ASSESSMENT OF IODINE DEFICIENCY STATUS AMONG ALBANIAN CHILDREN AND PREGNANT WOMEN

STUDY

unicef

INSTITUTE OF PUBLIC HEALTH

Hospital of Bolzano, Italy

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Foreword

Parathënie

Çrregullimet nga pamjaftueshmëria e jodit në vendin tonë janë identifikuar prej shumë vitesh si një shqetësim serioz i shëndetit publik. Një sërë masash të marra gjatë dekadës së fundit kanë synuar në crrënjosjen e këtij problemi. Studimi i prevalencës së pamjaftueshmërisë jodike në fëmijët dhe gratë shtatzëna, erdhi pikërisht si një nevojë për të vlerësuar produktin shëndetësor të pritshëm.

Rezultatet e studimit janë inkurajuese dhe dëshmojnë një punë të efektshme. Megjithatë ngelet e domosdoshme të vijohet me masat e nisura, përfshirë aprovimin e projekt ligjit për jodizimin universal të kripës. Nga ana tjetër kërkohet që të bëhen më shumë përpjekje për të sistematizuar monitorimin e profilaksisë me jod nëpërmjet studimeve epidemiologjike. Bazat tashmë janë vendosur, dhe ky studim kontribuon për të hedhur edhe një hap më tej në këtë proces.

Raporti i paraqitur nuk është thjesht fryt i një bashkëpunimi të suksesshëm midis UNICEF, Institutit të Shëndetit Publik dhe Spitalit të Bolzanos. Një garanci më tepër ka qenë mbështetja e Ministrisë së Shëndetësisë si dhe kontributi serioz e profesional i gjithë specialistëve të përfshirë.

Rezultatet e këtij raporti mund të përdoren si nga politikë bërësit në procesin e hartimit apo të modifikimit të programeve preventive, ashtu edhe nga punonjësit e shëndetësisë, përfshirë specialistët e shëndetit publik apo specialistët endokrinologë në punën e tyre të përditshme. Synimi final do të ishte gjithësesi i njëjti, lufta kundër pamjaftueshmërisë jodike dhe krijimi i kushteve më të mira për fëmijët shqiptar që të shprehin të gjithë potencialin e tyre gjenetik.

Dr. Alban Ylli
Drejtor i Institutit të Shëndetit Publik

Introduction

1
Introduction

Iodine is an essential element for human survival. It is needed for growth and development, even before birth. Although iodine is an important micronutrient, it is needed only in very small quantities. In order to prevent deficiency, a person needs only 150 mg of iodine per day, and over a lifetime, the total quantity of iodine needed is only one teaspoonful. Healthy humans require iodine, which is an essential component of the thyroid hormones. Failure to have adequate iodine leads to insufficient production of these hormones, which affect many different parts of the body, resulting in a number of pathologic conditions known as the Iodine Deficiency Disorders (IDD). Iodine deficiency continues to be a significant public health problem in many countries, it's deficiency not only causes goiter, it may also result in abortion, stillbirth, mental retardation, growth retardation, irreversible brain damage and retarded psychomotor development in the fetus, infant and in the child. It also affects reproductive functions and impedes children's learning ability. Iodine deficiency is now recognized as the most common preventable cause of brain damage in the world today.

Albania is a country with limited environmental resources of iodine. Since years IDD has been a great problem of public health. The levels of this microelement are very low in drinking water and food. This fact is strongly correlated with Iodine Deficiency Disorders in our country. The prevalence of IDD among children aged 7-14 years in areas with iodine –free water is 78-92% whereas where the iodine content of the water is 8.95µg/l, the prevalence of goiter is only 15.25% [(1)].

In the 1980, a national survey indicated that iodine deficiency was endemic in the country with total Goiter Rate (TGR) between 41% and 92%. Scattered surveys confirm the severity of IDD in the country [(2)] In 1994, TGR, determined by ultrasound, was 28.9%among 241 children in 4 villages in the north. A survey in 32 clusters among 2395 children 8-10 years old in 1993 found median Urinary Iodine Excretion between 2-49 mcg/l; 63% severe, 30% moderate, 5% mild [(3)].

In the same year 33% of 227 newborns in the capital, Tirana, had whole blood TSH levels>5mU/L. A recent study in March 2003 among 826 school children in 7 schools in Korce, Southern Albania reported a median UIE of 45 and 17µg/L for urban and rural children respectively [4].

The most recent information that is representative for the whole nation in the percentage of household that consume adequately iodized salt is a Multiple Indicators Cluster survey in year 2000. The result show that 56% of households consume adequately iodized salt [5].

In the past period it is not at all clear that the results of schoolchildren are representative also of pregnant women, even if they live in the same household.

Albania has made some commendable efforts that set the basis for a successful IDD control program. These include: the creation of national IDD committee, the issuance of a Decree requiring the iodination of salt for human consumption, the implementation of a massive public awareness campaign and the initiation of a salt quality monitoring system.

There is a total lack of data about the IDD problems in the pregnant women. This group is very important because the damage to the developing brain of the fetus due to iodine deficiency is taking place mostly while the (future) mother is pregnant. This study was very important to measure progress towards elimination of IDD on a National level, part of National Action Plan for the Eradication of the IDD in Albania and offer data on quality of iodized salt used by target groups to ensure optimum iodine nutrition for all household members (not just for school-aged children or pregnant women only)

No recent information on national scale was available for impact indicators, so after more than 10 years and after all these interventions it was necessary to implement a survey for the assessment of IDD status, monitoring and evaluation of the impact of the iodized salt used on the target population.

Indicators selected for this study were: Urinary iodine levels, thyroid gland examination, and salt iodine content in households

Goal and Objectives of the Project

2

The goal and primary objectives of the project

Goal: This study aims to assess the progress with elimination of IDD in Albania.

Objectives:

- To estimate the current prevalence of IDD since the implementation of iodized salt use for human consume via:
    1. Determination of urinary iodine concentration in schoolchildren 6-13 years old.
    2. Determination of urinary iodine concentration in pregnant women living in the same area with the children enrolled in study.
    3. Determination of the thyroid size in schoolchildren 6-13 years old.
- To determine the distribution of IDD, in relation to demographic characteristics.
- To evaluate the use of adequately iodized salt in household level by
    1. Determination of the iodine level in the salt
    2. Determination of the iodized salt brands used in different areas
- To present sound date for planning political advocacy and resource allocation.

Methods and Subjects

3
Methods and Subjects

3.1 Methods

Evaluation of the IDD prevalence requires the conduction of a transversal study on a representative sample group (6). Sampling method used is the “probability proportionate to size” cluster method used from several years in the estimation of the vaccination coverage, recommended by WHO, UNICEF, ICCIDD (7) (8) (9).

The main requirement for the adoption of this sampling design is the availability of the primary schools lists with the number of the children in national level. The sampling frame therefore consisted of lists of primary school categorized by territorial zones. Four territorial zones in Albania, supposed to be homogenous regarding the phenomenon in observation, are designed: cities and village of the coastal zone, cities and village of internal zone (10). For every territorial zone are extracted 30 clusters to insure a valid estimation of the prevalence (11). The division board between coastal zone and internal zone traverses the schools of these districts: Shkoder, Lezhe, Kurbin, Durres, Kavaje, Lushnje, Fier, Vlore and Sarande. (The districts mentioned above represent the costal zone).

Two field teams were formed to carry out the field work. Each team consisted of one endocrinologist, one pediatrician and one local coordinator (specialist of public health) and was supplied with an electronic balance (LAICA), a portable stadiometer (SECA), equipments approved and controlled from an expert of UNICEF, a portable ultrasonography equipment SonoSite 180 Plus of the Esaote firm (Italian office) with a 7.5 MHz 5 cm linear transducer.

These two equipments were donated to the Institute of Public Health in Tirana from the Autonomous Province of Bolzano (Italy).

Thyroid ultrasonography was performed with the child lying supine and the neck hyper extended. The volume of each lobe was calculated by the formula V (ml) = width (cm) x length (cm) x thickness (cm) x 0,479. The thyroid volume was the sum of the volumes of the two lobes since the volume of the isthmus. Thyroid volumes greater than the 97^{th} percentile are considered enlarged [12].A neck examination by palpation was performed too, according to the WHO/UNICEF/ICCIDD criteria [7]

In order to better field work, was organized the training of the local coordinators, endocrinologists and pediatricians. The aim of this training was the accurate identification of the selected sample group and the standardization of the measurements to insure accurate data (the same results for the same subjects).

3.2 Population and sampling design

3.2.1 Study population

Children aged 6-13 years and pregnant women (no more than 6 months of pregnancy as recommended by the IDD Albania National Committee), living in the same area with these children were the target groups of this survey.

School age children are a useful target group for the surveillance because of their combined high vulnerability easy access, and usefulness for a variety of surveillance activities.

The iodine status of pregnant women is particularly crucial because of susceptibility of the developing fetus to iodine deficiency.

The data were collected from October to December of the year 2006.

3.2.2 Sample size

The sample selection was carried out by the Epidemiologic Observatory of the Autonomous Province of Bolzano, Italy.

