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The glycogen contents of *Rastrelliger kanagurta* (Cuvier) from within PFZ and outside PFZ on the coast of Raigad District at Maharashtra State

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Abstract
The glycogen compostion of fishes from the muscles, livers and gonads of *Ratrelliger kanagurta* from Raigad district coast in the fish landing centre of Srivardhan, Murud and Karanja were studies from Within Potential Fishing Zone (PFZ) and Outside PFZ. The biochemicals such as glycogen were study and analyzed in the season of winter and summer. The glycogen content was increased in female liver than male liver and muscle, gonad respectively within PFZ than outside PFZ. The glycogen contents in the body liver, muscle and gonad of *Rastrelliger kanagurta* (Cuvier) were determined. The compositions varied seasonally in relation to reproductive cycle of the fish. The study showed that the glycogen content of fish liver is high than gonads and muscles from within PFZ than outside PFZ in female and male respectively from the year 2022-23.

Keywords: Glycogen content, *ratrelliger kanagurta*, within pfz and outside pfz, srivardhan, murud and karanja fish landing centre, 2022-23

Introduction

Fish is a good source of many important nutrients such as proteins. Fish has long been a popular meal of people living around the Konkan coast and has been a major source of food for people living this region. The biochemical contents of fishes are subject to marked seasonal Potential Fishing Zone and outside PFZ changes, which have been attributed to factors such as maturation, spawning, age, growth and feeding. The mackerel fish, *Rastrelliger kanagurta* is abundant in the Ratnagiri district coasts, at Maharashtra State and forms subsistent fishery. This fish is one of the favorite items of the diet of local people. The paper is an attempt to evaluate the variations in proteins in different body tissues like muscle, liver and gonad in relation to within PFZ and outside PFZ in winter and summer season from males & females' fish. (Bhaware *et al*; 2013). Fishes are rich source of animal protein for the population. The nutritive value of fish is recognized all over the world. Fishes is very important for rich source. It is therefore obvious that an understanding of the chemical constitution and nutritional quality of fish is important in its use as food of human. Reconsideration of the literature shows that biochemical composition of different body parts of fish has not received adequate attention. Fish is a major source of food for human nutrition providing an important amount of dietary protein diet in many countries.

Fish flesh is easily digestible because it contains long muscle fibers. Furthermore, it has been linked to health benefits, such as the prevention of cardiovascular diseases and some types of cancer, including colon, breast and prostate (Rose and Connoll, 1993 [4]; Marchioli, 2001 [5], 2002 [6]; Sidhu, 2003) [7]. Satellite based Sea Surface Temperature (SST) images are being used as an input for locating potential fishing zone (PFZ) of productivity and hence fish availability for commercial fishing operations (Pillai, 2005) [3]. The PFZ advisories pertaining to these coastal States are being generated using the satellite data sets and the SST and chlorophyll-a were derived from NOAA AVHRR, IRS-P4 OCM and MODIS AQUA. Fish catch data pertaining to the PFZ advisories were collected from both the boats operating within and outside PFZ.

