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IODINE IN MILK IN MACEDONIA

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A b s t r a c t: Iodine content in cow milk (n = 190), sheep milk (n = 22) and goat milk (n = 15) is between 2–3 microg/dl which is 2–3 times lower than Swedish or British milk. Breast milk, 2–3 microg/dl and iodopenic water in addition to unstable iodine supply of less than 10 mgKI/Kg NaCl by the principal dietary supplement iodinized salt are insufficient iodine contributors. The diet of newborns consisting of milk and milk preparations has a low iodine content, which in turn is important for the development of newborns and infants. These levels are below the provisions of the joint expert committee on food additives which are part of the Macedonian regulations.

Key words: iodine in milk, iodine deficiency, newborns.

The intake of iodine in Macedonia is entirely dependent on the iodine content of food. The water sources are iodopenic according to the evaluation 1970–1978 by Tošev at al. (1) of 2003 water sources in Macedonia. The federal law implemented in 1956 made 10 mgr KI/Kg NaCl compulsory for human and animal feed. This caused during this 3–4 decades a substantial decrease of endemic goiter but did not eradicate it (2). The diet of newborns in this area is changing from intensive and prolonged breast milk feeding to the gradual introduction of cow milk and formula preparations for at least the first half of the infant's diet, to a substantial part of the second half of the first year. Milk and milk products contributed approximatively one third of iodine intake according to british surveys (3). We suppose that our newborns are even more dependent on the iodine supply in milk and milk products. The iodine content of untreated cow milk collected from all 34 communities (until 1967 the whole area was divided in 7 regions) are presented in this paper.

Methods

1. Collection of milk samples

Samples were collected from all communal-owned dairies in 34 communities of Macedonia (90 samples) and from 76 private (individual producers of milk) in nearly all regions of Macedonia. Whole milk was taken in plastic sterile probes (4–8 ml) well stopped and transported to the cold room of the laboratory until iodine was tested at the department of chemistry at the University "Cyril & Metodius" in Skopje.

The samples were taken from dairies in Kumanovo, Sveti Nikole, Skopje, Debar, Ohrid, Struga, Bitola, Gevgelija, Valandovo, Štip, Kočani, Pehčevo, Berovo, Delčevo, Titov Veles, Tetovo, Gostivar.

Samples of whole milk were taken from sheep, and goat milk.

2. Iodine determination

Prepared samples were wet-ashed according to the method recommended by WHO consisting of destruction of all organic substances. Milk is digested in strong acid. Catalytic action on the reduction of ceric ion (Ce^{3+}) was coupled to the oxidation of arsenit (As^{3+} to $As^{5+}4$).

Results

1. Table 1. Fig. 1. The average iodine content during the sampling period (January 1996 – June 1996) was low (2.63 microg/dl) with individual levels varying from 0.1–23. Number of samples was 190. A substantial difference was observed between few samples of milk from Greece, Novi Sad (Vojvodina in Yugoslavia – a iodine sufficient region in the north-east, once in the neogen period belonging to the sea-bottom with maritime sediments, relatively rich in iodine), some samples of milk belonging to the United States armed forces stationed in Europe. The milk specimens of Slovenia, Serbia (south of the Danube river), Croatia as seen in the Table 2 were also iodine poor.

Specimens of goat milk (n = 15) and sheep milk (n = 22) for consumation as sour milk and cheese as seen in Figure 2, 3 are almost free of iodine.

Table 1 – Табела 1

Iodine (I) microg/dl in MILK

Milk	Number	Mean	Minimum	Maximum	STD Deviation	Mediana
Cow	190	2.60	0.1	23.0	4.300	2.10
Sheep	22	1.87	1.1	3.6	0.723	1.25
Goat	15	0.57	0.0	5.5	1.350	0.00

Table 2 – Табела 2

Imported milk in Macedonia 1995/96
(whole milk microg/dl Г)

