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Assessing the Elimination of Iodine Deficiency Disorder in Al ShaabiahBahri/ Khartoum State/ Sudan 2013

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Abstract: ***The major objective of this study has been to assess the iodine deficiency situation in, Shaabiah area– Khartoum Bahri / Sudan the study is designed to have precise epidemiological information of Iodine Deficiency Disorders (IDD). The indicators include goiter prevalence, and study of knowledge, attitude and practice (KAP) of students (aged 14 – 19 years) concerning IDD and the current iodized salt situation. During the survey a campaign was carried to raise the awareness level about (IDD), their prevention and control.A cross sectional School-based study was conducted during December, 2013, for a sample of 165 students aged 14-19 years, 79 males and 86 females were selected from (Omer Bin Abdul Aziz and Bahri Al Gadema schools) respectively, out of three hundred and thirty students. The study revealed that the goiter rate in Al Shaabia Schools is 21.2%, IDD affected both sexes; 26.7% of females were affected,versus 15.2% of the males. The Goiter rate in this study is of moderate severity which indicates that still there is IDD problem in this area. The prevalence was higher in females than males 1:1.83. Grade 1 was the most prevalent form of thyroid enlargement (18.2%). Approximately 24% of the students didn't know what iodine is; also no one knew the daily amount of iodine needed. Wrong concepts were noticed during interviews about the iodized salt, some of them thought that iodine may cause renal problems or sterility. In the focused group discussions; the majority of the students answered by saying iodine exist in sea food, milk and green vegetables, their knowledge about complications of IDD was poorThe usage of non-iodized salt among students is estimated to be 40.6%, 31.5% of the students don't know which type of salt they use in their homes.The results of this study imply that it is of major importance to improve the iodine situation in the whole area, and necessitate an intervention program. This includes distribution of iodine capsules as a short term strategy and iodized salt as a long term strategy. The study suggests that significant work is needed towards achieving the goal of raising the IDD awareness as well IDD elimination is required.***

Keywords: IDD, KAP study, Goiter, Iodine

1. Introduction

1.1 Background

Iodine is an essential micronutrient required for normal growth, development andfunctioning of the body, it is a constituent ofthe thyroid hormones, thyroxine (T4) and tri-iodothyronine (T3). Thyroid hormonesare important for the regulation of the body metabolism. The healthy human adultbody contains 15-20 mg of iodine of which 70-80% is stored in the thyroid gland, the gland weighs only 15-25 g, highlighting the its importance in the overallmetabolism of iodine (Hetzel B, 1989).

The most apparent manifestation of iodine deficiency is goiter, an enlargement of the thyroid gland, but the spectrum of diseases associated with iodine deficiency is much greater. The most prominent manifestation of iodine deficiency is the effect on brain function that may occur at all stages of life, from early foetal damage to hypothyroidism in the neonate, childhood, or adulthood (Hetzel B, 1989, Zimmermann M., 2009)**.**The extreme consequence of iodine deficiency is death in the form of fetal loss,stillbirth, and increased perinatal and infant mortality. Others include congenital anomalies, hearing impairment, endemic cretinism, and a wide range of physical and mental anomalies,even with mild iodine-deficient, individuals usuallyexperience moderate mental retardation, which decreases work capacity andeconomic potential,Cretinism caused by severe deficiency in early life is associatedwith extreme mental retardation (Hetzel B, 1989).

People living in areas affected by severe Iodine Deficiency Disorders (IDD) may have an intelligence quotient (IQ) of up to about 13.5 point below that of those from comparable communities in areas where there is no iodine deficiency (Hetzel B, 2005).This mental deficiency has an immediate effect on child learning capacity, women's health, the quality of life of communities and their economic productivity. On the other hand, IDD are among the easiest and cheapest of all disorders to prevent. A person needs only a teaspoon of this micronutrient – consumed in small amounts over a lifetime, since only minute amounts are required each day, it is known as a micronutrient (WHO/UNICEF/ICCIDD, 1999 and WHO/UNICEF/ICCIDD, 2007).

