



A review on present status, problems and prospects of quail farming in Bangladesh

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Abstract

The aim of this paper is to review the current status of quail production, problems and its future prospects in Bangladesh. Poultry industry is an important sub-sector of livestock production in Bangladesh that plays a crucial role in economic growth and simultaneously creates numerous employment opportunities. As a fundamental part of animal production in Bangladesh, the industry is committed to supplying nation with a cheap source of good quality nutritious animal protein in terms of meat and eggs. Approximately 25% of the protein consumed in Bangladesh originates from poultry. Despite this data, Bangladesh is still one of the lowest poultry meat consuming countries in the world. Here per capita meat consumption is only 1.2 kg per person per year and per capita egg consumption is also about 32 eggs per person per year. With increasing incomes, the demand for meat, especially the cheaper option of poultry meat, and eggs is set to rise. More importantly, quail becomes a promising poultry species in Bangladesh due to their smaller body size, hardiness against common chicken diseases, easy management, quick return over the invest, less labor cost and investment required for the farming. But still now the rearing quail is not yet popular like chicken farming due to poor marketing channel, subsistence farming, lack of specialized feed, lack of available day-old chicks, high chick mortality etc. Scientific feeding, training to the farmers about their management, creating organized marketing channel will be the probable solution for vitalizing this species in Bangladesh.

Key words: quail farming, present status, problem, prospect

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Introduction

Land and life are closely entwined in Bangladesh. Over 65.7% of the country's people live in the rural sector and are highly dependent on an agricultural system that is finely attuned to a tropical monsoon climate (BBS 2015). CIA World Fact book (CWF, 2017) indicates that the total population in Bangladesh is 15.62 crore at an annual growth rate of 1.05 percent. The per capita income is only US\$ 1602 (BBS 2006) and the percentage of literacy is around 61.5 per cent (CWF, 2017). About 50 percent of the households are functionally landless (22 percent of the households owning no land other than their homesteads and 28 percent owning only up to 0.50 acre) while 6 percent of the land-owning households are controlling more than 40 percent of the total land (Hossain 1997). About 47.5 percent people live below the poverty line and they receive less than 2318 calorie per person per day as against the standard of 2450 calories (BBS, 2010). In 1998-99, total meat production in Bangladesh was 656,000 tones, of which chicken and duck meat contributed 154,000 tones, which ranked second after beef. Per capita meat consumption was only 5.12 kg per year and per capita protein intake 63gm per day (Statistical yearbook of Bangladesh 2000).

As protein intake is recommended to be in the range of 0.8 to 1.6 g/day per kg body weight for humans (Anonymous 1998), this requires 56 to 112g protein per day for a person of 70 kg bodyweight. Thus, there is a need to increase the animal protein production to fulfill the demand of the people and subsequently to make them sound to build up a healthy nation. Meat production could be increased through quail rearing and quail meat contains more protein than the chicken (Ihejirikamba, 2012). In urban or rural areas, any great festival of either religion or social origin is unimaginable without meat. People think that it is a great dishonor not to serve meat at a festival. In a condition, where majority of the people are landless, under privileged, malnourished, uneducated and poor, quail rearing play a very important role for income generation, poverty eradication, women empowerment, nutrition, food security and country's economical and developmental procedure. There are over 2683.93 million chickens in Bangladesh (DLS, 2016). However, with increasing population and decreasing landholdings, the number of poultry is increasing at an annual rate of 5.9% (Reneta Statistical Year Book, 2005). At present most of the poultry species are reared under scavenging conditions (FAO, 2013). Despite rapid development of

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intensive poultry production in the private sector, per capita availability of poultry meat (20 g/head/day; FAO 2013) and egg (66.2 eggs/annum; DLS 2015) is still very low. This is largely due to lower productivity of the indigenous birds reared under scavenging conditions. So, there is a possibility to introduce quail in Bangladesh. In 1935 improved variety of birds were first imported from foreign countries by the Government. In 1947, six poultry farms were setup in different locations in the country for supplying hatching eggs and chicks (Reneta Statistical Year Book, 2005). After that, improved breed like White Leghorn, Rhode Island Red etc. from the western country like USA were imported by the Bangladesh government. In 1964, a commercial poultry farm namely "Eggs and Hens Ltd". was established by the Late Mr. EkramulHossain, which could be recognized as a mother poultry industry in the private poultry sector. After the liberation of Bangladesh, BIMAN Bangladesh Airlines started a commercial poultry farm in the name of "Biman Poultry Complex" at Savar, Dhaka with a contractual agreement with Poultry Breeding Farm of Canada for catering their own flying services and as well as transferring the commercial poultry farming technology to the farmers. In early nineties, a good number of private parent stock farms started their operation to produce commercial day-old broiler and layer chicks (Reneta Statistical Year Book, 2005). From above discussion we clearly say that chicken takes a lot of time to be fully commercialized and as the availability of protein in Bangladesh is still very low, so we consider quail farming.

