Economics of egg production in birds fed on diets containing different energy and protein levels with and without fish meal

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ABSTRACT

The present study was carried out to evaluate economics of egg production in birds (n= 80) fed on diets containing different energy and protein levels with and without fish meal divided into eight equal groups (T_1, T_2, T_3, T_4, T_5, T_6, T_7 and T_8). Birds in all the eight groups were fed maize, soybean meal, fish meal (Jawla fish) and deoiled rice polish (DORP). The economics of egg production was calculated on the basis of quantity of feed consumed, its cost and price of eggs. Cost of feed consumed daily per dozen eggs as well as per kilogram eggs was calculated. Considering the receipt per dozen eggs as well as per kg eggs and the cost of feed consumed and finally the return over feed cost was calculated based on the per dozen as well as per kg eggs. Based on the net return over feed cost per dozen as well as per kg eggs it was concluded that diet containing 14 per cent crude protein and 2700 kcal ME/kg was most economical. Hence considering the performance of the birds and economics of their egg production it was concluded that diet containing 14 per cent crude protein and 2700 kcal ME/kg along with lysine and methionine either through pure amino acids or fish meal was most economical.

Keywords: Poultry; economics; fish meal; egg; energy; protein

INTRODUCTION

Poultry is one of the fastest growing segments of the agricultural sector in India today. It is growing at a much faster rate and accounts for 100 billion rupees to the gross national product (GNP). In India egg production is growing at a compounded annual growth rate of over 8 per cent. The production of agricultural crops has been rising at a rate of 1.5 to 2 per cent while that of eggs at a rate of 8 to 10 per cent per annum. India although is the world's fifth largest egg producer its per capita egg consumption is poor ie 37 eggs per annum (Mehta 2002). These levels are too low as compared to the world average of 147 eggs on per capita basis (Vetrivel and Kumarmangalam 2010).

There is a large variation in the egg consumption among the people of rural and urban areas. Among rural mass it is only 7.7 per annum in comparison to 17.8 per annum in urban areas. The main sources of protein in poultry rations are animal or plant proteins. Vegetable proteins constitute around 30 per cent of total compounded poultry diet. Majority of the vegetable protein sources are deficient in one or more critical amino acids like methionine, lysine, etc (Adeyemo et al 2012). On account of it a single vegetable protein source cannot be used as a sole source of protein in layer ration. The nutrient requirements of poultry tend to change from one generation to the next because of the applied speed of genetic selection (McDonald et al 2002). Several factors influence nutrient requirements of poultry (Mandal et al 2006). Efforts are continuously made by the researchers to improve the production potential and efficiency of nutrient utilization in birds.

MATERIAL and METHODS

The experiment was laid out in completely randomized design. In the beginning of the experiment one hundred and twenty layer birds were weighed and

their egg production was regularly monitored for fifteen days. Eighty birds of average body weights were selected for the experiment. Rest of the birds with higher and lower body weights were rejected. Considering their body weights and egg production eighty birds were randomly distributed to eight different groups and were assigned eight different diets. Thus each diet was offered to ten layer birds.

The experiment consisted of eight dietary treatments. These were containing different levels of energy and protein. In all the diets lysine and methionine amino acids were maintained at least as per NRC level (Anon 1994). The dietary treatments were T_1 [Crude protein (CP) 14% and metabolizable energy (ME) 2600 kcal/kg without fish meal], T_2 (CP 14% and ME 2600 kcal/kg with fish meal), T_3 (CP 16% and ME 2600 kcal/kg without fish meal), T_4 (CP 16% and ME 2600 kcal/kg with fish meal), T_5 (CP 14% and ME 2700 kcal/kg without fish meal), T_6 (CP 14% and ME 2700 kcal/kg with fish meal), T_7 (CP 16% and ME 2700 kcal/kg without fish meal) and T_8 (CP 16% and ME 2700 kcal/kg with fish meal).

