Knowledge, attitude, and practice of iodine intake in community Al-Ahsa region, Saudi Arabia

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Abstract

Iodine deficiency and subsequent iodine deficiency disorders have been a longstanding problem in many areas of the world andremains as the leading cause of preventable brain damage.The term iodine deficiency disorders (IDD) refer to all the effects of iodine deficiency on growth anddevelopment in human and animal populations that can be prevented by correction of the iodine deficiency. Lack of iodine knowledge might be a risk factor for inadequate iodine intake in population. Therefore, we aimed to determine the relationship between iodine knowledge and intake in community of Al- Ahsa region of Saudi Arabia. A cross-sectional study was conducted in Al-Ahsa region of Saudi Arabia. Iodine intake was assessed by questionnaire. A total of 300 participants completed the study.The results revealed that out of total (300) participants, 115 (38.33%) were confident about the role of iodine in the body. Youngest subjects were unaware of iodine role in the body (P= .014). More respondents were familiar with aspects of excessive iodine intake compared to inadequate iodine intake. Lack of knowledge about iodine may lead to iodine deficiency. It is recommended to educate younger age group through health education at institutional level.

Keyword: Iodine intake, iodine deficiency, Al Ahsa, Saudi Arabia

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Introduction

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

Iodine deficiency, including impaired brain development and low IQ in children, and nodules and hyperthyroidism in adults, can occur in the absence of clinical manifestation, such as cretinism and goiter [18]. Worldwide, it is estimated that one third (~ 1.88 billion) of the world population lives in areas where natural sources of iodine are low, with approximately 29.8% (241 million) school-age children globally are estimated to have insufficient intake of iodine [3]. There has been remarkable progress in the global effort to eliminate IDD. In 1993, WHO estimated thatthe prevalence of goiter due to iodine deficiency affected 110 countries globally. Over the past decade, the number of iodine-deficient countries has fallen from 54 to 25 and the number of countries with adequate iodine intake has increased from 67 to 116 [18].

Despite the scarcity of substantial historical data on iodine deficiency in Saudi Arabia, the two national surveys, carried out nearly two decades apart, have shown that Saudi population has a sufficient iodine nutrition at the national level, however, both surveys and other regional studies demonstrated a degree of mild to moderate iodine deficiency especially in the southern regions based in goiter prevalence indicator [21–24].

Food fortification is a public health policy aims to reduce the number of people with dietary deficiencies within a population. Salt is a good vehicle for iodization because it is consumed almost universally without seasonal variation; there are relatively few production facilities, simplifying quality control; technology for iodization is well established; consumer acceptability of iodized salt is high; and iodization is very inexpensive [25].

Universal Salt Iodization (USI) is a strategy recommended by the WHO and UNICEF Joint Committee on Health Policy since 1994 to ensure sufficient intake of iodine by all individuals. It indicate that all food-grade salt, used in household and food processing should be fortified with iodine as a safe and effective strategy for the prevention and control of iodine deficiency disorders in populations living in stable and emergency settings [1, 9]. This strategy has been implemented in more than 120 countries around the world, many of them have successfully eliminated iodine deficiency disorders or made substantial progress in their control [18, 27]. Saudi Arabia adopted this strategy as a recommendation of the first national survey about iodine deficiency disorders among Saudi population in 1994–1995 [20]. Salt iodization begins first at the level 70–100 ppm [11], then subsequently adjusted to a level of 15–40 ppm [28] responding to WHO recommendation [29]. 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 goiter [11]. Studying the effect of knowledge on iodized salt consumption can perhaps facilitate a way to implement its consumption.

Research Methodology

Research Design

The study was conducted from January 2021 to March 2021. The questionnaire with nine questions, was created to find out basic data on participants age, level of education, habits on salt intake, knowledge of the iodine role in the body, insufficient or excessive intake of iodine, thyroid hormone test, possible presence of thyroid disease and any medication for thyroid disease. To each question answers were provided, except for one question where corresponding explanation should be included. The target population were both males and females of age between 15 – 68. The questionnaires in electronic were distributed to community consenting to participate in the survey.

The optimal sample size was 300, with 95% confidence interval (CI) and a 5% error. The questionnaires were distributed to males and females of age between 15 – 68 consenting to participate in survey. Questionnaires without complete or with vague responses were not further considered (N = 18). Thus, 300responses(instead of survey)were taken in final processing.

