

Iodized salt, knowledge versus practice among females in Fayum governorate

Safaa Khamis Hassan, Nashwa Sayed Hamed, Shima Elsayed Mohammed Mabrouk

Public Health and Community Medicine Department, Faculty of medicine Fayoum University

Submission Date: 2020-10-13 Revision Date: 2020-12-16 Acceptance Date: 2020-12-16

Abstract

Background: Iodine is observed as one of the most important trace elements in the human body, which is considered very essential during the synthesis of thyroid hormones. Iodine deficiency in humans can cause several diseases or problems, which include spontaneous abortion, increased infant mortality, cretinism, goiter, and mental defects. **Objective:** To evaluate the knowledge and practices of women toward the iodized salt. **Method:** A descriptive cross-sectional community-based study was conducted using a pre-tested structured interview questionnaire. Multi-stage cluster random sampling was used to select the study population which was 1789 women. **Results:** 55.4% of women reported a good knowledge score. Residence, history of thyroid disease, increasing level of education, and hearing about iodized salt were the significant predictors associated with good knowledge with odds ratios of 1.116, 2.405, 4.344 and 11.872 respectively. **Conclusion:** Although most of our studied participants (87.1%) were using iodized salt, however knowledge about iodine and iodized salt was not satisfactory and many of the participants had improper practices related to the iodized salt usage

Keywords: *Iodized salt, knowledge, practice, women*

Corresponding author: Shima Elsayed Mohammed Mabrouk Email : shima.mabrouk@yahoo.com

Introduction

Iodine is a prime ingredient for thyroid function; it is needed in tiny amounts for normal growth, development, and well-being of all human beings.¹ Iodine deficiency in humans can lead to many health problems as spontaneous abortion, increased infant mortality, cretinism, goiter, and mental defects.²

IDD is considered as a main public health problem worldwide due to its impact on many vulnerable groups of people such as children and lactating women. On a global scale, approximately 2 billion people suffer from ID of which approximately 50 million present with clinical manifestations.³ Deficient iodine in daily

food intake may lead to insufficient thyroid hormone secretions with many clinical consequences, especially neurological feedback.⁴ Although it may affect any age, ID consequences may appear from the fetus stage, due to an insufficient iodine food intake in the mother's diet. So, the most vulnerable time is intrauterine and the natal phase where, discrimination, growth, and brain development may be affected by the inappropriate quantities of iodine and by the thyroid hormones with general consequences related to irreversible neurological disorders and mental retardation.⁵ Preventive measures to prevent IDD are necessary and should be

taken into consideration, these measures include; salt iodization, the use of iodized oil, or the fortification of milk, bread, and water. Although all the efforts considered nowadays, there are still some ID areas and billions of people are suffering from IDD.⁶ The first-line strategy to secure adequate iodine intake by all individuals is global salt iodization which has been accepted as a safe and cost-effective measure.⁷ Owing to the strategy of iodine fortification by salt which is followed by many countries, severe iodine deficiency became a rare condition. However; mild-to-moderate iodine deficiency is still considered a major public health concern, even in some developed countries

In Egypt despite the implementation of a universal salt iodization program since 1996. and the demographic health survey (DHS), revealed that overall, 79% of Egyptian households were using adequately iodized salt.⁹ The prevalence of goiter is still high in Egypt (21.6 to 60.1%) and Eastern Mediterranean countries.¹⁰⁻¹¹ In many developing countries including Egypt, despite the improvement of salt production and marketing technology, the quality of salt is still poor, incorrectly iodized or spoilt due to excessive exposure to moisture, light, heat, and contaminants.^{12,34} It is necessary to raise the awareness of the population about the importance of iodine to their health and periodic public health education for proper storage and usage of iodized salt should be continued.² The aim of this study to evaluate the knowledge and practices of women toward the iodized salt.

Method

A community-based, cross-sectional descriptive study was carried out in Fayoum Governorate; The survey was conducted over six months between April and October 2019.

The participants included females 18 years old or more.

