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IODINE CONTENT OF MARINE FISH IN GHANA

P. LOKKO, E. ASIBEY-BERKO AND G. NERQUAYE-TETTEH
(P. L. & G. N.-T.: Food Research Institute, CSIR, Accra; E.A.B.: Department of Nutrition and Food Science, University of Ghana, Legon)

Abstract

The concentration of iodine in several commonly consumed Ghanaian fish was determined. This was done in order to recommend to the local populace local fish with high iodine content as part of the national effort to combat iodine deficiency disorders (IDD). Fresh fish samples were analyzed for moisture and iodine by A.O.A.C. *Official Methods of Analyses.* ANOVA was used to analyze the data obtained. The iodine content ranged from 0.62 μg/g to 4.09 μg/g on fresh weight basis. In all, Round Sardine - *Sardinella auritus,* had the highest mean concentration of iodine of 4.09 μg/g with Frigate Mackerel, - *Auxis thazard* having the lowest mean concentration of 0.62 μ/g. Iodine concentration in Chub/Spanish Mackerel- *Scomber japonicus,* Seabream - *Deutex* spp., Bumper- *Chloroscombus chrysurus,* Burrito- *Brachydeuterus auritus,* Round Sardines- *Sardinella aurita* and Shrimps - *Penaeus notialis* (2.07 μg/g -4.09 μg/g) were significantly higher ($P < 0.05$) than concentration of iodine in Frigate Mackerel - *Auxis thazard,* Atlantic Horse Mackerel - *Trachurus trachurus,* Scad Mackerel - *Caranx ronchus,* Longfinned Herring - *Ilisha africana* (0.62 μg/g-1.21 μg/g). Round Sardines and Shrimps (4.09 μg/g and 3.5 μg/g, respectively, were significantly different from all the 12 others.

Résumé

LOKKO, P., ASIBEY-BERKO, E. & NERQUAYE-TETTEH, G.: *Contenu d'iode de poisson de la mer du Ghana.* La concentration d'iode en divers poissons communément consommés au Ghana était déterminée. Ceci était fait pour recommander aux gens du pays le poisson local ayant le contenu d'iode élevé comme l'un de l'effort national pour combattre les Troubles de Carence Iodique (TCI). Les échantillons de poisson frais étaient analysés pour humidité et iode par les modalités officielles d'analyse de A.O.A.C. *Official Methods of Analyses.* ANOVA était utilisé pour analyser les données obtenues. Le contenu d'iode variait entre 0.62 μg/g et 4.09 μ/g en se basant sur le poid de poisson frais. Dans l'ensemble, la sardine ronde - *Sardinella auritus* avait la concentration iodique moyenne la plus élevée de 4.09 μg/g avec maquereau de frégate – *Auxis thazard* ayant la moindre concentration moyenne de 0.62 μg/g. Concentration iodique dans le maquereau chevaine/espagnol – *Scomber japonicus*, Daurade – *Deutex* spp., Bumper – *Chloroscombus chrysurus,* Burrito – *Brachydeuterus auritus,* les sardines rondes – *Sardinella aurita* et les crevettes – *Penaeus notialis* (2.07 μg/g – 4.09 μg/g) étaient considérablement plus élevés ($P < 0.05$) que la concentration iodique dans le maquereau de frégate – *Auxis thazard,* la maquereau de cheval atlantique – *Trachurus trachurus*, le maquereau bâtard – *Caranx ronchus*, le hareng blanc – *Ilisha africana* (0.62 μg/g -1.21 μg/g). Les sardines rondes et les crevettes (4.09 μg/g et 3.59 μg/g respectivement) étaient considérablement différentes de tous les douze autres.

Introduction

In Ghana fisheries make an important contribution to the national larder, providing protein which is of great nutritional significance. Sea foods provide more than just protein. They also provide fats as well as minerals and vitamins. Equally important is the contribution of seafood to the iodine requirement of the population. Iodine is

an essential trace element required for human growth and development. It helps the body to produce thyroxin - a hormone that regulates a variety of physiological functions and is critical for optimum development of the brain. A reduction in the hormone levels can result in irreversible brain damage in the infant and retard psychomotor development in the child (Hetzel, 1988). Iodine deficiency affects all age groups leading to a wide spectrum of disorders. These include goitre, cretinism, deaf-mutism, mental retardation, muscular disorders as well as spontaneous abortions and stillbirths in pregnancy.