World Health Organization (WHO) and UNICEF recommended universal salt iodization (USI) as the main strategy to achieve elimination of IDD. Because salt is consumed almost everywhere on daily basis, universal salt iodization is considered the most efficient means of virtually eliminating IDD**,** the recommended dietary allowance of iodine is 50 mcg/day for infants in first 12months of age, 90 mcg /day for children of 2-6 years, 120 mcg/day for school children of7-12 years, 150 mcg /day for adolescents and adults, and 200-300 mcg /day duringpregnancy and lactation (WHO/UNICEF/ICCIDD, 1999).Since 1992, there has been tremendous progress in increasing the amount of salt which is adequately iodized. As a result, many countries are now on threshold of achieving IDD elimination, In those countries, the

emphasis will shift to ensuring that the achievements are sustained for all time,nevertheless, IDD remains a major problem in developing countries where geographic, economic, and political issues block progress towards its eradication, it continues despite over half a century of research and iodine prophylaxis programs, to exist untreated in some regions of the world., poverty, with poor sanitation and general malnutrition, may worsen the effects of iodine deficiency. Goiter control can improve with socio-economic development;however, there is evidence from all over the world that iodine distribution programs have a dramatic effect as single interventions, even without a rapid improvement of other aspects of poverty, because they deal directly with this single primary cause,The many examples of effective programmes, cited by Dr. Hetzel(Hetzel, 1996),and in the ACC/SCN's global strategy to combat IDD (ACC/SCN, 1987),The two main intervention program are fortification, usually of salt; and capsules and injection (every 3-5 years) of iodized oil as an emergency measure.

Iodine deficiency in Sudan is widespread with less than 10% of the population having access to iodized salt(Federal Ministry of Health Khartoum Forum, 2005).It is particularly severe in the mountains of Darfur and Nile State where goiter rates approach 90%. An IDD Control Program was initiated in Sudan in 1989 using iodized oil capsules and this program continues in highly endemic regions of the country. In 1994 Sudan adopted salt iodization as the long-term strategy to control IDD, but there was no order or decree prohibiting the sale of non-iodized salt, **(Federal Ministry of Health Khartoum Forum, 2005).**Prevention of IDD will result in improved quality of life and productivity, and improved educability of children and adults suffering from this nutrient deficiency in the country.Sudan Federal Ministry of Health (FMOH) estimated that 22% of Sudan's population is iodine deficient, each year approximately 242,400 children are born with iodine deficiency in the country. Among this group 7,000 may become cretins, 24,000 may suffer of severe mental retardation and 210,000 newborns will grow up with a mild intellectual deficit. Two out of every ten children of school going age suffer from some form of iodine deficiency in Sudan, most of whom do not have visible signs and symptoms like goiter, (Federal Ministry of Health Khartoum Forum, (2005).

2. Materials and Methods

A cross-sectional study was conducted in Al Shaabiah - Al Khartoum Bahri – Sudan,during August, 2013. The study was done on secondary school males and females students aged14 – 19 years.A multistage, random sampling method was used to select the study sample. In the first stage, two schools (one for boys and one for girls) were selected randomly (simple random) from the two males secondary schools and two females secondary schools in Al Shaabiah, then systemic random sampling was usedto select the study the study sample.

Thyroid examination by palpation was done according to criteria of World Health Organization. Classification, as Grade 0, 1 and 2.A total of 165 questionnaires – based interview was done to the entire sample, with components on knowledge, attitude and practice (KAP) about IDD and Iodized salt was conducted. Knowledge about IDD and iodized salt, information about buying, storage, in addition to the practices were collected. The detailed data was filled during the interview. A Questionnaire based interview was done also to five retailers and two supermarkets' keeper, the information on buying, pricing and availability of iodized salt were collected.

2.1 Aim of the Study

The main purpose of the study was to provide information on IDD statusin Al Shaabiah area– Khartoum Bahri – Sudan and to assess the elimination of iodine deficiency disorder in Al ShaabiahBahri area.

