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Effect of Various Dietary Protein on Proximate Composition of *Sperata Seenghala*

Muhammad Asif Abbas Tahir[1], Muhammad Naeem*[2]

[1,2]Institute of Zoology, Bahauddin Zakariya University, Multan-60800, Pakistan

***Corresponding Author:** - Muhammad Naeem
Email: dr_naeembzu@yahoo.com

ABSTRACT
Maximum protein contents 83.97±1.86 and 20.05±0.78 (%dry weight and %wet weight) were experienced in T_2 (35%CP) while minimum 76.25±1.48 and 19.82±0.99 in T_1 (30%CP) respectively. Maximum fat contents (%wet weight) 1.92±0.12 were observed in T_4 while minimum 1.48±0.11 in T_6. Maximum fat contents (%dry weight) 7.79±1.19 were observed in T_4 while minimum 6.22±0.55 in T_6. Total organic content (% Dry weight) reported the parallel order as protein content as $T_2>T_3>T_4>T_5>T_6>T_1$ while Total organic contents (% dry weight) showed order as $T_4>T_1>T_3>T_2>T_5>T_6$. Ash contents (%wet weight) showed $T_1>T_6>T_5>T_3>T_2>T_4$ trend. Regarding whole wet body weight, water percentage has observed a reverse effect on proximate constituents in whole wet body weight; water percentage reported maximum value in samples while organic elements reported least values (% Fat, % Protein). Maximum Water concentration 76.15±1.74 was observed in (T_5) group fed with 50%CP while minimum 74.01±0.94 in T_1 fed with 30% crude protein. Percent ash contents determined a positive association to percent water with wet body weight; higher is the water concentration; higher is the % ash. % protein (Wet weight) demonstrated highly significant association with % water in all handling groups except T_4 however other % body components showed insignificant relations. Total length (cm) also revealed significant relations with % body ingredients like water, ash, fat and protein both with dry and wet weight. When Wet body weight (g) and total length (cm) were plotted against total body ingredients (g), highly significant association was perceived in all groups. Whole data demonstrating wet weight and total length reported highly associated ($P<0.001$) with total body ingredients disclosing positive influence on all content. Percentage of fat, ash and protein was reported to be amplified with increase of body weight and length while water content persisted almost constant.

Key words: Proximate composition, total length, fat content, protein content, ash content.

INTRODUCTION

White meat like fish is preferred by people instead of red meat because of its higher nutritional contents (Ayisi *et al*., 2017). Fish and shell fish comprise about 19% proteins with identical amino acid conformation as in muscle meat. The quantity of protein fluctuates conditional to fish species and timing of the year, up to 20%. Different fish species comprises strikingly lesser fat contents as compared to beef (Al-Ghanim, 2016; Tsironi and Taoukis, 2017). The costliest constituent in diet of fish is the protein which shows a significant part in Growth, reproductive ability and fish existence (Jayant *et al*., 2017; Wang *et al*., 2016; Ye *et al*., 2016). Dietary proteins deliver all the Essential and non-essential amino acid which are fundamental constituent and basic energy source for fish (Mohanty, 2011). Insufficient quantity of proteins in the food affects growth and fitness of fish, having negative impact on yield of fish and leads loss to growers. However, extreme quantity of protein raises expenditure of feed but also elimination of Ammonia, probably affecting antagonistic environmental influence (Jayant *et al*., 2017; Wang *et al*., 2016).

Sperata seenghala is natural predator and devours various organisms like frog, snake, earthworms, fish, frog larvae, insects, crab lobster and other fragments (Rahman, 2005). *Sperata seenghala* is predatory (Shammi and Bhatnagar, 2002), carnivorous (Rehman, 2005; Babare *et al*., 2013) and omnivorous fish (Yeragi and Yeragi, 2014). *Sperata seenghala* feeds on significant amount of insects, larvae of insects, crustaceans, shrimps, prawns, molluscs, worms, rarely algae and on aquatic weeds (Arif, 2012).

Sperata seenghala feeds on significant amount of insects, larvae of insects, crustaceans, shrimps, prawns, molluscs, worms, rarely algae and on aquatic weeds (Arif, 2012). Seasonal variation in feeding habits with breeding has been observed, generally with poor feeding intensity in reproducing time whereas vigorous eating afterwards hatching (Arif, 2012). When body size of *Sperata seenghala* increases represent increased organic material in food as compared to vegetal stuff (Babare *et al*., 2013). *Sperata seenghala* exhibits cannibalistic nature (Rajagopal, 1978). It is matured after four to five Months (Yeragi and Yeragi, 2014). Diet containing extensive protenaceious material is adopted to get liveliness that outcomes by enhancing nitrogen containing leftover like Ammonia removal (Cho and Bureau, 2001; Kim *et al.,* 2004). However, when there is an insufficient protein in diet, it results in reduction of development (Kim *et al.,* 2004).