The total number of the children selected in all the schools is 840 children. At least 3 pregnant women that live in the same area with the children of the selected cluster were included in the study (a total of 365 pregnant women).

3.2.3 Sampling method

Sampling method used is the "probability proportionate to size" cluster method used from Expanded Programme on Immunization (EPI) for the estimation of the vaccination coverage and adaptable for the other health status indicator, recommended by WHO, UNICEF, ICCIDD. (6) (8) (9)

Albanian elementary schoolchildren are the primary sampling units. The children that frequent the classes from the first to the seventh of elementary school are the target group of this study. (These children are randomly selected from the class list with the same probability of extraction, from 1-n number, n= number of children for every class.)

For every territorial zones there were extracted 30 cluster and for every cluster 7 children and 3 reserves. The total number of the children selected in all the schools was 840 children. Expected prevalence of goiter was 50% with a precision 10%.

The schools are selected randomly with replacement and probability of extraction proportionate to the number of the children.

3.2.4 Consent of the teachers and families

Oral consent was obtained from the teachers and families of the children. All families gave consent.

3.3 Data collection

Data collection was divided into 5 main parts:

1. The parents compiled a pre-designed questionnaire with general data of his child, family anamnesis about IDD, a short food frequency questionnaire and data on the use of iodized salt in household under the assistance of the trained public health specialist.
2. The anthropometric measurement (weight and height) of all the children was carried out and recorded using standardized procedures by the pediatrician specialist. The body surface area (BSA-m^2 used for the normalization of the thyroid volume)) was calculated by the formula BSA = Weight (kg) 0,425 x Height (cm) 0,725 x 71,84 x 10^{-4}. The children were weighted only with underwear. The equipments used were equal in both fieldwork groups. The Z scores for the height and weight were calculated with the revision of the year 2000 of United States CDC Growth Charts.
3. Children underwent neck examination by the palpation and ultrasonography (with the child lying supine and the neck hyper

extended) that was carried out by the endocrinologist. The measurements of the children were done in the Health Center of the schools.

4. For determination of urinary iodine concentration the casual urine was taken from children and pregnant woman. Samples of urine collected in sealed plastic containers (about 8 ml urine for each person) were transported to the Institute of Public Health laboratory in ice boxes within 48 hours. These were stored at -20° C. All the urine samples were analyzed in the Water Analyses Laboratory of the Environment Agency, Bolzano, Italy. The values of the urinary iodine were obtained from the analyses of the samples with the technique ICP-MS (Inductively Coupled Plasma Mass Spectrometry), with a preliminary dilution of the sample 1/10 (v/v).The equipment used was supplied from the Firm Perkin Elmer Sciex (model Elan DRC 6100) [13] The laboratory is accredited according to the UNI CEI EN ISO/IEC 17025 from SINAL "National System for the Laboratory Accreditation" with accreditation number 0434, even for the determination of the urinary iodine. The SINAL is recognized in the international level. The Laboratory also participated at the EQUIP (Ensuring the Quality of Urinary Iodine Procedures) of the CDC (Center for Disease Control and Prevention) from Atlanta (USA).

5. For the determination of the iodine in the salt were taken samples of salt used in the children and pregnant women households. Both children and women brought the samples at school. Samples of salt collected in plastic glasses (about 20 gr. salt for each person) were analyzed in the Food Chemistry Laboratory of the IPH. The iodine content of iodized salt samples is measured using a Standard iodometric titration prescribed by DeMaeyer, Lowenstein and Thilly (WHO Geneva 1979). Iodine is liberated using sulphuric acid. The free iodine is titrated with sodium thiosulphate, using starch as an indicator. 100 salt samples were analyzed with the method ICP-MS [14] with the same equipment used for the urinary iodine by Water Analyses Laboratory of the Environment Agency, Bolzano, Italy for the validation of the results obtained in Albania.

3.4. Data Analysis

Data were entered and stored on a computer data base file created from SAS Enterprise Guide 4.1 (Cary, NC, USA) [15].

Statistical evaluation of the iodine level in salt samples was performed using STATA Vs. 8.

The variables distributed normally are compared with the test t of Student. The variables not normally distributed are compared in terms of median with the Wilcoxon Rank Sums test. The associations are tested with correlation coefficient of Pearson whereas for the proportions were used the test of Chi-square and Fisher's exact test in cases where the expected number of observation was less than 5. The threshold of significance was 95%.

The result of thyroid gland examination was graded based on modified

WHO goiter classification system [7] as following:

Grade 0: No palpable or visible goiter

Grade 1: A mass in the neck that is consistent with an enlarged thyroid that is palpable, but not visible when the neck is in the normal position, It also moves upward in the neck as the subject swallows.

Grade 2: A swelling in the neck that is visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated.

The IDD severity was evaluated based on goiter prevalence in school-age children as in the following [7]

Mild IDD:	5.0 - 19.9 %
Moderate IDD:	20.0 - 29.9 %
Severe IDD:	> 30.0 %

The criteria used for assessing iodine deficiency (ID) based on median urinary iodine levels were based on the cut-off points and prevalence levels proposed for the classification of iodine deficiency into different degrees of public health significance [7] as follows:

Severe ID with median	< 20 µg/L
Moderate ID with median	20 – 49 µg/L
Mild ID with median	50 – 99 µg/L
No deficiency with median	> 100 µg/L

The criteria used for assessing the use of adequately iodized salt in households was based on the cut-off points proposed for the classification of the iodized salt [7] as follows:

Non adequately iodized salt	<15 ppm
Adequately iodized salt	≥15 ppm


Results

4
Results

A total of 840 school children aged 6-13 years, (7 children for each cluster) and 365 pregnant women (3 pregnant women that live in the same area with the children of the selected clusters) were included in the study. The male: female ratio was nearly 1:1. An equal number of children in each geographical region were studied.

The distribution of the sample according to the four geographic regions is given in Table1.

Table 1: Sample distribution of the school children according to the districts and geographical regions

	Costal region		Internal region		Total
	Urban	Rural	Urban	Rural	
Berat	-	-	14	7	21
Bulqize	-	-		7	7
Delvine	-	-	7	7	14
Diber	-	-	7	14	21
Durres	56	28	-	-	84
Elbasan	-	-	21	28	49
Fier	28	42	-	-	70
Gramsh	-	-	7	7	14
Kavaje	14	21	-	-	35
Korçë	-	-	14	14	28
Kruje	-	-	7	7	14
Kurbin	14	7	-	-	21
Kucove	-	-	7	7	14

	Costal region		Internal region		Total
	Urban	Rural	Urban	Rural	
Kukës	-	-	-	7	7
Lezhë	7	21	-	-	28
Librazhd	-	-	7	14	21
Lushnje	14	35	-	-	49
M. Madhe	-	-	-	7	7
Mallakaster	-	-	7	-	7
Mat	-	-	-	14	14
Përmet	-	-	7	-	7
Peqin	-	-	-	7	7
Pogradec	-	-	-	14	14
Puke	-	-	7	-	7
Sarande	14	7	-	-	21
Shkoder	35	35	-	-	70
Skrapar	-	-	-	7	7
Tepelene	-	-	7	-	7
Tirane	-	-	91	35	126
Tropojë	-	-	-	7	7
Vlore	28	14	-	-	42
Total	210	210	210	210	840

The required information wasn't available for all the children, particularly, in 13 of them lacked the birth date and for 5 children lacked the gender. In 835 children with the known gender resulted that 50.8% (424) were boys and 49.2% were girls. In seven cases lacked the result of neck examination by palpation, in two cases wasn't possible the calculation of the thyroid volume and in four cases the body surface.

4.1 Urinary iodine concentration

Analysis of urine samples showed that the median urinary concentration in the school children at the national level was 86.2 µg/L (weighted average, range, 113.0 µg/L in costal region /city; 69.6 µg/L in costal region /village; 119.0 µg/L in internal region/city and 59.1µg/L in internal region/village ($P<0.001$). (Table 2)

Table. 2: Median urinary iodine concentrations in the school children at national and region geographical levels where the regions are recorded to present concentrations in ascending order.

Geographical Regions	Median urinary iodine concentration µg/L**
Internal region/village	59.1 p<0,001 vs Internal/cities* p<0,001 vs Costal/villages* p<0,001 vs Costal/Cities*
Costal region /village	69.6 p<0,001 vs Costal/cities* p<0,001 vs Internal/cities*
Costal region /city	113.0 p<0,001 vs Internal/Cities*
Internal region/city	119.0
National level	86.2

* Wilcoxon Rank Sums

** Normal range 100-199µg/l

In the pregnant woman the median of urinary iodine in whole sample was 95,3 µg/L. In the geographical regions was: 122.0 µg/L in costal region /city; 98.0 µg/L in costal region /village; 100.0 µg/L in internal region/city and 70.7 µg/L in internal region/village (P<0.001) (Table 3).

Table. 3: Median urinary iodine concentrations in the pregnant woman at national and region geographical levels where the regions are recorded to present concentrations in ascending order.

