ORIGINAL ARTICLE

Knowledge, attitude, and practice of iodized salt use in Al-Riyadh and Al-Ozozab areas, Khartoum, Sudan

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ABSTRACT

Iodine deficiency and subsequent iodine deficiency disorders have been a longstanding problem in many areas of the world, including Sudan, and still remains as the leading cause of preventable brain damage. According to the Sudan Household Health Survey, in 2006, the consumption of iodized salt in Sudan was 11%, only to deteriorate later on in 2011 to 9.5%. This is a descriptive cross sectional study which assesses the knowledge, attitude, and practice regarding the use of iodized salt in two socioeconomically different residential areas, Al-Riyadh and Al-Ozozab, Khartoum city, Sudan. From total of 152 participants selected from Al-Riyadh and Al-Ozozab areas (50% from each), there were 87 (57 %) females. Participants from Al-Riyadh had a higher educational and income level than those from Al-Ozozab, and better knowledge regarding the importance of regular iodized salt consumption to treat iodine deficiency (61% and 54%, respectively). However, only 39% of the participants were actually buying iodized salt. There was a significant

relationship between residency and buying of iodized salt among the participants from Al-Riyadh (49%) and Al-Ozozab (30%) areas (p -value = 0.02). There was also significant association between the educational level and buying iodized salt (p -value = 0.014), but not with the income (p -value = 0.23). The consumption of potential goitrogenic foods (pearl millet or peanut butter) was high among the participants (n = 142) from Al-Riyadh and Al-Ozozab, and constituted 76% and 83%, respectively. Compulsory national salt specification needs to be established in Sudan, together with monitoring the market availability of iodized salt.

KEYWORDS

Iodine deficiency; Goitre; Iodized salt; Knowledge; Consumption; Goitrogenic food; Sudan.

INTRODUCTION

Iodine is a vital raw element for the human body. Its deficiency results in many diseases known as

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the iodine deficiency disorders, since it is needed for the synthesis of thyroid hormone by the thyroid gland [1]. Moreover, iodine deficiency is the most common cause of preventable brain damage [2]. Consuming supplemented table salt will provide daily 500 µg of iodine [3]. Iodine is also naturally found in the soil and seawater. Meat, some breads and eggs are other alternative sources. However, due to natural processes, like flooding and erosions, iodine has been depleted from soils. As a result, crops grown in these soils, and subsequently animals that feed on these crops will be deficient in iodine [4]. About one third of the world's population lives in the areas deficient in natural sources of iodine making iodine one of the most prevalent micronutrient deficiencies [5].

Two hundred forty one million schoolchildren are estimated to have insufficient iodine intake, most of which live in the South East Asia regions and African regions [3]. As for Sudan, iodine deficiency control programs have been implemented in the form of distributed iodized oil capsules and iodized sugar in the mid-1970s [2,6,7]. However, by 2006, there was no progress made in the implementation, and most of the programs have stopped. According to the Sudan Household Health Survey, by 2006, the consumption of iodized salt in Sudan was 11%, while in 2011 it even got worse and dropped to 9.5%.

Endemic iodine deficiency was also documented biochemically in Sudan since the 1980s [8], and the remarkably high prevalence of congenital and juvenile endemic hypothyroidism has been ascertained since early 1990s in Darfur Region [9]. It has been estimated that iodine deficiency affects yearly 200,000 children born in Sudan, 3% of whom may develop cretinism, 10% severe intellectual impairment and 87% less severe intellectual disability [10]. The promising outcome of congenital hypothyroidism, when early detected and promptly treated, speaks for the relevance and importance of a national screening program, as well as the importance of other effective measures to address iodine deficiency in the community.

Several approaches have been made regarding the issue of iodine deficiency in Sudan. However, it

still remains a problem with drastic consequences that could be controlled by a measure as simple as consuming iodized salt. Nevertheless, the access to iodized salt and its consumption are still inadequate. Moreover, several goitrogenic factors included in the diet have altered the adaptation of the thyroid gland and promoted the development of goitre [11]. Studying the effect of knowledge on iodized salt consumption can perhaps facilitate a way to implement its consumption.