The prevalence and severity of iodine deficiency disorders (IDD) in Ghana have been documented (Asibey-Berko & Oracca-Tetteh, 1994). One important observation made was that, generally, percentage goitre rate increased as the distance northwards from the sea.

Marine fish, shrimps, prawns and seaweed have been reported to be natural sources of very high levels of iodine and from the enormous variety of fish that can be caught, it is possible to get a wide range of fish with varying nutrient and iodine levels (Goslings, 1985).

A comprehensive data on iodine levels in raw fish is lacking. Except for the work of Aya & Esh (1976), Adom & Asibey-Berko (1998) which examined the iodine concentrations of some common Ghanaian foods, not much has been done in this area. Such data will be a very important tool for selection and promotion of particular types of fish, which can be introduced into iodine deficient areas as a way of controlling and preventing IDD.

Of all the minerals in fish, iodine seems to show the largest variability or range in concentration. Variations have been reported in fish from about 10 to 500 μg/100 g (Borgstrom, 1961). Fishing locality is known to have a considerable influence on the iodine content of fish. To arrive, therefore, at a representative concentration of iodine in fish in national coastal waters, sampling must not be confined to only one landing site. Most fish caught, for example, on Califonia coasts, are less rich in iodine than the same species caught on the Norwegian coasts. This may be due to the lower iodine content of plankton in the different fishing localities (Borgsrom, 1961). Iodine, in fact, shows the same large variations even in plants depending on soil iodine content (Davidson *et al.*, 1975). Carrots from Florida, Oklahoma and Louisiana in the USA, for example, have been shown to have iodine concentration of 240, 407 and 1283 μg/kg on dry weight basis, respectively (Guthrie, 1979).

Seafood are the richest sources of iodine and are about 30 times richer in iodine than fresh fish (Borgstrom, 1961), hence the focus on sea fish.

The objective of the study, therefore, was to determine the iodine content of the most popular fish species landed at the coastal regions and, therefore, recommend specific species of fish for iodine deficient areas of the country.

Experimental

Landing sites

Preliminary investigations were conducted to find the different types of fish landed on the beaches of Ghana. This involved gathering information from the Fisheries Department of the Ministry of Food and Agriculture, and visits to different landing sites in the four coastal regions of Ghana.

The landing sites selected for collection and analysis of fish were James Fort and Tema Fishing Harbour in the Greater Accra Region, Sekondi Naval Base and Sharma in the Western Region, Apam and Winneba in the Central Region, and Anloga, Woe, Anyanui and Atiteti in the Volta Region.

Sample collection and preparation

Samples of freshly landed fish were purchased from at least two landing sites in each region. They were packed into sealable polyethylene bags and placed in insulated boxes containing ice packs. The samples were then quickly transported to the laboratory and stored at -20 °C or less until analyzed. Fish samples for a particular region were thawed to room temperature. The edible portion of each type of fish was cut into smaller pieces

