MONITORING THE CONCENTRATION OF IODINE IN IODIZED SALT FOR THE POPULATION OF BIHOR COUNTY IN THE PERIOD 2003-2012

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***Abstract*t**

This study aims to assess the quality of iodized salt available to the population. In the period 2003-2013, the Public Health Authority of Bihor County analyzed, in conformity with the current national methodology, 744 samples from units that use or sell iodized salt. 342 samples were identified as inadequate (45.96 %). The under-iodized samples represent 78.07 % of the total of inadequate samples and 35.88 % of the total samples. The over-iodized samples represent 21.92 % of all inadequate samples and 10.08 % of the total samples. On average, during the 10 years evaluated, a higher percentage of adequate samples for imported salt was determined (62.25 %), as compared with the samples taken from the autochthonous salt (55.33 %). Only 54.04 % of samples were in conformity with the current legislative limits. The lowest concentration of potassium iodide was registered in 2006, the year when specific legislation was modified.

Key words: salt, iodization, monitoring defficiency, monitoring, prevention, dystrophy

INTRODUCTION

Iodine deficiency is still a public health problem in many countries. A total of 36.5% (285 million) school-age children were estimated to have an insufficient iodine intake, ranging from 10.1% in the WHO Region of the Americas to 59.9% in the European Region. Extrapolating this prevalence to the general population generated an estimate of nearly two billion individuals with insufficient iodine intake. Iodine intake was more than adequate, or excessive, in 29 countries (Andersson M et al, 2005). In most countries where iodine deficiency has been identified as a public health problem, control measures have been implemented (WHO, 1999). The causes of iodine deficiencies can be considered from both simplistic and more complex perspectives: from the leaching of iodine from soil resulting in crops with low iodine content to malnutrition resulting in impaired iodine absorption. Most of the iodine found in nature is in seaweed (Lew K, 2009).

Poor dietary diversification and impoverished socio-economic development can also lead to iodine deficiencies (Preedy VR, GN Burrow, R.Watson, 2009). Iodine deficiency is a major threat to the health and development of populations worldwide, particularly in preschool children and pregnant women (Hetzel BS, 1983). Estimates of the regional and global prevalence of insufficient iodine intake are based on the proportion of the population with a urinary iodine below 100 μg/l (UNPD, 2006). In areas of severe iodine deficiency, maternal and fetal hypothyroxinemia can cause cretinism and adversely affect cognitive development in children; to prevent fetal damage, iodine should be given before or early in pregnancy (Zimmermann MB, 2009). Pregnant and lactating women and their infants in countries with successful sustained iodized salt programs have adequate iodine status (Zimmermann MB, 2007). Monitoring iodine status during pregnancy is a challenge (Zimmermann MB, 2008). Although cretinism is the most extreme manifestation, the more subtle degrees of mental impairment leading to poor school performance, reduced intellectual ability and impaired work capacity are of considerably greater significance (DeLong GR, J Robbins, PG Condliffe, 1989; Stanbury JB, 1994). The European Region, which has the lowest household consumption of iodized salt (27%), has the highest proportion of the population with an insufficient iodine intake. Globally, 66% of households now have access to iodized salt (UNCF, 2004). The primary strategy to assuring adequate iodine nutrition in most populations is through the iodization of salt (Sullivan KM, 2010). Iodine has been added to table salt since the 1950s in the form of iodide or iodate to prevent affections caused by iodine deficiency (De John F, L Risher, S Keith, 2009). Universal salt iodization (USI), defined as iodization of all salt used for human and animal consumption and iodine supplementation are highly effective strategies for preventing and controlling iodine deficiency. USI is now implemented in nearly all countries worldwide, and two-thirds of the world's population is covered by iodized salt (WHO, 1996; WHO, 2001; Andersson M, B.de Benoist, L. Rogers, 2010). There is a time-lag between the implementation of a salt iodization programme and the disappearance of clinically detectable goitre (Delange F, 2001*)*.The World Health Organization and the United Nations Children's Fund recommend a complementary strategy of iodine supplements as a temporary measure when salt iodization could not be implemented (Untoro J, A.Timmer, W.Schultink, 2010). Iodine supplementation is usually restricted to areas in which severe iodine deficiency is endemic, and which have no access to iodized salt (WHO, 2001*).* Surveillance systems need to be strengthened to monitor both low and excessive intakes of iodine (De Benoist B et.al, 2008).