Geographical Regions	Median urinary iodine concentration µg/L**
Internal region/village	70,7 p=0,0037 vs Internal/cities* p=0,016 vs Costal/villages* p<0,001 vs Costal/Cities*
Costal region /village	98.0 p=0.039 vs Costal/Cities*
Internal region /city	100.0
Costal region/city	122.0
National level	95.3

* Wilcoxon Rank Sums

** Normal range 100-199µg/L

No significant difference was found in urinary iodine between school children and pregnant woman in the whole sample. A significant difference in urinary iodine levels between school children and pregnant woman was found only in the costal region/villages (p=0,026).

Considering children and pregnant woman together (N= 1204) the median of urinary iodine resulted to be 90.7µg/L. The significant differences between the median values of the urinary iodine concentrations are reported in the Table 4.

Table. 4: Median urinary iodine concentrations in the pregnant woman with the school children at national and region geographical levels where the regions are recorded to present concentrations in ascending order.

Geographical Regions	Median urinary iodine concentration µg/L**
Internal region /village	60.8 p<0,001 vs Internal/cities* p=0,004 vs Costal/villages* p<0,001 vs Costal/Cities*
Costal region /village	76.9 p<0.001 vs Costal/Cities* p<0.001 vs Internal/Cities*
Costal region /city	114.0
Internal region/city	114.0
National level	90.7

* Wilcoxon Rank Sums

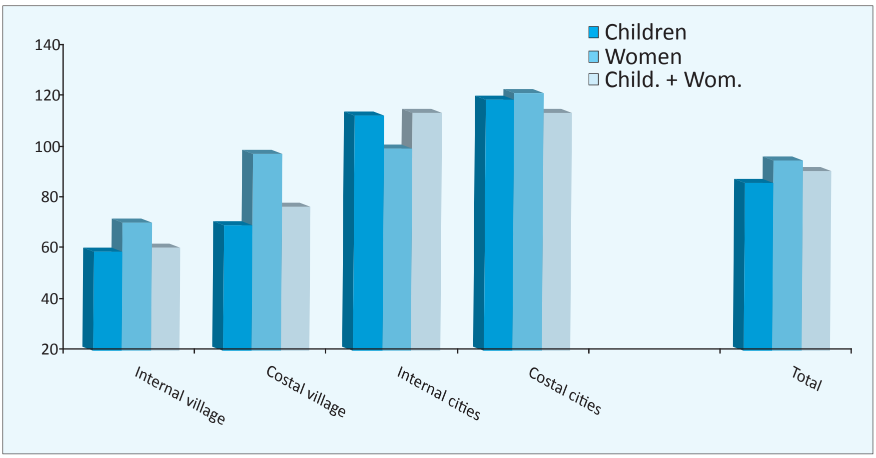
** Normal range 100-199µg/L

In the table 5 and graph.1 are represented median urinary iodine values for school children, pregnant women and both children and women at national and region geographical levels. The results indicated Mild Iodine Deficiency (see map of Iodine Deficiency in Albania 2006-Anex 1) according to the joint criteria of the WHO, UNICEF and ICCIDD [7]:

Tab 5. Median urinary iodine concentrations (µg/L) in the school children, pregnant women and both children and women at national and region geographical levels.

Geographical Regions	Children	Pregnant women	Children + Women
Internal region /village	59,1	70,7	60,8
Costal region /village	69,6	98,0	76,9
Costal region /city	113	122,0	114
Internal region /city	119	100,0	114
Total	86,2	95,3	90,7

Graph.1 Median urinary iodine concentrations (mg/L) in the school children, pregnant women and both children and women at national and region geographical levels.

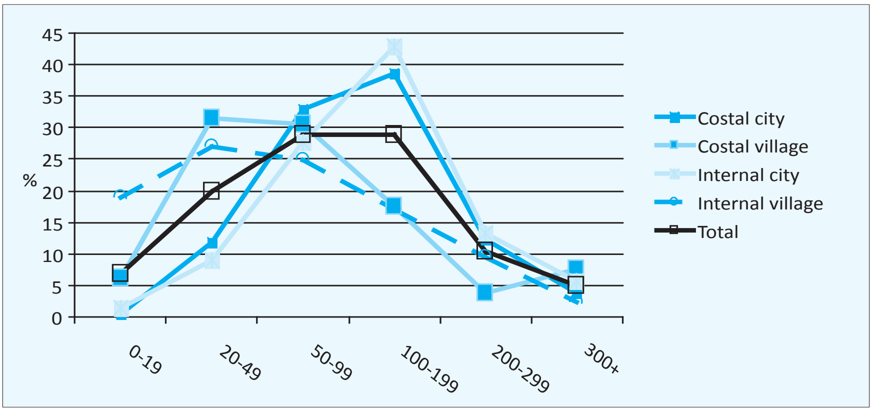


The iodine concentrations for all children were in the severe (<20µg/L) to excessive (300+ µg/L) ranges of iodine (Table.6 and Graph. 2)

Table. 6: Distribution of the iodine deficiency in children according to the geographical regions.

Geographical Regions	The percentage of children according to range of urine concentration (µg/L)					
	0-19.	20-49.	50-99	100-199	200-299	300+
Costal region /city	0,5%	11,9%	32,9%	38,6%	12,4%	3,8%
Costal region /village	6,2%	31,4%	30,5%	17,6%	3,7%	7,6%
Internal region/city	1,4%	9,0%	27,6%	42,9%	13,3%	5,7%
Internal region/village	19,0%	27,1%	24,8%	17,1%	9,5%	2,4%
Total	6,8%	19,9%	28,9%	29,0%	10,5%	4,9%
N	57	167	243	244	88	41

Graph. 2 The percentage of children for different regions, according to range of urine concentration (mg/L).

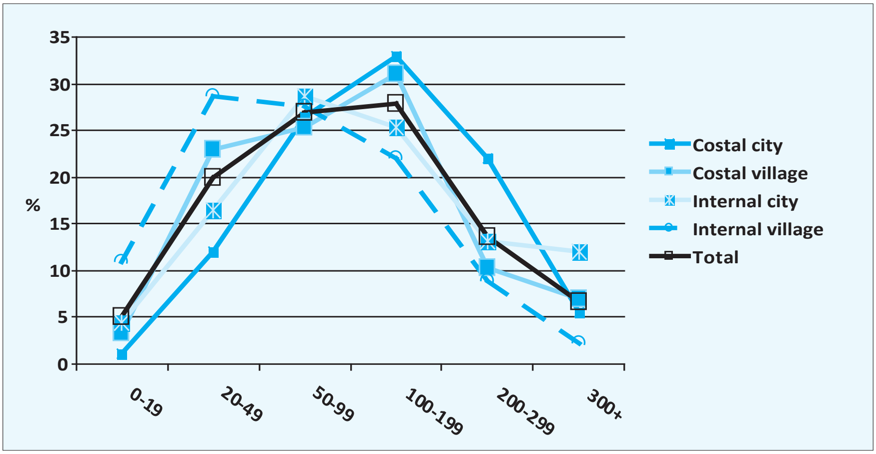


The iodine concentrations for pregnant women were in the severe (<20µg/L) to excessive (300+ µg/L) ranges of iodine (Table.7 and Graph. 3)

Table.7: Distribution of the iodine deficiency in pregnant women according to the geographical regions.

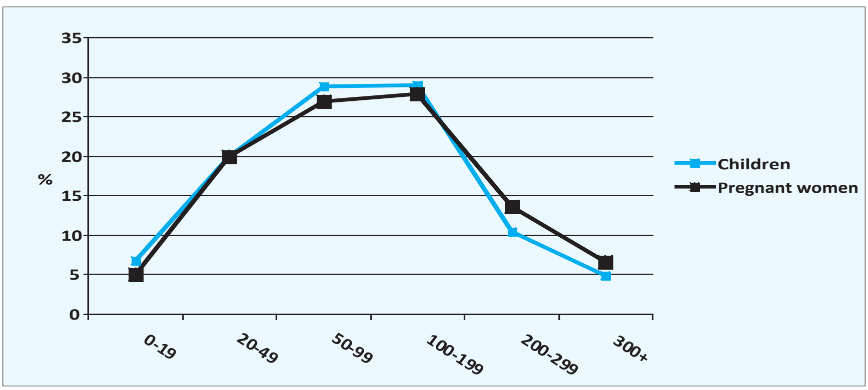
Geographical Regions	The percentage of pregnant women according to range of urine concentration (µg/L)					
	0-19	20-49	50-99	100-199	200-299	300+
Costal region /city	1.1%	12.1%	26.4%	33.0%	22.0%	5.5%
Costal region /village	3.4%	23.0%	25.3%	31.0%	10.3%	6.9%
Internal region/city	4.4%	16.5%	28.6%	25.3%	13,2%	12.1%
Internal region/village	11,0%	28.6%	27.5%	22.0%	8.8%	2,2%
Total	5.0%	20.0%	26,9%	27.8%	13.6%	6.7%

Graph. 3 The percentage of pregnant women for different regions, according to range of urine concentration (μg/L)



In the graphic 4 is presented the Distribution of the iodine deficiency in children and pregnant women according to range of urine concentration (µg/L) at national level.

Graph. 4 The percentage of children and pregnant women, according to range of urine concentration (μg/L) at national level.