Slovenia	0.4
Tetrapak Slovenia	5.2
Tetrapak Belo Zlato	1.1
Tetrapak Subotica	4.8
Tetrapak Olmi	3.1
Tetrapak Belgrade	1.3
Zaečar Mlekara	0.6
PKB Belgrade	1.2
Croatia (Slavonia)	2.9
NOVI SAD	*13.0*
U.S.A. (UNPROFOR)	*14.5*
U.S.A. (UNPROFOR)	*11.1*
Poland	0.6
Poland	5.2
GREECE	*17.5*

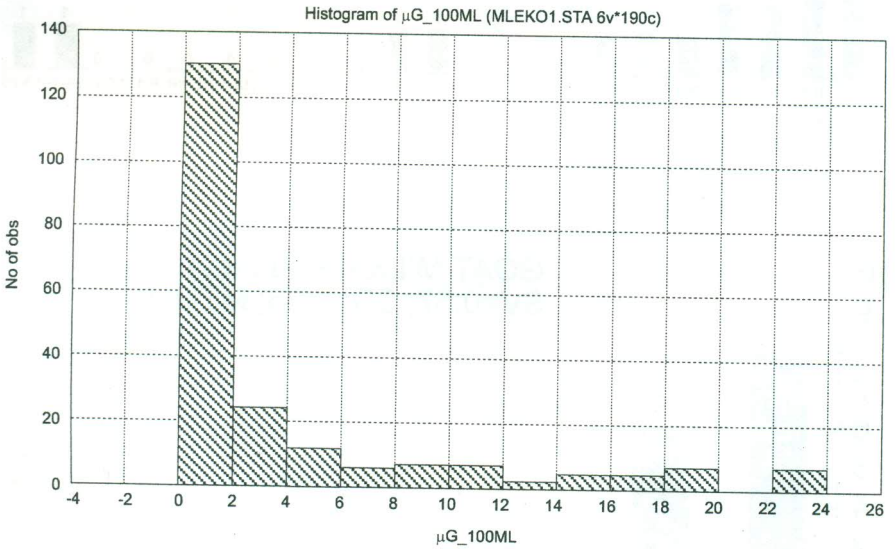

Figure 1

2. Formula imported and consumed in Macedonia in the last 5 years (during the civil war in former Yugoslavia) for newborns contains small quantities of iodine as seen in Table 3. For comparison at the bottom of this Table 3 (III) German formula data published by Heidemann et al. (5) in collaboration with Kinderklinik Berlin, Zu-

rich, Rotenburg, Helsinki Hospital, Oldenburg, Rensburg are presented. German babies in the Federal Republic of Germany have a "low iodine supply during the neonatal period, milk and artificial milk preparations have a low iodine content" (5) a similar situation as the newborns in Macedonia.

The newborns in Macedonia have an insufficient iodine supply by natural milk and imported artificial (formula) milk preparations as seen in Table 3.