Materials and Methods

The PFZ advisories are generated academic year 2022-23 by INCOIS thrice in a week (Monday, Wednesday and Friday), in non-monsoon and non-banned period and cloud free days, there were used by the fishermen along the coast of Raigad district coasts. Depending on the location of Potential Fishing Zone (PFZ), i.e. the advisories provided by personal contacts, fax or telephone messages and on Digital Display Boards installed at major landing centers. The boats were selected for the within and outside PFZ region in the Srivardhan, Murud and Karanja fish landing centre at Raigad districts. The PFZ boats and outside PFZ were returned to fishing at Srivardhan, Murud and Karanja FLC and collected the feedback from the users, fishing by the purse-seine and trawl. The pelagic fishes such as mackerel *R. kanagurta* caught by purse-seine within PFZ and outside PFZ region. The PFZ vessels using PFZ–Mission forecast and outside PFZ vessels not using the PFZ forecast. The mackerel samples of *R. Kanagurta* were collected from fishermen catches of within and outside PFZ region of Srivardhan, Murud and Karanja. After bringing them to the research laboratory the total length, body weight, sex and stage of maturity were determined based on findings (Nikolsky, 1963) [8]. The fishes washed thoroughly and the surface moisture was removed by blotting paper. The muscular, hepatic and gonadal tissues were dissected, weight to nearest 1 mg using digital electronic balance. The wet weight tissues were taken for further protein analysis. The optical density of the color developed for protein, glycogen and lipid was measured using spectrophotometer. The total protein estimation was made employing the method by (Lowry *et al*., 1951), Glycogen by De-zwaan and Zandee (1972) and Lipid estimation by Barnes and Black stock (1973) [10]. Results were expressed as mg/100mg wet weight tissues, biochemical constituents were correlated within and outside PFZ region. The standard deviations expressed were arithmetic means, S. D. and statistical analysis.

Results

Glycogen content (mg/100mg wet wt.) in males *R. kanagurta*

The results of the analysis of glycogen content from different body parts of males during winter and summer season are given in table. (1) and Fig. 1. In male's glycogen content from muscle was 2.30 ± 0.10 and content from liver 3.90 ± 0.25 within PFZ, while in testis it was 2.40 ± 0.10 within PFZ. From males the content in muscles was 1.90 ± 0.08 and content from liver 3.81 ± 0.25 while in testis it was 2.70 ± 0.25 outside PFZ during winter season from Murud fish landing centre. In males' content from muscle was 3.76 ± 0.10 and content in liver 4.10 ± 0.20 while, in testis it was 3.93 ± 0.14 from within PFZ. From outside PFZ males' muscle was 3.61 ± 0.10 and in liver it was 3.93 ± 0.20 while in testis glycogen content was 3.81 ± 0.20 outside PFZ during summer season from Murud fish landing centre.

The comparisons were made between muscle and liver, liver and gonad from glycogen content and comparison was made muscle to gonad. The muscle to liver and muscle to gonad content was Non-significant, while in the liver and gonad content was highly significant decline (P<0.001) observed in male liver within PFZ and from outside PFZ muscle to liver Non-significant and liver to gonad significant value, whereas muscle to gonad Non-significant during winter season. In muscle to liver comparative was made less significant (P<0.05), liver to gonad value was No significant and muscle to gonad less significant (P<0.05) within PFZ during summer season, while in outside PFZ muscle to liver significant and liver to gonad and muscle to gonad value was No significant outside PFZ. Overall result showed that in the liver glycogen content was significantly high as compare to muscle and gonad and from within PFZ the glycogen content was significantly high and significantly less in outside PFZ.

Glycogen content (mg/100mg wet wt.) in males *S. commerson* Landing centre Harnai:

The results of the analysis of glycogen content from different body parts of males during winter and summer season are given in table. (23) and Graph. 17. In males muscle glycogen content was 3.42 ± 0.20 and content in liver 5.10 ± 0.10 within PFZ, while in testis it was 3.40 ± 0.10 within PFZ. In males muscles the content was 3.40 ± 0.10 and content in liver 4.95 ± 0.45 while in testis it was 3.80 ± 0.34 outside PFZ during winter season. In summer season males muscle content was 3.30 ± 0.10 and content in liver 5.60 ± 0.25 while, in testis it was 4.01 ± 0.10 in within PFZ, whereas in outside PFZ males' muscle was 3.25 ± 0.41 and in liver it was 4.61 ± 0.20 while in testis glycogen content was 3.93 ± 0.20 during summer season.

The comparisons were made between muscle and liver, liver and gonad and comparison were made muscle to gonad. The muscle to liver, liver to gonad and muscle to gonad content was Non-significant within PFZ, while in outside PFZ muscle to liver, liver to gonad and muscle to gonad content was Non-significant observed in male's glycogen content during winter season.

