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Effects of feeding detoxified rubber seed meal on growth performance and haematological indices of *Labeo rohita* (Hamilton) fingerlings

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ABSTRACT

A feeding trial was conducted for 60 days to study the effect of detoxified rubber seed meal as protein source in the diet of *Labeo rohita* fingerlings on growth performance and haematological indices. One hundred and eighty fingerlings (22.5 ± 7.7 g) were equally distributed in four experimental groups having three replicates each. The experiment was conducted in FRP tanks of 500 L capacity each and temperature range was 22.6–28.5 °C. Four isoproteinous (329.9–323.1 g/kg) and isocaloric (17.0–18.0 MJ/kg) diets were prepared with detoxified rubber seed meal incorporated at the level of 0 g/kg (control diet), 100 g/kg (diet T1), 200 g/kg (diet T2) and 300 g/kg (diet T3) of diet. The growth parameters such as weight gain, feed conversion ratio (FCR), protein efficiency ratio (PER), specific growth rate (SGR) and survival rate were monitored in the study period. Blood samples were collected to determine the different haematological indices like total red blood cells count, white blood cells count, packed cell volume, haemoglobin concentration, mean corpuscular volume, and mean corpuscular haemoglobin concentration. The water quality parameters were maintained within the optimum range. Control, T1 and T2 group showed significantly ($P < 0.05$) higher growth performance in terms of biomass gain, FCR and SGR as compared to T3 groups. Haematological parameters like PCV were significantly better ($P < 0.05$) in C and T1 groups as compared to T3. However, haemoglobin content of control, T1 and T2 groups were significantly ($P < 0.05$) similar. Based on the findings up to 200 g of detoxified rubber seed meal could be incorporated in 1 kg diets of *L. rohita* fingerlings without compromising the growth response and health status in terms of haematological indices.

1. Introduction

Aquaculture is the fastest growing food producing sector in the world. Over the decades, aquaculture has been expanded, intensified and diversified, globally (Bostock et al., 2010). However, the feeding fish with prepared diets is a principal factor in aquaculture to increase growth and production (Abdel-Tawwab et al., 2007; Liti et al., 2005; Thankur et al., 2004). Feed

Abbreviations: BHT, butylated hydroxy toluene; CMC, carboxymethyl cellulose; DRSM, detoxified rubber seed meal; EC, total erythrocyte count; FCR, feed conversion ratio; FRP, fibreglass reinforce plastic; Hb, haemoglobin; LC, total leucocyte count; MCHC, mean corpuscular haemoglobin concentration; MCV, mean corpuscular volume; MOC, mustard oil cake; PCV, packed cell volume; PER, protein efficiency ratio; RBC, red blood cells; SGR, specific growth rate; WBC, white blood cells.

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Table 1
Proximate composition of raw rubber seed and detoxified rubber seed meal.

Parameter	Raw rubber seed	Detoxified rubber seed meal
	Mean	Mean
Moisture (g/kg)	38.0	16.0
Protein (g/kg)	175.0	254.0
Fat (g/kg)	480.0	391.0
Ash (g/kg)	31.0	24.0
Fibre (g/kg)	72.0	75.0
Carbohydrate (g/kg)	314.0	332.0
Cyanide (mg/kg)	415.1	60.1

accounts for more than 50% of the total production costs in modern intensive aquaculture. Any reduction in feed costs has a direct positive effect on profitability (Pandian et al., 2001).

The cost of feed is largely influenced by the level and source of protein which is the most expensive component of a fish diet (Singh et al., 2006). On the other hand, prices of the conventional feedstuff increased to a level that their inclusion at a required quantity completely eroded the expected profit of the farmers (Njidda and Isidahomen, 2010). In such situation the utilisation of non-conventional protein sources is the ultimate solution to serious feed deficits, rising cost of production, continuing low animal productivity, and inability of the components of the animal industries to meet national targets (Devendra, 1988). Among the non conventional protein sources, the use of rubber seed, which is a by-product from the rubber seed industry, has been studied thoroughly in many tropical countries such as Sri Lanka, Malaysia for livestock production (Chanjula et al., 2011; Eka et al., 2010; Rajaguru, 1971). The seeds are abundant throughout the years and are mainly wasted except a small part is used for plantation (approximately 30% of seeds are used in plantation purpose (unpublished data)). However, rubber seed are found to be contained a toxic factor *i.e.*, cyanogenic glycoside or hydrocyanic acid that creates a problem when used as animal feed (Tacon, 1990). Many scientists reported that heat treatment and storage can be used to reduce the level of this toxic factor (Gandhi et al., 1990) which helps in the effective utilization of the rubber seed meal (Igene and Iboh, 2004; Stosic and Kaykay, 1981; Ugwuene and Kong, 2004). The dietary cyanogenic glycoside has the great affinity toward the haem component of the erythrocyte (Isom and Way, 1974) which reduces the animal performance inhibiting cellular respiration. However, until the present study no systemic attempt was made to utilize the detoxified rubber seed in aquafeeds. With this backdrop, the present study was conducted to evaluate the efficacy of detoxified rubber seed in maintaining growth and haematological indices of *Labeo rohita* fingerlings. The species have been chosen because among the Indian Major Carps, rohu (*L. rohita*) is the most preferred species and constitute about 35% of the Indian Major Carps production. Moreover Rohu is commonly cultured, preferred and as well as high priced in all the North East Region. Most of the people preferred it in this region; it is the fast growing species among the cultivable carps (FAO, 2000).

2. Materials and methods

2.1. Collection, proximate analysis and detoxification of rubber seed

The fresh rubber seeds were collected from the local farm holder (Bijit Debbarma, Lembucherra, Tripura) and proximate composition (Table 1) viz. Moisture, ash, protein, ether extract, fibre and carbohydrate of detoxified rubber seeds were analysed following AOAC (2000). The seeds were detoxified in triplicates by following Okafore and Anyanwu (2006) with slight modifications like storing them for four months in hygienic condition at room temperature. After four months of storage, soaking in water for 24 h, boiling for half an hour, after that the kernel were separated and dried for 72 h and finally made the meal using the mixer grinder. The cyanide content of the fresh seeds as well as in the partially detoxified seeds were also analysed according to alkaline titration method of AOAC (2000).

2.2. Experimental design

The experiment was carried out over a period of 60 days at the wet laboratory of Fish Health and Environment, College of Fisheries, Central Agricultural University, Lembucherra, Tripura, India. *L. rohita* fingerlings were procured from college fish farm (23°54.327N and 91°18.493E), Tripura, India. Fishes were acclimatized to experimental rearing conditions for 15 days and fed with control feed. One hundred eighty fingerlings (average length 12.7 ± 1.5 cm and weight 22.5 ± 7.7 g) were distributed in triplicate groups of each treatment following a completely randomized design (CRD). Aeration was provided for 24 h in all the experimental FRP tanks of 500 L capacity (Plasto Craft, Mumbai).

2.3. Feed preparation and Feeding

Four experimental isocaloric (17.2–17.7 MJ/kg) and isoproteinous (329.9–323.1 g/kg) diets containing 0 g, 100 g, 200 g, and 300 g detoxified rubber seed meal (DRSM) per kg of diet, designated as Control diet, diet T1, diet T2 and diet T3, respectively, were prepared using locally available feed ingredients as shown in Table 2. Dried and powdered ingredients were sieved