https://doi.org/ 10.33472/AFJBS.6.5.2024. 6625-6637

African Journal of Biological Sciences

RADIOACTIVITY STUDY ON ANCHOVY (*STOLEPHORUS INDICUS*) AND THEIR SIMULATIONS STUDIES

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Article History
Volume 6, Issue 5, 2024
Received: 22 May 2024
Accepted: 29 May 2024
doi: *10.33472/AFJBS.6.5.2024. 6625-6637*

Abstract

An Anchovy is a small, common forage fish of the family Engraulidae. They are small, green fish with blue reflection due to a silver coloured longitudinal stripe that run from the base of the caudal fin. They range from 2 to 40 centimeters in adult length and their body shape variable with more slender fish in northern population. Energy content of fish is a dynamic measure of their energy balance, which is regulated by physiological function (Albo-puigserver *et al*., 2017). The effect of Anchovy fish supplementation on the level of N-3 LC PUFA in egg yolk was studied by (Marcelia Sugata *et al*., 2020). In present study we analyse the protein, fat, carbohydrate content in the fish Anchovy. The sample was collected from two areas, one from Idinthakarai (Near Koodankulam atomic power plant) and the other is from kanyakumari. Comparatively the average protein content in kanyakumari Anchovy is higher than the protein content in Idinthakarai Anchovies. The protein content varies from 29.03% to 20.38%. Protein content in the body of fishes tends to decrease during spawning season. Lipid content is also higher in fishes from kanyakumari varying from 10.2% to 8%. Lipid content in body of fishes tends to decrease during spawning season. Carbohydrate content seen in the month of December and the minimum carbohydrate content is seen maximum in the month of March it shows 0.08 deviations in Idinthakarai. The E-Total value obtained shows a good interaction between the Anchovy fish oil and components of influenza virus. The interaction of EPA with influenza has provided very high values. In the other causes, few more modification can result in better interaction. In this experiment, the Beta activity in sample A is 2427.184 (Bq/kg) and the Beta activity in sample B is 3236.25 (Bq/kg).

Key words: Anchovy, spawning, Influenza, Idinthakarai, kanyakumari

1. INTRODUCTION

An Anchovy is a small, common forage fish of the family *Engraulidae*. Most species are found in marine waters, but several will enter brackish water, and some in South America are restricted to fresh water. More than 140 species are placed in 17 genera: They are found in Atlantic, Indian and Pacific Oceans, and in the Blacksea and the Mediterraneansea. Anchovies are usually classified as *Oily fish.* They are small, green fish with blue reflections due to a silver-coloured longitudinal stripe that runs from the base of the caudal fin. They range from 2 to 40 centimeters in adult length, and their body shapes variable with more slender fish in northern populations. Energy content of fish is a dynamic measure of their energy balance, which is regulated by physiological functions (i.e. growth, maintenance or reproduction) and environmental factors (i.e. temperature and food availability) (Albo-Puigserver *et al.,* 2017).

Anchovies are rich in omega-3 fatty acids, which offer powerful benefits for our heart. Studies show they may reduce our triglyceride levels, slow the buildup of plague in arteries, and reduce blood pressure. They may also lower risk of stroke by reducing bloodclotting.

However, studies on the effects of artificial radionuclide accumulation in marine products are rare, other than those conducted immediately following the Fukushima accident (Schiermeier,2011; Kryshev *et al*., 2012; Fisher *et al.*,2013). More recently, Kim *et al*. (2019) reported that 137Cs in some fishes increased with

increasing size. However, this study categorized fishes into only two growth stages, limiting the evaluation of artificial nuclide accumulation patterns based on a lack of detail at various growth stages. Pulutonium absorbed by marine organisms is known to pose significant health risks to humans via seafood consumption (Kim *et al.*,2020. Moreover, Pu is known to affect human liver and bone tissues, potentially causing cancer (Nielsen *et al.*, 2012).

In this study, radioactivity of Anchovies of same species in two different places (Idinthakarai, Near Koodankulam atomic power plant and Kanya Kumari) were estimated.

