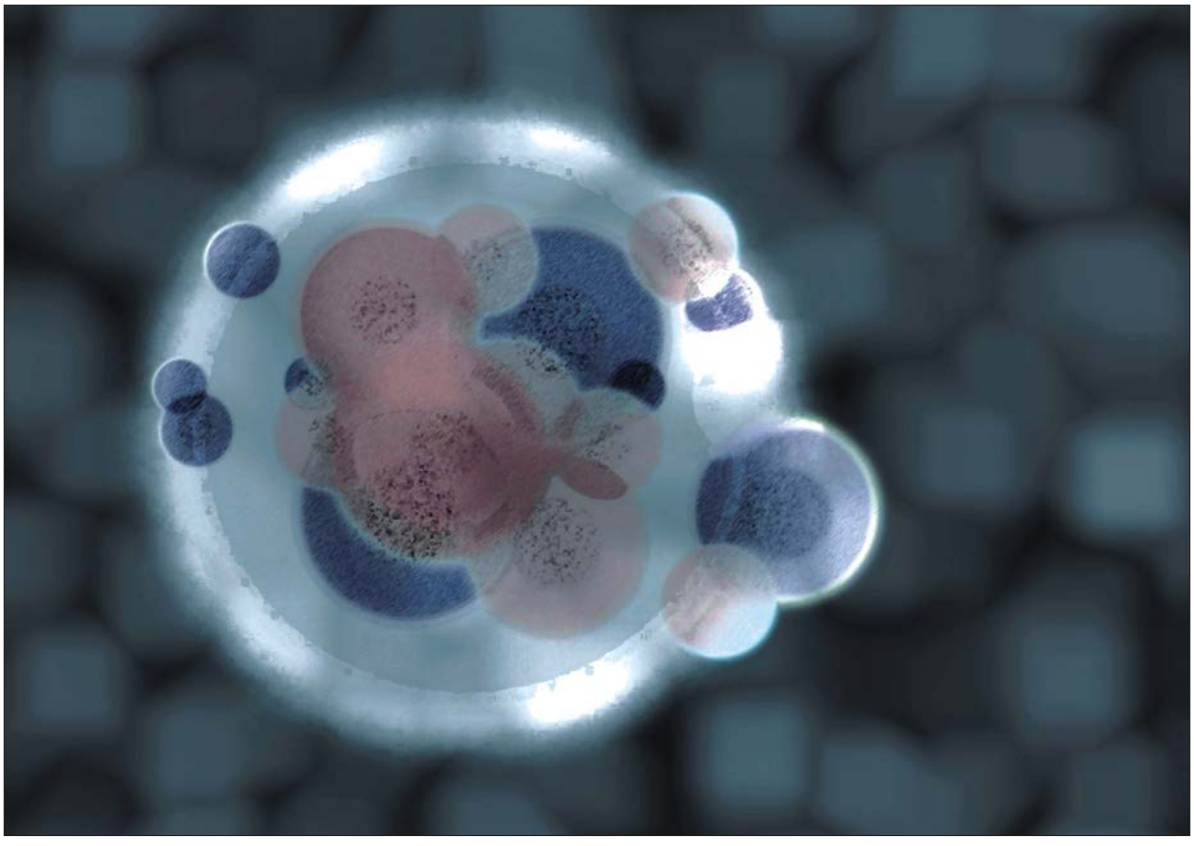

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Biological Sciences 7 (2): 327-332, 2007
ISSN 1727-3048

Study on Production System of Existing Ducks at Potuakhali District of Bangladesh and Development of a Self-sustainable Ducks Rearing Model Under Semi-scavenging System at Farmer's Condition

[1]F. Kabir, [1]M.S. Sultana, [2]G. Mustafa, [1]M.M.O. Rashid, [1]M.S.I. Khan and [1]M.A. Asgar
[1]Barisal Government Veterinary College, Babugonj, Barisal, Bangladesh
[2]Department of Livestock Services, Farmgate, Dhaka, Bangladesh