The present review paper has focused on four specific areas such as (i) present status of quail farming in Bangladesh, (ii) problems in quail farming, (iii) prospect of quail farming in Bangladesh and finally (iv) some options proposed for profitable quail farming. A small conclusion is also given at the bottom figuring some future remarks.

Present status of quail farming

Quail farming in Bangladesh was started in 1992 and remained static for about one decade (1992-2003) since its inception, thereafter, gradually increased till 2009 (highest in 2009) and

gradually declined thereafter (Figure 1)(Nasar et al., 2016). The reasons might be outbreak of epidemics, faulty management systems, higher price of feeds, the higher incidence of different infectious diseases, and lack of veterinary care.(Das et al. 2008;Rahman et al. 2010; Siddiquiet al. 1996).

Majority of the farmers in Bangladesh have practiced mixed type quail farming. Rahman et al. 2016 reported that layer, parent stock and broiler or meat type quail were only reared by 21.1%, 3.8% and 9.6% farmers, respectively. Mixed type quail farming is practiced worldwide because Japanese quails are suited for commercial rearing for egg and meat production under intensive management (Egbeyaleet al. 2013). This is because of their hardiness and ability to thrive in small cages (Odunsiet al. 2007); the relative short generation interval and cheaper cost of production (Ojo et al. 2014)

In a recent study found that Japanese quail produce hatching egg weight ranges from 10 to 12 g, average body weight at 5-6 weeks is 180-200 g, and adult body weight is 200-250 g. However, Sultanet al. (2013) reported that there might be a significant variation in all the laying parameters among different local and imported stocks of Japanese quails. The domestic quail shows rapid growth and attains sexual maturity at 5-6 weeks of age. Nowadays, bobwhite strains are slaughtered at 5 weeks of age with a weight of 160-250 g. Females enter into full lay at about 8-9 weeks of age. Layers are usually kept up to 8-10 m of age and produce about 300 eggs per year each with an egg weightranges between 7-11 g/egg.

Rahman et al., (2016) found that the average quail pullet weight was 145.0±0.12, 110.0±0.07, 120.0±0.22 and 128.0±0.17 g for layer, parent stock, hatchery and mixed farms, respectively (Table 1). The average age at the first lay was 46.0±0.04, 42.0±0.31, 42.0±0.09, and 45.2±0.05 days; rearing period was 15.0±0.01, 12.0±0.14, 15.0±0.32, and 15.2±0.18 months; culling period 15.5±0.14, 13.0±0.06, 15.0±0.03, and 15.4±0.26 months for layer, parent stock, hatchery and mixed farms, respectively.

Table 1. Patterns of layer type quail farming in Bangladesh

Farming categories	Pullet weight (g/bird)	Age at first lay (days)	Rearing period (months)	Age of culling (month)
Layer	145.±0.12	46.0±0.04	15.0±0.01	15.5±0.14
Parent stock	110.±0.07	42.0±0.31	12.0±0.14	13.0±0.06
Hatchery	120±0.22	42.0±0.09	15.0±0.32	15.0±0.03
Mixed	128±0.17	45.2±0.05	15.2±0.18	15.4±0.26

