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Effect of Somatotropin on Growth Performance and Protein Metabolism of Fish, *Labeorohita (Hamilton,1822)*

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ABSTRACT

Growth hormone (GH) has multiple targets and diverse effects in vertebrates. It is a principal promoter of growth, and also influences the metabolism. This paper reports the effect of exogenous Somatotropin(Growth Hormone-GH) on growth promoting efficiency, total proteins, RNA and DNA levels in fish,*Labeorohita*. The present study was conducted to assess an anabolic impactof Somatotropin (Growth Hormone-GH) on protein content and RNA levels in certain tissues *i.e.* skeletal muscle and liver of fish, *Labeorohita*. The hormone was incorporated in the diet and fed to the three groups of fish upto 40 days, in the form of three pelleted diets containing 2, 4, 6 mg GH/ kg diet along with a fourth control group fed diet without hormone. From the results obtained, it was clear that the hormone GH has promoted the growth of fish over the control. Growth performance was monitored by recording the bodyweight gain(g) and liver weight. SGR values increased with the increase of hormone dose.The present study revealed that the GH induced growth enhancement of *Labeorohita*.The highest increment in tissue Protein content, RNA and DNA content was observed under 6 mg GH/ kg diet followed by 4 mg GH/ kg diet and 2 mg GH/ kg diet in skeletal muscle and liver of fish. Hence, it was clear that the anabolic hormones such as GH play an important role in enhancing the tissue protein content for nutritional purpose of man. There was not much change in DNA levels.

Keywords: Somatotropin (Growth Hormone -GH);Weight gain; SGR; Protein content; RNA; DNA and *Labeorohita*.

INTRODUCTION

One of the major sources of animal protein for human consumption is fisheries resource. Therefore, considerable attention has been given to the production and growth of freshwater fish in aquaculture[18]. Aquaculture is one of the main food production sectors to deal with the high demand for food due to the human population explosion. Aquaculture, probably the fastest growing food-producing sector, now accounts for nearly 50 percent of the world's food fish[9]. Aquaculture plays a leading role in the fight against food insecurity, malnutrition, and poverty globally[24,26]. Primary fish culture on a large scale for a commercial purpose is to obtain faster

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tissue growth on a low budget.

The development of Aquatic Biotechnology has supported the application of experimental techniques to manipulate fish growth, as diets enriched in specific protein nutrients and administrating hormones like: prolactin, insulin and growth hormone (GH)[31].

GH is a single chain polypeptide of approximately 22 kDa, produced by the pituitary gland and with pleiotropic functions among vertebrates. It mainly regulates body growth, being also involved in reproduction, immunity and osmosis regulation in teleost fish, and in metabolism regulation through its lipolytic activity and protein anabolism in vertebrates[34].GH has also been recognized as relevant for the aquatic industry due to its role on growth and as immune stimulator[10,15].

In mammals, the GH secretion from the pituitary is under multifactorial stimulatory and inhibitory regulation by the hypothalamus, with somatostatin being the major inhibitor of both basal and stimulated GH secretion[12]. In teleost fish, a similar regulatory system seems tobe present[2,28].

Apart from GH effects on growth, the number ofbiological effects that can be attributed to GH haveexpanded greatly since its discovery. It now standsclear that as in mammals[12],GH in fish elicits a varietyof biological effects in several different tissues andcell types.Several authors stated that GH participated in nearly all main physiologic processes such as ionic and osmotic regulation; protein, lipid and carbohydrate metabolisms as well as reproduction and immune system[3,13,32].

The growth promoting effects of GH have been well documented in a variety of species of fish either as endogenous or exogenous hormone[23]. Studies investigating the use of recombinant growth hormone (rGH) for promoting growth in salmonids[22], flounder[19], tilapia[1], giant gourami[14] and many other species found that rGHable to accelerate thegrowth. The aim of this work was to quantify the effects of mammalian GH on Growth and protein synthesis in *Labeorohita*.