In summer season comparisons was made No significant in muscle to liver, liver to gonad and muscle to gonad outside PFZ. The overall results showed that in the liver glycogen content was significantly high as compare to muscle and gonad and from within PFZ the glycogen content was significantly high and significantly less in outside PFZ.

The comparative study was determined in the Srivardhan results of the analysis of glycogen content from different body parts of males during winter and summer season were high than Murud and Karanja location of PFZ. It is given in table. 1. and 2. In males muscle glycogen content was 4.12 ± 0.04 and content in liver 4.23 ± 0.11 within PFZ, while in testis it was 3.40 ± 0.10 within PFZ. In males muscles the content was 3.40 ± 0.10 and content in muscle glycogen content is 2.30 ± 0.10 while in testis it was 2.40 ± 0.10 within and outside PPFZ during winter and summer season.

Table 2: Glycogen content ((mg/100mg wet wt.)) in males *R. kanagurta* from Stivardhan, Murud and Karanja during winter and summer season.

Landing centre	Season	Fishing zones	Tissue		
			Muscle	Liver	Gonad
Srivardhan	Winter season	Within PFZ	3.11 ± 0.01	3.90 ± 0.25	2.40 ± 0.10 ***
		Outside PFZ	1.90 ± 0.08	3.81 ± 0.25	2.70 ± 0.25 **
	Summer season	Within PFZ	4.12 ± 0.04	4.10 ± 0.20	3.93 ± 0.14 •°
		Outside PFZ	3.61 ± 0.10	3.93 ± 0.20	3.81 ± 0.20 ••
Murud	Winter season	Within PFZ	3.40 ± 0.20	4.10 ± 0.45	4.01 ± 0.10
		Outside PFZ	3.30 ± 0.10	3.87 ± 0.42	3.70 ± 0.25
	Summer season	Within PFZ	3.36 ± 0.10	4.30 ± 0.45	3.92 ± 0.35 ** °
		Outside PFZ	3.30 ± 0.10	4.20 ± 0.33	4.01 ± 0.10
Karanja	Winter season	Within PFZ	3.42 ± 0.20	4.23 ± 0.11	3.81 ± 0.35 ***
		Outside PFZ	3.40 ± 0.10	4.61 ± 0.34	3.20 ± 0.35 ***
	Summer season	Within PFZ	3.60 ± 0.20	4.72 ± 0.35	3.91 ± 0.25 •
		Outside PFZ	3.53 ± 0.35	4.44 ± 0.34	4.20 ± 0.35 °°

•=P<0.001, ••= P<0.01, •••=P<0.05 comparison was made muscle to liver
* =P<0.001, **= P<0.01, ***=P<0.05 comparison was made liver to gonad
° =P<0.001, °°= P<0.01, °°°=P<0.05 comparison was made muscle to gonad

Discussions

The glycogen cycle appears to be having a strong correlation with feeding and spawning reported in a number of fish species in the summer seasons. Maximum glycogen values recorded in male and female during summer season and winter season coincided with a period of intense feeding & maturing stage of this fish. This intense feeding perhaps is more in the seasons, i.e., immediately after spawning as the fish. (Bhaware and Mane, 2012) [2]. While spawning incurs energy expenditure along with the loss of gonadal elements and recoups to compensate the expenditure through vigorous feeding activity. According to Standby,

(1954) also found similar observations in the trout fish. The present study showed that protein value was high within PFZ than outside PFZ among winter season than summer season. The study was observed that the seasonal variation of protein of mackerel the proportions of the components muscle tissue varied with the change of season. The seasonal variation found in females greater than the males. Biochemical composition of any organisms are known to vary with season, size of animal, stages of maturity and availability of food, temperature etc. (Soundarapandian and Ananthan, 2008) [12]. Meanwhile, for protein contents, no significant differences were found in the R. kanagurta species of pelagic fish. (B. G. Bhaware, 2019) [15]. The fish were observed to contain with mean value shows Table.1. & Fig. 1. from within PFZ while, outside PFZ. However, the glycogen content could be considered as insignificant instead, as the values were derived and estimated from the difference of PFZ and outside PFZ. (Payne *et al*., 1999 [13]; Anthony *et al*., 2000) [14].

