Studies on oreochromis niloticus nutrition

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The present study was carried out at El-Kanater El-Khairia Fish Research Station, Kalubia Governorate, National Institute of Oceanography and Fisheries (NIOF). This study include two experiments. The first experiment aimed to study the effect of dietary protein and energy levels on growth performance of Nile tilapia (Oreochromis niloticus) of small initial size (22.87 g), whereas the objective of the second experiment was to investigate the effect of dietary protein and energy levels on growth performance of Nile tilapia fish with 39.82 g initial weight (large size). The experimental diets contained three CP levels (20, 25 and 30%) and three energy levels (2500, 3000 and 3500 kcal ME/kg), and fed as dry pellets at a daily rate of 3% of fish biomass, 5 days/week and once daily. The first and second experiments started on the 13th of May and continued until the 13th of November, 2000 (180 days). Fish growth performance, feed utilization and fish chemical composition as well as nutrients digestibility and economical efficency of the experimental diets were determined.Results obtained can be summarized as follows: First experiment:- Fish fed the diet with 30% CP (PL3) showed the highest final body weight (BW) and weight gain (WG) values followed by those fed the 25% dietary CP level (PL2), with no significant differences between the two CP levels in either final BW or WG values. The lowest (P<0.05) final BW and WG values were achieved by fish fed the 20% CP dietary protein level(PL1). The best final BW and WG values were recorded with fish fed the diet contained 3000 kcal ME/kg (EL2), followed by those fed the 2500 kcal ME/kg (EL1), the differences between the two levels of energy in both final BW and WG values were not significant. whereas, fish fed the diet with 3500 kcal ME/kg (EL3) showed the lowest (P<0.05) final BW and WG values.- The longest final body length (BL) was recorded by fish fed the diet contained 30% CP, followed by that of fish fed 25% dietary CP level, with no significant differences in final BL. whereas, the shortest (P<0.05) BL was achieved by fish fed on the diet with 20% CP. The longest final BL was recorded by fish fed either 3000 or 2500 kcal ME/kg diet (EL2 or EL levels), while the shortest (P<0.05) final BL was shown by fish fed the 3500 kcal ME/kg energy level (EL3).- Protein levels (20, 25 and 30% CP) and energy levels (2500, 3000 and 3500 kcal ME/kg) had little effect on condition factor (K). The differences due to either PL or EL effects on K values were not significant.- Specific growth rate (SGR) values increased with increasing PL from 20 to 25%, then decreased with increasing PL to 30%. Fish fed the lower EL (2500 kcal ME/kg) showed the highest SGR value and those fed the higher EL(3500 kcal ME/kg) recorded the lowest value. The differences in SGR values due to effects of either PL or EL were almost significant.- The best FCR was obtained with Nile tilapia fed 25% dietary CP level, followed by that of fish fed 30% CP level, with no significant differences between the two CP levels. whereas,I - I ? ...1.1141.4140.•the poorest (P<0.05) FCR was recorded by fish fed the diet of 20% CP. Fish fed the dietary 2500 kcal ME/kg level recorded the best FCR, followed by those fed the 3000 kcal ME/kg level, with no significant differences. whereas, fish fed 3500 kcal ME/kg dietary energy level achieved the poorest (P<0.05) FCR value.- Values of PER increased with increasing the dietary CP level from 20 to 25%, then slightly decreased with increasing the protein level from 25 to 30%. Fish fed 25 and 30% dietary CP levels recorded the best PER values, with no significant differences between the two levels of protein. While, fish fed the 20% CP level showed the poorest (P<0.05) PER value. The PER values decreased significantly (P<0.01) with increasing the energy level from 2500 to 3000 and 3500 kcal ME/kg. The best PER value was achieved by fish fed 2500 kcal ME/kg, followed by those fed 3000 kcal ME/kg. The lowest (poorest) PER value was recorded by fish fed 3500 kcal ME/kg.- The PPV’s