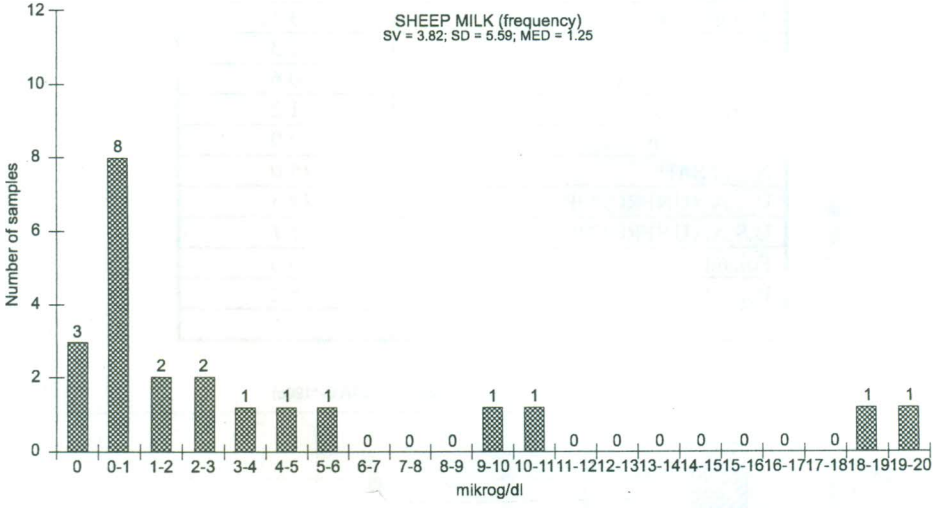

Figure 2

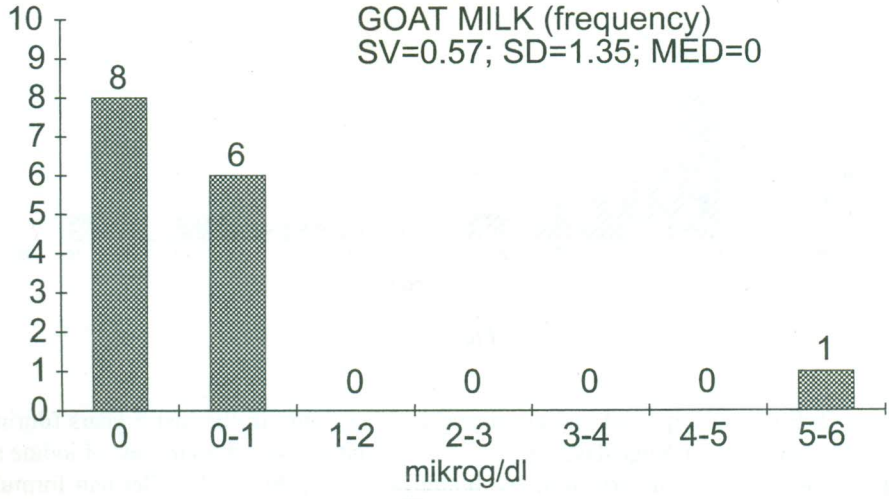

Figure 3

Table 3 – Табела 3

FORMULA MILK – IODINE content of milk samples
IODINE CONTENT microg/dl

Sample	Mean
I. Products from former Yugoslavia	
Spyal	1.3
Nutrilon	1.5
Bambax	3.8
LIMO-SOYA I, II, III, IV, V	0.6, 0.16, 0.7, 0.7, 0.1
II. MILK POWDER consumed in Macedonia (Γ microg/g powder)	
NIDO	1.1
Bulgarian	2.2
German	3.6
German	2.1
UKRAINA	1.8
Customs	1.6
Customs	1.0
ENSULAC (Holland)	3.0
HUMANA Zagreb	2.0
HUMANA I Zagreb	1.25
Fullcream, Holland	1.55
Babelac I	1.5
III. German formula milk (DMW, 1984 microg Γ/dl (5)	
DMW-report-HUMANA-0	3.5
Pre-APTAMIL	1.88
HIPPON I and II	4.2, 6.5
HUMANA II	1.75
HUMANA-SONANA	1.35
HUMANA-Heilnahrung	1.35
NESTLE-Beba	2.25

Discussion

Deficiency of iodine in water sources in Macedonia (1) and unsatisfactory iodine supplementation through iodinized salt is about 50% under the mark of 10 mgr KI/Kg NaCl, prescribed by law in this area as seen in the Table 4 of Dr. L. Kolevska and coworkers, (6) expose newborns to iodine deficiency. The supplementation of iodine with milk and milk products is necessary. According to Lamberg, Haikonnen, Käkelä and Jukkara 1982 (8) the population of Finland up to 70–80% has an iodine supply of 250–300 microgr. through milk and dairy products.

Table 4 – Табела 4

Situation of Salt Iodization in Republic of Macedonia

Salt Iodization Analysis in the period 1992–1996

Year	Total samples	<5mgKJ/kg (%)	5.1–10mgKJ/kg (%)	10.1–25mgKJ/kg (%)	>25mgKJ/kg (%)
1992	383	51.8	29.4	15.8	2.86
1993	457	36.5	16.8	43.4	3.28
1994	780	7.17	41.9	47.7	3.20
1995	329	20.9	46.2	30.1	2.70
1996	340	14.1	37.6	45.6	2.35