Statistical methods Data for analysis were obtained by counting. Results were presented as numbers or relative fre-quencies (percentages) of total number of participants. Comparision between groups was performed by Chi square test. The value of $P < 0.05$ was considered statistically significant. If result of $P < 0.05$ were obtained, difference between certain categories was calculated by comparisons of proportions. Post hoc tests were used for paired comparisons, applying the Bonferroni correction.

Data analyses were performed using Microsoft Excel 2010 (Microsoft, Redmond, Washington) and MedCalc 11.5.1., statistical software (MedCalc Software, Maraikerke, Belgium).

Result

The sample size of survey and percentages of obtained answers summarized in Table 1. Majority of the respondents were between the age group of 15-25 yrs. (78%).

Table 1 Survey responses and results

Question	Response	Frequency (N= 300)	Percentage (%)
Your age is:	15-25 years	234	78
	26-35 years	20	7
	36-49 years	21	7
	50-68 years	25	8
Your qualification is:	High school	112	37.3
	Bachelor's degree	162	54.0
	Master's Degree	16	5.3
	Not applicable	10	3.3
How much salt you use in	Large Quantity	34	11.3

food?	Moderate Amount	237	79.0
	Avoid Using salt	29	9.7
Do you know what is the main role ofiodine in the body?	Yes	123	0.41
	No	177	0.59
Insufficient iodine intake in food can lead to:	Osteoporosis and other bone diseases	50	16.7
	Skin and nail changes, as well as hair loss	41	13.7
	The appearance of drowsiness and deprivation in psychomotor development	73	24.3
	Do not cause any disease	2	0.7
	I do not know	129	43.0
	Option 6	5	1.7
Excessive intake of iodine will cause:	Health problems	243	81.0
	No problem	12	4.0
	I do not know	45	15.0
How often do you do thyroid hormone test?	In 6 months	22	7.3
	In one year	19	6.3
	When doctor ask to do	105	35.0
	Never do the test	154	51.3
Do you suffer from any thyroid disease?	yes	22	7.3
	No	278	92.7
Are you taking any medicine for thyroid disease?	Yes	16	5.3

	No	284	94.7

3.1 *Role of Iodine in the body*

The results revealed that out of total participants, 115 (38.33%) were confident that they knew what iodine was, while 185 (61%) participants appeared not to be aware of iodine role in the body (P= .0028) Table2. When respondents based on the awareness of iodine role considered, higher proportion of youngest subjects (138) were not familiar with iodine role in the body (P= .014).

Table 2 Level of awareness regarding role of Iodine in body

Age	No	Yes	Total
15-25 years	138	96	234
26-35 years	16	4	20
36-49 years	9	12	21
50-68 years	22	3	25
Total	185	115	300

Note: Chi Square statistics, p-value = .0028; Regression analysis P value = .014

Statistically no significant difference was observed among the respondents considering the degree of education (P= .300) Table 3.

Table 3 Relation between education and level of awareness of iodine role in body

Qualification	Yes	No	Grand Total
High school	44	68	112
Bachelor's degree	63	99	162
Master's Degree	7	9	16
Not applicable	1	9	10
Grand Total	115	185	300

Note: Chi Square statistics, p-value = .3007

Those respondents aware of iodine role were more familiar with its relation to thyroid gland and formation of thyroid hormones.

3.2 *Iodine Intake Perception*

In general, more respondents were familiar with aspects of excessive iodine intake compared to inadequate iodine intake (243 vs 166; 81% vs 44%; P < .001) Table 4 and 5.

Table 4 Level of awareness of participants for inadequate iodine intake

Age	Osteoporosis and other bone diseases	Skin and nail changes, as well as hair loss	Appearance of drowsiness and deprivation in psychomotor development	Do not cause any disease	I do not know	Option 6	Total
15-25 years	39	33	62	2	94	4	234
26-35 years	3	4	4		9		20

36-49 years	3	2	3		12	1	21
50-68 years	5	2	4		14		25
Total	50	41	73	2	129	5	300

Note: Chi Square statistics, p-value = .8843

Table 5 Level of awareness of participants for Excessive iodine intake

Age	Health problems	No problem	I do not know	Grand Total
15-25 years	189	9	35	234
26-35 years	18	1	2	20
36-49 years	18	1	2	21
50-68 years	18	1	6	25
Grand Total	243	12	45	300

Note: Chi Square statistics, p-value = .8539

Subjects aged between 15 and 25 yrs., were more familiar with the effects of excessive iodine intake compared to inadequate iodine intake (189 vs 136; 63% vs 45%; P <.001) Fig. 1.