In total, 26.7% of the children and 25% of the pregnant women had urinary iodine concentrations <50µg/L; this is another indicator used to assess iodine deficiency and monitor progress towards eliminating IDD as a public health problem. As indicated by the joint WHO, UNICEF, and ICCIDD criteria [(7)], the goal for IDD elimination as a public health problem is that the proportion of the samples <100 µg/L should be <50% and the proportion <50µg/L should be <20 %. (Table 8)

Table. 8: Comparison of the survey results with criteria for monitoring progress towards eliminating IDD as a public health problem.

Indicator Urinary iodine	Goal	Survey result Children	Survey result Pregnant women
• Proportion below100µg/L	<50%	55.6%	54.9%
• Proportion below 50µg/L	<20%	26.7%	25.0%

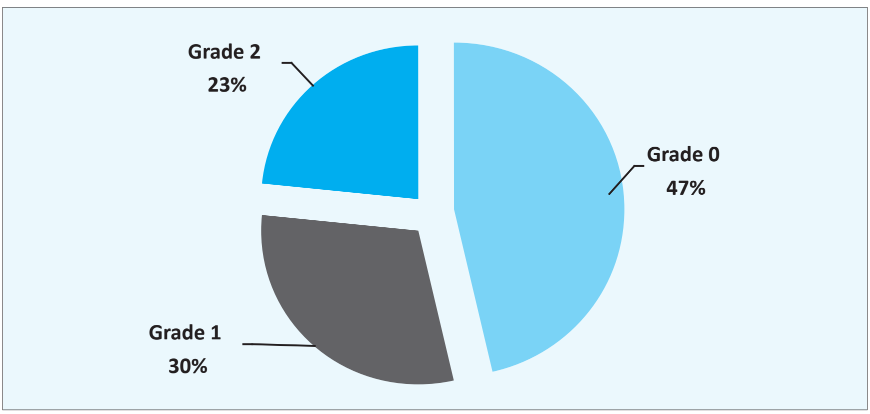
More children living in the Internal region/village (19%) than in the Costal region city (0.5%) were severely iodine deficient and more children living in the Internal region city (42.9 %) than those living in the Internal region village (17.1%) had adequate iodine intake.

Iodine deficiency was therefore more severe in villages of both geographical regions than in the cities of these regions, without significant differences between males and females ($p>0.05$). Almost situation presented for the pregnant women too.

4.2 The results of neck examination

Prevalence of goiter with palpation was 53, 5 %,(445 children) respectively 30.3% (252 children) grade 1 and 23.2% (193 children) grade 2. (Graphic 5)

Graph .5 Prevalence of the goiter by palpation



In the table 9 is reported the prevalence of goitre expressed in grade according to the geographical regions. From the results is observed that the higher prevalence of the grade 2 is in Internal region/village and Costal region/village, whereas the higher prevalence of the grade 1is in the Internal region/city.

Table. 9: Goitre grade by the palpation of the Thyroid in the geographical regions

	Costal region/city	Costal region /village	Internal region /city	Internal region /village	Total
Grade 0	64,7%	45,7%	52,2%	23,9%	46,5%
Grade 1	23,7%	31,0%	34,8%	31,6%	30,3%
Grade 2	11,6%	23,3%	13,0%	44,5%	23,2%
Total	100,0%	100,0%	100,0%	100,0%	100,0%
N	207	210	207	209	833

According to the gender, the goitre prevalence resulted 50.3% in males (31.1% grade 1 and 19.2% grade 2) and 57.5% in females (29, 7% grade1 and 27, 5% grade 2) table 10.

Table. 10: Grade of goitre by the palpation according to the gender.

	Grade 0	Grade 1	Grade 2	Total
Male	49,6%	31,1%	19,2%	100,0%
Female	42,8%	29,7%	27,5%	100,0%
Total	46,3%	30,4%	23,3%	100,0%
N	383	252	193	828

The average of the thyroid volume evaluated by ultrasonography (WHO 2003) resulted 2, 21 ml in grade 0; 3, 62 ml in grade 1 and 6, 05 ml in grade 2 (Table 11).

Table. 11 : Average Thyroid volume according to the goitre grade

Goitre grade	Average Thyroid volume (ml)	Std Dev	N
Grade 0	2,21	0,82	388
Grade 1	3,62	1,15	252
Grade 2	6,05	3,12	193

Pearson's correlation: r 0.658 p<0,001

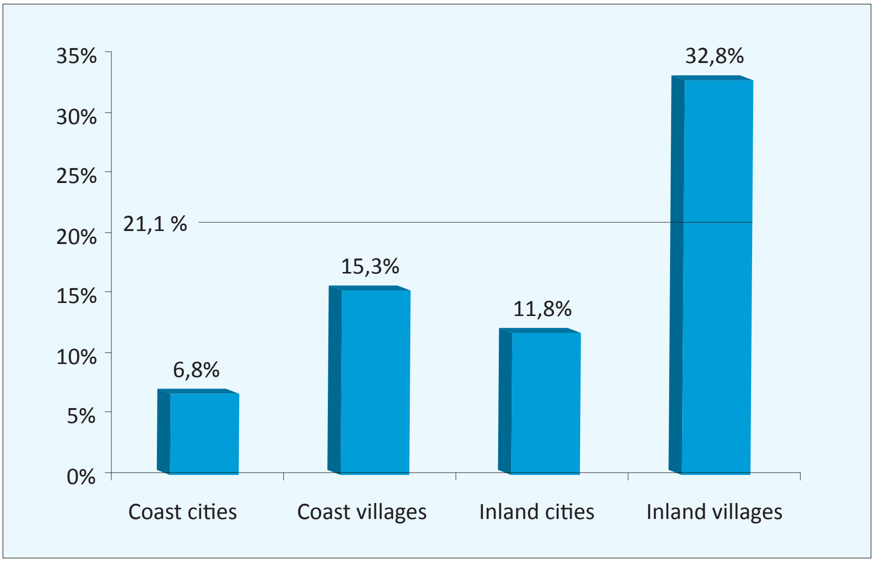
In the table 12 are reported the values of the thyroid volumes by gender and age. In the graph.6 is shown the prevalence of the thyroid volume >97° percentile of the reference class by age and gender in the different regions and in the graph.7 the prevalence of the thyroid volume >97° percentile of the reference class by BSA and gender in the different regions.

Table. 12: Thyroid volume for sex and age (mean value, standard deviation and sample size).

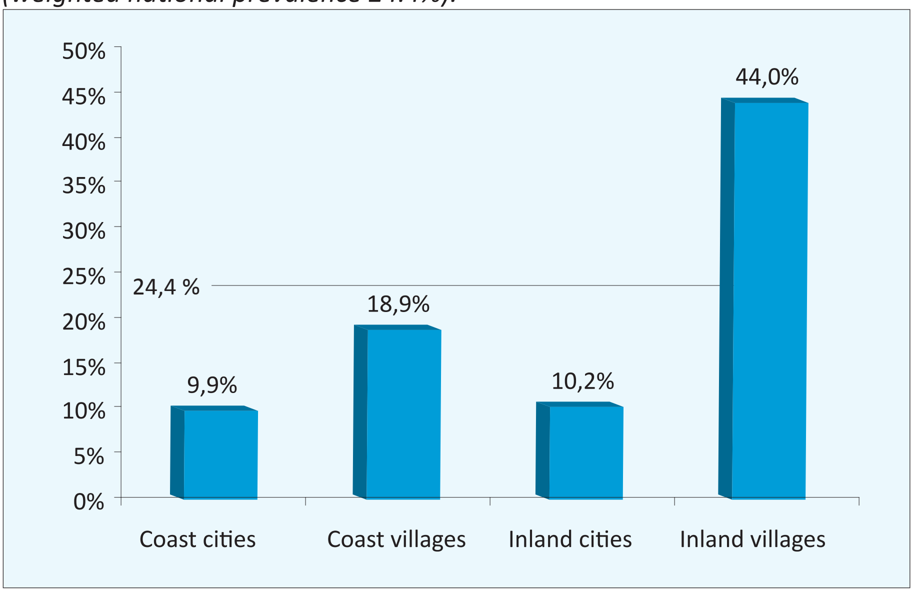
	Male			Female		
Age(years)	Mean	Std Dev	N	Mean	Std Dev	N
6	2,14	0,89	44	2,12	1,30	28
7	2,20	1,23	59	2,52	1,75	48
8	2,59	1,15	44	2,91	1,49	63
9	3,14	1,38	49	3,11	1,56	61
10	3,60	1,49	70	3,81	2,08	58
11	3,70	1,34	59	4,24	1,95	63
12	5,12	3,32	62	5,39	3,57	67
13	4,35	1,89	23	5,80	4,58	17

The goitre prevalence evaluated by ultrasound in age- and BSA adjusted mean was 15, 6% (p<0.001), (by gender 42.9% in males and 57.1% in females (p=0, 09)

Graph 6: The prevalence of the children with thyroid volume >97% percentile of the reference class by age and gender in different regions (weighted national prevalence 21.1%).



Graph 7: The prevalence of the children with thyroid volume >97% percentile of the reference class by BSA and gender in different regions (weighted national prevalence 24.4%).



