International Scholars Journals

Advances in Food Science and Technology ISSN: 6732-4215 Vol. 4 (11), pp. 001-007, November, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Factors influencing the use of adequately iodated salt in Ghana

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Accepted 21 July, 2016

Ghana is one of the largest producers of salt in West African region yet, access to and the use of adequately iodized salt is not widespread. Using the Ghana Multiple Indicator Cluster Survey (MICS) 2006, this paper examined the factors influencing the use of adequately iodized salt in Ghana. Factors that influence the use of adequately iodized salt included knowledge, access to information and the wealth status. Where access to formal education opportunities were not available, access to information through media still served as an important instrument to educate the public and increase the community's knowledge on the nutritional value of consuming adequately iodized salt. Based on these findings, it was recommended that the cost of iodized salt should be reduced to make it more affordable particularly for the poor since wealth is an important factor influencing the use of adequately iodized salt. Furthermore, monitoring and ensuring enforcement of the law of salt fortification with iodine would help Ghana achieve universal salt iodisation.

Key words: Ghana, iodine, iodized salt, wealth, education, media.

INTRODUCTION

A large body of research evidence demonstrates the contribution of micronutrient malnutrition to adverse public health outcomes globally, with most cases occurring in poor and developing countries (Zimmerman et al., 2008; WHO, 2004). Micronutrient malnutrition may occur as a result of insufficient quantities of micronutrient consumption in the diet. Deficiencies of Zinc, Iron, Vitamin A and Iodine constitute the most common forms of micronutrient malnutrition (Black et al., 2008). The current article focuses on iodine deficiency.

Iodine deficiency is considered the single greatest cause of irreversible but preventable brain damage in the foetus (Zimmerman et al., 2008; Hetzel, 2007; WHO, 2000). Additionally, prenatal iodine deficiency is associated with increased risk of abortions, stillbirth, mental retardation and congenital malformations. Among young children and adolescents, depletion of iodine leads to impaired mental function and physical development. Indeed, even among adults, goitre and signs of mental impairments are traceable to iodine deficiency.

In almost all settings, fortification of salt with iodine is considered the preferred technology for combating iodine deficiency and eliminating its related disorders. This is partly because salt iodization is a simple and efficient process which could be achieved with minimal technology. Additionally, salt constitutes an optimal vehicle for delivering iodine because salt is one of the few dietary ingredients which is consumed universally, in roughly the same amount daily, irrespective of socio-economic status (WHO/UNICEF/ICCIDD, 2007; Mannar and Dunn, 1995). Further, the benefit of salt iodization far outweighs the cost of investment as reported by several authors (World Bank, 2006). Wesley and Horton (2011)

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discuss that for both developed and developing countries, investment in micronutrient fortification outweighs the cost making the economic benefits more favourable and highly cost effective. The international council for control of iodine deficiency disorders (ICCIDD) recommends that adequately iodized salt for human consumption should have about 20 to 40 parts per million (ppm) of iodine in food grade salt (WHO/UNICEF/ICCIDD, 2007).

Global efforts to address iodine deficiency through salt iodization have resulted in dramatic improvements in the consumption of iodized salt from about 20% in the 1990s to current estimates of about 70% at the household level (Dalmiya et al., 2004). Nevertheless, the global goal of 90% households using adequately iodized is yet to be realized. In Ghana, a legislative instrument was passed in 1995 to drive a mandatory mass fortification of food grade salt with iodine. This intervention sought to ensure that, at least, 90% of households consumed adequately iodized salt by 2005, however this was not achieved and the achievement of this national goal was set for 2011 (Ghanaweb, 2009). In 2003, the demographic and health surveys reported that less than one-third of Ghanaian households used adequately iodized salt ($\geq$ 15 ppm). This situation has persisted although Ghana is one of the largest producers of salt in the West African region (Lantum, 2008) and has the potential to supply iodised salt to other countries in the Sub-Saharan Africa region.

Ghana's universal salt iodization strategy seeks to achieve household consumption of salt with at least 15 parts per million (ppm) iodine by end of 2011 (GHS and UNICEF, 2009). In the multiple indicator cluster survey (MICS) data set, the variable —iodized saltǁ was divided into five categories namely salt not iodized, less than 15 (ppm) iodized salt (also called inadequately iodized salt), 15 ppm or more iodized salt (adequately iodized salt), no salt in the home and salt not tested. A few years ago, the ICCIDD and world health organization (WHO) made a recommendation for salt to be iodized at minimum and maximum levels of 20 to 40 ppm, respectively at the factory (WHO et al., 2007). After preparing about 10 Ghanaian food products with iodized salt (20 ppm) in studies carried out at the University of Ghana, none had enough iodine left to meet health needs (15 ppm). At 40 ppm, only a few had enough iodine left to meet the adult need of 150 Mg of iodine per day. After meetings at the Ghana Standards Board it was agreed and recommended that salt be iodized at 50 ppm in Ghana. Enough iodine would be left in all foods tested to satisfy health needs of 15 ppm (GHS and UNICEF, 2009).