We used multi-stage cluster random sampling to select the study population. First, Fayoum governorate is divided into 7 districts: (Fayoum city, Fayoum district, Etsa district, Tamea district, Senoris district, Yousef elsedeq district, Ebshoy district). Each of them has urban and rural areas. We randomly assigned three districts (Fayoum district, Tamea, and Etsa). In the second phase, two regions or villages from each district were randomly selected. In the third phase, the prime street was chosen in the two regions, then proceed in one direction. In the fourth stage, the first house was chosen randomly, and then every other house. The Studied participants were all adult females who aged ≥ 18 years and agreed to join in the study. If the family refused to participate in the survey we take the next house family.

A sample size of 1541 was calculated using open epi considering the following assumptions more than half of the respondent (56%) knows about iodine deficiency disorder⁽²⁾, a design effect of 4 and confidence limit 95% $\pm 5\%$. The required sample size was increased by 15% to be 1800.

Data of the study were collected with a pre-tested structured interview questionnaire. The questionnaire was adopted from previous studies^(2, 15). The questionnaire investigated the following themes:

- 1- Socio-demographic characteristics of the interviewed female (age, residence, education, occupation, marital status, family history of thyroid diseases). monthly income level less than 1500, from 1500 to 2000 and more than 2000LE^(16,17)
- 2- Women knowledge about iodized salt (importance, how to store it, how and when to use it in cooking)

Women practice regarding iodized salt use (how to store it, how and when to use it in cooking).

Data analysis

Data were collected, coded, and analyzed using Statistical Package for Social

Table 1: Characteristics of study participants, Fayoum.

Variables	Number (1789)	Percent
Age in years		
18-27	649	36.0
28-37	455	25.4
38-47	419	23.4
≥48	266	14.9
Mean ±SD		
	34.33±11.35	
Residence		
Urban	651	36.4
rural	1138	63.6
Marital state		
Married	1474	82.4
unmarried	315	17.6
Education		
Illiterate	270	15.1
Read and write	184	10.3
Primary education	136	7.6
Secondary education		
High education	568	31.7
	631	35.3
Working		
	701	39.2
The family income per month		
≤1500 LE	491	27.5
1500-2000	1045	58.4
>2000	253	14.1
Having or having family history of thyroid disease		
	238	13.3

Science (SPSS) software version 16. Simple descriptive–statistics in the form frequencies and percentages were calculated for numerical data. The Mean and S.D were calculated for quantitative variables in the form of simple descriptive statistics. Non-parametric tests (chi-square) and Binary logistic regression were used. $P < 0.05$ was considered statistically significant.

Ethical considerations

This study was approved by the Research Ethical Committee of Fayoum University. The questionnaires included explanations about the purpose of the study, confirmation of confidentiality of data, and assuring that it will never be used for purposes other than scientific research. A formal consent form was given to the participants. The participants were assured of confidentiality. To ensure privacy, respect, and honesty, the used questionnaire was-anonymous

Results

The data was collected from 1789 women. Most of them the age from 18 to 47 years old with a mean age, 34.33 ± 11.35 , more than two thirds (63.6%) of the participants were from rural areas. The majority (82.4%) were married, and (15.1%) of them were illiterate. 60.8% of participants were not working and 27.5% of them with a family income of less than 1500 LE. out of 1789 women, 238 (13.3%) of them mentioned that there was a history of thyroid disease in their family. (Table 1) Many of the participants (65.7%) heard or knew about iodized salt. Regarding knowledge about iodine element, (65.3%) of the participants were aware that iodine is an essential element, and (50%) knew that iodine is related to the thyroid gland. However, Only 12.8% of the participants were aware of the requirement of iodine, and (41.3%) were aware that iodine is available in salt. Regarding the complications of iodine deficiency nearly half of the females (54.2%), (47.8%) and (53.2%) were not aware of the complication in pregnant women, in children and adults respectively (Table 2).

The study revealed that more than one third (36%) knew how to identify the iodized salt bag, more than half of the participants (59%) knew that humidity can affect the iodine in the salt bag. only

5.5% knew the shape of the healthy bag. Only (19.4%) of the studied population knew about how to conserve iodized salt bag after opening. More than one-third of them (36.7%) knew when salt should be used (Table 3).

