THE EVALUATION OF IODINE DEFICIENCY, DETERMINED BY URINARY IODINE CONCENTRATION IN THE SCHOOL CHILDREN OF THE VILLAGE OF GURA RÂULUI (SIBIU)

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Abstract: *In the country of Sibiu, endemic goiter secondary to iodine deficiency is known as the main endemic disease. The village of Gura Raului is one of the most expressive regions in this matter. Using urinary iodine concentration, the present study has as purpose the evaluation of the iodine status among the school children aged 6-12 years old. More, it appreciates the evolution of this one in last 5 years, after the issuance of the Government Ordinance 568/2002 regarding the universal salt iodisation. The values are compared to the ones obtained from a whiteness group in Slimnic, a village with no proven iodine deficiency. The study included the school children of the villages of Gura Raului and Slimnic (130 and 132 respectively). They were clinically examined and an urine sample was aleatorily taken. The urinary iodine concentration was determined, using the Sandell Koltoff method. The main urinary iodine concentration in Gura Raului was 45,69+/-23,78 microgr/l (mild iodine deficiency). In Slimnic, the obtained medium value was 149.76+-37.33 microgr/l (optimal iodine nutrition). The statistical significance was major (p 0,00012). There was no statistical significant difference between the urinary iodine in boys or girls, also between different age groups. In the village of Gura Raului, during the last 5 years, no statistical significant difference has occurred regarding the urinary iodine value. The iodine deficiency persists in Gura Raului, the values are much alike the previous published ones, the need for sustained prophylactic measures is still an emergency issue.*

Keywords: *Iodine nutrition status, urinary iodine, school children*

Rezumat: *În judeţul Sibiu, guşa endemică secundară deficitului iodat este cunoscută ca fiind principala afecţiune cu distribuţie în masă. Localitatea Gura Râului este consacrată prin patologia hipotiroidiană secundară carenţei iodate. Studiul, folosind determinarea iodului urinar, işi propune evaluarea evoluţiei statusului iodat în Gura Râului, la şcolarii claselor I-IV, după emiterea în 2002 a HG 568 privind referitoare la „Iodarea universală a sării destinată consumului uman, hranei animalelor şi utilizării în industria alimentară" şi compararea acestuia cu un lot martor de elevi de aceeaşi vârstă, rezidenţi într-o zonă fără deficit iodat, respectiv din localitatea Slimnic. Studiul a inclus elevii ciclului primar din Gura Râului şi Slimnic (130 respectiv 132). Şcolariiau fost examinaşi somatic(insistând pe exemenul local tiroidian) şi aleator s-a recoltat o probă de urină pentru determinarea ioduriei (metoda Sandell-Kolthoff). Ioduria medie în Gura Râului a fost de 45,69+/-23,78 microgr/l (deficit iodat moderat), iar în Slimnic149.76+-37.33 microgr/l (optimă din punct de vedere al nutriţiei cu iod). Diferenţa între mediile celor două loturi este în mod cert semnificativă statistic, (p=0.00012). În Gura Râului nu s-a semnalat diferenţă semnificativă între ioduria determinată în ultimi 5 ani şi cea actuală. Nu s-au inregistrat diferenţe semnificativ statistic între sexe, între vârste (atât la la băieţi cât şi la fete, în ambele loturi. De remarcat persistenţa carenţei iodate în Gura Râului, după emiterea Ordonanţei privind iodarea universală a sării. La 5 ani de la ultimele date publicate referitoare la această zonă, ioduria nu variaza semnificativ statistic, reconfirmând necesitatea unei profilaxii specifice susţinute.*

Cuvinte cheie: *Status iodat, iodurie, copii scolari*

INTRODUCTION

Iodine is one of the essential minerals for a good development of the human body. A low iodine intake alters the somatic and neurobehavioral development starting with the intrauterine life.