The economics of egg production was calculated on the basis of quantity of feed consumed, its cost and price of eggs. Cost of feed consumed daily per dozen as well as per kilogram eggs was calculated. Considering the receipt per dozen as well as per kg eggs and the cost of feed consumed finally the return over feed cost was calculated based on the per dozen as well as per kg eggs.

The data obtained during the experiment were analysed statistically using completely randomized design as per the procedure described by Snedecor and Cochran (1980) and differences among the treatments were tested for significance by Duncan's new multiple range test (Duncan 1955).

RESULTS and DISCUSSION

Economics of egg production

The economics of egg production in birds assigned diets with different energy and protein levels without and with fish meal at different slabs of weeks of the experiment is given in Table 1 and the comparative economics of egg production in birds on diets with different energy and protein levels without and with fish meal of the experiment is furnished in Table 2.

During 0-4 weeks of the experiment (32-36 weeks of age): The feed cost per dozen eggs was maximum in birds assigned T_7 diet. In comparison to it slightly lower feed cost was observed in birds fed on T_1, T_3 and T_5 diets but differences were non-significant. Minimum feed cost per dozen eggs was noted in birds assigned T_8 diet. It was also statistically similar to those allotted T_2, T_4, T_5 and T_6 diets.

Receipt per dozen eggs was same in all the birds. But receipt per kg eggs was maximum in birds offered T_1 diet. Statistically it was similar with those allotted T_5 and T_7 diets. Minimum receipt per kg eggs was obtained in birds assigned T_4 diet. However among large groups of birds (T_2, T_3, T_6, T_7 and T_8) receipt per kg eggs did not differ significantly.

The return over feed cost per dozen eggs was maximum in birds offered T_8 diet that was statistically similar to those allotted T_6 diet. Lowest return was recorded in birds assigned T_7 diet. But statistically it was also similar to those assigned T_1, T_3 and T_5 diets. Return over feed cost per kg eggs was maximum and significantly higher in birds assigned T_8 diet. Minimum return over feed cost per kg eggs noted in birds fed T_7 diet was comparable with T_3 diet.

Among birds offered diets without fish meal, feed cost per dozen eggs did not differ significantly. The feed cost per kg eggs was significantly higher in birds allotted T_1, T_3 and T_5 diets in comparison to those offered T_7 diet. Receipt per dozen eggs was similar while receipt per kg eggs was maximum in those allotted T_1 diet however statistically it was comparable to those allotted T_5 and T_7 diets. It was minimum in birds assigned T_3 diet. Return over feed cost per dozen eggs did not differ significantly. The return over feed cost per kg eggs was maximum in birds raised on T_1 diet and minimum in those allotted T_7 diet. However between T_1, T_3 and T_5 groups differences were non-significant.

Among the birds assigned fish meal diets feed cost per dozen eggs was statistically similar. But feed cost per kg eggs was maximum in birds offered T_4 diet and it was minimum in birds assigned T_8 diet. However between groups allotted T_2, T_4 and T_6 diets differences were non-significant. Receipt per dozen as well as per kg eggs among these groups did not differ significantly. Return over feed cost was maximum in birds assigned T_8 diet. However it was statistically

Table 1. Economics of egg production in birds fed on diets with different energy and protein levels without and with fish meal

