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The length weight relationship of *Ctenopharyngodon idella* fed with formulated feed

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Abstract
Aquaculture is a dynamic industry that continues to offer regulars with a practically priced, high quality protein. The impact that any aquaculture system has on the environment, is today, and will continue to be, in the forefront when environmental issues are discussed. The length-weight relationship is key for appropriate development and management of the population of fish species. To obtain the relationship between total length and weight are also crucial for understanding the proper growth of fishes.

Keywords: Formulated feed, Aquaculture, Length-weight Relationship, *Ctenopharyngodon idella*.

1. Introduction
The Length-Weight Relationship (LWR) is widely accepted as an important tool in aquaculture, especially in ecology, population dynamics, and stock management [1, 2]. These relationships permit estimating the weight of a specimen easily when only its total length is known. For this reason, these relationships are useful when rapid estimations of biomass are necessary [1].
The changes in weight in relation to length are generally not on the basis of specific gravity, but due to changes in the form of volume because the density in the organism and that of the surrounding water. Such changes are analyzed by the condition factor or "Pondered index" [3]. The present work has been done on the morphometrics aspects such as length-weight relationship of *Ctenopharyngodon idella*.
A length-weight relationship provides information on growth patterns and growth of fish. During their development, fish are known to pass through stages in their life history, which are defined by different length-weight relationships. It is applicable for basic needs in order to make fish stocks assessment and population [4].

2. Materials and Methods
Feed formulation is the processes of designing the mixture that will meet the nutritional requirement of fish. Selection of ingredients in present feed formulation was based on their qualities such as protein content. Feed was formulated by soyabean meal as plant protein sources in present feed formulation. The other ingredients such as milk powder, corn flour, eggs, cod liver oil, vitamin mixture containing vitamin B Complex and E, agar powder, garlic paste, pepper powder, and cumin powder were also used.

2.1 Formulation of feeds
Soyabean meal was taken in powder form as main ingredient. Ingredients mentioned above were added. All the ingredients were heated for some time to avoid infection and kept under refrigeration for 12 hrs. Then the mixture was squeezed over plastic tray and dried at room temperature for 48 hrs. The strands were cut into short pieces sun dried for three days to avoid fungal infection. Following the above procedure all the feeds were formulated, in the percentage composition of 25% (soyabean meal 25% +groundnut oil cake 75%), 50% (soyabean meal 50%+groundnut oil cake50%), 75% (soyabean meal 75% +groundnut oil cake 25%), 100% formulated (only of soyabean meal) and 100%conventional (only of groundnut oil cake).

2.2 Experimental protocol

Studies were conducted on *Ctenopharyngodon idella*, Fish weighing 1.34±0.089 gm with body length 5±0.7 cm and kept in aquarium for seven days of acclimatization. Then they were randomly selected and experiment was conducted in five glass aquaria has dimension (35×36.5×35 cm^3) with water volume 60 liter under continuous aeration and experimental set up were under natural light and dark cycle. For each feed i.e. conventional and different combination of feed three replicates was used and in each replicate 25 fishes were stocked. They were fed at the rate of 2% of live net weight once in a day. A water change was implemented by replacing one half of the water in each aquarium with dechlorinated water every day. Length weight relationship measurement was done at stipulated time interval i.e. 30, 45, 60, 75 and 90 days throughout the experimental period.

The first step in length-weight investigation is to obtain a random sample of fish, which is true representation of the total population. Total length should be measured from snout tip to the caudal fin using measuring scale in cm and weight was recorded instantly by electronic weight balance. The length-weight study is an important tool to know the fish health. The length-weight relationship was recorded by using figures which was measured. The length-weight of *Ctenopharyngodon idella* is expressed by using the Le Cren method.

$$W = aLb^{3,1}$$

Where, W = weight of fish in grams (gm),

L = length of the fish in centimetres (cm),
a = constant (intercept), b = constant.

$$\text{Log } w = \log a + b \log L$$

Where;

a = Constant
b = the regression co-efficient

Where the values of 'log a' and 'b' were calculated by the formula,

$$\log a = \frac{\Sigma \log W . \Sigma (\log L)2 - \Sigma \log L . \Sigma (\log L \times \log W)}{N . \Sigma (\log L)2 . (\Sigma \log L)}$$

$$b = \frac{\Sigma \log W - (N . \log a)}{\Sigma \log L}$$

3. Results and Discussions

Table 1: Length weight relationship of *Ctenopharyngodon idella* fed with conventional and different combinations of formulated fish feed (Table 1: i-v) shows the Length weight relationship (LWR) of *Ctenopharyngodon idella* fed with conventional and different combinations of formulated fish feed at each stipulated time interval. (Table 2: i-v) depicts the Length (L), Weight (W), their logarithmic values of each, such as Log L and Log W, the square of log L and Log L X Log W values.