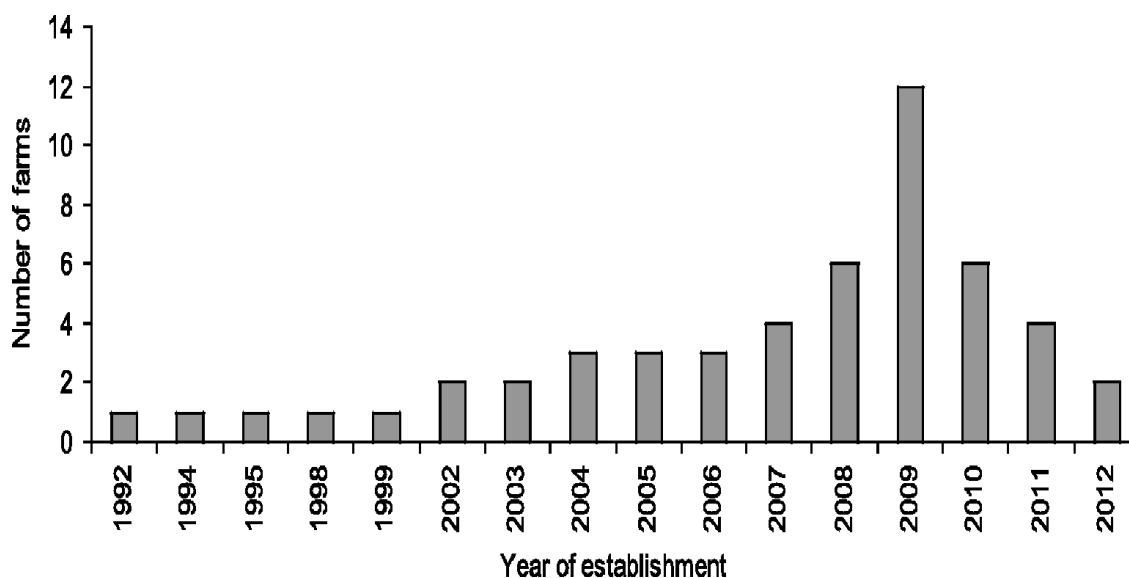


Figure 1. Establishment of quail farms in Bangladesh during the period from 1992 to 2012.

In our country, most of the broiler quail farms had an average size ranging from 5000-6000 birds/farm and the average marketing age of these birds was 30 days (Rahman *et al.* 2016). The average weight for broiler quail is 110-120 g at slaughter and 75-80 g after dressing. The female birds were heavier in weight than the male both at slaughter and after dressing. In a previous study, Sultana *et al.* found the highest weight of 162.5 g/quail and an average weight of 145.8 g/bird experimentally in Bangladesh with different dietary nutrients supplementation.

Problems of quail farming in Bangladesh

In the poultry world, quail meat and egg production is negligible when compared to broilers and layer chicken. In addition, the global profile of production is quite different from the one of its larger relative (except for China). Besides, the sector does not seem to be experiencing any substantial and sustained growth, despite attractive marketing features of the meat. In Bangladesh, quail is not yet popular because of some unique characteristics such as; sensitive bird, cannibalism rate is very high; management is uncommon in the farmer level, high chick mortality, egg production peculiarity, low body and egg weight.

a. Higher lighting requirement than chicken

If the day gets shorter, they stop laying. They like all birds, are daylight sensitive, when the daylight gets too short they reduce or stop laying. Quail tend to be

quite sensitive to daylight length. To get desired egg production from adult quail lighting system must be provided (Pizzolante *et al.*, 2006). In another report, Gilders leeve *et al.*, (1976) stated the lighting hours requirement depending on age of the quail (Table 2).

Table 2. Suggested lighting hours required for quail

Age	Light hour
1 week	24
2 weeks	24
3 weeks	12
4 weeks	12
5 weeks	12
6 weeks	13
7 weeks	14
8 weeks	15
9 weeks	16
Other time	16

But often the farmer does not properly maintain the mentioned lighting schedule, which, thereafter affect the egg production performance. So, the farmer become worried and shows less interest about quail rearing. The relationship of lighting and production parameters was explained by Sakurai (1983) (Table 3).

Table 3. Influence of light in egg production of Japanese quail

Light programme	Age at 50% laying (days)	Rate of laying (%)	Egg weight (g)
Short day(8L:16D)	70	81.7	10.4
Long day (16L:8D)	55	88.6	10.5
Continuous(24L:0D)	56	87.2	10.5

b. Very sensitive to different protein level than other poultry species

They are also very sensitive to the protein. If the protein contents in the supplied feed is lower than they reduce their egg production without showing any symptom. Quail birds are very sensitive to high salt level in the feeds. The optimum level of this mineral should be kept at 7% and in no case, be more than 7%(Nance 1965).Since the farmers use commercial chicken broiler or layer feed for feeding quail, certainly it does not match the exact nutrient requirements. So, it's an additional problem for imbalance nutrients requirement and availability. Wilson & Harms (1992) reported that quail performed better at 21% protein level (Table 4).

