EFFECTS OF VARYING LEVELS OF DIETARY PROTEIN ON THE PERFORMANCE AND PRODUCTION COST OF WHITE PEKIN DUCKLINGS

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Summary

An experiment was conducted to investigate the performance and production cost of Pekin ducklings fed varying levels of dietary protein. One hundred and twenty ducklings in four separate groups received either 16, 18, 20 or 22% CP in the starter period (day-old to 3rd week of age). These four groups ate either 12, 14, 16 or 18% CP respectively during the grower-finisher period (4th week to 12th week of age). The results of the study indicated that in a tropical country like Bangladesh, the protein needs of Pekin ducklings should be satisfied depending on the age at which the birds are to be marketed. If the ducklings are to be marketed at 6 weeks, 22/18% CP would be sufficient. When the marketing is aimed at 9 weeks of age, 20/16% would be adequate. For ducklings which are to be marketed at 12 weeks of age, a protein level of 18/14% would be required. All these results should help the producers to keep production cost to a minimum. The exceptional capacity of ducklings for compensatory growth would help keep birds on low protein levels if they are reared upto 9 or 12 weeks before marketing.

(**Key Words**: Ducklings, CP, Weight Gain, Feed Consumption, Feed Efficiency, Protein Efficiency, Production Cost)

Introduction

White Pekin is a meat-type duck available in Bangladesh. Ducklings from this variety are genetically superior for weight gain and therefore considered for meat production. The importance of feeding a diet containing adequate amount of protein to meat producing poultry is well recognized. In view of this, considerable attention have been focused on broiler-type chicken but little research has so far been done on protein requirements of meat-type ducks. In addition, there exists considerable disagreement among various workers with regard to dietary level of protein that should be maintained in the ration for ducklings. Dean (1972) observed maximum body weight when Pekin ducklings were fed as little as 16% CP during the period from day-old to market age (6 or 8 week). Wilson (1975) stated that at 2 weeks, male Pekin ducklings were significantly heavier at 22 or 24% CP in comparison with 18 or 20% CP level. On the other hand, Hoj (1975) obtained best growth at 19 to 21% CP level during the first 2 weeks of age and recommended 14 to 15% CP as sufficient during 3-8 weeks of age. Siregar et al. (1982a) suggested 19 and 16% CP for the first 2 weeks and 3 to 8 weeks respectively to meet the protein needs for growth and feed conversion efficiency of White Pekin ducklings. Surprisingly, Siregar et al. (1982b) suggested a dietary protein level of only 12% for maximum growth, best feed conversion and highest protein efficiency ratio during the period from 2 or 3 weeks to 8 weeks of age. Auvergne et al. (1991) suggested a minimum protein requirement of 10.3 g CP/MJ ME for Muscovy ducklings but obtained a slightly higher growth rate at 12.7 g CP/MJ ME in ducklings with delayed growth. The discrepancy with regard to protein requirements as stated above has probably resulted from differences in uncontrollable environmental factors particularly regional differences in temperature to which birds were exposed during experimentation. The fact that feed efficiency and protein efficiency decreased with the increase in age (Pilla and Quilici, 1975; Ali and Ahmed, 1990; Ali and Sarker, 1992), suggests an economic use of protein in order

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to keep production cost of ducklings as minimum as possible. NRC (1977) without mentioning type of birds (meat or egg-type) recommended 16% CP but was in favour of increasing CP level up to 22% for the first 2 weeks to increase early growth.

The nutrition of ducks particularly that of protein and amino acids has been little investigated (Elkin, 1987). So, data on estimates of requirements for ducks are scanty. Because of this fact Blair et al. (1983) while recommending International Nutrition Standards for Poultry, could not specify protein requirements of ducks for Asiatic region. Therefore, it seemed worthwhile to make a study on the protein requirements of ducklings in Bangladesh. The present study was undertaken to investigate growth response of ducklings fed varying levels of dietary protein and also to work out a level of dietary protein that would keep production cost to a minimum.

