Pak. j. sci. ind. res., vol. 33, no.7, July 1990

VARIATIONS IN THE BIOCHEMICAL COMPOSITION OF *GOBIOIDES RUBICUNDUS* HAM-BUCH AT DIFFERENT STAGES OF MATURITY

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(Received September 2, 1989; revised July 28, 1990)

The highest percentages of protein and moisture were observed in the gravid and spent individuals of *Gobioides rubicundus* respectively while the highest percentages of fat, ash and carbohydrate were observed in the maturing fish. Significant negative correlations between fat and moisture were found in all the three main stages of maturity viz. maturing, gravid and spent. However no relation was observed between protein and moisture of the fish. Of the three essential elements viz. Ca, Fe and P, the percentage of Fe (275.9 mg/100 g) was notably higher than that of any other commercial fish of the subcontinent.

Key words: Fish analysis, Fat-moisture relationship, Nutrition evaluation.

Introduction

Gobioides rubicundus is a euryhaline fish. Fresh larger fishes of this species are preferred by the people of Bangladesh as food fish. Dried fish is preferred by the people of Bangladesh specially by those of the coastal Districts. Being cheap, this fish is used as a raw material for making fish meal and pelleted feed for shrimp and fish in large scale and its demand is rapidly increasing. But this fish has neither been categorised as a food fish nor the relationship between its water, lipid and protein contents have been established although many workers [2,3,6,7,10,12,18,21] have established an inverse relationship between water and lipid in fish. The two workers [10,21] have also reported an inverse relationship between protein and water contents. The fluctuations in the major biochemical constituents are influenced by breeding and feeding cycles [11,18,21] An attempt is therefore made here [1] to categorise *G. rubicundus* as food fish and [2] to establish the relationship if any between its water content, lipid and protein at different sexual stages of maturity.

Materials and Methods

Maturing, gravid and spend specimens of *G. rubicundus* were collected by Behundi nets from the estuary of the Karnaphuli River near Chittagong, Bangladesh during the months of May, June and August, 1982 and March, 1983 and were brought alive to the BCSIR Laboratories, Chittagong for biochemical analysis.

Fat, protein, moisture, ash (minerals) and carbohydrate contents of fresh degutted fish of different sexual stages were determined.

Fresh fish samples were made into a paste with a blender and its fat contents were extracted following the extraction method [15] in which the fat solvent petroleum spirit (b.p.60- 80°) was used.

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Protein was estimated from the fresh tissue of the fish following the Kjeldahl method [23].

Fresh whole fish contained on an aluminium foil was dried in an woven at 103° for the determination of moisture following the Direct distillation method [15].

The ash content (actual weight) was found out after [15] by subtracting the weight of silica from the weight of the total ash obtained by burning away fresh fishes in porcelain crucibles at 600°. Weight of the residual silica was obtained after filtration of the dissolved ash in 5% HCl (Stock solution) and the minerals were estimated from this stock solution.

Iron (Ferric) was estimated with the Ortho-phenanthroline method and calcium with the titration method [22] while phosphorus was estimated with the Vando-Molybdate colorimetric method [5].

The percentage of carbohydrate was calculated by simply subtracting the total percentage of fat, protein, moisture and ash from 100.

For statistical analysis formulae for ungrouped data were used.

Results and Discussion

Table 1,2 and 3 show the percentages of fat, protein, moisture, ash and carbohydrate of fresh maturing, gravid and spent individuals of *G. rubicundus* of standard length range 165- 205 mm (on wet and dry weight basis). The mean values of ash, calcium, iron and phosphorus of the three fish examined were found to be 3.21±0.07g, 1213.65± 0.46 mg, 276.90± 0.66 mg and 453.89 ± 0.94 mg per 100 g respectively on wet weight basis.

A drastic fall in the percentage of fat is evident in the spent fish whereas the highest percentage of fat is observed in the maturing fish and those of protein, moisture and ash are observed in the gravid, spent and maturing fishes respectively. Negative correlation between fat and moisture

TABLE 1. PERCENTAGES OF DIFFERENT CHEMICAL COMPOSITION OF 10 FRESH MATURING *G. RUBICUNDUS* (OF STANDARD LENGTH RANGE 165-205 MM) DURING MAY AND EARLY JUNE, 1982.

Observation Nos.	Fat	Protein % (g)	Moisture % (g)	Ash % (g)	Carbohydrate (by difference) % (g)
1	2.49	13.41	78.94	3.67	1.49
2	2.32	13.26	81.29	3.02	0.11
3	2.34	13.38	80.6 8	3.30	0.30
4	2.52	13.34	79.48	3.26	1.40
5	2.61	13.45	78.80	3.51	1.63
6	2.58	13.46	78.90	3.62	1.44
7	2.54	13.40	79.40	3.32	1.34
8	2.45	13.40	79.10	3.65	1.40
9	2.40	13.42	80.26	3.00	0.92
10	2.37	13.34	80.34	3.03	0.92
Total	24.62	133.86	797.19	33.38	10.95
Mean (on wet weight basis)	2.46±0.09	13.39±0.06	79.72±0.82	3.34±0.25	1.09
Mean (on dry of weight basis)	12.13	66.02		16.47	5.37

TABLE 2. PERCENTAGES OF DIFFERENT CHEMICAL COMPOSITIONS OF 10 FRESH GRAVID *G. RUBICUNDUS* (OF STANDARD LENGTH RANGE 165-205 MM) DURING THE MONTH OF AUGUST, 1982.