WHO, UNICEF and ICCIDD consider that there are still many regions, mainly in Africa, South-East Asia, Eastern Europe, where the endemic goiter is still present, because of the lack of a sustained prevention. From this point of view, the salt iodisation is considered an emergency.(1)

Since 1962, in Romania, by governmental decision, the distribution of iodised salt in endemic regions has started. That time, almost 60-65% of the people residing in sub-Carpathian areas were affected by iodine deficiency. According to WHO, in 1990, this percent became lower (30%).

In 1995, the Government Ordinance 779 stipulates the salt iodisation of 40-50 mgKIO3/kg salt. In 2002, another Government Ordinance no. 568/2002 was issued on the universal salt iodization (concerning human and animal food and food industry).(2)

The main disease with endemic distribution in the county of Sibiu is represented by endemic goiter. Several repeated studies confirmed the iodine deficiency

in this area.(3,4,5). The village of Gura Raului is located 25 km away from Sibiu, 556 m altitude and is well known due to the high percentage of hypothyroidism secondary to iodine deficiency. Former studies proved its persistence and the local authorities do not seem to be interested in a correct iodine supplementation policy.

PURPOSE OF THE STUDY

Using urinary iodine concentration, the study followed two objectives:

- Establishing the evolution of iodine nutrition status in the village of Gura Raului among the school children aged between 6-12, after the issuance of the Government Ordinance 568 in 2002, regarding the universal salt iodization,
- Comparing the obtained values with those obtained from a same aged school children living in the village of Slimnic, an area with no proven iodine deficiency.

MATERIAL AND METHODS

Subjects

Two groups of school children aged between 6-12, (practically all the pupils having this age) from the village of Gura Raului (130) and from the village of Slimnic (132) were included. A complete clinical examination was performed, insisting on local thyroid examination.

Urinary iodine concentration was determined aleatorily in 30% of the children of each group. The groups were homogenous in terms of age and gender (p 0,901, respectively 0,732).

Urinary iodine

In the morning, before classes, at 8 o'clock, 1/3 from the pupils who were clinically examined (51 in Gura Raului and 49 in Slimnic), were asked to give a sterile urine sample (5 ml). The samples were taken in aprox.40 minutes to the Laboratory of the Biochemical Department from the Faculty of Medicine in Sibiu - Lector Carmen Gavrila. The urinary iodine was determined by Sandell-Kolthoff method, implying the reduction reaction-catalyzed by iodine- of Ce^{4+} in the presence of As^{3+}.

The statistic analysis was performed by using the last version of SPSS for Windows, in order to obtain the means, the standard deviations, the confidence intervals and the graphics.

RESULTS

Table no. 1 Urinary iodine according to the gender in the village of Gura Raului

	Gender	no. of tests	Medium value	Std. deviation	Mean error of std. dev.
Urinary iodine (µg/l)	Male	26	46.2646	25.9757	5.0943
	Female	25	52.0268	29.5645	5.9129

P 0.656

Table no. 2. Urinary iodine according to the gender in the village of Slimnic

	Gender	No .of tests	Medium value	Std. Dev.	Mean error of std. dev..
Urinary iodine (µg/l)	Male	25	151.0269	33.7687	6.6226
	Female	24	135.9921	44.1791	9.0180

P=0.517

Picture no. 1 Urinary iodine for the two studied groups (p 0,0002)

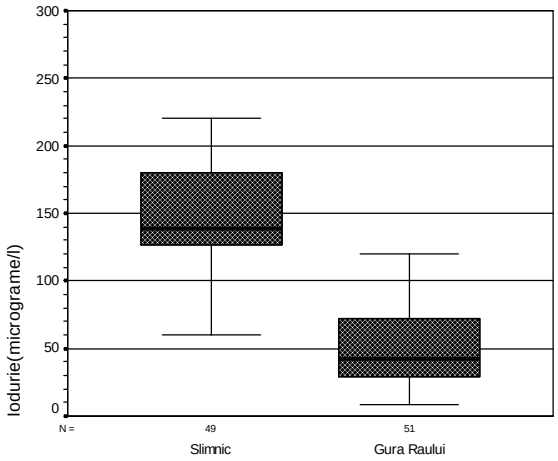
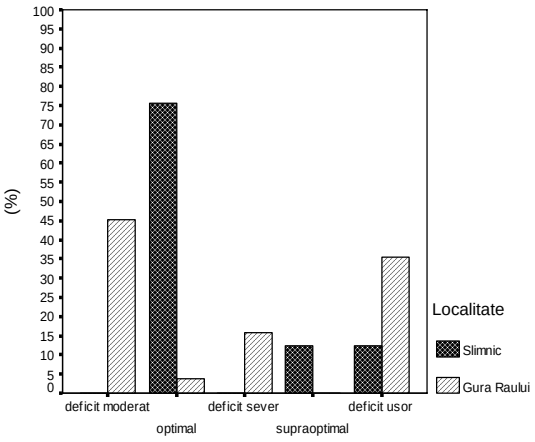