Materials and Methods

Birds and diets

One hundred and twenty day-old straight-run White Pekin ducklings were selected and randomly distributed to four dietary treatment groups having three replications each of 10 birds. Isocaloric diets (12.0 MJ/kg; NRC, 1977) varying in CP levels were formulated and fed during starter period (day-old to 3rd weeks) and grower-finisher period (4th weeks to 12th weeks). In the starter period, four dietary groups of birds received 16, 18, 20 and 22% CP while 12, 14, 16 and 18% CP respectively in the grower-finisher period. Variation in the amount of fish meal in different diets were made in order to make variation in total protein contents. Sawdust was added to some diet groups for keeping nutrient densities as desired. It contributed no nutrient except a little amount of fibre. The detailed composition of the experimental diets is shown in table 1.

Management

Ducklings were battery brooded during starter period by providing temperatures of 32.2, 28.4 and 26.6℃ in the first, second and third week

TABLE 1. COMPOSITION OF THE EXPERIMENTAL DIETS

Feed ingredients	CP in starter diets (%)				CP in grower-finisher diets (%)			
(%)	16	18	20	22	12	14	16	18
Wheat	60	57	49	44	50	50	50	46
Rice polish	13	11	10	10	23	22	22	21
Soyabean oil	0	0	0.5	0.5	3	2.25	0.5	0.5
Sesame oil cake	13	16	23	26	9	11	16	18
Fish meal	9	12	14	17	3	6	7	11
Bone meal	2	2	1	1	3	3	2.5	2
Oyster shell	1.5	1	1.5	1	2	1.5	1.5	1
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Saw dust	1	0.5	0.5	0	6.5	3.75	0	0
Vitamin-mineral premix*	+	+	+	+	+	+	+	+
Chemical composition:								
Crude protein (%)	16	17.9	20	21.9	11.9	13.9	15.9	18
ME (MJ/kg)	12.1	12.1	12	12	11.9	12.1	12.1	11.9
Cystine (%)	0.24	0.37	0.41	0.45	0.26	0.29	0.33	0.37
Lysine (%)	0.89	1.06	1.22	1.39	0.46	0.72	0.83	0.99
Methionine (%)	0.42	0.54	0.66	0.75	0.26	0.33	0.42	0.50
Tryptophan (%)	0.26	0.30	0.36	0.40	0.15	0.18	0.23	0.26

* Added @ 0.25 kg/100 kg mixed feed.

Each 2.5 g premix contained:

Vit A 12,000 I.U.; Vit D_3 2,500 I.U.; Vit. E 20 I.U.; Vit. K_3 4 mg; Vit. B_1 1.5 mg; Vit B_2 5 mg; Vit. B_6 4 mg; Nicotinic acid 30 mg; Pantothenic acid 10 mg; Vit B_{12} 10 mg; Folic acid 0.50 mg; Co 0.3 mg; Cu 16 mg; Fe 24 mg; Mn 48 mg; Zn 40 mg; Se 0.12 mg; DL-Methionine 50 mg and Choline chloride 50%.

respectively. They were subsequently transferred to saw dust litter floors at the beginning of grower-finisher period and kept there until completion of the experiment. All mash dry feed was supplied *ad libitum* and the availability of clean and cold water to birds at all times was ensured.

Record keeping

During the entire experimental period, the daily air temperature was recorded from the Bangladesh Agricultural University weatheryard. The average weekly temperature was calculated from these data. Body weight was first noted at the beginning of the experiment and thereafter both body weight and feed intake were recorded weekly. Body weight gain and feed conversion efficiency were determined by calculations. The protein efficiency data were obtained by dividing g weight gain by protein intake in g. This was free of unit. Market price of feed ingredients was considered in determining feed cost and both feed cost and cost of day-old ducklings were taken into account to determine production cost of live ducklings fed varying levels of protein up to a given period.

Statistical treatments of data

Data collected and obtained by calculations were subjected to analysis of variance in a completely randomized design. Duncan's new multiple range test was performed where ANOVA showed a significant difference. All statistical procedures were in accordance with Steel and Torrie (1980).

Results and Discussion

Performance during 0 to 3 weeks

It appears from table 2 that weight gain increased with the increasing level of dietary protein and significant differences were observed between 16 and 18, 16 and 20, 16 and 22 and 18 and 22% CP levels. This result indicates that 20% CP dietary level is adequate for optimum growth of Pekin ducklings during the first 3 weeks of age. This is partially consistent with the reports of Hoj (1975), Rous et al. (1976) and Ali and Sarker (1992).