Results from iodine determination in salt samples during 1993

	Imported from	Total samples	Iodine (mg/kg) <10	%	10–20	%	>20	%
1.	Bulgaria	225	145	64.4	62	27.5	18	3.5
2.	Greece	83	39	46.9	36	43.3	8	9.6
3.	Romania	22	9	40.9	13	59.0	–	–
4.	Albania	18	11	61.1	5	5.5	2	11.1
5.	Yugoslavia	18	11	61.1	7	38.8	–	–
6.	Austria	30	7	23.3	12	40.0	1	3.3
7.	Czech Republic	3	1	33.3	2	66.6	–	–
8.	Turkey	9	6	66.6	3	33.3	–	–
9.	Italy	2	–	–	2	100.0	–	–
10.	Russia	36	14	38.8	22	61.1	–	–
11.	Germany	2	–	–	2	100.0	–	–
12.	Iran	3	–	–	1	33.3	2	66.6
13.	Netherlands	5	–	–	5	100.0	–	–
14.	Moldavia	1	1	100.0	–	–	–	–
	TOTAL	**457**	**244**	**53.4**	**172**	**37.6**	**31**	**6.7**

Iodine in breast milk in 20 mothers we found to be 2.1. mcrg/dl (8) whereas in the milk-pool in Stockholm the concentration is 6.5.–7 microg/dl.(5). Daily iodine intake of newborns should be 25–40 microg/day. The iodine content of breast milk and cow milk can hardly meet the iodine requirements of our newborns.

The results shown in Table 1 and Figure 1, 2 and 3 suggest that iodine levels in our region are low, that not only cow milk, but sheep and goats have the same levels. The levels in milk found in this study are lower than those in English towns 19 microg/dl in winter, 11 microg in summer (9).

Iodine is an essential element in the diet of dairy cattle, it is added to manufactured animal feed. It is provided in the Macedonian prescription as an optimum of 0.0038%/Kg premixes, about 38 mg/kg close to the British maximum of 40 mg in complete feed for dairy cattle. Feed consumed by animals varies within the herd, within the farm, with facilities for crystal salt containing iodine on average of about 3.8 mgr/kg NaCl. According to our expert Prof. Dr. Šokarevski (11) the feeding of cattle varies very much, proportion of pasture feeding to supplemental feeding has regional variation of unpredictable size. Total diet studies of the Nutritional Survey of British adults reports milk and milk products contributed about one third of iodine intake (3). The Canadians have a high intake of iodine in total diet (1046 microg) daily, over six times the recommended minimum of 160 microg/day, in addition to iodized salt the second most important source, which provided 239 microg/day was dairy products (10). Current iodine intakes estimated roughly by excretion of iodine in urine (Tadžer et al. 12) are not important. However there are certain sectors of the population that have relatively low intakes: pregnant women, infants and newborns because they are high consumers of milk.

Milk from all producers in Macedonia – private and collective farms – is iodine deficient. Sheep milk and goat milk have also low levels of iodine. Certain sectors of the population (newborns, infants and pregnant women) have a relatively higher intake of milk and are potentialy at risk and may have low dietary intakes of iodine.

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Резиме

ЈОД ВО МЛЕКОТО ВО МАКЕДОНИЈА

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Во 1996 г. е испитан јод во млекото од сите 34 општини во Македонија. Примероци се земени од комуналните млекари и од приватните производители. Вкупно се испитани 190 примероци од кравјо млеко, 22 од овчо млеко и 15 од козјо млеко. Јодните вредности се 2,1 microg/dl, што е пониско од прифатените норми, кои изнесуваат повеќе од 9 microg/dl. Исхраната на новородените е загрозена од јодопенија не само поради ниското ниво на јодот во млекото туку и поради дефицитот на јод во формула-препаратите на млеко од увозно потекло. Јодниот дефицит во млекото го наоѓаме и во примероци од Словенија, Хрватска, Србија. Нормално ниво на јод се најде во млекото од Грција, млекото од UNPROFOR (U.S.A.) и млекото од Нови Сад (делови на Војводина се јодосуфициентни). Имајќи предвид дека водите во Македонија се сиромашни со јод и дека увезената сол ги нема дури во околу 50% пропишаните 10 mgr KI/Kg NaCl, се налагаат некои мерки, како од медицинската така и од ветеринарната служба.

Клучни зборови: јод во млеко, јод во исхрана, дефицит на јод.

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