MATERIALS AND METHODS

Study design, study area and participants

This is a descriptive, cross sectional community-based study aiming to assess the knowledge, attitude, and practice of iodized salt use in Al-Ozozab and Al-Riyadh areas in Khartoum city, Sudan (December 2017). Equal number of participants from each neighbourhood was included in the study. Al-Riyadh area is classified as first class neighbourhood with regards to the socioeconomic status, whereas Al-Ozozab is a third class residential area. The participants were adults (above 18 years) of both genders, residing within the two study areas at the time of the study.

Sample size and technique

The sample size was calculated using the formula:

$$n = z^2pq / d^2$$

$$P = 0.11 \quad q = 1 - P = 0.89 \quad z = 1.96 \\ d = 0.05$$

Therefore, sample size = 151; however, 152 questionnaires were collected since 151 is not divisible by 2; hence, 76 questionnaires were collected from each of Al-Riyadh and Al-Ozozab. Cluster sampling was planned; but due to inability to obtain the total number of houses in both study areas, systematic random sampling could not be performed, hence a convenience non probability sampling was used.

Study variables

Dependent variables

Knowledge about iodized salt and attitude towards use of iodized salt.

Independent variables

Use of iodized salt, history of goitre, use of goitrogens (e.g., pearl millet and peanuts), availability of iodized salt, level of education, income level and storage of the salt.

Data management and analysis

Data were collected using a self-administered questionnaire over a period of 3 weeks (December 2017). An informed consent was obtained from the participants of the study. The questionnaire items were translated to Arabic to facilitate communication with the participants.

The questionnaire was based on a questionnaire used in a similar study by the United Nations Children's Fund. The data was collected by one of the Authors (LMAS) with the help of colleagues.

Data analysis

Data was analysed using SPSS version 25, p -value of <0.05 was used as cut-off point for statistical significance. The knowledge was assessed by a scoring system, as each correct option was given a score of one, making the total score 5. The mean for both areas was calculated using Mann–Whitney test. Descriptive and inferential statistics were conducted on all the items using chi square, Mann–Whitney and

Spearman's tests. Although the sample was a convenience sampling, we tried to display the possible correlations within the sample.

RESULTS**Sociodemographic**

Regarding the sociodemographic data (Table 1), 56.5% of the participants were females, 34.8% of them were from Al-Ozozab, and 21.7% from Al-Riyadh, while 43.5% were males, 15% of them were from Al-Ozozab and 28.5% were from Al-Riyadh. Concerning the monthly income, about half (46%) of the participants residing in Al-Ozozab area had an income of 1,000 to less than 3,000 Sudanese pounds (SDG), while more than half (54%) of those residing in Al-Riyadh area had an income of 5,000 SDG and more. Ninety one percent of participants residing in Al-Riyadh area are College graduates, while 56% of those living in Al-Ozozab area had reached this level of education.

The participants of AL-Ozozab have a higher knowledge score regarding iodized salt and iodine deficiency disorders (Table 2), the mean of knowledge of Al-Ozozab was 2.13 in contrast to that of Al-Riyadh being 1.82 (p -value = 0.21). Regarding the advantages of iodized

Table 1. The sociodemographic characteristics of the participants in Al- Riyadh and Al-Ozozab areas ($n=152$).

Variables	Al- Riyadh area ($n = 76$)		Al-Ozozab area ($n = 76$)	
	Category	Percentage	Category	Percentage
Gender	Male	57%	Male	30 %
	Female	43%	Female	70 %
	Total	100%	Total	100 %
Monthly income	> 1,000 SDG	7%	> 1,000 SDG	31%
	1,000 to > 3,000 SDG	15%	1,000 to > 3,000 SDG	46%
	3,000 to > 5,000 SDG	24%	3,000 to > 5,000SDG	14%
	5,000 SDG and more	54%	5,000 SDG and above	09%
	Total	100%	Total	100%
Educational level	College graduate	91%	College graduate	56%
	Completed high school	06%	Completed high school	33%
	Completed primary school	02%	Completed primary school	5.5%
	Illiterate	02%	Illiterate	5.5%
	Total	100%	Total	100%

SDG, Sudanese pound.

salt, the results were quite similar for the two neighbourhoods (50% of both groups were aware of it). Two thirds of the participants from Al-Riyadh heard about the iodized salt, while 58% of those from Al-Ozozab did the same thing. Again almost similar percentage of both groups (81% and 85%) added salt to the food when it is being cooked. Participants from Al-Riyadh area had better knowledge than those from Al-Ozozab regarding the importance of

regular iodized salt consumption to treat iodine deficiency (61% and 54 %, respectively). However, only 39% of the total participants were actually buying iodized salt.