MATERIAL AND METHOD

The study was performed by processing the results of laboratory chemical tests of iodized salt samples collected by the Food Hygiene Department of Bihor Public Health Authority, as part of National Health Programmes, in the period 2003-2012. The methodology adopted was developed by the National Institute of Public Health Bucharest, responsible for the national synthesis on the theme “Monitoring and inspecting iodized salt”. Analyses were performed in the chemistry laboratory of Bihor Public Health Authority, determining the iodine concentration in samples, expressed as potassium iodate.

RESULTS AND DISCUSSIONS

In the period 2003-2012, 744 samples of autochthonous and imported iodized salt from production units (bakeries), food warehouses, catering units (restaurants, cafeterias, fast food), retail stores were collected and analyzed. The number of samples collected in the period mentioned above are distributed annually as follows: in 2003 - 21 samples; in 2004 - 20 samples; in 2005 - 33 samples; in 2006 - 228 samples; in 2007 - 149 samples; in 2008 - 25 samples; in 2009 - 38 samples; in 2010 - 90 samples; in 2011 - 70 samples; in 2012 - 70 samples, as shown in figure 1.

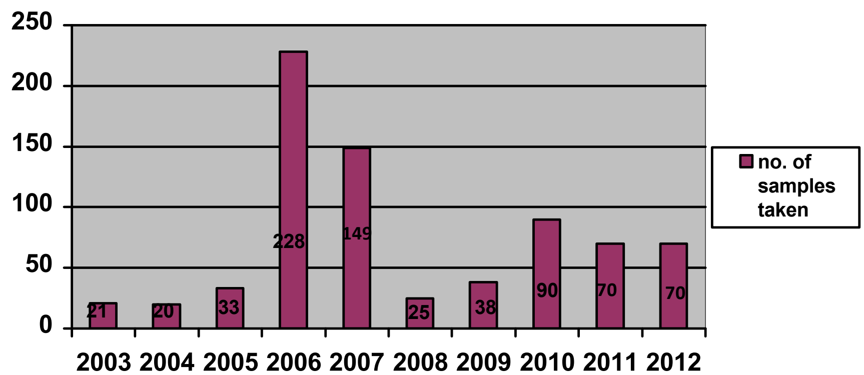

Fig 1. Annual distribution of salt samples collected in the period 2003-2010

In 2006 and 2007 the largest number of samples were collected since the program also included in Public Health Authority territorial laboratories from Salonta and Beiuş, for collecting and analyzing samples, which increased the efficiency of iodized salt supervision .

Inadequate samples: fter determining the level of iodine, a total of 342 inadequate samples (45.96 %) of all samples taken during the period studied were identified. Annual percentages of inadequate samples are as follows: 2003 - 31.25 %, 2004 - 45 %, 2005 - 84.84 %, 2006 - 53.50 %, 2007 - 20.13 %, 2008 - 40 %, 2009 – 68.42 %, 2010 - 50 %, 2011 - 45.71 %, 2012 - 50 %.The annual distribution of the results obtained, interpreted in accordance with the law, is presented in figure 2.

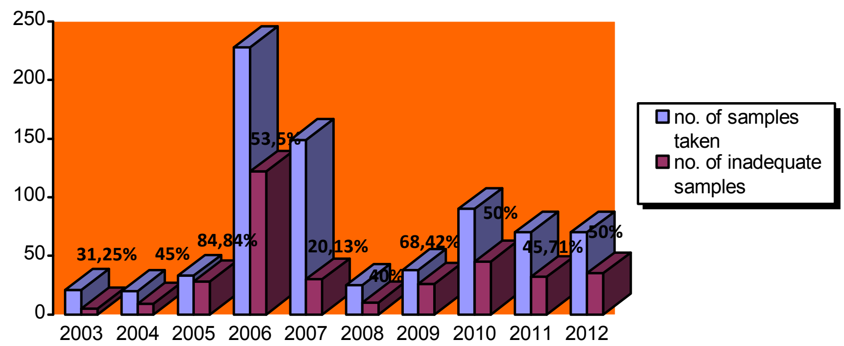

Fig 2. Annual percentage and numerical distribution of inadequate iodized salt samples in the period 2003-2012

It should be pointed out here that the year with the highest percentage of inadequate samples was 2005, followed in descending order by 2009, 2006, 2010 and 2012 - at equality, and then 2011, 2004, 2008, 2003, 2007, the year with the lowest percentage of inadequate samples (figure 3).