Table 4. Performance of 52-week-old egg type quail fed diets with different protein level

Performance	Protein level (%)			
	12	18	21	28
Rate of laying (%)	59.6	71.9	74.7	69.1
Egg weight (g)	10.5	11.0	11.0	10.9
Egg yield (g egg /day)	6.3	7.9	8.2	7.6
Feed intake (g/bird/day)	24.5	25.5	27.3	26.9
Feed Conversion ratio (g feed: g egg)	4.0	3.3	3.3	3.6

c. Quail chicks are very sensitive to temperature than chicken

When the temperature rises above 28°C, the production and quality of eggs decreases. Seasonal temperature increases can reduce egg production by about 10 percent.(Ciftci *et al.* 2005).Kekeocha (1985) cited that layer quail performed better at 11-26°C and reduced egg production with high mortality at 40°C or above temperature (Table 5).

Table 5. Temperature and its effects on egg production

Temperature (°C)	Effects
11 to 26	Good production
26 to 28	Some reduction in feed intake
28 to 32	Feed consumption reduced and water intake increased; eggs of reduced size and thin shell.
32 to 35	Slight panting.
35 to 40	Heat prostration sets in, measures to cool the house must be taken.
40 and above	Mortality due to heat stress.

d. Higher cannibalism rate than other poultry species

Many forms of cannibalism occur in quail raised in captivity. Cannibalism comprises vent pecking, feather pecking, toe pecking, head pecking and nose pecking. The latter, which is the most common type of cannibalism among quail, is generally seen only in birds of two to seven weeks of age (Randall *et al.*, 2008) Cannibal birds peck at the top of the nose where the fleshy portion merges with the beak and the victim may die from loss of blood. Even if the bird survives, the beak will be permanently deformed and males will be unsatisfactory for breeding stock. Condition that may result in cannibalism include insufficient feeder or drinker space, underfeeding, insufficient nesting space, overcrowding, nutritional and mineral deficiencies, an excess of maize in diet, feed consisting compressed feed or pellets only, strong artificial light, high ambient temperatures and irritation from external parasites.

e. Protein requirement is high and have no specialized feed

There are 59 registered commercial Feed Mills in Bangladesh but no feed miller produces specialized feed for the quail production (BPD, 2009). Low level of dietary protein affects growth and egg production of quail negatively (Aboul-Elaet *et al.*, 1992).As the most of the farmers in Bangladesh are familiar with supplying the ready feed, so they fall a problem in quail rearing. As they don't have enough knowledge about the nutritional profile of feedstuffs and nutritional requirement of quail, so they cannot formulate the balance ration for the quail. So, they often

use feed of other spices. Mostly they use the commercial chicken feed. This is an erroneous practice and it should be corrected. There is a significant difference between laying quail and chicken in term of energy and protein requirement (Table 6).

Table 6. Comparative nutrient requirements of layer quail and chicken at different stages of life

Nutrients	Laying quail (NRC 1994)	Laying chicken (Hy-Line 2009)
STARTER		
ME (Kcal)	2900	2900
CP (%)	28	20
Lysine (%)	1.3	1.1
Methionine (%)	0.6	0.45
Calcium (%)	1.3	1
Avaiable P (%)	0.6	0.45
GROWER		
ME (Kcal)	2900	2850
CP (%)	17	18
Lysine (%)	0.9	0.9
Methionine (%)	0.51	0.41
Calcium (%)	1.1	0.95
Avaiable P (%)	0.48	0.42
LAYER		
ME (Kcal)	2950	2850
CP (%)	18	17
Lysine (%)	0.85	0.78
Methionine (%)	0.52	0.39
Calcium (%)	3.1	4.5
Avaiable P (%)	0.45	0.38

Table 7. A comparison between quail and chicken in term of protein requirement

Production stage	Quail	Chicken
Starter stage	28%	21%
Grower stage	24%	16%
Layer stage	26%	15%

From the above information, we can clearly see the mark difference in the protein requirement of both the species of poultry. Quail cannot show its optimum production potential when raised on chicken feeds for a long time and reduce survival rate. If ever they will survive, the mortality rate will be very high sometimes reaching up to 70% from day old to 45 days. More ever the growth of the bird is very uneven and the survivors will not be efficient layers. The productive laying period for quails fed chicken feed does not go beyond six months. Another point is that, quail fed the chicken mash is the very occurrence of molting which affects severely the egg production. On the other hand, mixing extra protein concentrate to the chicken mash for quail production is not economical.

f. Higher chick mortality

The chicks are very small in size ranging from 8-10g, and the mortality is very high. In extreme condition the chick mortality will be 100%. For their small body size more, heat is needed in the brooding condition which is another problem in farmer level. Absence of adequate temperature and exposure to high speed cool winds leads to clustering of young ones, which results in high mortality. It was reported that (Shanaway, 1952) temperature requirement of quail vary according to age ranging from 35°C to 21°C (Table 8).

