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Condition Factor and Length-weight Relationship of Pond Reared *Labeo rohita*

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Abstract:
Labeo rohita is commercially important freshwater fish, commonly known as rohu. A total of 240 samples of *Labeo rohita* collected from the twelve (12) different ponds treated with 3 concentrations of n-3 fatty acid (0.3%, 0.6%, and 0.9%), 2 levels of vitamin C (0.75g/Kg and 1.5 g/Kg) and Vitamin E (300 mg/g and 600 mg/g) were investigated for condition factor and length-weight. The relationship between length and weight of *Labeo rohita* from fish catch was calculated between the two parameters by creating correlation and regression. Weight was highly correlated with total length in all *Labeo rohita* in the current study. The minimum (0.975) and maximum (0.997) values of coefficient of determination (R^2) were noted in *Labeo rohita* collected from different ponds. Positive isometric growth was recorded in all sampled *Labeo rohita* of all treated ponds. The values of condition factor (K) calculated for, *Labeo rohita*, ranged between 0.964-1.896 in all ponds indicated the good condition of fish. It could be concluded that *Labeo rohita* attains more weight per unit of length in different ponds. These observed parameters were useful to evaluate the wellbeing of *Labeo rohita* population in the water bodies and provided useful information on fish biology for fisheries management scientifically.
Keywords: *Labeo rohita*, length-weight relationship, condition factor.

INTRODUCTION

Indian Major Carps especially *Labeo rohita* considered the world's 10th highest cultured fish by production volume. *Catla catla, Labeo rohita* and *Cirrhinus mrigala* in Pakistan are important poly cultured species because of faster growth rate, palatability, size, and superior nutritional status. Fish is a healthy diet that contains essential omega-3 fatty acids (Petricorena, 2015; Hadyait *et al.,* 2018). These essential Fatty acids must be involved in diets like the other essential amino acids which are not produced in the human body (Ismail, 2005).

Most significant biological tool in fishery management is the length-weight relationship (LWR). It is used to estimate the average weight at which a fish can achieve the given length (Lawson *et al*., 2013). Relationship between length and weight also stipulates the security of fishes (Hamid *et al*., 2015). The dissimilarity in the length-weight relationship of fish is based on body shape and individual condition. Condition factor shows the degree of security of fishes in their environment, which is expressed by the coefficient of body situation. It is a quantity of numerous biological and environmental factors with regard to their feeding conditions (Nehemia *et al*., 2012). High values of condition factor specify improved body condition. However, it is affected by season, sex, stress, food availability and water quality in the surrounding environment (Ighwela *et al*., 2011). The condition factor and length-weight relationship of *L. intermedius* have been described from numerous water sources (Melaku *et al.,* 2017).

The length-weight relationship is measured to be significant to get different kinds of information of fish in fish biology such as structure, growth rate, age, age at first maturity and segregation of stocks (Karakulak *et al.,* 2006). Length-weight relationship as character can be used in defining taxonomic units, growth and onset of maturity, developmental pattern of life like metamorphosis and to convert unknown weight from known length or vice versa because weight is a function of length (Kashyap *et al*., 2015). Condition factor value of a fish varies due to various factors like sexual maturity, food availability, sex and age of some species (Anibeze *et al.*, 2000).

Therefore, keeping in mind the scarcity of information, the present study was commenced on condition factor and length-weight of the commercially important species of major carp, *Labeo rohita* collected from different ponds that can be useful to relate the populations of the same species in various water bodies situated in the same climatic zone.

MATERIALS AND METHODS

The current study was carried out during April 2017 to November 2017 with the aim to examine the biology of *Labeo rohita* of different treated ponds. For this purpose, laboratory studies were conducted in Saline Fisheries Laboratory, Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad.

The samples of *Labeo rohita* were collected from twelve (12) different ponds treated with 3 concentrations of n-3 fatty acid (0.3%, 0.6% and 0.9%) and 2 levels of vitamin C (0.75g/Kg, 1.5 g/Kg) and Vitamin E (300 and 600 mg/g) at Fisheries Research Farms, University of Agriculture, Faisalabad. The samples were transported to the laboratory in a large polythene bag.