From the results is shown that exist a significant association between the results of neck examination by palpation and examination of the thyroid volume by ultrasonography (Wilcoxon Rank Sums test, p<0,001), between neck examination by palpation and urinary iodine (Wilcoxon Rank Sums test, p<0,001) and between examination of the thyroid volume by ultrasonography and urinary iodine (Pearson's Correlation, p<0,001). (Table, 13, 14,15 and 16)

Table.13

Wilcoxon Scores (Rank Sums) for Variable VOL_TH Classified by Variable GOITRE_PALP					
GOITRE_PALP	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1	444	255396.0	186258.0	3497.27635	575.216216
0	394	96145.0	165283.0	3497.27635	244.022843
Average scores were used for ties.					

Table.14

Neck exam. By palpation	Thyroid Volume	Std Dev	IC 95%
Grade 0	2.21	0.84	2,13-2,30
Grade 1	3.65	1.19	3,50-3,80
Grade 2	6.18	3.08	5,77-6,59

Table. 15

Wilcoxon Scores (Rank Sums) for Variable IODURIA Classified by Variable GOITRE_PALP					
GOITRE_PALP	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
1 and 2	445	171024.50	187122.50	3509.81607	384.324719
0	395	182195.50	166097.50	3509.81607	461.254430
Average scores were used for ties.					

Table.16

Neck exam. by palpation	Urinary iodine	Std Dev	IC 95%
Grade 0	123.80	93.50	114,0-133,6
Grade 1	123.80	103.00	111,2-136,5
Grade 2	80.00	103.60	66,3-93,8

$r=-0.17$, $p<0.001$

4.3 Anthropometric results

The mean height of the schoolchildren was 136.4 cm, the median 136.3 cm; the mean weight is 31.9 kg, the median 29.9 kg, the mean age 9.5 years old, the median 10 years old, the mean body surface 1.10 m^2, the median 1.08 m^2

The mean urinary iodine concentration 112.9µg/l, the median 86,2 µg/l, mean thyroid volume 3,70 ml and the median 3,20 ml (Tab. 17).

Table. 17: Mean, standard deviation, and median of some parameters. Total sample.

	Mean	Std. Dev.	Median
Height (cm)	136,4	12,8	136,3
Weight (kg)	31,9	9,5	29,9
Age (years)	9,5	2,1	10
BSA (mq)	1,10	0,21	1,08
Urinary iodine (µg/l)	112,9	103,1	86,2
Thyroid volume (ml)	3,70	2,28	3,20

In the table 18 are reported the positive comparisons in the terms of z-scores for weight and height in different geographical regions.

From the data results that in the region Internal/village the height and weight are significatively lower than in the other regions.

Table. 18: Comparison test of z-score between different regions.

	Internal /Villages vs Coast/Cities	Internal/Villages vs Coast/Villages	Internal /Villages vs Internal/Cities
z Height	p=0.004	P=0.006	P<0.001
z Weight	p=0.004	p=0.014	P<0.001
N	404	404	405

4.4 Use of iodized salt

From the analysis of the questionnaires results that the iodized salt is used from 837/ 840 schoolchildren (99, 6%)

At the end of the field work were collected 839 salt samples from the children and 365 salt samples from the pregnant women. The iodine content of iodized salt samples is measured using a Standard iodometric titration.

In the table 19 and 20are reported the median, sample size, mean value, standard deviation and p50 of the salt iodine concentrations by the different geographical regions.

Table. 19: Median salt iodine concentrations at national and geographical region levels where the regions are recorded to present concentrations in ascending order.

Geographical Regions	Median salt iodine concentration mg/kg*
Costal region /village	15.9
Internal region/village	16.4
Costal region /city	18.5
Internal region/city	26.5
National level	21.2

* Value of adequately iodized salt ≥15mg/kg (ppm)

Table.20 Salt iodine levels according to the regions (sample size, mean value, standard deviation and p 50).

Iodine level (ppm)	N	MEAN	SD	p50
Costal village	300	19.67*	17.59*	15.90*
Costal city	302	21.70	15.79	18.5
Internal village	301	20.54	19.12	16.40
Internal city	301	26.63	16.02	26.50
Total	1204	22.14	17.37	21.20

* mg/kg

From the analyses of the iodine level in these sample resulted that 60.3% of the samples was adequately iodized and 39.7% was not adequately iodized (Tab. 21).

Table. 21: Evaluation of the levels of the salt iodine in Albania

Iodine concentration	Number of samples	Percentage
Adequately iodized ≥15ppm	726	60.3
Non adequately iodized <15ppm	478	39.7
Total	1204	100.0

The highest percentage of this adequately iodized salt was in the internal region (63.62%), whereas the highest percentage of this inadequately iodized salt was in the costal region (43.02%) Table 22

*Table. 22: The distribution of the use of the iodized salt, based in the percentage of iodine in salt in the internal and costal region (P=0.018)**

Region	<15ppm	≥15ppm	Total
Costal	259 43.02 **	343 56.98	602 100.00
Internal	219 36.38	383 63.62	602 100.00
Total	478 39.70	726 60.30	1204 100.00

*Pearson chi ^{2}

** The figures below are in percentage

The percentage of the adequately iodized salt in the costal region was 53 % in the village and 60, 93 % in the city (Table. 23).

*Table. 23: The distribution of the use of the iodized salt based in the percentage of iodine in salt in the costal region (p = 0.058)**

Costal region	Non adequately iodized <15ppm	Adequately iodized ≥15ppm	Total
Village	141 47.00 **	159 53.00	300 100.00
City	118 39.07	184 60.93	302 100.00
Total	259 43.02	343 56.98	602 100.00

*Fisher's test

** The figures below are in percentage

The percentage of the adequately iodized salt in the internal region was 52.49 % in the village and 74.75% in the city (Table. 24).

*Table. 24: The distribution of the use of the iodized salt based in the percentage of iodine in salt in the internal region (p = 0.000)**

Internal region	Non adequately iodized <15ppm	Adequately iodized ≥15ppm	Total
Village	143 47.51**	158 52.49	301 100.00
City	76 25.25	225 74.75	301 100.00
Total	219 36.38	383 63.62	602 100.00

*Fisher's test

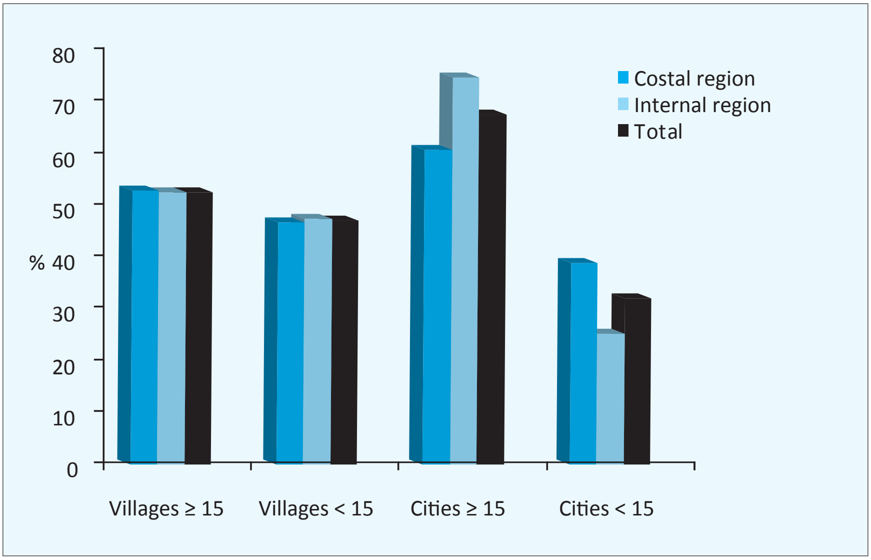
** The figures below are in percentage

The results obtained show the use of the adequately iodized salt in the cities of the internal region is greater than in the villages. (p = 0.000), whereas in the cities of the costal region the use of adequately iodized salt is relatively greater than in villages (p=0.058).

The percentage of salt samples that was not adequately iodized ranged from 36.38% in internal region to 43.02% in the costal region with the highest percentage of non- adequately iodized salt use in the villages of both regions (47.51% in internal region/village and 47.0% in costal region/ village).

In the Graphic 8 are reported the percentages of the adequately iodized salt and these of the inadequately iodized in Albania.

Graph. 8: Distribution of the adequately/no adequately iodized salt according to the regions (in %).



