A COMPARATIVE STUDY ON THE BIOCHEMICAL COMPOSITION OF STOMACH CONTENTS OF *ETROPLUS SURATENSIS* AND *TILAPIA MOSSAMBICA*

ABSTRACT

The two Cichlid fishes *Etroplus suratensis* and *Tilapia mossambica* thrive well in almost identical environments along the west coast of India. During the immature stage (65-105 mm) both feed on phytoplankton, algae, roots of aquatic weeds, etc. But during the second stage of maturity (106-146 mm) both become omnivorous, *T. mossambica* showing a preference for protozoans, copepods ; while *E. suratensis* prefers zooplankton. During the ripe condition (147-187 mm) *T. mossambica* consumes more of larvae and eggs of fishes while *E. suratensis* turns more to detritus feeding.

Chemical analysis of the stomach contents (protein, fat and carbohydrate) shows that *T. mossambica* consumes the most nutritious substances during its first and second stages of growth. In *E. suratensis* it could be observed that the protein, fat and carbohydrate are decreasing from the size range of 65-105 mm to 147-187 mm and the ash content is increasing *vice versa*. Significant differences exist in the stomach contents of these two species.

AN ACCURATE knowledge on the food and feeding habits of the fish is an essential prerequisite for the effective management of pisciculture. Despite detailed informations on the food and feeding habits of several fishes, very little information is on hand regarding the chemical estimation of the stomach contents (Ishida, 1935 ; Vallet *et al.*, 1970 ; Marias and Erasmus, 1977). The earliest systematic study of the feeding habits of cichlidae are of Gopinath, 1948 ; Menon and Chacko, 1956 ; Fryer *et al.*, 1972 ; Aravindan, 1976; Jayaprakas, 1980. There studies reveal that cichlids are herbivores, though occasionally it may also resort to feed on insect larvae, worms and micro crustaceans. Although the specific nature of the food items ingested by the species are well known, little is known on their chemical composition. The present study deals with the chemical composition of stomach contents of *Etroplus suratensis* and *Tilapia mossambica*.

Materials and methods

Etroplus suratensis and *Tilapia mossambica* collected from Veli Lake were grouped into three size ranges *viz.*, 65-105 mm, 106-146 mm and 147-187 mm respectively. The contents of stomach in each fish were removed and the following analyses were performed : Moisture (24 hrs at 100°C), fat (extraction with ethanol : ether 3 : 1 and chloroform : methanol 1 : 1) protein (nitrogen × 6.25), Ash (5 hrs at. 500°C) and carbohydrate (anthrone reagent). The data obtained were statistically analysed. Analysis of variance technique (Hays, 1963) was used to test whether there is any significant differences in the biochemical constituents between the three size ranges in each species. 't' test was also used to compare the biochemical constituents between the two species in each size ranges.

Results and discussion

The mean percentage ± standard error values of the various biochemical constituents for *T. mossambica* and *E. suratensis* are presented in Table 1. Table 2 represents 't' values comparing the differences in biochemical composition between *T. mossambica* and *E. suratensis* in the three size ranges. The results of the analysis of variance are given in Table 3 and 4.

TABLE 1. *Mean ± standard error of the different biochemical constituents in the three size group of* Tilapia mossambica *and* Etroplus suratensis

	65-105 mm		106-146 mm		147-187 mm	
	T. mossambica	*E. suratensis*	*T. mossambica*	*E. suratensis*	*T. mossambica*	*E. suratensis*
Moisture	59.84 ± 1.33	45.79 ± 1.28	59.55 ± 1.73	38.86 ± 1.50	79.29 ± 1.59	28.87 ± 1.73
Protein	5.82 ± 0.29	14.07 ± 0.29	3.42 ± 0.70	11.99 ± 0.22	2.19 ± 0.56	10.94 ± 0.21
Fat	8.49 ± 0.30	12.65 ± 0.28	9.15 ± 1.70	9.99 ± 0.18	7.66 ± 1.19	8.91 ± 0.10
Ash	16.53 ± 0.53	22.68 ± 0.93	17.99 ± 1.57	36.20 ± 1.94	5.91 ± 0.57	55.40 ± 0.55
Carbohydrate	9.48 ± 0.85	4.80 ± 0.44	9.88 ± 0.65	3.29 ± 0.53	4.96 ± 1.00	1.03 ± 0.15