Treatment	Feed cost/dozen eggs (Rs)	Feed cost/kg eggs (Rs)	Receipt/dozen eggs (Rs)	Receipt/kg eggs (Rs)	Return over feed cost/dozen eggs (Rs)	Return over feed cost/kg eggs (Rs)
0-4 weeks of the experiment						
T_1	30.22^{a}	52.99^{a}	45.6	79.98^{a}	15.38^{e}	26.99^{cd}
T_2	28.04^{b}	46.80^{cd}	45.6	76.11^{bc}	17.56^{bc}	29.31^{bc}
T_3	30.03^{a}	50.38^{ab}	45.6	76.50^{bc}	15.57^{de}	26.12^{de}
T_4	28.94^{b}	48.07^{bc}	45.6	75.74^{c}	16.66^{cd}	27.67^{c}
T_5	30.34^{ab}	52.64^{a}	45.6	79.13^{ab}	15.26^{e}	26.49^{d}
T_6	27.56^{b}	46.23^{cd}	45.6	76.46^{bc}	18.04^{ab}	30.23^{b}
T_7	30.88^{a}	53.05^{a}	45.6	78.30^{abc}	14.72^{e}	25.25^{e}
T_8	26.55^{b}	44.44^{d}	45.6	76.38^{bc}	19.06^{a}	31.94^{a}
LSD	1.595	2.837	-	3.359	1.135	1.634
5-8 weeks of the experiment						
T_1	29.04^{b}	44.02^{b}	45.6	69.14^{a}	16.56^{b}	25.12^{b}
T_2	27.08^{c}	40.88^{c}	45.6	68.87^{a}	18.52^{a}	27.99^{a}
T_3	30.84^{a}	46.54^{a}	45.6	68.79^{a}	14.76^{c}	22.25^{c}
T_4	29.22^{b}	44.44^{b}	45.6	69.38^{a}	16.38^{b}	24.94^{b}
T_5	29.01^{b}	44.55^{b}	45.6	70.01^{a}	16.59^{b}	25.46^{b}
T_6	26.84^{c}	40.71^{c}	45.6	69.17^{a}	18.76^{a}	28.46^{a}
T_7	31.50^{a}	47.58^{a}	45.6	68.87^{a}	14.10^{c}	21.29^{c}
T_8	28.82^{b}	43.61^{b}	45.6	69.00^{a}	16.78^{b}	25.39^{b}
LSD	1.327	1.987	-	1.419	1.146	1.433
9-12 weeks of experiment						
T_1	32.52^{ab}	49.01^{a}	48.0	72.32^{a}	15.48^{c}	23.31^{bc}
T_2	29.99^{bc}	45.28^{bc}	48.0	72.45^{a}	18.01^{a}	27.17^{a}
T_3	33.63^{a}	48.80^{a}	48.0	69.65^{b}	14.37^{c}	20.85^{d}
T_4	33.08^{a}	49.62^{a}	48.0	72.01^{a}	14.92^{c}	22.39^{cd}
T_5	30.13^{bc}	45.09^{bc}	48.0	71.81^{a}	17.87^{ab}	26.72^{a}
T_6	29.53^{bc}	43.95^{bc}	48.0	71.40^{ab}	18.47^{a}	27.45^{a}
T_7	31.25^{b}	46.16^{b}	48.0	70.91^{a}	16.75^{b}	24.75^{b}
T_8	29.33^{c}	42.98^{c}	48.0	70.32^{a}	18.67^{a}	27.34^{a}
LSD	1.733	2.314	-	2.137	1.239	1.752
12 weeks period						
T_1	30.59^{a}	48.67^{a}	46.4	73.81^{a}	15.81^{bc}	25.14^{bc}
T_2	28.37^{bc}	44.32^{b}	46.4	72.48^{a}	18.03^{ab}	28.16^{ab}
T_3	31.50^{a}	48.57^{a}	46.4	71.65^{a}	14.90^{c}	23.07^{c}
T_4	30.41^{a}	47.38^{a}	46.4	72.38^{a}	15.99^{abc}	25.00^{abc}
T_5	29.83^{ab}	47.43^{a}	46.4	73.65^{a}	16.57^{abc}	26.22^{abc}
T_6	27.98^{c}	43.63^{b}	46.4	72.34^{a}	18.42^{a}	28.71^{a}
T_7	31.21^{a}	48.93^{a}	46.4	72.69^{a}	15.19^{c}	23.76^{c}
T_8	28.23^{c}	43.68^{b}	46.4	71.90^{a}	18.17^{ab}	28.22^{a}
LSD	1.837	2.412	-	2.236	2.552	1.837