Length-weight relationship

About 240 individuals, of *Labeo rohita*, were sampled during April 2017 to November 2017 for condition factor and length-weight relationship. The weight and length of fish specimens were measured in gram and centimeter, respectively. The samples of *Labeo rohita* collected for the relationship (correlation and regression) between body length and total weight for each group was calculated by using formula (LeCren, 1951).

$$W = a\ L\ n$$

Where,

W =fish Weight in g

L = Total length in cm

a & n = Constants

The standard statistical procedure was used (Snedecor *et al*., 1967) to calculate the correlation coefficient (r).

Condition factor

Condition factor (K) was determined for different lengths and weights data with (Le Cren, 1951) equation

$$K = (W * 100/L^3)$$

Where,

W = Fish Weight (g)

L = Fish Standard Length (cm)

W = Fish calculated Weight (g)

The length-weight relationship was developed by using the linear equation

$$Log\ W = Log\ a + b\ Log\ L$$

RESULTS

Phytochemical screening

The length-weight relationship equations and values of correlation of coefficient (r) and their types of growth of *Labeo rohita* collected from different ponds are given in Table 1. Weight is highly correlated with total length significantly in all the populations of *Labeo rohita* in the current study where the value of the correlation of coefficient ranged between 0.951– 0.995. The minimum (0.975) and maximum (0.997) coefficient of determination (R^2) were noted in *Labeo rohita* collected from different ponds Table 1 and Figure 1(a-l) respectively. To explore the length-weight relationship towards the growth of major carp the regression models were calculated among length and weight (Table 1). The following results were achieved from these regression models. The regression coefficient calculated among weight and length of *Labeo rohita* which displayed interaction between weight and length highly significant ($P<0.01$) for all the treated ponds. The value of R^2 for all treated ponds were 0.98, 0.995, 0.997, 0.981, 0.975, 0.985, 0.994, 0.994, 0.981, 0.997, 0.980 and 0.978 respectively (Table 1).

The minimum (0.964) in pond 1 and maximum (1.894) in pond 12 value of condition factor (K) was observed. The condition factor (K) characterizes health status or security of *Labeo rohita* having a value of condition factor (K) greater than 1 are supposed to be better in health conditions. In the current study, the value of 'K' in all *Labeo rohita* under different treated ponds were found to be more than 1 which indicated the good health status of fish. The values of condition factor (K) calculated for, *Labeo rohita*, ranged between 0.964-1.891 in pond1 during 3 and 8 fortnights, 1.247-1.884, 1.225-1.583, 1.250- 1.894, 1.299- 1.891, 1.175-1.891, .192-1.602, 1.296-1.891, 1.328-1.866, 1.389-1.468, 1.334-1.866 and 1.260-1.894 in pond 2 to pond 12 respectively, under various fortnights (Table 2).