Effect of size

There is significant differences in biochemical composition, between the three size ranges of each species (Table 3 and 4). In *T. mossambica*, the moisture content is maximum (79.29 ± 1.59) in the size range of 147-187 mm. The size range 106-146 mm (59.55 ± 1.73) shows similar pattern with that of the size range of 65-105 mm (59.84 ± 1.35). Protein intake is maximumin the size range of 65-105 mm (5.82 ± 0.29) when compared to other two size ranges (3.42 ± 0.70 for 106-146 mm and 2.19 ± 0.56) for 147-187 mm). Fat content is more in the size range of 106-146 mm (9.15 ± 1.70) when compared to the other two size ranges (8.49 ± 0.30 for the 65-105 mm and 7.66 ± 1.19 for 147-187 mm). The differences in the amount of fat in different size ranges of *Tilapia* are not statistically significant. In the case of ash content, there is vast difference in between the size ranges of 106-146 mm (17.99 ± 1.57) and 147-187 mm (5.91 ± 0.57). The carbohydrate content is found to be similar to that of ash and fat. The carbohydrate content is more in 106-146 mm size range (9.88 ± 0.65).

TABLE 2. *'t' values comparing the differences in biochemical composition between* Tilapia mossambica *and* Etroplus suratensis *in the* 3 *size ranges*

	65-105 mm	106-146 mm	147-187 mm
Moisture	6.996*	8.280*	19.725*
Protein	18.284*	10.746*	13.352*
Fat	9.339*	0.450	0.965
Ash	5.292*	6.695*	57.593*
Carbohydrate	4.513*	7.199*	3.581*

* Significant ($P < .01$)

From the above observation it could be seen that the size range of 106-146 mm shows higher values of fat, ash and carbohydrate when compared to the other two groups. This may be due to their feeding nature. The fact that smaller size ranges consumed material with a higher feeding value can be ascribed to more efficient selection for smaller size particles by smaller fish, as was found by Masson and Morais (1975), for the mullet species studied; Odum (1968b) has conclusively indicated that the smaller the particle, the higher its relative food content.

Studies on the feeding habits of *T. mossambica* (Aravindan, 1976) have shown that under natural conditions the fish feeds mainly on vegetable matter and detritus. The food item consumed by the fish shows considerable changes during the growth of the fish (Aravindan, 1976), corresponding to the biochemical composition of food in different size ranges.

In *E. suratensis* it could be observed that there is a gradation in between the three size ranges (Table 1). Moisture, protein, fat and carbohydrate are decreasing from the size range of 65-105 mm to 147 to 187 mm and the ash content is increasing and vice-versa. This is probably due to their specific nature of feeding habits. Marias and Erasmus (1977) noticed the low ash content and relatively high carbohydrate in the stomach contents of *Liza tricuspidens*. This can also be attributed to the specific nature of the food material ingested by the fish. In *E. suratensis*, a vegetable feeder (Jayaprakas, 1980), major portion of the stomach contents during collection was unidentifiable organic aggregates and the colour of the material varied from grey, green and bluish green, but the texture is always pulpy like fine sands. Filamentous algae and diatoms formed the major food items. It is probable that *E. suratensis* eat larger aquatic plants and algae primarily to obtain the epiphytic diatoms growing on it. Such a phenomenon has been reported for *Tilapia esculenta* from Lake Victoria (Fish, 1951).