2.3 Objectives

1. Identifying the current status of IDD by assessing goiter grade in the secondary schools students in Al Shaabiah area- Khartoum Bahri.
2. Assessing the knowledge, attitude and practice (KAP) among secondary schools students about iodine deficiency disorder.
3. Discus the marketing of salt and the perception of the retail shops and supermarkets keepers atthe area.

2.4 Ethical Consideration

Written consent was obtained from the ministry of education and the education office in Bahri (secondary school level), the schools' principles also gave their permission in order to curry out the study in respective schools.A verbal consent was taken from each student before starting the interview. The ethical risk in this study is only the breaking of confidentiality, such as disclosure of the findings of the individual.

2. 5Data Entry and Data Analysis

The data was double checked and coded according to the questions, then entered into a computer database and analyzed using SPSS version 20. Means and proportions of the socio-demographic characteristics were compared between the female and male students using student test and for categorical variables Chi-squares was used, $P<0.05$ was considered significant.

3. Results

3.1 Goiter Examination

Table 3.1 indicates the distribution of goitrous cases according to goiter grade, sex. From the table, only five cases of grade 2 goiter were observed, Females were 2.4% versus 0.6% males. Grade 1 goiter recorded a higher prevalence (18.2%) among examined students.

Table 3.1: Percentage distribution of sample examined by Age group, sex and grade of goiter

Age Groups	Total No. Of students	Grade 0				Grade 1				Grade 2			
		Male		Female		Male		Female		Male		Female	
		No	%	No	%	No	%	No	%	No	%	No	%
<14-15	10	2	100%	6	75%	0	0	2	25%	0	0	0	0
>15-17	91	29	78.4%	39	72.2%	7	18.9%	12	22.2%	1	2.7%	3	5.5%
>17-19	64	36	90%	18	75%	4	10%	5	20.8%	0	0	1	4.2%
Total	165	67	40.6%	63	38.2%	11	6.6%	19	11.5%	1	0.6%	4	2.4%

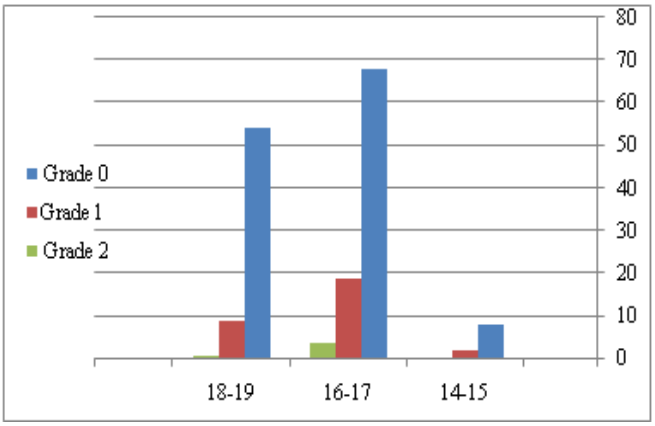

Figure 3.1: Distribution of the sample examined by the age group and the goiter grade

Table 3.2: Brief outline for the overall results

Variable	Value
Number of students studied	165
Mean age	16
Goiter Grade 1	18.2%
Goiter Grade 2	3%
Total Goiter Rate	21.2%

3.2 Results of the questionnaire based interview with the secondary schools students in Al Shaabiah Area

KAP study about IDD was conducted by questionnaire based-interviewfor the secondary schools students at Al Shaabiah schools and the results whereas follow:

When the students where asked about iodine, 48.5% said that iodine is a chemical element, 27.9% said it is a vitamin and 23.6% claimed that they didn't know the answer. Figure 3.2

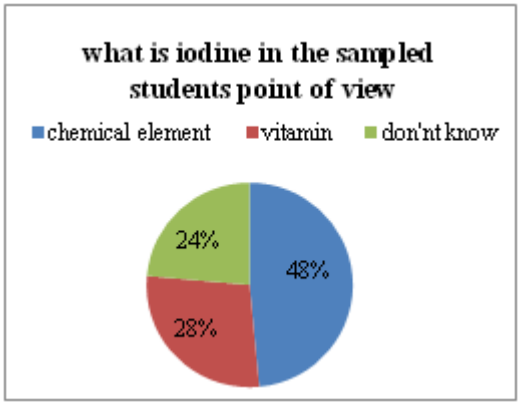

Figure 3.2

About iodized salt, 86.1% of students heard about it and 13.9 didn't.Approximately 19.7% of the students who heard about iodized salt got the information from their families, 8.5% from multimedia, 0.7% from hospitals, 71.1% from the school curriculum.

