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Research Article

GROWTH, FOOD UTILIZATION RESPONSES AND SURVIVAL RATE OF INDIAN MAJOR CARP, *LABEO ROHITA* (HAMILTON) FINGERLINGS UNDEREXPOSURE OF COW URINE DISTILLATE

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ABSTRACT

Objective: The study evaluated the effect of cow urine distillate (CUD) of different breeds on the growth performance and food utilization of Indian major carp *Labeo rohita* fingerlings.

Methods: Fishes were exposure with different CUD in the medium at 0.1% (v/v) as C (Without CUD), T1 (Gir), T2 (Haryana), and T3 (Holstein Friesian [HF] crossbred) for 7 days, a study was conducted. Various growth, food utilization parameters and mortality were examined at 10, 20 and 30 days, respectively, of post-exposure of CUD.

Results: The results showed that Gir CUD was a more effective to compare with Haryana and HF crossbred CUD. The maximum growth rate of 0.0160 mg/daywas observed in the *L. rohita* fingerlings treated with Gir CUD treated fingerlings when compared with control. The maximum feeding rate of 0.0039 mg/body wt/day was observed in the same group. The survival rate of 90% was observed in the same treated group when compared with 60% survival rate in control.

Conclusion: Our results indicate that growth parameter and food utilization parameter values were increased significantly due to CUD exposure while comparing with control group. In addition, levels of growth rate, feed conversion rate, percentage increased body weight, and specific growth rate were also increased in the treatment groups.

Keywords: Aquaculture, *Bos indicus*, Cow urine distillate, Indian cow breeds, *Labeo rohita.*

INTRODUCTION

Aquaculture is the fastest growing food-producing sector in the world [1]. Globally, production from capture fisheries has level at the same time as the world human population continues to grow. Aquaculture has the potential to make a significant contribution to the increasing demand for aquatic food in many regions of the world [2-5]. During recent decades, there is significant progress in the aquaculture sector characterized by intensified production and new species. Scientific achievement, production technology, including breeding and feeding, have been important factors contributing to this progress. A healthy population of armed fish has also been a decisive factor for increased production. It is more and more accepted that a favorable health situation is crucial for aquaculture-related to food security. One reason for this is recognition of the fact that aquaculture industries in some countries have faced challenges due to microbial infections in aquatic environments. Diseases with high morbidity and mortality have caused significant economic losses in fish farming. This applies to many levels of the industry, from individual fish farms to countries [6-9].

Labeo rohita, (Rohu) an Indian major carp is one of the most preferred species in the subcontinent, which contributes about 35% of the total production [10-12]. *L. rohita* is the highly valued of all carp species farmed using traditional or modern aquaculture systems in the Indian subcontinent. It has been introduced to other areas of India beyond its natural range for aquaculture. Rohu is likely to become an even more important aquaculture species in near future, as research on selective breeding of rohu in India lead to the availability of the seed of faster growing strains. Monoculture of rohu in cages, pens, running waters, and closed re-circulatory systems might be possible. Both fresh and processed rohu might then become significant commodities with much wider markets. Hence, this study objective of stimulating growth of rohu with cow urine distillate (CUD) is having more socio-economic importance.

Indigenous cattle or Zebu cattle or *Bos indicus* is considered as sacred in Indian literature because its products like urine, dung, milk, curd, and butter has many wonderful medicinal properties [13]. Among these products cow urine has recently caught the attention of the researchers and a lot of work is going on its medicinal properties. Cow urine has certain volatile and nonvolatile components, which might have very high antimicrobial activity [14]. Urine of cow contains all the beneficial elements, so it is natural and universal medicine that fulfills the deficiency of the elements in the body. Cow urine consists of few important components such as estrogen [15], phosphorus [16], nitrogen [17], chloride [18], potassium [19], calcium [20], urinary proteins [21], and pheromones [22]. Since the difference in the isomers of casein has been reported by Keith Woodford [23] as devil in the milk, this study has been focused on finding the differences between the growth potentiating effect of CUD of Indian cow breeds and the Holstein Friesian (HF) crossbred cow in *L. rohita* fingerlings.

METHODS

Fish and their maintenance

Fingerlings of *L. rohita* weighing (1.0 g±0.2 g) and length (5 cm±0.2 cm) of both sexes were procured from S.M Fish farm, Swamimalai, Kumbakonam. Fishes were brought to the wet laboratory and acclimatized for 1 week before experimentation. Chorine free water was used throughout the course of the experiment. Glass aquaria were washed and then sundried to avoid fungal contamination. Healthy fishes were then transferred to glass aquaria (volume 20 L). They were regularly fed with formulated food and the medium was changed daily to remove feces and food remnants.

