Effects of water flow rates on growth and welfare of Nile tilapia (Oreochromis niloticus) reared in a recirculating aquaculture system

The effects of water exchange on growth and welfare of Nile tilapia (Oreochromis niloticus) were investigated in a recirculating aquaculture system during an 8-week trial. Fish of initial body mass of ~27 g (n=8 per tank) were reared in 60-L tanks with water exchange rates, corresponding to 1.5 (LE), 3 (ME) and 6 (HE) tank volumes/h. Treatments were triplicated and fish were fed at 3% of their biomass each day. The LE treatment resulted in significantly higher (p<0.05) levels of ammonia nitrogen and phosphate in the culture water relative to the higher water exchange treatments. The specific growth rate (SGR) of fish cultured under the HE treatment (2.74% day−1) was significantly higher than the SGR (2.21% day−1) of the LE fish. Mean final body weights of the LE, ME and HE fish were 97.67 ± 8.13, 110.50 ± 22.45 and 123.92 ± 10.00 g, respectively. Higher prevalence of dermal ulcerations, oral lesions and poor fin conditions were associated with the LE and ME fish. After 4 weeks, 34 and 24% of the LE and ME fish, respectively, had advanced mouth lesions compared to 0% for the HE fish. Haematological indicators of long-term oxygen stress and disease conditions, as evidenced by erythrocyte and platelet indices, were generally higher in fish under the LE and ME treatments. This study has shown that although the Nile tilapia is a hardy species, long-term exposure to poor water conditions can result in reduced growth and compromised welfare.

Digestibility and postprandial ammonia excretion in Nile tilapia (Oreochromis niloticus) fed diets containing different oilseed by-products

The present study was undertaken to evaluate the potential for using oilseed by-products (soybean, copra and palm kernel meals) as partial replacements of fishmeal in feeds for Nile tilapia (Oreochromis niloticus). Nutrient digestibility and postprandial ammonia excretion rates were examined. A fishmeal-based diet served as control against three test diets in which 30 % of each of the oilseed by-products was included. Diets were randomly assigned to triplicate groups of fish (similar to 1 kg bulk weight) for the digestibility trials which spanned a total of 9 days. The partial inclusion of oilseed meals did not significantly affect apparent protein digestibility, although lipid, ash and dry matter digestibilities were significantly affected (p <0.05). Fish fed the soybean meal diets significantly reduced their feed intake and showed lower growth and feed utilization efficiencies over the trial period. The inclusions of the plant proteins caused a reduction in ammonia excretion rates with the palm kernel meal diet recording the lowest mean excretion rates of 117 mg kg(-1) day(-1) which was twofold lower than the highest mean daily ammonia excretion rate of the fish group fed the fishmeal-based control diets. Overall, the study confirmed the potential of using copra and palm kernel meals to partially replace fishmeal in Nile
tilapia diets based on their effects on short-term growth and feed utilization, nutrient digestibilities and lower ammonia excretion rates, while soybean meal in an unrefined form is not a promising replacement for fishmeal in tilapia diets.

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**Effects of dietary inclusions of oilseed meals on physical characteristics and feed intake of diets for the Nile Tilapia, Oreochromis niloticus**
The present study investigated the effects of the inclusion of three oilseed by-products (soybean, copra and palm kernel meals) on some physical characteristics of pelletized feeds as well as on voluntary feed intake and faecal matter production by the Nile tilapia, Oreochromis niloticus. The dietary inclusion of soybean meal resulted in a significantly higher feed bulk density relative to the fishmeal control diet. The inclusions of copra and palm kernel meals, however, resulted in lower feed bulk densities. Sinking rates, water stabilities and nutrient retention efficiencies of feed pellets were directly related to feed bulk densities. The soybean meal diet had the fastest sinking velocities, greatest water stability and highest nutrient retention rates. The dietary inclusion of soybean meal, however, significantly impaired feed intake compared to the other three diets. Mean daily feed intakes of the control, palm kernel meal and copra meal diets corresponded to 28.88, 27.01 and 28.31g during the experimental period and varied significantly from the mean daily intake of the soybean meal diet which corresponded to 20.01g. Faecal matter production (g dry mass kg−1 ingested feed) was significantly higher in the tilapia groups fed the copra and palm kernel meals. The results obtained from this study show that 30% inclusions of unrefined forms of copra and palm kernel meal in Nile tilapia diets is possible, without adversely affecting feed intake or pellet nutrient losses prior to ingestion.

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Local agro-industrial by-products with potential use in Ghanaian aquaculture: a review

The inability of Ghana's capture-based fisheries to meet national demand has placed aquaculture in an advantageous position to satisfy this supply deficit. The majority of fish farmers in Ghana, however, resort to local feed mixtures, occasionally in combination with commercial aquafeeds, demonstrating that the sector has not yet reached its full potential in terms of production volumes and efficiency. Fish meal is available in limited quantities and is prohibitively expensive in Ghana, making it essential to develop suitable complete and supplementary diets using low-cost and locally available plant by-products for use in fish grow-out facilities, particularly in tilapia production, which accounts for over 80 % of aquaculture production. This review thus identifies local agro-industrial byproducts with potential use in fish feeds based on their nutritional composition, total annual production, competition for and seasonal availability and dynamics of these products as well as prices. The effects of dietary inclusions of these by-products on fish growth and feed utilisation are also reviewed. Based on the published works and other practical information reviewed, these by-products represent huge potentials as alternative aquafeed protein sources because of their abundance, very affordable prices and healthy nutritional profiles for fish growth. Although this review focuses on Ghana, it can also be of direct benefit to fish farmers, feed manufacturers, researchers and the policy-makers in other regions of the world where these crops and their resulting by-products are produced in commercial quantities.