Regarding the practices towards the iodized salt; only 8.0% of the participants mentioned that they use an opaque and

Table 2: Answers to questions regarding iodine	N (1789)	%
Know or hear about iodized salt	1175	65.7
Knowledge about iodine element		
Iodine is an essential component of human life		
Yes*	1168	65.3
No	46	2.6
Don't know	575	32.1
Iodine is an essential component for making gland hormones		
Parotid gland	15	0.8
Thyroid gland*	894	50.0
The pancreas	21	1.2
Don't know	859	48.0
Very few*	229	12.8
Few	651	36.4
Many	173	9.7
Don't know	736	41.1
seafood such as fish*	596	33.3
Salt*	738	41.3
Don't know	455	25.4
Knowledge about iodine deficiency disorders		
Iodine deficiency in pregnant women		
doesn't cause anything	136	7.6
Abortion*	268	16.0
Early death for children*	71	4.0
A mentally handicapped child*	326	18.2
Don't know	970	54.2
Iodine deficiency in children		
doesn't cause anything	60	3.4
short stature*	392	21.9
A decrease in the IQ*	317	17.7
Weak academic achievement*	164	9.2
don't know	856	47.8
Iodine deficiency in adolescents and young adults		
Doesn't cause anything	79	4.4
Poor physical and mental development*	556	31.1
Menstrual disturbances*	202	11.3
Don't know	957	53.2

*The right answer

sealed packaging to keep salt after opening, also, (67.8 %) of them use a dry spoon and more than one third (32.9%) put salt at the end of the cooking process. Most of the participants use the salt bag (87.1%) and buy the salt from the supermarket (80.4%). Only 35.6% of the

participant care about the producing company (Table 4).

Out of 1789 studied women, 991 (55.4%) were with a good knowledge score. The knowledge score was significantly higher (p value=0.000) among the urban people and with

decreasing in age. The knowledge was significantly good among unmarried females, with an increasing level of education and among the working females especially the governmental employees. The knowledge score also was significantly good with increasing the income >2000, with the presence of thyroid disease and hearing about iodized salt ($p=0.000$) (Table 5).

The practice score was significantly good

(p value= 0.000) among the urban people and with decreasing in age ($p=0.002$).

The

Table 3: Knowledge about Iodine

Knowledge about iodized salt	N	%
How do you identify the iodine salt bag?		
has a picture of navigation	198	11.1
has a tick Mark	220	12.3
has a tick and navigation mark*		
don't know	644	36.0
	727	40.6
Is salt affected during storage by		
Sun and temperature*	413	23.1
Humidity*	1056	59.0
Don't know	320	17.9
Do you know what a healthy salt bag would look like?		
Tightly closed during purchase or storage	1253	70.0
Not petrified	359	20.1
both*	99	5.5
Not tightly closed	4	0.2
Petrified	18	1.0
don't know	56	3.1
Thinking about how we can conserve salt after opening the bag		
Transparent packaging	113	6.3
Opaque packaging	60	3.4
Sealed packaging	559	31.2
Transparent and sealed packaging	572	32.0
Opaque and sealed packaging*	347	19.4
Don't know	138	7.7
Taking salt from the package by		
Dry spoon*	1538	86.0
Not dry spoon	72	4.0
Don't know	179	10.0

Salt should be placed in food

At the beginning of cooking	173	9.7
During cooking	811	45.3
At the end of the cooking process*	657	36.7
Don't know	148	8.3

Total knowledge score 5.98 ± 2.9

practice score was significantly good among unmarried females ($p=0.002$), with an increasing level of education, among the working females especially the government employees and private workers. The practice score also was significantly ($p=0.001$) good with increasing the income >2000 and with hearing about iodized salt ($p=0.000$), however there no significant difference with the presence of a history of thyroid disease ($p=0.394$) (Table 6).

The significant predictors for good knowledge by logistic regression analysis; residence, history of thyroid disease, increasing level of education, and hearing about iodized salt were the significant predictors' associated with good knowledge with odds ratios of 1.116, 2.405 4.344 and 11.872 respectively (Table 7).