Mode of feeding

Each of the growth treatment was fed with formulated feed of 2% total body weight [24]. The fish were fed twice a day for an hour between 9.00 to 10.00 am and 4.00 to 5.00 pm.

Collection of cow urine
Six disease free cows of each breed were selected for the study for urine collection. The early morning (4.00-5.00 am) first urine of Gir, Haryana and HF crossbred cattle was collected from Goshala, Sri Vittal Rukmini Samsthan, Govindapuram, near Kumbakonam as the three breeds were maintained with same feed and other facilities in that Goshala. The urine of each was pooled, separately and transported to the laboratory in airtight sterile containers.

CUD
Different breeds of cow urine were distilled at 50-60°C using by glass multiple distillation apparatus [25]. Care was taken that all the three breed cow urine was distilled at the same temperature and same duration simultaneously.

Experimental setup
After 2 weeks of acclimatization three groups of fish were treated, each with Gir (T_1), Haryana (T_2), and HF crossbred (T_3) CUD at 0.1% concentration, respectively. A control group was maintained separately without cow urine treatment [26].

Morphological analysis
The length and weight of the fishes were measured individually. The fishes were weighed by the digital electronic balance of mg sensitivity (Systronics, India). The ruler was used to measure the total length from head and tip of the caudal fin. The fingerlings were released in water immediately after body measurements.

Growth parameters
The growth parameters were calculated by using the following formulae [27].

Growth=Final weight−Initial weight (mg)

$$\text{Growth rate}=\frac{\text{Weight gain}}{\text{Number of days} \times \text{initial weight}}\left(\text{mg / day}\right)$$

$$\text{Specific growth rate}=\frac{\text{Ln final weight} - \text{Ln initial weight}}{\text{Number of days}}\times 100$$

$$\text{Percentage of increase in body weight}=\frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}}\times 100$$

$$\text{Average daily growth}=\frac{\text{Final body weight} - \text{Initial body weight}}{\text{Number of feeding days}}(\text{mg/day})$$

Food utilization parameters
Every day the fish were fed with known quality of feed and on the next day the unfed was collected and dried at 60°C in a hot air oven (Modern, India) and weighed. The daily fecal matter was also collected, dried and weighed in a similar way [27].

$$\text{Feeding rate}=\frac{\text{Total dry food consumed}}{\text{Number of days} \times \text{initial live weight of fish}}\left(\text{mg / g/body wt / day}\right)$$

$$\text{Food absorbed}=\text{Food consumed}-\text{faeces produced}\left(\text{mg / g/body wt / day}\right)$$

$$\text{Absorption rate}=\frac{\text{Total food absorbed }\left(\text{dry}\right)}{\text{Number of days}\times\text{initial live weight of fish}}$$

$$\text{Absorption efficiency}=\frac{\text{Food absorbed}}{\text{Food consumed}}\times 100$$

$$\text{Gross conversion efficiency }\left(\text{K1}\right)=\frac{\text{Growth rate}}{\text{Feeding rate}}\times 100$$

$$\text{Net conversion efficiency }\left(\text{K2}\right)=\frac{\text{Growth rate}}{\text{Absorption rate}}\times 100$$

Survival rate
Survival rate is calculated by following formulae:

$$\text{Survival rate}=\frac{\text{Initial number of fish} - \text{mortality}}{\text{Initial number of fish}}\times 100$$

Statistical analysis
The results of these studies were expressed as mean±standard error. The significance of sample mean between control and CUD treated fish was analyzed one-way analysis using SPSS (version 21, USA). Differences were considered significant at $p<0.05$.

RESULTS

Growth performance
The growth response of *L. rohita* in terms of increase in body weight, growth rate, specific growth rate (SGR) are presented in Tables 1 and 2. The experiments revealed that on the 30th day, the highest growth rate of 0.0016 mg/day was recorded in T_1 ($p<0.05$). Fig. 1 when compared with 0.0107 mg/day of control, T_2 0.0151 mg/day and T_3 0.0146 mg/day. The maximum increase in length was recorded in T_1 (5.2 cm±0.3018 cm) followed by T_3 (5.15 cm±0.03 cm), T_2 (5.13 cm± 0.25 cm) and control (5.03 cm±0.30 cm).

