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Research paper

Prospects and Limitations of Management and Breeding of Japanese Quail *Coturnix coturnix japonica* in Jammu India

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Abstract: The exponential increase in population size in the developing countries necessitates a corresponding demand in animal protein supply to sustain the availability of protein for the human populace. The present paper reviews the prospects of production, management, diseases and control strategies of quail which is a small to medium sized, migratory, ground dwelling, game bird related to pheasant family.
The small size, low feed requirements, easy handling, short life cycle, good reproductive potential, good meat taste, better laying ability, rapid growth rate, shorter time of hatching and resistance to common poultry diseases as compared with the different species of poultry are the factors that have been suggested to make quail farming an important poultry business contributing enormously to excellent and affordable source of protein supply through meat and egg production in the UT of J&K, India.

Keywords: Quail, pheasant, livestock, poultry, breeding, Japanese quail, *Coturnix coturnix japonica*.

INTRODUCTION

Livestock plays an important role in the Indian economy. About 20.5 million people depend upon livestock for their livelihood. As per the 20th Livestock Census (2019), livestock contributed 16% to the income of small farm households as against an average of 14% for all rural households. Livestock provides a livelihood to two-third of the rural community. It also provides employment to about 8.8 % of the population in India. India having vast livestock resources, contributes 4.11% GDP and 25.6% of total Agriculture GDP as per the Annual Report (2018-19), Department of Animal Husbandry, Dairying and Fisheries Ministry of Agriculture & Farmers Welfare Government of India. However, poultry farming consists mostly raising of chicken, duck, turkey and geese in India to produce meat or eggs for food.
In J&K there is 69 per cent shortfall in poultry meat production and 97 per cent shortfall in poultry egg production as per the draft J&K Poultry Policy 2018. This gap of production and need is fulfilled by the purchase of large quantity of eggs and poultry meat from outside thus draining the state exchequer. According to a recent report of National Action Plan for Egg & Poultry-2022 (For Doubling Farmers' Income by 2022), J&K state import bill for meat, poultry and eggs is approximately Rs.2,000 crore per annum. It has been estimated that every year, Kashmir imports

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around 5.5 crore chickens from our neighbouring states Haryana and Punjab. It is estimated that poultry traders in Punjab supply over half a million eggs and 40,000 to 50,000 chickens per day to mitigate the poultry in J&K.

The present study aims at boosting the growth of poultry industry in Jammu (J&K) with a short generation interval as an alternative means of alleviating the deficiency of animal protein. One such alternative is farming of Quail, a small,ground dwelling game bird belonging to the Pheasant family(Order: Galliformes) raised primarily for their meat and eggs. The Japanese quail have the advantage of small size, short life cycle, rapid growth rate, good reproductive potential, high fecundity rate, and shorter hatching periods when compared with the different species of poultry (El-Katcha et al., 2015 and Owen & Dike 2013).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 (Redoy et al., 2017).

The first attempt to domesticate quail was done in Japan in 1595. In year 1974, Central Avian Research Institute, Bareilly, Uttar Pradesh, imported Japanese quail from California. Since then a lot of improvement have been made in their economic traits and rearing practices. Two species of quail are found in India i.e. the Black breasted quail(*Coturnix coromandelica*) and other species is the Brown color Japanese quail(*Coturnix coturnix japonica*). The meat of quail has low fat content than the chicken meat. This meat helps to promote body and brain development in children. Quail egg is small in size (about 10 gms) but has about equal nutritional value like chicken egg. Quail requires minimum floor space as compared to chicken. Mostly, commercial chicks are kept in multi-tier cages, thereby increasing labor efficiency and better utilization of land space. Japanese quail (*Coturnix japonica*) hasgained importance as commercial poultry species in recent years and many quail farms have been established throughout the country both for egg and meat production. It is essential to select the stocks, which have the inherent capacity to yield better quality meat and egg in order to meet consumer demand. Quail is a very hardy bird that can adapt itself with almost all types of climate and environmentand Indian climate is very suitable for raising Japanese quail. They can be comfortably raised with other birds and animals too.At present quails have become the third largest commercially reared avian species in number only next to chicken and duck in the country.

