

Original Research Article

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**Protein, Carbohydrate and Lipid Analysis of *Ficus ficoides* (Lamarck, 1822) from Vanjiure, Southeast Coast of India**

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The marine edible gastropod *Ficus ficoides* was collected from Vanjiure coast and its biochemical composition quantified in different organs such as whole animal, Foot, Mantle, Gill, Hepatopancreas, Testis & Ovary sex wise by using a standard methods. The percentage of total protein, Carbohydrate and lipid range was recorded in different organs of male *F.ficoides* was WA, F, M, G, HP, & T was (22.19-25.23, 44.98-47.50, 34.24-45.73, 35.23-42.99, 43.08-46.85 and 35.63-39.12) (12.39-18.34, 11.80-16.41, 15.51-17.97, 17.76-20.50, 15.80-20.00 & 15.22-18.59) and (21.75-23.91, 17.74-26.46, 22.28-23.34, 18.93-22.62, 22.95-24.97 & 26.51-29.71) respectively. In female it was WA, F, M, G, HP, & O was (20.95-23.90, 35.14-38.48, 31.41-35.92, 34.13-40.41, 33.39-37.76 & 29.08-34.05), (11.96-14.25, 10.31-13.00, 11.63-14.21, 14.57-16.90, 12.00-16.33 & 10.84-15.73) and (18.19-21.61, 17.03-21.56, 15.40-20.24, 15.84-21.40, 15.01-21.49 & 22.54-25.67) respectively. Season wise the maximum and minimum biochemical content recorded and analyzed in different organs and the F- value of ANOVA shows significance at alpha 0.05 in both male and female animal. Present study result shows the seasonal variations of protein, carbohydrate and lipid content is due to the availability of food and growth of this study animal.

**Introduction**

Figsnails (Mesogastropods: Ficidae) are commonly called palchangu found in the warm seas of the world (Feinberg, 1979), Figsnails can be caught in sandy or muddy sub tidal habitats by bottom trawling (Lai, 1987).

In most of the Indian coasts it was seen that molluscs family so collected during fishing are regarded as fishery waste and are not used for edible purposes in India but rather

used for poultry feedings, manure preparations and ornamental purposes. These molluscs, however, are a vital source of bioactive compounds of pharmaceutical importance (Morse *et al.*, 1991).

The demand for protein rich food is increasing, especially in developing countries, stimulating the exploration of unexploited or non-traditional resources. In contrast to other countries the value of the edible gastropods as food has not been

realized in India by majority of the people. The nutritional potential of the edible gastropod *Ficus ficoides* captured from Vanjiure coast has largely remained unexploited locally.

The knowledge on biochemical composition of any edible organisms is extremely important since the nutritive value is reflected in its biochemical contents (Nagabhushanam and Mane, 1978). Investigation on biochemical composition in different body parts will be more meaningful than the whole animal (Giese, 1969). Seasonal variations in the biochemical constituents of gastropod were reported by Stickle, 1973; Lambert and Dehnel, 1974; Suryanarayanan and Nair, 1976; Ansari. *et al* 1981; Maruthamuthu, 1988; Thivakaran, 1988; Stella, 1995 and Shanmugam, 2006.

Cyclical changes in biochemical composition of animal tissue are mainly studied to assess the nutritive status of an organism. This information may, however, be used in supplementing other studies like assessment of the course of the reproductive cycle. Marine bivalves indicated that seasonal cycle of energy storage and biochemical cycles are closely related to reproductive activity (Ruiz, *et al.*, 1992).

Hence, the present study is planned to observe the protein, carbohydrate and lipid content in different body organs of *F. ficoides* to understand the nutritive value of this species and to undertake future studies on the reproductive biology of this animal.

## **Materials and Methods**

### **Study Area and Period of Data Collection**

The marine gastropod *Ficus ficoides* (Fig:1) was collected from Vanjiure (Latitude: 100 51'52" N and Longitude: 0790 50' 56" E) coast. The study was conducted from

January 2014 to December 2014. Four seasons recognized at the study area viz., post monsoon (January –March), summer (April-June), Pre monsoon (July-September) and Monsoon (October -December). The Northeast monsoon brings in heavy rainfall to the study area and is the deciding factor of the nature and extent of various seasons.

### **Test Sample Preparation**

To observe the protein, carbohydrate and Lipid content in different organs such as the foot, mantle, gill, hepatopancreas, Testis, Ovary and whole animal body tissue of adult male and female animals were collected fortnightly from the field and were brought to the laboratory and kept in the tanks filled with sea water for 24 hours to ensure that the gut contents were released. These animals were dissected and the respective tissues were pooled up for biochemical analysis. The proximate compositions such as protein, carbohydrate and lipid of the experimental samples were determined by using standard methods and values were expressed as percentage of wet weight (mg/100mg) tissue.