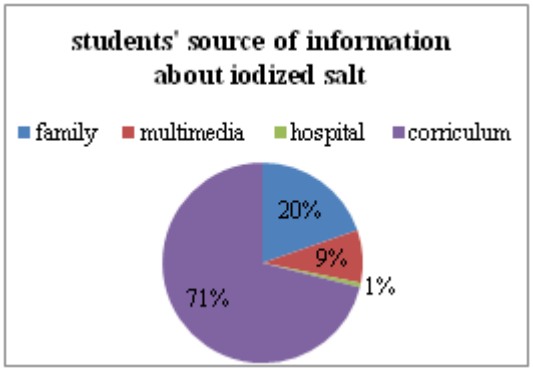

Figure 3.3

In the identification of iodized salt at shops 57.6% of the students can identify it, 8.5% of the students cannot and 33.9% they claimed they didn't know if they could. The usage of regular non-iodized salt was high in the area, about 40.6% of the students use it in their homes, 27.9% of the students said that they use iodized salt in their homes and 31.5% didn't know what type of salt they use.

Table 3.3 Association between usage of iodized salt and Goiter

Goiter grade by examination	Do you use iodized salt at home			total
	yes	no	I don't know	
No goiter	43	44	43	130
Grade 1	3	18	9	30
Grade 2	0	5	0	5
total	46	67	52	165

P value= 0.003 (significant).

Chi-square test was done to see the association between goiter and the use non- iodized salt and it was significant.All the students who use iodized salt purchased it from super markets because of its unavailability in local retails shops. The students who don't use iodize salt due to family preference were 9%, Approximately1.5% didn't use it due to its higher cost and 89.5% said they use non iodized salt because it is more available and easy to approach.

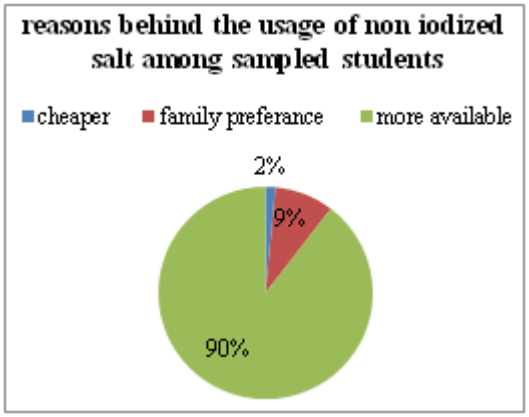

Figure 3.4

Seventy five percent of the student thought that the iodized salt is important for health and development, 3.6% thought it is not important and the rest of the students didn't know whether it is important or not.For the storage of iodized salt 30.3% answered the right answer by saying in closed dry bottle, 18.8% said they would store it in open bottle or plastic bag, 50.9% didn't know how to store it.About the effectof iodized salt by heat, 38.2% answered right by saying yes, 19.4% said no, 42.4% didn't know whether it is affected or no.

Table 3.4 Frequency and percentage of students in the sample with relatives affected by IDD

Relative with IDD	frequency	percent
yes	71	43
no	94	57
total	165	100

3.3Results of Focused Group Discussion with the students

Fifteen to seventeen focused group discussions was done for females and males secondary schools in Al Saabiah area by guiding questions about natural sources of iodine, symptoms and complications of IDD, prevention of goiter and regular use of iodized salt.Most of the students mentioned sea food as source of natural iodine; some of them mentioned milk, egg and vegetables as sources also, but the majority of them didn't know the effect of heavy rains and floods on lowering the iodine content of the soil.