Feed consumption was least at 16% level and differed significantly from the remaining dietary groups. The results partially agree with Wilson (1975), Leclerceq and Carville (1976) and Siregar et al. (1982a). Feed efficiency was found to be improved as the dietary level of protein was increased. The feed efficiency was lowest with 16% CP level. This is probably due to lowest food consumption and lowest weight gain. Protein efficiency was significantly better in the diet groups of 16 and 18% CP than 20 and 22% CP levels.

Performance during 0 to 6 weeks

The weight gain increased with the increasing level of dietary protein during this period and the differences were significant. Feed consumption was not affected significantly among 18/14, 20/16 and 22/18% CP levels while this was lowest at 16/12% CP and differed significantly from other levels. Feed efficiency was found to be improved with the increasing level of dietary protein and the differences were significant among the levles studied. Protein efficiency was found to be the best at 16/12% CP and differed significantly from the remaining dietary groups. The production cost of live ducklings at the age of 6 weeks significantly decreased with the increasing level of dietary protein but the differences of production cost between 20/16 and 22/18% CP was nonsignificant.

Performance during 0 to 9 weeks

It is clear from table 2 that weight gain increased with the increasing level of dietary protein during 0 to 9 weeks and significant differences were observed between 16/12 & 18/14, 16/12 & 20/16, 16/12 & 22/18% and 18/14 & 22/18% CP levels. The results indicate that increasing the dietary protein above 16% during grower-finisher period did not show significant improvement during 0 to 9 weeks period. Feed consumption was not affected significantly among 18/14, 20/16 and 22/18% CP level while it was lowest at 16/12% CP and differed significantly from the remaining dietary groups. Feed efficiency significantly improved with the increasing level of dietary protein while protein efficiency was significantly better at lower protein levels. The production cost of live ducklings at the age of 9 weeks significantly decreased with increasing level of dietary proteins. However, the differences between 20/16 & 22/18% CP was nonsignificant.

TABLE 2. PERFORMANCE OF WHITE PEKIN DUCKLINGS FED VARYING LEVELS OF DIETARY PROTEIN

Variables		Dietary protein levels (%)			
		$16^x/12^y$	$18^x/14^y$	$20^x/16^y$	$22^x/18^y$
During 0-3 weeks					
Weight gain (g)	**	293^a	374^b	427^{bc}	472^c
Feed consumption (g)	**	446^a	524^b	568^b	591^b
Feed efficiency	*	1.52^a	1.40^{ab}	1.33^b	1.25^b
Protein efficiency	**	4.11^a	3.96^a	3.76^b	3.63^b
During 0-6 weeks					
Weight gain (g)	**	727^a	948^b	$1,032^b$	$1,145^c$
Feed consumption (g)	**	$1,376^a$	$1,682^b$	$1,688^b$	$1,747^b$
Feed efficiency	**	1.89^a	1.77^b	1.64^c	1.53^d
Protein efficiency	**	3.97^a	3.70^b	3.52^b	3.39^b
Production cost[1] (Tk/kg)	**	30.76^a	26.39^b	24.33^c	22.79^c
During 0-9 weeks					
Weight gain (g)	**	$1,170^a$	$1,370^b$	$1,440^{bc}$	$1,532^c$
Feed consumption (g)	**	$2,960^a$	$3,311^b$	$3,378^b$	$3,445^b$
Feed efficiency	**	2.53^a	2.42^b	2.35^c	2.25^d
Protein efficiency	**	3.13^a	2.83^b	2.56^c	2.38^d
Production cost[1] (Tk/kg)	**	27.72^a	26.05^b	24.61^c	24.51^c
During 0-12 weeks					
Weight gain (g)	**	$1,579^a$	$1,658^{ab}$	$1,717^b$	$1,733^b$
Feed consumption (g)	NS	4,540	4,643	4,713	4,662
Feed efficiency	**	2.88^a	2.80^{ab}	2.74^b	2.40^c
Protein efficiency	**	2.81^a	2.47^b	2.21^c	2.01^d
Production cost (Tk[1]/kg)	**	26.81^a	26.75^a	25.56^b	26.38^a

[x] Dietary protein content in the starter period.