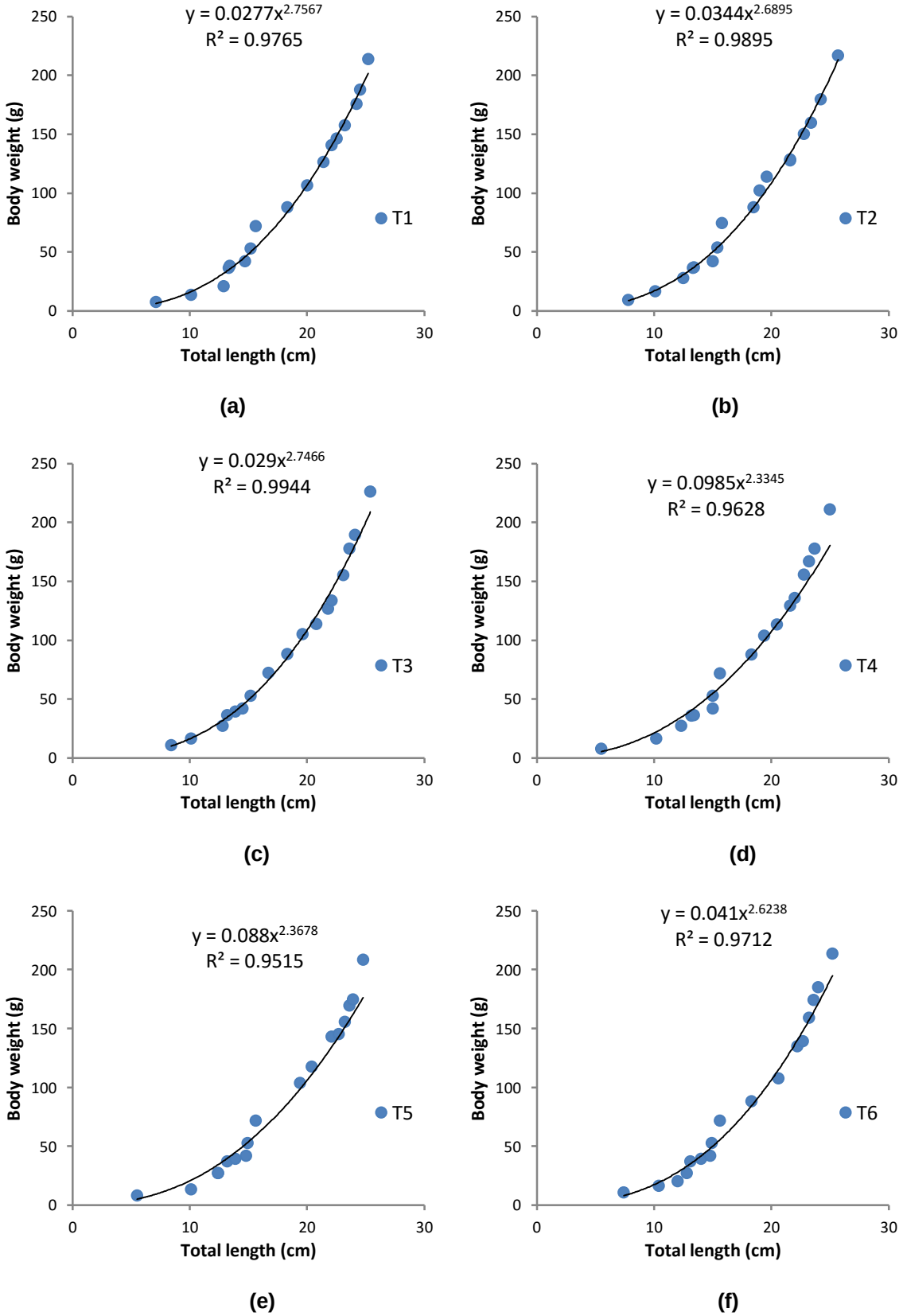
Table 1. Logarithmic regression equations of weight on length and values of the correlation coefficient for *Labeo rohita* collected from different treated ponds.

Treatment	Regression Equation	Correlation Coefficient (r)	Coefficient of determination (R^2)
T1	log W = -1.558 + 2.757 log L	0.977**	0.988
T2	log W = -1.463 + 2.690 log L	0.989**	0.995
T3	log W = -1.538 + 2.747 log L	0.994**	0.997
T4	log W = -1.007 + 2.334 log L	0.963**	0.981
T5	log W = -1.056 + 2.368 log L	0.951**	0.975
T6	log W = -1.387 + 2.624 log L	0.971**	0.985
T7	log W = -1.429 + 2.655 log L	0.988**	0.994
T8	log W = -1.573 + 2.785 log L	0.987**	0.994
T9	log W = -1.042 + 2.365 log L	0.962**	0.981
T10	log W = -1.493 + 2.723 log L	0.995**	0.997
T11	log W = -0.989 + 2.319 log L	0.960**	0.980
T12	log W = -1.118 + 2.423 log L	0.957**	0.978

** = Highly significant (P<0.01)

Table 2. Condition factor ($K=W/L^3*100$) for different ponds regarding Labeo rohita.