There was a positive correlation (Correlation coefficient= 0.451) between the knowledge and practice scores and the correlation was significant ($p=0.000$) (Figure 1)

Discussion

Iodized salt is the main source of dietary iodine in Egypt.^{7, 10} In 1995, a national survey indicated an epidemic with goiter and the lower urinary iodine concentration in several regions of Egypt. Despite salt iodization in Egypt, studies reveal that there is prevalence of endemic goiter, and it could be the result of inadequate iodization of salt or high consumption of goitrogenics. Nevertheless, iodine deficiency is a major public health problem in certain areas of Egypt. Several surveys among Egyptian children revealed that there is mild iodine deficiency in 60.6% of

children and moderate to severe deficiency in 31.3%; the prevalence of goiter is higher in some regions such as South Sinai.¹⁸

This is a community-based study that was conducted to determine the knowledge status, factors associated with knowledge and the utilization practices of women on iodized salt in Fayoum governorate. The use of iodized salt by individuals and households is the major approach in the control of iodine deficiency diseases worldwide¹⁹ so; strengthening salt iodization program improving its monitoring is a crucial step to eradicate the problem.²⁰

Our study found that more than two-thirds of participants heard or knew about iodine (65.7%) and iodized salt, and a slightly lesser percent claimed to know that iodine is an important element for human nutrition (65.3%). On the other hand, it seems that they did not know the meaning, as only less than half of them when asked about where iodine is available, reported salt by (41.3%) and more than quarter said they don't know (25.4%). This was comparable with what was found in an Indian study¹ that, 68.9% of participants heard about iodized salt and 26.7% replied that it is ordinary common salt with a small quantity of iodine; but less than reported by a study¹⁵ they mentioned that most of the participants (93.4%) were aware of iodized salt.

Regarding women's Knowledge about the importance of iodine although, half of the respondents (50%) related the iodine to the thyroid gland however nearly half of the participants did not know the consequences of iodine deficiency disorders in different human life cycle we found also, that less than fifth (18.2%) of respondents relates between iodine deficiency during pregnancy and affection of mental abilities of newborn or children this is much higher than what was found in

other studies where less than (2 %) knew that iodine deficiency impedes brain development.²¹⁻²³ However De Zoysa et al, 2015 found that 50.8% knew the connection between iodine and thyroid hormones. Nearly 52% of pregnant women knew that iodized salt is especially important during pregnancy and the bad consequences of maternal iodine deficiency on their babies.

Regarding knowledge about the identification of iodized salt packets, more than forty percent did not know how to identify the iodized salt packet (40.6%), and only (5.5%) mentioned how a healthy salt bag would look like. This was slightly higher than reported in India

Table (4) Practices iodized salt.

Questions	N (1789)	%
How do you keep the salt at home after opening the bag?		
sealed packaging	1046	58.5%
A non-sealed package	86	4.8%
A transparent packaging	223	12.5%
An opaque packaging	124	6.9%
don't care	167	9.3%
opaque and sealed package*	143	8.0%
Dry spoon*	1213	67.8%
Don't care	576	32.2%
When do you put salt during cooking food?		
at the beginning of cooking	240	13.4%
During cooking	961	53.7%
At the end of the cooking process*	588	32.9%
What type of salt do you use?		
Packed Salt *	1558	87.1%
Non packed salt	231	12.9%
Which places do you Buy salt from?		
Unknown places	144	8.0%
Supermarket*	1438	80.4%
Don't care	207	11.6%
Are you sure about the salt-producing company		
Yes*	637	35.6%
	1152	64.4%

The mean total practice score was 3.2±1.3

that less than twenty percent could identify a logo or iodine level printed on the packet.^{15,22}

In our study we found that (55.4%) of women were with a good knowledge score, this was similar to what reported in Ethiopia as they found that more than half women had good knowledge about iodized salt²⁴ and higher than what found

in Sudan, they revealed that only (41%) correctly answered about the knowledge of iodized salt² but too much lower than the results of a study conducted in Ghana.²⁵

This study revealed that good knowledge of iodized salt was associated with young age, marital status, urban residence,

Table 5: the relation between knowledge score and participants' characteristics.

