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An Assessment of Causes of Incidents of Thyroid Diseases in Thyroid Patients at the Central Regional Referral Hospital in Cape Coast, Ghana

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Abstract

Since 1996 the Government of Ghana has been improving the quality and quantity of iodised salt, consumption of which eliminates iodine deficiency disorders. That notwithstanding, there are reports of increasing thyroid cases in hospitals. The study was to assess the causes of the thyroid diseases presented with at the Referral Hospital in Cape Coast, Ghana. Seventy (70) patients were interviewed to solicit information about iodine deficiency disorders. SPSS 21 statistical tool was used to analyze the responses. Majority of the respondents, 54, used iodised salt, whilst 21 of the cases were in the age bracket of 40-49 years. Superstition was cited as one of the causes of IDDs. The study revealed that all the respondents consumed goitrogens, and were also ignorant about Ghana's mandatory salt iodisation law and iodine status test.

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State agencies must create awareness at the community level to address ignorance about iodine status test, the legislation and the scientific causes of iodine deficiency disorders.

Keywords : goitrogens; iodine deficiency; thyroid.

1. Introduction

Iodine is an essential nutrient that is required by the body to produce thyroid hormones. The iodine is obtained by dietary sources [1]. Some potential causes that may result in iodine deficiency include low dietary iodine, intake of goitrogens, gender, tobacco smoking, alcohol, and age (2,3,4,5).

Iodine deficiency disorders (IDDs) are among the easiest and least expensive of all nutrient disorders to prevent since a program for its prevention that costs between $0.02 and $0.05 per capita could result in such huge benefits both in humanitarian and economic terms for the global health community [1]. The programme which should be given the highest priority by governments and international agencies involves the addition of a small constant amount of iodine to the salt that people consume daily to eliminate IDD [6].

Some of the reasons for increasing IDDs globally are decrease in salt consumption, variety in the amount of the iodine added during the iodisation process, varying dimension of iodine in salt batches and in individual packages, loss of iodine during cooking and storage or at the kitchen counter, and the effect of goitrogenous foods (2,7,5,8).

Iodine deficiency is the single most important preventable cause of brain damage worldwide [1]. It has been established that there is a decrease of IQ points of 13.5 of residents living in areas of comparable communities affected by severe IDD and where there is no IDD. This mental deficiency has an effect on the quality of life in communities, and economic productivity (9,1).

Globally, about 38 percent are at risk of IDDs, 13 percent are affected by goiter with the highest prevalence in Eastern Mediterranean (32%) and Africa 20 percent [10] and inadequate iodine nutrition has been reported to be 30.6 percent covering a population of 1901 million, with a household access to iodised salt as 70 percent. Specifically, Western Pacific has accessibility of 89.5 percent and 21.2 percent of inadequate iodine nutrition whilst Europe had 49.2 percent accessibility and 52.0 percent inadequate iodine nutrition [1]. The reasons for the inadequacy include poor implementation of the universal salt iodisation programme, iodine losses during cooking, increased goitrogens in the environment, diet and water (4,11). Africa has 20 percent IDD prevalence with 11 countries remaining iodine deficient, yet over 50 countries including Ghana have iodisation programs, and 70 percent of all Africans have regular access to iodised salt (10,4). A national survey in 1992 showed incidents of IDD in Ghana and as a result the country adopted the universal salt iodisation (USI) strategy by legislation in 1996. In 2004, the Government enforced the legislation and increased national awareness of the benefits of iodised salt. Consequently, Ghana has been classified as moderately iodine deficient (4,1), whilst another national survey has established a national adequacy in iodine status, a substantial improvement since the 2009-10 survey according to National Iodine Survey Report, 2015 [12]. However, the prevalence of IDDs has been reported in certain parts of Ghana [13], and attributed to inadequate iodisation of salt and behavioral

patterns of consumers (14,15,16,13). Between 2011 and 2020 loss of productivity due to the prevalence of IDD was about $67m annually and the potential economic gains by 2021 was estimated to be US$303 million according to Ghana Nutritions Profile, 2011 [17].The aim of this present study is to assess the causes of thyroid diseases in thyroid patients at the referral hospital in Central Region of Ghana.

2. Material And Methods

Study Setting and Design

The study was conducted in ten (10) months from February, 2017 to November, 2017 at the Central Regional Hospital in Cape Coast, Ghana. The hospital was chosen for the study because of the high number of thyroid patients it serves, referred from the health centres across the region. It is also the referral hospital for the Central Region, and serves as the teaching hospital for the University of Cape Coast's Medical School, and the training centre for the numerous nurses' training colleges in the region.