Analysis of body composition is imperative to confirm the necessities of food guidelines and marketable conditions (Ismot and Nabi, 2018b). Fish flesh moisture is a better representator of its comparative amount of energy, proteins and lipids (Aberamoud and Pourshafi, 2010). Flesh of fish comprises considerably little fats and greater amount of water as compared to Beef or Chicken and is preferred over other red meat or white meats (Nestel, 2000). Fish ash contents and fat contents fluctuate by the growing mass or size of fish, seasons and diverse habitats (Ismot and Nabi, 2018b). Among the proximate

composition amino acids configuration and high digestibility rate, protein in fish is tremendous source in proximate composition (Louka, 2004). Lipids are preserved in form of fats in different parts of fish as their major energy sources (Fei *et al.*, 2022).

MATERIALS AND METHODS

Effect of various dietary proteins on proximate composition of *Sperata seenghala*

After completion of trial, five fish samples from each replicate were sacrificed for the analysis of proximate composition of body by using standard method (AOAC, 1997). Water contents of fish samples were calculated by differentiating weights initially and finally dried up by electrical oven on 70°C for 48 hours till weight stability. Each dried was firstly powdered, further uniformed by Pestle mortar and then eventually well-preserved in Plastic bottles with appropriate cataloging for additional exploration. Properly measured powdered form of each fish sample was retained in China clay receptacles being heat resistant, managing in Muffle Furnace (RJM, 1.8 -10, China) ranging temperature 500 to 600 °C for 24 hours to evaluate their ash contents.

Fat contents of fish samples were perceived by withdrawal in ratio of 1:2 mixtures of chloroform and methanol (Bligh and Dyer, 1959). Proteins contents were assessed through differentiating masses of ash, fats and water content (Dawson and Grimm, 1980) as a fish normally has Carbohydrates in minor capacity (Elliott, 1976; Salam and Davies, 1994). Fulton Condition factor per fish specimen was designed by succeeding technique of Weatherley and Gill (1987) as formulae of K = (W/L3) X 100. Regression study and Correlation were managed as a part of statistical exploration.

RESULTS

Values of mean percentage of proximate composition components with Dry body weight and whole Wet body weight of *Sperata seenghala* fingerling raised at various crude protein ratio in Aquaria are given in table 1.1. In present study maximum protein contents 83.97±1.86 and 20.05±0.78 (%dry weight and %wet weight) were experienced in T_2 (35%CP) while minimum 76.25±1.48 and 19.82±0.99 in T_1 (30%CP) respectively. The order of Protein content was observed as $T_2>T_3>T_4>T_5>T_6>T_1$. Maximum fat contents (%wet weight) 1.92±0.12 was observed in T_4 while minimum 1.48±0.11 in T_6. Maximum fat contents (%dry weight) 7.79±1.19 were observed in T_4 while minimum 6.22±0.55 in T_6. Total organic content (% Dry weight) reported the parallel order as protein content as $T_2>T_3>T_4>T_5>T_6>T_1$ while Total organic contents (% dry weight) showed order as $T_4>T_1>T_3>T_2>T_5>T_6$. Ash contents (%wet weight) showed $T_1>T_6>T_5>T_3>T_2>T_4$ trend (Table 1.1).

Water Percentage Impact on % Body Ingredients

Regarding whole wet body weight, water percentage has observed a reverse effect on proximate constituents in whole wet body weight; water percentage reported maximum value in samples while organic elements reported least values (% Fat, % Protein). Maximum Water concentration 76.15±1.74 was observed in (T_5) group fed with 50%CP while minimum 74.01±0.94 in T_1 fed with 30% crude protein. The order of water percentage in whole wet body weight was determined as $T5>T_2>T_6>T_3>T_4>T_1$.Percent ash contents determined a positive association to percent water with wet body weight; greater is the water concentration; higher is the % Ash. The log based association between water percentage and body ingredients was calculated by regression analysis (Table 1.2). Water percentage was kept on x-axis as an independent variable and % fat wet weight on y-axis as a dependent variable, T_3 and T_4 reported significant association while non-significant association ($p<0.01$) with all other groups. % protein (Wet weight) demonstrated highly significant association with % water in all handling groups except T_4 however other % body components showed insignificant relations (Table 1.2).

Body Size Impact on Body Ingredients

Wet body weight (g) of *Sperata seenghala* depicted significant association with % body elements as of water, protein and ash (Both dry and wet weight) except fat dry weight (Table 1.3). Total length (cm) also significant relations with % body ingredients like ash, water, ash, fat and protein both with dry and wet weight (Table 1.3). When wet body weight (g) and total length (cm) were plotted against whole body ingredients exceedingly significant association was perceived in entire groups (Table 1.3). The exponent b value for mass /mass in Log -Log scale nominated Isometric condition. Log-log system with wet body weight exposed a highly significant association ($p<0.001$) by total water, fat, protein, organic content and ash while disclosed insignificant association of ash in T_4, while b =1 (Table 1.4). Whole data demonstrating wet weight and total length reported highly associated ($P<0.001$) with total body ingredients disclosing positive influence on all content. Variations in body elements have a solid association with mass and length of body as student's t test was used to display slope (*b*) value of regression outline that were statistically diverse from $b = 0$ in all groups. Percentage of fat, ash and protein was reported to be amplified with increased body weight and length however water content persisted fairly constant. For mass-length of Log-log scale all ingredients of body represented isometric association for amplified mass however total length specified positive allometric growth when plotted against all ingredients of body by increased total length, when b = 3 (Table 1.5).