2. **MATERIALS AND METHODS**:

Experimental fish: Anchovy (*Stolephorus indicus*)

2.1 Estimation of Protein by Lowry *et al.* (1951)

2.2 Estimation of Carbohydrate by Johnston and Davies (1972)

2.3 Estimation of Lipid by Folch *et al.* (1957)

2.4 Radioactivity of the samples were counted by Alpha counting system and Beta counting.

3. RESULT

3.1 Protein content in Fish

Proteins showed inverse relationship between moisture and lipid content. During the study period, Protein content tends to vary in different places. Comparatively the average protein content in Kanyakumari Anchovies is higher than the protein content in Idinthakarai Anchovies. The higher concentration of protein content is propably seen between the months of December and January. The

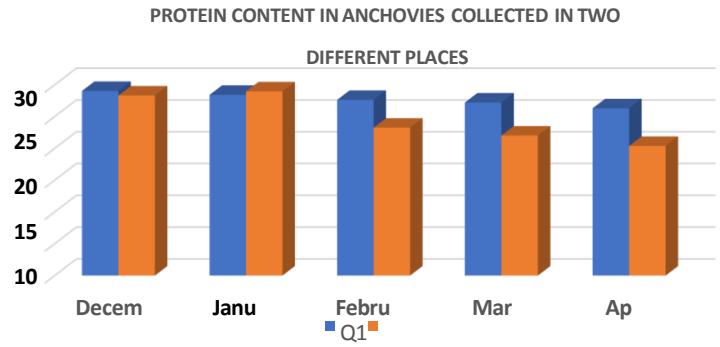
minimum protein content is seen in middle of May, April and continues. Protein content showed steady decrease during the spawning season (i.e) middle ofMay to the middle of August. The major reason behind the higher deviation of protein content is spawning season. In Anchovies the protein content is studied between the months of December to April (1.2%, 9.03%, 28.42%, 27.63%, 27.21%, 26.31%, 2. 28.32%, 28.97%, 23.26%, 22.02%, 20.38%).The study clearly showsthe Protein content in the body of fishes tends to decrease during spawning season.

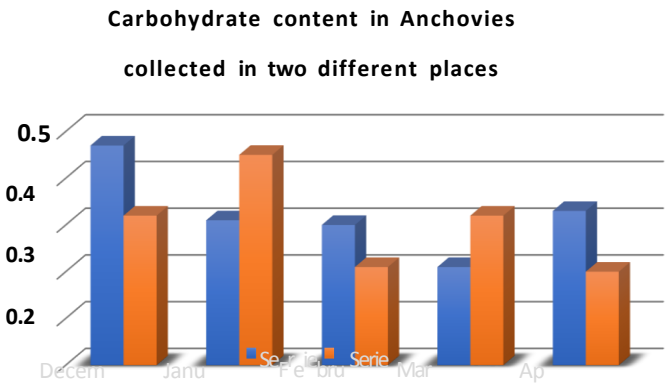
3.2 Carbohydrate content in Fish

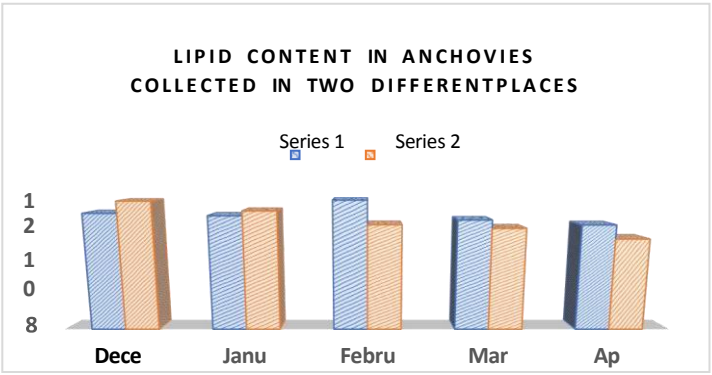
Generally, very low amount of Carbohydrates is seen in fishes particularly Anchovies shows very low carbohydrate content in their body. In Kanyakumari Anchovy, the maximum carbohydrate content is seen in the month of December and the minimum carbohydrate content is seen in the month of March it shows 0.08 deviation. In Idinthakarai Anchovy the maximum carbohydrate content is seen in the month of January and the minimum carbohydrate content is seen in the month of April it shows 0.09 deviation.