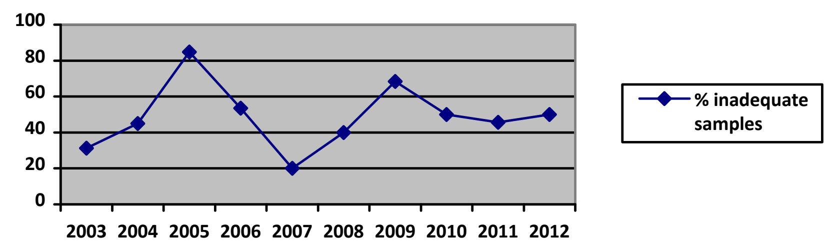

Fig 3. Annual percentage evolution of inadequate samples in the period 2003-2012

Inadequate samples identified may be classified as follows, according to the type of inadequacy (under-iodated or over-iodated): in 2003 - 5 samples, all over-iodated; 2004 - 9 samples, of which 1 was under-iodated and 8 over-iodated; 2005 - 28 samples, of which 10 under-iodated and 18 over-iodated, 2006 - 122 samples, of which 115 under-iodated and 7 over-iodated; 2007 - 30 samples, of which 21 under-iodated and 9 over-iodated; 2008 - 10 samples, of which 8 under-iodated and 2 over-iodated; 2009 - 26 samples, of which 23 under-iodated and 3 over-iodated; 2010 - 45 samples, of which 37 under-iodated and 8 over-iodated; 2011 - 32 samples, of which 17 under-iodated and 15 over-iodated; 2012 - 35 samples, all under-iodated (figure 4)

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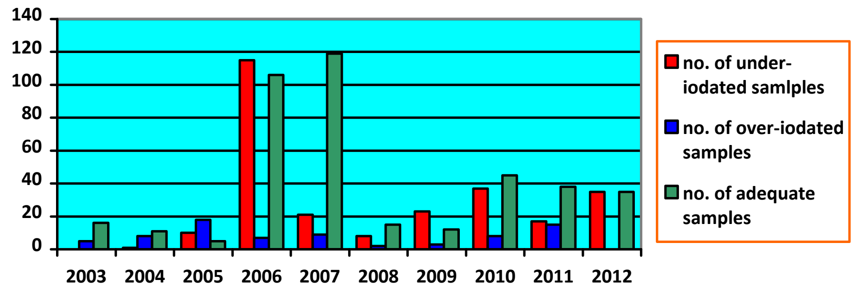


Fig4. Annual distribution of analyzed samples results, for the period 2003-2012

The most frequent inadequate samples found in the 10 years analyzed are under-iodated, presenting iodine concentration below the minimum required by law (267 samples, representing 78.07 % of all inadequate samples), these being 3.5 times more numerous than the number of under-iodated samples (75 samples , i.e. 21.92 % of all inadequate samples). Under-iodated samples make up for 35.88 % of the samples monitored¸ the over-iodated samples form a percentage of 10.08%, the remaining 54.04 % being represented by samples with adequate iodine content.

Regarding the percentage of adequate samples, classified by two categories (autochthonous/indigenous and imported salt), of all samples in the same category, the situation is as follows : 2003 - 100% indigenous salt and 50 % imported salt; 2004 – 91.66 % indigenous salt and 0 % imported salt; 2005 - 22.72 % indigenous salt and 0 % imported salt; 2006 - 44.03 % indigenous salt and 100% imported salt; 2007 - 78.57 % indigenous salt and 100% imported salt; 2008 - 50 % indigenous salt and 100% imported salt; 2009 - 16.66 % indigenous salt and 87.5 % imported salt; 2010 - 51.42 % indigenous salt and 45 % imported salt; 2011 - 53.33 % indigenous salt and 60 % imported salt; 2012 - 45 % indigenous salt and 80 % imported salt (figure 5).

The average of the 10 years studied shows a higher percentage of adequate samples for imported salt (62.25 %) than for domestic salt (55.33 %).