### **Estimation of Total Protein**

The Folin-Ciocalteu Phenol method of Lowry, *et al.*, 1951 was adopted for the estimation of total protein in the tissue.

### **Estimation of Total Carbohydrate**

The estimation of total carbohydrate content, the procedure of Dubois, *et al.*, 1956 using phenol-sulfuric acid was followed.

### **Estimation of Total Lipid**

The total lipid was estimated gravimetrically using chloroform-methanol method described by Folch, *et al.* (1956).

## Statistical Analysis

Statistical significance was evaluated by using ANOVA two factors with MS Office Excel Statistical Tool pack.

## Results and Discussion

Biochemical contents quantified during the entire study period shown in Table 1-3. The fluctuation of protein, carbohydrate and lipid in the entire study period is due to the availability of food, growth and reproductive cycle.

Biochemical contents in male *F.ficoides*:

The percentage of total protein range was recorded in different organs of adult species was whole animal body tissue (WA), Foot (F), Mantle (M), Gill (G), Hepatopancreas (HP), and Testis (T) was 22.19-25.23, 44.98-47.50, 34.24-45.73, 35.23-42.99, 43.08-46.85 and 35.63-39.12 respectively. The carbohydrate content observed in the different organs viz., WA, F, M, G, HP & T were 12.39-18.34, 11.80-16.41, 15.51-17.97, 17.76-20.50, 15.80-20.00 & 15.22-18.59 respectively. The range of lipid content observed in the organs of WA, F, M, G, HP & T were 21.75-23.91, 17.74-26.46, 22.28-23.34, 18.93-22.62, 22.95-24.97 & 26.51-29.71 respectively

Biochemical contents in Female *F.ficoides*:

The percentage of total protein range was recorded in different organs of adult species was whole animal body tissue (WA), Foot (F), Mantle (M), Gill (G), Hepatopancreas (HP), and Ovary (O) was 20.95-23.90, 35.14-38.48, 31.41-35.92, 34.13-40.41, 33.39-37.76 and 29.08-34.05 respectively. The carbohydrate content showed in different organs viz., WA, F, M, G, HP & O was 11.96-14.25, 10.31-13.00, 11.63-14.21, 14.57-16.90, 12.00-16.33 and 10.84-15.73 respectively. The lipid content ranges in the

organs of WA, F, M, G, HP & O was 18.19-21.61, 17.03-21.56, 15.40-20.24, 15.84-21.40, 15.01-21.49 & 22.54-25.67 respectively.

## Season Wise Biochemical Content

Season wise the maximum and minimum biochemical content recorded in different organs shows significant results Table 4-5. Seasonal changes of protein, carbohydrate and lipid content proves the growth and reproductive cycle of the study animal *F.ficoides*.

In the male *F.ficoides* the maximum protein content observed seasons and its respective organ was Postmonsoon- HP (46.85) and rest of the seasons the foot has protein between ranges of 44.98-47.50. The whole animal body tissue shows minimum protein in all the seasons with the ranges of 22.19-25.23. In case of female *F.ficoides* the highest and lowest of protein recorded in the organ of gills & WA body tissues in all the seasons were Postmonsoon (36.97 & 23.90), summer (48.41 & 22.64), Premonsoon (40.11 & 22.12) & Monsoon (35.37 & 20.95) respectively.

Carbohydrate was quantified in both male and female animal's season wise. In both male and female maximum carbohydrate observed in the organ of gill in all the seasons were postmonsoon (20.50, 15.66), summer (19.86, 16.90), Premonsoon (19.06, 15.58) and Monsoon (17.76, 14.57). The minimum carbohydrate recorded in both male and female *F.ficoides* in the organ of foot in all the seasons were postmonsoon (16.41, 10.31), summer (15.31, 12.29), Premonsoon (13.60, 13.00) and Monsoon (11.80, 10.79) respectively.

In all the seasons the highest lipid content recorded in the organ of Testis & Ovary

were postmonsoon (26.51, 22.86), summer (28.32, 23.27), Premonsoon (29.71, 25.65) and Monsoon (26.87, 22.54). The minimum lipid observed in different organs of male animal were postmonsoon (mantle-23.24), Summer & premonsoon (gills-22.62 & 21.00) and monsoon (foot-17.74). In female animal minimum lipid observed data were postmonsoon & monsoon (HP- 18.45 & 15.01) and summer & premonsoon was (mantle- 20.24 & 17.72) respectively.

