheese	7.75±2.33	17.70±10.3	6.68±1.86	1.05±0.32	---	---	---	---	Park 2000

Lead, being a serious cumulative body poison, enters into the body system through air, water and food, and cannot be removed by washing the fruits and vegetables /7/ (Divrikli *et al.* 2006). The average lead concentration was found between 0.04–0.75 μg/g in Kes cheeses. These values are lower than in the literature /12,5/, (Orak *et al.*, 2005; Mendil, 2006) for Turkish White cheeses and were similar to those reported earlier /16/, (Demirozu-Erdinc and Saldamli, 2000) for White cheeses (Table 2). Cadmium is a nonessential element in foods and natural waters, and is accumulated principally in the kidneys and liver. Cadmium in foods is mostly derived from various sources of environmental contamination /7/, (Divrikli *et al.* 2006). The cadmium levels in Kes cheeses are between 0.03-0.26 μg/g, these values are similar to results found by Orak *et al.* (2005), /12/, lower than values determined by Demirozu-Erdinc and Saldamli (2000), /16/. According to the results on levels of Pb and Cd in cow milk /16,12/, (Demirozu-Erdic and Saldamli, 2000; Orak *et al.* 2005), a portion of the lead cadmium must have come from sources other than milk. The sources of high levels of Pb and Cd are likely to be the transferred from the tin can and salt used in the brine /12/, (Orak *et al.* 2005). The FAO/WHO has set a limit for heavy metal intakes based on body weight. For an average adult (60 kg body weight), the provisional tolerable daily intakes (PTDI) for lead, iron, copper and zinc are 214 μg, 48 mg, 3 mg and 60 mg, respectively /17,4,5/ (FAO/WHO, 1999; Yuzbasi *et al.*, 2003; Mendil, 2006).

Cobalt and chromium contents were reported to be 0.04–0.44 and 2.31–7.25 μg/g, respectively. These values are higher than those reported by Gambelli *et al.* (1999), /10/, in Italian Stirred curd cheeses. The manganese contents of cheese samples were between 0.23 and 1.92 μg/g. Our results were higher than those reported by Merdivan *et al.* (2004) /6/, for White cheeses and by Prieto *et al.* (1999), /11/, in Picon Bejes-Tresviso cheeses. The values of cadmium in samples were found to be minimum and maximum value, 0.03 and 0.26, respectively. These values are in agreement with reported data from other researches /16,15,12/, (Demirozu-Erdinc and Saldamli, 2000; Kilicel *et al.* 2004; Orak *et al.* 2005). Mn and Cr are recognized as essential trace elements for humans, and several of their metabolic roles have been determined. These include Mn-containing enzyme systems and Cr involvement in insulin function. However, for neither of the elements have human requirements or levels of absorption from the diet been clearly determined /18,5/ (Tinggi *et al.*, 1997; Mendil, 2006). Chromium is

used mainly in the production of stainless steel materials. Release from stainless steel vessels seems to be the main sours of contamination /19,12/, (alberti-fidanza *et al.* 2002; Orak *et al.* 2005).

CONCLUSION

The results of the present study indicated differences among the trace metal contents of Turkish traditional commercial Kes cheese samples. This milk product is an important source of animal protein, vitamins, minerals and essential fatty acids for humans in Turkey. In order to evaluate the convenience of including foods in diets, metal levels of cheese samples can be useful as nutritional guidance. Also the values in the present work for the levels of the traces metal ions in the cheese samples from Turkey could help in the cheese composition tables for Turkish people.

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