Characteristics	Knowledge score		Chi-square χ^2	p-value
	Good (N=991) N (%)	Poor(N=798) N (%)		
Age in years				
18-27 (649)	432 (66.6)	217 (33.4)	74.950	0.000
28-37(455)	254 (55.8)	201 (44.2)		
38-47(419)	206 (49.2)	213 (50.8)		
≥48 (266)	99 (37.2)	167 (62.8)		
Residence				
Urban (651)	451 (69.3)	200 (30.7)	79.840	0.000
Rural (1138)	540 (47.5)	598 (52.5)		
Marital state				
Married (1474)	761 (51.6)	713 (48.4)	48.047	0.000
Unmarried (315)	230 (73.0)	85 (27.0)		
Education				
Illiterate (270)	38 (14.1)	232 (85.9)	4.149	0.000
Read and write (184)	64 (34.8)	120 (65.2)		
Primary education (136)	59 (43.4)	77 (56.6)		
Secondary education (568)	309 (54.4)	259 (45.6)		
High education (631)	521 (82.6)	119 (17.4)		
Working				
Working (700)	490 (70.0)	210 (30.0)	99.285	0.000
Not (1089)	501 (46.0)	588 (54.0)		
Type of work				
Housewives (1089)	483 (44.4)	606 (55.6)	1.548	0.000
Governmental employee (411)	325 (79.1)	86 (20.9)		
NG employee (126)	77 (61.1)	49 (38.9)		
Private work (163)	106 (65.0)	57 (35.0)		
The family income per month				
≤1500 LE (491)	216 (44.0)	275 (56.0)	42.003	0.000
1500-2000 (1045)	606 (58.0)	439 (42.0)		
>2000 (253)	169 (66.8)	84 (33.2)		
If you or someone in your family have a thyroid hormone deficiency				
Yes (238)	179 (75.2)	59 (24.8)	43.627	0.000
No (1551)	812 (52.4)	739 (47.6)		
Hearing about iodized salt				
Yes (1175)	906 (77.1)	269 (22.9)	6.532	0.000
No (614)	85 (13.8)	529 (86.2)		

NG=Non-Governmental, Significant p value < 0.05

higher educational status, higher family income, have personal or family history of thyroid dysfunctions, and hearing about iodine. This is like Dessu et al., 2018 who stated that higher educational levels and higher family income to be associated with good knowledge. We also found that urban residence, high education level, having a personal or family history of iodine deficiency, and hearing about iodized salt to be

predictors of good knowledge. This might be due to different access to the information system, increased accessibility of the television and radio, and more accessibility of electronic media in urban societies. It may also be due to variation in educational activities and increased motivation to know and become aware of

Table 6: The relation between practice score and participants' characteristics.

Characteristics	Practice Score		Chi-Square X ²	P-Value
	Good(N=729) N (%)	Poor(N=1060) N (%)		
Age in years				
18-27 (649)	298 (45.9)	351 (54.1)	14.585	0.002
28-37(455)	181 (39.8)	274 (60.2)		
38-47(419)	162 (38.7)	257 (61.3)		
≥48 (266)	88 (33.1)	178 (66.9)		
Residence				
Urban (651)	342 (52.5)	309 (47.5)	58.876	0.000
Rural (1138)	387 (34.0)	751 (66.0)		
Marital state				
Married (1474)	576 (39.1)	898 (60.9)	9.689	0.002
Unmarried (315)	153 (48.6)	162 (51.4)		
Education				
Illiterate (270)	50 (18.5)	220 (81.5)	1.702	0.000
Read and write (184)	54 (29.3)	130 (70.7)		
Primary education (136)	38 (27.9)	98 (72.1)		
Secondary education (568)	211 (37.1)	357 (62.9)		
High education (631)	376 (59.6)	255 (40.4)		
Working				
Working (701)	356 (50.9)	344 (49.1)	48.664	0.000
Not (1088)	373 (34.3)	716 (65.7)		
Type of work				
Housewives (1089)	365 (33.5)	724 (66.5)	69.947	0.000
Governmental employee (411)	225 (54.7)	186 (45.3)		
NG employee (126)	50 (39.7)	76 (60.3)		
Private work (163)	89 (54.6)	74 (45.4)		
The family income per month				
≤1500 LE	167 (34.0)	324 (66.0)	14.540	0.001
1500-2000	443 (42.4)	602 (57.6)		
>2000	119 (47.0)	134 (53.0)		
If you or someone in your family have a thyroid disease				
Yes (238)	103(43.3)	135(56.7)	0.727	0.394
No (1551)	626(40.4)	925(59.6)		
Hearing about iodized salt				
Yes (1175)	584(49.7)	591(50.3)	1.137	0.000
No (614)	145(23.6)	469(76.4)		