Conclusions

The glycogen values calculated for different tissues based on the content of within PFZ and outside PFZ during winter and summer season from male and female. It was observed that among different tissues, glycogen content was maximum in the liver of females and gonads of females, while it was minimum in the muscle of both the sexes from within PFZ than outside PFZ. The present study was also revealed that within PFZ glycogen content was higher in females and males than the outside PFZ. The overall results showed that the glycogen content was increased within PFZ than outside PFZ in both sexes during winter and summer season. In conclusion, all marine fish species could be considered as a good source of glycogen, llipid and protein composition and represent a very valuable essential nutrient choice for the maintenance of a healthy body of the people.

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References

1. Bhaware BG. Study of Coastal Fisheries in the Coast of Maharashtra State. A Multidisciplinary International Peer Reviewed/Refereed Journal, 2018, 63. APH Publishing Corporation.
2. Bhaware BG. Seasonal variation in the protein composition of *Rastrelliger kanagurta* (Cuvier) from within PFZ and outside PFZ at Sakhri-Natye fish landing centre on the coast of Ratnagiri district at Maharashtra state. Recent Research in Science and Technology,2012:4(10):1–4.
3. Pillai VN. Satellite remote sensing applications for the benefit of coastal fisher folk – a case study. Innovations and technologies in oceanography for sustainable development, 2005, 83–84. University of Malaya Maritime Research Centre.
4. Rose DP, Connoll JM. Effects of dietary omega-3 fatty acids on human breast cancer growth and metastases in nude mice. Journal of the National Cancer Institute,1993:85:1743–1747.
5. Marchioli R. Efficacy of n-3 polyunsaturated fatty acids after myocardial infarction: Results of gissi-prevenzione Trial. Lipids,2001:36:119–126.
6. Marchioli R. Early protection against sudden death by n3 polyunsaturated fatty acids after myocardial infarction: Time course analysis of the results of GISSI-prevenzione. Circulation,2002:105:1897–1903.
7. Sidhu KS. Health benefits and potential risks related to consumption of fish or fish oil. Regulatory Toxicology and Pharmacology,2003:38:336–344.
8. Nikolsky CV. The ecology of fishes, Academic Press, New York and London. Lowry OH, Rosenbrough HJ, Farr AL, Randall RJ. Protein measurement with the folin phenol reagent. Journal of Biological Chemistry,1963:193:265–275.
9. De Zwaan A, Zandee DI. Body distribution and seasonal changes in the glycogen content of the common mussel, *Mytilus edulis*. Comparative Biochemistry and Physiology,1972:43A:53–58.
10. Barnes H, Blackstock J. Estimation of lipids in marine animals and tissues. Detailed investigation of the sulphophovanillin method for total lipids. Journal of Experimental Marine Biology and Ecology,1973:12(1):103–118.
11. Stansby ME. Composition of certain species of freshwater fish. Food Research,1954:16:231–234.
12. Soundarapandian P, Ananthan G. Effect of unilateral eyestalk ablation on the biochemical composition of commercially important juveniles of *Macrobrachium malcolmsonii*. International Journal of Zoological Research,2008:4(2):106–112.
13. Payne SA, Johnson BA, Otto RS. Proximate composition of some north-eastern Pacific forage fish species. Fish Oceanography,1999:8(3):159–177.
14. Anthony JA, Roby DD, Turco KR. Lipid content and energy density of forage fishes from the Northern Gulf of Alaska. Journal of Experimental Marine Biology and Ecology,2000:248:53–78.
15. Bhaware BG. The Societal Benefits and Scientific Approach to the OSF and PFZ Forecast in Catch Per Unit Efforts (CPUE) along the Coast of Ratnagiri District, Maharashtra, India. International Journal of Research and Analytical Reviews,2019:2349–5138.