MATERIAL AND METHODS

Procurement and maintenance of fish:

In the present study,*Labeorohita* weighing 9-10 g were procured from State fisheries culture tanks. They were transported to the laboratory in oxygenated containers and treated with KMnO4 to avoid dermal infection and acclimatized to laboratory conditions for 10 days. The fish were fed with commercial feed once a day at a rate of 2% of body weight before and during the experimental period. The temperature was maintained at 27 ± 1°C and water in the containers was replaced by fresh water at every 24 h. During experimental period, the fish were fed with control diet (without GH) and experimental diets (GH containing diets).

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Preparation of control and Growth Hormone containing diets:

A control diet was prepared by mixing 30% of fish meal, 30% of soya bean meal, 18% of wheat bran, 13% of yellow corn, 6% of corn oil, 2% of vitamins and minerals premix and 1% of carboxymethyl cellulose(Table-1). In addition to the control diet, other three experimental diets were prepared with the addition of 2, 4 and 6 mg of GH/kg of diet. The diets were prepared by spraying the hormone dissolved in 50 ml of 95% ethyl alcohol and mixed well. Glycerin was added at 0.5%/kg by volume to render the harmful effect of the alcohol. The mixture of diet has been completely dried at room temperature and then sealed in air tight black containers and stored in refrigerator until use to avoid bacterial or fungal contamination. The diets containing GH were characterized as follows:

Diet (1): Control diet (without GH)
Diet (2): 2 mg of GH/kg of control diet.
Diet (3):4 mg of GH/kg of control diet.
Diet (4): 6 mg of GH/kg of control diet.

Table 1. Ingredients of Control Diet

Ingredients	Dry Matter (g 100 g-1)
Fish meal	**30.0**
solvent-extracted soya bean meal	**30.0**
wheat bran	**18.0**
Yellow corn	**13.0**
Corn oil	**6.0**
Vitamins	**1.0**
Minerals premix	**1.0**
Carboxymethyl cellulose (CMC)	**1.0**
Total	**100.0**

Impact of Growth Hormone on Weight gain, SGR and HSI of fish, *Labeorohita* were studied in three experimental fish groups along with control group.

Growth parameters

Growth performance was calculated as follows:

I. Weight gain/ loss was estimated by Ricker method (1975)[33]

Wt. gain = W_2 - W_1.

Where, W_1 and W_2 are the Initial and final weight of fish in grams.

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II. Specific Growth Rate (SGR) was estimated by Ricker method (1975)[33]

SGR = 100(log W_2 –log W1) / T

T - is the no. of days of the feeding period.

III.Hepatosomatic Index (HSI) was estimated by Parameswaran*et. al.* method (1974)[27]

HSI = Weight of Liver / Weight of fish x 100.

Tissue Biochemical Analysis

The biochemical parameters such as Protein, RNA and DNA were estimated in muscle and liver of the fish, *Labeorohita*. These biochemical parameters were estimated by using the following methods.

- ✓ Estimation of **TotalProtein levels** by Bradford method (1976)[5].
- ✓ **Nucleic acids** (RNA & DNA) were extracted by Munro and Fleck Method (1966)[25].
- ✓ **RNA**(Ribose Nucleic acid) was estimated byOrcinol method.
- ✓ **DNA**(Deoxyribose Nucleic acid) was estimated by Diphenylamine method.

Statistical analysis:

In order to calculate the statistical significance between the control and treated groups with different doses of GH, t - test was used.The results were statistically analyzed by using Students t-test.

RESULTS AND DISCUSSION

In the present investigation, the effect of Somatotropin (Oral mode -GH in diet) on Growth parameters such as Weight gain, SGR,HSI (Tables- 2 to 5) and biochemical parameters such as Total Proteins, RNA, DNA levels(Tables- 6 to 11)of fish, *Labeorohita,* were studied.

Growth parameters:

Different dosages of Growth hormone have been found to be enhanced the growth of fish, *Labeorohita*in the present investigation. The weight gain in fish was more at higher dosage of Somatotropin (Growth hormone -6mg/kg diet) and higher duration (40 days). The increase of fish growth difference in grams after 40 days was observed as 6.17 g in control, 7.60 g in 2 mg/kg, and 9.88 g in 4 mg/kg and 12.39 g in6mg of GH /kg diet. Using different GH treatment protocols, it has been shown that GH increases specific growth rates in length and weight in a variety of teleost species[21,29]. The increase in weight has been suggested to be caused by a GH-induced increase in appetite[16] and/or increased feed conversion efficiency[37].