3.3 Lipid content in Fish

Lipid content shows wide fluctuations during the study period in two area fishes respectively. Comparatively average recorded lipid content value is higher in Kanyakumari Anchovies compared to Idinthakarai Anchovies. The higher concentration of Lipid content isseen between the months of December, January and February. And the lower concentration oflipid content is seen during the spawning season. In Anchovies the lipid content is studied between December to April shows the lipid content in body of fishes tends to decrease during spawning season.







3.4 Radio activity

Efficiency of the Detector

Efficiency of Alpha count -

19.7% Efficiency of Beta

count - 10.3%

Table (Background (for 120 seconds)

Alpha	Beta
0	3
0	10
1	7
0	10
0	12
Total : 1	42 (for 600 seconds)

Sample A (for 120 seconds)

Alpha	Beta
0	10
0	8
0	10
0	10
0	13
Total : 0	51 (for 600 seconds)

Sample B (for 120 seconds)

Alpha	Beta
0	8
0	13
0	14
1	9
0	10
Total : 1	54 (for 600 seconds)

$$\text{Activity} = \frac{\text{Net count}}{\text{Efficiency} \times \text{Weight}}$$

Sample A

Time(t)=600 sec

Weight(W)=0.06g

Net alpha=0

Net beta =9

Activity=2427.184/kg

Sample B

Time(t)=60sec
Weight(W)=0.06g

Net alpha=0

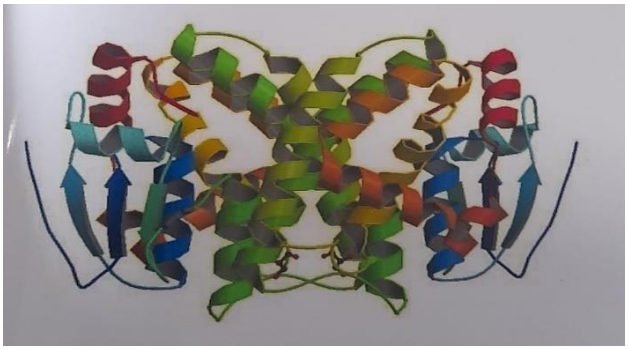
Net beta=12 Activity=3236.25/kg

3.5 MOLECULAR DOCKING STUDIES

The components of anchovy fish oil Omega-3 and Eicosapentaenoic acid (EPA) as ligand were subjected to molecular docking with Influenza, Dengue and HIV virus as receptor using HEX Docking software. Simulations were done to check the influence of each ligand and their rate of interaction

3.5.1 Docking of Omega-3

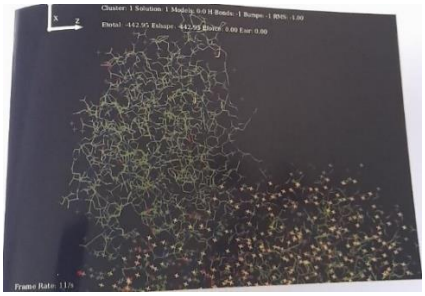
The docking of Omega-3 is done with the various virus molecules



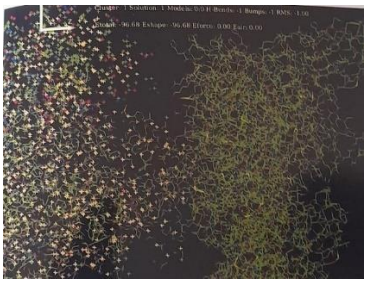
The influenza virus as receptor has the maximum E Total with Omega-3 as the ligand and dengue has the least value. Interaction of Omega-3 is maximum with Influenza which shows the molecule as a potential target molecule for treatment of Influenza Virus.