Specific characters of Japanese quails: At the time of hatching the chicks weigh around 6-7 g. Their body is covered with yellowish down feathers marked with dark stripes. After three days flight feathers begin to appear and the birds are fully feathered in about four weeks. The adult male weigh about 100-140 g while the females are slightly heavier, weighing from 120-160g. The plumage is a mixture of different shades of brown with some black. The upper part of the male breast is cinnamon while the lower part is light brown. In females, the face, throat and upper breast are brown with black dots while lower part is tan (Mills et al., 1997 and Hubrecht & Kirkwood, 2010).In males on the upper edge of the vent is present a bulbous cloacal gland. The eggs are mottled brown in color which are often covered with light blue chalky material. The egg shell is very delicate and easily susceptible to breakage.

REARING SYSTEM:

Rearing system should be designed to ensure comfort of the birds, to make food and water easily accessible to permit easy and effective sanitation and protection from predators. Quails can be reared in both deep litter system and battery system (Quail Production and Management Technology, ICAR Research Complex for Goa (2010). Rearing space recommended for adult quail in floor type is 145sq.cm / quail and in battery system is 125 sq.cm/ quail.

A) Deep Litter System: Six quails can be reared in a one square foot area. For good body- weight gain quails can be reared in cages after 2- weeks.

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B) Battery System: Each unit is about 6 feet in length and 1foot in width and subdivided into 6 sub-units and arranged up to 6 tiers high to save the place.7mm square welded mesh is recommended to provide secure footing, prevent leg injuries and prevent chick escaping from side walls. The bottom of cage is fixed with removable wooden plates to clean the litter. Long narrow feed troughs are placed in front of the cages while water troughs are placed at the back of the cages. Commercial egg layers are usually housed in colonies of 10-12 birds per cage. For breeding purposes, quails are introduced in the cages in the ratio of 1 male:5 females.

MANAGEMENT

Management of hatching eggs: Proper selection and care of hatching eggs is essential for production of healthy quail chicks. It also gives good hatchability. Eggs should be collected several times a day and optimum temperature for storage is 15^{o}C, however, they should not be stored longer than a week. The eggs should be handled carefully as their egg shell is very fragile. Beforesetting the eggs for incubation the hatchery should be thoroughly washed and disinfected properly. Soiled eggs should be cleaned and fumigated properly as they can be a source of infection (Rudithongru & Das, 2017).

Incubation period for the quail is 15-17 days. Physical factors necessary for successful incubation are temperature, humidity, gaseous environment and turning of eggs (8 times per day). Forced draft incubators can be used for incubation of quail eggs with the temperature range(36.9 – 37.2^{0}C) and relative humidity (60-70%).Still air incubators require 1^{o}F more temperature for incubation as compared to Forced draft incubators(Rudithongru & Das, 2017).

Management of Young birds: As the newly hatched chicks are small(7-8 gm) and less feathered so maintenance of proper brooding temperature is essential for young quails. They need supplementary heat for about 3-4 weeks. For the first week a temperature of 35^{O}C is required, which can then be decreased @3.5^{o}C per week till 3-4 weeks untilthey are fully feathered. The chicks will be away from the source of heat if too hot, and shall be panting. This condition can be corrected by either reducing the heat or by increasing ventilation or by combination of these factors. If too cold the chicks will be near the source of heat, huddling together and will emit a peculiar distressing sound. This situation can be overcome by increasing the heat or by heat conservation or both. If the temperature is comfortable the chicks will be peaceful and evenly distributed over the floor area (Adkins-Regan, 1995; Petek et al., 2003; Hassan et al., 2003).