In the present study, Specific Growth Rate (SGR) of control fish was 0.55±0.043; in 2 mg/kg was 0.64±0.060; in 4 mg/kg was 0.78±0.061 ($p < 0.01$) and in 6 mg/kg was 0.92±0.048 ($p < 0.001$). SGR in fish was significantly increased and more increase was at higher dosage of Growth Hormone (6mg/kg) and higher duration (40 days).Although some data indicate a positive correlation between specific growth rate and plasma GH levels. First, a relatively small increase in circulating GH levels may account for a large increase in growth rate[4]. Growth hormone (GH),

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a pituitary hormone, plays a key role in the regulation of Salmon growth[39].

Table: 2. Growth performance of fish, *Labeorohita*after Somatotropin (mg/kg feed) containing diet fed for 10 days.

S.No.	Growth Parameters	Dosages of Somatotropin (Growth hormone-GH)			
		Control	2 mg/kg	4 mg/kg	6 mg/kg
1	Initial body weight (gm)	9.41 ± 0.501	9.34 ± 0.482	9.44 ± 0.559	9.28 ± 0.491
2	Final body weight (gm)	11.29 ± 0.396	12.11 * ± 0.529	13.74 **± 0.653	15.47 ***± 0.742
	weight gain (gm)	1.88	2.77	4.30	6.19
3	Specific growth rate (SGR)	0.79 ± 0.055	1.13 ** ± 0.041	1.63 *** ± 0.060	2.22 *** ± 0.073
4	HepatoSomatic Index (HSI)	1.542 ± 0.056	1.732 NS ± 0.073	1.921 ** ± 0.104	2.428 *** ± 0.089

Each value is the Mean± SE of six individual observations.
NS: Not Significant * P < 0.05 ** P < 0.01 *** P < 0.001

Table: 3. Growth performance of fish, *Labeorohita*after Somatotropin (mg/kg feed) containing diet fed for 20 days.

S.No.	Growth Parameters	Dosages of Somatotropin (Growth hormone-GH)			
		Control	2 mg/kg	4 mg/kg	6 mg/kg
1	Initial body weight (gm)	9.29 ± 0.537	9.36 ± 0.496	9.33 ± 0.577	9.41 ± 0.422
2	Final body weight (gm)	12.12 ± 0.558	12.69 *± 0.650	14.10 **± 0.654	15.58 *** ± 0.501
	weight gain (gm)	2.83	3.33	4.77	6.17
3	Specific growth rate (SGR)	0.58 ± 0.037	0.66NS ± 0.053	0.89 ** ± 0.049	1.09 *** ± 0.037
4	Hepato Somatic Index (HSI)	1.612 ± 0.067	1.941* ± 0.109	2.368 ** ± 0.094	2.617 *** ± 0.086

Each value is the Mean± SE of six individual observations.
NS: Not Significant * P < 0.05 ** P < 0.01 *** P < 0.001

Table: 4. Growth performance of fish, *Labeorohita*after Somatotropin (mg/kg feed) containing diet fed for 30 days.

S.No.	Growth Parameters	Dosages of Somatotropin (Growth hormone-GH)

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		Control	2 mg/kg	4 mg/kg	6 mg/kg
1	Initial body weight (gm)	9.33 ± 0.574	9.42 ± 0.478	9.38 ± 0.744	9.44 ± 0.650
2	Final body weight (gm)	13.14 ± 0.582	14.78 *± 0.411	16.71 **± 0.630	18.11 *** ± 0.401
	weight gain (gm)	3.81	5.36	7.33	8.67
3	Specific growth rate (SGR)	0.50 ± 0.031	0.65 * ± 0.055	0.83 *** ± 0.036	0.94 *** ± 0.057
4	Hepato Somatic Index (HSI)	1.725 ± 0.107	2.142 ** ± 0.088	2.536 ** ± 0.095	2.941 *** ± 0.113

Each value is the Mean± SE of six individual observationsNS: Not Significant * P < 0.05 ** P < 0.01 *** P < 0.001

Table: 5. Growth performance of fish, *Labeorohita*after Somatotropin (mg/kg feed) containing diet fed for 40 days.

