

Research article

Cost-benefit analysis of the backyard duck production systems in the rural areas of Bangladesh: A study in Laksam upazila, Comilla

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ABSTRACT

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The study was conducted to explore the present status, production practices and cost-benefit analysis of the existing backyard duck rearing systems in the rural areas of Comilla district, Bangladesh. A cross-sectional survey was conducted using simple random sampling technique and data were collected directly from the duck farmers through face to face interview using a structured questionnaire during 13th October to the 12th December 2019 from 4 villages under Laksam upazila of Comilla district. Socio-economic status of the duck farmers, feeding systems of ducks, availability of feeds for raising ducks, productive performance of scavenging ducks and cost-benefit analysis of raising ducks were evaluated. Results indicated that the most of the duck farmers (56%) were middle aged (25-50 years). About 66.0% of them had only primary education. Majority of them (56%) were landless. Only 18.0% of them owned large duck flocks (75-200). The ducks attained sexual maturity at the age of 6.0 months and produced on an average 110 eggs per year. Egg production reached the peak during the winter season specially after crop-harvest. Approximately, 10% of the respondents did not spend any money for supplementary feeding. The mortality rate was 19% which reached the peak during the winter season (27%). The ducks were vaccinated mostly against duck plague. Around 80% of the households sold eggs to the local market and 20% to the wholesalers and other local dealers. On average, total gross expenditure and annual income per duck were 453.0 and 1450.0 BDT, respectively. It was concluded that the knowledge of the duck farmers related to the housing, feeding, breeding, prevention and control of duck diseases was not satisfactory. Introduction of improved duck breeds, training of the duck farmers, easy access of vaccination, financial and technical supports to the farmers could boost up the productivity of the rural ducks.

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1. INTRODUCTION

Micronutrient deficiencies and stunting in Bangladesh are among the highest in the world, with 36% of the children stunted (NIPORT, 2015), almost 50% of people being anemic and over 40% anemia prevalence among nonpregnant women (NIPORT, 2013). Duck is one of the most

important and potential sources of egg and meat in the rural areas of Bangladesh (Hoque et al., 2010) which can address the above issues. Rearing of chicken, and duck or both is practiced in Bangladesh. There are different types of duck rearing systems which can be classified as household (scavenging), semi-intensive (semi-scavenging) and intensive duck farming (Khan et

al., 2013). Household duck farming or scavenging system of raising ducks provides no feed to the duck while semi-scavenging system provides little amount (20-30 g) of supplementary feed (Latif et al., 1993; Rahman et al., 2014; Begum et al., 2018). However, at least the first two duck rearing systems are greatly influenced by the presence of large water body like bog, marshy and wet land. The intensive farming of duck is less and mostly operated by the government to facilitate the small scale farmer (Hoque et al., 2011). The household duck scavenges in the nearby large water bodies for snail, duck weed, fish and algae (Khanum et al., 2005; Rahman et al., 2009; Pervin et al., 2013; Pushpa, 2019; Parvez et al., 2020). The availability of the scavenging feeds varies from season to season. The management system of duck is moderate for the semi-scavenging farming systems (Hoque et al., 2010; Pervin et al., 2013; Dey et al., 2017).

The Char Fassion on the Island of Bhola in Barisal division, the coastal areas of Lakshmipur district, Tarail and Netrakona in Mymensingh division and Kalia in Khulna division are the most duck dense areas in Bangladesh (Rahman et al., 2005, 2009, 2014; Hoque et al., 2010; Pervin et al., 2013). However, Comilla district is the most important place for duck rearing (Hoque, 2016). Laksam upazila under Comilla district occupies an important place in respect of backyard duck farming practices in Bangladesh. It is a densely populated upazila where people traditionally practice cattle, buffalo, sheep, goat, poultry and duck rearing. There is a considerable amount of lowlands in this upazila which are rich in natural feed available in the ponds, canals, and waterlogged lowlands for duck foraging (Rahman et al., 2009; Begum et al., 2018; Pushpa, 2019). As a result, many small scale duck farms have been established close to the water logging areas.

