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THE EVALUATION IODINE DEFICIENCY IN PRIMARY SCHOOL-AGE CHILDREN

İLKOKUL ÇAĞI ÇOCUKLARINDA İYOT EKSİKLİĞİNİN DEĞERLENDİRİLMESİ

Ayça TÖREL ERGÜR[1], Metin MURAT[2], Ferda CANDAN[3], Fikret TAŞ[4]

[1] Department of Pediatric Endocrinology, Faculty of Medicine, Ufuk University, ANKARA
[2] Department of Pediatrics, Faculty of Medicine, Cumhuriyet University, SIVAS
[3] Department of Chemistry, Faculty of Arts and Sciences, Cumhuriyet University, SIVAS
[4] Department of Radiology, Faculty of Medicine, Cumhuriyet University, SIVAS

ABSTRACT

Aims: Iodine deficiency which may cause mental motor retardation still considered to be an important problem. Various epidemiologic studies required to identify and dissolve the effects of iodine deficiency for human body. This study has been undertaken in an attempt to identify the iodine status in school-age children.

Subjects and Methods: In this study; 401 primary school children aged 7-12 years comprised the study group. All cases were classified in three socioeconomic groups as higher, middle and lower groups. The urinary iodine excretion levels of all cases were determined by spectrophotometric method.

Resuts: The mean urinary iodine excretion level in 401 cases was 7.05±0.48µgr/dl. The lowest mean iodine excretion level was observed in the lower socioeconomic group. Conclusion: In our study we determined mild iodine deficiency in primary-school-age children In addition, it was observed that the iodine excretion level was affected by socioeconomic level.

Key words: Childhood, urinary, iodine, excretion

Correspondence Address:
Prof. Dr. Ayça TÖREL ERGÜR
Bilkent 1,Çamlık Sitesi
D2 Blok No:11 Bilkent ANKARA

e-mail: aycaergur@superonline.com

ÖZET:

Amaç: Mental motor geriliğe yol açabilen iyot eksikliği dünya üzerinde halen önemli bir problem olarak yerini korumaktadır. Bu durumun insan vücut sistemlerinde yarattığı negatif etkilerinin saptanabilmesi ve gerekli önlemlerin alınabilmesi için çeşitli epidemiyolojik çalışmalara gereksinim bulunmaktadır. Bu çalışmanın amacı ilkokulçağı çocuklarında iyot durumunu belirlemektir.

Olgular ve Metod: Bu çalışmaya yaşları 7-12 yıl arasındaki 401 ilköğretim öğrencisi dahil edildi. Tüm olgular yüksek, orta ve düşük olmak üzere üç sosyoekonomik gruba ayrıldı. Tüm olguların idrar iyot atılımları (İİA) spektrofotometrik yöntemle saptandı.

Bulgular: 401 olguda ortalama idrar iyot ekskresyonu 7.05± 0.48 µgr/dl'tu. En düşük ortalama İİA düşük sosyoekonomik gruptu.

Sonuç: Bu çalışmada ilkokulçağı çocuklarında hafif derece iyot eksikliği ile uyumlu bulgular saptandı. Ek olarak sosyoekonomik düzeyin İİA düzeylerini etkilediği gözlendi.

Anahtar Kelimeler: Çocukluk çağı, idrar, iyot, atılım

INTRODUCTION

Since iodine is an important element in thyroid hormones synthesis, iodine deficiency may lead to serious diseases such as congenital abnormalities of the fetus and newborn, stillbirth, cretenism (mental retardation, deafness, spastic diplegia, dwarfism); goiter of the newborn, marked or subclinical hypothyrodism; mental retardation, and reduced intellectual capacity (1). Regarding to these clinical conditions, iodine deficiency has been considered to be an important health problem among people. Prevention of these diseases begins with determining the iodine levels of the region and next steps should be planned by considering the degree of iodine levels. In Turkey, many investigations have been and are being made with a view to determine the iodine deficiency level. In these investigations, it has been indicated that the daily need of iodine could not sufficiently be met by natural nutritional resources and iodinization of salt which has been applied for the last 50 years to eliminate iodine deficiency. However, only 17% of salts produced in Turkey are enriched with iodine and this level seems to be far from the aim (1). Recently, Erdoğan et al a school-based survey was conducted in 900 school-age children from different urban, suburban and rural areas. They reported that iodine deficiency has been eliminated in 20 of 30 cities surveyed, but it's still an important problem in rural areas. According to their study; there were severe iodine deficiency in 7.2%, moderate and mild iodine deficiency in 20.6% and 19.3% of children; respectively. Moderate

to severe iodine deficiency stil exists in 27.8% of the Turkish population which is much better compared to 1997 (the rate of iodine deficiency; 58%) and 2002 (the rate of iodine deficiency; 38.9%) surveys (2). The iodine level in school-age children in Sivas Centrum has been determined for the first time in this study to determine iodine status and recommend some measures to prevent iodine deficiency.