METHODS

Data

The survey data was obtained from the multiple indicator cluster survey (MICS) for the year 2006 (GSS et al., 2006). The MICS is Designed to be nationally representative and is carried out in several developing countries in order to obtain information on indicators of the health status of women, men and children.

Using a representative probability sample of 6,302 households nationwide and a list of 660 Enumeration Areas (EAs) from the Ghana Living Standards Survey 5 (GLSS5) as a sampling frame, the data was stratified into 10 administrative regions of the country and further into urban and rural EAs using a two stage stratified sample design. 300 out of 660 census EAs (124 urban and 176 rural) were chosen in the first stage of sampling. Regional clusters were chosen using systematic sampling with probability proportional to size.

A systematic sampling of households was chosen based on the GLSS5 list in the second stage. Through this, the MICS households were chosen systematically from the GLSS5 household listing after eliminating previously selected households by the GLSS5 (20 per EA). Twenty households per EA were selected in all regions for the MICS survey except in the Northern, Upper East and Upper West regions in which 20 households per EA were chosen in urban areas and 25 households per EA in rural areas. This was done to make sure there were an adequate number of complete interviews to offer estimates for important population characteristics with acceptable statistical precision per region. No self weighting was applied to the MICS 2006 household sample due to the disproportionate number of EAs and different sample sizes selected per EA among regions. To report the national level results, sample weights were used (see MICS report in GSS, 2006).

As mentioned earlier, 6,302 households were surveyed in the MICS 2006 data. This reduced to 5482 households after removing households that did not have any information on the use of iodized salt. Adequacy of household salt iodization was tested by the trained research assistants using rapid iodization test kits (GSS et al., 2006). Data was also collapsed so that all analysis was done at the household level. Figure 1 shows the distribution of the different categories of salt iodization status in Ghanaian households. Rapid iodization test kits were used as the method of assessment. Most Ghanaian households had salt available to test with only about 8% not having any salt available for testing. The survey found that almost half of Ghanaian households (42%) had available salt that was not iodized and 18% of households had inadequately iodized salt. The proportion of households with adequately iodized salt ($\geq$ 15 ppm) was only 32%.

The variables identified *a priori* to explain the factors relating to the use of adequately iodized salt were age of household head, gender of household head, access to media, wealth, household size, region of residence and education level of household head. The presentation of the results will focus on comparisons between non-iodized and adequately iodized salt in order to clearly identify any stark differences between the two salt categories.

Empirical methodology

Here, a household's likelihood to use adequately iodized salt as a function of a combination of his or her personal characteristics as well as the characteristics of the household and community or region was estimated. We define the probability of iodized salt usage as:

$$P(y_i = 1|\mathrm{X}) = P(y_i^* > 0|\mathrm{X}) = P(\epsilon_i > -\mathrm{X}\beta|\mathrm{X}) = \Phi(\mathrm{X}\beta) = \Phi(\beta_0 + \mathrm{X}_1\beta_1 + \mathrm{X}_2\beta_2 + \mathrm{X}_3\beta_3)$$

where y_i is an indicator variable equal to 1 if the household consumes non-iodized salt and 0 otherwise (the household consumes adequately iodized salt); y_i^* is the latent variable modeled under linear model assumptions, $\epsilon_i \sim N(0,1)$ with Φ

as the normal cumulative distribution function, and $(X_1 - X_2)$ correspond to sets of individual, household, and community characteristics, respectively. The dependent variable is binary; since we are measuring the likelihood of a household consuming iodized salt. Since the household may use or may not use adequately iodized salt, the outcome is either 1 or 0. This standard binary choice model is suitable for measuring salt iodization programmes because it informs the reader firstly on whether the household uses iodized salt or not and secondly the factors that influence the household's choice of salt (Amemiya, 1981). The model is estimated with a probit function corrected for survey design. The estimates are probability-weighted with survey sampling weights and standard errors are adjusted for clustering at the primary sampling unit (PSU) level and stratification at the regional level. The estimation sample is restricted to households that provided information on the usage or non-usage of iodized salt, and the coefficients are shown as marginal changes in the probability of participation for continuous variables and the discrete change in the probability for dummy variables.