S.No.	Growth Parameters	Dosages of Somatotropin (Growth hormone-GH)			
		Control	2 mg/kg	4 mg/kg	6 mg/kg
1	Initial body weight (gm)	9.24 ± 0.544	9.41 ± 0.498	9.36 ± 0.657	9.33 ± 0.561
2	Final body weight (gm)	15.41 ± 0.706	17.01 **± 0.585	19.24 ***± 0.482	21.72 *** ± 0.629
	weight gain (gm)	6.17	7.60	9.88	12.39
3	Specific growth rate (SGR)	0.55 ± 0.043	0.64^{NS} ± 0.060	0.78** ± 0.061	0.92 *** ± 0.048
4	Hepato Somatic Index (HSI)	1.823 ± 0.138	2.019 ** ± 0.110	2.452*** ± 0.164	2.783 *** ± 0.180

Each value is the Mean± SE of six individual observationsNS: Not Significant * P < 0.05 ** P < 0.01 *** P < 0.001

Hepatosomatic Index (HSI) in fish was significantly increased. HSI in control was 1.823±0.138, in 2 mg/kg was 2.019±0.110 ($p < 0.01$), in 4 mg/kg was 2.452±0.164 ($p < 0.001$) and in 6 mg/kg was 2.783±0.180($p < 0.001$). HSI in Fish was more at higher dosage of GH (6 mg/kg) and higher duration (40 days). Hepatosomatic index (HSI) is another biological parameter that helps in studying growth of fish. Hepatosomatic index of the Nile tilapia; *Oreochromisniloticus* collected from the different studied sites showed progressive natural increase appeared in the untreated control and treated fish that amounted to a significant increase in the treated fish[38].

According to the obtained results, Growth hormone in different dosages affected fish growth.

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Higher dosage (6 mg/kg) showed the most positive effects from point of view of all growth parameters.The study clearly indicated that the inclusion of the growth hormone, Somatotropin in the diets significantly enhanced the growth performance of *Labeorohita.* However, significantenhancement among the treatment groups was observed in weight gain, SGR and HSI. Higher dosage of 6 mg/ kg was estimated as more effective in growth performance. These findings suggested that GH can be used as growth-promoting agent for young *Labeorohita* for at least 40 days.

Biochemical Analysis

The biochemical contents such as total proteins, RNA,and DNA levels were estimated in response to the different dosages of Growth Hormone for 10 days, 20 days, 30 days, and 40 days.

In the present study, the effect of Somatotropin (Growth Hormone-GH) on Total Proteins, RNA (Ribose Nucleic acid), DNA (Deoxyribose Nucleic acid) in Skeletal Muscle and Liverof Labeo*rohita* were studied up to 40 days (10,20,30& 40 days). The variations of Total Proteins, RNA, and DNA in different tissues were given in Tables(6 to 11) in terms of SEM (Mean± SE) along with control. The results were statistically analyzed using Student's t-test, all data were presented as Mean ± SE. P values were determined using the t - statistics and denoted as NS- Not Significant, * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Protein levels in different tissues:

At the end of experimental durations, Protein levels in different tissues were significantly increased. The increase of protein levels was more at a higher dosage of Growth Hormone (6mg/kg) and a higher duration (40 days). The order of increase was observed at higher dosage (6mg/kg) and longer duration (40 days) as Liver (66.53%; $P < 0.001$) > Muscle (44. 98%; $P < 0.001$) of fish. The present study revealed that improvement in the quality of flesh in terms of higher protein after the fed of GH up to 40 days. Silverstein et al., (2000)[36]found that recombinant bGH (Bovine Growth Hormone) injection induced protein and lipid content in USDA-103 strain and Norris strain of channel catfish. Whereas, Peterson et al., (2004)[30] observed no effect of recombinant bGH injection on body composition in NWAC103 strain and Norris strain of channel catfish. In rainbow trout, GH increases white muscle and whole body protein accretion along with a stimulatory effect of GH on muscle growth[6,11]. According to Liu et al. (1999)[20], crude protein and crude fat content of muscle in flounder were increased by feeding recombinant yeast containing salmon GH. Donaldson et al. (1979)[7] suggested that exogenous GH enhances fish growth by stimulating appetite and then improving feed and protein conversion.