NG=non-Governmental

iodized salt, its importance, preservation, and use.

So, regarding the actual utilization practices, we found most respondents (87.1%) use iodized salt this is higher than the national level (77.7%).⁷ But it is still lower than the criterion 90% coverage of USI goal by WHO.⁷

Regarding the different utilization practices to keep the iodine content of

salt, we found contradictory results, as compared to the majority of respondents using iodized salt only 8% keep it in a sealed opaque container and less than the third add it at the end of the cooking process. But more than two-thirds use a dry spoon. This was inconsistent with Karmakar et al., 2019 who found the

Table 7: Binary logistic regression of predictors of knowledge score.

Variables	B	P-value	Adjusted Odds ratio	Confidence interval 95%	
				Upper limit	Lower limit
Residence (urban versus rural)	0.374	0.006	1.453	1.116	1.893
Education					
• Illiterate (reference)					
• Secondary education	0.577	0.018	1.781	1.104	2.873
• High education	1.469	0.001	4.344	2.564	7.358
History of iodine deficiency (Yes, versus no)					
	0.877	0.001	2.405	1.621	3.567
Hearing about iodized salt (Yes, versus no)					
	2.474	0.001	11.872	8.809	16.000

Table 8: Binary logistic regression of predictors of practice score.

Variables	B	P-value	Adjusted Odds ratio	Confidence interval 95%	
				Upper limit	Lower limit
Residence (Urban versus rural)					
	0.398	0.001	1.489	1.196	1.853
Education					
• Illiterate (reference)					
• High education	0.962	0.001	2.616	1.659	4.123
Knowledge score (Good versus bad score)					
	0.995	0.001	2.704	2.076	3.521

majority (96.3%) of his respondents' store salt in a dry closed container and only small percent (8.9%) reported salt exposure to sunlight.

Conclusion

Although most of our studied participants (87.1%) use iodized salt, however knowledge about iodine and iodized salt in this study population was not satisfactory and many the subjects had improper practices related to the iodized salt usage this emphasis on the role of health education programs through different means to inform our

population about the value of iodized salt and its right handling.

References

1. Karmakar N, Datta A, Nag K, Datta SS, Datta S. Knowledge, attitude, and practice regarding household consumption of iodized salt among rural women of Tripura, India: A mixed-methods study. *J Edu Health Promot* 2019; 8(1):21-21.
2. Elmanssury AE, Elnour SA, Elmosaad YM. Knowledge and Attitude of Population Towards Iodized Salt in Shendi Locality River Nile State in Sudan. *European Scientific Journal* 2017; 13(6):312-22.