Birds can be reared in litter system or in cages. In litter system a5-10 cm deep layer of wood shavings, saw dust or sand can be used as litter and it should be covered with paper for the first week. Feed should be sprinkled on the paper so that young chicks could easily eat. In wire cage system the floor surface must be covered with coarse paper for first week to prevent injuries. Beak trimming can be done at the age of 2 weeks to prevent feather picking during fighting and other forms of cannibalism. In general, in deep litter system 70 birds can be housed in one square meter area and in cage system 80 birds per square meter can be accommodated (Adkins-Regan, 1995; Petek et al., 2003; Hassan et al., 2003).

Adequate ventilation is essential to provide fresh air to the growing chicks and to remove carbon dioxide, excess of moisture and ammonia.Chicks should be given 24 hours light for first two weeks and thereafter only for 12 hours. For early maturity the chicks should be brooded under 24 hours light up to 6 weeks of age. Like all other poultry animals clean drinking water is also essential and its regular and sufficient supply should be ensured.

Management of breeders: Normal body growth and development of sexual organs are essential for optimum fertility in the breeding stock. The strains genetically bred for improved fertility must get proper environment during the growth period to show desired results.

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Balanced diet to the breeder quail is very important to sustain good fertility. Animal proteins generally improve fertility better than the vegetable proteins as latter lack essential amino acids like methionine and lysine. Environmental temperature is another factor which influences the reproductive fitness, due to altered feed consumption and other physiological reasons. For quality egg and semen production temperature range is 21 to 24^{o} C. Photoperiod also affects sexual maturity and egg production in the females, hence a 16-18 hour regular photoperiod per day is suggested for good results. Fertility reduces with advance in age of the breeders. Hence, the young stock should be preferred to obtain good fertility (KulenKamp et al., 1973). The optimum period in quails for good results is 9-10 weeks of age. For the fertile eggs production, the male quails should be reared along with the females at 8-10 weeks of age. The male, female ratio should be 1:5 as suggested earlier.

Feeding management of quail: The feed should be balanced, economical and preferably prepared with locally available low cost ingredients. Soon after hatching the chicks are provided with "starter diet" until the age of 6-8 weeks. Starter diet should be high protein (approx. 25%) (Howes, 1964). With increase in age their protein requirement decreases but energy, calcium and phosphorous requirement increases. When chicks reach 6-8 weeks "finisher diet" should be given with protein content approximating 19%; that is before egg production "layer diet" is provided. Quail diet should contain adequate amount of vitamins and minerals for the good health and performance.

Feeder and water space is more important than the floor space for growth of chicks. Inadequate space will result in poor growth and enhanced morality. Whereas excess of water or feeders will lead to more of feed wastage and improper utilization of floor and equipment space. For chicks up to 3 weeks of age 2 cm of feeder and 1 cm of water space is essential. During summers electrolytes should be added in the water. The water and feeder should be cleaned daily. Fresh water should be added twice a day and feed should be given once a day.

Table 1: Feed can be formulated as follows: (As per Mishra and Shukla, 2014)

Ingredient	Chick mash	Grower mash
Maize	27	31
Sorghum	15	14
De-oiled Rice Bran	8	8
Sunflower Cake	12.5	12.5
Soya meal	8	-
Fishmeal	10	10
Mineral Mixture	2.5	2.5
Shell grit	-	5

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Healthcare management for quails: Although, they are resistant to most of the poultry diseases and require no vaccination, several types of medications are used for preventing and treating the diseases. Coccidiostats and antibiotics are most commonly added to the feeds. Coccidiosis is the protozoan disease which can be prevented by continuous use of coccidiostats. Similarly antibiotics when added at low doses prevents many diseases and promotes faster growth (Bigland et al., 1965).