Three hypotheses were tested in this paper. Firstly, the use of adequately iodized salt is influenced by the knowledge of the household head which is measured by formal education level completed. It was assumed that higher educational attainment would be a function of greater use of adequately iodized salt because educated individuals would have learnt the nutritional importance of consuming adequately iodized salt instead of none-iodized salt. Secondly, even if the household head was not formally educated, greater access to information through the media will motivate greater use of adequately iodized salt. Lastly household's ability to purchase iodised salt, measured by wealth status will positively correlate with the use of adequately iodized salt.

RESULTS AND DISCUSSION

The results are presented in Tables 1 and 2. Table 1 shows descriptive statistics on the factors related to the use of iodized salt and Table 2 presents the multivariate probit regression results. The regression is controlled for age, education, gender of the head of the household and income (or wealth status). Regional dummies are included to control regional fixed effects.

The average age of the household head was 45 years. The regression analysis showed a non-significant negative association between age of the household head and use of non-iodized salt (p=0.469). About 11% of the households in the sample were female headed. Of this proportion, 10% used non-iodized salt and 14% used adequately iodized salt. Female-headed households were more likely to use adequately iodized salt (p=0.001). This suggests that females may be priority targets for iodised salt interventions. In Colombia, Staten et al. (1998) found that although female headed households were economically poorer than male headed or dual headed households, they did not find any nutritional difference between these households because female-headed households coped arranging their expenditures in the order of what was most important. A similar result was found for Ghana by Baden et al. (1994) who found that female headed households allocated a larger share of their budget to food even at higher income levels. Nevertheless, as Haddad (1999) says, women play a key role in household nutrition and food security in the home. Thus they are able to make better household decisions that can contribute positively to good nutrition at home. This suggests a role for gender in the use of adequately iodized salt.

Each household had about 4 to 5 members. In the regression analysis, household size exhibited a positive relationship with the use of non-iodized salt and this result was statistically insignificant (p=0.753) showing that household size is not a significant determinant of iodized salt usage.

About 75% of households in the sample had access to a television or radio. Here access to television or radio is used as a proxy for being informed. In households that used adequately iodated salt, 88% were informed and in households that used non-iodized salt, 66% of them were informed. The regression results show that access to radio or television was significantly and positively associated with the type of salt used in a household (p=0.025). Health campaigns through television and radio, among other methods, serve as an instrumental educative form of media through which public awareness and the use of adequately iodized salt can be increased.

About 61% of households that used non-iodized salt had household heads who were either uneducated or had completed primary education only, whereas 39% of household heads with junior secondary school (JSS) and/or senior secondary school (SSS) education and above used non-iodized salt. Among households using adequately iodized salt, 36% of these household heads were either uneducated or had at least primary education compared to 64% who had JSS and above level of education. The regression output shows that with regard to the education of the household head, any level of education, when compared with having no education, was associated with the use of adequately iodated salt. However, this effect was significant only among households in which the head had education at junior secondary school (JSS) level or above. Thus, education is an important tool through which the nutritional benefits of using iodized salt can be realized.

Among households using non-iodized salt, 34% were in the poorest category and 5% were in the richest category whereas in households where adequately iodized salt is used, 5% were in the poorest category and 40% in the richest category. The regression results show that compared to the richest category, all other lower levels of wealth were more likely to use non-iodized salt and these results are statistically significant (p=0.000). It also shows that wealth is a significant determinant of one's likelihood of using adequately iodized salt or not. The fact that people change their consumption patterns when their income increases by purchasing better quality food only attests to the fact that a lack of income involuntarily forces people to a certain extent to consume lower quality foods. Income plays an important role and is the most Important determinant in achieving adequate nutrition in the household (Iram and Butt, 2004).

In terms of regional location, people living in the Volta,

Table 1. Descriptive statistics.

Variable	Non- Iodized	Inadequately Iodized	Adequately Iodized
Household characteristics			
Mean age of household head	47	46	45
Female headed home (%)	10	10	14
Average Household size	4.8	4.8	4.2
Access to media (%)			
Radio or TV	66	75	88
Education of household head (%)			
None	13	14	9
Primary	48	45	27
JSS	30	31	36
SSS and above	9	10	28
Wealth (%)			
Poorest	34	29	5
2nd	27	27	12
3rd	20	19	16
4th	14	15	26
Richest	5	11	40
Regions (%)			
Western	9	5	12
Central	9	11	5
Greater Accra	6	12	24
Volta	14	1	2
Eastern	14	7	7
Ashanti	8	14	24
Brong Ahafo	3	8	13
Northern	19	8	4
Upper East	14	9	4
Upper West	4	23	5

Source: Authors' calculations.