In Al-Ozozab the mass media seems to have a major role in regards to their knowledge since 52.6% of the participants claim to have obtained their knowledge from it (Figure 1). In contrast, 55.3% of the participants of Al-Riyadh claim

Table 2. Knowledge of iodized salt use in Al-Riyadh and Al-Ozozab areas.

Variables	Al- Riyadh area		Al-Ozozab area	
	Category	Percentage	Category	Percentage
Knowledge of advantages of use of iodized salt	Yes	50	Yes	50
	No	50	No	50
Who have heard about iodized salt	Yes	66	Yes	58
	No	34	No	42
Storage of salt among the participants	Opened jar	4.5	Opened jar	2.8
	Jar with lid	91.2	Jar with lid	94.4
	Others	4.3	Others	2.8
Addition of salt to the food when it's being cooked	Yes	85	Yes	81
	No	15	No	19
Knowledge on regular iodized salt consumption to treat iodine deficiency	Yes	61	Yes	54
	No	13.6	No	19
	I don't know	25.4	I don't know	27

Figure 1. The source of knowledge among the participants regarding iodized salt use in Al- Riyadh and Al-Ozozab areas ($n = 152$).

to have obtained their knowledge from medical workers. Moreover, the participants of Al-Riyadh also buy iodized salt at higher rate (Table 3). Sixty three percent of people from Al-Ozozab area did not buy iodized salt because they did not know why it is important, while a lower percentage of this (53%) did so in Al-Riyadh area (Figure 2).

There is a statistically significant association between the educational level and buying iodized salt (p -value = 0.014, Table 4). However, the

Table 3. The relationship between residency and buying of iodized salt among the participants from Al-Riyadh and Al-Ozozab areas*.

Buy iodized salt		Residence		
		Al-Ozozab	Al-Riyadh	Total
Yes	Frequency	22	36	58
	Percent	30.14%	48.65%	39.46%
No	Frequency	51	38	89
	Percent	69.86%	51.35%	60.54%
Total	Frequency	73	74	147
	Percent	100%	100%	100%
p -value		0.022		

*There is a significant relationship between residency and buying of iodized salt among the participants from Al-Riyadh and Al-Ozozab areas, p -value = 0.02.

association between the income and buying iodized salt was not significant (p -value = 0.232, Table 5). Finally, there was no significant association between iodized salt consumption and presence of goitre among the participants from Al-Riyadh and Al-Ozozab (p -value = 0.673). The consumption of potential goitrogenic foods (pearl millet or peanut butter) was high among the participants ($n = 142$) from Al-Riyadh and Al-Ozozab and constituted 76% and 83%, respectively. These were consumed on daily bases by 21% of Al-Riyadh residents and by 6% of Al-Ozozab neighborhood, and from time to time by 31% and 46%, respectively (Figure 3).

DISCUSSION

There is a difference in socioeconomy between Al-Ozozab and Al-Riyadh (Table 1) with Al-Riyadh having a higher income level than Al-Ozozab, as 54% of the participants from Al-Riyadh had an income of more than 5,000 SDGS in contrast to the 9% of participants from Al-Ozozab. Moreover, there was also a marked difference between Al-Ozozab and Al-Riyadh regarding the educational level (Table 1), as 91% of the participants from Al-Riyadh were college graduates as opposed to the 56% of the participants from Al-Ozozab.

Figure 2. Reasons for not buying iodized salt among the participants in Al- Riyadh and Al-Ozozab areas ($n = 152$).

Table 4. The relationship between the educational level and buying of iodized salt among the participants from Al-Riyadh and Al-Ozozab areas*.