EGG PRODUCTION:

Quail starts clutch at 6-7 week of age and reach peak production by about 9-10 week. Under favorable environments, quails produced an average of 280-290 eggs per year. 75% quail eggs are laid between 3 to 6 p.m. and 20% of the eggs in darkness. Quail eggs are multi-colored and heavily mottled with black, brown and blue. The average quail egg weight is about 10 gm which is about 8% of the quail body weight. Incubation period of quail egg is 18 day.The eggshells are spotted, with colors ranging from white to brown. As per the nutritional criteria, the quality of these eggs is far better that of chicken eggs and they contain less cholesterol. The proportion of yolk (the yellow inside part) to albumen (the white part), at 39:61, is higher compared to chicken eggs (Jennifer and Masoumeh, 2017).

The eggs of quail are known to 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) (Tunsaring et al. 2013). Leucine is useful and functional to protein structure for 60-70% in human body, and helps in 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.

Quail eggs have enormous vitamins and minerals. The nutritional value of these eggs is three to four times greater than chicken eggs.The most fat soluble vitamins of egg yolks are vitamin E (tocopherol, 5920.0 µg/100g) which is significantly higher than vitamin A (717.0 µg/100g, $p<0.001$) and vitamin D (1.14 µg/100g, $p<0.001$). 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 (Redoy et al., 2017).

Contrastingwith chicken eggs, quail eggs have not been known to cause any kind of allergies. They are active 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(Garcia et al., 2000). They help with anemia by increasing the level of hemoglobin in the body while removing toxins and heavy metals from the body (Redoy et al., 2017).

Components of quail egg

Water	Protein	lipid	Carbohydrates	Total Ash	Calorific value
74%	13%	11%	1%	1%	649 k J/100g liquid

Sources: http://www.aeb.org/food/nutrient.html

QUAIL MEAT:

Quail meat is leaner than chicken meat with low cholesterol value. It is rich in micronutrients and a wide range of vitamins including the B complex, folate and vitamin E and K (Ihejirikamba, 2012).

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Table 2: Comparative nutritive value of chicken and quail meat (As per Redoy et al. 2017)

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
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%

PRECAUTIONS TO BE TAKEN DURING REARING

The quails being very sensitive and delicate in nature, demand extra care, attention and hygiene in orderto avoid outbreak of diseases although other requirements of their management are quite simple. The important thingsto be considered are:

1. The adult and young stocks may be kept separately to ward off the carriers.
2. The breeder stock should be free from egg-borne diseases like salmonellosis and only healthy stocks should be selected.
3. The wild birds should be kept away since they might be carriers of some diseases transmissible to quails.
4. The birds of different species should be kept separately.
5. Efforts should be made to break the cycle of infection by adopting thorough sanitation measures from hatchery to marketing.
6. The feed and water should always be from a clean source.
7. The houses and equipment used should be disinfected while starting a fresh lot and thereafter well cleaned frequently at regular intervals.
8. The litter material or the scrapings from the dropping trays should be dumped in a pit. In the event of any disease outbreak such materials must be burnt.
9. The dead birds should be disposed of through incineration or by burying them in a pit under a layer of lime and then earth.

LIMITATIONS:

Egg Production: Domesticated quails do not have the tendency for brooding and hence eggs must be incubated under a broody live, or by artificial incubation (Ukashatu et al., 2014). Recent studies revealed that oval eggs are probably the best to be selected for incubation to achieve optimum hatchability in quail production. Whilst spherical eggs may not hatch at all and round eggs may only hatch sparingly (Idahor, 2015).

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 (Randall and Bolla, 2008). Condition that may result in cannibalism include insufficient feeder or drinker space, underfeeding, insufficient nesting space, overcrowding, nutritional and

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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 (Redoy et al., 2017).

Higher chick mortality: The chicks are very small in size ranging from 8-10g, and the mortality is very high.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, 1994) temperature requirement of quail vary according to age ranging from 35ºC to 21^0C.

Table 3: Suitable temperature for quail chick at different ages (Shanaway, 1994)

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

CONCLUSION

Recognizing the massive prospects of Japanese quail as a substitute to chicken farming in providing profitable occupation, extra revenue and as a valuable source of meat and egg, quail farming should be encouraged and promoted in J&K.

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