

CALCULATED IODINE INTAKE BY BREAD CONSUMED IN THE POPULATION OF MACEDONIA

Isak S. Tadžer¹, Bogdan Bogdanov², Mihail Gonev³

¹ *Macedonian Academy of Sciences and Arts – Skopje*

² *Institute of Chemistry, Faculty of Natural and Mathematical Sciences – Skopje*

³ *Republic Sanitary Inspection Service – Skopje*

A b s t r a c t: The compulsory iodination of salt (10 mgKI/kg NaCl) in Macedonia since 1956 is still not entirely effective in goiter prophylaxis. Additional iodine supplementation also occurs with bread. It is here a nutritional item of 300–500 g/daily per capita. Specimens collected from all bakeries of the centralized type in the whole of Macedonia presented very low content of iodine – 20 microg I per kg bread. Dutch bakeries use special bread salt 60–65 mg KI/kg bread which improves the total intake of iodine.

Key words: iodine in bread, iodine.

Iodine diet is insufficient in Macedonia established by indirect parameters: I in urine of new-borns and pregnant women less than 8 mcrg/dl, palpable thyroid in about 10% schoolchildren, low level of iodine in mother's breast milk, in cows, sheep and goats, very low iodine level in formulae milk of all brands. The experience of the Dutch Surveillance Authority for Goiter introducing special bread salt (60–65 mg KI/kg NaCl) for bread baking and on the other hand, the favorable clinical trial on population groups by Russian nutritionists and endocrinologists with iodine supplementation of bread (500–600 mcrg I/kg bread) seems to be attractive in increasing the iodine diet in iodine deficient regions thus avoiding an inconvenient brutal iodization through other procedures.

Macedonia is a well-known goitrous area in the middle of the Balkan Peninsula. Preventive measures taken by the previous federal authority consisted of compulsory iodination of salt for human and animal feed since 1956 (10 mg KI/kg salt). It was concluded however that the goiter prophylaxis is still not entirely effective. To estimate the effect of this prophylactic measure on the intake of iodine among the population, a survey was carried out of foodstuffs water, milk, eggs (1, 2). Bread is in our population the cheapest dietary item, a very important nutritional product. In some population groups it covers the principal caloric and nutritional minimum. In this paper we report on iodine content in bread produced in urban centrally located bakeries. Bread is an important ingredient of our daily diet.

Data collection and method

1. Iodine supplementation consists using government imported salt 20 g/kg bread. The KI component according to the law is 10 mgKI/kg NaCl. The survey of the Department of Nutrition of the Institute of Health Protection of Macedonia publishes yearly data on iodine constituent in samples of salt collected by the inspectors (3). Almost 45% of all investigated samples contain less than 5 mgKI/kg NaCl.

2. Dosage of iodine in bread: prepared samples were dry ashed at 600°C in presence of ZnSO₄, K₂CO₃. The residue was dissolved in water for subsequent photometric measurement based on Cerium-Arsen reaction (Intern. Council of IDD, WHO and UNESCO measurement of Iodine manual, Geneve, Suisse). The average recovery rate was near 100%. Analyses were performed at the laboratory of organic chemistry at the Institute of Chemistry, Faculty of Natural and Mathematical Sciences, at the University "St. Cyril & Methodius", Skopje, Macedonia. The validity of results was previously confirmed using reference materials and cross testing from the University Center Virginia (USA) Medical Center, Charlottesville.

Results

Iodine content in bread (I mcrg) expressed per kilogram is presented in table 1. Average values are 20.8–3.7 (I mcrg), median is 10.228 (I mcrg) per kg bread in a total of 48 samples. Dutch contains 20 mcrg per slice, about 600 microg per kg bread. The proportion is roughly 1 : 20–30. Dutch bread salt contains 46–60 mg KI/kg NaCl whereas Macedonian bread content of KI is 10 mg

Table 1

On the left site iodine (I) micrg/kg BREAD in 50 items collected in whole Macedonia's urban centralized BACKERIES. On the right site the results of same specimens without item 14 and 15 probably contaminated with iodine.

	COLUMN I (n = 50)	COLUMN II (n = 48)
Mean I kg/bread	30.5	21.18
Standard Error	7.4	3.21
MEDIAN micrg/kg/bread	10.28	10.28

33.16	33.16
50.29	50.29
22.88	22.88
0	0
53.7	53.7
22.8	22.8
33.16	33.16
2	2
0.8	0.8
8.15	8.15
2	2
8.15	8.15
72.85	72.85
197.73	10.228
217.82	28.369
10.228	10.228
28.369	0.104
10.228	10.228
0.104	19.551
10.228	10.228
19.551	0
10.228	19.551
0	10.228
19.551	28.369
10.228	0.104
28.369	10.228
0.104	19.551
10.228	83.433
19.551	10.228
83.433	0.104
10.228	90.715
0.104	10.228
90.715	36.836
10.228	0.104
36.836	19.551
0.104	28.369
19.551	28.369
28.369	10.228
28.369	
10.228	

KI/kg NaCl (4). The Macedonian additive for table salt is 10 KI/kg NaCl (the same as bread baking salt), whereas the Dutch Nutrition Surveillance System provides 23–29 mg KI/kg NaCl. Dutch bread salt and Dutch table salt are different in iodine content, a proportion 2 : 1, six times more than Macedonian bread salt which is really table salt.