MATERIAL AND METHODS

This is a prospective study which conducted between October 1999 and June 2000. In this study, 202 female and 199 male children with age range of 7 to 12 years and different socieconomic levels (higher, middle and lower) were comprised the study group (3).The schools in Sivas were selected according to the socioeconomic levels of the regions.The number of the cases are selected by systematic sampling method from all of the socioeconomic levels (4). In determining the urinary iodine excretion (UIE), 2-5 cc fresh urinary sample was taken to glasstubes. The elementary urinary iodine levels were measured by spectrophotometric method (405 wavelength) and the results are recorded as mgr/dl. According to this method, UIE of 2 mgr/dl or below considered as severe iodine deficiency, the level of UIE between 2-4.9 mgr/dl considered as moderate deficiency, and 5-9.9 mgr/dl considered as mild iodine deficiency (5,6). The statistical analyses were made using Kolmogorov-Simirnov test, Kruskal-Wallis test in SPSS (Statical Package for the Social Science) statical programme. p values less than < 0.05 were considered as statistically significant.

RESULTS

This study was carried on 401 children with age range of 7-12 years from 8 primary schools Of these 401 children, 202 were girls and 199, boys. The mean UIE level of 401 children was 7.05±0.48 mgr/dl (Table1). In this study, the schools were divided into three groups according to the socioeconomic level of the regions. Accordingly, the 37.40% of children were classified as Group A (higher), 32.66% as Group B (middle) and 29.92% as Group C (lower) socioeconomic level (Table 2). A statistical difference was determined in the median UIE among the three groups (A-B:$p<0.05$; B-C:$p<0.001$; A-C:$p<0.001$) Among median UIE of the 3 groups, UIE of group C (lower) was the lowest (Graphic 1). Table 3 shows mean UIEs according to ages and Table 4 shows iodine status of all children.

Table 1. Mean and median UIE in our cases

Case (n)	*UIE (mgr/dl)*	*UIE (mgr/dl)*
401	7.05±0.48	5.7 (0.1-25)

Table 2. Median UIE Levels according to socioeconomic Level

Socioeconomic condition	*n*	*UIE (gr/dl)*	*p*
Group A (lower)	150	4.5 (0.1-12)	<0,05*
Group B (middle)	131	5.6 (0.1-25)	<0,001*
Group C (higher)	120	9.8 (0.6-19.6)	<0,001*

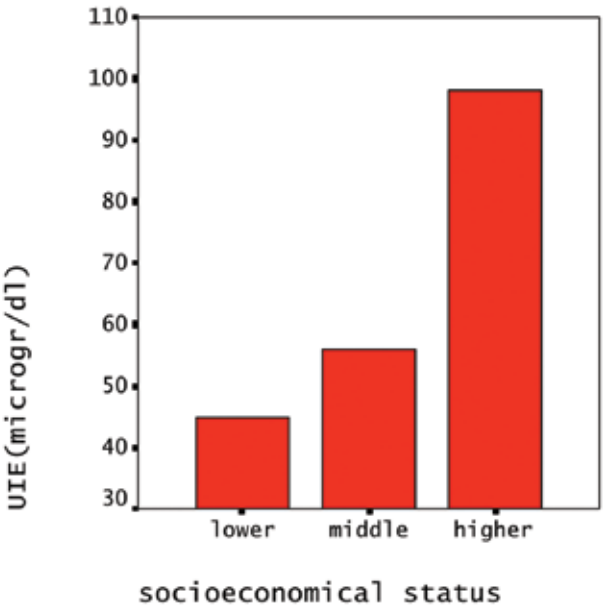
GroupA-B ;* p<0,05, significant (Kruskal-Wallis)
GroupB-C; * p<0,001 significant
Group A-C; * p<0,001 significant

Table 3. The mean UIE Levels According to Ages

Age	*n*	*%*	*UIE(mgr/dl)*
7;8	150	37.40	7.07±0,49
9;10	193	48.12	6.84±0.33
11;12	58	14.46	7.42±0.57

Table 4. Iodine status of all the cases

Levels of ID	*n*	*%*
Mild	156	38.90
Modarete	90	22.44
Severe	51	12.71
Normal	104	25.93



Graphic 1. Urinary iodine excretion levels of all cases according to socieconomical status

DISCUSSION

The iodine deficiency disorders (IDD) is basically a part of micronutritient malnutrition and it is estimated that two billion people in the world suffer from micronutritient malnutrition. There is a wide geographical area in the world where natural nutritive resources cannot meet the iodine requirement of human physiology. In the areas of South America, Africa, China and the Himalayes, it is not possible to prevent the increase of IDD risk (1). In many European countries including Turkey, there are local IDD areas.