Study population and sampling procedures

A total of seventy (70) patients who have been diagnosed with thyroid diseases participated in the study. They were between the ages of ten (10) and seventy-nine (79) years. The participants presented with breast cancer and growth over the neck region. Socio-demographic characteristics of the respondents that were employed in the study included age, education and gender. Due to administrative issues and ease of obtaining a sample for the interview data convenience sampling was used as the primary selection criterion for the respondents. The respondents were interviewed as they consulted the medical practitioner. The limitation however is the inability to generalize the results of the survey to the population as a whole because of the possibility of under-representation of the population.

Data Collection Instruments and Procedures

A questionnaire prepared in English was administered to the respondents with the help of the hospital staff. The questionnaire was made up of both closed and open ended statements, and the respondents were guided to solicit the responses. Issues in the questionnaire concerned socio-demographic characteristics, and queries to assess knowledge and practice of the respondents toward consumption of iodised salt and iodine deficiency disorders (IDD), iodine status test and the mandatory salt iodisation law of Ghana. Respondents' diagnosis status were extracted from their hospital records.

Data Processing and Analysis

The data was statistically analysed at 95% CI using SPSS version 21. The statistical tools used included frequency, percentage and mean.

Ethical Approval and Consent to Participate

Ethical approval was granted by the Institutional Review Board of the University of Cape Coast Ghana, with identification number UCCIRB/CANS/2016/01. Then an official letter of cooperation was written to the thyroid triage of the referral hospital which was approved. The participants were then briefed individually about their rights, privacy and confidentiality of the data being gathered. The questionnaire were coded to conceal the identity of the respondents.

3. Results

Socio-demographic information of respondents

The Socio-demographic information categorised under gender, education status, and age of respondents is shown in Table 1.

Table1: Socio-demographic Characteristics of Respondents.

Socio-demographic characteristics	***Female***	***Male***	***Non-formal***	***Formal***	***Age grouping***	***%, (n)***
Gender, %	*89*	*11*				
n	***62***	***8***				
Education, %			*14*	*86*		
n			***10***	***60***		
Age, yrs					*10-19*	*4 **(3)***
					20-29	*23 **(16)***
					30-39	*24 **(17)***
					40-49	*31 **(21)***
					50-59	*14 **(10)***
					60-69	*3 **(2)***
					70-79	*1 **(1)***

Source: Bartels, statistics, 2017

Gender

As shown in Table 1, majority of the respondents [**62**, 89%] were females. That could be an indication that thyroid and nutrition health education and other relevant awareness programs aimed at combating iodine deficiency disorders have not impacted well on them. Majority of Ghana's women have no access to such information [18], it is therefore important that such programs be intensified on female groups. As corroborated by this study, thyroid diseases are prevalent among females [19], and considering its associated health complications [20], the economic contributions (18,21) of these female [22] respondents to their respective communities and Ghana in general would suffer.

Age and Percent Thyroid Cases

The age group of 10 -19 years was made up of three (3) adolescent girls who were in school, and constituted four (4) percent of the total thyroid cases. This observation suggests that awareness programs relevant to eradicating IDD should target girls at the household and school levels, and that parents and school authorities

should ensure iodised salt is added to their meals. The study revealed a distinguishing property of the "age-thyroid cases". It was revealed that as age increased, the thyroid cases of respondents increased from 3 at the age of 10-19 years and peaked to 21 at 40-49 years and reduced to 14 at 50-59 years and then declined to 1 at 70-79 years.

Education

In this context, education and access to information assess the extent of the diagnosis of the respondents.

As shown in Table 1, all the respondents were educated. To the extent that majority [**60**, 86%] of respondents had formal education could mean that information in their communities had been inaccessible. The other reason might be sheer ignorance about IDD of which behaviour may not prevent IDD.

4. Attitude of respondents towards consumption of iodised salt

The attitude of the respondents towards the consumption of iodised salt is shown in Tables 2-6. As shown in Table 2, a high proportion of the respondents (**54**, 77%) who consumed iodised salt cited specifically the ability of the iodised salt to prevent goitre as the reason for their preference.

Table 2: Reasons for Preference of Salt.