In total, 726 (60.3%) of the salt samples analyzed have a concentration ≥15ppm. This is an indicator used to asses the progress in a country toward reaching the goal of universal salt iodization. As indicated by the joint WHO, UNICEF, and ICCIDD criteria, the goal for IDD elimination as a public health problem is that the proportion of the households consuming effectively iodized salt should be >90 % (Tab. 25). [7]

Table. 25: Comparison of the survey results with criteria for monitoring progress towards eliminating IDD as a public health problem

Indicator : Salt iodization	Goal	Survey result
• Proportion of households consuming effectively iodized salt	> 90%	60.3%

The percentage of the samples with the iodine content 0 is nearly equal in both regions (costal region 15.83% and internal region 15.98%). Exist a significant difference between the two regions regarding the percentage of the samples in the range >0 ppm <7 ppm (costal region 48.65% and internal region 60.73%). In the iodine content range ≥7 and <15 the percentage of the samples in costal region (35.52%) is higher than in internal region (23.29%) (Table 26, table 27 and graphic 9)

Table. 26: Number of salt samples non adequately iodized at various iodine concentrations

Iodine concentrations (ppm)	Costal region	Internal region	Total
0	41 / 15.83**	35 / 15.98	76 / 15.90
>0 and <7	126 / 48.65	133 / 60.73	259 / 54.18
≥7and <15	92 / 35.52	51 / 23.29	143 / 29.92
Total	259 / 100.00	219 / 100.00	478 / 100.00

* Fisher's exact p* = 0.01

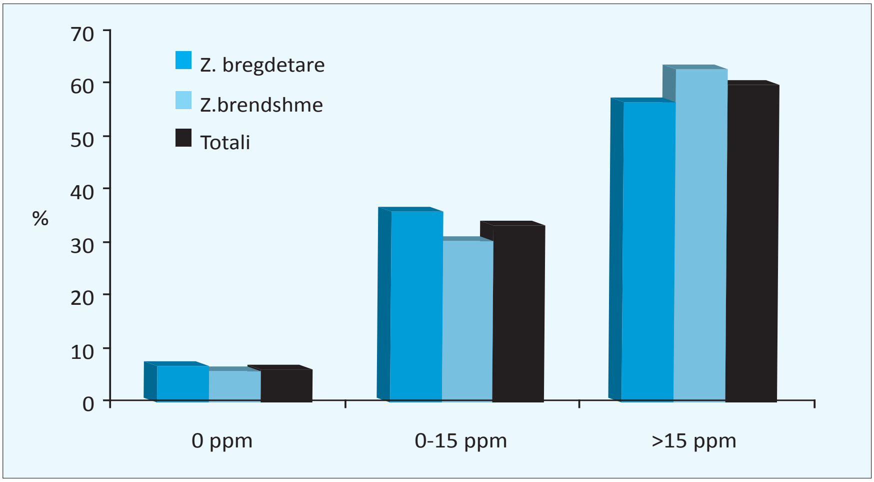
** The numbers below are the percentages.

Table. 27: Distribution of salt samples at various iodine concentrations according to the different regions and national level.

Iodine concentrations (ppm)	Costal region	Internal region	Total
0	41 / 6.8*	35 / 5.8	76 / 6.3
>0 and <15	218 / 36.2	184 / 30.56	402 / 33.4
≥15	343 / 56.9	383 / 63.1	726 / 60.3
Total	602 / 100.00	602 / 100.00	1204 / 100.00

* The numbers below are the percentages

Graph. 9: Distribution of the salt samples at various iodine concentrations according to the regions (in %).



Brands of the salt samples collected are recorded in descending order as follows (Table. 28)

Niki is the most consumed salt in the national level 63.65%. Nearly 10% of the samples are unpackaged, not allowed for human consumption.

Table. 28: Distribution of the samples according to the salt brands.

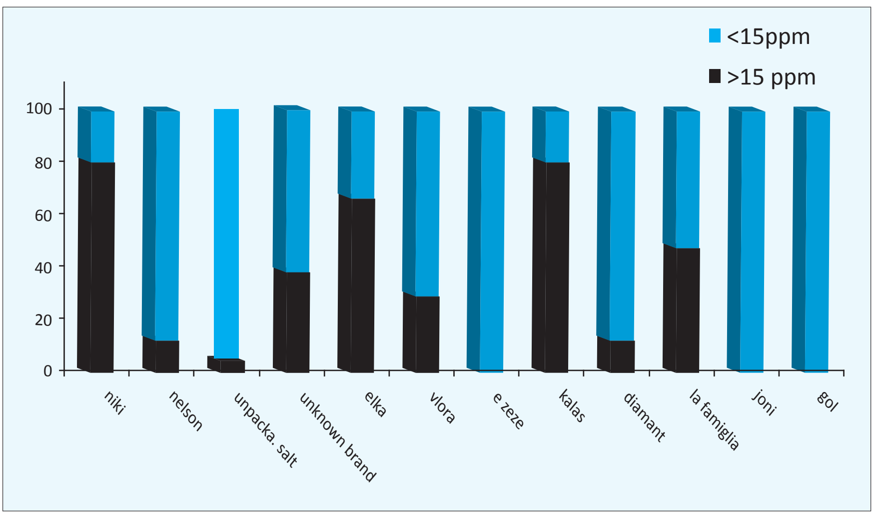
Brand	Number of samples	Percentage
Niki	767	63.65
Nelson	106	8.8
Unpackaged salt	85	7.05
Unknown brand	42	3.49
Elka	39	3.24
Vlora	38	3.15
E zeze	37	3.07
Kalas	36	2.99
Diamant	4	1.99
La famiglia	19	1.58
Joni	9	0.75
Gol	2	0.17
No Sample	1	0.08
Total	1205	100.00

Iodine content of salt by brands is shown in the Table 29 and in Graphic 10.

Table. 29: Iodine content of salt by brands (in number and %)

Brand	<15ppm	≥15ppm	Total
Niki	152 / 19.82	615 / 80.18	767 / 100.00
Nelson	93 / 87.74	13 / 12.26	106 / 100.00
Unpackaged Salt	81 / 95.29	4 / 4.71	85 / 100.00
Unknown brand	26 / 61.90	16 / 38.2	42 / 100.00
Elka	13 / 33.33	26 / 66.67	39 / 100.00
Vlora	27 / 71.05	11 / 28.95	38 / 100.00
E zeze	37 / 100.00	0 / 0.00	37 / 100.00
Kalas	7 / 19.44	29 / 80.56	36 / 100.00
Diamant	21 / 87.50	3 / 12.50	24 / 100.00
La famiglia	10 / 52.63	9 / 47.37	19 / 100.00
Joni	9 / 100.00	0 / 0.00	9 / 100.00
Gol	2 / 100.00	0 / 0.00	2 / 100.00
Total	478 / 39.70	726 / 60.30	1204 / 100.00

Graph. 10: Iodine content in salt by brands



To confirm the analytical quality of the Institute of Public Health laboratory were analyzed 100 iodized salt samples by the Water Analyses Laboratory of the Environment Agency, Autonomous Province of Bolzano, and (Italy). The correlation between these two analytical determinations was r=0.71 (p<0,001) (Tab. 30).

Table. 30: Mean, Standard Deviation, for the analytical determinations of the iodine in the salt carried out by the Laboratory of Tirana and Laboratory of Bolzano

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
E.A. Bolzano	99	21.46687	20.86071	2125	0.20000	118.00000
I.P.H. Tirana	99	22.60657	16.20063	2238	0	63.50000

r = 0, 71 (p<0,001)

4.5 Elaboration of the questionnaires

From the analysis of the school children food frequency questionnaires results that fruits and vegetables are consumed more frequently in the internal regions than in the costal zones. The meat is consumed more frequently in the regions costal/city, costal/village and internal/city than in the internal/village. (Table.31)

Table. 31: The median number in times/week of the several food consumption.

Region		Vegetables	Fruits	Meat	Fish	Salt
	N	Median	Median	Median	Median	(yes/not)
Costal/Cities	210	4.25	5.50	3.00	0.50	yes
Costal/ Villages	210	5.50	5.50	3.00	0.50	yes
Internal/ Cities	210	5.50	7.00	3.00	0.50	yes
Internal/ Villages	210	7.00	7.00	1.00	0.50	yes

In the table 32 are reported, the percentages of schoolchildren's thyropathies (by the goitre grade) according to the reported thyropaties anamnesis in their families. Is observed that the presence of the thyropathies is found in 6.5% of the schoolchildren families with a progressive percentage according to the goiter grade.

Table. 32: The result of the manual examination of the neck and familiar thyropathy anamnesis (%).

Familiar thyropathy anamnesis	Grade 0	Grade 1	Grade 2	Total	N
Positive anamnesis	2,6%	8,4%	11,6%	6,5%	53
Negative anamnesis	97,4%	91,6%	88,4%	93,5%	767
Total	100,0%	100,0%	100,0%	100,0%	820
N	380	250	190		820

Discussion and Recommendations

5 Discussion and Recommendations

Albania results with a **Mild Iodine Deficiency** (median urinary iodine: **86, 2** µg/L). But 28.9% of the schoolchildren surveyed have a urinary iodine level between 50 and 99µg/L, 19.9% have a urinary iodine level between 20 and 49µg/L and 6,8% < 20 µg/L. The internal region/village is significantly worse than all other regions. The situation in the costal region/ village is better than in internal region/village, but worse than all cities.

About 10.5% of children resulted to have urinary iodine concentrations in the ranges (200–299µg/L) at risk of iodine-induced hyperthyroidism and risk of adverse health consequences (>300µg/L) had 4.9% of children.

From the anthropometric data results that in the region Internal/village the height and weight are significantly lower than in the other regions.