Condition factor Impact on other Body Ingredients

Linear regression analysis exposed that when % water was plotted against Condition factor, significant association was perceived in T_5 and T_3 however other groups depicted non-significant interaction. %Ash (dry as well as wet Weight) against Condition factor exposed non-significant association, representing no influence on ash content. %fat both wet and dry weight reported non-significant association in all feeding trials. T_5 and T_3 (% protein) both dry and wet weight perceived highly significant association while other groups exposed non-significant associations, representing that Condition factor have negative impression on %protein and % fat (Table 1.6).

Table 1.1: Proximate Body constituents of experimental fish (*Sperata seenghala*) reared for 90 days in aquaria.

Body constituents	Diet variables T_1 Mean ± S.D	Range	T_2 Mean ± S.D	Range	T_3 Mean ± S.D	Range	T_4 Mean ± S.D	Range	T_5 Mean ± S.D	Range	T_6 Mean ± S.D	Range
Water content (%)	74.01±0.94	72.15-75.81	76.12±0.82	75.02-78.36	75.94±2.22	73.49-81.49	75.00±2.74	69.91-79.43	76.15±1.74	73.82-79.82	76.05±1.74	72.29-78.40
Ash content (%Wet weight)	4.25±0.09	4.02-4.35	2.31±0.29	1.75-3.01	2.45±0.18	2.21-2.80	2.56±0.21	2.13-2.78	3.12±0.20	2.69-3.62	3.83±0.22	3.56-4.43
Ash content (%dry weight)	16.38±0.43	15.46-16.88	9.68±1.12	7.25-12.04	10.32±1.64	8.49-15.13	10.39±1.72	7.85-13.21	13.14±1.29	11.28-15.74	16.07±1.54	13.25-19.05
Fat content (%wet weight)	1.91±0.31	1.29-2.35	1.52±0.27	1.19-2.25	1.69±0.22	1.23-1.97	1.92±0.12	1.76-2.16	1.71±0.15	1.51-1.99	1.48±0.11	1.26-1.64
Fat content (% dry weight)	7.37±1.26	5.05-9.21	6.35±1.10	4.94-9.37	7.10±1.37	4.86-9.95	7.79±1.19	5.99-10.27	7.22±0.88	6.14-8.81	6.22±0.55	5.08-6.92
Protein contents (%wet weight)	19.82±0.99	18.07-21.94	20.05±0.78	18.20-21.23	19.92±2.39	13.86-22.92	20.52±2.89	15.97-25.66	19.02±1.77	15.28-21.56	18.64±1.77	16.53-22.35
Protein contents (%dry weight)	76.25±1.48	73.97-78.76	83.97±1.86	80.61-87.81	82.58±2.74	74.91-86.48	81.81±2.79	77.27-85.28	79.64±1.84	75.70-82.44	77.72±1.75	75.44-81.67
Total organic contents (%wet weight)	21.74±0.89	20.16-23.55	21.57±0.77	19.45-22.72	21.61±2.31	15.70-24.22	22.44±2.84	17.84-27.46	20.73±1.75	17.00-23.29	20.12±1.79	17.84-23.87
Total organic contents (%dry weight)	83.62±0.43	83.12-84.54	90.32±1.12	87.96-92.75	89.68±1.64	84.87-91.51	89.60±1.72	86.79-92.15	86.86±1.29	84.26-88.72	83.93±1.54	80.95-86.75
Fat Free Dry mass (% wet weight)	24.08±1.05	22.09-26.24	22.36±0.79	20.39-23.35	22.37±2.29	16.66-90.05	23.07±2.79	18.69-28.29	22.14±1.77	18.45-24.53	22.47±1.72	20.29-26.16
Fat Free Dry mass (% dry weight)	92.63±1.26	90.79-94.95	93.65±1.10	90.63-95.06	92.89±1.37	90.05-95.14	92.20±1.19	89.73-94.01	92.78±0.88	91.19-93.86	93.78±0.55	93.08-94.92

Table 1.2: Statistical parameters of % water content versus % body constituents of *Sperata seenghala* reared at various crude protein