Observation Nos.	Fat % (g)	Protein % (g)	Moisture % (g)	Ash % (g)	Carbohydrate (by difference) % (g)
1	2.44	14.76	79.01	3.28	0.51
2	1.42	15.10	80.13	2.86	0.49
3	1.26	15.12	80.36	3.21	0.05
4	1.46	15.45	79.00	3.90	0.19
5	1.65	15.32	80.00	3.00	0.03
6	1.60	15.18	80.25	2.90	0.07
7	1.56	15.32	80.33	2.77	0.02
8	1.50	15.20	80.42	2.81	0.07
9	1.34	15.10	80.50	3.00	0.06
10	1.62	15.23	80.10	3.01	0.04
Total	15.85	151.78	800.10	30.74	1.53
Mean (on wet weight basis)	1.58± 0.31	15.18 ± 0.17	80.01± 0.52	3.07 ±0.31	0.15
Mean (on dry weight basis)	7.90	75.94		15.36	0.80

TABLE 3. PERCENTAGES OF DIFFERENT CHEMICAL COMPOSITIONS OF 10 FRESH SPENT *G. RUBICUNDUS* (OF STANDARD LENGTH RANGE 165 - 205 MM) DURING THE MONTH OF LATE MARCH, 1983.

Observation Nos.	Fat % (g)	Protein % (g)	Moisture % (g)	Ash % (g)	Carbohydrate (by difference) % (g)
1	0.87	13.65	81.83	3.19	0.46
2	0.87	13.67	81.90	3.16	0.40
3	1.03	13.78	80.78	3.16	1.25
4	0.91	13.54	80.92	3.20	1.43
5	0.89	13.72	81.68	3.32	0.39
6	0.92	13.66	80.95	3.22	1.25
7	0.95	13.57	80.75	3.12	1.61
8	0.92	13.75	80.97	3.25	1.11
9	0.90	13.71	80.96	3.15	1.28
10	0.88	13.62	81.82	3.30	0.38
Total	9.14	136.67	812.56	32.07	9.56
Mean (on wet weight basis)	0.91± 0.04	13.67 ± 0.07	81.26 ± 0.4 6	3.21± 0.06	0.95
Mean (on dry weight basis)	5.11	76.84		18.04	5.34

were found in the maturing (r = -0.88; |t| = 5.30), gravid (r = -0.65; |t| = 2.42) and spent (r = -0.72; |t| = 2.96) fishes (5% level of significance with 8 degrees of freedom). However the highest percentage of carbohydrate was seen in the maturing fish.

Discussion

The highest average percentage composition of fat (2.46 ± 0.09), protein (15.18 ± 0.17), ash (3.34 ± 0.25), calcium (1213.65 ± 0.46 mg/100g) iron (276.90 ± 0.66 mg/100g) and phosphorus (453.89 ± 0.94 mg/100 g) of *G. rubicundus* when compared to those of the fat of *Hilsa ilisha* (19.40), protein of *carcharhinus limbatus* (26.10), ash of *Leiognathus* sp. (3.57), calcium of *Chirocentrus dorab* (1150.00 mg/100g), iron of *Heteropneustes fossilis* (226 mg/100 g) and phosphorus of *Leiognathus sp.* (663.70 mg/100g) [16,17,19] show that it is a nutritious fish. Based onthe protein and lipid contents, *G. rubicundus* can be included under category A [20]. The protein content of the gravid (ripe) fish shows the highest value (15.18± 0.17) and this highest value is expected as the yolk is a reserve of lipoproteins to be utilized in the development of the embryo. This agrees well with the highest percentages of protein of ripe *Barbus puntius* and *Puntius filamentosus* as reported by[1,21]. The presence of all the essential amino acids in the flesh as reported by Kader (1984) also confirms its suitability as a good food fish.

The results of hepatosomatic index [8] showed an increased trend during late March (a prespawning period) in the liver of the female of *G. rubicundus*. Similar increase in the fat content of the fish in this month was also evident indicating the tendency of the fish to accumulate fat. This agrees with the highest percentage of lipids (7.94 - 9.00) and protein (8.55 - 11.95) in the liver of the ripening *Puntius filamentosus* [21].

A drastic fall in the fat content of the spent *G. rubicundus* indicates that the fish starves during and immediately after spawning when it lives on the reserved food materials. This situation was also observed by Adhikari *et. al.* [1] in *Barbus puntius* and by Vijayakumar [21] in *Puntius filamentosus*. Drumond *et. al.* [4] and Mannan [13] reported that much body fat and protein reserves are expended by female fish for their movement to the breeding field.

A significant inverse relationship between fat and moisture content in the maturing, gravid and spend *G. rubicundus* is in agreement with the general concept of the relationship. Adhikari *et. al.* [1] however, have reported this inverse relationship between fat and moisture to be a fallacy. Vijayakumar [21] reported that the water content of the liver of male of *P. filamentosus* showed a direct relationship with lipid and protein contents. Similar direct relationship between moisture and protein contents was also reported by Adhikari *et. al.* [1] in *B. puntius*; however in the present work no such relationship was evident.

The negligible quantity of carbohydrate observed in *G. rubicundus* agrees well with the reports of Sastri [19] in that 'fish flesh contains negligible quantities of carbohydrates and the glycogen present in the living fish rapidly converts to lactic acid after death'. Lagler *et al.* [9] also reported that carbohydrate present in muscle for immediate energy release make up less than 1% of the wet weight of fishes but they are more concentrated than this in the liver where they are stored as glycogen. This however slightly differs from the carbohydrate content (2.4%) of the freshwater fish *Labeo rohita* as reported by Mukundan *et al.* [14].

Considering the quantities of all these biochemical compositions of *G. rubicundus* it can be concluded that this fish may well be used as a nutritious food fish as well as a raw material for preparing nutritious fish meal and pelleted feeed.

Acknowledgements. The authors wish to thank Mr. Zahid Hossain, Senior Scientific Officer, BCSIR Laboratories, Chittagong for his revision of the manuscript and specially for helping the first author in different ways during the work.

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