Table 8. Suitable temperature for quail chick at different ages

Age (days)	Temperature(°C)
1	35
2	35
3	35
4	34
5	34
6	33
7	33
14	29
21	24
28	21-23

g. Problems of raising quail chicks

Quails never incubate their eggs. So, we can produce chicks by hatching their eggs through chickens or artificially through using incubators. Incubation period for quail egg is about 16 to 18 days. For maximum egg production, 16- 16.5 hours of lighting period is required daily inside the quail house. Keep newly born quail chicks in a brooder house. Chicks need artificial heat and temperature management system for 14 to 21 days from their birth. Quail chick becomes very

sensitive. They can be raised in both litter and battery system. There are a lot of factor should be considered during raising quail chicks like adequate temperature, sufficient light, proper air movement, density of quail chicks, supply of food and water, hygienic rearing rules etc.(Randall *et al.* 2008). Yilmaz *et al.*, (2011) suggested that layer quail chicks should be provided the heat and light according to their age (Table 9).

Table 9. Suggested temperature and lighting hours for brooding quail chicks

Baby age	Temperature (°C)	Light (hour)
1 Week	37.7	24
2 Week	35	24
3 Week	32.2	12

h. Egg production problem

They lay about 280-300 eggs in the first year whereas 150-175 eggs in the second year. So, it is not economic to rear quail up to 2nd years. Laying efficiency can be easily maintained within the average range of 63-68% for maximum 300 days if balance ration is provided (Woodard *et al.*, 1976).

i. Low body and egg weight

Nowadays, meat type (broiler) quail strains are slaughtered at 5 weeks of age with a weight of 160-250 g (Nasar *et al.*, 2016). Females enter into full lay at about 8-9 weeks of age. Layers are usually kept up to 8-10 m of age and produce about 300 eggs per year each with a weight of 7-11 g(Ophir *et al.* 2003; Ophir *et al.* 2005).Average dressing percentage of quail meat is 70-73%. On the other hand, in case of chicken it will be 67-70%. So, 100 g quail meat is obtained from a quail having the live weight 140 g. But in our country the average marketing weight of chicken is 1.5 – 2 kg. So, 1.0- 1.3 kg meat is obtained from a chicken, which is 10- 13 times higher than a quail. So, people don't prefer the quail meat in Bangladesh.

j. They are very noisy

Male quails usually make a different sound, which is usually disturbing to the human. When rearing the male and female quails together, the male quails peck the other quails and make them blind.

k. Low market range

The market range of quail is very limited comparing to chicken. Chicken products can be marketed all over the Bangladesh but in case of quail it is very much limited. Quail egg has some popularity in the several regions, but meat is not yet popularized in the Bangladesh. So, because of narrower market range, farmers are not interested about the quail farming (Siddiquiet *al.* 1996).

Prospects of quail farming in Bangladesh

This business is a very lucrative business. Quail bird farming is five times better than chicken and turkey rearing, and a person with 400 quail laying birds is better off than a person with a person with 2000 laying chickens. Many people are interested to rear quail on commercial basis due to lower initial investment and risk rather than commercial broiler farming (Islam *et al.*, 2014). Commercial quail production is established mainly for meat in Europe and for eggs in Japan (Minvielle, 1999). Meat type quails are marketed at about 4 weeks of age in China (Minvielle, 1999). Meat type quails are more popular than egg type quail production in Bangladesh (Rahman *et al.*, 2010). The demand of commercial quail production is increasing day by day in the country (Islam *et al.*, 2014).

a. Quails are smaller sized bird, so they can be raised within small place

Quail is very small bird. Mature male and female are approximately 140 and 200 g. Japanese quail farming has enormous potentiality and could be an alternative to chicken farming particularly in providing gainful employment, supplementary income and as a valuable source of meat and egg, quail farming should be encouraged and promoted in Bangladesh (Rahman *et al.*, 2016).Shanaway (1952) suggested floor space, feeder and drinker space for quail rearing (Table 10).