Abstract: The experiment was conducted at Mirzagonj and Bauphol upazilas of Potuakhali district of Bangladesh to estimate the need for supplementary feeding of rearing ducks. In this experiment, 50 farmers were studied. Sxteen farmers were studied as control group (no supplementation) and other 34 farmers were studied as supplemental group, i.e., 17 farmers for Level-I (50% supplementation) and 17 farmers for Level-II (70% supplementation). The results showed that all the year round scavenging feeds are not available *ad-libitum* as per requirement for rearing ducks. It was observed that grazing season of ducks may be divided into lean season (summer) that is March to June, abundance season (rainy) that is July to October and moderately abundance season (winter) that is November to February. Rainy season appeared to be the best season for rearing ducks, followed by winter and summer. The results also showed that the crop and gizzard contents contain significantly ($p<0.01$) higher amount of ME and P in winter and in rainy season than that of summer. It was also observed that the crop and gizzard contents contain significantly ($p<0.01$) higher percentage of Ca in rainy season than those of winter and summer. The results indicated that the total live weight gain of ducks in supplemented Level-I and Level-II was significantly ($p<0.01$) higher than that of the total live weight gain of control group. The results also showed that the average daily live weight gain of ducks in supplemented Level-I and Level-II was 8.85 and 9.04 g, which was significantly ($p<0.01$) higher than that of the average daily live weight gain of control group (7.88 g). It was observed that the total dry matter (DM) intake of ducks in supplemented Level-II was significantly ($p<0.01$) higher than those of the total dry matter (DM) intake of ducks in supplemented Level-I and control group. It was revealed that the average daily dry matter (DM) intake of ducks in supplemented Level-II was significantly ($p<0.01$) higher than those of the average daily dry matter (DM) intake of ducks in supplemented Level-I and control group. The results showed that the average time of first lay in control group of ducks was significantly ($p<0.01$) higher than those of supplemented Level-I and supplemented Level-II. The average duck-day egg production of supplemented Level-I was 43.93% and supplemented Level-II was 45.53%, which was significantly ($p<0.01$) higher than that of the control group of ducks (23.45%). The observation revealed that the average egg weight of ducks in supplemented Level-I and supplemented Level-II was significantly ($p<0.01$) higher than that of the control group. The results showed that the average net return of supplemented Level-I was higher than those of the control group and supplemented Level-II group of ducks. It is concluded that only scavenging system of feeding cannot fulfill the nutritional requirements of growing and productive ducks. It may be suggested that minimum level of supplemental feeds should be given to the ducks for getting maximum production under semi scavenging system at farmer's condition.

Key words: Ducks, production, semi-scavenging, farmer's condition

INTRODUCTION

Bangladesh is an agricultural country. Poultry play a significant role in the subsistence economy of Bangladesh. Ducks are one of the most important poultry species in our country. Bangladesh is also a revering country. Ducks rearing in our country is suitable, most popular and profitable also. Ducks gives us eggs and meat that is a source of animal protein. Animal protein is important for well-balanced essential amino acids. According to BARC (1990) the present per day egg production is 1.66 million against the requirement of 12.06 million, resulting a deficiency of 87%. Any improvement in poultry production would certainly help

Corresponding Author: Faisal Kabir, Barisal Government Veterinary College, Babugonj, Barisal, Bangladesh

to minimize the existing gap between the lower production and higher demand of animal protein to provide balanced diet for the people. Poultry meat and eggs are the most desirable form of animal protein and therefore, a small change in their product yields may be financially important. At present, prices of meat and eggs are beyond the buying capacity of the poor people. Increased ducks egg and meat production can play a vital role in solving these problems in a shortest possible time. There are about 85 million chickens and 33 million ducks. More than 90% of these birds are raised in the backyards (UNDP/FAO, 1983) and 96% of the poultry meat and eggs come from village poultry reared in scavenging system by landless and small landholder farmers. The poor village people of our country can rear ducks easily. Most of the farmers don't give any supplemental diets to their ducks. They can get maximum return by giving minimum supplemental diets to their ducks. Until now most of the efforts of poultry development activities in Bangladesh have been taken to improve the native stock with the introduction of exotic breeds or varieties through cross breeding/upgrading program. Little or no attention is given about he nutritional status of scavenging ducks. Non genetic factors like poor nutrition has much greater effect on production parameters than the genetic influence for the improvement of ducks under scavenging system of rearing (Sazzad *et al*., 1988). On the other hand improved feeding system of scavenging ducks was suggested by Haque *et al.* (1991) to achieve optimum production. The prospect of ducks rearing in Potuakhali District of Bangladesh lies in the fact that there are large areas of low-lying water reservoirs where waters stand throughout the year. These water reservoirs contain weeds, fishes, snails, insects, fallen grains etc., which are the only feeds for ducks reared under scavenging system. There is a great potentiality in improving the productivity of ducks in these areas through better feeding and management practices. Feed supplementation increased egg production of indigenous ducks (Haque *et al.* 1991). Increasing ducks production under semi-scavenging system is closely related with the development of feeding system. No information is available on the nutritional status or availability of nutrients to semi-scavenging ducks in our country. Therefore, an urgent approach is needed to know the existing production system and to develop a modern feeding system for optimizing productivity of the semi-scavenging ducks. The ultimate goal of this experiment is to improve the socio-economic condition of the rural poor farmers through rearing ducks.