The backyard duck has been identified as a major area for human resource development program in the lowlands and the coastal areas (Rahman et al., 2005, 2009, 2014; Hoque et al., 2010; Pervin et al., 2013). Information on the backyard duck is scarce. The performance and profitability of the backyard ducks in the semi-scavenging farming systems are not yet evaluated in this area. This study, therefore, aims to provide information regarding feeding, rearing, and utilization patterns of family ducks, income generated in

rural households through duck rearing and the constraints of duck production in the lowland areas of Laksam.

2. MATERIALS AND METHODS

Study area

A 60-day long cross-sectional survey was carried out on household duck rearing system in the 4 selected villages of Laksam upazila under Comilla district during 13th October to 12th December 2019. The villages were selected on the basis of the availability of backyard ducks and communication facilities with a view to collect desired information on duck rearing practices. Fifty household duck farms were selected randomly from 4 villages under the upazila. Households having at least 5 ducks reared under scavenging systems were included in the study.

Study population

The local ‘Deshi’, Khaki Campbell, Indian Runner and Pekin ducks were included in this study. Sexing of ducklings was done by color, feather and vent sexing method. Age of duck was recorded by interviewing the farmers. Vaccination, types of treatment, intervention and types of drugs used for each case, and marketing systems of eggs and ducks were also recorded.

Data collection and analysis

A cross-sectional survey was conducted using simple random sampling technique and data were collected directly from the duck farmers through face to face interview using a structured questionnaire. The data related to duck breed, age, types of housing, feeding system, number of egg production, egg hatching, duckling brooding, cost effectiveness, socio-economic condition of the farmer were recorded in the data sheet through farmer’s face to face interview system. Data obtained were entered into Microsoft Excel 2016 and simple descriptive statistics were calculated. Results were expressed as percentage of the frequency number.

3. RESULTS AND DISCUSSION

Socio-economic status

Age of the duck farmers ranged from 25 to 50 years. The farmers were stratified into 3

categories, i.e., the young ≤ 25 , the middle aged 25-50 and the old >50 (Table 1). The highest number of farmers (56%) was found in middle age group that agrees with the findings of other investigators (Rahman et al., 2009; Pervin et al., 2013; Islam et al., 2016; Parvez et al., 2020) but differ with Jha et al., (2016) who noticed that the number of young farmers were higher than the middle aged and old farmers in haor areas of Sylhet. The number of young farmers was also dominant in another study conducted by Khanum and Salim Al Mahadi (2016) who reported that mostly the young women used to rear ducks in the haor areas of Bangladesh. Similar results were reported elsewhere (Jha et al., 2015, 2016).

Level of education is an important indicator for duck farming. The literary level of the duck farmers were categorized into four groups, i.e., the illiterate, primary, secondary and above. In our study, it was evident that 8% of the farmers were illiterate followed by 66% having primary education and the rest 26% had schooling after primary education (Table 1). These findings are in close alignment with the observations of Ghosh et al. (2012); Khanum and Al Mahadi (2015) and Islam et al. (2016), where most of the farmers had only primary education. However, the illiteracy rate observed here in the current study was much lower than the results mentioned in the earlier studies. The rate of illiteracy of the duck farmers was found higher in some studies conducted in the Sylhet (44-75%) (Jha et al., 2016; Khanum and Salim Al Mahadi, 2016; Parvez et al., 2020), Mymensing (32%) (Islam et al., 2016) and the coastal areas

of Noakhali and Lakhmipur (57% and 49%, respectively) (Rahman et al., 2009; Pervin et al., 2013). The current study area, i.e., the district of Comilla has comparatively better facilities for education, and therefore, the socio-economic status of the people here is much better (literacy rate $>90\%$) than the coastal and haor people of Bangladesh (NIPORT, 2015).

