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Dietary crude protein requirement of *Tilapia nilotica* fry

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To determine growth and survival of *Tilapia nilotica* fry fed formulated practical dry diets with varying crude protein levels, fish were stocked at three per liter in wooden tank compartments or glass aquaria filled with 50 or 35 l of fresh water in three separate feeding trials. Isocaloric practical diets containing 20, 25, 30 and 35% crude protein were fed to the fry at 15% of fish biomass daily for seven weeks in the first two trials (Table 1). Another set of diets containing 20, 25, 30, 35, 40, 45 and 50% crude protein were given for eight weeks in trial 3 (Table 2).

Weight gains and increases in total length of *T. nilotica* fry were directly related to the dietary crude protein level up to 35% in the first two trials (Table 3). Growth of the fry in trial 3 (Table 4) was significantly highest at 35% crude protein. Growth rates were depressed at protein levels higher than 35%. In channel catfish, weight gain was lower when high-protein (42%) diet with insufficient non-protein energy was used than when the diet contained medium percentage (36%) of protein with same low level of energy, which indicated that when too much of the calories come from protein, efficiency of diet utilization is suppressed (Prather and Lovell, 1973; Lovell, 1976). The same could be true for tilapia fry fed isocaloric diets in this study.

Growth rate of fry seemed affected by water temperature. As there was a lowering of ambient temperature from June to December, growth slowed down from trial 1 to trial 3.

Survival rate was significantly high at 35% crude protein compared to 20% (trial 1) or 30% (trial 2) crude protein level. Survival rate of 35% crude protein in trial 3 was not significantly different from all other treatments.

On the basis of growth, survival and feed conversion, *T. nilotica* fry required 35% crude protein in the practical diets given at 15% of fish biomass.

Feed conversion values were best at 35% dietary crude protein in all trials. Less efficient feed conversion were obtained at protein levels higher or lower than 35%.

Table 1. Percentage composition of experimental diets with varying crude protein levels for trials 1 and 2.

Ingredients	DIET 1	2	3	4
Fish meal	17.24	21.55	25.86	30.17
Soybean oil meal	14.83	18.54	22.25	25.95
Ipil-ipil leaf meal	4.63	5.79	6.94	8.10
Copra meal	6.56	8.20	9.84	11.48
Rice bran	6.99	8.74	10.49	12.24
Dextrin	37.42	25.85	14.29	2.73
Cod liver oil	2.5	2.0	1.5	1.0
Vegetable oil	2.5	2.0	1.5	1.0
Starch	3.0	3.0	3.0	3.0
Vitamin premix [1]	0.69	0.69	0.69	0.69
Mineral premix[1]	3.6	3.6	3.6	3.6
B. H. T.	0.04	0.04	0.04	0.04
Estimated crude protein (%)	20	25	30	35
Analyzed crude protein (%) (as fed)	20.9	24.9	31.3	36.0
Estimated digestible energy (Kcal/100 g)[2]	250	250	250	250

1/ For complete and practical diets (NRC, 1977).

2/ Based on values for channel catfish: protein, 3.5 Kcal/g; 8.1 Kcal/g; NFE, 2.5 Kcal/g (NRC, 1977; Wilson, 1977).

Table 2. Percentage composition of experimental diets with varying crude protein levels for trial 3

Ingredient	DIET 1	2	3	4	5	6	7
Fish meal (63.5% crude protein)	31.50	39.37	47.24	55.12	63.0	70.87	78.74
Dextrin	38.95	33.78	28.60	23.42	18.23	13.06	7.93
Cod liver oil	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Vegetable oil	9.00	8.00	7.00	6.00	5.00	4.00	3.00
Starch	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Vitamin premix	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Mineral premix	3.60	3.60	3.60	3.60	3.60	3.60	3.60
B. H. T.	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Celite	10.22	8.52	6.83	5.13	3.44	1.74	0.0
Estimated crude protein (%)	20	25	30	35	40	45	50
Estimated digestible energy (Kcal/100 g)	278	278	278	278	278	278	278

Protein requirement of fishes generally vary according to species. Within the same species the requirement varies with size or age of fish, water temperature, salinity, protein quality, amount of non-protein energy, daily feed allowance and culture system (Andrews, 1977; Delong *et al.*, 1976; Lovell, 1977; NRC, 1977).

Table 3. **Mean weight gains, increases in total length (TL), survival rates and feed conversions of *T. nilotica* fry fed varying dietary crude protein levels in trials 1 and 2.**

Crude Protein (%)	Trial 1				Trial 2			
	Weight gain (g) 1/	Increase in TL (mm) 1/	Survival rate (%) 2/	Feed Conversion 2/	Weight gain (g) 1/	Increase in TL (mm) 1/	Survival rate (%) 2/	Feed Conversion 1/
20	1.2821	32	25[b]	3.18[a]	0.7913	20.2	42[ab]	2.61
25	1.3011	32	43[a]	2.09[b]	0.9212	22.4	34[b]	2.64
30	1.4332	33	36[ab]	2.28[b]	1.0434	21.0	52[a]	2.38
35	1.4950	33	43[a]	1.86[b]	1.1868	22.7	50[a]	2.30

1/ Means are not significantly different (P = 0.05). Initial measurements were 0.020 g and 10 mm TL for trial 1; 0.0304 g and 12 mm TL for trial 2.

2/ Means followed by the same superscript are not significantly different (P = 0.05)

Table 4. Mean weight gains, increases in total length (TL), survival rates and feed conversions of *T. nilotica* fry fed varying dietary crude protein levels (trial 3)[1]

Crude protein (%)	Weight gain (g)	Increase in TL (mm)	Survival rate (%)	Feed Conversion
20	0.3362[b]	16.6[ab]	22[b]	5.38[a]
25	0.2894[b]	14.7[b]	40[ab]	2.54[ab]
30	0.3402[b]	14.6[b]	42[ab]	2.34[ab]
35	0.5945[a]	20.0[a]	49[ab]	1.78[b]
40	0.2835[b]	12.9[b]	50[ab]	2.35[ab]
45	0.3306[b]	15.8[ab]	47[ab]	3.05[ab]
50	0.2630[b]	13.8[b]	56[a]	3.03[ab]

1/ Means followed by the same superscript are not significantly different (P = 0.05).
Initial measurements were 0.0128 g and 10 mm TL.

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