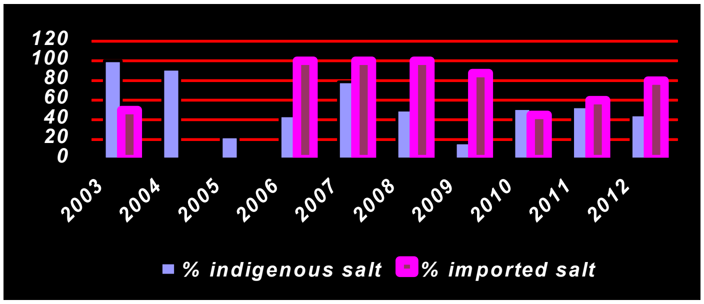
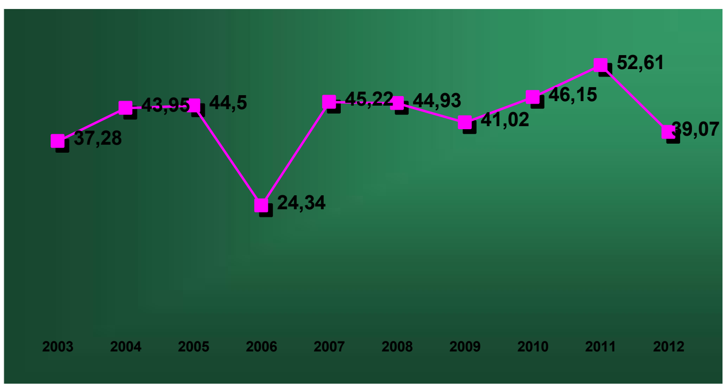


Fig5. Annual share of adequate indigenous and imported iodized salt samples

In terms of potassium iodate (KIO3) content of salt samples collected and analyzed , the average annual values (in mg ‰ or mg/kg), during the period studied, are: 2003 - 37.28 mg ‰ , 2004 - 43.95 mg ‰ ; 2005 - 44.5 mg ‰; 2006 - 24.34 mg ‰; 2007 - 45.22 mg ‰; 2008 - 44.93 mg ‰ ; 2009 - 41.02 mg ‰; 2010 - 46 15 mg ‰; 2011 - 52.61 mg ‰; 2012 - 39.07 mg ‰, as shown in figure 6.



Average annual concentration of potassium iodate (mg ‰)

Figure 6. The curve of annual average values for KIO3 concentration recorded 2003-2012

The lowest concentration of potassium iodide was registered in 2006, in conjunction with the time when iodized salt quality legislation was changed, by increasing the minimum value allowed for potassium iodate, from 25.5 mg‰ to 42 mg ‰ and of the maximum allowed value 42.5 mg‰ to 67.2 mg ‰ (GD no.568 from 2002, as amended by Government Decision no.1904 from 2006) .

Even if the annual average values of potassium iodide concentration of the samples fall within the limits imposed by law of those times (2003, 2007, 2008, 2010, 2011), the percentage of inadequate (under-iodated or over-iodated) salt continue to be too high since legislative provisions apply to each sample. In Romania salt is a universal ingredient, widely used by the population, both in food consumption and in meals prepared in households. Being located in a geographical area with iodine deficiency in the environment (soil, water, food), ensuring the minimum intake of iodine through iodized salt becomes more important.

CONCLUSIONS

In the ten years studied, 744 samples of iodized salt were monitored, as part of National Health Programs, focusing on preventive aspects. The supervision activity was correlated with that of inspection and control of hygienic conditions in the units selected for monitoring. A total of 342 inadequate samples (45.96 %) were identified: 35.88 % under-iodated and 10.08% over-iodated samples. On average, in the 10 years studied, a higher percentage of adequate samples for imported salt (62.25 %) was determined, as compared with the situation of autochthonous salt (55.33 %). Only 54.04 % of all samples analyzed were in accordance with current legal provisions, a rate well below the expected and accepted one, which indicates possible shortcomings in the chain of production, packaging, distribution/transport or storage of iodized salt. 2006 was identified as the year with the lowest average concentration of potassium iodide, a possible correlation with the change in legislative requirements for this indicator (increase of accepted limits, with 16.5 ‰ for the lower limit and 24.7 ‰ for the maximum limit).

Even though there has been substantial progress towards the elimination of iodine deficiency, continued efforts are needed to cover at-risk populations and salt iodization programmes need to be strengthened and maintained in order to reach the goal of eliminating IDD (Iodine deficiency disorders).

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