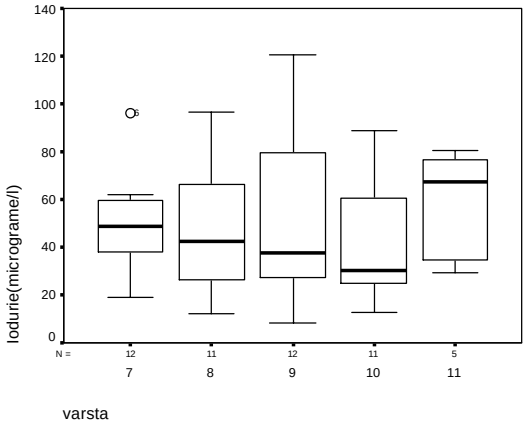
Table no. 3 Urine iodine repartition regarding the two batches

Iodine nutrition	Slimnic	Gura Raului
Moderate deficiency	0%	23(45.09%)
Optimal	37(75.5%)	2(3.92%)
Severe deficiency	0%	8(15.68%)
Supraoptimal	6(1.22%)	0%
Low deficiency	6(1.22%)	18(35.29%)

Picture no. 2 Urine iodine values according to age



Picture no. 3 Graphic representation of urinary iodine according to age



DISCUSSIONS

The main method for evaluating the iodine intake remains, according to WHO, the urinary measurement of iodine (Sandell Kolthoff method). For epidemiologic purposes, it is enough to determine ioduria in one sample of the morning urine(1) There is no need to relate the urinary iodine to urinary creatinine, because the alteration of results is without significant statistical importance. Also, it is not necessary to perform the determination of urinary iodine among the entire population, if they are living in an area confirmed as an endemic one.

Salt was chosen as an iodine „transporter", due to the fact that, despite the social differences, all the members of a community use it. KI and also KIO3 can be used for this purpose. KI gives 77 mg iodine/salt kg, but it is not very stable in salt, especially if the technical procedure is made in the presence of high humidity, sun exposure or excessive heat.

In Romania, in 1962, almost 60-65% of the people living in the sub-Carpathian areas, were affected by iodine deficiency.(1,4) After starting the distribution of iodised salt, according to WHO, the incidence dropped at about 30 % in 1990.

The Government Ordinance no. 779/1995 stipulates the salt iodisation to 40-50 mg KIO3/kg, while in 2002, the Government Ordinance no. 568/2002 was issued on the universal salt iodation.(2)

It is important that in the well-known endemic area (from the IDD point of view), periodic evaluation of iodine status should be performed.

The present study supports other local research, mainly that done by the Endocrinology Clinic of Sibiu, (6) and also aims at establishing the evolution of the specific parameters after the issuance of the last governmental ordinance.

The epidemiologic criteria necessary for the evaluation of iodine nutrition status in schoolchildren are listed bellow:(1)

In the whiteness group, in the village of Sliminic, the medium urinary iodine was of 149.76+-37.33 microgr/l, meaning an optimal iodine nutrition status. The males had a medium ioduria of 151.026+-33.7687, no statistical differences between ages were reported (p 0,42). The girls had a medium ioduria of 135.992+-44.1791, also without statistic significance in terms of age (p 0,49). The girls had a medium ioduria a little bit lower but without significance (P 0,517).