Table 10. Suggested floor space, feeder and drinker space for quail

Stage of life	Floor (cm ² /bird)	Waterer (cm ² /bird)	Feeder (cm ² /bird)
Brooding	75	0.7	1.5
Growing	100	1	2.5
Laying	130 to150	1.2 to1.5	2.5 to 3

b. Quail are less susceptible to common diseases

Although Japanese quails are comparatively more resistant to infectious diseases than chickens, like salmonellosis, coccidiosis, infectious coryza, enteric diarrhea, and pneumonia have etc.(Rahman et al., 2016). So, no vaccination is given to quails. Any medicine that is given is administered through drinking water. While giving medicine through water, make sure that the birds drink the water completely.

c. Quails grow very fast and gain maturity faster than any other poultry birds

Quails need only 40-50 days to become mature and come in production from 45 days of age. On the other hand, chicken need average 6 months to be mature. Cain and Cawley (1914) summarized life cycle of quail with appropriate body weight at different stage of life (Figure 2).

d. Japanese quail as laboratory animal

The interest in the Japanese quail as a research animal was greatly increased after 1957 due to groups at the University of California and Auburn University who proposed its value in biomedical research. It is now widely used for research purposes in state, federal, university, and private laboratories. Fields in which *Coturnix japonica* is widely utilized include: genetics, nutrition, physiology, pathology, embryology, cancer, behavior, and the toxicity of pesticides(Huss et al 2012). It has now become a standard laboratory animal in many areas of biological and medical research. It has also proven to be a useful laboratory animal in teaching biology courses. Japanese quails are used for laboratory animal for many reason like require little space and maintenance, adaptable to laboratory conditions, short generation intervals and high fecundity, many specialized strains (Ophiret et al. 2005).

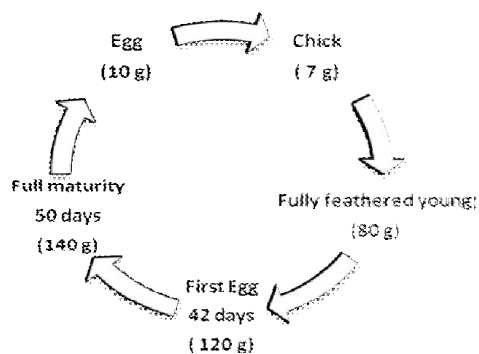


Figure . Life cycle of quail

For the past 50 years, the Japanese quail (*Coturnix japonica*) has been a popular animal model in numerous fields of research. The quail's 16-d developmental period and its easily accessible embryo make *Coturnix japonica* a convenient model for studies of developmental biology. Because its lifespan is relatively short and its physiology is comparable to that of humans, the adult quail is useful for studies of aging and disease (Coturnix standards. 1969).

e. Nutritive value of quail egg

Quail eggs contain 13 percent proteins compared to 11 percent in chicken eggs. The most essential amino acid (EAA) of quail egg whites are leucine (1139.0 mg/100g), valine (869.5 mg/100g) and lysine (790.0 mg/100g) (Tunsaringkarn et al. 2013). Leucine is a branched chain amino acid along with valine and isoleucine. It is beneficial and functional to protein structure for 60-70% in human body, and blood sugar level regulation which maintains a balance of insulin and glucose (Khan, 1999-2012). Valine is required for muscle metabolism, repair and growth of tissue and maintaining the nitrogen balance in the body. Valine also assists to regulate blood sugar and energy levels (Vitalhealthzone, 2007).

While lysine is also needed to produce antibodies, hormones, enzymes, collagen formation as well as repair of tissue. The total essential fatty acid (EFA) (5486.5 mg/100g) and total non-esterified fatty acids (NEFA) (5297.0 mg/100g) were not significant different concentration in quail egg (Tunsaringkarn et al. 2013). Tunsaringkarn et al. (2013) also reported that the most EFA in egg yolks were linoleic acid (2.58 g/100g), docosahexaenoic acid (0.50 g/100g and arachidonic acid (0.44 g/100g) which they were unsaturated fatty acids. While most non-essential fatty acid (NEFA) in egg yolks were oleic acid (8.84 g/ 100g), palmitic acid (5.13 g/100g) and stearic acid (2.03 g/100g). Total NEFA (17.09 g/100g) was higher than EFA (3.70 g/100g). Quail eggs are packed with vitamins and minerals. Even with their small size, their nutritional value is three to four times greater than chicken eggs. The most fat soluble vitamins of egg yolks were vitamin E (tocopherol, 5920.0 µg/100g) which was significantly higher than vitamin A (717.0 µg/100g, $p < 0.001$) and vitamin D (1.14 µg/100g, $p < 0.001$).