i) 100% Conventional feed

Duration in days	Length (L) cms.	Weight (W) Gms	Log L	Log L^2	Log W	Log L x Log W	Values of Log W by formula
30	5.376±0.130	1.754±0.053	0.729±0.009	0.533±0.014	0.2422±0.0124	0.229±0.107	0.2420±0.0123
45	6.246±0.390	2.43±0.131	0.794±0.027	0.631±0.043	0.3815±0.0251	0.304±0.027	0.3815±0.0251
60	6.798±0.099	2.936±0.040	0.832±0.006	0.692±0.010	0.4666±0.0051	0.388±0.006	0.4665±0.0051
75	7.138±0.250	3.572±0.043	0.852±0.014	0.727±0.025	0.5418±0.0068	0.468±0.010	0.5479±0.0068
90	7.376±0.150	3.752±0.043	0.867±0.009	0.752±0.015	0.5730±0.0047	0.497±0.008	0.5729±0.0046

ii) 25% Formulated fish feed

Duration in days	Length (L) cms.	Weight (W) Gms	Log L	Log L^2	Log W	Log L x Log W	Values of Log W by formula
30	5.404±0.104	1.796±0.033	0.732±0.008	0.536±0.012	0.2536±0.0078	0.185±0.606	0.2535±0.0078
45	6.246±0.421	2.45±0.156	0.794±0.029	0.632±0.046	0.3847±0.0302	0.306±0.029	0.3846±0.0302
60	7.074±0.208	3.074±0.072	0.849±0.013	0.721±0.021	0.4958±0.0161	0.421±0.019	0.4958±0.0161
75	7.57±0.143	4.168±0.059	0.877±0.006	0.770±0.010	0.6188±0.0060	0.543±0.004	0.6188±0.0059
90	7.82±0.055	4.208±0.201	0.892±0.003	0.797±0.005	0.6225±0.0203	0.556±0.017	0.6225±0.0201

iii) 50% Formulated fish feed

Duration in days	Length (L) cms.	Weight (W) Gms	Log L	Log L^2	Log W	Log L x Log W	Values of Log W by formula
30	5.53±0.280	1.87±0.048	0.741±0.021	0.5263±0.0773	0.3011±0.0640	0.217±0.031	0.3011±0.0640
45	6.39±0.031	2.51±0.092	0.804±0.001	0.6164±0.0698	0.3965±0.0142	0.319±0.011	0.3944±0.0146
60	7.23±0.123	3.17±0.062	0.858±0.007	0.7379±0.0127	0.5009±0.0076	0.430±0.003	0.5010±0.0076
75	7.89±0.120	4.54±0.110	0.896±0.007	0.8042±0.0122	0.6551±0.0093	0.587±0.006	0.6549±0.0093
90	8.744±0.190	5.70±0.151	0.941±0.009	0.8861±0.0180	0.7537±0.0122	0.710±0.017	0.7536±0.0122

iv) 75% Formulated fish feed

Duration in days	Length (L) cms.	Weight (W) Gms	Log L	Log L^2	Log W	Log L x Log W	Values of Log W by formula
30	5.54±0.271	1.816±0.097	0.742±0.019	0.5522±0.0301	0.2551±0.0186	0.191±0.020	0.2551±0.0186
45	6.5±0.112	2.612±0.032	0.812±0.007	0.6604±0.0124	0.4151±0.0055	0.337±0.005	0.4152±0.0054
60	7.208±0.207	3.320±0.065	0.857±0.012	0.7356±0.0213	0.5450±0.0642	0.468±0.062	0.5449±0.0642
75	7.818±0.088	4.34±0.096	0.891±0.009	0.7988±0.0090	0.6535±0.0072	0.584±0.007	0.6534±0.0073
90	8.556±0.100	5.694±0.186	0.931±0.005	0.8686±0.0096	0.7521±0.0155	0.701±0.015	0.7519±0.0154

v) 100% Formulated fish feed

Duration in days	Length (L) cms.	Weight (W) Gms	Log L	Log L^2	Log W	Log L x Log W	Values of Log W by formula
30	5.464±0.049	1.762±0.069	`0.733±0.008	0.538±0.012	0.2432±0.0166	0.179±0.011	0.2420±0.0166
45	6.834±0.232	2.636±0.055	0.834±0.014	0.696±0.024	0.4143±0.0135	0.356±0.018	0.4141±0.0136
60	7.128±0.061	3.162±0.072	0.852±0.003	0.727±0.006	0.4978±0.0095	0.425±0.007	0.4975±0.0193
75	7.708±0.061	4.272±0.106	0.886±0.003	0.773±0.027	0.6286±0.0120	0.557±0.012	0.6286±0.0120
90	8.302±0.094	5.196±0.088	0.918±0.005	0.844±0.009	0.7131±0.0078	0.655±0.010	0.7130±0.0078

