Iodine status among primary school children in Albania

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Abstract

Aim: Iodine deficiency disorders (IDDs) currently constitute a major global public health problem. IDDs remain a public health concern in Albania too. We undertook this survey in Albania to determine median urinary iodine concentration in a sample of school children, and asses the level of iodine in salt samples at the household level.
Methods: A nationwide cross-sectional study was conducted in Albania in 2012 including a representative sample of 1027 school children aged 6-13 years. Urine and salt samples were examined for iodine concentration.
Results: The median urinary iodine concentration was 100.4 µg/l, indicating no iodine shortage. Conversely, 49.6% of the examined urine samples indicated iodine deficiency. Iodine content was found to be adequate in 62.1% of salt samples. The median iodine concentration of salt samples was 18.5 mg/kg.
Conclusion: Our findings indicate that IDDs are still an important public health problem in Albania. These results point to the need for strengthening the national IDD Control Program in Albania, and the need to ban production, trading and use of the non-iodized salt.

***Keywords**: Albania, iodine deficiency disorders, median iodine concentration, school children.*

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 µg of iodine per day, and over a lifetime, the total quantity of iodine needed is only one teaspoonful of iodine. 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 (IDDs). Iodine deficiency continues to be a significant public health problem in many countries. Their effect is hidden and profound affecting the quality of life (1). Globally, 2.2 billion people live in areas with iodine deficiency and are at risk for IDD-related complications (2). Iodine deficiency not only causes goitre, but it may

also result in abortion, stillbirth, mental retardation, growth retardation, irreversible brain damage and retarded psychomotor development in the fetus, infant and the child. It also affects reproductive functions and impedes children's learning abilities. Iodine deficiency is currently recognized as the most common preventable cause of brain damage at a global level. Therefore, IDDs are currently one of the major worldwide public health problems.

Albania is a country with limited environmental resources of iodine. Traditionally, IDD has been a major public health problem. The levels of iodine are very low in drinking water and food. This fact is strongly correlated with IDDs in Albania. The prevalence of IDD among children aged 7-14 years in areas with iodine-free water is 78%-92% whereas, in areas where the iodine content of the water is 8.95mg/l, the prevalence of goitre is only 15.25% (3). In the recent past, Albania had severe IDDs, as shown in several studies. Thus, a study conducted in March 2003 among 826 school children in 7 schools in Korçë, South Albania, reported a median UIE of 45mg/ L and 17mg/ L for urban and rural children respectively (4). Following the examples of many countries, public health decision-makers in Albania employed an effective policy of IDD elimination based on the exclusive supply of iodized salt, and a massive public awareness campaign was launched to promote a rapid increase in acceptance of the consequent exclusive iodized salt consumption. A population-representative survey conducted in the fall of 2006 showed that 6% of the consumers' salt was not iodized at that time and that 60% of the households were already using adequately iodized salt (5). Albanian Demographic and Health Survey (ADHS) data 2008-9 indicate that 76% of families use adequately iodized salt (6). The use of adequately iodized salt in the cities was higher than in rural households.

Notwithstanding the considerable progress in Albania regarding the universal salt iodization strategy, the median urinary iodine concentrations in school-aged children and pregnant women in the same survey indicated that the iodine status in the population remains marginal.

The data of the 2006 survey were encouraging and showed a good progress, but nevertheless Albanian population is still iodine insufficient. Therefore, there is a clear case for continuation of the proposed measures and undertaking different activities and programs to eliminate IDDs in Albania.

On the other hand, there is a need for documenting and monitoring systematically the IDD prevention through epidemiological studies. The basics are in place, and the current study aims to contribute a further step in this process. Thus, the objective of this study was to provide operational data on iodine status in the Albanian population at national level and evaluate the progress towards achievement of IDD elimination in Albania.

In this framework, a survey was carried out during the period September-December 2012 to determine median urine iodine concentration in a representative sample of school children, and assess the level of iodine in salt samples at household level.