MATERIALS AND METHODS

The experiment was conducted at Potuakhali district of Bangladesh for 500 days during the period from April, 2005 to August, 2006. Mirzagonj and Bauphol upazilas of Potuakhali district of Bangladesh were selected for this purpose.

Selection of farmers: The farmers were selected from both Mirzagonj and Bauphol upazilas. For this purpose 50 farmers were selected. Twenty five farmers were selected from each upazila. In this experiment, more emphasis was given to the small and marginal farmers. Those farmers were selected who were interested to rear ducks and who had previous experience on rearing ducks. The farmers were selected randomly.

Design of experiment: In this experiment, 50 farmers were studied. Sixteen farmers were studied as control group of ducks, i.e., Level-0 that didn't give any supplemental feed and were reared them under semi-scavenging system with naturally available feed ingredients. Another 34 farmers were studied as supplemental group of ducks that was supplied supplemental feed. Supplemental feed was supplied depending upon the scarcity of scavenging feed in different season of the year. In case of supplementation of ducks the farmers were grouped into two, i.e., 17 (seventeen) farmers for Level-I and 17 (seventeen) farmers for Level-II. Level-I group of ducks were supplied minimum level of supplemental feed (50% of the daily requirement) and Level-II group of ducks were supplied maximum level of supplemental feed (70% of the daily requirement) depending upon scarcity of scavenging feed.

Collections and supplying of ducklings: Twenty five Jinding day old ducklings were supplied to each farmer. Before supplying ducklings sexing was done manually. Male and female ratio was maintained 1:6. For this purpose 18 female and 3 male ducklings were supplied and 4 extra ducklings (3 female and 1 male) were supplied for security measure as mortality or any loss or damage. Ducklings were collected from Narayangonj Central Duck Breeding Farm, Narayangonj, Bangladesh.

Methods of feeding: All ducks were reared in semi-scavenging system. Level-0 group of ducks didn't give any supplemental feed and were reared them with naturally available feed ingredients. Level-I group of ducks were supplied minimum level of supplemental feeds and Level-II group of ducks were supplied maximum level of supplemental feeds. Supplemental feeds were given

depending upon the scarcity of scavenging feeds in different season of the year. Supplemental feeds were prepared by mixing of wheat, maize, wheat bran, rice polish, soybean meal, oil cakes, vitamins, oyster shell, bone meal, vegetable oil and locally available feed ingredients that are commercially available in the market. The supplemental feeds contains Metabolizable Energy 2850 kcal kg^{-1}, Crude Protein 20%, Methionine 0.47%, Lysine 1.12%, Calcium 1.0% and Phosphorous 0.45% as starter ration and Metabolizable Energy 2750 kcal kg^{-1}, Crude Protein 18%, Methionine 0.4%, Lysine 0.90%, Calcium 2.5% and Phosphorous 0.4% as finisher ration. Starter ration was supplied up to three months of age and after three months of age finisher ration was supplied. Supplemental feeds were supplied two times daily, in the morning before 8 am and in the evening before 5 pm. At all times, fresh and clean drinking water was supplied.

Housing: A model house was prepared for rearing ducks. House was made by locally available materials. The houses were gable type or shed type. The slate was made in one feet high from the ground level and total height 5-6 feet, 5 feet width and 6-7 feet long. Ducks were kept in house at night and during day they were allowed to rear in scavenging.

Vaccinations and medication: All ducks were vaccinated properly. Duck plague and duck cholera vaccine was given to the ducks. Vaccination was given as per schedule given in Table 1. Medication was done when needed.