However, the most essential mineral of whole eggs was nitrogen (6.36 %) which it was mostly in egg whites (12.2 %) (Tunsaringkarn et al. 2013). Quail eggs also contain 140 percent of vitamin B1 compared to 50 percent in chicken eggs. In addition, quail eggs provide five times as much iron and potassium. While most of trace mineral of whole egg were iron (80.8 mg/L) and zinc (46.9 mg/L). Both of iron (116.0 mg/L) and

zinc (70.6 mg/L) were higher in egg yolks. (Tunsaringkarn *et al.* 2013). Unlike chicken eggs, quail eggs have not been known to cause allergies or diathesis. Actually, they help fight allergy symptoms due to the ovomucoid protein they contain. Regular consumption of quail eggs helps fight against many diseases. They are a natural combatant against digestive tract disorders such as stomach ulcers. Quail eggs strengthen the immune system, promote memory health, increase brain activity and stabilize the nervous system. They help with anemia by increasing the level of hemoglobin in the body while removing toxins and heavy metals. The Chinese use quail eggs to help treat tuberculosis, asthma, and even diabetes. If you are a sufferer of kidney, liver, or gallbladder stones quail eggs can help prevent and remove these types of stones (Tunsaringkarn *et al.* 2013). Quail eggs contain comparative higher calories, proteins, fats, vitamins and minerals (Poultry Line, 2006) (Table 11) and higher stearic acid (C18:0) and linoleic acid (C18:1) than chicken egg (Shanaway, 1952) (Table 12).

a. Nutritive value of quail meat

Quail meat is a sweet and delicate white game meat with extremely low skin fat and low cholesterol value. Ihejirikamba (2012) reported in his paper that quail meat was rich in micronutrients and a wide range of vitamins including the B complex, folate and vitamin E and K (Table 13). Now a days the people are being more and more health conscious with emphasis given to low cholesterol meat. Compare to ruminants and other non-ruminant species chicken meat contained lower cholesterol. Quail meat is leaner than chicken meat. It is therefore recommended for people with high cholesterol levels and those who want to maintain a low level of cholesterol.

Table 11. Comparative nutritive value of chicken and quail eggs

Component	Chicken egg	Quail egg
Calories	147	158
Total fat	9.9g	11.1g
Saturated fat	3.1g	3.6g
Cholesterol	423mg	844mg
Carbohydrate	0.8g	0.4g
Protein	12.6g	13.1g
Vitamin A	487 IU	543 IU
Ca	53 mg	64 mg
Iron	1.8mg	3.6mg
Sodium	140mg	141mg

Table 12. Fatty acid composition of total lipid and cholesterol content of yolk in quail and chicken egg

Fatty acid	% Total in yolk	
	Quail egg	Chicken egg
C14:0	0.6	0.3
C16:0	25.2	25.4
C16:1	6.3	4.2
C18:0	7.7	9.8
C18:1	44.0	43.7
C18:2	10.2	14.0
C18:3	0.7	0.7
C20:1	-	0.2
C20:4	1.6	0.9
C20:5	0.8	-
C22:5	1.1	0.4
C22:6	1.0	0.6

Table 13. Comparative nutritive value of chicken and quail meat

Parameter	Chicken breast Muscle 100g	Quail Meat 100g
Calories	263 (calories from fat 142)	134 (calories from fat 134)
Total Fat	16g	5g
Saturated Fat	3g	1g
Trans Fat	0g	0g
Cholesterol	41mg	70mg
Total CHO	15g	0g
Dietary Fibre	1g	0g
Protein	15%	22%
Iron	6%	25%
Calcium	2%	1%
Vitamin C	0%	1%
Vitamin A	0%	1%

Table 14. Comparative cost benefit analysis of 100 quail and chicken layer farm

Cost (BDT)	100 Japanese quail farm	100 chicken layer farm
Cost of bird up to ready for production	45 (BAU)/bird Total: 45×100=4500	450/bird Total:450×100=45000
Production	90%	90%
Amount of feed required /day	23 g/ day Total:23×100=2.3 kg	120 g / day Total: 120 ×100= 12 kg
Cost of feed	42 Tk/ kg Total: 42 × 2.3 = 97 Tk	37 Tk/ kg Total: 12 × 37= 444 Tk
Feed cost/ egg	97 ÷ 90= 1.07 Tk	444 ÷90 = 4.93 Tk
	Housing cost = 0.01 Tk	Housing cost = 0.08Tk
Other cost/ Egg	Chick, medicine, other cost = 0.07 Tk	Chick, medicine, other cost = 0.56 Tk
	Total cost other than feed = 0.08 Tk	Total cost other than feed = 0.64Tk