Fortnight	pond1	pond 2	pond 3	pond 4	pond 5	pond 6	pond 7	pond 8	pond 9	pond 10	pond 11	pond 12
2	1.310	1.592	1.582	1.555	1.320	1.449	1.564	1.330	1.592	1.649	1.640	1.390
3	0.964	1.413	1.307	1.472	1.432	1.175	1.388	1.432	1.455	1.437	1.421	1.411
4	1.547	1.551	1.583	1.565	1.437	1.307	1.602	1.575	1.413	1.554	1.334	1.326
5	1.579	1.529	1.475	1.521	1.617	1.655	1.422	1.460	1.513	1.530	1.513	1.513
6	1.328	1.247	1.384	1.250	1.463	1.432	1.241	1.296	1.328	1.407	1.394	1.356
7	1.501	1.468	1.506	1.564	1.299	1.299	1.192	1.587	1.506	1.468	1.539	1.536
8	1.891	1.884	1.550	1.894	1.593	1.593	1.550	1.891	1.866	1.884	1.866	1.894
9	1.436	1.388	1.439	1.433	1.891	1.891	1.439	1.439	1.439	1.407	1.439	1.434
10	1.334	1.487	1.398	1.426	1.426	1.439	1.353	1.401	1.391	1.405	1.381	1.438
11	1.288	1.514	1.265	1.316	1.385	1.232	1.298	1.357	1.384	1.389	1.388	1.352
12	1.303	1.265	1.225	1.285	1.328	1.235	1.313	1.407	1.271	1.407	1.356	1.418
13	1.284	1.276	1.240	1.277	1.245	1.192	1.318	1.399	1.300	1.334	1.327	1.340
14	1.263	1.266	1.260	1.314	1.249	1.275	1.317	1.365	1.324	1.307	1.260	1.318
15	1.240	1.248	1.355	1.337	1.293	1.328	1.296	1.345	1.346	1.287	1.291	1.338
16	1.278	1.267	1.355	1.337	1.281	1.339	1.298	1.313	1.378	1.290	1.298	1.314
17	1.337	1.278	1.381	1.351	1.368	1.337	1.267	1.296	1.404	1.344	1.335	1.311


y = 0.0277x^2.7567
R² = 0.9765
Body weight (g)
Total length (cm)
T1
(a)
y = 0.0344x^2.6895
R² = 0.9895
Body weight (g)
Total length (cm)
T2
(b)
y = 0.029x^2.7466
R² = 0.9944
Body weight (g)
Total length (cm)
T3
(c)
y = 0.0985x^2.3345
R² = 0.9628
Body weight (g)
Total length (cm)
T4
(d)
y = 0.088x^2.3678
R² = 0.9515
Body weight (g)
Total length (cm)
T5
(e)
y = 0.041x^2.6238
R² = 0.9712
Body weight (g)
Total length (cm)
T6
(f)