Values carrying similar letters under each slab of weeks did not differ significantly (P>0.05)

T_1 [Crude protein (CP) 14% and metabolizable energy (ME) 2600 kcal/kg without fish meal], T_2 (CP 14% and ME 2600 kcal/kg with fish meal), T_3 (CP 16% and ME 2600 kcal/kg without fish meal), T_4 (CP 16% and ME 2600 kcal/kg with fish meal), T_5 (CP 14% and ME 2700 kcal/kg without fish meal), T_6 (CP 14% and ME 2700 kcal/kg with fish meal), T_7 (CP 16% and ME 2700 kcal/kg without fish meal), T_8 (CP 16% and ME 2700 kcal/kg with fish meal)

Table 2. Comparative economics of egg production in birds fed on diets with different energy and protein levels without and with fish meal

Treatment	CP/ME	Feed cost/dozen eggs (Rs)	Feed cost/kg eggs (Rs)	Receipt/ dozen eggs (Rs)	Receipt/ kg eggs (Rs)	Return over feed cost/dozen eggs (Rs)	Return over feed cost/kg eggs (Rs)
0-4 weeks of experiment							
Without fish meal							
T_1	14/2600	30.22^{a}	52.99^{a}	45.6	79.98^{a}	15.38^{e}	26.99^{cd}
T_5	14/2700	30.34^{ab}	52.64^{a}	45.6	79.13^{ab}	15.26^{e}	26.49^{d}
T_3	16/2600	30.03^{a}	50.38^{ab}	45.6	76.50^{bc}	15.57^{de}	26.12^{de}
T_7	16/2700	30.88^{a}	53.05^{a}	45.6	78.30^{abc}	14.72^{e}	25.25^{e}
With fish meal							
T_2	14/2600	28.04^{b}	46.80^{cd}	45.6	76.11^{bc}	17.56^{bc}	29.31^{bc}
T_6	14/2700	27.56^{b}	46.23^{cd}	45.6	76.46^{bc}	18.04^{ab}	30.23^{b}
T_4	16/2600	28.94^{b}	48.07^{bc}	45.6	75.74^{c}	16.66^{cd}	27.67^{c}
T_8	16/2700	26.55^{b}	44.44^{d}	45.6	76.38^{bc}	19.06^{a}	31.94^{a}
LSD	- 1.595	2.837	-	3.359	1.135	1.634	
5-8 weeks of experiment							
Without fish meal							
T_1	14/2600	29.04^{b}	44.02^{b}	45.6	69.14^{a}	16.56^{b}	25.12^{b}
T_5	14/2700	29.01^{b}	44.55^{b}	45.6	70.01^{a}	16.59^{b}	25.46^{b}
T_3	16/2600	30.84^{a}	46.54^{a}	45.6	68.79^{a}	14.76^{c}	22.25^{c}
T_7	16/2700	31.50^{a}	47.58^{a}	45.6	68.87^{a}	14.10^{c}	21.29^{c}
With fish meal							
T_2	14/2600	27.08^{c}	40.88^{c}	45.6	68.87^{a}	18.52^{a}	27.99^{a}
T_6	14/2700	26.84^{c}	40.71^{c}	45.6	69.17^{a}	18.76^{a}	28.46^{a}
T_4	16/2600	29.22^{b}	44.44^{b}	45.6	69.38^{a}	16.38^{b}	24.94^{b}
T_8	16/2700	28.82^{b}	43.61^{b}	45.6	69.00^{a}	16.78^{b}	25.39^{b}
LSD	-	1.327	1.987	-	1.419	1.146	1.433
9-12 weeks of experiment							
Without fish meal							
T_1	14/2600	32.52^{ab}	49.01^{a}	48.0	72.32^{a}	15.48^{c}	23.31^{bc}
T_5	14/2700	30.13^{bc}	45.09^{bc}	48.0	71.81^{a}	17.87^{ab}	26.72^{a}
T_3	16/2600	33.63^{a}	48.80^{a}	48.0	69.65^{b}	14.37^{c}	20.85^{d}
T_7	16/2700	31.25^{b}	46.16^{b}	48.0	70.91^{a}	16.75^{b}	24.75^{b}
With fish meal							
T_2	14/2600	29.99^{bc}	45.28^{bc}	48.0	72.45^{a}	18.01^{a}	27.17^{a}
T_6	14/2700	29.53^{bc}	43.95^{bc}	48.0	71.40^{ab}	18.47^{a}	27.45^{a}
T_4	16/2600	33.08^{a}	49.62^{a}	48.0	72.01^{a}	14.92^{c}	22.39^{cd}
T_8	16/2700	29.33^{c}	42.98^{c}	48.0	70.32^{a}	18.67^{a}	27.34^{a}
LSD	-	1.733	2.314	-	2.137	1.239	1.752
12 weeks period							
Without fish meal							
T_1	14/2600	30.59^{a}	48.67^{a}	46.4	73.81^{a}	15.81^{bc}	25.14^{bc}
T_5	14/2700	29.83^{ab}	47.43^{a}	46.4	73.65^{a}	16.57^{abc}	26.22^{b}
T_3	16/2600	31.50^{a}	48.57^{a}	46.4	71.65^{a}	14.90^{c}	23.07^{d}
T_7	16/2700	31.21^{a}	48.93^{a}	46.4	72.69^{a}	15.19^{c}	23.76^{cd}
With fish meal							
T_2	14/2600	28.37^{bc}	44.32^{b}	46.4	72.48^{a}	18.03^{ab}	28.16^{a}
T_6	14/2700	27.98^{c}	43.63^{b}	46.4	72.34^{a}	18.42^{a}	28.71^{a}
T_4	16/2600	30.41^{a}	47.38^{a}	46.4	72.38^{a}	15.99^{abc}	25.00^{bc}
T_8	16/2700	28.23^{c}	43.68^{b}	46.4	71.90^{a}	18.17^{ab}	28.22^{a}
LSD	-	1.837	2.412	-	2.236	2.552	1.837