The consumption of bread in Macedonia according to the Central Bureau of Statistics of Republic Macedonia is 0.31 kg per capita daily, in urban conditions 0.33 kg/day (annual reports of the official agency of Macedonia, page 559/1994 and page 555/1992 Consumption of articles of Population). The Dutch consumption of bread per capita is twice lower than the Macedonian 0.149–0.058 bread/day, female bread consumption is lower 0.107–0.047 kg/day (5).

Discussion

Data related to bread consumption in Macedonia, now estimated around 310–350 g/day about 8–10 slices with many inhabitants now eating less (children, elderly urban inhabitants, well-to-do middle class and upper class residents), the factual iodine intake from drinking water (almost under 5 microg/L) (6) and other foodstuffs (milk less than 5 microg/L), salt (50% under the licensed 10 mgKI/kg mark), all indicate that struma prophylaxis has long been falling short of standards set by the recommendation of the WHO level of iodine requirement per adult per day 100 mcrg, the optimum level between 150–300 microg per person per day (5). Bread iodine (7) in Brouc contains 9.5 mcrg/slice (316 mcrg/kg), about 15 times more than our bread. Caplan R. H. et al. (8) found in Minnesota 02–26.7 mcrg per slice (1.9–700 mcrg per kg bread). Marked bread contains 150 mcrg/per slice (4995 mcrg/kg per kg bread). Daily bread allowance consisting of four slices plus 2 rolls furnishes five times the recommended optimum in iodine (8). Gerasimov and co-workers (9) in “Russia and Other Newly Independent States” stated recently that by tradition practically all meals are eaten with bread. The average bread consumption is more or less as in Macedonia 350 g per person/daily (121 kg per capita/year). In a clinical trial (9) they investigated the feasibility of bread iodization to reach the final level of 500–600 mcrg KI/kg bread and to study the effects of iodized bread on target groups. They found that iodized bread (according their preparation) intake of 300–500 g daily “within three months normalizes iodine intake”. They found considerable improvement even in children receiving only 100 g iodized bread per day (9). Gerasimov and his group (9) recommend iodization of bread using their method as a model for implementation in regions with an established infrastructure centralized of bread production and mild or moderate io-

9. Gerasimov G. et al. (1997). *Bread Iodization for Iodine Deficiency Regions of Russia*. IDD Newsletter (Charlottesville, USA), 13: 1: 12–13.

10. Hostalek-Merck K. G. A. Darmstadt Deutschland – personal letter to prof. Tadžer (co-author of this article).

11. Lee M. Susan et al. (1994). *Iodine in British foods and diets*. British Journal of Nutrition 72: 435–436.

Резиме

ВНЕСУВАЊЕ НА ЈОД ПРЕКУ ЛЕБОТ ВО ИСХРАНАТА НА ЖИТЕЛИТЕ НА МАКЕДОНИЈА

Исак С. Таџер¹, Богдан Богданов², Михаил Гонев³

¹ Македонска академија на науките и уметностите – Скопје

² Институт за хемија, Природно-математички факултет – Скопје

³ Републичка санитарна инспекција – Скопје

Испитана е количината на јод во народниот леб кој се консумира во Македонија. Примероци се земени од сите делови на Република Македонија (60 примероци). Јодот е одредуван со методот на суво претворање во пепел на 600°C, со субсеквентно применување на класичната постапка на Арсен-Гериумскиот метод на Светската здравствена организација. За компарација се користени и стандарди од центарот за изучување на јоден дефицит (IDD – Charlottesville, VA, School of Medicine, USA).

Установена е мошне ниска содржина на јод во сите лебни примероци, со средна вредност од 20 μg на kg леб. Лебот во Германија, Велика Британија и Русија има слични ниски вредности на јод. Во Холандија лебот се меси со специјална сол збогатена со јод (60–65 mg) според уредбата на централната контролна санитарна служба (GESONDHEIDSTAAD, Health Council of Netherlands, Postbus 1236, 2280 CE Rijswijk). Сегашната количина на јод во солта што се користи во холандските фурни за подготовка на леб изнесува 60–65 mg KI/kg NaCl, за разлика од солта што се користи во македонските фурни која содржи 10 mg KI/kg NaCl. Конзумацијата на леб во Македонија изнесува околу 350 g/жител дневно. Во Холандија оваа бројка е 120 g/жител дневно. Лебот во САД содржи дваесет до сто пати повеќе јод поради посебната технологија со квасец сатуриран со јод за да се зачува лебот свеж десетина дена. Оние земји што не го јодираат лебот посебно, го достигнуваат јодниот минимум од 100 μg дневно, оптимално 150–300 μg дневно (според препораката на ICCIDD, WHO, UNESCO), со додавање на јод преку исхраната (млеко, сирење, месо, јајца и јодирани сол со 25–30 g KI/kg сол). Оваа година (1997) Герасимов и сор. предлагаат рускиот леб да се

јодира дополнително за да се обезбеди јоден минимум во јододефицитните региони на Русија преку потрошувачка на 300–500 g леб, како што е и кај нас.

Клучни зборови: јод во лебот, јод.

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