TABLE 1
*Marine fish commonly landed on the beaches of Ghana**

Local name	*Common name*	*Scientific name*	*Common processing method*
Yiyiwa (Ga) Wiriwiriwa (Akan)	Sea Bream Red fish	*Dentex*	Smoking
Boboe	Burrito	*Brachydeuterus auritus*	Smoking
Kpanla	Atlantic Horse Mackerel	*Trachurus trachurus*	Smoking
Apapa (Ga) Op/Epae (Akan) Fafa/Glamat (Ewe)	Jack Horse Mackerel	*Caranx hippos*	Smoking
Antuanu (Ga) Fiayi (Ewe) Antsowanu (Akan)	Horse Mackerel	*Caranx crysos*	Smoking
Ebandzi (Akan Tsiyi (Ewe) Emule (Ga)	Scad Mackerel		Smoking
Saman (Ga, Akan) Adzadu (Ewe)	Chub/Spanish Mackerel	*Scomber japonicus*	Smoking
Antele (Ga) Tantemire (Akan) Dzodzoe (Ewe)	Bumper	*Chloroscombus chrysurus*	Smoking
Kankama (Ga) Vetsi (Ewe) Krakrama (Akan)	Round Sardine	*Sardinella aurita*	Smoking
Antebo (Ga) Eman/Anter (Akan) Adruku/Deyi (Ewe)	Flat Sardine	*Sardinella eba/ cameronnensis*	Smoking
Amoni (Ga) Abobi (Ewe)	Anchovy	*Anchoa guineensis*	Smoking
Opoku (Ga) Kpokponku (Ewe) Popoku (Akan)	Frigate Mackerel	*Auxis thazard*	Smoking
Kanfla (Ga, Ewe) Kanfera (Akan)	Longfinned Herring	*Ilisha africana*	Frying
Sonn (Ga) Sesew (Akan) Gna (Ga) Ana (Akan)	Shrimps Lobsters	*Penaeus notialis* *Panulirus regius*	Smoking and drying Cooking
Pusu (Akan) Kakadiamaa (Ga)	Cuttle Fish/ Squid Octopus	*Serpia bertheloti* *Octopus defilippi*	Salting

* D. W. Ofori-Adu (1974) (7) Some common fishes landed at the Ghanaian Beaches. Fishery Research Unit, Tema, Accra.

and pooled together into a composite sample for the region. The composite sample was blended without water at 18000 rpm for 20-35 seconds with Encore Blender and Mixer (Encore Industries, Bombay, India).

Moisture and iodine determinations

Moisture was determined on triplicate samples of the blended fish at 105 °C using AOAC method of analysis (1970). One-gram sample was wet-digested and analyzed for iodine using the method of Fisher & L' Abbe (1981). Quality control samples were used to monitor assay performance. ANOVA was used to analyze the data obtained.

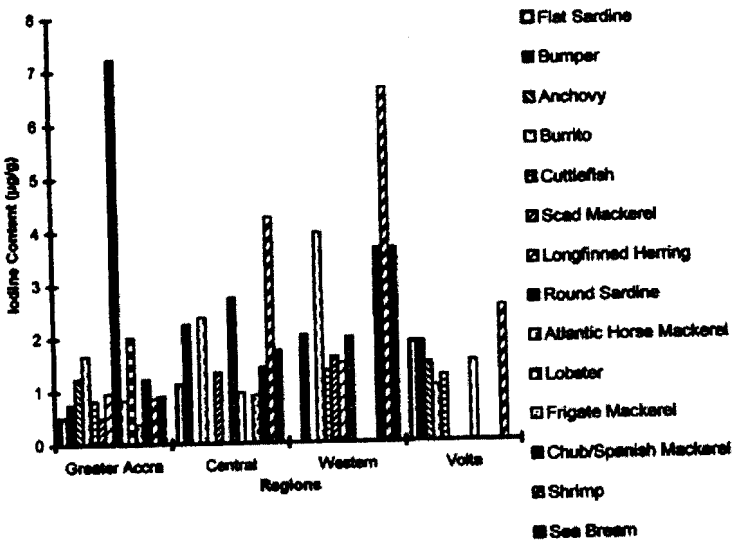

Fig. 1. Mean iodine content of fish from the four coastal regions of Ghana (fresh weight basis)