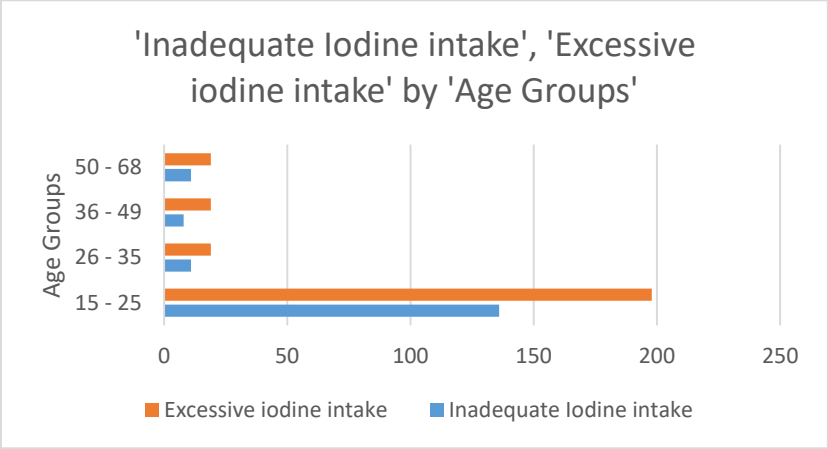

Fig. 1 Participants' responses towards low and high iodine intake

3.3 *Thyroid Hormone testing and Thyroid Disease*

The frequency of thyroid hormone determination was reported 13.66%. Among these subjects (N= 41) most were not familiar with iodine role in the body. Presence of thyroid disease was identified in 22 (7%) subjects (Table 6).

Table 6 Respondents status for any thyroid disease

Age	Yes	No	Grand Total
15-25 years	12	221	234
26-35 years	1	20	20
36-49 years	6	15	21
50-68 years	3	22	25
Grand Total	22	278	300

Note: Chi Square statistics, p-value < .001

The results revealed that there was higher prevalence of thyroid disease in subjects aged between 15 – 25 yrs., Fig. 2.

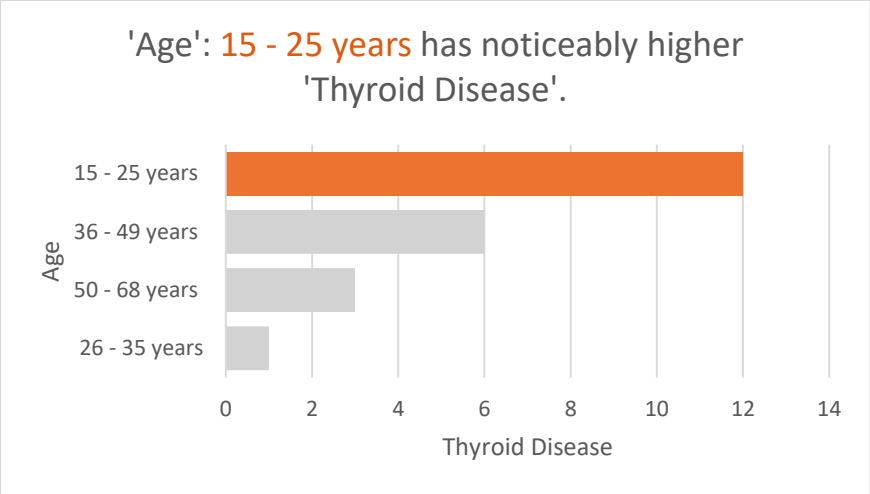

Fig. 2 Presence of thyroid disease by age

Treatment for thyroid disease was recorded in 16 subjects out of 22 with thyroid disease. Presence of thyroid disease and its treatment were not associated with comprehension of iodine role on health.

Discussion

Iodine has an essential role in thyroid hormone formation in our body. However, in routine use, there is reduction of knowledge related to iodine details including its role and usage, [30]. The cross-sectional community-based study was conducted to evaluate the knowledge and awareness of iodine intake. The study was conducted among 300 participants in Al-Ahsa city in the Eastern province of Saudi Arabia. Similar study was carried out by Al Yahya et al. in January 2021, among Eastern Province population to assess the knowledge about thyroid disorders and risk factors [31]. A cross sectional study was conducted by Yifan Jin et al. in 2020 in Suzhou, Jiangsu Province China to assess the relationship between iodine knowledge and intake in young Chinese adults [32]. The results of our study reveal peculiar information on patterns of Al- Ahsa residents' level of awareness and knowledge about iodine intake. Participants randomly selected and majority of the respondents (78%) were found between the age group of 15-25 yrs. A study by Yifan Jin et al. reported age 19-21 yrs., (male and females) as the target population while assessing the knowledge of iodine intake [32].