[y] Dietary protein content in the grower-finisher period.

Means in the same row bearing uncommon superscripts differ significantly; ** $p < 0.01$; * $p < 0.05$; NS: Not significant.

[1] Tk. = Taka (local currency).

Tk 39.5 = 1 US$.

Performance during 0 to 12 weeks

It appears from table 2 that the weight gain was not significantly affected by 18/14, 20/16 and 22/18% levels of dietary protein while weight gain at 16/12% level was significantly lower than 20/16 and 22/18% levels but not at 18/14% CP level. This indicates that 14% CP is adequate for optimum growth during the grower-finisher period of 3 to 12 weeks for Pekin ducklings. Feed consumption was not affected by a variation in protein levels. Feed efficiency between 16/12 & 18/14% and 18/14 & 20/16% CP level were nonsignificant. Protein efficiency was significantly better at lower protein levels. The production cost/kg live ducklings was significantly lower at 20/16% CP level in comparison with other dietary groups.

The results of the present study indicate that the protein needs of ducklings should be satisfied depending on the age at which the birds are to be marketed. This is to keep the production cost to a minimum. If the ducklings are to be marketed at younger ages, i.e. 6 weeks, 22/18% CP would be sufficient for optimum growth. When the marketing of live ducklings is aimed at 9 weeks, 20/16% CP would be adequate for optimum growth. These results are almost similar to those reported previously by Pilla and Quilics (1975) and Siregar et al. (1982a). For ducklings which are to be marketed at 12 weeks, a protein level of 18/14% would be required for optimum growth. This might be due to exceptional capacity of the ducklings for compensatory growth as reproted by Dean (1972). This is also evident

from figure 1. The daily gain was better at higher level of dietary protein upto the age of 6 weeks while reverse growth pattern was observed afterwards ie more gain at lower dietary protein levels. Therefore, it appears that if the ducklings are allowed sufficient time to compensate the early growth restriction, even lower level of protein would be sufficient for optimum growth during grower-finisher period. It is also clear from figure 1 that the maximum daily gain in Pekin ducklings occur at the age of 6th week depending on the level of protein in the diet. The results agreed well with Ziegleral et al. (1986).

The feed consumption was not affected by the dietary protein level of 18/14 to 22/18% levels while significantly lowered at 16/12% during the grower-finisher period of 6 and 9 weeks. The cause was unknown. The results partially agreed with Leclercq and Carville (1976) and Siregar et al. (1982a, 1982b). It is evident from figure 2 that the daily feed consumption/bird at the first week was between 20 and 24 g which rose to 72 to 88 g at the age of 8th week and again gradually declined to 43 to 69 g at 12th week. This reflects the lower body weight gain in the present study in the tropical region. The body weight gain of ducklings as obtained in this study was lower with all diet groups in general. Therefore, the growth curve plotted with the data might not be true for fast growth strains. The possible reason for it might be the poor genetic potentiality of the breeding stock from which eggs were hatched. In spite of this fact, the results of this study should not undermine the effect of varying levels of protein in the diet since all birds were considered from the same hatch belonging to same genetic group. Siregar et al. (1982a) in a study with Pekin male and female duckling at the University of New England, reported daily feed consumption of 25 to 30 g/duckling at the age of 1st week which sharply rose to 200 to 225 g at the age of 6th week and maintained the same level upto the age of 8th week. In this study, the air temperature at 8th week was 26.9℃ which sharply rose to 30℃ at 9th week and maintained almost similar level during the rest of the experimental period. The protein efficiency was found to be significantly better at lower dietary protein levels. The results are consistent with Reddy et al. (1980) and Ali and Sarker (1992). The production cost/kg live duckling at the age of 12 weeks was significantly lower at 20/16% CP levels in comparison with other dietary levels.