Reason	%
Health benefits	18.0
Prevents goitre	77.0
Contains iodine	2.0
Medicinal	3.0
Total	**100.0**

Source: Bartels, statistical analysis, 2017

While reason cited by most of the respondents (**12**, 75%) who consumed non-iodised salt (**16**, 23%) as shown in Table 3 being 'used to it'. Again, 15 percent (2) cited relatively high cost of iodised salt, with 5 percent (1) citing 'unusual taste to meals'. Moreover, another 5 percent (1) cited no availability of iodised salt in their communities as reason for the preference.

Table 3: Reasons for Preferring Non-iodised Salt.

Reasons	%	**(n)**
Used to it	75.0	(**12**)
Cost of iodised salt	15.0	(**2**)
Non availability	5.0	(**1**)
Unusual taste to meals	5.0	(**1**)
Total	100.0	**16**

Source: Bartels, statistical analysis, 2017

During use 36 percent constituting twenty-five of the respondents stored the salt in open containers, and then 1 percent made of one respondent did so in the original polyethene sachet, whilst 19 percent of the respondents stored it 'anyhow', as shown in Table 4.

Table 4: Storage Conditions of Iodised Salt During Use.

Storage conditions	%	(**n**)
Open container	36.0	(**25**)
Salt dispenser	4.0	(**3**)
Close container	40.0	(**28**)
In the original sachet	1.0	(**1**)
Anyhow	19.0	(**13**)
Total	**100**	**70**

Source: Bartels, statistical analysis, 2017

Concerning the duration of use of the salt, most of the respondents (**54**, 77%) had used it in less than 10 years whilst few (**7**, 10%) had consumed it for more than 20 years as shown in Table 5.

Table 5: Duration of Salt Use.

Duration of use, years	%	(**n**)
< 10	77	(**54**)
>20	10	(**7**)
No idea	13	(**9**)
Total	**100**	**70**

Source: Bartels, Field work, Cape Coast, 2017

About the consumption of goitrogens, majority of the respondents (**53**, 76%) consumed raw cabbage as shown in Table 6.

Table 6: Consumption of Goitrogens.

Goitrogens	%	(**n**)
Raw cabbage	76	(**53**)
Smoking tobacco	4	(**3**)
Millet	20	(**14**)
Total	**100**	(**70**)

Source: Bartels, Field work, Cape Coast, 2017

Thus the attitudinal factors that predispose the respondents to thyroid disorders were choice of salt, cost of iodised salt, careless handling of salt during use, and consumption of goitrogens.

5. Knowledge of respondents about iodine deficiency disorders, iodised salt, iodine status test and the mandatory iodised salt legislation of Ghana

This information about the knowledge is found in Tables 7-8. Few (**5**, 7%) of the respondents attributed the cause to superstition, whilst one respondent (1%) thought it was 'Adams apple'. The respondents thus showed their ignorance in the scientific knowledge about the causes of thyroid disorders.

Table 7: Knowledge about Iodine Deficiency Disorders.

Knowledge	% (**n**)
Correct answer	56 (**39**)
Superstition	7 (**5**)
No idea	36 (**25**)
Adams apple	1 (**1**)
Total	**100 70**

Source: Bartels, Field work, Cape Coast, 2017

Majority (**67**, 96%) of the respondents had never checked their iodine status because they were unaware they could do so, whist all the respondents (100%) had never heard about the 'mandatory salt iodisation law', as depicted in Table 8.

Table 8: Knowledge about Benefits of Iodised Salt, Iodine Status Test, and Mandatory Legislation.

Knowledge	Benefits of iodised salt, %	Iodine status test, %	Mandatory legislation, %
Yes	65	4	0
No	35	96	100

Source: Bartels, statistical analysis, 2017

The respondents showed their ignorance about the existence of the iodine status test and the salt legislation. Such ignorance suggest that publicity of the scientific causes of thyroid disorders, iodine status test and the salt legislation must be intensified in the communities.

6. Discussion

Iodine deficiency is endemic in Ghana. In a study a wide spectrum of thyroid disorders in patients aged between 1-86 years with an annual incidence of 185.7 cases were found, most (27.4%) of the cases were between 30-39 years group, and majority (87.8%) were females [23]. In another study that compared the prevalence of thyroid disorders before and after the introduction of iodization in 1996, the thyroid cases from the middle belt of Ghana between 1982 and 2014 increased over the decades [13].

