© 2016 IJSRST | Volume 2 | Issue 6 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Occurrence-Variability of Iodine in Salt-Water and Fresh-Water Seafoods

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ABSTRACT

Seafood make good delicacies for most families in Bayelsa State. Seafood accumulate iodine from the surrounding water, and are therefore a good dietary source of iodine. However, the economic importance of iodine in the body cannot be over-emphasized; adequate consumption of seaweed can eliminate iodine deficiency disorders, but excessive iodine intake is not good for health. Iodine variability needs to be taken into consideration since it explains why the same food item may have widely different iodine content depending on the locality where it was produced. In this paper, the iodine concentrations in Tilapia, Crayfish, Lobster, Shrimp, Prawn, and Crab of salt water and fresh water origins in Bayelsa State are reported. 25 g of sample (catfish, tilapia, crayfish, lobster, shrimp, prawn, and crab) was dried to constant weight. 0.2 g of dry weight sample was prepared via three stages; ashing, derivatization, and liquid-liquid extraction. The extractant was analyzed for iodine content using UV-VIS spectrophotometer at 320 nm. The iodine concentrations (mg/kg) in the salt water samples were found to be; catfish, 0.30; tilapia, 0.25; crayfish, 3.00; lobster, 2.70; shrimp, 2.64; prawn, 2.84; crab, 25.00. The iodine concentrations (mg/kg) in the salt water samples found to be; catfish, 0.021; tilapia, 0.023;crayfish, 0.200; lobster, 0.208; shrimp, 0.220; prawn, 0.258; crab, 1.786. These figures show that salt water seafoods contain iodine concentrations, 11 to 15 times the concentrations in the fresh water seafood. These differences were significant using a 2-tailed independent samples T test. Seafood of salt-water origin are very rich sources iodine.
Keywords : Iodine, Seafood, UV-VIS, Spectrophotometer, Extraction

I. INTRODUCTION

Iodine is a micronutrient of crucial importance for the health and well-being of all individuals and just a trace amount of it is sufficient to meet the life-time needs of an individual with a life-span of 70 years ([1], [2]). It is ubiquitous in the biosphere [3].

The major source of iodine for man is the food chain [5]. While iodine abundance in our Earth´s crust is only 0,000061% [5], oceans are the main reservoirs of this element.

The seaweed iodine concentration is 100 – 1000 times higher than in fish. For example, fish with very high iodine concentration like sardine and horse mackerel have approximately 250 µg of iodine/100 g, while *Kombu*, a typical and common seaweed, contains approximately 130.000 µg of iodine/100 g [2].

A diet deficient in iodine is associated with a range of adverse health effects collectively referred to as iodine deficiency disorders (IDD) [6] and has been identified as the single most important cause of preventable brain damage and mental retardation in the world [6]. The well-known consequence of iodine deficiency is goitre, an enlargement of the thyroid gland.

Prolonged years of iodine deficiency can lead to adverse changes in the thyroid, which can predispose individuals to thyroid disease (such as iodine-induced hyperthyroidism and thyroid cancer) later in life or following increases in iodine intake [7]. The importance of seafood as sources of iodine cannot be overemphasized and owing to its importance, many researchers have developed and used different methods of determining iodine in seafood **(**[8]; [9]; [10]; [11]; [12]; [13]). However, a comprehensive review of the determination of iodine in seafoods is published by [14].

Iodine variability needs to be taken into consideration since it explains why the same food item may have widely different iodine content depending on the locality where it was produced. However, this location-dependent iodine variability has not been studied, especially in sea foods available in Bayelsa State. Therefore, the aim of this study was to compare the iodine concentration in catfish. tilapia, crayfish, lobster, shrimp, prawn, and crab of salt water and fresh water origins in Bayelsa State.

II. METHODS AND MATERIAL

Experimental

Materials and Reagents

Potassium iodide, 3-pentanone, potassium dichromate, sodium hydroxide, sulphuric acid, n-Hexane, and potassium nitrate were all Sigma-Aldrich products of good quality and purity. Salt water samples (catfish, tilapia, crayfish, lobster, shrimps, prawns, and crabs) were collected from Ekeni, in Southern Ijaw Local Government Area, fresh water samples (catfish, tilapia, crayfish, lobster, shrimps, prawns, and crabs) were collected from Toru-ebeni, in Sagbama Local Government Area, all in Bayelsa State.