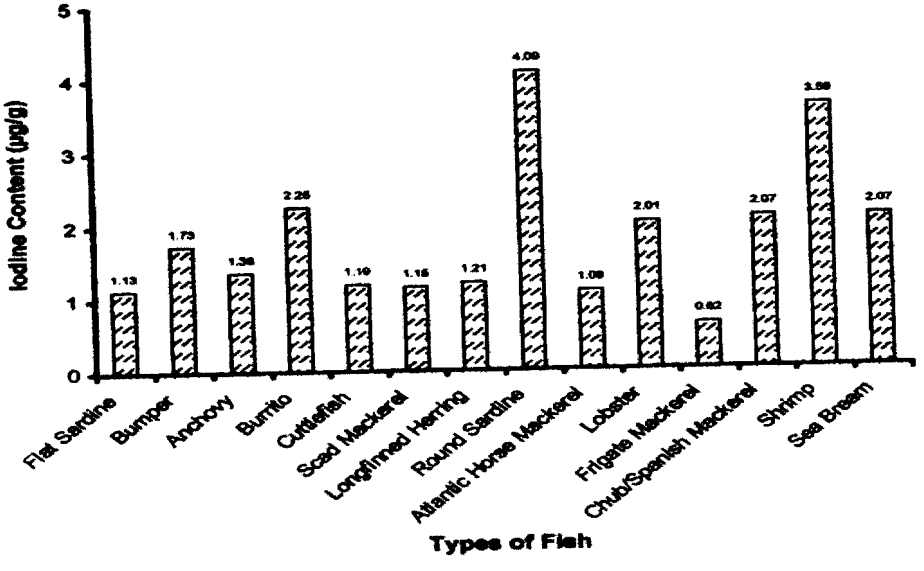

Fig. 2. Summary of mean iodine content of the fish from the four coastal regions of Ghana (fresh weight basis)

Results and discussion

Shrimps, cuttlefish/squid and lobsters were added making fourteen (Table 1). The selection was guided by information from the Ministry of Food and Agriculture, Fishery Research Unit on artisanal fish production of selected species by regions from 1992 to 1994 (Ofori-Adu, 1974; Wolfgang, 1995). Round sardines and anchovies were the most landed fish while smoking was found to be the most widespread and popular method of fish processing. Moisture levels of the samples were between 70 and 8 per cent Eleven species of fish were selected for the study.

Results of iodine content determinations are shown in Fig. 1 and 2. In all cases, triplicate analyses determinations were made and the means presented. National mean iodine concentrations (Fig. 2) ranged from 0.62 μg/g to 4.09 μg/g in the samples on fresh weight basis. Round Sardine had the highest mean iodine concentration of 4.09 μg/g followed by Shrimps with 3.59 μg/g iodine concentration. Other fish with moderately high iodine concentrations were Burrito (2.25 μg/g), Sea Bream (2.07 μg/g), Chub/Spanish Mackerel (2.07 μg/g), Lobster (2.01 μg/g) and Bumper (1.73 μg/g) (Fig. 2).

Some species of seaweed are the richest sources of iodine in nature. Consequently, seafish that feed on such seaweed form an excellent source of iodine (Ranganathan & Reddy, 1995). This may explain the wide variation in iodine content in the different types of fish and even in the same type of fish. The iodine content may also vary with species, the age of the fish, as well as the feeding sites (Borgstrom, 1961; Aye & Ash, 1976).

Mean calculated iodine in sea foods, reported in Accra for anchovy, crab, sardines, lobsters, shrimps and tuna in descending order ranged from 58 to 201 μg/100 g wet weight, whereas iodine content of plant foods (green leafy vegetables, starchy root and tubers, fruits and cereals) ranged from 9 to 41 μg/100 wet weight (Adom & Asibey-Berko 1998). In the Netherlands, iodine values for herrings, mussels, shrimps, cod and haddock ranging in ascending order are from 50 to 400 μg/100 g wet weight (Goslings, 1985). This is comparable to the 0.62 - 4.09 μg/g obtained for Ghanaian fish in the study. In India, the iodine content of fish ranges between 28-178 μg/100 g, while those of common Indian plant food range from 1.0 to 70 μg/100 g (Ranganathan & Reddy, 1995).

Comparing the iodine concentrations of fish to other food crops commonly consumed in Ghana, (millet - 0.20 μg/g, nkontomire - 0.07 μg/g and cassava - 0.16 μg/g) (Adom & Asibey-Berko, 1998), iodine concentrations are still far higher even in fish with lower levels of iodine than in plant foods. Plant foods, especially fruits and vegetables, are very poor sources of iodine. Foods grown in iodine deficient soils also have very low levels of iodine (Ranganathan & Reddy, 1995). Fish can, therefore, be recommended in the control and prevention of IDD.

Conclusion

Levels of iodine in fish were found to be relatively higher than in other plant foods commonly consumed in Ghana. Round sardine and shrimps were found to have the highest iodine concentrations, whereas frigate mackerel, atlantic horse mackerel, flat sardine and scad mackerel were found to have lower iodine concentrations.

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