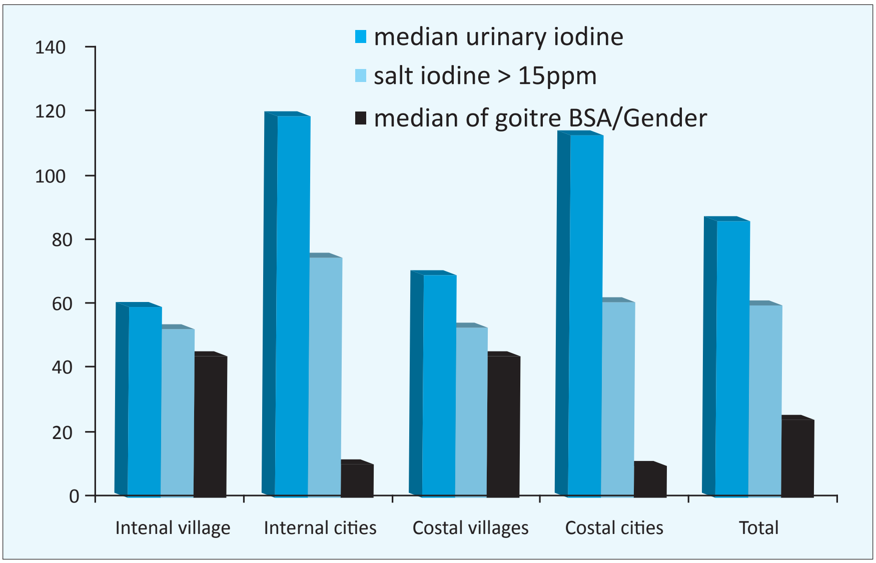
In the pregnant woman the median of urinary iodine in whole sample was **95, 3 µg/L.** Considering children and pregnant woman together the median of urinary iodine resulted to be **90.7µg/L**.

Although there aren't comparable data on the IDD for the pregnant women in the past, this study shows a mild prevalence of IDD. It shows that iodine status of pregnant women is not worse even slightly better than for children, although highly inadequate as compared to the recommended levels.

The median of the goiter by palpation, according to the WHO/ICCIDD criteria, was **53.5%** respectively 30.3% grade 1 and 23.2% grade 2, with a higher accentuation in the internal/village and mostly in the costal/village region, and less in the cities of the two regions. This data shows that Albania is still a country with a severe IDD (based on the epidemiological criteria for assessing the severity of IDD by the prevalence of goiter in school-aged children, WHO, UNICEF, ICCIDD[11]).

The goiter prevalence evaluated by ultrasound in age- and BSA adjusted mean was **15, 6%** (p<0.001). The median of the goitre (adjusted by BSA and gender) by ultrasonography resulted 24.4%. and the median of urinary iodine was 86,2 µg/l, with more difference in the different geographical region (44% of goiter by BSA and 59,1 µg/L of UI in Internal/village, 18.9 and 69,6 µg/L in Costal/ village, 10.2% and 119,0 µg/L in Internal/city and 9.9 % and 113,0 µg/L in Costal/city) (correlation goiter-urinary iodine p<0,001). The graphic nr.11 presents the correlation between urinary iodine–adequately iodized salt -goiter by BSA/gender at children, by region and in total.

Graph.11: The geographical distribution of urinary iodine- adequately iodized salt -goiter by BSA/gender at children



This indicate the importance of the social – economic conditions and therefore nutritional in the determinism of the goiter.

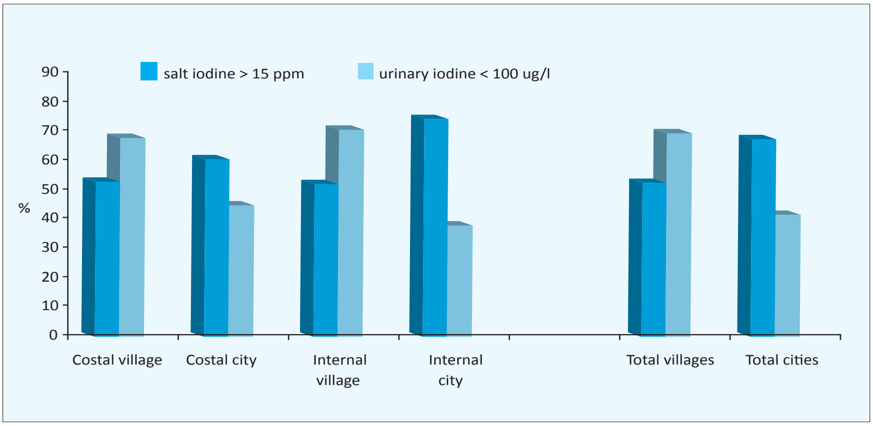
Exist a low presence of the thyroid nodules by ultrasonography: 11 cases above 838 (1.3%).

From the analyses of the iodine level in the salt samples resulted that **60.3%** of the samples was adequately iodized and **39.7%** was not adequately iodized. The highest percentage of this adequately iodized salt was in the internal region (63.62%), whereas the highest percentage of this **inadequately iodized** salt was in the costal region (43.02%).

Population of the cities that used adequately iodized salt in a higher percentage, resulted less iodine deficient than villages' population. Special in the internal cities where consume of adequately iodized salt was 74, 75%, median urinary iodine result to be 114μg/l, (Graphic 12). That means higher iodine consumption is leading to higher iodine status. So, iodized salt prophylaxis is effective in correcting iodine deficiency.

The worse situation presented in the internal region village where the inadequately iodized salt was 47, 51%, median urinary iodine 60, 8μg/l and the higher prevalence of goiter/grade 2 (44, 5%).

Graph. 12 Relationship between adequately iodized salt and urinary iodine deficiency for different regions (both children and women).



In some districts, where there is confirmed a presence of severe iodine deficiency a program of iodine supplementation will need to be considered.

Niki is the most consumed salt in the national level 63.65%. Nearly 10% of the samples are unpackaged, not allowed for human consumption.

99.6% of the schoolchildren families claimed to use iodized salt.

The median of the iodine concentration in the salt is 21.2mg/kg, but only 60.3% of the used salt presents an iodine concentration ≥ 15 ppm.

To obtain better results would be opportune that the iodized salt necessary for the Albanian population to be domestically produced using the existing plant that produce salt in Vlora (with modest investments it can be strengthen the productive capacity of the iodized salt to cover the national requirement -

11,650 metric tons/year), or otherwise the Albanian Government should take measures to strengthen the monitoring of imported salt ensuring adequately iodized salt at household level.

To provide a correct iodine intake in population, the production/ importation and the consumption of the iodized salt should avoid long shelf life of iodized salt, as it usually happens for the imported salt that leads in the loss of the iodine in the product.

The National Committee for the Eradication of Iodine Deficiency Disorders in Albania, can use the data of the study to advocate with the Government for improvement of the legislative framework to achieve universal salt iodization.

The progress towards elimination of iodine deficiency could be monitored through the epidemiological studies on the children of the elementary school by urinary iodine and with determination of the iodine levels in salt performed by a unique center with adequate equipment like Institute of Public Health in Tirana.

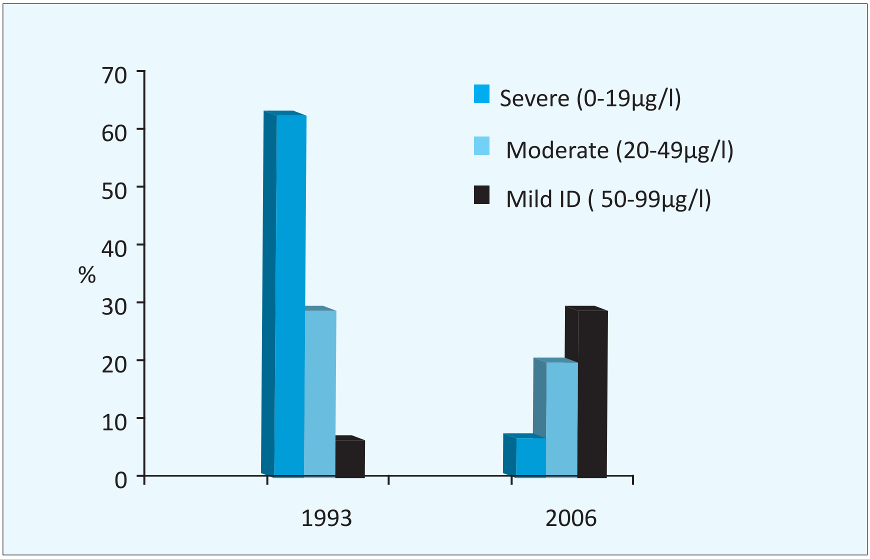
It is also necessary to evaluate iodine prophylaxis' impact in the high urinary iodine values and to control the content of iodine in iodized salt, which should be enough for iodine prophylaxis, but not too high because 15, 4 % of children and 20, 3 % pregnant women examined, present high urinary iodine values (> 200ug/l) (at risk for hypothyroidism).

Practically, we are planning to double check these children and women from this cluster with high urinary iodine, to exclude if they have any other thyroid pathology or it is simply from iodine supplement to the salt.