The majority of the students were surprised and shocked when they were discussed about giving the livestock and farm animals enough iodine in their diet, and they didn't know that animals can be affected by iodine deficiency and this will affect the iodine content of their products.When the students were asked about symptoms of IDD the commonest answer was goiter, some of the students said weakness and fatigue, none of the students appreciated any relation between mental dullness, bowel habits alternation and menstrual disturbances with IDD.

The knowledge about complications of IDD was poor among the students; most of the students didn't know any complication and minority mentioned mental retardation.Most of the students believed that goiter can be prevented by regular use of iodized salt.From observation most of the students who answered correctly had relatives with goiter or IDD and their families were their source of information.

3.4 Results of the in depth interview with the retails and supermarket keepers

Three retail shops and two super markets around the schools area were selected to conduct in depth interview with their keepers.All the keepers of the super markets that were selected knew what iodized salt is, and they are selling it, but regarding the retails keepers two out of three knew iodized salt but all of them were not selling it.All the shops whether supermarket or retail sell non iodized salt as well.

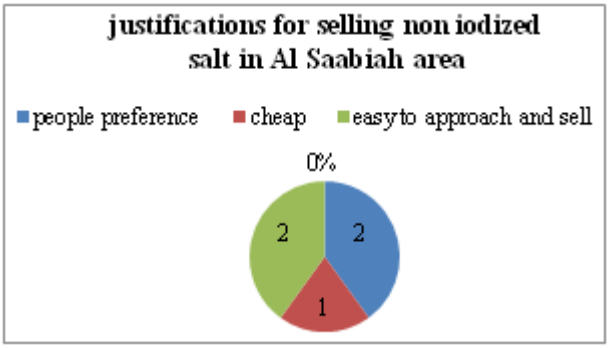

Figure 3.5

The price of non iodized salt ranges from 0.500 to 1.000 Sudanese pound for 500 gram, on the other hand the price of iodized salt ranges from 2.500 for the local product versus 6.000 Sudanese pounds for the imported one.The super market keepers said that the majority of customers who buy iodized salt complain about the higher price.One out of the five keepers knew what IDD is and its association with goiter and that it can be prevented by regular use of iodized salt, he claimed that he would advise the customer to buy iodized salt if he was asked. By observation non iodized salt was definitely more available than the iodized salt.

4. Discussion

4.1Goiter examination

A sample of 165 students aged 14-19 years -79 males and 86 females were selected from (Omer Bin Abdul Aziz and Bahri Al Gadema) respectively, out of three hundred and thirty students. The study revealed that the goiter rate in Al Shaabia Schools was21.2%, IDD affected both sexes; however, the prevalence is higher in females (26.7%), than (15.2%) in males. In previous national studies done in 1989 and 1997 in different zones in Sudan, always female had more prevalence than males. In 1997 survey, the distribution of the cases by sex at state level showed that in both states (Khartoum and Darfur), more cases were among females than males, 408 (30.5%) in South Darfur and 341 (25.5%) in North Darfur but in south Darfur the females lie in the severe status while those in North Darfur are in moderate status. Among males; the number of cases in South Darfur 362 (27.1%) and in North Darfur 225 (16.8%) both are in the moderate status,by looking at the total goiter rate "TGR" in Khartoum state by sex, there was a problem among females (7.1%, 283) than (3.7%, 159) among males. (Sudan Federal ministry of health –FMOH-, 1999).

In this study chi-square test was done to assess the association between the goiter grade and the sex and it wasn't significant. This is could be precipitated by the family history of goiter, also it can be due to low hygiene, low socio-economic status, higher consumption of goitrogens, and the significant numbers of displaced people from the western regions.Considering goiter prevalence by grade; 18.2% of cases had grade 1 goiter, 63.3% of them were females. goiter grade 2 was found in 3% (80% were females). The classification method of goiter grades used in this study was based on the modified plan proposed by WHO, UNICEF and ICCIDD in 1993 (WHO/UNICEF/ICCIDD, 1999) which combined grades 1A and 1B together, and grades 2 and 3 into a second grade.It is apparent that IDD is a public health problem of moderate range in Al Shaabiah area.