Table no. 4 Correlation between iodine contribution and nutrition with ioduria medium value

Medium urinary iodine (microg/l)	Iodine intake	Iodine nutrition status
Under 20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Optimal
200-299	More than adequate	Hyperthyroidism is possible
Over 300	Excessive	Great risk for hypothyroidism, Thyroid autoimmune diseases

In the village of Gura Raului, the medium ioduria was of 45,69+/-23,78 microgr/l, mild iodine deficiency. Between the two groups, there is a statistical significant difference, p 0,00012.

The urinary iodine was not statistical significant when related to gender (p,178).

The study confirms once again that in the village of Gura Raului, there is a persistent iodine deficiency, even after the issuance of the government ordinance regarding the mandatory salt iodisation. The data are almost the same with the ones published in March 2003 by Dr. Mihaela Stanciu, Prof. I.Ghe.Totoianu(6): medium urinary ioduria 39,53+-26,99 micrograms/l.

It also matches (p 0,34) with the values published for the city of Cisnadie and for the village of Cisnadioara (county of Sibiu), 58.21+-31 g/l (3,4).The date published by J. Balasz, for the county of Mures (7) give very close values, as well: 42 g/l (p=0.57).

The present study proves that there are no significant differences among the 6-12 years old group. Still between the 6-7 and 12 years old subjects, the urinary iodine is significant from the statistical point of view (p 0,0021). At the limit regarding the statistical significance there are the groups of subjects aged 9 and 12 (p 0,043). These data are also in accordance with the previous ones published in this area.

Before puberty, the results were lower, according to higher needs in this age. The extremlly low values were registered in the children with an unstable socio-economic environment, with a similar alimentary status.

Unfortunately, one can confirm the persistence of iodine deficiency in the village of Gura Raului, the difference between the most recent study having no statistical relevance (p 0,19)

Although, after performing local studies, the

need of a sustained prophylaxis (with KI tablets) was insisted upon, it has never taken place. A national programme is missing, and the parents do not want to support the minimum cost of this simple prophylactic measure. What seems to be the solution?

It is very important to insist on the medical education of the population, especially in schools, no matter what the social incomes are.

We must also consider that in the village of Gura Raului, the iodine in the water is low, if compared with the normal range: 1.496+-0.008 mg/l comparing to 5+-1.8 microg/, so the iodine supplementation is necessary.

Regarding the intake of iodised salt and the persistence of iodine deficiency, some facts can be observed. The daily iodine requirement is of 150-200 micrograms, so approximately 10 grams of iodised salt must be consumed.

If the daily intake of iodinated salt is appropriate, one must take in consideration the salt quality, the industrial procedures, factors that can lead to the deiodisation of the salt (50 % of iodine can be lost during transportation and storage), so on.(8)

KI is unstable in moistured or overheated environment, too much sun light, in the presence of impurities. Very often, the iodine content of the commercial packages is much lower than the recommended one. Storing the salt several months in cellars decreases the iodine content. More, the iodised salt is not currently used for all food preparation (pickells for instance).

This study proves once again that in the village of Gura Raului, there still persists an endemic area from the iodine deficiency point of view, and that a sustained prophylaxis should be applied.

CONCLUSIONS

The mean urinary ioduria in school children aged between 6-12, in the village of Gura Raului was of 45,69+/-23,78 microgr/l. This value, according to WHO, classifies the village among those having a mild iodine deficiency (inadequate iodine intake). The urine iodine measurements within the control group (Slimnic) were 149,76+/-37,33 microgr/l, representing an optimal iodine nutrition. Between the two groups, the difference was significant, p 0,00012.

No significant differences were noticed in terms of gender, in both groups (p 0,178, respectively 0,517).

A significant difference was observed, in both groups, between the children aged 6-7 years and the pre-teenagers ones (0,0021).

Even after 2002, when the last Government Ordinance on the universal salt iodisation was given, the iodine deficiency still persists. After 5 years from the last published data (6) the urinary iodine had not significantly improved (p 0,19), reconfirming the need for a sustained prophylaxis.

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