increased with increasing the protein level from 20 to 25 and 30%, indicating that fish utilize dietarty protein more efficient with each increase in protein level. Moreover, the differences in PPV% between 20% CP level and each of 25% CP and 30% CP level were significant, whereas, no significant differences were detected between 25% CP and 30% CP levels. On the contrary, PPV% decreased significantly (P<0.05) with each increase of energy level from 2500 to 3000 and 3500 kcal ME/kg, indicating that fish fed the lower energy level (2500 kcal ME/kg) utilize the dietary protein more efficiently thanthose fed the higher energy levels (3000 and 3500 kcal ME/kg).- Values of ER decreased with increasing the protein level from 20 to 25 and 30%. The differences in ER values between fish fed 30% CP level and those fed each of 20% CP and 25% CP level were significant, whereas, those between fish fed 20% CP level and fish fed 25% CP level were not significant. Fish fed the diet of 3000 kcal 'ME/kg recorded the highest ER value, followed by those fed the diet of 2500 kcal ME/kg, with no significant differences. whereas fish fed the diet with 3500 kcal ME/kg showed the lowest (P<0.05) ER value.- The HSI values showed that fish fed the 30% CP level had the highest value and those fed the 25% CP level had the lowest one. Howerever, the differences in HSI values due to protein level effect were not significant. Values of HSI decreased with increasing the energy level from 2500 to 3000 and 3500 kcal ME/kg, but the differences were not significant.- Fish males fed the diet contained 25% CP recorded the highest (P<0.05) GSI value, while those fed the diet contained either 20% CP or 30% CP had nearly the same GSI values, with no significant differences among these two levels. On the contrary, females fed the 25% CP level recorded the lowest (P<0.05) GSI value and those fed 20% CP and 30% CP levels had nearly similar GSI values, with no significant differences. Averages of GSI values for males fed the different energy levels, showed the same trend observed with males fed the different protein levels. Males fed 25% CP level achieved the highest (13<0.05) GSI value, while those fed the 20% and 30%CP levels had nearly the same values, with no significant differences. On contrast, GSI values for females decreased with increasing the energy level from 2500 to 3000 and 3500 kcal ME/kg. The differences were only significant between fish fed the 3500 kcal ME/kg energy level and those fed either 2500 or 3000 kcal ME/kg energy level.Results of carcass traits showed that fish fed 20% CP level recorded the highest (P<0.05) head percentage and the lowest dressing (P<0.05), flesh (P<0.05) and bone percentages. whereas, fish fed 25% CP level achieved the highest dressing and flesh percentages and the lowest head percentage. Fish fed 30% CP level showed the highest bone percentage. The highest flesh percentage and the lowest head (P<0.05) and bone percentages were recorded by fish fed the diet with 2500 kcal ME/kg. whereas the highest dressing and bone (P<0.05) percentages were shown by fish fed the diet with 3500 kcal ME/kg. The highest (P<0.05) head percentage and lowest dressing (P<0.05) and flesh percentages were achieved by fish fed the diet with 3000 kcal ME/kg.- Results of chemical composition of whole fish showed that fish fed the higher CP level (30%) recorded the highest moisture, protein and fat contents and the lower (P<0.05) ash content, while those fed the lower CP level (20%) showed the highest ash percentage and lowest fat percentage. Fish fed 25% CP level achieved the lowest moisture (P<0.05) and protein content. With regard to the effect of energy level, fish fed 3500 kcal ME/kg energy level showed the highest protein content and lowest ash content, whereas, those fed 2500 kcal ME/kgSUMMARY 155energy level recorded the highest moisture (P<0.05) and fat percentages. Fish fed 3000 kcal ME/kg energy level recorded the highest ash content and lowest moisture, protein and fat contents.- Chemical composition of fish flesh showed that fish fed the 30% CP level had the highest (P<0.05) fat content and the lowest moisture and ash contents, whereas those fed the 20% CP level showed the highest (P<0.05) protein and ash percentages and lowest moisture and fat (P<0.05) percentages. The lowest protein content was recorded by fish fed the 25% CP level. Results of energy level effects revealed that fish fed the highest energy level (3500 kcal ME/kg) had the highest protein content and lowest ash content, while those fed the lowest energy level (2500 kcal ME/kg) had the highest moisture (P<0.05) and ash percentages and lowest fat percentage. However, the highest (P<0.05) fat content and lowest moisture and protein (P<0.05) contents were achieved by fish fed 3000 kcal ME/kg diet.- Fish fed the 25% dietary CP level showed the highest fish production, while those fed the 20% dietary CP level recorded the lowest fish production (kg/m2). The same trend was observed with profit index. Moreover, fish fed the 25%