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Table: 6. Protein content in Muscleof *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0mg/kg)	**Mean**	73.100	74.590	75.600	76.210
	SE	± 1.378	± 1.987	± 1.874	± 1.785
2mg/kg	**Mean**	74.150^{NS}	79..210 *	82.140 **	85.890 ***
	SE	± 1.790	± 1.846	± 1.957	± 1.885
	%V	1.44	6.19	8.65	12.70
4mg/kg	**Mean**	78.110 *	87.500 **	92.410 ***	99.100 ***
	SE	± 1.765	± 1.781	± 1.603	± 1.710
	%V	6.85	17.31	22.24	30.04
6mg/kg	**Mean**	86.750 ***	90.170 ***	98.560 ***	110.490 ***
	SE	± 1.839	± 1.862	± 1.939	± 2.020
	%V	18.67	20.89	30.37	44.98

Each value is the Mean ± SE of six individual observations. Values are expressed as mg of protein/gram wet weight of tissue. SE - Standard Error, %V- Percent variation, NS: Not Significant, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table: 7. Protein content in Liver of *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0 mg/kg)	**Mean**	52.480	53.410	53.990	55.100
	SE	± 1.845	± 1.781	± 1.523	± 1.627
2 mg/kg	**Mean**	55..100 ^{NS}	58.900 *	63.890 **	69.210 ***
	SE	± 1.708	± 1.698	± 1.910	± 1.843

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	%V	4.99	10.28	18.34	25.61
4 mg/kg	**Mean**	61.270 **	69.120 **	73.870 ***	82.230 ***
	SE	± 1.911	± 1.807	± 1.718	± 1.836
	%V	16.75	29.41	36.82	49.24
6 mg/kg	**Mean**	67.720 ***	76.410 ***	79.110 ***	91.760 ***
	SE	± 1.558	± 1.483	± 1.752	± 1.517
	%V	29.04	43.06	46.53	66.53

Each value is the Mean ± SE of six individual observations.Values are expressed as mg of protein/gram wet weight of tissue.
SE - Standard Error, %V- Percent variation, NS: Not Significant, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

RNA levels in different tissues

In the present study, the Nucleic acid levels (RNA) in different tissues like Muscle and Liver were observed under different dosages of Somatotropin (GH). There was a significant increase in RNA levels in all tissues at all durations and in all different dosages were observed. The order of increase in different tissues when exposed to different dosages was observed as Muscle (83.39%, $p < 0.001$)>Liver (69.32%, $p < 0.001$) of fish. An increase of RNA amount was more at a higher dosage of Somatotropin (GH- 6mg) and a higher duration (40 days). Similar results were observed that the RNA arising in larger quantity is instrumental in turning out a greater quantity of protein[10].

A raise in RNA content in the tissues of *Labeorohita*would reflect the induced synthesis of nucleic acids. This clearly evidences that the protein synthesis machinery of the fishes has been adversely affected. GH injections stimulate IGF-I mRNA expression in several tissues of fish[8,35]. The same result showed that increased growth is represented by an increase in protein and with constant DNA and increased RNA[29].

Table: 8.RNA levels in Muscle of *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0 mg/kg)	**Mean**	2.160	2.270	2.410	2.890
	SE	± 0.090	± 0.081	± 0.097	± 0.087

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2 mg/kg	**Mean**	2.340^{NS}	2.760 *	3.010 **	3.980 ***
	SE	± 0.098	± 0.096	± 0.102	± 0.130
	%V	8.33	21.59	24.90	37.72
4 mg/kg	**Mean**	2.680 *	3..120 **	3.600 ***	4.510 ***
	SE	± 0.106	± 0.125	± 0.145	± 0.125
	%V	24.07	37.44	49.38	56.06
6 mg/kg	**Mean**	3.110 ***	3.710 ***	4.200 ***	5.300 ***
	SE	± 0.104	± 0.110	± 0.108	± 0.100
	%V	43.98	63.44	74.27	83.39