Our results revealed that most of the respondents (59%) in overall study group for the level of awareness do not know about the main role of iodine in the body. Marakis et al., conducted study to assess knowledge, attitude and behaviour related to iodine intake and reported that half of the respondents (50.5%) (European and Asian participants, 20.3% versus 39% respectively) appeared to have better knowledge about the relationship between iodine and health explaining that lack of progress in salt iodisation programmes has been partly associated to inadequate information and education of the community about iodine [33]. Similarly, the level of iodine knowledge found low among the young women in Norway, Australia, the UK, and Ireland and adults in South Africa and among students in the Philippines [34,35]. Lack of awareness about the Iodine role in body revealed in our study was in accordance to results related to inadequate iodized salt consumption among Saudi households and a regional heterogeneity explored by Al-Dakheel et al., [36].

Our study also revealed that higher proportion of youngest subjects (138) were not familiar with iodine role in the body. This may be in accordance with most respondents between age 15 – 25 yrs. participated in our study. On

the Contrary Yifan Jin et al. conducted the study and found a relatively higher iodine knowledge level among young Chinese adults [32]. Very few studies have chosen adults as a target population. There are still sparse studies assessing the relationship between iodine knowledge and iodine status in the young adult population [32,37,38].

Our results revealed dominant qualification of respondents as bachelor's degree (54%) and high school level (37%). There was statistically no significant difference among the respondents considering the degree of education. Similarly, no statistically significant relationship found considering level of education in studies conducted for assessing the level of awareness for thyroid diseases among the population in Saudi Arabia [30,39]. This indicates that there are some flaws in education concerned with thyroid gland and its disorders [30]. Thus, the study highlighted a need to update curricula of educational institutes to increase awareness related to iodine role in the body and its usage in the new generations that participate in reducing preventable thyroid disorders. Studies have shown that increasing awareness about salt and iodine among younger age group appears ideal, as behavioural changes related to nutrition are more difficult to adapt in later years of the life [33].

Most of the participants (81%) in this study were familiar with excessive intake of iodine as causing health problems while awareness of the impact of low iodine intake found in a smaller number of participants (43 %). However, 24% of them are aware that an insufficient intake of iodine in food can lead to drowsiness and deprivation of psychomotor development. Findings regarding awareness of impact of inadequate iodine intake in the present study were in accordance with the study conducted by Marakis et al. in 2021 where only 26.4% of respondents were familiar about the impact of iodine deficiency as poor cognitive development. The poor awareness about iodine noted in European populations and considered as matter of concern [33]. knowledge is associated with behaviour [33], findings suggest that improving knowledge could result into effectual behavioural change.

The present study revealed that 51% respondents never did thyroid hormones test, 35% do it when a doctor ask them while 13.66% (N= 41) reported thyroid hormone determination. Among these subjects (N= 41) most were not familiar with iodine role in the body. Our findings were contrary to study conducted by Marakis et al., [33] for thyroid functions in respondents among participating countries with less than 50% in Europe and approximately 70% in Asia, revealing more appropriate understanding among Asian participants regarding iodine role in health than those from Europe.

Although Kingdom of Saudi Arabia (KSA), currently classified by the IGN (2019) as iodine sufficient [40]. In our study majority of the respondents (93%) were not suffering from any thyroid disease. However, presence of thyroid disease was identified in 7% subjects (N=22) with higher prevalence in subjects aged between 15 – 25 yrs. Azzeh and Refaat conducted a study in general population and reported goiter in Saudi children living in high altitude areas in western region [41]. In our study regarding treatment, 16 subjects out of 22 with thyroid disease were using medicine. A study conducted by Alotaibi and Almousa in central region of Saudi Arabia revealed that low level of knowledge among respondents was related to low concern with few precautions for thyroid disorders. Health education brings productive change in behavior by improving knowledge [42].

Conclusion

The respondents have inadequate knowledge about iodine role in body. There was no statistically significant relationship between the level of awareness regarding iodine role in body and education level among the public of Saudi

Arabia. Lack of knowledge about iodine may lead to iodine deficiency. Insufficient knowledge can result into undetected cases. Improving knowledge could bring effective behavioral changes. This study recommended that health authorities should arrange more advantageous health education sessions and public awareness campaigns through different means of communication to increase knowledge about iodine role and its importance for health among the community. Adequate awareness about iodine among the general population is expected to reduce preventable thyroid disorders. It is essential to start any planned actions from younger age group through integration of health education in curriculum of schools, colleges, and universities.

Declaration of conflict of interest

None

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