Eastern, Northern, and Upper East regions mostly used non-iodized salt. Adequately iodized salt was used to a greater extent in the Western, Greater Accra, Ashanti and Brong-Ahafo regions. The regression analysis shows that relative to households resident in Greater Accra, households in the Western, Ashanti, Brong-Ahafo, Upper East, and Upper West are more likely to use adequately iodized salt whereas the Central, Eastern, Volta, Northern regions were less likely to use adequately iodized salt. We find these results a bit surprising because we expected the Upper East and Upper West to behave in a similar pattern as the Northern region and consume more non-iodized salt since these are the poorest regions in Ghana and the cost of adequately iodized salt may have a role to play here. Perhaps there has been a lot of promotion on the importance of using adequately iodated salt in those regions and maybe a lot of media campaigns have been going on in the Upper East and Upper West increasing the use of adequately iodized salt in those regions. Attesting to this intervention, Asibey-Berko (2007) in a study on goitre prevalence in the Upper West and Upper East regions of Ghana showed that goitre prevalence in the Jirapa region in the Upper West had significantly reduced from 56.6% to 10.6% and in the Bongo regions in Upper East, goitre prevalence had reduced from 56.6 to 38.4% (GhanaHealthNews).

The discussion so far has shown the factors that influence the use of iodated salt in Ghanaian households. Although the analysis so far has unearthed important factors that could influence the use of iodized salt in Ghana, factors such as quality assurance and control and legislation for example could not be captured in the data

Table 2. Probit regression showing factors related to of the use of iodized salt.

Variable	None iodized salt
Household characteristics	
Age of household head	-0.004
Female headed home	-0.15***
Household size	0.001
Access to media	
Radio or TV	-0.054**
Education of household head	
Primary	-0.023
JSS	-0.113**
SSS and above	-0.350***
Wealth	
Poorest	0.371***
2nd Poorest	0.326***
3rd Poorest	0.292***
4th Poorest	0.187***
Region	
Western	-0.20***
Central	0.12***
Volta	0.16***
Eastern	0.11***
Ashanti	-0.24***
Brong Ahafo	-0.39***
Northern	0.09**
Upper East	-0.01
Upper West	-0.12**

Source: Authors' calculations. Marginal effects are reported. *significant at 10%, **significant at 5%, ***significant at 1%

analysis.

Earlier in this paper, it was established that Ghana has the best salt producing potential in the West African region (Affam and Asamoah, 2011). Lantum (2008) in his study on salt production in the West African region noted that only 60% of the salt produced in Ghana was iodized. Furthermore, he also found that not all the salt exported from Ghana is iodized. Therefore, in order to achieve the universal salt iodization in Ghana, various other important strategies need to be in place.

Firstly, it would be very important for government, politicians and policymakers in Ghana to understand the negative impact that iodine deficiency could have on the development of the nation (Sullivan et al., 1995). Current national strategies under construction cannot be properly understood and implemented if the population is iodine deficient. Efforts to educate the public on the importance of iodated salt is important to ensure that individuals even out of their own initiative demand iodated salt for their everyday use owing to the awareness they have about the importance of iodized salt. This will also increase con-sumer demand for iodized salt and reduce the availability of none iodized salt in the market place. The media and health industry in Ghana have made tremendous efforts to educate the public on the importance of iodized salt particularly through the use of radio. However, more could still be done since universal salt iodization has not yet been achieved in Ghana.

Secondly, it is important to formulate legislation in Ghana to ensure only salt with the correct iodine content is made available for sale in the market place. This can be achieved by institutionalizing mechanisms that will en-sure that correct labelling, packaging, storage procedures are correctly followed. To correctly label packages of salt

as iodized salt, the Ministry of Health can work closely with the Food and Drugs Board (FDB) in Ghana to create a unique seal to show that the packaged salt meets standards set for ensuring the correct level of iodine in salt. The public should also be well educated in knowing how to identify this seal when making purchases from the market place (and also clearly distinguish it from counterfeit logos). It would greatly go a long way to ensure that none iodized salt is not sold in market places and simultaneously increase the availability of iodized salt in the market place. Ghana still has a long way to go to ensure legislature and monitoring mechanisms are put in place so that all salt made available for sale in the market place is iodized (Sullivan et al., 1995).