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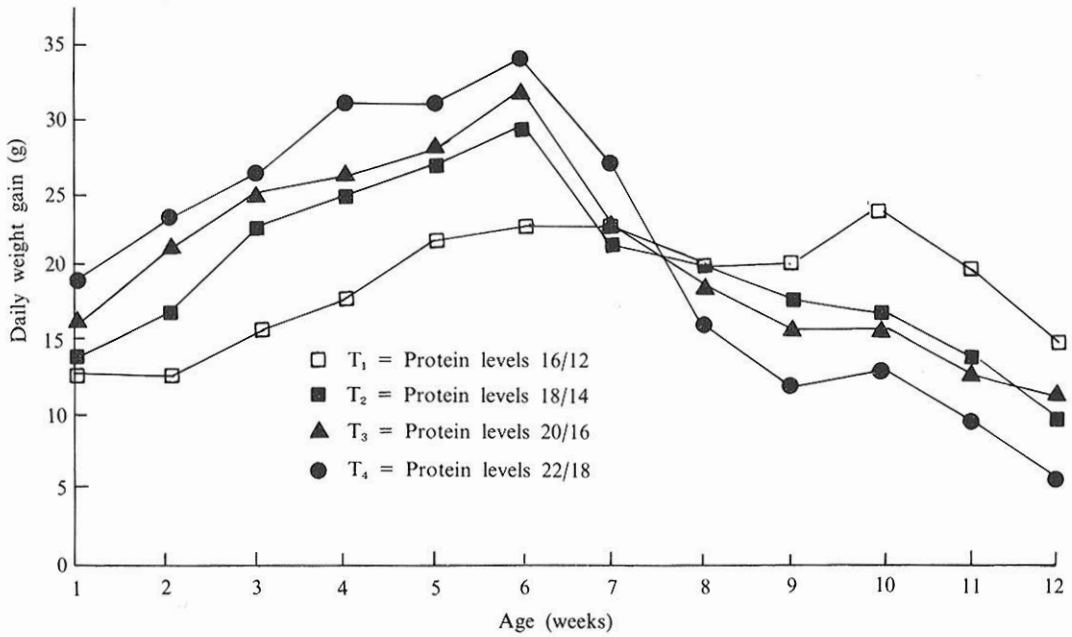

Figure 1. Relationship between age in weeks and daily weight gain.

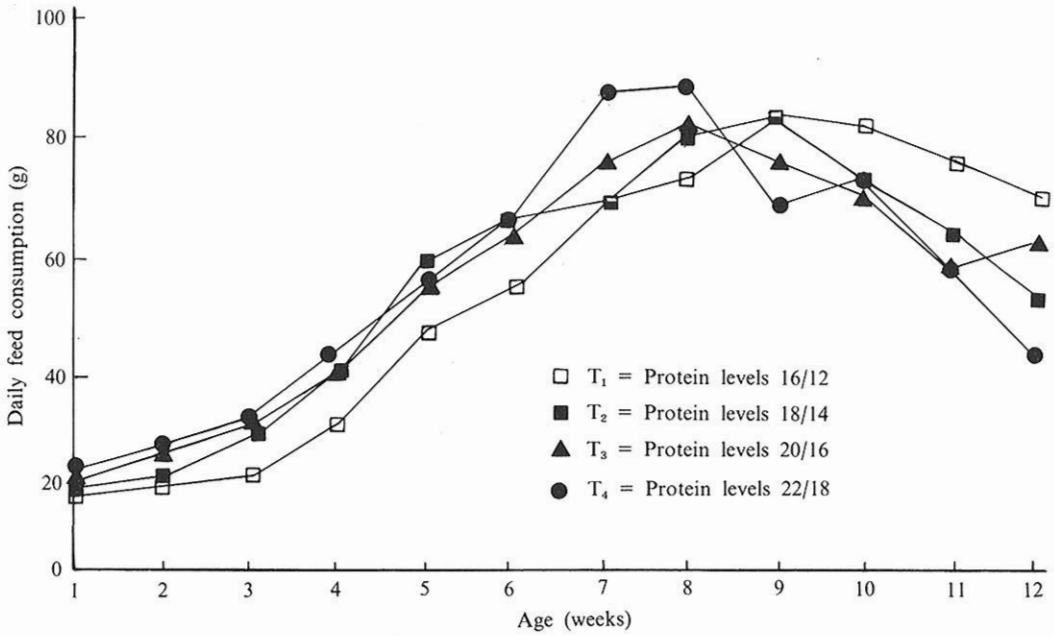

Figure 2. Relationship between age in weeks and daily feed consumption.

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