Table 2 (i-v): Comparative table of Log L and Log W values of *Ctenopharyngodon idella* fed with conventional and different combinations of formulated fish feed

i) 100% Conventional fish feed

Duration (in days)	Values of Log L	Values of Log W by reading	Values of Log W by formula
30	0.7298±0.0099	0.2422±0.0124	0.2420±0.0123
45	0.7940±0.0273	0.3815±0.0251	0.3815±0.0251
60	0.8321±0.0062	0.4666±0.0051	0.4665±0.0051
75	0.8527±0.0148	0.5481±0.0068	0.5479±0.0068
90	0.8671±0.0090	0.5730±0.0047	0.5729±0.0046

ii) 25%Formulated fish feed

Duration (in days)	Values of Log L	Values of Log W by reading	Values of Log W by formula
30	0.7326±0.0083	0.2536±0.0078	0.2535±0.0078
45	0.7943±0.0295	0.3847±0.0302	0.3846±0.0302
60	0.8493±0.0130	0.4958±0.0161	0.4958±0.0161
75	0.8773±0.0060	0.6188±0.0060	0.6188±0.0059
90	0.8928±0.0030	0.6225±0.0203	0.6225±0.0201

iii) 50%Formulated fish feed

Duration (in days)	Values of Log L	Values of Log W by reading	Values of Log W by formula
30	0.7419±0.0213	0.3011±0.0640	0.3011±0.0640
45	0.8047±0.0016	0.3965±0.0142	0.3944±0.0146
60	0.8589±0.0074	0.5009±0.0076	0.5010±0.0076
75	0.8965±0.0070	0.6551±0.0093	0.6549±0.0093
90	0.9411±0.0097	0.7537±0.0122	0.7536±0.0122

iv) 75%Formulated fish feed

Duration (in days)	Values of Log L	Values of Log W by reading	Values of Log W by formula
30	0.7423±0.0193	0.2551±0.0186	0.2551±0.0186
45	0.8124±0.0076	0.4151±0.0055	0.4152±0.0054
60	0.8575±0.0123	0.5450±0.0642	0.5449±0.0642
75	0.8914±0.0093	0.6535±0.0072	0.6534±0.0073
90	0.9318±0.0052	0.7521±0.0155	0.7519±0.0154

v) 100%Formulated fish feed

Duration (in days)	Values of Log L	Values of Log W by reading	Values of Log W by formula
30	0.7333±0.0085	0.2432±0.0166	0.2420±0.0166
45	0.8340±0.0145	0.4143±0.0135	0.4141±0.0136
60	0.8528±0.0037	0.4978±0.0095	0.4975±0.0193
75	0.8866±0.0036	0.6286±0.0120	0.6286±0.0120
90	0.9187±0.0050	0.7131±0.0078	0.7130±0.0078

The length weight relationship (Table 1) is widely recognized as an important tool in fisheries sciences, especially in ecology, population dynamics, and stock management [1, 5, 6, 7, 8, 9]. These relationships permit estimating the weight of a specimen easily when only its total length is known. For this reason, these relationships are useful when rapid estimations of biomass are necessary [1, 8]. The study of the Length-Weight Relationship of any fish species have purpose to serves as basis for the calculation of unknown weight from know one of the most commonly used analysis of fisheries data is length weight relationship [10]. The length weight relationship of different fishes were carried out by many researchers, viz, *Tilapia mossambicus* [11] marine prawn [12] *Puntius stigma* [13] *Alia coila* [14] *Chanda nama* and *Chanda ranga* [15], *Botia lohachata* [16], *Rhinomugil*, freshwater fairy shrimp [18], *Labeo boga* [19] A study of length –weight relationship will have two purposes, first to establish the mathematical relation between the known, the other would be computed and the second to measure the variations from the expected weight for length of individual fish groups an indication of fatness or health [3] in aquaculture. The possible variations in the measurable and countable characters reveal the adaptation to environmental condition and help in clarifying their identity in the location of population [20].

All the species do not show the same capacity to use vegetable proteins. One can replace until 100 % of the fishmeal by the vegetable meal (Soya) to the rainbow trout [21] but a replacement of more than 20 % of the fishmeal by a vegetable meal led to a decline in the growth of the turbot [22]. However, recent studies show that, due to combinations of proteins of various vegetable sources and by the addition in the formulation limited amino acids, one can increase the part of a vegetable meal in the food of most demanding species of fishes. It will however be necessary to eliminate the most possible present antinutritional factors in vegetables, as trypsin inhibitors, tannins, lectines or Glucosinolates [23]. When these two conditions are fulfilled the balancing of amino acids in the food formula and the elimination of antinutritional factors, the need in protein is not a restrictive factor for the domestication of fish species. Length and weight data provide statistics that are cornerstones in the foundation of fishery research and management [24].

It can be seen that there is a less work was found in tank fisheries in comparison to wild fishery so this work cannot be compared with other works. Our observations are in contrast to those noted by other nutritionists those observed a decline in feed intake of lupin and soy protein isolates fed at higher than 40% inclusion levels to carp and rainbow trout [25, 26].

4. Conclusion

Values by reading and by calculations of freshwater fish *Ctenopharyngodon idella* fed with conventional and different combinations of formulated fish feed. The present study shows the highest values in all the formulated feeds as compared to the conventional feed. Table 2 depicts that the Log W values by calculation and by reading were nearly equal in all the fishes fed on formulated feed. The Log L and Log W values were found to be highest in fishes fed with formulated feed than fishes fed with conventional feed.

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