Food utilization parameters
The effect of CUD on *L. rohita* fingerlings in food utilization parameters such as feeding rate, food absorbed, absorption rate, absorption efficiency, gross conversion efficiency, and net conversion efficiency were shown Table 2. The food utilization parameters were significantly higher

Table 1: Effect of cow urine distillate of different breeds on the growth parameters of *Labeo rohita* fingerlings

Parameters	Control	T_1	T_2	T_3
Initial weight W_1 (g)	0.428±0.0269	0.427±0.1059	0.426±0.0084	0.426±0.0195
Final weight W_2 (g)	0.566±0.0355	0.632±0.0.0292*	0.62±0.0374	0.613±0.1897
Initial length (cm)	3.29±0.2183	3.20±0.1563	3.33±0.1337	3.36±0.1897
Final length (cm)	4.25±0.4370	4.9±0.2636*	4.46±0.314	4.58±0.3188
Growth W_1-W_2 (g)	0.138	0.205	0.194	0.187
Growth rate (mg/day)	0.01074	0.0160	0.0151	0.0146
Average daily growth	0.0046	0.0068	0.0064	0.0062
Percentage of increase in body weight (%)	32.24	48.00	45.53	43.89
Specific growth rate (%)	0.4588	0.5691	0.4780	0.4893
Survival rate (%)	60	90*	70	75
Mortality (%)	40	10	30	25

Data represent mean±SD (n=12). *Significant, $p<0.05$. SD: Standard deviation

in experimental fishes treated with CUD when compared to the controls. It was noted that highest feeding rate of 0.0039 mg/day was observed in T_1, which is significantly higher ($p<0.05$) when compared with the control which feeding rate is 0.0033 mg/day (Table 2 and Fig. 2).

Survival rate

The survival during the experimental study was high in all the treatments when compared to control (Table 1). The mortality was recorded at 10 days interval. The highest survival rate of 90% was recorded in the T_1, which is significantly higher ($p<0.05$) than the untreated control group and T_2 and T_3 having a survival rate of 75% and control 60% (Fig. 3).

DISCUSSION

Aquaculture is emerging as one of the most viable and promising sector for providing nutritional and food security to the human [6,8,9,29]. Rohu is important among the three Indian major carp species used in carp polyculture systems. Its high growth potential coupled with high consumer preference an high nutritive value have established rohu as the most important freshwater species cultured in India and other adjacent countries in the region. Rohu fingerlings treated with different breeds of CUD has significantly higher weight gain, growth, growth rate and higher feed conversion ratio showed better performance of fish than that of fish untreated CUD groups. This study demonstrated that the CUD is effective on *L. rohita* fingerlings for best growth performance, and the most effective is Gir breed. The chemicals, adversely affect aquatic fauna. In spite of this, chemicals and hormones are also used as growth promoters to increase food utilization in fishes and to achieve high growth and production in fishes [10,30,31]. Different authors reported the suitability of food components of both plant and animal origin for their ability to contribute better growth performance in cultured stocks [32]. In this study, the highest but similar SGR was found in T_1, T_2, T_3 and then the control groups, this may be correlated with the fact that CUD is better utilized by *L. rohita* fingerlings. This observation is in agreement with Sattanathan and Venkatalakshmi [33], who reported that growth and feed efficiency of carp were highest when exposure the CUD of different breeds. Padmapriya and Venkatalakshmi [26], Vasanthi and Venkatalashmi, [34] also reported that cow urine exposure registered maximum growth performance in *Cirrhinus mrigala.* In this study, we found that from T_2 group to T_1 group SGR increases, again T_3 to control it decreases. It clearly shows a higher growth almost at similar inclusion level of Gir CUD.

Among the expansion promoters, Ca plays a significant role in growth promoting on fishes. Moni *et al.* (1990) reportable to accrued levels of Ca+ and hardness is additionally found to be having a positive influence over growth promoters of carp. Similar results were additionally created by Navarathinam [35] and Marimuthu [37] in *Catla catla* and *L. rohita* severally. Gomutra has been reportable to contain Ca^+ and thus it should be the explanation of the promotion of growth [20]. Cow urine is the important source of micronutrients like ascorbic acid and minerals that plays important roles in improving immune function. It improves growth as evident from good health, feed conversion and survival, resisting stress and oxidation [33]. Relatively higher percentage of survival rate in Gir CUD exposed groups as compared to control may be due to oxidative stress not induced by ammonia. Although no work has performed in this aspect, possible interaction of different breeds of CUD in the exposure to be interesting and needs further study. A similar trend was also noticed for FCR. Higher FCR was observed in T1 groups when compared to control.

Cow dung is found to be an effective source of organic fertilization that completely influences the expansion performance of major carps of fish production [37]. Pond fertilization could be a management protocol to boost biological productivity exploitation each organic manure and inorganic chemical fertilizers. Analysis of fertilizer price of various organic manure (pig, cow, chicken and green manure) has been a topic of analysis in cultivation.