Values carrying similar letters under each slab of weeks did not differ significantly (P >0.05)

T_1 [Crude protein (CP) 14% and metabolizable energy (ME) 2600 kcal/kg without fish meal], T_2 (CP 14% and ME 2600 kcal/kg with fish meal), T_3 (CP 16% and ME 2600 kcal/kg without fish meal), T_4 (CP 16% and ME 2600 kcal/kg with fish meal), T_5 (CP 14% and ME 2700 kcal/kg without fish meal), T_6 (CP 14% and ME 2700 kcal/kg with fish meal), T_7 (CP 16% and ME 2700 kcal/kg without fish meal), T_8 (CP 16% and ME 2700 kcal/kg with fish meal)

comparable to those allotted T_6 diet. The return over feed cost per kg eggs was maximum and significantly higher in birds offered T_8 diet. Minimum return was noticed in birds allotted T_4 diet. Between groups assigned T_2 and T_4 diets differences were non-significant.

During 5-8 weeks of the experiment (37-40 weeks of age): Treatment means of the feed cost per dozen eggs indicated minimum feed cost in birds assigned T_6 diet which was comparable with those allotted T_2 diet. Maximum feed cost per dozen eggs observed in birds allotted T_7 diet was comparable with those assigned T_3 diet. The feed cost per kg eggs was maximum in birds allotted T_7 diet that was statistically similar to those offered T_3 diet. Minimum feed cost per kg eggs recorded in birds offered T_6 diet was statistically comparable with those raised on T_2 diet. However the feed cost per kg eggs between groups assigned T_1, T_4, T_5 and T_8 diets was statistically similar. Receipt per dozen as well as per kg eggs was similar among the birds of different groups. Return over feed cost per dozen as well as per kg eggs was maximum in birds assigned T_6 diet which was comparable with T_2. While minimum return over feed cost was obtained in birds assigned T_7 diet but it was statistically comparable to those allotted T_3 diet.