Measurements and procedures: During the whole experimental period different parameters were measured. Natural feed resources in different season of the year were identified, physically evaluated, sampling and were analyzed in the laboratory through proximate analysis following the method of AOAC (Association of Official Analytical Chemistry, 1990). Natural feeds were collected from the crop and gizzard content of ducks. Scarcity in scavenging feed in different season of the year was properly recorded. Feed intake was recorded both in scavenging and supplied. Feed intake in scavenging period was recorded following weight gain method. Mortality was recorded in every month. Chemical analyses of feeds were done through proximate analysis following the method of AOAC (Association of Official Analytical Chemistry, 1990). Body weight gain of ducks was recorded in every week. Feed conversion efficiency was measured in every two months interval (FCR = Amount of Feed Consumed/LWG). In every day, total number of ducks, total number of eggs produced and average weight of eggs was recorded. Cost and return analysis of rearing ducks were calculated. Growth rate and FCR were calculated for the period of 180 days and all other traits were calculated for the period of 500 days.

Table 1: Vaccinations of ducks

	Dose (days)		
Name of Vaccine	First	Second	Third
Duck plague	14	29	180
Duck cholera	42	57	187

Chemical analysis: Feed samples were analyzed for dry matter, crude protein, crude fiber, ether extract, total ash and nitrogen free extract according to AOAC (Association of Official Analytical Chemistry, 1990).

Statistical analysis: The experimental data for different parameters were analyzed using MSTAT statistical program for interpretation of results. Data collected for different variables were subjected to analysis of variance in accordance with the procedures of Completely Randomized Design (CRD) and Randomized Complete Block Design (RCBD). Significant differences were identified by using Duncan's New Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Data related to production system of existing ducks at Potuakhali district of Bangladesh and development of a self-sustainable ducks rearing model under semi-scavenging system at farmer's condition are presented here

Production system of existing ducks: It was observed that mostly small and marginal farmers are rear ducks. But they are very poor and they rear ducks without any supplemental feed and mostly depending upon only natural feeds. Natural feeds are not available *ad libitum* as per requirement for ducks through out the year. Very few farmers were supplied supplemental feeds to their ducks but they didn't supplied balanced feed and they didn't know the requirement of ducks at different stages of growth and production. So they didn't get expected production from their ducks all the year round. The experiment was conducted upon the small and marginal farmers.

Availability of natural feeds for ducks: Natural feeds are not available all the year round for rearing ducks at scavenging. Under scavenging system of management ducks remains underfed and it obviously affects their

Table 2: Availability of scavenging feeds

Seasons	Availability of scavenging feeds	Degree of supplementation
Lean season (Summer)	Green grass, snails, small fishes duck weeds etc.	Supplementation is needed
Abundance season (Rainy)	Small fishes, snails, oyster, duck weeds, azolla, green grass, tadpoles crabs, weed seeds, earth worm, insects etc.	No supplementation is needed
Moderatelye abundanc season (Winter)	Whole paddy, grains, weed seeds, snails, crabs, small fishes, green vegetables etc.	Supplementation is needed

Table 3: Chemical compositions of crop and gizzard contents

	Seasons					
Parameters	Summer	Rainy	Winte	CV%	SEM	Level of significance
CP (g/100 g DM)	8.31	9.88	8.97	7.13	0.37	NS
CF (g/100 g DM)	16.13	18.58	14.63	13.67	1.30	NS
EE (g/100 g DM)	2.66	3.13	3.02	15.93	0.27	NS
Ash (g/100 g DM)	13.46^{b}	19.90^{a}	15.31^{b}	6.16	0.58	**
NFE (g/100 g DM)	59.44^{a}	48.51^{b}	58.07^{a}	4.64	1.48	*
ME (Kcal kg^{-1} DM)	1816.55^{b}	2027.68^{a}	2131.57^{a}	2.85	32.81	**
Ca (g/100 g DM)	1.30^{b}	2.87^{a}	1.61^{b}	10.51	0.12	**
P (g/100 g DM)	0.27^{b}	0.36^{a}	0.42^{a}	6.60	0.01	**

^{ab}Data having dissimilar superscripts differ significantly, (*p<0.05); SEM = Standard Error of Mean; CV% = Co-efficient of Variation; NS = Not Significant; *p<0.05; **p<0.01

growth and reproduction. Depending upon the availability of natural feeds at scavenging, the grazing season of ducks may be divided into three major periods in a year which are (a) Lean season that is March to June, (b) Abundance season that is July to October and (c) Moderately abundance season that is November to February.