The farming experience of the duck rearers was classified into 3 categories, namely short (<5 years), moderate (5-10 years), and long (>10 years) (Table 1). Table 1, indicated that 50% of the farmers were involved with duck rearing for 5-10 years. This result appears similar with the findings of Islam et al. (2016), where they showed that 40% of the farmers had the experience of duck rearing for less than 10 years and another 40% had 10-20 years of experience. In another study, Pervin et al. (2013) reported that 42.5% of the farmers in the coastal areas were involved in duck rearing for 11-20 years which was much higher than the present finding (10%). The majority of the duck farmers (56%) in the present study were identified landless who used to rear their ducks on the shared lands. The scenario was common in the another study conducted by Khanum and Al Mahadi (2015) although a much higher percentage (99%) of landless women were involved in duck rearing either in own or in the shared lands owned by the male counterparts (husband or father) of the family. Contrastingly, the study of Parvez et al. (2020) doesn't support this ratio. In fact, they found that 65% of the duck farmers used to rear their flocks on own lands (size varied from 0.05 to 2.5 acres).

Table 1. Characteristics of the backyard duck farmers (N=50) in the lowland areas of Laksam upazila, Comilla.

Characteristics	Category	% of farmers (n)
Age	Young (<25 years)	8.0 (4)
	Middle age (25-50 years)	56.0 (28)
	Old (>50 years)	36.0 (18)
Education	Illiterate	8.0 (4)
	Primary	66.0 (33)
	Secondary and above	26.0 (13)
Rearing experience	Short (<5 years)	40.0 (20)
	Moderate (5-10 years)	50.0 (25)
	Longer (>10 years)	10.0 (5)
Land holding capacity	Landless (No own land)	56.0 (28)
	Small and marginal farmer (<1 acre)	26.0 (13)
	Medium farmers (1-3 acres)	16.0 (8)
	Large farmers (>3 acres)	4.0 (2)

Demography

According to flock size of the duck, the farmers were classified into three categories, e.g., low producer holding <25 ducks, the medium producers holding 25-75 ducks and the high producer having 75-200 ducks (Table 2).

Table 2. Population size of the backyard duck farmers (N=50) in the lowland areas of Laksam upazila, Comilla.

Category (flock size)	% of farmers (n)
Small (5-24)	28.0 (14)
Medium (25-75)	54.0 (27)
Large (75-200)	18.0 (9)

Table 3. Flock size and composition of the backyard ducks (N=50) in the lowland areas of Laksam upazila, Comilla.

Age of the ducks	% of farmers (n)
Duckling (1-2 months)	20.0 (10)
Grower (3-5 months)	16.0 (8)
Drake (> 5 months)	10.0 (5)
Duck (> 5 months)	14.0 (7)
Laying (1-3 years)	40.0 (20)
Total	100.0 (50)

However, the number of ducks reared by each farmer ranged from 5 to 200. Highest proportion (54%) of the farmers used to rear medium sized flock of the ducks which was much higher than the findings of Parvez et al. (2020), who reported that only 15% of the farmers in the study areas had a medium sized flock (25-100 ducks) and majority (70%) of the study area had a small flock (<25 ducks). Similar trends were also reported by Islam et al. (2016) and Pervin et al. (2013), where most of the duck farmers (48-52%) had small flock size (5-12 ducks). Table 3 indicates the percentage of ducks reared according to age group and category in the study areas. It is evident that the highest percentage of duck population was of laying type (40%) in the study areas. The reasoning was that the farmers reared ducks mainly for egg production which accounted for the highest percentage of laying ducks in our study.

Housing systems

Ducks do not need well-structured and organized housing systems (Islam et al., 2016). The minimum requirement would be to have a shelter

and guarded free run area. The house/shelter should be well ventilated, dry and rat proof. Housing materials used by the farmers in the present study were wood and tin (40%), brick (15%), bamboo and soil (35%), bamboo (8%) and others (2%). In fact, wood and tin are the most common materials used for building of duck houses in different parts of Bangladesh. The availability, ease of preparation and cheap rate might be the main reasons behind use of these materials. Similar results were reported elsewhere (Rahman et al., 2009; Pervin et al., 2013; Islam et al., 2016; Jha et al., 2016) indicating wood and tin as the most common housing materials for ducks. Other common materials used for duck housing were straw, bamboo, soil, brick and other local materials (Islam et al., 2016).