dietary CP level showed the lolVest feed costs/kg ,WG and those fed the 30% dietary CP level recorded the highest one. Fish fed 2500 and 3000 kcal ME/kg dietary energy levels recorded the same fish production value, while those fed the higher dietary energy level (3500 kcal ME/kg) showed the highest value. Profit index decreased and feed costs/kg WG increased withincreasing _dietary energy level from 2500 to 3000 and 3500 kcal ME/kg.Second experiment:- Final BW and WG values of fish increased (P<0.05) with increasing PL from 20% to either 25 or 30% CP, however, no significant differences were detected in either final BW or WG values between fish fed 25 and 30% CP. The final BW and WG values of fish varied slightly with dietary EL consumed. Fish fed EL3 (3500 kcal ME/kg) had slightly higher final BW and WG values than those fed either EL 1(2500 kcal ME/kg) or EL2 (3000 kcal ME/kg), the differences in both final BW and WG values of fish due to EL effects were not significant.- Fish fed PL2 (25% CP) showed the longest final BL, while those fed PL1 (20% CP) recorded the shortest one. The differences in final BL of fish fed PL 1 and those fed either PL2 or PL3 (30% CP) were significant (P<0.05), whereas the differences in final BL of fish fed PL2 and PL3 were non-significant. Fish fed EL2 (3000 kcal ME/kg) had significantly (P<0.05) shortest final BL than those fed either EL1 (2500 kcal ME/kg) or EL3 (3500 kcal ME/kg). The differences among the latter dietary energy levels (ELI and EL3) in final BL were not significant.- The final K values increased with increasing PL from 20 to 25% CP, then decreased with PL3 (30%CP). However, the differences in final K values due to PL effects were not significant. Also, energy levels used in this experiment (2500, 3000 and 3500 kcal ME/kg) had no significant effect on final K values of fish.- Values of SGR increased with increasing PL from 20 to 25% CP, then it decreased with increasing PL from 25 to 30% CP. The differences in SGR values between fish fed 20% CP level and those fed either 25 or 30% CP were significant (P<0.05), while those between fish fed 20% and 30% CP were not significant. The SGR values decreased with increasing EL from 2500 to 3000 and 3500 kcal ME/kg (EL1, EL2 and EL3, respectively). The differences in SGR values of fish fed EL 1 and those fed either EL2 or EL3 were significant (P<0.05), whereas no significant differences were detected in SGR values of fish fed either EL2 or EL3.- Fish fed the dietary 25% CP level showed the best FCR, followed by those fed the 30% dietary CP level, whereas the poorest FCR was recorded by fish fed the 20% dietary CP level. The differences in FCR between fish fed 25% CP diet and those fed 20% CP diet were significant (P<0.05), while the differences between fish fed 30% CP diet and those fed 20% or 25% CP diet in FCR were not significant. Results of the effect of energy level on FCR indicated that fish fed 2500 kcal ME/kg diet showed the best FCR, while those fed 3000 kcal ME/kg diet recorded the poorest value. Dietary energy level (2500, 3000 or 3500 kcal ME/kg) had no significant effect on FCR values.Results of PER values showed that fish fed 25% dietary CP level recorded the best value, followed by that of fish fed 30% dietary CP level with no significant differences between the two levels. whereas, fish fed 20% CP level showed the lowest (13<0.05) value. The PER values decreased with increasing therisroomarommomproor.menienergy level from 2500 to 3000 and 3500 kcal ME/kg, and the decrease was significant (P<0.05) with each increament in energy level.The best PPV was achieved by fish fed the 25% CP level. The differences in PPV's between fish fed 20% dietary CP level and those fed either 25% CP or 30% CP were significant (P<0.05), whereas those between fish fed 25% CP and 30% CP level were not significant. With regard to the effect of energy level on PPV's, results indicated that PPv's decreased with each increase in energy level from 2500 to 3000 and 3500 kcal ME/kg. The differences in PP's for fish fed 2500 kcal ME/kg and those fed either 3000 or 3500 kcal ME/kg were significant (P<0.05), while no significant differences were observed between PPV's of fish fed 3000 kcal ME/kg and those fed 3500 kcal ME/kg .Results of ER cleared that fish fed the diet with 25% CP retained more energy than those fed the diet with either 20% or 30% CP. The differences in ER values between fish fed 25% CP and those fed either 20% CP or 30% CP were significant (P<0.05), while those among fish fed 20% CP and those fed 30% CP were not significant. Values of ER slightly increased with increasing the energy level from 2500 to 3000 and 3500 kcal ME/kg, and the differences between these ER values were not significant.- Values of HSI increased with increasing the protein level from 20 to 25 and 30% CP, but the differences were not significant. Similarly dietary energy level (2500, 3000 and 3500 kcalME/kg) had little effect on HSI of fish and the differences were not significant.- - Results of GSI values showed that fish fed the 20% dietary

