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FULL LENGTH ARTICLE

Dietary effects of two medicinal plants (*Sesamum indicum*) and (*Croton zambesicus*) on the reproductive indices in female African catfish (*Clarias gariepinus*) broodstock

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KEYWORDS

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Gonadosomatic index;
Egg size

Abstract The effect of dietary *Sesamum indicum* (beniseed) and *Croton zambesicus* seed powder on growth and reproductive indices of female catfish, *Clarias gariepinus* broodstocks were investigated in two experiments. Fish fed experimental diets showed significantly improved growth performance and reproductive indices over the control treatment. Significantly higher ($P < 0.05$) gonadosomatic index was recorded for the fish fed diet of 100 mg kg^{-1} *S. indicum* seed powder compared to other experimental diets. In a *C. zambesicus* trial, the best performance and reproductive indices were achieved in fish fed on dietary *C. zambesicus* seed powder compared to the control. These results reveal that supplement diets with medicinal plants (*S. indicum* and *C. zambesicus*) enhance growth and improve gonadosomatic index, and reproductive indices of female *C. gariepinus* broodstocks and has a potential pro-fertility property which can be exploited in fish seed production by hatchery operators.

Introduction

Sesame (*Sesamum indicum*) is a traditional oilseed cultivated mostly in Asia and Africa (64% and 31% of world production, respectively) whose production is similar to that of linseed, i.e. about 3 millions of tons in 2003 (Reigh, 2008). Sesame plant is reputed in folk medicine in Africa and Asia in the traditional management of cancer and blood cholesterol (Shittu et al., 2007).

Biological studies have supported some of these traditional uses (Ashamu et al., 2010). Previous phytochemical studies on the seeds led to the isolation of carboxylic phenolic groups such as (sesamol, sesamin) and other compounds such as thiazole, pyrroles, disulphate, ketones and aldehyde (Shittu et al., 2006).

Many studies have shown that antioxidants can enhance fertility either directly or indirectly and that most plants rich in antioxidants have the tendency to increase sperm count, motility, and enhance sperm morphology (Oluyemi et al., 2007; Adesanya et al., 2007). *S. indicum* has quite a number of antioxidants such as sesamol, sesamolin sesamin, sesaminol

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triglucoside and sesaminol diglucoside. There is, therefore a high possibility that *S. indicum* can promote fertility.

Sesame plant especially the seed, oil and leaves are consumed locally as a staple food by subsistence farmers in South-West and Middle-Belt areas of Nigeria (Akpan-Iwo et al., 2006) and this may account for the high fecundity among the male and female population in these areas (Shittu, 2006).

Croton zambesicus, is a component of tiger bush, is a medicinal plant grown in villages and towns in Nigeria (Okokon et al., 2005). *C. zambesicus* is reputed in folk medicine in Africa in the traditional management of hypertension, urinary infections and malaria (Adjanohaun et al., 1989). *C. zambesicus* has lots of components appropriate for detoxification and quite a number of antioxidants such as flavonoid, trans-phytol, sterols, a-amyrin, trachlobane and isopimarane (Okokon et al., 2005).*C. zambesicus* has been shown to be a free radical scavenger and to protect against lipid peroxidation. This ability has been reported to increase peripheral testosterone level in swiss albino mice (Ofusori et al., 2007). There is, therefore a high possibility that *C. zambesicus* can promote fertility in fish.

Many medicinal plants have also been reported to have profertility effects in fish. *Garcinia kola*, a tropical plant, reputed in traditional medicine to have anti-inflammatory, anti-microbial, anti-diabetic and antiviral properties (Adedeji et al., 2008) was reported to cause dose dependent changes in the sperm and egg characteristics in *Clarias gariepinus* (Dada and Ajilore, 2009; Dada, 2012). *Kigelia africana*, another medicinal plant with very potent profertility activities has also been reported to enhance ovulation and spermiation in *C. gariepinus* (Adeparusi et al., 2010; Dada et al., 2010).