Table 2 shows that rainy season appeared to be the best season for rearing ducks, followed by winter and summer. In lean season of rearing ducks maximum level of supplementation is needed due to scarcity of scavenging feed. In rainy season no supplementation is needed due to availability of sufficient scavenging feeds for ducks. On the contrary, in winter natural feeds for ducks at scavenging is available moderately but not sufficient as per requirement, so minimum level of supplementation is suggested.

Chemical compositions of crop and gizzard contents: The results showed that CP, CF and EE contents did not differ significantly (p>0.05) in different season of the year. Though CP, CF and EE contents did not differ significantly (p>0.05) but it showed that CF content was higher in Rainy season followed by summer and winter. However, Ash, NFE, ME, Ca and P contents were significantly (p<0.05, p<0.01) differ in different season of the year. The mean value of Ash content was significantly (p<0.01) higher in Rainy season (19.90%) compared to winter (15.31%) and summer (13.46%). The results also showed that the NFE content was significantly (p<0.05) higher in summer (59.44%) and winter (58.07%) than rainy season (48.51%). It was observed that the crop and gizzard contents contain ME 2131.57 (Kcal kg^{-1} DM) in winter and ME 2027.68 (Kcal kg^{-1} DM) in Rainy season, which was significantly (p<0.01) higher than that of ME 1816.55 (Kcal kg^{-1} DM) in summer (Table 3). Haque and Ukil in 1993 found that the ME and CP contents of feeds consumed by scavenging ducks were 2421.16 Kcal kg^{-1} and 9.36% respectively. On the other hand Biswas and Chowdury in 2003 reported that 2045.12 Kcal kg^{-1} ME and 9.27% CP in the crop content of scavenging ducks, which is similar to the findings of the present study.

It was also observed that the crop and gizzard contents contain Ca 2.87% in Rainy season, which was significantly (p<0.01) higher than that of Ca 1.61% in winter and Ca 1.30% in summer. The results also showed that the crop and gizzard contents contain significantly (p<0.01) higher amount of P in winter (0.42%) and in rainy season (0.36%) than that of summer (0.27%). Scavenging feeds are deficient in protein but higher in fibre and ash, imbalanced in Ca and P ratio (Asaduzzaman *et al.*, 1992). They concluded that supplementary feeding to the scavenging birds might be required to optimize production performance of ducks in backyard.

Production performance of jinding ducks: The initial live weight of ducklings did not differ significantly. The results showed that the final live weight of supplemented Level-I and Level-II was 1.63 and 1.67 kg, which was significantly (p<0.01) higher than that of the final live weight of control group (1.46 kg). The results indicated that the total live weight gain of ducks in supplemented Level-I and Level-II was 1.60 and 1.63 kg, which was significantly (p<0.01) higher than that of the total live weight gain of control group (1.42 kg), (Table 4) Sazzad *et al.* (1988) was studied on the effect of nutrition and genotype of ducks on production performances and found that the poor nutrition had a much greater effect on production performance than genetic influence and the

Table 4: Production performance of Jinding ducks

Parameters	Control group	Supplemented group		CV%	SEM	Level of significance
		Level-I	Level-II			
Initial live weight (g)	39.51	39.24	38.74	5.01	1.13	NS
Final live weight (kg)	1.46^{b}	1.63^{a}	1.67^{a}	3.67	0.03	**
Total live weight gain (kg)	1.42^{b}	1.60^{a}	1.63^{a}	3.81	0.03	**
Average live weight gain (g/d)	7.88^{b}	8.85^{a}	9.04^{a}	3.89	0.19	**
Total dry matter (DM) intake (kg)	19.21^{c}	28.40^{b}	33.35^{a}	4.90	0.76	**
Dry matter (DM) intake (g/d)	38.42^{c}	56.80^{b}	63.17^{a}	5.14	0.57	**
FCR (DMI/LWG)	4.86^{c}	6.43^{b}	7.01^{a}	6.81	0.24	**
Time of first lay (d)	141.00^{a}	128.00^{b}	126.00^{b}	2.45	1.86	**
Duck-day egg production (%)	23.45^{b}	43.39^{a}	45.53^{a}	5.19	1.12	**
Average egg weight (g)	57.25^{b}	61.15^{a}	62.46^{a}	3.95	1.37	**
Mortality (%)	11.75	9.41	8.71	53.26	3.06	NS