Each value is the Mean ± SE of six individual observations.Values are expressed as mg of RNA/gram wet weight of tissue.SE - Standard Error, %V- Percent variation. NS: Not Significant, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table: 9.RNA levels in Liver of *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0 mg/kg)	**Mean**	3.310	3.430	3.520	3.650
	SE	± 0.234	± 0.179	± 0.185	± 0.220
2 mg/kg	**Mean**	3.520^{NS}	3.670 *	4.110 *	4.600 *
	SE	± 0.266	± 0..335	± 0.190	± 0.266
	%V	6.34	7.00	16.76	26.03
4 mg/kg	**Mean**	4.010 ^{NS}	4.340 *	4.830 **	5.510 **
	SE	± 0.322	± 0.252	± 0.249	± 0.276
	%V	21.15	26.53	37.22	50.96
6 mg/kg	**Mean**	4.420 *	4.700 **	5.380 ***	6.180 ***
	SE	± 0.244	± 0.271	± 0.196	± 0.290
	%V	33.53	37.03	52.84	69.32

Each value is the Mean ± SE of six individual observations.Values are expressed as mg of

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RNA/gram wet weight of tissue.SE - Standard Error, %V- Percent variation. NS: Not Significant, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

DNA levels in different tissues

The present study revealed that DNA levels in different tissues like Muscle and Liver were not changed much under different dosages of GHeven at higher dosages (6 mg/kg) and higher duration (40 days).DNA binding activity by STAT5 (signal transducers and activators of transcription5) was evident in fat but not muscle tissue samples. Likewise, significant GH-dependent IGF-I mRNA expression was only detectable in adipose tissue, whereas mRNA expression tended to increase in muscle and fat, respectively[17].

Table: 10.DNA levels in Muscle of *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0 mg/kg)	**Mean**	0.710	0.720	0.730	0.720
	SE	± 0.010	± 0.014	± 0.026	± 0.022
2 mg/kg	**Mean**	0.700^{NS}	0.710^{NS}	0.720^{NS}	0.730^{NS}
	SE	± 0.015	± 0.023	± 0.032	± 0.046
4 mg/kg	**Mean**	0.720^{NS}	0.730^{NS}	0.740^{NS}	0.730^{NS}
	SE	± 0.029	± 0.018	± 0.042	± 0.034
6 mg/kg	**Mean**	0.730^{NS}	0.720^{NS}	0.730^{NS}	0.730^{NS}
	SE	± 0.013	± 0.025	± 0.027	± 0.029

Each value is the Mean ± SE of six individual observations.Values are expressed as mg of DNA/gram wet weight of tissue. SE - Standard Error, NS: Not Significant.

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Table: 11.DNA levels in Liver of *Labeorohita* fed with diet containing different levels of Somatotropin (mg/kg feed).

GH/Kg diet		**Days of feeding Somatotropin (Growth Hormone-GH) along with diet**			
		10 days	**20 days**	**30 days**	**40 days**
Control (0 mg/kg)	**Mean**	0.620	0.600	0.610	0.610
	SE	± 0.011	± 0.022	± 0.027	± 0.013
2 mg/kg	**Mean**	0.610^{NS}	0.620^{NS}	0.630^{NS}	0.620^{NS}
	SE	± 0.015	± 0.017	± 0.012	± 0.019
4 mg/kg	**Mean**	0.630^{NS}	0.610^{NS}	0.630^{NS}	0.620^{NS}
	SE	± 0.012	± 0.014	± 0.018	± 0.022
6 mg/kg	**Mean**	0.620^{NS}	0.630^{NS}	0.640^{NS}	0.630^{NS}
	SE	± 0.019	± 0.024	± 0.020	± 0.027

Each value is the Mean ± SE of six individual observations.Values are expressed as mg of DNA/gram wet weight of tissue. SE - Standard Error, NS: Not Significant.

CONCLUSION

The purpose of this present study was to ascertain the anabolic effect of Somatotropin (Growth Hormone-GH) on fishgrowth and protein metabolism. Based on the results obtained from the present investigation, it was concluded that Somatotropin elevated protein and RNA levels in different tissues of *Labeorohita.* Hence, it is clear that the anabolic hormones such as Growth Hormone play an important role in enhancing the tissue protein content in fish for the nutritional purpose of man.

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