Among the birds offered diets without fish meal feed cost per dozen as well as per kg eggs was significantly lower in groups assigned T_1 and T_5 diets while it was significantly higher in those assigned T_3 and T_7 diets. Receipt per dozen as well as per kg eggs among the groups did not differ significantly. Return over feed cost per dozen as well as per kg eggs was significantly higher in birds assigned T_1 and T_5 diets in comparison to those allotted T_3 and T_7 diets.

Among the groups received fish meal diets feed cost per dozen as well as per kg eggs was significantly lower in groups assigned T_2 and T_6 diets while it was significantly higher in those allotted T_4 and T_8 diets. Receipt per dozen as well as kg eggs among different groups did not differ significantly. Conversely return over feed cost per dozen as well as per kg eggs was significantly higher in birds raised on T_2 and T_6 diets and lower in those maintained on T_4 and T_8 diets.

During 9-12th weeks of the experiment (41-44 weeks of age): The maximum feed cost was in birds assigned T_3 diet. However statistically it was comparable with those allotted T_1 and T_4 diets. The minimum feed cost per dozen eggs was realised in birds allotted T_8 diet. However it was also comparable to those assigned T_2, T_5 and T_6 diets. Receipt per dozen eggs was similar in all the groups. While receipt per kg eggs except in birds fed on T_3 diet where it was minimum among all other groups differences were non-significant.

Return over feed cost per dozen eggs was maximum in birds assigned T_8 diet which was comparable to those raised on T_2, T_5 and T_6 diets. The feed cost per kg eggs was maximum in birds allotted T_6 diet that was statistically similar to those maintained on T_1 and T_3 diets. Significantly lower return over feed cost per dozen as well as per kg eggs was observed in birds raised on T_3 diet.

Among the groups of birds fed diets without fish meal feed cost per dozen as well as per kg eggs was significantly higher in groups allotted T_1 diet that was statistically comparable with those offered T_3 diet. Lowest feed cost per dozen eggs recorded in groups assigned T_7 diet was comparable with those fed on T_5 diet. Receipt per dozen eggs was similar in all the groups and receipt per kg eggs was significantly higher in birds offered T_1, T_5 and T_7 diets in comparison to those allotted T_3 diet. Return over feed cost per dozen eggs was maximum in birds assigned T_5 diet which was statistically comparable with those allotted T_7 diet. Minimum return noted in birds assigned T_3 diet was statistically similar to those allotted T_1 diet. Return over feed cost per kg eggs was also maximum in birds fed T_5 diet. It was minimum and significantly lower in birds allotted T_3 diet.

Among the groups of birds offered fish meal diets feed cost per dozen as well as per kg eggs was maximum and significantly higher in birds assigned T_4 diet. It was followed by those allotted T_2 and T_6. Minimum feed cost noted in groups assigned T_8 diet was statistically comparable with those fed T_2 and T_6 diets. The receipt per dozen as well as per kg eggs was statistically similar in all the groups. Return over feed cost per dozen as well as per kg eggs was significantly higher in birds assigned T_2, T_6 and T_8 diets. These returns were significantly lower in birds allotted T_4 diet.

Cumulative economics of egg production: The feed cost per dozen as well as per kg eggs was significantly higher in birds assigned T_3 diet that was

statistically comparable with those allotted T_1, T_4, T_5 and T_7 diets. Lowest feed cost noted in birds offered T_6 diet was statistically comparable with those assigned T_2 diet. Receipt per dozen as well as per kg eggs did not differ significantly among different groups of birds.