4.2 Discussion of the questionnaire based interview aspect of the study

Knowledge, attitude and practice (KAP) study among the secondary school students was conducted by questionnaire based-interview- for 165 student aged 14-19 years in the study area. The questionnaire–based interview was completed for 165 students. Opportunity was taken during the KAP study to raise the awareness of the students about the causes, prevention and control of IDD.The source of information about iodized salt was the school curriculum, family, mass media, especially television and radio, and those who had experience with goitrous relatives had the information from health care providers. This illustrates the effectiveness of providing basic health knowledge by school education (although the topic is very brief for grade or level8 in the curriculum).Almost 31.5% of the students were not aware of the type of salt they were using, 40.6% of the students were using non iodized salt and 27.9% used iodized salt.

The iodized salt was available some years ago, and its price was higher than the non iodized. Approximately 24%% of the students don't know what is iodine, also no one knew the daily amount of iodine needed.Wrong concepts were noticed during interviews even from the teachers about the iodized salt, some of them thought it may cause renal problems or sterility!

Depending upon package, transportation and storage, 20 to 40 percent of iodine may be lost from the salt. Iodized salt should be shielded from moisture, sunlight and high temperature. It should be stored in airtight containers with well-fitting lid, in the study area, 27.9% found to be using iodized salt but the majority of them don't know about the proper storage of iodized salt, They leave the cover open and they add the salt while cooking, exposing the iodized salt to high temperature and vapors.

4.3 Focused group discussions:

Majority of the students answered by saying iodine exist in sea food, milk and green vegetables. The majority of them didn't know about the effect of floods and heavy rains in lowering iodine content of the soil, the Nile fishes have low iodine content and if the animal diet didn't have enough iodine it will affect the their products weather milk or meat. The recognized symptom of IDD among the students was goiter, their knowledge about complications of IDD was poor. There was a chance to do health education to raise the awareness of each study group after the discussion to correct wrong concepts and believes.

4.4 At the Retail level

Four shopkeepers (3 retail shops and 2 supermarkets were visited), they knew about iodized salt, but they don't know about its advantages. Some of them said that, people don't buy the iodized salt, till it becomes expired, because its price was higher than the non iodized, and they don't know about any legislations for the iodized salt.Imported iodized salt was found only in the 2 supermarket. Its price ranges between 2.500–6.00 Sudanese pounds, 4 - 12 times higher than non-iodized.The price differences are among the factors preventing people from purchasing and consuming iodized salt, also the unavailability of the iodized salt in all the shops and the family preferences. The iodized salt under various brand names are generally sold in large supermarkets, which are used by the economically better and literate people. Shops generally supply raw powdered non iodized salt seems to be major source of supply for most people. These sources need to be targeted to sell iodized salt.

5. Conclusions

1) Goiter in students aged 14-19 years (21.2% prevalence) is of moderate severity in AlShaabia schools which indicates that still there is IDD problem in this area. The prevalence was higher in females than males1:1.83. Grade 1 was the most prevalent form of thyroid enlargement (18.2%).
2) The usage of non iodized salt among students is estimated to be 40.6%, 31.5% of the students don't know which type of salt they use in their homes.
3) It is not possible for poor families to buy enough grains, fish, meat and vegetables from the market, The poorest people will stay the most vulnerable of IDD, especially if the price of the iodized salt still be more expensive than the non-iodized salt.
4) Iodized salt has to be covered by legislation. This will also ensure that no selling of non-iodized salt in the markets.
5) IDD is micronutrient deficiency and can be affected by other micronutrients deficiencies, so comprehensive approach is advised.
6) The existence of IDD problem is due mainly to the lack of health education in iodine-deficient areas, marketing non-iodized salt, low production and higher price of the imported iodized salt, all these contribute to the aggravation of IDD.
7) Universal Salt Iodization is summed up by the five As: **A**wareness, **A**vailability, **A**ccessibility, **A**cceptability, and **A**ffordability.

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