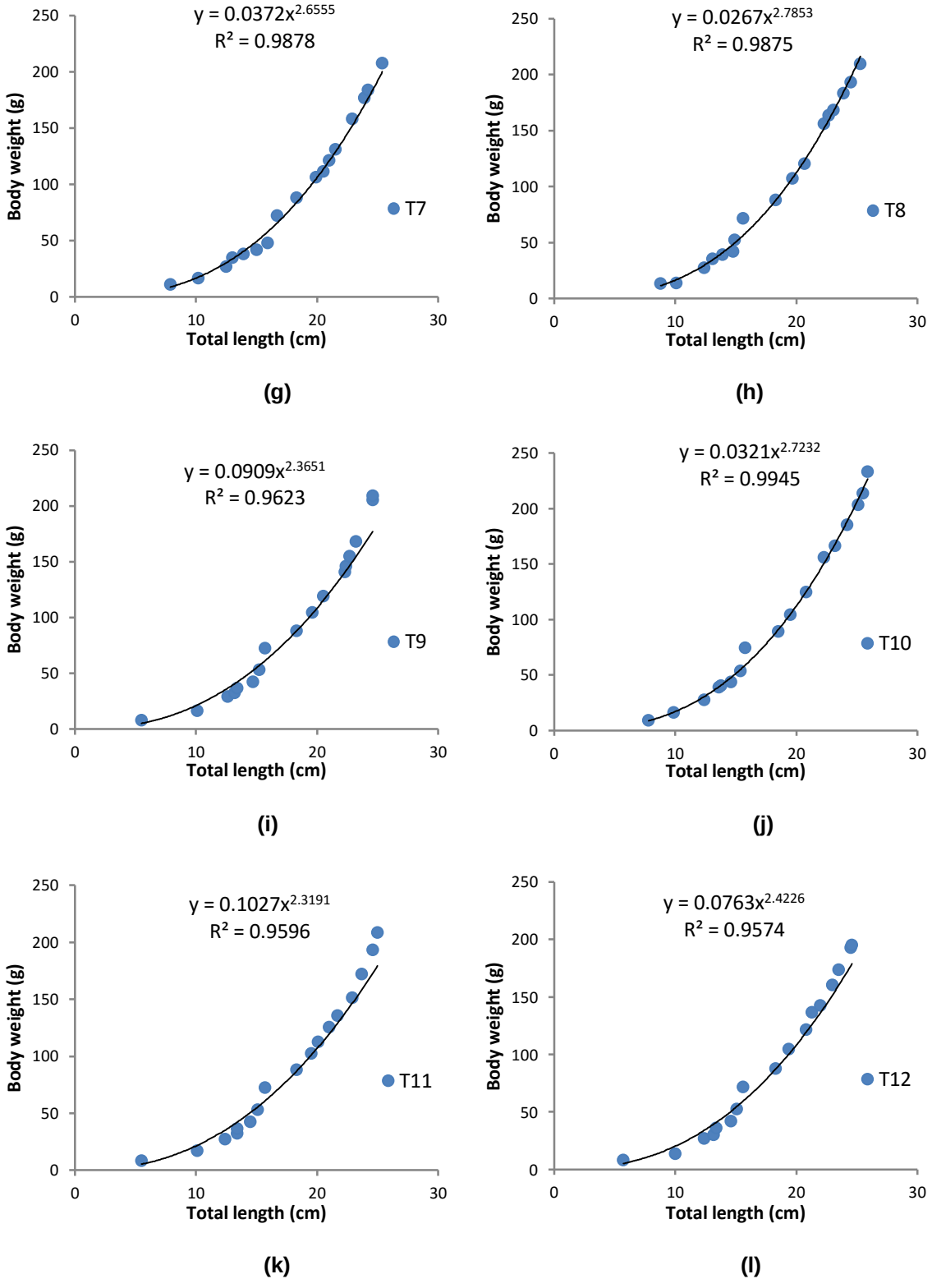


Fig. 1 (a-l). Length-weight relation of *Labeo rohita* collected from different treated ponds

DISCUSSION

Length-weight relationship in *Labeo rohita* collected from different ponds a highly positive significant relationship between weight and length was observed. The length-weight relationship in three species of major carps i.e., *Catla catla, Labeo rohita,* and *Cirrhinus mrigala* a positive significant relationship between standard body weight and body length was reported (Ujjania, 2003). The values of condition factor (K) in all *Labeo rohita* under different treatments were found to be more than 1 which directed the good health status of fish. The value of condition factor for *Labeo rohita* ranged from 0.964-1.894 in treatment no 1and 12 respectively. The length-length relationship showed both lengths are highly correlated to each other while the values of condition factor were found to be more than 1 in all individuals of the fish showed the good condition of fish (Singh *et al*., 2017). The values of condition factor in culture cobia were significantly higher as compared to wild stock (Chuang *et al*., 2010). The condition factor and length-weight relationship of *Schizopyge esocinus* and k valves can be credited to the reproductive cycle, feeding and environmental factors Fulton's condition factor (K) represents health condition or well-being of fish. The fish havinga value of more than 1 in condition factor are said to be good in health condition (Dar *et al*., 2012). In the present study, the value of 'K' in all *Labeo rohita* was found to be more than 1 which indicated the good health condition of fish collected from different ponds (Table 2). Regression coefficients obtained from length-weight relationships (L-W) which are indicative of isometric or allometric growths differ not only between species but sometimes also between stocks of same species. The development of fish involves several stages, each of which has its own length-weight relationships. There may also be differences in the relationships due to sex, maturity, season and environmental conditions. On the basis of proponent value of length-weight relation, it could be concluded that *Labeo rohita* attains more weight per unit of length in different ponds. Growth patterns of fish varied in the various water sources however, reasonably good condition factor was noted in the *Labeo rohita* of different ponds.

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CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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