Relationships	Diet variables	r	a	b	S.E. (b)	t value when b=0
	T_1	0.19ns	-2.68	0.06	0.09	0.70
	T_2	0.28ns	8.64	-0.09	0.09	-1.05
% Water (x)	T_3	0.33ns	-0.88	0.03	0.03	1.28
%Fat wet weight (y)	T_4	0.40**	0.57	0.02	0.01	1.56
	T_5	0.14ns	0.84	0.01	0.02	0.49
	T_6	0.20ns	2.42	-0.01	0.02	-0.73
	T_1	0.39*	-30.75	0.52	0.34	1.51
	T_2	0.10ns	16.75	-0.14	0.37	-0.37
% Water (x)	T_3	0.79***	-29.98	0.49	0.11	4.63
%Fat dry weight (y)	T_4	0.91***	-21.92	0.40	0.05	7.89
	T_5	0.72**	-20.49	0.36	0.10	3.73
	T_6	0.60**	-8.05	0.19	0.07	2.69
	T_1	0.95***	93.85	-1.00	0.09	-10.75
	T_2	0.82***	79.48	-0.78	0.15	-5.17
% Water (x)	T_3	1.00***	101.38	-1.07	0.03	-38.08
%Protein wet weight (y)	T_4	0.51**	38.68	-7.10	3.35	-2.12
	T_5	0.99***	95.83	-1.01	0.03	-28.99
	T_6	0.99***	95.32	-1.01	0.03	-31.64
	T_1	0.58**	142.86	-0.90	0.36	-2.53
% Water (x)	T_2	0.11ns	65.83	0.24	0.62	0.38
%Protein dry weight(y)	T_3	0.93***	170.38	-1.16	0.12	-9.36
	T_4	0.65**	104.50	-8.87	2.85	-3.11

	T_5	0.88***	150.58	-0.93	0.14	-6.69
	T_6	0.88***	145.57	-0.89	0.13	-6.85
	T_1	0.67**	8.82	-0.06	0.02	-3.29
	T_2	0.36*	11.87	-0.13	0.09	-1.37
%Water (x)	**T_3**	0.48**	-0.50	0.04	0.02	1.95
%Ash wet weight (y)	**T_4**	0.45**	0.02	0.03	0.02	1.82
	T_5	0.02ns	3.33	0.00	0.03	-0.09
	T_6	0.16ns	2.27	0.02	0.04	0.58
	T_1	0.84***	-12.11	0.38	0.07	5.50
	T_2	0.07ns	17.41	-0.10	0.38	-0.27
% Water (x)	**T_3**	0.90***	-40.40	0.67	0.09	7.42
%Ash dry weight (y)	**T_4**	0.91***	-32.50	0.57	0.07	7.88
	T_5	0.76***	-30.08	0.57	0.13	4.23
	T_6	0.79***	-37.52	0.70	0.15	4.70

r = Correlation coefficient; a = Intercept; b = slope; S. E= Standard Error; *** P<0.001

Table 1.3: Statistical parameters of body weight (W, g) and Total length (TL, cm) versus % body constituents (wet and dry weight, g) of *Sperata seenghala*

Relationships		**r**	**a**	**b**	**S.E. (b)**	**t value when b=0**
	T_1	0.977***	53.883	0.673	0.041	16.396
	T_2	0.699***	64.065	0.348	0.099	3.525
Body weight (x)	**T_3**	0.863***	134.884	-1.581	0.257	-6.162
% Water (y)	**T_4**	0.788***	118.661	-0.910	0.197	-4.612
	T_5	0.929***	112.307	-1.136	0.125	-9.057
	T_6	0.422*	92.276	-0.629	0.375	-1.677
	T_1	0.294ns	-0.058	0.066	0.059	1.111
	T_2	0.392ns	3.779	-0.065	0.043	-1.536
Body weight (x)	**T_3**	0.185ns	2.961	-0.034	0.050	-0.678
%Fat wet wt. (y)	**T_4**	0.548**	3.305	-0.029	0.012	-2.361
	T_5	0.162ns	2.246	-0.017	0.028	-0.594
	T_6	0.043ns	1.382	0.004	0.026	0.156
	T_1	0.482**	-5.856	0.443	0.223	1.984
	T_2	0.272*	12.671	-0.183	0.179	-1.020
Body weight, (x)	**T_3**	0.625**	33.494	-0.708	0.245	-2.884
%Fat dry wt. (y)	**T_4**	0.831***	27.861	-0.418	0.078	-5.390
	T_5	0.686**	20.727	-0.425	0.125	-3.401
	T_6	0.260ns	9.369968	-0.12224	0.125499	-0.974
	T_1	0.953***	40.549	-0.693	0.061	-11.369
	T_2	0.287*	24.762	-0.136	0.126	-1.080
Body weight (x)	**T_3**	0.851***	-42.709	1.680	0.287	5.846
%Protein wet wt. (y)	**T_4**	0.798***	-26.135	0.972	0.204	4.774
	T_5	0.920***	-17.380	1.144	0.135	8.481
	T_6	0.447**	1.201	0.676	0.376	1.799
	T_1	0.635***	96.725	-0.685	0.231	-2.963
	T_2	0.570**	61.724	0.643	0.257	2.499
Body weight, (x)	**T_3**	0.787***	16.009	1.785	0.388	4.597
%Protein dry wt. (y)	**T_4**	0.810***	35.936	0.956	0.192	4.975
	T_5	0.797***	46.835	1.031	0.217	4.753
	T_6	0.455**	60.072	0.684	0.372	1.841
	T_1	0.727***	5.626	-0.046	0.012	-3.821
	T_2	0.834***	7.394	-0.147	0.027	-5.456
Body weight (x)	**T_3**	0.433**	4.865	-0.065	0.037	-1.731
% Ash wet wt. (y)	**T_4**	0.386*	4.169	-0.034	0.022	-1.508
	T_5	0.064ns	2.827	0.009	0.039	0.233
	T_6	0.266*	5.142	-0.051	0.051	-0.993
	T_1	0.765***	9.132	0.243	0.057	4.276
	T_2	0.679**	25.606	-0.460	0.138	-3.335
Body weight (x)	**T_3**	0.792***	50.498	-1.078	0.230	-4.683
%Ash dry wt. (y)	**T_4**	0.740***	36.204	-0.538	0.135	-3.973
	T_5	0.665**	32.438	-0.606	0.189	-3.208
	T_6	0.424*	30.558	-0.562	0.333	-1.689
Total length (x)	**T_1**	0.624**	43.349	1.818	0.632	2.876
% Water (y)	**T_2**	0.506**	48.720	1.602	0.757	2.116

