Saponin in tilapia feed to control maturation

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A preliminary trial indicated that saponin-supplemented diets could substitute for hormones in the control of reproduction of tilapia in brackishwater ponds

In the 1940s, tilapia was introduced to Asia from its native Africa. The decade from 1960 and 1970 saw the farming of the fish for the production of food for local consumption and for social elevation of rural populations related to agriculture and animal husbandry. By 2005, production of farmed tilapia reached more than 2.0 million tonnes.

Today the international trade in tilapia is growing rapidly and prospects of million-dollar businesses with the tilapia is attracting interest in its culture in Asia, Africa and Latin America. The top producers of tilapia however are still in Asia, with China, the Philippines, Taiwan as well as Indonesia and Thailand top ranked. Those 5 countries had 75% of the total tilapia production in 2005.

Large-scale commercial culture of tilapia is limited almost exclusively to three species: *Oreochromis niloticus*, *O. mossambica* and *O. aureus*. Of these, the species with recognized aquaculture potential, the Nile tilapia, *O. niloticus* is by far the most common species in fish farming. However farming of tilapia *O. niloticus* in freshwater or brackishwater ponds usually result in early maturation in as low as 70 g fish body weight. With excessive breeding, overcrowding and stunted growth follows and farming becomes unprofitable.

Early maturation

These early maturation and frequent spawning of the tilapia has prompted several workers to seek ways to control reproduction in order to produce good-size marketable fish. The technique of using hormones to sexually inverse tilapia to an all male stock is a common practice in farm production. The use of hormones however poses apprehension among fish consumers due to its possible negative effect to human health.

The use of hormones is prohibited in some countries. Such steroids for sex reversal for instance are a cause of concern since the US Food and Drug Agency (FDA) does not approve the sale of tilapia treated with steroids and harmless approved agents are yet to be identified.

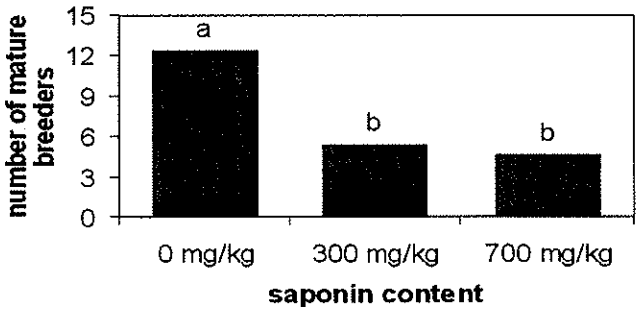
Saponin in reproduction

Saponin, a glycoside linked to hydrophobic aglycone (sapogenin) that may be a steroid in nature, can be an alternative to androgenic hormone used for tilapia sex inversion and sterility. Studies on the effect of saponin on the reproductive activity of tilapia recently showed the possible infertility of females when fed with diet containing 300 mg/kg saponin, sex inversion to all male population at 700 mg/kg saponin inclusion, and higher number of males in fish fed with 150-500 mg/kg saponin diet. These positive results on saponin in aquaria experiment however may require testing it in large pond production to ascertain its positive effect.

It was therefore of general interest to investigate reproductive capability of female and male tilapia under commercial conditions, when fed diets supplemented with different levels of saponin; treatment I: 0 mg/kg, treatment II: 300 mg/kg and treatment III: 700 mg/kg). Commercial feed containing about 25-30% crude protein and 5-7 % fat supplemented with 0, 300 and 700 mg/kg saponin was fed to saline tolerant tilapia reared in brackishwater ponds with three replicates in a randomized complete block design (RCBD).

The trial carried out at the Aklan State University in the Philippines investigated the following parameters: growth (length and weight), specific growth rate, survival, sex ratio, fry count, egg count, number of nests, gonadal development (number of mature breeders, egg development stages and egg diameter) and egg production.

Number of mature tilapia breeders after 120 days of pond culture



After 120 days of culture, the final weight of fish did not differ significantly between treatments (75.3±1.4 g, 71.8±6.2 g and 72.4±1.5 g for I, II and III respectively). Survival was also not different between treatments. The first mature breeders were observed during day 75 of the pond culture period. On day 120, the mean number of mouth brooders in treatment I was significantly highest (12.3 fish per pond, $p<0.05$) compared to treatments II and III (5.3 and 4.5 fish per pond respectively), which did not differ from each other (Fig. 2). The sex ratio of treatment I tended to be higher than treatment II ($p<0.1$), indicating more males than females in the latter.

However, the sex ratio in treatment III did not differ significantly from that of either the control or treatment II. Egg diameter varied from 0.30 mm in treatment II to 0.43 mm and 0.47 mm for treatments I and III respectively, but without statistical significance. Histological analysis of a sub-sample of 21 female tilapia per treatment showed higher numbers of fish with eggs in the vitellogenic stage.

Conclusion

The results of this study showed no differences in final weight which did not support previous reports of depressed growth. It did not agree with reports on growth enhancement due to the application of saponin. However, tilapia in this study indicated lower numbers of mature breeders and of females when fed with saponin-supplemented diets.

This showed the potential of saponin as a substitute for hormones in the control of reproduction to produce good-sized fish and sex inversion of tilapia. The non-detection of significant effects on egg development may have been due to experimental error where sample sizes were too small. Repeat trials to cover more than one growth period was suggested to confirm these results.

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