Brooding practices

The space provided per bird for artificial brooding ranged from 0.2-0.9 square feet per duckling. A brooding temperature of 95°F was provided for the first week which was reduced by 5°F every week. Incandescent lamps of 60-100 watt were provided for heating the ducklings and the wattage was altered accordingly how the duck reacted. Feeders and waterers were accessible to the ducklings during brooding period. In some cases under natural conditions, a broody duck was used to brood about 10-15 ducklings. As an essential management aspect to ensure growth and productive life of the newly hatched duckling, a minimum brooding period of 3-4 weeks was adopted in the study areas (Hoque, 2016).

Breeding and Hatching

Natural mating was practiced for the rural ducks (Islam et al., 2016; Bhuiyan et al., 2018; Pushpa, 2019). A standard male-female ratio of 1:5 was maintained by the most of the duck farmers. The majority of the duck farmers reported that the sexual maturity of Deshi ducks was attained between 5.5-6.0 months and average egg production was 110 per year (Table 4). It was also documented that the egg production reached the peak during winter especially after crop harvesting season. Table 4 shows the average age of first laying egg, egg production per year and Hatchability rate. It was found that most of the house holder use natural procedure of hatching by using hen.

Table 4. Productivity of the backyard ducks (N=50) in the lowland areas of Laksam upazila, Comilla

Parameters	Categories	% farmer (n)
Sexual maturity (days)	Early (<190)	80.0 (40)
	Moderate (190-200)	10.0 (5)
	Late (>200)	10.0 (5)
Egg production (no./year)	Low (80-100)	30.0 (15)
	Medium (101-150)	50.0 (25)
	High (150-200)	20.0 (10)
Hatchability (%)	Low (<84%)	30.0 (15)
	Medium (84-88%)	60.0 (30)
	High (>88%)	10.0 (5)

Feeds and feeding

Ducks are capable of converting grains, insects, snails, plant materials, leftover food particles and pond materials into egg and meat efficiently (Khanum et al., 2005; Islam et al., 2016; Begum et al., 2018; Pushpa, 2019). Commercial duck feeds are available according to age group as pellets and crumbles (Table 5). Different types of duck feeds, i.e., starter for up to 0-2 weeks, grower for 3-8 week, adults for 9 to 20 weeks and finally the layers and breeders are available in Bangladesh (Nahas, 1991; Rahman et al., 2005, 2009; Ghosh, 2009; Parvez, 2014; Alam, 2015; Hoque, 2016; Pushpa, 2019). Duck should always be provided access to drinking water because they prefer to have wet feed. Feeding of ducklings during brooding should be taken care of until they get adapted. The ducklings should be provided with coarse cereal grains moistened

with water initially before moving to the mash feed (Nahas, 1991). Grit should be available along with other ingredients. Ducklings normally consume 12.5 kg of feed in 20 weeks. Common feed ingredients used in the study areas were wheat, maize, rice bran, soybean meal and common salts. Other studies reported rice, broken rice, rice polish and paddy as the mostly used supplemental feed along with wheat bran and maize (Rahman et al., 2009; Pervin et al., 2013; Islam et al., 2016; Jha et al., 2016). Since paddy is the staple food in Bangladesh, its production is much higher than the other cereal grains which make it one of the most available ingredients in most of the households. Accordingly, this is the most common reason why duck farmers frequently use rice or paddy as the supplemental feeds for their ducks (Rahman et al., 2009; Pervin et al., 2013; Islam et al., 2016; Jha et al., 2016).

Table 5. Feed formulation of the backyard ducks in the lowland areas of Laksam upazila, Comilla.

Ingredients (%)	Khaki Campbell			Pekin		
	Starter	Grower	Layer	Starter	Grower	Layer
Wheat	45.0	48.0	42.0	60.0	40.0	40.0
Yellow maize	-	-	10.0	-	29.0	20.0
Deoiled rice bran	14.0	25.5	6.5	-	10.0	-
Soybean meal	25.0	15.0	20.0	25.0	10.0	20.0
Fish meal	10.0	6.0	10.0	10.0	6.0	10.0
Lucerne leaf meal	2.0	2.0	2.0	2.0	2.0	2.0
Mineral mixture	2.5	2.5	2.5	2.5	2.5	2.5
Shell grit	-	-	5.5	-	-	5.0
DCP	1.0	0.5	1.0	-	-	-
Vitamin premix	0.5	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Immunization and health