	T_3	0.691**	148.093	-4.145	1.204	-3.444
	T_4	0.557**	130.036	-3.055	1.265	-2.415
	T_5	0.413**	193.079	-6.917	4.229	-1.635
	T_6	0.326*	111.571	-2.134	1.718	-1.242
	T_1	0.008ns	2.032	-0.007	0.263	-0.027
	T_2	0.503**	10.626	-0.533	0.254	-2.098
Total length (x)	**T_3**	0.035ns	2.060	-0.021	0.168	-0.128
%Fat wet wt. (y)	**T_4**	0.341*	3.457	-0.085	0.065	-1.307
	T_5	0.491**	13.479	-0.696	0.342	-2.033
	T_6	0.006ns	1.523	-0.002	0.112	-0.021
	T_1	0.13ns	-1.40	0.52	1.07	0.49
	T_2	0.42*	37.19	-1.80	1.07	-1.69
Total length (x)	**T_3**	0.42*	34.24	-1.56	0.94	-1.67
%Fat dry wt. (y)	**T_4**	0.58**	32.71	-1.38	0.54	-2.56
	T_5	0.60**	92.71	-5.06	1.89	-2.68
	T_6	0.23ns	14.16	-0.48	0.56	-0.86
	T_1	0.55*	48.26	-1.69	0.71	-2.36
	T_2	0.06ns	23.38	-0.19	0.83	-0.23
Total length (x)	**T_3**	0.68***	-56.59	4.40	1.32	3.34
%Protein wet wt. (y)	**T_4**	0.55**	-36.46	3.16	1.35	2.35
	T_5	0.42**	-102.14	7.17	4.28	1.67
	T_6	0.30*	-14.87	2.01	1.76	1.15
	T_1	0.26ns	96.33	-1.19	1.22	-0.98
	T_2	0.66**	2.83	4.74	1.49	3.18
Total length (x)	**T_3**	0.62**	2.62	4.59	1.62	2.83
%Protein dry wt. (y)	**T_4**	0.52**	29.41	2.91	1.33	2.19
	T_5	0.39*	-37.86	6.95	4.52	1.54
	T_6	0.17ns	59.24	1.11	1.81	0.61
	T_1	0.47*	6.36	-0.13	0.07	-1.91
	T_2	0.78***	17.27	-0.87	0.19	-4.53
Total length (x)	**T_3**	0.47**	6.43	-0.23	0.12	-1.90
% Ash wet wt. (y)	**T_4**	0.06ns	2.97	-0.02	0.11	-0.20
	T_5	0.23ns	-4.41	0.45	0.52	0.85
	T_6	0.15ns	1.78	0.12	0.23	0.53
	T_1	0.50*	5.07	0.67	0.32	2.08
	T_2	0.68**	59.98	-2.94	0.87	-3.37
Total length (x)	**T_3**	0.68**	63.15	-3.04	0.91	-3.35
%Ash dry wt. (y)	**T_4**	0.44*	37.89	-1.53	0.86	-1.78
	T_5	0.15ns	45.16	-1.89	3.42	-0.55
	T_6	0.11ns	26.61	-0.63	1.60	-0.39

r = Correlation Coefficient; a = Intercept; b = slope; S. E= Standard Error; *** P<0.001; $^{n.s}$ p > 0.005

Table 1.4: Statistical parameters of wet body weight (W, g) versus total body constituents (wet weight, g) of *Sperata seenghala*