There has not been any documented report on the effect of *S. indicum* and *C. zambesicus* on egg parameters. This study was therefore carried out to investigate the effect of the dietary supplementation of *S. indicum* and *C. zambesicus* seed powder on the reproductive indices in female *C. gariepinus* broodstocks.

Materials and methods

Fish, plant seeds and cultured facilities

Healthy seeds of *S. indicum* and *C. zambesicus* were obtained from a local market in Akure, Ondo State, Nigeria. The seeds were authenticated in the crop, soil and pest management department, Federal University of Technology, Akure, Nigeria. The seeds were sun- dried and milled to a fine powder using Maulinex electric blender and mixed with a basal feed (40% crude protein), comprising standard amounts of fish meal, yellow maize, soy bean meal, blood meal, fish oil, vegetable oil, vitamin premix and starch.

C. gariepinus broodstocks used in the present study were collected from Joseph Ayo Babalola University Arakeji, Osun State, Nigeria fish farm. The fishes were transported to research farm of the department of fisheries and aquaculture technology, Federal University of Technology, Akure, Ondo State, Nigeria in oxygenated bags. The fish were distributed into outdoor concrete tanks ($1 \times 1 \times 0.6$ m), filled with well water and acclimatized to the experimental conditions for 2 week, during which they were fed the test diets. The concrete tanks were cleaned weekly, and about 50% of the culture water was replaced with fresh, well water. Water quality parameters including O_2, pH and temperature were monitored daily. The average values of these parameters throughout the study for experiments I and II were: $O_2 = 6.01 \pm 0.21$ mg L^{-1}, pH 7.35 ± 0.21 and temperature $= 25.20 \pm 0.28$ °C.

Experimental design

Experiment I – dietary supplementation of ***S. indicum***

The experiment was designed to study the effect of dietary supplementation of *S. indicum* on growth and reproductive indices of female *C. gariepinus* broodstock. The fish (with an average initial weight of 250–300 g) were stocked into the concrete tanks at a density of 10 fish per tank in replicate.

The fish were acclimatized for 2 weeks, during which they were fed a commercial catfish diet (40% crude protein). At the termination of the acclimation period, all the fish were netted, weighed collectively, and their initial weights were recorded. The fish were fed the test diets containing 0, 50, 100, 150 and 200 g kg^{-1} *S. indicum* seed powder (designated as D1, D2, D3, D4 and D5) at a daily rate of 3% body weight (BW), twice a day (09:00 and 16:00 h) for 8 weeks. The fish in each tank were collectively weighed fortnightly and their average weights recorded.

Experiment II – dietary supplementation of C. zambesicus

This experiment was conducted to investigate the effect of *C. zambesicus* on the performance and reproductive indices of female *C. gariepinus* broodstocks. The broodstock (250 g $fish^{-1}$) were stocked into concrete tanks ($2 \times 2 \times 1.25$ m) at a density of 10 fish per tank with three replicates per treatment. The culture conditions and feeding regimes were the same conditions adopted in the *S. indicum* experiment.

Four isonitrogenous diets were formulated from practical ingredients (Table 1) where the control basal diet (D1) was

Table 1 Ingredient composition (kg) and proximate composition (% DM) of basal diet.

Ingredients	g/kg diet
Menhaden fish meal	250
Corn meal	100
Soybean meal	350
Blood meal	100
Cod liver oil	90
Vegetable oil	60
Vitamin–mineral premix	30
Corn starch	20
Proximate composition (%)	
Crude protein	40.4
Crude lipid	13.4
Ash	12.1
Gross energy (MJ/kg)	16.9

Vitamin premix – A Pfizer livestock product containing the following per kg of feed: $A = 4500$ I.U, $D = 11252$ I.U, $E = 71$ I.U, $K_3 = 2$ mg, $B_{12} = 0.015$ mg, panthothenic acid = 5 mg, nicotinic acid = 14 mg, folic acid = 0.4 mg, biotin = 0.04 mg, choline = 150 mg, cobalt = 0.2 mg, copper = 4.5 mg, iron = 21 mg, manganese = 20 mg, iodine = 0.6 mg, selenium = 2.2 mg, zinc = 20 mg, antioxidant = 2 mg.