Efforts to reduce endemic iodine deficiency had slackened due to behavioural patterns of consumers of iodised salt and the lack of proper institutions to monitor activities to ensure a smooth programme. These have led to only 32.5 percent coverage in some areas, while in other areas overexposure of iodine has meant an increase in toxic thyroid disorders, and death (14,15,16,13).

7. Socio-demographic status

Socio-demographic information obtained to support the assessment of the causes of the diagnosis were differences in gender, education and age, as shown in Table 1.

The data regarding gender indicated that numbers of females diagnosed were more than males; the susceptibility of females to thyroid diseases is attributed to Hashimoto's thyroiditis, which is in general more common in females (18,12). Such a hospital-based data highlights a useful evidence of admission trends and reflections of thyroid disorders in the community [13]. In the Central region of Ghana, the contribution of women to socio-economic development is about 25 percent, which could eventually be lost to IDDs [24] if not properly addressed.

In Africa particularly, women's health is fundamental to socioeconomic development, and since it is a global public health concern, it was emphasized by the fourth World Conference on Women held in Beijing in 1995, and the United Nation's Sustainable Development Goals, SDGs [25] in an attempt to address it.

As shown in Table 1, the data on age showed a characteristic pattern whereby the thyroid cases increased at the lower age (10-19 years), peaked at middle age (40-49) and then declined at old age (above 70). This observation agreed with the findings that thyroid disorders have no age limits, but it is also contrary to the findings that the prevalence increases with age. As aging slows down metabolism, the thyroid gland undergoes important functional changes in hormone production (26,27,28).

Specifically, the age bracket of 10-19, which encompasses the adolescent girls who were in school, is a priority group for low iodine intake and therefore requires careful monitoring of their iodine status [29]. Otherwise, they might eventually become unproductive in their communities due to severe brain damage, poor academic performance and delayed physical development [1] they may suffer, which will make it difficult to take decisions.

In view of the 4 percent incidence that was recorded for the adolescents suggests that education about IDD has not effectively targeted school - aged children especially girls. Incidence of thyroid cases among school-aged children in two studies in India varied from 10.89 to 36 percent; other studies in Sweden and South Tajikistan reported incidence of 36 and 46.6 percent respectively (11,2,30) higher than the 4 percent we reported. This is an indication that the adolescents in those cases could be at higher risk than the subjects we studied. The global effort for urgent intervention for children is necessary due to their high biologic needs [1] and potential as the primary source from which older generations emanate.

On the other hand, the highest prevalence (**21**, 31%) was the age bracket of 40-49, in this age group thyroid disorders are more common [1]. In Ghana, such group constitutes a greater portion of the working population [21], and therefore needs to be healthy in order to contribute to the economy of their communities. It is pertinent that the programme for the promotion of consumption of iodised salt intensifies in the communities.

As shown in Table1, majority of the respondents [**60**, 86%] had formal education which level did not influence positively on the diagnosis of the respondents. This has corroborated previous finding where cohorts with either high or low educational level and subjects with less educated caretakers had higher prevalence (3,31).

In Ghana, educational programme broadcasts about IDD are available on radio, television, and through health workers [14]. Specifically, the Central region of Ghana has a literacy rate of 78.2 percent. From 12 years and above, ownership of ICT is 44.9 percent, exposure to internet is 7 percent, whilst ownership of laptops of all households being 5.3 percent.

In addition, there are forty-four (44) authorised radio stations, eleven (11) authorised television stations [32], and six (6) urban districts out of seventeen [21]. The expectation is that such a high interplay of literacy and information technology would influence positively on the goitre status of the respondents. It could possibly mean that the failure of such a high literacy rate to translate into fighting IDDs is either information about benefits of iodised salt in their communities has been inaccessible or the respondents are disinterested.

8. Behaviour of respondents towards consumption of iodised salt

Behaviour offers a better understanding of one's inclination towards a certain preference with respect to preventing diseases.

In Table 2, majority (**54**, 77%) of the respondents consumed iodised salt and they cited prevention of goitre as the reason for their preference, yet did not translate into avoiding IDDs. *Salt could be of inferior quality.*

However, for the non-iodised salt users, few (**11**, 15%), as shown in Table 3 cited high cost of iodised salt for their refusal to patronise it. In the Central region of Ghana, the most patronised iodised salt (Annapurna) was GH3.50 per 500g compared to the non-iodised salt (common salt) which cost GH1.00 per 500g. Such wide disparity of 71.4% in cost makes the iodised salt unaffordable for the average respondents, and could influence their decision making them susceptible to IDD (14,3).