^{abc}Data having dissimilar superscripts differ significantly (*p<0.05); SEM = Standard Error of Mean; CV% = Co-efficient of Variation; NS = Not Significant; **p<0.01

improved ducklings under scavenging condition did not show better growth rate. Unless the supplementary feeding practices are followed, improved ducklings for genetic improvement would not give the expected results.

The results also showed that the average daily live weight gain of ducks in supplemented Level-I and Level-II was 8.85 and 9.04 g, which was significantly (p<0.01) higher than that of the average daily live weight gain of control group (7.88 g). Haque *et al.* (1991) conducted an experiment with indigenous ducks and they supplied supplementary feed in addition of scavenging. The result was found significantly higher growth rate and egg production in feed supplementation group compared to only scavenging, which is similar to the findings of the present study.

It was observed that the total Dry Matter (DM) intake of ducks in supplemented Level-II was 33.35 kg, which was significantly (p<0.01) higher than those of the total Dry Matter (DM) intake of ducks in supplemented Level-I (28.40 kg) and control group (19.21 kg). It was also observed that the total dry matter (DM) intake of ducks in supplemented Level-I was 28.40 kg, which was significantly (p<0.01) higher than that of the total Dry Matter (DM) intake of ducks in control group (19.21 kg). The observation showed that the average daily Dry Matter (DM) intake of ducks in supplemented Level-II was 63.17 g, which was significantly (p<0.01) higher than those of the average daily dry matter (DM) intake of ducks in supplemented Level-I (56.80 g) and control group (38.42 g). The observation also indicated that the average daily Dry Matter (DM) intake of ducks in supplemented Level-I was 56.80 g, which was significantly (p<0.01) higher than that of the average daily dry matter (DM) intake of ducks in control group (38.42 g). Feed conversion efficiency (FCR) of ducks in supplemented Level-II was 7.01, which was significantly (p<0.01) higher than those of the feed conversion efficiency (FCR) of ducks in supplemented Level-I (6.43) and control group (4.86). It was also observed that the feed conversion efficiency (FCR) of ducks in supplemented Level-I was 6.43, which was significantly (p<0.01) higher than that of the feed conversion efficiency (FCR) of ducks in control group (4.86). The results showed that the average time of first lay in control group of ducks was 141 days, which was significantly (p<0.01) higher than those of supplemented Level-I (128 days) and supplemented Level-II (126 days). The average duck-day egg production of supplemented Level-I was 43.39% and supplemented Level-II was 45.53%, which was significantly (p<0.01) higher than that of the control group of ducks (23.45%).

The observation revealed that the average egg weight of ducks in supplemented Level-I was 61.15 g and supplemented Level-II was 62.46 g, which was significantly (p<0.01) higher than that of the control group of ducks (57.08 g). The production performance of Jinding breed of ducks was described by Zhang *et al.* (1989). They described that Jinding ducks are medium-sized (1.5 kg body weight at 120 days of age) and are found on the south east coast of China. The average egg production is 260-300 at 500 days of age, age at sexual maturity is 110 days and egg weight in the First year of lay is 70 g.

The results of the present study showed that the average mortality of ducks in different treatment groups did not differ significantly (p>0.05). It was also observed that the rate of mortality of ducks was decreased in supplemented Level-I and supplemented Level-II group of ducks in compared to the ducks of control group. Nahid and Rashid (1992) found that supplementary feeding increased live weight by about 7% in deshi ducks (p<0.05). They also reported that supplementary feeding decreased mortality by about 54.57%.