As regards return over feed cost per dozen as well as per kg eggs maximum return was noted in birds assigned T_6 diet. However return over feed cost per dozen eggs was statistically comparable among birds allotted T_2, T_4, T_5 and T_8 diets. Similarly maximum return over feed cost per kg eggs noted in birds fed T_6 diet was statistically similar to birds allotted T_2, T_4, T_5 and T_8 diets. Minimum return was noted in birds assigned T_3 diet. Return over feed cost per dozen eggs recorded in birds assigned T_3, T_4 and T_7 diets was statistically similar. Similarly return over feed cost per kg eggs observed in birds allotted T_1, T_3, T_4, T_5 and T_7 diets was statistically comparable.

Among the groups of birds offered diets without fish meal feed cost as well as receipt per dozen and per kg eggs did not differ significantly. While return over feed cost per dozen eggs was although maximum in birds assigned T_5 diet but differences were non-significant. While return over feed cost per kg eggs was significantly higher in birds assigned T_5 diet in comparison to those allotted T_3 and T_7 diets where significantly lower return was noted.

Among the groups of birds offered fish meal diets feed cost per dozen as well as per kg eggs was maximum and significantly higher in those maintained on T_4 diet. In remaining three groups (T_2, T_6 and T_8) differences were non-significant. Receipt per dozen as well as per kg eggs was statistically similar among all the groups of birds. The return over feed cost per dozen eggs was although maximum in birds offered T_6 diet but among groups differences were non-significant. While return over feed cost per kg eggs was minimum and significantly lower in birds assigned T_4 diet in comparison to other groups where statistically higher return was noted. However among these groups differences were non-significant.

Cumulative economics of egg production revealed that feed cost per dozen as well as per kg eggs was maximum in birds fed T_7 diet containing 16 per cent CP and 2700 kcal ME/kg but without fish meal. However statistically it was comparable with birds assigned T_1, T_3, T_4 and T_5 diets. Minimum cost was noted in birds allotted T_6 diet containing 14 per cent CP and 2700 kcal ME/kg with fish meal however it was also statistically similar with those allotted T_2 and T_8 diets. Receipt per dozen as well as per kg eggs did not differ significantly among different groups of birds assigned diets without or with fish meal. Return over feed cost (per dozen as well as per kg eggs) was maximum in birds assigned T_6 diet having 14 per cent CP and 2700 kcal ME/kg with fish meal. Birds offered T_2, T_4, T_5 and T_8 diets although had slightly lower return over feed cost but these were statistically similar to those assigned T_6 diet. Minimum return was noted in birds allotted T_4 diet having 16 per cent CP and 2600 kcal ME/kg with fish meal.

Economics of egg production among birds allotted diets without fish meal indicated no significant difference about feed cost as well as receipt per dozen as well as per kg eggs. The return over feed cost per dozen eggs was also statistically similar among different groups. Only return over feed cost per kg eggs was significantly higher in birds fed on T_1 diet containing 14 per cent CP and 2600 kcal ME/kg and T_5 diet consisting of 14 per cent CP and 2700 kcal ME/kg in comparison to those allotted T_3 diet having 16 per cent CP and 2600 kcal ME/kg.

On perusal of the economics of egg production among birds assigned fish meal diets it was observed that feed cost per dozen as well as per kg eggs was significantly higher in birds assigned T_4 diet containing 16 per cent CP and 2600 kcal ME/kg in comparison to other groups. While receipt per dozen as well as per kg eggs and return over feed cost per dozen eggs was statistically similar among these groups of birds. Only the return over feed cost per kg eggs was significantly lower in birds offered T_4 diet in comparison to other groups having maximum return. El-Maksoud et al (2011) also observed that the most economical efficiency and relative economical efficiency values were for hens fed on 14 per cent CP diet supplemented with methionine and lysine followed by hens fed 16 per cent CP diet.

CONCLUSION

Based on the net return over feed cost per dozen as well as per kg eggs it has been concluded that diet containing 14 per cent crude protein and 2700 kcal ME/kg was most economical. Hence considering the performance of the birds and economics of their egg production it was concluded that diet containing 14 per cent crude protein and 2700 kcal ME/kg along

with at least NRC requirements of lysine and methionine either through pure amino acids or fish meal was most economical.

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