Analysis of cost benefit ratio:

	Quail farm	Chicken farm
Feed Cost / egg	1.07 Tk	4.93 Tk
Other cost/ egg	0.08 Tk	0.64 Tk
Total Cost/ egg	1.15 Tk	5.57 Tk
Price/egg	1.80 Tk	6.50 Tk
Profit/ egg	1.80 - 1.15 Tk = 0.65 Tk	6.50- 5.57 Tk = 0.93 Tk
Cost Benefit Ratio	0.65 1.80 = 36%	0.93 6.50 = 14.3%

b. Quail farming needs small capital and higher return than chicken

Quail farming require less investment to start and provide quick return from it. And also provide higher cost benefit ration compare to chicken layer farming (Own analysis). Production cost of per egg is 0.63 and 0.93 Tk for quail and chicken egg respectively. Due to lower production cost and comparatively higher pricing quail farming provide higher cost benefit ratio (Table 14).

Option forwarding to establishing a profitable quail farm

a. Scientific feeding management

As the 60-70% of the rearing cost is feeding cost so we must give emphasis on that. As the quail ready feed is not available so we must use chicken feed with some moderation. Apsinge (2012) reported that broiler starter mash could

be used by adding 5 kg of oil cakes to 75 kg feed the particle size of oil cake was reduced by grinding the feed for one more time and suggested a feeding schedule for quail (Table 15). Appropriate feeds for *coturnix* can usually be obtained from local feed stores.

Table 15. Suggested feeding schedule for quail

Life stage of quail	Protein level	Type feeding program recommended
Starting (0-3 wks)	25-28%	Turkey or game bird starter mash, free choice
Growing (3-6 wks)	20%	Chicken starter mash or crumbles, free choice
Laying	17%	Chicken laying mash or crumbles
Breeding	20%	Chicken starter mash or crumbles plus calcium(Free choice) *

*fine oyster shell or limestone must be available to provide adequate calcium for egg shell formation (Ralph, 1978)

b. Government initiatives

To develop human resources to operate quail farming effectively to compete locally and globally; government has to take major step like create institutions for training quail farmers and businessmen, increasing infrastructure and financing. Government has to motivate the businessmen and their allied to come up for better training and education. In line with this, the department of livestock service might take initiative to expand the quail farming contemporarily with poultry farming.

c. To design proper HRD planning for quail farmers

Government authority should take the overall responsibility to make effective human resources through co-ordination of various agencies. This agency should monitor the co-ordination matter. Effective HR planning and coordination is equally significant for the private and the public sector in Bangladesh. Especially educational infrastructure should be updated based on need. In Bangladesh, there is no quail production training institutions, it should be more than that otherwise unskilled labor will never be able to meet up the future demand of protein through poultry sector.

To arrange easy loan

Every organization like government, private financial institutions, NGOs, and foreign investors should come up to give micro credit to develop the quail farming in Bangladesh. In every developing nation, the ongoing crucial issue is socio-economic development and poverty alleviation. As a developing country, Bangladesh has been putting vigorous attempts towards achieving this goal. Micro-credit is considered as one of the vital tools for poverty alleviation in Bangladesh (The Role of Micro-Credit in Poverty Alleviation, 2009).

d. To employ professional trainer

To generate the admirable flow of skilled human resources in quail production, professional trainer is mandatory for all. Professional trainer such as Animal Husbandry Graduates should be hired from domestic or foreign sources to give technical knowledge, proper education, training, and motivations to the quail farmers.

e. To arrange workshop, seminar, and live demonstration for relevant Poultry workers

The relevant authority should arrange workshops, seminars, conferences, and live demonstrations for imparting training to the farmers regarding the latest knowledge of quail farming, production & marketing.

Conclusion

Recognizing the enormous potentiality of Japanese quail as an alternative to chickens in providing gainful employment, supplementary income and as a valuable source of meat and egg, quail farming should be encouraged and promoted in Bangladesh. However, the major constraints of Japanese quail farming throughout the country which brought about many challenges to the researchers, academicians and professional people to adopt the strategies to make quail farming economically and commercially viable in near future in Bangladesh.

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