Costs and return of rearing ducks: Table 5 showed that considering the cash costs per duck cost of production of

Table 5: Costs and return of rearing ducks (BDT/Duck)

Parameters	Unit	Control group up	Supplemented group Level-I	Supplemented group Level-II
Initial costs	BDT	23.50	23.50	23.50
Costs of vaccine and medicine	BDT	4.30	4.30	4.30
Costs of feed	BDT	82.15	314.45	384.75
Costs of housing	BDT	25.00	25.00	25.00
Total Costs (TC)	BDT	134.95	367.25	437.55
Selling of eggs	BDT	327.00	657.00	711.00
Selling of ducks	BDT	85.00	95.00	100.00
Gross Income (GI)	BDT	412.00	752.00	811.00
Net Return (GI-TC)	BDT	277.05	384.75	373.45

control group, supplemented Level-I and supplemented Level-II group of ducks were calculated BDT 134.95, 367.25 and 437.55, respectively. The results showed that the average initial costs for ducklings; costs of vaccine and medicine and costs of housing were similar to all treatment groups of ducks. The results indicated that the average costs of feeds of control group, supplemented Level-I and supplemented Level-II group of ducks were BDT 82.15, 314.45 and 384.75, respectively. The results showed that the average costs of feeds of supplemented Level-II was higher than those of supplemented Level-I and control group of ducks. The observation also showed that the average costs of feeds of supplemented Level-I was higher than that of the control group of ducks. The results also showed that the average gross income from selling of eggs and selling of ducks was higher in supplemented Level-II than those of other treatment groups. Table 5 also indicated that the average Gross income of control group, supplemented Level-I and supplemented Level-II group of ducks were BDT 412.00, 752.00 and 811.00, respectively. It was observed that the average Gross income of supplemented Level-II was higher than those of control group and supplemented Level-I group of ducks. It was also observed that the average Net return of control group, supplemented Level-I and supplemented Level-II group of ducks were BDT 277.05, 384.75 and 373.45, respectively. The results showed that the average costs of production of supplemented Level-II was 437.55 and the average gross income of supplemented Level-II was 811.00, which was higher than that of the control group and also supplemented Level-I group of ducks. On the other hand, the Net return of supplemented Level-I group of ducks was 3 84.75, which was higher than those of the control group and also supplemented Level-II group of ducks.

From the present findings, it is concluded that all the year round scavenging feed are not available *ad libitum* as per requirement for rearing ducks and only scavenging feeds cannot fulfill the nutritional requirements of growing and productive ducks. Considering the above perspective, it may be suggested that minimum level of supplemental feeds should be given to the ducks depending cupon the availability of scavenging feeds for getting optimum production from ducks under semi-scavenging system at farmer's condition.

ACKNOWLEDGMENT

The author would like to give thanks to Small holder Live stock Development Project-2 for financial assistance to complete this research work.

REFERENCES

AOAC, 1990. Official Methods of Analysis, 15th Edn., Association of Official Analytical Chemistry, Washington D.C.

Asaduzzaman, M.U., 1992. Availability of Nutrients to Scavenging Chickens and Ducks in Bangladesh. M.S. Thesis, Department of Poultry Science, BAU, Mymensingh.

BARC, 1990. World Food Day. Bangladesh Agricultural Research Council, pp: 15.

Biswas, S. and S.D. Chowdhury, 2003. Study on the seasonal availability and chemical composition of scavengable feed resources for ducks in potuakhali district. M.S. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Haque, Q.M.E. and M.A. Ukil, 1993. Supplementary feeding of laying ducks under scavenging condition. Bang. J. Livest. Res., 1: 57-62.

Haque, Q.M.E., M.U. Asaduzzaman and M.J. Hossain, 1991. Supplementary feeding for laying ducks under scavenging condition. Bangl. J. Livest. Res., 1: 1.

Nahid and Rashid, 1992. A study on the performance of Khaki Campbell, Khaki Campbell X Deshi and Deshi with and without supplementary feeding under rural condition of Bangladesh. M.S. Thesis, BAU, Mymensingh.

Sazzad, M.H., S.M.H. Mamotazul and M.U. Asaduzzaman, 1988. Growth pattern of Deshi and Khaki Campbell ducks under rural condition. Ind. J. Poultry Sci., 23: 165-166.

UNDP/FAO, 1983. Project of the Govt. of the Peoples Republic of Bangladesh. No. BGD/82/2003. Dhaka, Bangladesh.

Zhang, S., Y. Chen and Y. Lai, 1989. Jinding Duck (a layer Duck). Waterfowl Production. Proceedings of the International Symposium on Waterfowl Production, The Satellite Conference for the XVIII World's poultry Congress, September 11-18, 1988 Beijing, China, pp: 66-71.