Relationships		**R**	**a**	**b**	**S. E. (b)**	**t value when b=1**
	T_1	0.977***	53.883	0.673	0.041	16.396
	T_2	0.699**	64.065	0.348	0.099	3.525
Body weight (x)	**T_3**	0.863***	134.884	-1.581	0.257	-6.162
Water content (y)	**T_4**	0.788***	118.661	-0.910	0.197	-4.612
	T_5	0.929***	112.307	-1.136	0.125	-9.057
	T_6	0.422*	92.276	-0.630	0.380	-1.680
	T_1	0.999***	-0.533	1.273	0.016	78.785
	T_2	0.990***	-0.359	1.156	0.045	25.938
Log body weight (x)	**T_3**	0.486**	1.068	0.244	0.122	2.006
Log water content (y)	**T_4**	0.688***	0.840	0.426	0.125	3.416
	T_5	0.946***	0.585	0.532	0.051	10.524
	T_6	0.859***	0.185	0.785	0.130	6.045
	T_1	0.519**	-0.581	0.039	0.018	2.191
	T_2	0.151ns	0.804	-0.008	0.015	-0.550
Body weight (x)	**T_3**	0.079ns	0.426	0.005	0.019	0.286
Fat content (y)	**T_4**	0.251*	0.660	0.005	0.006	0.934
	T_5	0.339**	0.176	0.012	0.009	1.298

	T_6	0.557**	-0.023	0.016	0.007	2.415
	T_1	0.508**	-3.343	2.098	0.987	2.125
	T_2	0.157ns	0.500	-0.511	0.894	-0.572
Log body weight, g (x)	T_3	0.038ns	-0.454	0.158	1.163	0.136
Log fat content (y)	T_4	0.269*	-0.537	0.298	0.296	1.007
	T_5	0.360*	-1.337	0.713	0.513	1.390
	T_6	0.551**	-1.959	1.092	0.458	2.381
	T_1	0.150ns	6.187	-0.009	0.017	-0.546
	T_2	0.682***	1.662	0.152	0.045	3.360
Body weight (x)	T_3	0.905***	-22.497	0.803	0.105	7.680
Protein content (y)	T_4	0.880***	-21.807	0.661	0.099	6.667
	T_5	0.964***	-11.368	0.548	0.042	13.007
	T_6	0.714***	-4.780	0.372	0.101	3.675
	T_1	0.155ns	0.843	-0.048	0.086	-0.566
	T_2	0.692**	-0.323	0.756	0.219	3.454
Log body weight (x)	T_3	0.909***	-6.054	4.405	0.560	7.861
Log protein content (y)	T_4	0.890***	-4.628	3. 342	0.474	7.051
	T_5	0.360*	-1.337	0.713	0.513	1.390
	T_6	0.704***	-1.892	1.823	0.510	3.571
	T_1	0.899***	0.431	0.028	0.004	7.388
	T_2	0.630**	1.717	-0.027	0.009	-2.921
Body weight (x)	T_3	0.024ns	0.868	0.001	0.014	0.087
Ash content (y)	T_4	0.243*	0.751	0.010	0.011	0.903
	T_5	0.601**	-0.071	0.033	0.012	2.710
	T_6	0.479**	0.338	0.025	0.013	1.969
	T_1	0.907***	-0.897	0.678	0.088	7.744
	T_2	0.621**	1.676	-1.154	0.404	-2.854
Log body weight (x)	T_3	0.016ns	-0.090	0.032	0.556	0.057
Log ash content (y)	T_4	0.217ns	-0.497	0.348	0.434	0.802
	T_5	0.617***	-1.686	1.119	0.395	2.830
	T_6	0.488**	-0.964	0.678	0.337	2.016

r = Correlation Coefficient; a = Intercept; b = slope; S. E= Standard Error; *** P<0.001; ** P<0.01

Table 1.5: Statistical parameters of Total length (TL, cm) versus total body constituents (g) of *Sperata seenghala*

Relationships		**R**	**a**	**B**	**S. E. (b)**	**t value when b=3**
	T_1	0.615**	-19.255	2.454	0.872	2.813
	T_2	0.813***	-52.423	4.606	0.914	5.038
Total length (x)	T_3	0.628***	14.451	0.795	0.274	2.907
Water (y)	T_4	0.580**	12.429	1.305	0.509	2.564
	T_5	0.238*	0.559	1.399	1.585	0.883
	T_6	0.643**	-12.868	1.951	0.645	3.024
	T_1	0.606**	-0.894	1.825	0.665	2.744
	T_2	0.814***	-2.278	2.999	0.593	5.057
Log total length (x)	T_3	0.625**	0.847	0.487	0.169	2.883
Log water content (y)	T_4	0.592**	0.727	0.660	0.249	2.646
	T_5	0.235*	0.188	0.974	1.116	0.873
	T_6	0.651**	-0.748	1.670	0.540	3.092
	T_1	0.156ns	-0.253	0.049	0.086	0.568
	T_2	0.317*	2.371	-0.108	0.090	-1.203
Total length (x)	T_3	0.209ns	-0.192	0.047	0.061	0.772
Fat content (y)	T_4	0.278ns	0.404	0.029	0.027	1.044
	T_5	0.295ns	2.877	-0.138	0.124	-1.112
	T_6	0.398*	-0.440	0.049	0.032	1.565
	T_1	0.130ns	-1.805	1.268	2.685	0.472
	T_2	0.334*	3.957	-3.441	2.692	-1.278
Log total length (x)	T_3	0.164ns	-1.530	1.068	1.785	0.598
Log fat content (y)	T_4	0.286ns	-0.753	0.571	0.530	1.077
	T_5	0.287ns	4.868	-4.180	3.874	-1.079
	T_6	0.377*	-2.982	2.099	1.429	1.469
	T_1	0.028ns	6.037	-0.007	0.072	-0.102
Total length (x)	T_2	0.706***	-10.208	1.002	0.279	3.594
Protein content (y)	T_3	0.753***	-30.681	2.191	0.530	4.132
	T_4	0.617**	-29.815	2.204	0.779	2.830