Receptor	E Total
Influenza	**-442.95**
Dengue	**-96.68**
HIV	**-240.33**

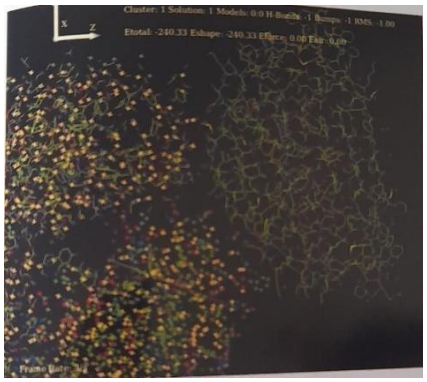
Docking of Omega-3 Vs Influenza



Docking of Omega-3 Vs Dengue Virus



Docking of Omega-3 Vs HIV



3.5.2 **Virus Docking of Eicosapentaenoic acid (EPA)**

The docking of EPA is done with the all the three virus molecules Influenza, Dengue and HIV.

Receptor	E Total
Influenza	**35301.39**
Dengue	**-16.70**
HIV	**-523.17**

Similar to Omega-3, EPA has a good interaction and higher E-Total with the Influenza virus and the least with Dengue. The E-Total value with Influenza virus is very much high for EPA compared to Omega-3. The molecule style of the dengue is much different from the HIV and Influenza and that is the reason for much lower value. EPA can be a potential drug target molecule for Influenza and HIV

Docking of EPA Vs Influenza Virus

Docking of EPA Vs HIV Virus

Docking of EPA Vs Dengue Virus

The absence of Alpha activity in the sample. Is due to the lack of metals like Uranium, Radium and so on. These elements may emit Alpha radiation. From this experiment, We conclude that there is no Alpha emitting particles in anchovy. Basically, Beta emision is due to the particles like thorium. This experiment proves that there is low Beta emision particles in anchovy.

The Beta emision of the sample B = 3236.25(Bq/kg) if heigher than that of sample A (ie)., 2427(Bq/kg). This clearly show that the fish collected at Idinthakarai emit high Beta radioactivity than that of the fish collected at Kanyakumari.

4. DISCUSSION

The proximate composition of fish varies greatly due to physiological reasons and changes in environmental conditions. Moisture content of the fish under study varied from 70.79% to 78.16% ($P<0.05$). Protein forms the largest quantity of dry matter in fish.Protein content of Anchovy varied from 20.38% to 29.03%.According to that Anchovy could be classified as a high protein fish since, the protein content in anchovy fish is greater. The Carbohydrate content in fishes is generally low. Low carbohydrate content in fish suggest that glycogen in marine animals do not contribute significantly to the total reserves in the body. Ash content in the fish is an indicator of mineral content of fish.

Anchovy showed variation in the lipid content from 8% to 11.32%.Lipid content of Anchovy studies showed an increasing trend with decresing moisture content in fish. Thelipid content of fish varies with species, diet, geographic origin, season, reproduction.

The study showed that the seasonal variation in the proximate composition of Anchovy is influenced by many factors including the nutrition of the organism Recent studies have clearly shown the importance of polyunsaturated fatty acids (PUFAs) and its nutritional value for human health (Kinsella, 1986). Fish is one of the richest sources of dietary supply of these fatty acids. Polyunsaturated fatty acids (especially the n3 and n6 PUFAs) have beenfound as the essential fatty acids with curative and/or preventive effects on cardiovascular disease, cancers, and

neurodevelopment status in infants (Conner, 1997)

5. Conclusion

Anchovy are rich in omega 3 fatty acid helpful in preventing heart diseases. Canned Anchovy contain energy, Protein, Lipid or fat, Calcium, Iron, Magnesium, Phosphorus, Potassium, Sodium and Zinc. In the present study, the biochemical composition of Anchovies in two different cost were studied. The protein, lipid and carbohydrate contents were low in the fishes captures from radiation exposure coast whereas the content was normal in the radiation free coast area.

Exposure to ionic radiation from natural sources is a continuous and unavoidable future to life on earth. It is an established fat that the radio activity is harmful to living beings however small it may be natural background radiation areas provided good scope for evaluating biological effects of caused by radiation exposure on a long-term basis.

The E-Total value obtained shows a good interaction between the Anchovy fish oil components and Influenza virus. The interaction of EPA with influenza has provided very high values. In the other cases, few more modification can result in better interactions.

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