In the present study the fluctuations in the biochemical constituent are largely attributable to the reproductive and feeding activities of the study animal. Further, the male *F.ficoides* have higher percentage of protein content than the female animal in all

the seasons. Male and female *F.ficoides* has maximum protein in foot and gill organ shows more activity during the season of monsoon is a copulation period and minimum amount of protein recorded during the season of post monsoon period is the snail shows less activity after that spawning period. This present study was supported by Ranajit kumar khalua, *et al.*, 2014 in his work he is reported that the maximum protein storage is due to the edible gastropod snail *Bellama bengalensis* having more activity during spawning period. This present work was supported by earlier studies of Soma Saha, 2004 in *K.opima* and similar, observations have been made by Palpandi *et al.* 2010 in *C.melo* and *Thais mutabilis* by Kamalkanth *et al* 2014.

**Fig.1** *Ficus ficoides*



**Table.1** Seasonal Changes of Protein Content in Different Organs of *F. ficoides* in Both Male and Female Animals

Seasons	Whole Animal body		Foot		Mantle		Gill		Hepatopancreas		Gonad	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Post-monsoon	25.23 ± 0.10	23.90 ± 0.5	46.58 ± 2.8	35.14 ± 0.74	45.73 ± 2.60	31.41 ± 5.77	42.99 ± 0.60	36.97 ± 1.31	46.85 ± 0.36	33.39 ± 0.67	39.12 ± 0.25	29.08 ± 0.83
Summer	24.70 ± 1.2	22.64 ± 0.7	47.50 ± 1.16	38.48 ± 1.27	42.60 ± 1.68	34.79 ± 2.03	42.10 ± 1.54	40.41 ± 0.23	44.28 ± 2.86	37.76 ± 0.06	36.86 ± 2.46	30.52 ± 0.27
Pre-monsoon	23.67 ± 0.5	22.12 ± 0.4	47.43 ± 0.8	37.60 ± 1.28	39.97 ± 3.72	35.92 ± 2.29	41.00 ± 1.78	40.11 ± 3.32	44.90 ± 2.79	35.67 ± 1.31	35.69 ± 5.04	31.92 ± 2.64
Monsoon	22.19 ± 0.2	20.95 ± 0.39	44.98 ± 2.91	35.37 ± 2.85	34.24 ± 2.92	34.03 ± 1.48	35.23 ± 0.99	34.13 ± 1.35	43.08 ± 0.80	35.23 ± 0.99	35.63 ± 0.51	34.05 ± 1.17

♂- Male; ♀- Female

**Table.2** Seasonal Changes of Carbohydrate Content in Different Organs of *F. ficoides* in Both Male and Female Animals

Seasons	Whole Animal body		Foot		Mantle		Gill		Hepatopancreas		Gonad	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Post-monsoon	18.34 ± 5.56	13.28 ± 5.69	16.41 ± 1.75	10.31 ± 1.13	17.97 ± 0.31	14.21 ± 1.04	20.50 ± 0.36	15.66 ± 1.14	20.10 ± 0.50	16.33 ± 2.01	18.59 ± 2.06	15.73 ± 0.69
Summer	17.56 ± 2.76	14.26 ± 1.33	15.31 ± 1.75	12.29 ± 1.13	17.29 ± 0.88	14.08 ± 1.49	19.68 ± 0.90	16.90 ± 0.56	17.10 ± 5.49	13.53 ± 1.57	18.23 ± 2.91	14.48 ± 1.06
Pre-monsoon	16.67 ± 2.76	14.25 ± 1.33	13.60 ± 1.75	13.00 ± 1.13	17.03 ± 0.52	13.23 ± 0.31	19.06 ± 0.70	15.58 ± 1.51	15.80 ± 2.71	12.94 ± 0.64	17.20 ± 2.14	13.78 ± 0.89
Monsoon	12.39 ± 2.76	11.96 ± 1.33	11.80 ± 1.75	10.79 ± 1.13	15.51 ± 0.21	11.63 ± 1.36	17.76 ± 2.15	14.57 ± 1.00	17.39 ± 0.69	12.00 ± 0.26	15.22 ± 2.51	10.84 ± 1.53