	T_5	0.413*	-48.322	3.218	1.967	1.636
	T_6	0.519**	-14.964	1.188	0.542	2.191
	T_1	0.031ns	0.800	-0.023	0.205	-0.112
	T_2	0.706***	-2.164	2.436	0.677	3.598
Log total length (x)	**T_3**	0.749***	-6.128	5.638	1.384	4.073
Log protein content (y)	**T_4**	0.642***	-4.462	4.341	1.438	3.020
	T_5	0.394*	-10.171	8.917	5.769	1.546
	T_6	0.509**	-3.844	3.704	1.736	2.133
	T_1	0.531**	0.086	0.070	0.031	2.260
	T_2	0.655***	3.802	-0.176	0.056	-3.127
Total length (x)	**T_3**	0.058ns	1.079	-0.010	0.046	-0.208
Ash content (y)	**T_4**	0.446*	-0.332	0.086	0.048	1.799
	T_5	0.371*	-3.782	0.282	0.196	1.440
	T_6	0.679***	-1.617	0.156	0.047	3.339
	T_1	0.522**	-1.029	0.923	0.418	2.207
	T_2	0.651***	4.609	-3.820	1.235	-3.092
Log total length (x)	**T_3**	0.066ns	0.215	-0.206	0.862	-0.239
Log ash content (y)	**T_4**	0.426*	-1.455	1.229	0.724	1.697
	T_5	0.374*	-6.131	4.989	3.431	1.454
	T_6	0.683***	-3.263	2.666	0.791	3.371

r = Correlation Coefficient; a = Intercept; b = slope; S.E= Standard Error; *** P<0.001; ** P<0.01; * P<0.05; $^{n.s}$ p > 0.005

Table 1.6: Statistical parameters of Condition factor versus % body constituents (wet weight, g) of *Sperata seenghala*

Relationships		**R**	**a**	**b**	**S. E. (b)**	**t value when b=0**
	T_1	0.163ns	70.769	5.199	8.722	0.596
	T_2	0.378*	64.775	16.403	11.136	1.473
Condition factor (x)	**T_3**	0.444**	47.945	39.577	22.166	1.786
% Water (y)	**T_4**	0.120ns	68.969	7.343	16.791	0.437
	T_5	0.807***	109.511	-50.655	10.296	-4.920
	T_6	0.088ns	80.892	-8.663	27.260	-0.318
	T_1	0.288ns	0.052	2.982	2.748	1.085
	T_2	0.162ns	-0.104	2.346	3.972	0.591
Condition factor (x)	**T_3**	0.092ns	2.271	-0.826	2.488	-0.332
% Fat (y)	**T_4**	0.019ns	1.878	0.052	0.771	0.067
	T_5	0.040ns	1.569	0.215	1.473	0.146
	T_6	0.065ns	1.264	0.393	1.686	0.233
	T_1	0.233ns	24.715	-7.844	9.070	-0.865
	T_2	0.390*	31.197	-16.119	10.546	-1.528
Condition factor (x)	**T_3**	0.436**	49.579	-41.927	23.981	-1.748
% Protein (y)	**T_4**	0.096ns	25.608	-6.195	17.761	-0.349
	T_5	0.793***	-14.329	50.639	10.778	4.699
	T_6	0.156ns	9.892	15.648	27.429	0.570
	T_1	0.115ns	4.464	-0.337	0.804	-0.419
	T_2	0.172ns	4.132	-2.630	4.186	-0.628
Condition factor (x)	**T_3**	0.436*	0.205	3.176	1.817	1.748
% Ash (y)	**T_4**	0.261ns	3.544	-1.200	1.229	-0.976
	T_5	0.027ns	3.249	-0.200	2.022	-0.099
	T_6	0.582**	7.952	-7.378	2.862	-2.578

r = Correlation Coefficient; a = Intercept; b = slope; S. E= Standard Error; ^{ns} p > 0.05

DISCUSSION

Whole wet body weight reported protein content as 12.06 % in Hybrid *Catla catla* and *Labeo rohita* (Naeem *et al.*, 2011), however present study reported maximum protein content was experienced in T_2 (35% CP) as 83.97±1.86 and 20.05±0.78 (%dry weight and %wet weight) respectively which are greater comparative to be observed in *Ctenopharyngodon idella* by Khalid and Naeem (2018) and kousar *et al.* (2020) and these disparities may be resulted by feed components and various ecological circumstances (Ebrahimi and Ouraji ,2012). Present study disclosed maximum protein content (67.61) in T_2 (35% CP) as 83.97 (%dry weight) (Table 1.1) having contradiction with Tossavi *et al.* (2020) who reported highest whole body protein with 45% dietary protein in Silver Catfish *Schilbe intermedius*.