Thirdly, the cost element of using iodized versus none iodized salt is also a factor that has been debated particularly in relation to making it more affordable for the poor. In as much as it is very cost effective to iodise salt, the fact still remains that iodised salt is more expensive than none iodised salt. Because the poor are constrained by money, they are more likely to buy none iodized salt. It is therefore crucial for government interventions to take great strides to reach the poor in unreached areas where access to iodized salt may be greatly limited. Access to and affordability of iodized salt by the poor can be increased by packaging iodized salt in smaller quantities for poor households (Sullivan et al., 1995). If the cost of iodized salt differs by size of packaged salt, then it is possible for the poor to still use iodized salt by buying smaller packages which would be cheaper. However for the poor, it would also be important to educate them in foods which are naturally rich in high iodine content so that even if they are still unable to afford the iodated salt, access to foods rich in iodine would help meet the iodine content necessary for their health. With these procedures in place, Ghana would be in a better position to achieve universal iodization at a quicker pace.

Nevertheless, in as much as effort to put these procedures in place is a good, some bottlenecks in the Ghanaian salt industry need to be addressed to fully implement the afore-mentioned procedures. The Ghanaian salt industry is still constrained by poor industrial infrastructure, obsolete technology, and numerous small producers and lacks local expertise. Because of some of these constraints, Ghana is producing only 10% of the industry‘s potential to produce salt (Affam and Asamoah, 2011).

Although both large and small producers are actively involved in salt production in Ghana, small producers pose a greater challenge because they are numerous and often located in hard to reach areas with no fixed addresses (IDD Newsletter, 2008). They may be less informed about the importance of iodising their salt or lack income to purchase correct iodization equipment. Targeting this group of producers has been challenging but it is important to still continue to locate them because they will be instrumental in attaining universal salt iodisation in Ghana.

Some progress has been marked in the Bolgatanga area of Ghana where United Nations Children's Fund (UNICEF) in collaboration with Ghana Health Service (2011) used radio campaigns to teach the community about the benefits of iodized salt. When this project started in 2009, only 24% of the households had adequate levels of iodated salt but by, this had increased to 63% (UNICEF, 2012). However they also mentioned that achieving USI was challenging because of weak law enforcement, limited availability of potassium iodide and a large number of small producers who are difficult to monitor.

The World Food Programme (WFP) has also been involved in school feeding in Ghana, particularly monitoring the use of iodised salt when preparing food for school children (Cheung et al., 2007). They find that to increase the assurance that feeding programs are using iodised salt; salt should be purchased only from large producers to guarantee purchasing iodised salt. The cost element of producing iodised salt can be improved if efforts are made to reach small producers and develop a central salt bank firstly to ensure that all salt is iodised and further to reduce production costs and increase competition among producers of iodised salt.

Conclusion

The objective of this paper was to assess the factors influencing the use of adequately iodized salt in Ghana. The empirical results reveal that the education level of the household head, access to media and wealth status of the household were seen to play a strong role in influencing whether a household used adequately iodized salt or not.

These results suggest that knowledge, access to information and the wealth status of the household influence a household‘s use of adequately iodated salt.

Our findings indicate that the presence of a household head with JSS and/or SSS and above level of education significantly increases the likelihood of using adequately iodized salt. Where access to education opportunities have not been available, access to information through media still serves as an important instrument to educate the public and increase the community‘s knowledge on the nutritional value of adequately iodized salt.

Further research also unearthed various challenges facing the salt industry in Ghana. These were obsolete machinery, numerous small producers located in hard to reach areas, lack of local expertise to run iodization machinery and also issues pertaining to monitoring and legislation which would help improve aspects of quality assurance (QA) and quality control (QC). Much coordination between Government, health industry and salt producers is still needed to ensure they are working harmoniously with one another to increase the availability

of iodized salt on the markets. Addressing the constraints raised above, together with correct monitoring of the whole production process of iodising salt until it gets to the consumer (household) would go a long way in helping Ghana eradicate iodine deficiencies. Also, more marketing of the benefits of using iodised salt, especially in locations where the poor may be found need to be encouraged. Subsidising the cost of iodised salt for the poor or packaging it in smaller more affordable quantities for them would also help ensure that no one is excluded in all efforts to make iodised salt reach the whole population. Private sector investment in social marketing of iodized salt should also be encouraged.

The availability of adequately iodized salt on the market needs to be increased and one way to achieve this would be to ensure the unavailability of non-iodized salt on the market by enforcing the law on fortification and iodized salt marketing. Indeed, in the coming years, if these limitations are correctly addressed, iodine deficiencies will be an issue of the past and iodised salt will be the only salt available for sale in the market due to consumer demand arising from a solid understanding of the importance of consuming iodised salt for healthier living.

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