Another step for the correction of the IDD relates to the screening of the congenital hypothyroidism[16].

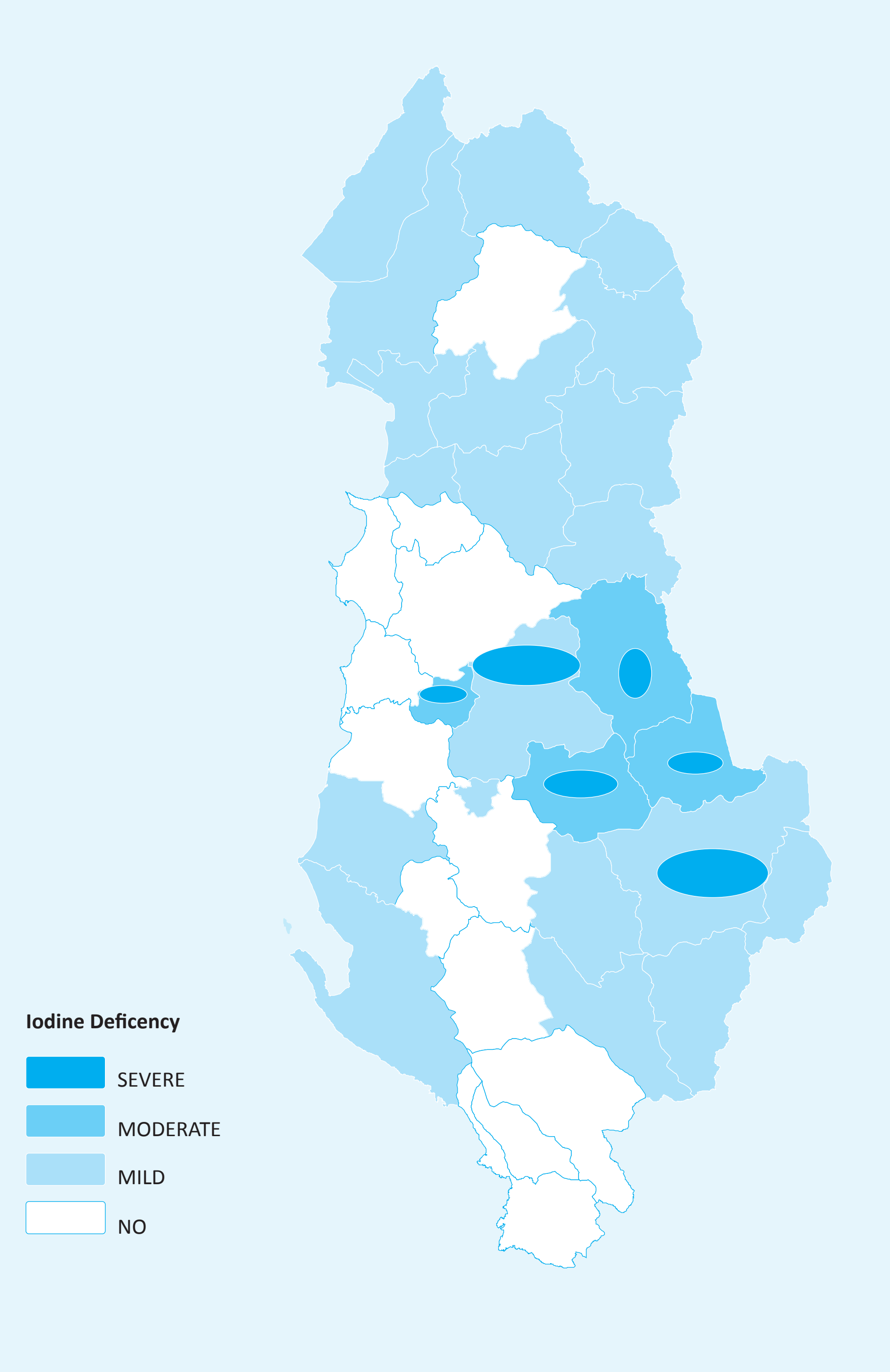
The data, obtained from this study, indicates an evident improvement of the IDD situation in the population comparing with the results of the year 1993 (Graphic 13). Albania, from a country with a IDD prevalence 97.2% (62.7% severe IDD, 29.1% moderate and 6.4% mild *-A survey in 32 clusters among 2395 children 8-10 years old in 1993 based on the median Urinary Iodine Excretion),* today results with a IDD prevalence **55.6%** (6.8% severe IDD, 19.9% moderate, 28.9% mild). Based on these data, from a severe IDD prevalence in 1993 (median of urinary iodine **2-49µg/L**), in the last study results to have a mild IDD prevalence (median of urinary iodine **86.2µg/L**).

Graph. 13 Iodine Deficiency Status in Albania 1993-2006



In spite of the improved situation, approval of the Universal Salt Iodization Law would be an important step for the progress toward the eradication of the IDD in Albania.

Anex 1 IODINE DEFICENCY IN ALBANIA (2006)



References

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References

1. IDD in Albania. Kalo,I. Karafili,L. Poster presented at Brussels Symposium on IDD 4/1992
2. Current IDD status database ICCIDD

   : http://www.people.virginia.edu/~jtd/iccidd/mi/idd_003.htm
3. IDD in Albania. Bardhoshi et.al IDD Newsletter 13(1) 1997
4. Zimmermann MB, Bridson J, Bozo M et al. Severe iodine deficiency in Southern Albania. Int.J.Vitam. Nutr. Res; 73(5), 2003, 347-350
5. "Multiple Indicators Cluster Survey " INSTAT 2000
6. Sullivan KM, May S Maberly G. Urinary iodine assessment: a manual on survey and laboratory methods, 2nd ed. UNICEF, PAMM, 2000.
7. WHO, UNICEF, ICCIDD Indicators for assessing Iodine Deficiency Disorders and their control through salt iodization 1992.
8. World Health Organization. Expanded Program on Immunization. The EPI coverage Survey, training for mid level managers. WHO, 1991.
9. Description and comparison of the methods of cluster sampling and lot quality assurance sampling to assess immunization coverage. WHO, 2001
10. INSTAT, Institute of Statistics. http://www.instat.gov.al
11. World Health Organization. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. A guide for programme managers, 2nd ed. WHO, 2001.
12. Zimmermann, M.B.; Hess, S.Y.; Molinari, L. et al. New reference values

for thyroid volume by ultrasound in iodine-sufficient schoolchildren: a World Health Organisation/Nutrition for Health and Development Iodine Deficiency Study Group Report. Am. J. Clin. Nutr. 2004;79:231-7

13. Justine Turner, Ben Fairman, Chris Harrington, LGC. The accurate analysis of trace metals in clinical samples using ICP-MS. VAM Bulletin 20 (1999)

14. Amtliche Sammlung von Untersuchungsverfahren nach § 35 LMBG- L 49.00.6Beuth Verlag GMBH (September 1998).

15. SAS Enterprise Guide 4.1 (Cary, NC, USA).

A.Olivieri, M.A.Stazi, at al Ipotiroidismo congenito e carenza iodica: I dati del registro Nazionale degli Ipotiroidei Congeniti. :http:// www.iss.it


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7
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3. Entela Bushi/ Chemist , Institute of Public Health
4. Luciana Luisi/ Chemist /Leopoldo Bonetti Chemist Water Analyses Laboratory of the Environment Agency, Bolzano .
5. Antonio Fanolla/ Statisticien, Epidemiologic Observatory, Department of Health, Bolzano
6. Giulia Morosetti/Hygienist, Public-Health Office, Department of Health, Bolzano

2nd. Central Coordination Team:

1. Jolanda Hyska/ Nutritionist, Institute of Public Health ,Tirana.
2. Entela Bushi/ Chemist , Institute of Public Health, Tirana
3. Lindita Grimci/ Endocrinologist, University Hospital Center “Mother Teresa”
4. Arben Luzati/Hygiene expert, Institute of Public Health ,Tirana
5. Enkeleda Mema/ Chemist , Institute of Public Health, Tirana

3rd. Field Work team

1. Julinda Bizhga pediatrician
2. Arta Ago pediatrician
3. Nexhmije Kotani pediatrician assistant
4. Blertina Olldashi endocrinologist
5. Entela Lamcaj endocrinologist
6. Local coordinator of each district.

4 th. Field Supervisor:

1. Pranvera Shehu/ MOH (Ministry Of Health)
2. Nedime Ceka/ MOH
3. Enkeleda Pellumbi/ MOH
4. Ledia Xhafaj/ MOH
5. Mirela Cami/ MOH

5th. Laboratory Technicians:

1. Suzana Backa/ Chemist, Institute of Public Health, Tirana
2. Olimbi Mato/ Laboratory Technician, Institute of Public Health, Tirana
3. Leopoldo Bonetti/ Laboratory Technician, Water Analyses Laboratory of the Environment Agency, Bolzano

6th. Data entry & Analysis:

1. Gazmend Bejtja/ Statistician, Ministry of Health, Tirana
2. Antonio Fanolla/ Statistician, Epidemiologic Observatory, Department of Health, Bolzano

7th. Review of draft report.

1. Petrit Vasili Public Health Expert.