Average mortality of the ducks was found 19%. Most of the households reported that the ducks were affected in diseases mostly in the winter season (27% mortality) that does not agree with the findings of Ghosh et al. (2012) who reported

that most of the ducks were sick in the monsoon. Farmers hardly treated the sick ducks (Hoque et al., 2010; Islam et al., 2016) and used to slaughter them for consumption. About 80% of the farmers reported that the duck plague and duck cholera were the main reasons for mortality. Due to lack of awareness, a

considerable number of households do not vaccinate regularly to their ducks (Hoque et al., 2010). Controlling procedure of duck diseases were variable (Islam et al., 2016). Most of the farmers (55%) controlled duck diseases with medication and only 30% of the farmers used vaccine to prevent the duck diseases and the rest 15% did nothing for controlling diseases. Vaccination rate was found poor (14.5-17.5%) in the study of other investigators (Rahman et al., 2009; Pervin et al., 2013; Jha et al., 2016) except in a study where higher rate (46.7%) was reported by Ghosh et al. (2012). Ducks are generally resistant to common duck diseases in comparison to the chickens. However, they could be occasionally susceptible to the viral

diseases like Duck Plague and Duck Viral Hepatitis (Akter et al., 2004; Rahman et al., 2009; Hoque et al., 2010; Pervin et al., 2013; Fakhrul Islam, 2016; Dey et al., 2017; Hassan et al., 2018). Vaccination is the most suitable option to prevent the diseases from affecting the flock. Duck Cholera caused by *Pasteurella multocida* could be treated using sulfur drugs. Botulism or food poisoning due to ingestion of bacterium from decaying plants (Hoque et al., 2010) may affect young ducks and could be treated by adding epsom salt which acts as purgative. Aflatoxicosis which arises due to fungal infestation in feed can result in mortality over a period of time. Withdrawal of infected feed could result in recovery of the duck.

Table 6. Vaccination schedule followed for the backyard ducks (N=50) in the lowland areas of Laksam upazila, Comilla.

Name of vaccine	Dose	Age of ducks	Route
Duck cholera	Duckling 1ml	3-4 weeks	Subcutaneous
	Adult 2 ml	Boosting after 1 month of primary vaccination	
Duck plague	Adult 1 ml	8-12weeks	Subcutaneous
		Boosting after 1 month of primary vaccination	

Cost-benefit analysis

Average annual expenditures and economic return of rearing ducks in the study regions are showed in Tables 7. The farmers with 3-20 ducks usually did not hire any labor and used to manage by themselves. It was found that the average cost for ducklings, feed, housing, vaccination and medication was 35.0, 350.0, 20.0 and 50.0, respectively according to the farmer's view. It was evident that the net return per backyard duck after one year of effective laying was BDT 997.0.

Table 7. Gross cost of the backyard ducks (N=50) in the lowland areas of Laksam upazila, Comilla.

Line items	Amount (Tk)
Costs	
Duckling cost	35.0
Feed cost	350.0
Vaccination/medication	50.0
Housing cost	20.0
Total depreciation cost	2.0
Total gross cost	453.0
Returns	
Return from selling eggs	1200.0
Return from selling duck	250.0

Total income	1450.0
Total cost	453.0
Net annual return	997.0

Marketing of eggs and ducks

Around 80% of the duck farmers sold duck eggs to the nearby market and 20% of them sold their duck eggs to the retailers. Duck meat exhibited high demand in Laksam and this is the reason why most of the household ducks were either sold or consumed locally. Similar results were reported elsewhere (Rahman et al., 2009; Hoque et al., 2010; Ahsan et al., 2016; Afrin et al., 2017).

4. CONCLUSIONS

Most of the farmers in the study areas reared Deshi duck. Existing knowledge of the farmers related to the breeding, feeding, housing, prevention and control of diseases were not satisfactory. Therefore, a need-based extension program should be introduced among the farmers giving more focus on management and health of duck. Regular vaccination and use of balanced diet may accelerate productivity of ducks which will increase consumption of eggs

and meats for reducing the nutritional deficiencies of people in the flood prone water logged areas of Laksam, Comilla.

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