**Table.3** Seasonal Changes of Lipid Content in Different Organs of *F. ficoides* in Both Male and Female Animals

Seasons	Whole Animal body		Foot		Mantle		Gill		Hepatopancreas		Gonad	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Post-monsoon	23.91 ± 0.80	21.14 ± 1.01	26.46 ± 1.95	20.77 ± 0.76	23.34 ± 1.80	18.27 ± 2.71	21.50 ± 1.10	18.92 ± 3.83	24.21 ± 1.56	18.45 ± 2.72	26.51 ± 0.95	22.86 ± 1.78
Summer	23.66 ± 1.70	21.61 ± 0.38	24.48 ± 2.60	21.56 ± 1.23	23.30 ± 1.09	20.24 ± 1.73	22.62 ± 1.01	21.40 ± 1.21	24.97 ± 1.71	21.49 ± 0.20	28.32 ± 0.41	23.27 ± 0.95
Pre-monsoon	23.55 ± 0.43	21.00 ± 0.68	22.45 ± 0.85	20.40 ± 1.93	22.65 ± 1.14	17.72 ± 1.52	21.00 ± 0.88	19.70 ± 1.10	22.95 ± 0.80	19.95 ± 0.53	29.71 ± 0.62	25.67 ± 0.67
Monsoon	21.75 ± 1.22	18.19 ± 1.78	17.74 ± 0.85	17.03 ± 1.93	22.28 ± 1.14	15.40 ± 1.52	18.93 ± 0.53	15.84 ± 1.96	23.41 ± 1.96	15.01 ± 1.69	26.87 ± 1.33	22.54 ± 2.03

**Table.4** Anova Analysis for between Seasons and Organs in Male *F. ficoides*

Source of Variation (Male)	SS	Df	MS	F	P-value
<b>Protein</b>					
Between seasons	86.51336	3	28.83779	9.371048	0.000982
Between organs	1308.362	5	261.6724	85.03234	1.83E-10
Error	46.15992	15	3.077328		
<b>Carbohydrate</b>					
Between seasons	42.77636	3	14.25879	14.81754	9.34E-05
Between organs	53.86225	5	10.77245	11.19458	0.000124
Error	14.43437	15	0.962291		
<b>Lipid</b>					
Between seasons	27.53379	3	9.177929	4.02927	0.027503
Between organs	104.6746	5	20.93492	9.190793	0.000365
Error	34.16721	15	2.277814		

Significance at p= 0.05

**Table.5** Anova Analysis for between Seasons and Organs in Female *F. ficoides*

Source of Variation (Female)	SS	Df	MS	F	P-value
<b>Protein</b>					
Between seasons	25.96388	3	8.654626	2.757386	0.078768
Between organs	638.5666	5	127.7133	40.6898	3.34E-08
Error	47.0806	15	3.138706		
<b>Carbohydrate</b>					
Between seasons	21.36458	3	7.121528	6.218702	0.005884
Between organs	33.82844	5	6.765688	5.907974	0.003271
Error	17.17769	15	1.145179		
<b>Lipid</b>					
Between seasons	61.03879	3	20.34626	19.8739	1.75E-05
Between organs	80.49049	5	16.0981	15.72436	1.68E-05
Error	15.35652	15	1.023768		

Significance at p = 0.05

Carbohydrate content was higher in the gills of both male and female *F.ficoides* in all the seasons followed by foot, mantle Hepatopancreas, gonad and whole animal body. Season wise changes in the carbohydrates content may be due to accumulation and utilization of carbohydrate at different stages of their life cycle like gametogenesis and spawning. Similar work was reported by Baskara 2001 in the foot tissue of Lambis lambis and in the C.melo by Palpandi *et al.*, 2010.

In the present study the lipid content was higher than the carbohydrate and lower than that of the protein values. The highest lipid content recorded in all the seasons in the gonad of both male and female *F.ficoides*.

The lipid content higher in gonad was followed by foot, mantle, gill, HP and whole animal body tissue. The significance of the present study also confirms the fact that the high lipid level in the tissue is due to intensive feeding and maturation of the gonads.

This similar work is reported in other edible molluscs are Ananda Kumar *et al.*, 1986 reported in the value of lipid to range from 15.0- 23.6 in *Hemifusus pugilinus*; Ramesh, *et al.*, 1992 observed in *Chicoreus ramosus*, the lipid values assessed at 2 percent in foot muscle; Rajakumar, 1995 observed the lipid content in *Rapana rapiformis* ranged from 0.85-2.12 percent in male and 0.95-2.96 in female.

The spawning cycle and food supply are the main factors responsible for this seasonal variation of protein, carbohydrate and lipid content. The nutritional contents of adult *F.ficoides* are closely linked to the reproductive cycle and availability of natural food

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