CP level recorded the highest value for males and females. The lowest value for males was shown by fish fed the 30% dietary CP level, while that for females was recorded by those fed the 25% dietary CP level. The differences in GSI for fish males fed 20% dietary CP level and those fed either 25% or 30% dietary CP level were significant (P<0.05), whereas, the differences between fish males fed 25% and 30% CP levels were not significant. For females, the differences in GSI for fish fed the diet contained 25% CP and those fed the diets contained either 20% or 30% CP were significant, while those between fish fed the diets with 20% CP and 30% CP were not significant. Concerning the effect of energy level on GSI values, results obtained showed that males fed 3500 kcal ME/kg diet recorded the highest value and those fed 3000 kcal ME/kg showed the lowest one, the differences were only significant between GSI values of fish fed 3000 kcal ME/kg and those fed 3500 kcal ME/kg. For females, the GSI values increased with increasing the energy level, fish fed the higher energy level (3500 kcal ME/kg) showed the highest value and those fed the lower energy level (2500 kcal ME/kg) recorded the lowest value with significant differences only between fish fed 3500 kcal ME/kg and those fed either 2500 or 3000 kcal ME/kg.- Results of carcass traits showed that increasing dietary PL from 20 to 25% CP significantly (P<0.05) increased both dressing and flesh percentages, while it decreaSed (P<0.05) headpercentage. A reverse trend was observed with increasing PL from 25 to 30%. However, increasing PL from 20 to 25 and 30% had no significant effect on bone percentage. Increasing EL from 2500 to 3000 kcal ME/kg significantly (P<0.05) decreased dressing, flesh and bone percentages, whereas the percentage of head was increased (P<0.05). A reverse trend was observed when EL was increased from 3000 to 3500 kcal ME/kg.Averages of chemical composition of whole fish revealed that fish fed PL3(30% CP) recorded the highest (P<0.05) protein content and the lowest fat and ash (P<0.05) percentages, whereas, those fed PL1 (20% CP) showed the highest moisture percentage and the lowest protein content. The highest fat (P<0.05) and ash contents and lowest (P<0.05) moisture percentage were achieved by fish fed 25% CP (PL2). Fish fedEL1 (2500 kcal ME/kg) had the highest fat (P<0.05) and ash contents and lowest (P<0.05) protein percetage, while those fedEL2 (3000 kcal ME/kg) recorded the highest moisture and protein percentages and the lowest ash content. Fish fed EL3 (3500 kcal ME/kg) had the lowest moisture and fat contents.- Results of chemical composition of fish flesh indicated that fish fed the lower CP level (20%) recorded the highest moisture content and the lowest (P<0.05) fat percentage, while those fed the higher CP level (30%) showed the highest protein, fat and ash contents. The lowest moisture (P<0.05), protein and ash (P<0.05) contents were achieved by fish fed PL2 (25% CP). Fish fed on EL3 (3500 kcal ME/kg) had the highest protein content and the lowest fat percentage, whileSUMMARY 161those fed on EL 1 (2500 kcal ME/kg) showed the highest fat content and lowest moisture, protein and ash percentages. The highest moisture and ash contents were recorded by fish fed EL2 (3000 kcal ME/kg).Fish production (kg/m2) increased with increasing protein level from 20 to 25%, then slighlty decreased with increasing dietary CP level to 30%. Profit index decreased and feed costs/kg WG increased with each increase in PL from 20 to 25 and 30% CP. Increasing dietary EL from 2500 to 3000 kcal ME/kg increased fish production (kg/m2), while increasing the EL to 3500 kcal ME/kg decreased fish production. Profit index decreased with each increase in dietary EL from 2500 to 3000 and 3500 kcal ME/kg. whereas, a reverse trend was observed with feed costs/kg WG.Nutrients digestibility of the experimental diets showed that increasing the dietary CP level from 20 to 25 and 30% increased CP and GE digestibilities, but decreased DM (P<0.05) and NFE ones. Digestibility of EE significantly (P<0.05) increased with increasing dietary CP level from 20 to 25%, but decreased with the higher level (30% CP). However, increasing the dietary EL from 2500 to 3000 kcal ME/kg increased DM, NFE (P<0.05) digestibilities, but decreased (P<0.05) CP and EE ones. The diets contained the higher dietary EL (3500 kcal ME/kg) recorded the lowest digestibility values for all nutrients except for GE digestibility.