3. Lazarus JH. The importance of iodine in public health. *Environ Geochem Health* 2015; 37(4):605-18.
4. Fiore E, Tonacchera M, Vitti P. Influence of iodization programmes on the epidemiology of nodular goitre. *Best Pract Res Clin Endocrinol Metab* 2014; 28(4):577-88.
5. Biban BG, Lichiardopol C. Iodine Deficiency, Still a Global Problem? *Curr Health Sci J* 2017; 43(2): 103-11.
6. Podoba J, Racova K, Urbankova H, Srbecky M. Current status of iodine deficiency-related disorders prophylaxis in Slovakia - the life's work of Julian Podoba remained unfinished. *Endocrine Regulations* 2016; 50(1):3-9.
7. World Health Organization, United Nations Children's Fund, International Council for Control of Iodine Deficiency Disorders. Assessment of iodine deficiency disorders and monitoring their elimination. A guide for program managers. 3rd edition. Geneva: World Health Organization; 2007.
8. Pearce EN, Andersson M, Zimmermann MB. Global iodine nutrition: where do we stand in 2013? *Thyroid* 2013; 23(5):523-8.
9. El-Zanaty F, Way A. Egypt Demographic and Health Survey. Ministry of Health, El-Zanaty and Associates, and Macro International. 2008; 13-22.
10. Egypt Iodine Survey, Summary report. National Survey of Household Iodized Salt Use and Iodine Status among Primary School Children and Pregnant Women in Egypt 2014/2015.
11. Yamamah GA, Kamel AF, Dayem SA, Hussein AS, Salama H. Thyroid volumes and iodine status in Egyptian South Sinai schoolchildren. *Archives Med Sci* 2013; 9(3): 548-54.
12. Azizi F, Mehran L. Experiences in the prevention, control and elimination of iodine deficiency disorders: a regional perspective. *Eastern Mediterranean Health Journal* 2004; 10 (6): 761-70.
13. United Nations Development Programme Egypt (UNDP). Egypt Human Development Report 2008. cited 2020 Mars 12 Available from https://www.eg.undp.org/content/egypt/en/home/library/human_development/publication_3.html
14. National Information Center (NIC). Central Agency for Public Mobilization and Statistics; (CAPMAS). cited 2020 Mars 11 Available from <https://www.capmas.gov.eg/Pages/populationClock.aspx>
15. De Zoysa GE, Hettiarachchi M, Jayathilaka KA, Liyanage KD. Knowledge and practices of iodized salt consumption among pregnant women in Galle district, Galle Medical Journal 2015; 20(1): 10-16.
16. World Bank. Poverty & Equity Brief. Middle East & South Africa. Arab Republic of Egypt 2020. Available from www.worldbank.org/poverty.
17. Trading Economics. Egypt Minimum Monthly Wages. Available from. <https://tradingeconomics.com/egypt/minimum-wages>
18. Mohammadi M, Azizi F, Hedayati M. Iodine deficiency status in the WHO Eastern Mediterranean Region: a systematic review *Environ Geochem Health* 2018 ; 40:87-97.
19. Aburto NJ, Abdou M, Candeias V, Wu T, World Health Organization. Effect and safety of salt iodization to prevent iodine deficiency disorders: a systematic review with meta-analyses. Geneva; World Health Organization: 2014.
20. UNICEF. Universal salt iodization in Central and Eastern Europe and the Commonwealth of Independent States: experiences, achievement, and lessons learned during the decade 2000-2009. Geneva: UNICEF Regional Office for CEECS; 2011.
21. Kumar P, Tiwari VK, Gautam RK. Knowledge, attitude, and behavior regarding the use of iodized salt: An evaluation of the national iodine deficiency disorders control program in India. *Int J Sustain Dev* 2013; 5:95-106.
22. Gidey B, Alemu K, Atnafu A, Kifle M, Tefera Y, Sharma HR. Availability of adequate iodized salt at the household level and associated factors in rural communities in Laelay Maychew District, Northern Ethiopia: A cross-sectional study. *J Nutr Health Sci* 2015; 2(1):103.
23. Lowe N, Westaway E, Munir A, Tahir S, Dykes F, Lussier M, et al. Increasing awareness and use of iodized salt in a marginalized community setting in

North-West Pakistan. *Nutrients* 2015; 79(11):9672-82.

24. Dessu S, Dawit Z, Alemu G. Assessment of Knowledge on Iodized Salt Utilization and Associated Factors among Households in Arba Minch Town, Southern Ethiopia. *International Journal of Research Studies in Medical and Health Sciences* 2018; 3(12): 17-23.

25. Buxton C, Baguune B. Knowledge and practices of people in Bia District, Ghana, with regard to iodine deficiency disorders and intake of iodized salt. *Archives of Public Health* 2012; 70(1): 5.

26. Iodine Global Network. Global Iodine Nutrition Scorecard for 2015. Cited 2020 Feb 20 Available from: http://www.ign.org/cm_data/Scorecard_2015_August_26_new.pdf