Methods

A nationwide cross-sectional survey was conducted in Albania including a representative sample of school children. Data were collected from September to December 2012. Sampling method used was the *"multistage cluster sampling with probability proportionate to size"*, recommended by WHO, UNICEF and ICCIDD (7, 8).

Albanian primary schoolchildren were the primary sampling units. The children from the first to the seventh grade were targeted for inclusion in the current survey.

The sampling frame, therefore, consisted of a list of all primary schools categorized into regional areas. Four regional areas in Albania, supposedly homogenous, were designated (9). For every regional area, 30 clusters were drawn to insure a valid estimation of the IDD prevalence (10). The division board between coastal region and internal region traverses the schools of these districts: Shkoder, Lezhe, Kurbin, Durres, Kavaje, Lushnje, Fier, Vlore and Sarande (the districts mentioned above represent the coastal area).

The total number of children selected from all schools was 1060 children. The expected prevalence of goitre was anticipated at 45% with a precision of 10%. The schools were selected randomly with replacement and with a probability proportional to size (i.e. proportional to the number of children in each school).

All families and teachers from the selected schools

gave their oral consent for participation in the current survey.

Data collection consisted of two main components:
i. For determination of urinary iodine concentration, the casual urine was taken from the children included in the survey. Samples of urine, collected in sealed plastic containers (about 8 ml urine for each person), were transported to the Institute of Public Health Urinary Laboratory for analysis. The Laboratory participates at the EQUIP Program (Ensuring the Quality of Urinary Iodine Procedures) of the CDC (Center for Disease Control and Prevention), Atlanta, USA.

ii. For determination of iodine in the salt, there were drawn samples of salt used in the children's households. Children brought the samples at their respective schools. Salt samples, collected in plastic glasses (about 20 g. of salt for each person), were analyzed at the Food Chemistry Laboratory of the Institute of Public Health.

Results

Urinary excretion of iodine

A total of 1027 urine samples were tested for median iodine concentration. The median iodine concentration was 100.4 mg/L, indicating no iodine deficiency. Median iodine concentration showed mild deficiency in rural areas of both internal and coastal regions included in the survey (Table 1).

Table 1. Median concentration of urinary iodine in a nationwide representative sample of Albanian school children by region

Geographical region	Median concentration of urinary iodine (in μg/L)
Coastal region / rural	84.8
Internal region / rural	91.6
Coastal region / urban	111.7
Internal region / urban	137.5
National level	100.4

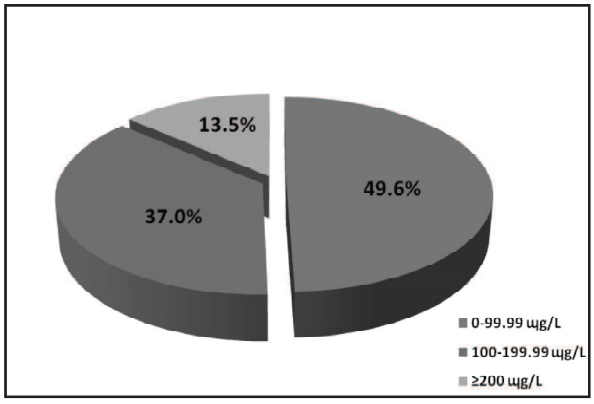
Range of normal values: 100-199 μg/l.

Overall, 49.6% of the examined urine samples showed iodine insufficiency, 37.0% of children had sufficient intake of iodine and 13.5% had excessive intake of iodine.
Overall, iodine concentration in the urine samples ranged from a severe iodine deficiency (<20mg/L) to excessive iodine (e"300 mg/ L), where 33.7% of the examined children had a concentration level of urinary iodine between 50 and 99μg/ L – indicating *mild iodine deficiency* level; 13.4% had a concentration level of urinary iodine between 20 and 49μg/ L – displaying *moderate iodine deficiency* level, and; 2.4% of the children had concentration levels of <20 μg/ L – indicating *severe iodine deficiency* level (Table 2 and Figure 1).
Compared with the distribution of urinary iodine from the study conducted in 2006, there is evidence of an improvement of the IDDs situation in the Albanian population (Figure 2).