TABLE 3. *Results of analysis of variance comparing the three size groups of* Tilapia mossambica

Source		SSQ	DEF	MSS	F	Inference
Moisture						
Total	..	1795.8097				
Size group	..	1536.1243	2	768.0624	33.25	Significant*
Replication	..	28.6875	5	5.7375	0.25	Not significant
Error	..	230.9998	10	23.1000		
Protein						
Total	..	72.7021				
Size group	..	40.9646	2	20.4823	6.73	Significant*
Replication	..	1.2832	5	0.2566	0.08	Not significant
Error	..	30.4543	10	3.0454		
Fat						
Total	..	163.2813				
Size group	..	6.7090	2	3.3545	0.36	Not significant
Replication	..	63.4477	5	12.6895	1.36	Not significant
Error	..	93.1245	10	9.3124		
Ash						
Total	..	630.9261				
Size group	..	521.9826	2	260.9910	32.08	Significant*
Replication	..	27.5764	5	5.5153	0.68	Not significant
Error	..	81.3672	10	8.1367		
Carbohydrate						
Total	..	165.6950				
Size group	..	89.9075	2	44.9537	21.75	Significant*
Replication	..	55.1157	5	11.0231	5.33	Significant**
Error	..	20.6719	10	2.0672		

* $P < .01$; **$P < .05$

Interspecific differences in chemical composition

Marked interspecific differences in the chemical composition of stomach contents can be inferred from Table 1 and 2. 't'

values show that moisture content in these two species are highly significant ($P < 0.01$). *T. mossambica* has the higher moisture content in the size range of 147-187 mm (79.29 ± 1.59) while *E. suratensis* shows a value of 28.87 ± 1.73 in the size range of 147-187 mm. For protein content, the sequence is same as that differences in carbohydrate content between these two species are significant.

Marked interespecific differences in the biochemical constituents of these species are due to their nature of food and feeding habits. The low ash and relatively high carbohydrate

TABLE 4. *Results of analysis of variance comparing the three size group of* Etroplus suratensis

Source		SSQ	DEF	MSS	F	Intference
Moisture						
Total	..	1112.5699				
Size group	..	868.2266	2	434.1112	26.06	Significant*
Replication	..	77.7851	5	15.5570	0.93	Not significant
Error	..	166.5625	10	16.6562		
Protein						
Total	..	36.8401				
Size group	..	30.5141	2	15.2571	33.09	Significant*
Replicatior	..	1.7153	5	0.3431	0.74	Not significant
Error	..	4.6106	10	0.4611		
Fat						
Total	..	48.5637				
Size group	..	44.2981	2	22.1490	73.99	Significant*
Replicatior	..	1.2720	5	0.2544	0.85	Not significant
Error	..	2.9937	10	0.2994		
Ash						
Total	..	3420.9841				
Size group	..	3245.5553	2	1622.7780	05.65	Significant*
Replication	..	21.8281	5	4.3656	0.28	Not significant
Error	..	153.6016	10	15.3602		
Carbohydrate						
Total	..	60.8058				
Size group	..	43.0956	2	21.5478	21.37	Significant*
Replication	..	7.6381	5	1.5276	1.52	Not significant
Error	..	10.0722	10	1.0072		

* P — .01

of moisture, 2.19 ± 0.56 in *T. mossambica* and 10.94 ± 0.21 in *E. suratensis* in the size range of 147-187 mm. The differences in protein content between *T. mossambica* and *E. suratensis* are highly significant ($P = 0.1$). The sequence of carbohydrate content is also same as that of ash and protein contents. The contents (Table 1) of the gut contents of *T. mossambica* reveal the specific nature of the food materials ingested. Unicellular algae, diatoms, filamentous algae and protozans constitute the major food items of *T. mossambica*. Fish (1951) found that stomach content of *Tilapia esculenta* from Lake Victoria

contained predominantly filamentous algae and attached diatoms as well as fragments of larger aquatic plants, mainly *Zostera*.

Conclusion

Significant differences exist in the composition of the stomach contents of *E. suratensis* and *T. mossambica*. The examination of food items and their chemical composition, indicate that smaller specimen, irrespective of species, consume the most nutritious substances. The chemical composition of the gut contents of the Cichlid family should give an insight into the nutritional ecology of shore fish and adds to our understanding of the inter-relationships between the different species.

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