Sample Pre-treatment

4 mL NaOH (4N) and 2 mL KNO_3 (20%) was added to 0.2 g of the dry sample (catfish, tilapia, crayfish, lobster, shrimp, prawn, and crab) to form the ashing solution and this solution was heated to slurry and then to dryness. The completely dried slurry was placed in a crucible with the lid on and was then placed in the ashing furnace. The furnace was programmed as follows: 100^{o}C for 1 hour, 200^{o}C for 1 hour, and carbonization at 500^{o}C for 2 hours. The resulting ash was cooled, 15 mL de-ionized water was added, heated, ultrasonicated, and filtered under suction pressure. The filtrate was made up to 50 mL with de-ionized water. 5 mL of this solution was used for derivatization. The derivatization reagents included: 0.5 mL 3-pentanone, 1 mL 0.5% (w/v) potassium dichromate, 1 mL 50% (v/v) H_2SO_4 was added in and mixed well. The test tube was allowed to stand for 6 hours for the reaction to go to completion. The iodoketone was extracted via liquid-liquid extraction in a separatory funnel. 10 mL n-hexane was added to the separation funnel, which was then shaken for 10 minutes. The separation funnel was allowed to stand until a clear delineation of two layers appeared. The upper hexane layer was filtered through a 0.45-mm syringe filter and ready for analysis.

III. RESULT AND DISCUSSION

The iodine concentrations (mg/kg) in the salt water samples were found to be; catfish, 0.30; tilapia, 0.25; crayfish, 3.00; lobster, 2.70; shrimp, 2.64; prawn, 2.84; crab, 25.00 (Table 1). The iodine concentrations (mg/kg) in the salt water samples found to be; catfish, 0.021; tilapia, 0.023;crayfish, 0.200; lobster, 0.208; shrimp, 0.220; prawn, 0.258; crab, 1.786 (Table 2). These figures show that salt water seafoods contain iodine concentrations, 11 to 15 times the concentrations in the fresh water seafood. The high concentrations of iodine in seafoods of salt water origin is consistent with the results reported by Huang, et al., 2009; he found out that the iodine concentrations in organisms such as algae, seaweed and sea sponges were 19 g/kg dry weight. A statistical treatment of the data was carried out using a 2-Tailed Independent Samples T test and the results (Table 3) show significant differences in the level of iodine in seafoods obtained from fresh water and salt water.

Table 1: Concentrations of iodine in seafoods of salt water origin

Salt water			
Sample	**Concentration mg/kg**	**Equation of straight line**	**R-SQUARE**
Catfish	0.30 ± 0.02	Y = 25095 X + 30.623	0.9998
Tilapia	0.25 ± 0.05	Y = 25095 X + 30.623	0.9998
Crayfish	3.00 ± 0.01	Y = 15536X - 14643	0.9990
Lobster	2.70 ± 0.05	Y = 15536X - 14643	0.9990
Shrimp	2.64 ± 0.08	Y = 15536X - 14643	0.9990
Prawn	2.84 ± 0.01	Y = 15536X - 14643	0.9990
Crab	25.00 ± 0.01	Y = 67343X - 1985.7	0.9993

Table 2 : Concentrations of iodine in seafoods of fresh water origin

	FRESH water		
Sample	**Concentration mg/kg**	**Equation of straight line**	**R-SQUARE**

catfish	0.021 ± 0.05	Y = 25547X + 24.659	0.9990
tilapia	0.023 ± 0.06	Y = 25547X + 24.659	0.9990
crayfish	0.200 ± 0.01	Y = 25547X + 24.659	0.9990
lobster	0.208 ± 0.05	Y = 25547X + 24.659	0.9990
shrimp	0.220 ± 0.02	Y = 25547X + 24.659	0.9990
prawn	0.258 ± 0.01	Y = 25547X + 24.659	0.9990
crab	1.786 ± 0.02	Y = 15536X - 14643	0.9990

Table 3 : Results of statistical test

Sample	Habitat	N*	Sig (2-tailed) ($p<0.05$)
Catfish	Salt water fresh	3 3	0.04
Tilapia	Salt water fresh	3 3	0.04
Crayfish	Salt water fresh	3 3	0.03
Lobster	Salt water fresh	3 3	0.01
Shrimp	Salt water fresh	3 3	0.02
Prawn	Salt water fresh	3 3	0.02
Crab	Salt water fresh	3 3	0.001

N* = number of samples

IV. CONCLUSION

The concentration of iodine in seafoods obtained from salt and fresh waters show great variability; concentrations in salt water samples are higher than those of the fresh water samples. This explains why salt water seafoods are the richest food sources of iodine.

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