Research related to iodine status of Turkey was initiated in 1950 and since then, Turkey has been accepted as a mild-moderate iodine deficiency region (7). In order to observe the iodine deficiency and/or the results of iodine prophylaxis applied, it is essential to cover all the population in the study, particulary the pregnant women, fertile women, the newborn, and nursing mothers. However, as IDD may be detected with laboratory studies and/or clinically observed in school–age children, complementary studies covering children or students are frequently conducted (8).

One of the most important methods to show iodine deficiency in a population is the determination of urinary iodine excretion in the population. The most reliable technique is to collect 24 hours of urine to calculate urinary iodine (UI) level. Howevere this system is not practical in public health studies. Because of this reason, a method as iodine/creatinine in the on-spot urine sample has been developed. However, as malnutrition may be found together with iodine deficiency in developing countries and this may cause false results. For this reason, different methods have been developed in developing countries to study the on-spot UI levels. Examinations of the UI level as mgr/dl in at least 100 urinary samples is accepted as the best and the most effective method (9). For this reason, we thought that this method is appropriate to use in our cases; Yordam et al. determined the amount of UI level as 15.7 mgr/g creatinine and 62.7 mgr/g creatinine in Kayseri and Ankara; respectively (9,10). Hatun et al. determined the median iodine excretion is 15.3 mgr/g creatinine in 5562 primary school children in Kocaeli (11). Semiz et al reported that the iodine excretion amount is 64.1 mgr/g creatinine in 212 primary school children in Antalya (11,12). This result seems to be acceptable with iodine deficiency of a moderate degree. Tarım et al determined that the median iodine excretion level is 4.6 mgr/dl in 115 random urine samples in Bursa (13). Erdoğan et al studied iodine status in Turkey before obligatory iodization (14). They investigated UI concentrations of 5948 school age children from 20 cities. They determined that median UI concentration ranged between 14 to 78 mg/L indicating severe to moderate iodine deficiency. According to these results, obligatory iodization of household salt is the essential measure taken for the moment, additional measures may be needed in the near future. It was reported that 50-70 mg/kg KI or 25-40 mg/kg KIO3 was necessary for the obligatory iodization of the household

salt according to the later legislation in 1999 and this was strictly enforced in July, 2000 (13).

In an investigation performed in Europe, the median UI concentration per country have been determined and according to this investigation, median UI concentration is 25-50 mgr/g creatinine in Spain, 71-86 mg/g in France, 18.5 mg/g in Italy (Sicily), 10-49 mg/g in Portugal, 100-132.5 mg/g in Austria, 50 mg/g in Belgium, 38.8 mg/g in Denmark, 60 mg/g in Germany, 340 mg/ g in Finland, 94.5 mg/g in Grece, 300 mg/g in Iceland, 70-137.5 mg/g in Ireland, 96-138 mg/g in U.K, 147-247 mg/g in Norway, 141 mg/g in Switzerland, 150 mg/g in Sweden, 96-138 mg/g in Holland, and 70 mg/g in Turkey (15). Recent data shows that Pakistan is now number 1 on the list of the top 10 iodine-deficienct countries with the greatest numbers of school-age children with inadequate intake of iodine (16).

In our study, we observed that the lowest UIE was determined in Class C (Low socioeconomic level). This situation has been explained by nutritional deficiency and low rate of education in families with low socioeconomic conditions. The other main causes are poorly usage of iodized salt, use of rock salt and putting in iodized salt in food during cooking. Maternal iodine deficiency due to insufficient nutrition lead to low serum iodine levels of their babies. So it causes inadequate mental functions. Thus, inadequate mental functions also lead to low socioeconomy. As a result, this is a vicious cycle. According to Villalpando et al. low UIE was greater in 1363 children of low socioeconomic level (17). Yun Low et al. reported that UI levels were significantly differed with mother's race (18). In contrast, Gomo et al. detected cases with significantly higher UI concentrarions in the rural areas than those in the urban areas. According to these authors this finding was suprising because one would usually expect the availability of iodized salt is much more available in urban areas and suggest that a dietary source other than iodized salt contributed significantly to dietary iodine intake in the rural areas (19).

In conclusion, we determined mild degree of iodine deficiency in primary school-age children and the iodine excretion level has been affected by socioeconomical levels of the population Iodine deficiency is an important problem in children. Solving this problem will improve these children's school performance and growth. In the other hand this study is the first epidemiological study on this topic and we hope it will be useful for future epidemiological investigations. Furthermore, it has a great significance on assesing the effectiveness of iodinization programs. On the other hand, we believe that compaigns against iodine deficiency and encouraging people to use iodized salt should be the next step to protect people against IDD.

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