Table 2: Effect of cow urine distillate of different breeds on the food utilization parameters of *Labeo rohita* fingerlings

Parameters	Control	T_1	T_2	T_3
Feeding rate (mg/day)	0.0033	0.0039*	0.0032	0.0036
Food absorbed (mg/day)	0.0021	0.0028	0.0020	0.0014
Absorption rate (mg/day)	0.0091	0.0022	0.0016	0.0011
Absorption efficiency (mg/day)	5.08	5.62	4.44	3.43
Gross conversion efficiency (%)	321.98	402.28	403.10	464.12
Net conversion efficiency (%)	633.7	751.73	907.70	969.25

*Significant, $p<0.05$, (n=12)

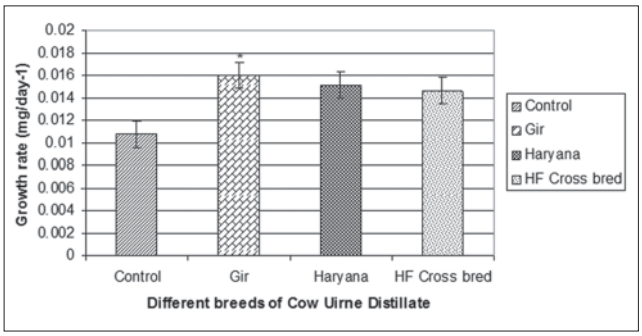

Fig. 1: Effect of cow urine distillate (CUD) of different breeds on growth rate of *Labeo rohita* fingerlings. *denote significant differences ($p<0.05$) between CUD treatments on 30th day

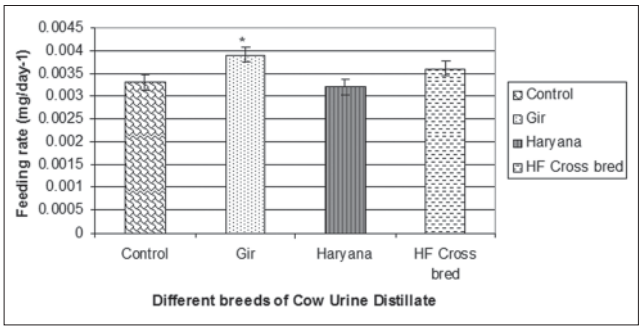

Fig. 2: Effect of cow urine distillate (CUD) of different breeds on feeding rate of *Labeo rohita* fingerlings. *denote significant differences ($p<0.05$) between CUD treatments on 30th day

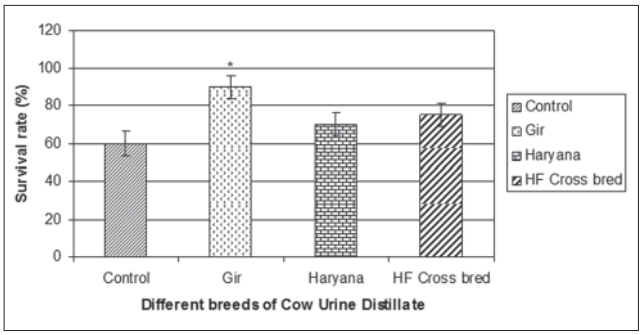

Fig. 3: Effect of cow urine distillate (CUD) of different breeds on survival rate of *Labeo rohita* fingerlings. *denote significant differences ($p<0.05$) between CUD treatments on 30th day

The growth and survival of rohu supplemented with manure compared with manure or substrate alone have been reported by many researchers [38]. Various factors influence the food utilization of fishes. The factors like temperature [39] and growth stimulating factors are found to influence food consumption, growth and conversion potency

in fishes. CUD has nutrients and hormones, which are stimulating factor, may be induced growth in *L. rohita* fingerlings. The results indicate indigenous breed CUD is better than exotic breed CUD.

Garg *et al.* [40] evaluated the result of distilled cow urine on the nutrient utilization by the white leghorn layers. The results showed that there were gradually increase in feed intake, shriveled feed conversion quantitative relation and feed potency quantitative relation. Edibleness of dry matter, crude protein, ether extract, crude fiber and organic matter increased considerably within the cow urine treatment. Padmapriya and Venkatalakshmi [26], Vasanthi and Venkatalakshmi [34] reported an increase in growth rate of *C. mrigala* fingerlings treated with the different breeds of cow urine. Sattanathan and Venkatalakshmi [33,41] according to an increase in growth rate, food utilization and survival rate of *L. rohita* fingerlings treated with the various concentration of CUD. However, the results of the present study reveal that the higher survival of 90% and growth rate was increased by the use of CUD of Gir maximally through there is an increase in all the treatments. This reveals the exposure of Gir CUD is better for increased survival rate of *L. rohita* fingerlings.

As literature reveals, this study also confirms the potential of CUD in promoting the health, which was expressed as good survival rate, increased growth rate and feeding rate. Hence, this study suggests the CUD of Gir as the best Gir CUD for enhancement of growth and food utilization parameters in *L. rohita.*

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