Table 2. Distribution of iodine deficiency in Albania based on urinary iodine content (mg/L)

Urinary iodine (in μg/L)	Number	Percentage	Cumulative percentage
0-19.99	25	2.4	2.4
20-49.99	138	13.4	15.9
50-99.99	346	33.7	49.6
100-199.99	380	37.0	86.6
200-299.99	86	8.4	94.9
300+	52	5.1	100.0
Total	**1027**	100.0	

Figure 1. Distribution of iodine intake among Albanian school children (percentages) based on urinary excretion of iodine



Iodine in the salt

A total of 1027 salt samples were tested for median iodine concentration. The median iodine concentration was 18.5 mg/ L (mean value: 21.0 mg/ L).
In the coastal region, median salt iodine was 19.0 mg/ kg, whereas in the internal region it was 18.0 mg/ kg (Table 3). In the rural areas of the internal region, there was evidence of the lowest salt iodine concentration (15.9 mg/ kg) followed by the rural areas in the coastal region (16.9 mg/ kg). This difference in median salt iodine concentrations may

be explained by the fact that individuals in rural areas are reluctant to use the iodized salt due to their necessity to preserve food products for the winter season.

On the other hand, about 62% of the samples had the iodine content of e"15 ppm (i.e. iodized in accordance with WHO/ ICCIDD recommended values), whereas 38% of the samples contained no iodine or, less than 15ppm.

Coastal region displayed a higher consumption of iodized salt (66.3%) compared with the internal region. Conversely, the highest prevalence of non-iodized and/ or insufficiently iodized salt (d"15 ppm) was evident in the internal region (41.7%).

The difference in iodized salt consumption between urban areas and rural areas was considerable (75.3% vs. 58.1%) and statistically significant ($P<0.01$). Furthermore, there was evidence of a statistically significant correlation between iodized salt consumption and urinary iodine concentration level ($P<0.01$) [data not shown].

Discussion

The main findings of this survey, which included a nationwide representative sample of school children in Albania, point to a further improvement of the IDDs' situation in Albania compared with the previous study conducted in 2006. Thus, in 2006, Albania had an IDD prevalence of 55.6 %, with 6.8% of the population exhibiting a *severe iodine deficiency* status, 19.9% showing a *moderate deficiency* status, and 28.9 % displaying a *mild deficiency* status (5). Conversely, 44.4% of the population did not exhibit any iodine deficiency (5). In our study, the prevalence of iodine deficiency was 49.6%, whereas the prevalence of severe iodine deficiency was 2.4%.

A further improvement was also evident for dietary intake of iodine in the current study sample: in 2006, median urinary iodine was 86.2 mg/ L (5), whereas in our study median urinary iodine increased up to 100.4 mg/L.

As for the trend in iodized salt consumption, there is evidence of a slight increase at the national level compared with the previous report pertinent to the year 2006 (5). Regarding regional differences, there is a decreasing trend of iodized salt consumption in the internal region of Albania from 63.1% in 2006 (5) to 58.3% in the current survey, but an increase of almost 10% in the coastal region.

Data on urinary iodine reflect the consumption of iodized salt in each region. Thus, in urban areas of both regions (which exhibit a higher median of urinary iodine), there is also a higher median of urinary iodine.

Therefore, prevention of IDDs through employment of iodized salt is demonstrated as a rather effective approach.

In conclusion, in spite of the improvement of iodine intake of the Albanian population, this study showed that IDDs constitute still an important public health problem in Albania. Our findings, therefore, point to the need for strengthening the National IDD Control Program, and the need to ban production, trading and use of the non-iodized salt in Albania.

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