Effiong *et al.* (2019) reported maximum protein content with 50% dietary protein having contradictory findings to present research in which it was determined maximum with 35% CP. Different protein diets in *S. intermedius* determined lipid and body protein content as positively interrelated however ash of fishes has contrary interaction protein diets with dietary protein levels while in present study order of protein content with % dry weight was observed as order of $T_2>T_3>T_4>T_5>T_6>T_1$ representing contradictory findings prediction with Tossavi *et al.* (2020), while diet 1 and diet 3 reported significant correlation with fat content (Ananias *et al.*, 2016).

Fat and ash contents were disclosed as 2.22 % and 6.58% respectively in Hybrid (*Catla catla* and *Labeo rohita)* and in present study maximum fat was experienced as (%wet weight) 1.92±0.12 in T_4 and T_6 (Table 1.1) while Ash contents (%wet weight) showed order as$T_1>T_6>T_5>T_3>T_2>T_4$ while ash showed non-significant correlation with various dietary proteins in *Clarias gariepinus* (Effiong *et al.,* 2019). Lipid was found to be increased from 40% to 50% protein diet (Effiong *et al.,* 2019) while in present study fat contents were determined as maximum with 45% CP and then decreased with 50% CP. While protein and ash reported significant correlation with diet 2 (Ananias *et al.*, 2016).

Equations were developed by Naeem *et al.* (2011) showed non-significant relation concerning % water and % age of other body ingredients with all other constituents and showed significant correlation with protein (wet body weight) that is parallel to present study in which % protein (Wet weight) reported highly significant association with percent water in all handling groups except T_4. kousar *et al.* (2020) also reported strong relation between water and body weight while all other %body constituents showed insignificant relations parallel to present study.

According to Naeem *et al.* (2011) Log-transformed total wet body weight and total length represented highly significant positive association. Body ingredients of Hybrid (*Catla catla* and *Labeo rohita*) showed parallel findings to present study as log-log transformed weight and length of all the body components reported Isometric relationship for enlarged quantity(Table 1.5) however positive allometric association was reported with total length when plotted against all the body ingredients with increased total length, when b =3 ,while non-significant relations was reported by kousar *et al.* (2020) which is contrary to present study and other findings of Khalid and Naeem (2018) and Naeem and Ishtiaq (2011).

In present study when %Ash (dry as well as wet weight), %fat (wet and dry weight) and % protein were plotted against condition factor showed insignificant relationship in various feeding trials (except T_5 and T_3) representing negative impact, (Table 1.6) similar findings were also observed by Naeem *et al.* (2011), while kousar *et al.* (2020) reported smallest significant relationship of % fat in T_2 and non-significant association in T_1 and T_3 with condition factor. Similarly, non-significant modifications were also practiced amongst parameters of body conformation of fish with different feeding groups (khan *et al.*, 2018).

In Present study % water showed highly significant correlation with % protein wet weight parallel by Khalid *et al.* (2023) and % fat dry weight (except T_2) contradiction by Khalid *et al.* (2023), % protein dry weight (except T_2) and % ash dry weight (except T_2) that reported non-significant relation. Khalid *et al.* (2023) conveyed that total length revealed a highly significant negative relationship of total length with Log water, protein and fats contradictory to present study in which total length showed significant relation with protein content (Table 1.5). Iqbal *et al.* (2020) determined no effect of total length with T_1, T_2 and T_3 feeds on total water and total proteins that is different from findings of present study where significant relation was observed.

CONCLUSION

In present study maximum protein contents 83.97±1.86 and 20.05±0.78 (%dry weight and %wet weight) were experienced in T_2 (35%CP) while minimum 76.25±1.48 and 19.82±0.99 in T_1 (30%CP) respectively. Maximum fat contents (%wet weight) 1.92±0.12 was observed in T_4 while minimum 1.48±0.11 in T_6. Maximum fat contents (%dry weight) 7.79±1.19 were observed in T_4 while minimum 6.22±0.55 in T_6. Regarding whole wet body weight, water percentage has observed a reverse effect on proximate constituents in whole wet body weight; water percentage reported maximum value in samples while organic elements reported least values (% Fat, % Protein). Maximum Water concentration 76.15±1.74 was observed in (T_5) group fed with 50%CP while minimum 74.01±0.94 in T_1 fed with 30% crude protein. Percent ash contents determined a positive association to percent water with wet body weight; higher is the water concentration; higher is the % ash

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