Non-availability of iodised salt in the localities or communities was cited by 25 percent of the respondents, such reason has also been reported in earlier studies [14]. Such lack of the iodised salt in communities result in a setback to Government's efforts to eliminate IDD as respondents would continually depend on non-iodised salt.

As shown in Table 4, the study revealed a careless attitude by 36 percent of respondents when they stored the salt in open containers during use, a situation which reduced the amount of iodine originally present in the salt and denied them the maximum benefit they would have derived. This careless attitude suggests the lack of knowledge about the storage conditions of iodised salt and need attention in their communities.

About the frequency of use, majority of the respondents (**57**, 82%) used it regularly and still diagnosed with thyroid disease. This anomaly supports the assertion that thyroid disease does not only depend on the frequency of use but on other factors including the quality of the salt, the dosage [33] and the effect of goitrogens [34]. The combined effect of these factors could limit the iodine in the thyroid gland.

The duration of use of the iodised salt was set at 20 years, the timeframe when the consumption was legislated in Ghana in 1996 [35]. A high proportion (**54**, 77%) of the respondents had used it for less than 10 years while only few (**7**, 10%) for more than 20 years, as shown in Table 5. This could be an indication that with time the respondents were disinterested in the effects of IDD.

Eleven percent (11%) did not to consume iodised salt which finding supports the assertion that in countries that have implemented programmes to eliminate IDD there is still a smaller percentage that has not used iodised salt yet.

The percentage of the respondents that consumed foods that contain chemical compound called goitrogens is shown in Table 6. The consumption of these foods prevent the uptake of iodine by the thyroid gland [36]. Fifty-three, (76%) of the respondents consumed raw cabbage, fourteen (20%) consumed millet whilst three (4%) were smokers of tobacco. The raw cabbage, millet and the tobacco respectively contain the following goitrogens, goitrin and thiooxazolidones (36,37), and cyanide [19].The study has revealed that the respondents' behaviour has been largely responsible for the diagnosis, suggesting that education and policies on IDD are lacking in the communities.

9. Knowledge of respondents about iodine deficiency disorders, iodised salt, iodine status test and the mandatory iodised salt legislation of Ghana

This knowledge of respondents about iodine deficiency disorders, iodised salt, iodine status test and the mandatory iodised salt legislation of Ghana is shown in Tables 7-8. Majority, (**39**, 56%) of the respondents knew that goitre is a growth, swelling or expansion of the thyroid gland due to lack of iodine. However, few were ignorant in their responses, for instance, 5 attributed it to superstition, indicating their unscientific approach to the cause of IDD. Others, 1 percent confused it with 'Adams apple'.

Concerning iodine status test, as shown in Table 8, nearly all the respondents, 96 percent were ignorant and thus had never checked their status. Knowing their iodine status would have equipped them with the knowledge to regulate their salt iodine intake since over consumption or under consumption of iodine could lead to thyroid diseases. With regards to the mandatory legislation [38], all the respondents (100%) were ignorant as depicted in Table 8. This could be due to lack of effective publicity of the law on the part of state agencies. Such lack of publicity has made the law dormant to the respondents and deprived them of important nutritional education. In the intervening twenty-one years of implementation, it should be a 'household law' among consumers to enable them to probe the quality of the iodised salt being sold or served to them.

Acquiring such knowledge would have offered the respondents the facts and understanding of the iodine deficiencies and deepened the awareness of the disorder.

10. Conclusion

That 62 (89%) and 57 (82%) respectively consumed iodised salt and did so regularly is commendable. However, that 36 (52%) lost iodine in the salt during use, and 56 (80%) consumed foods that contained endocrine

disruptors would deprive them the maximum benefit of the iodine in the salt, and might explain part of the causes of their diagnosis. The study also revealed that the interest in the consumption of iodised salt waned with time as 56 (80%) used iodised salt in less than 10 years, while only 5 (7%) had used it for more than 10 years. The high incidence of ignorance where 67 (96%) and 70 (100%) respectively were unknowledgeable about their iodine status and the legislation could be another cause of their diagnosis. The study also revealed a characteristic prevalence pattern with respect to age of the respondents, and that as age increased from adolescence the prevalence also increased and then declined at old age.

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11. Data Availability

Data is available upon request

12. Conflicts Of Interest

The authors do not declare any conflict of interest

13. Funding Interest

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