Buy iodized salt		Educational level			
		College graduate	Completed high school	Completed primary school	Illiterate
Yes	Frequency	51	5	0	1
	Percent	89.47%	8.77%	0%	1.75%
No	Frequency	60	22	3	2
	Percent	68.97%	25.29%	3.45%	2.30%
Total	Frequency	111	27	3	3
	Percent	77.08%	18.75%	2.08%	2.08%
<i>p</i> -value		0.014			

*There is a significant relationship between the educational level and buying of iodized salt among the participants from Al-Riyadh and Al-Ozozab areas, *p*-value = 0.014.

Table 5. The relationship between the monthly income and buying of iodized salt among the participants from Al-Riyadh and Al-Ozozab areas*.

Buy iodized salt		Monthly income (SDG)			
		Less than 1,000	From 1000 to less than 3,000	From 3000 to less than 5,000	5,000 and more
Yes	Frequency	8	15	9	24
	Percent	32%	34.88%	34.62%	52.17%
No	Frequency	17	28	17	22
	Percent	68%	65.12%	65.38%	47.83%
Total	Frequency	25	43	26	46
	Percent	100%	100%	100%	100%
<i>p</i> -value		0.232			

SDG, Sudanese pound.

*There is no significant relationship between the monthly income and buying of iodized salt among the participants from Al-Riyadh and al-Ozozab Areas, *p*-value = 0.232.

Despite a higher educational status of Al-Riyadh participants, there was statistically insignificant difference in the knowledge regarding iodized salt and iodine deficiency disorders between the two groups as the mean of knowledge of Al-Ozozab was even higher being 2.13 in contrast to that of Al-Riyadh being 1.82 (*p*-value = 0.21) even though the same exact percentage of participants of both groups claimed that they can list the problems related to iodine deficiency disorders. Moreover, the participants of Al-Ozozab are more aware of the iodine deficiency in the environment.

It is noteworthy that only 39% of the participants in the two residential areas were actually buying

iodized salt. Those from Al-Riyadh buy iodized salt more than those of Al-Ozozab with a statistically significant association between the educational level and buying iodized salt (Table 4). These results are consistent with those of a study done in 2012 in Sudan which concluded that education correlates with the chances of buying iodized salt. They also indicate that throughout the years there has been lack of effort to educate the public. This is prompting to consider running campaigns, or perhaps using the mass media to spread the knowledge.

Moreover, the availability of iodized salt seems to play a major role. This is because even though

Figure 3. Times of pearl millet and peanuts consumption among the participants from Al-Riyadh and Al-Ozozab areas ($n = 152$).

the mean of knowledge of both areas was similar, residents of Al-Riyadh buy iodized salt more, which could be explained by its availability in their supermarkets and their higher income level facilitating buying iodized salt. This supports the results of a research done in 2006 in Sudan which concluded the lack of efficient iodine deficiency control programs and poor availability of iodized salt [12,13].

There seems to be no association between iodized salt consumption and prevalence of goitre which could be explained by lack of awareness and clinical diagnosis. Moreover, thyroid function test would have been more useful in detecting subclinical cases, since as established by a previous research done in Denmark the slightest difference in iodized salt consumption can have significant impacts on the thyroid function [14].

A study done in 2001 in Asfahan city of Iran showed that despite adequate iodine intake, the rates of goitre were still high, suggesting the contribution of goitrogens in developing goitre [15]. Therefore, a clinical diagnosis of goitre in the participants of Al-Ozozab and Al-Riyadh would have also been useful in evaluating the effect of goitrogens on the size of the thyroid gland, since most of the

participants from both study areas consume the goitrogens, pearl millet and peanut butter.

Most of the participants of both studies store their salt in closed lids which is fortunate since this protects the salt from humidity that affects the stability of iodized salt [16].

CONCLUSIONS

The participants of Al-Ozozab area have a higher knowledge score with a mean of knowledge of 2.13 in contrast to that of Al-Riyadh (classified as affluent neighbourhood with regards to the socioeconomic status), being 1.82. There is a statistically significant association between the educational levels and buying iodized salt. We recommend implementation of public campaign to increase the awareness of the society, establish compulsory national salt specification, increase the availability of iodized salt in the local stores and to conduct further researches.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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ETHICAL APPROVAL

The study was approved and received ethical clearance from the Faculty of Medicine, University of Khartoum. Informed consent was obtained from the participants of the study ensuring the confidentiality of all their information.

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