Original Research

Reproductive Performance and Egg Quality Traits of Kadaknath in Intensive Managemental Condition under Hot and Humid Climate

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Abstract

The present study was carried out to determine the reproductive performance and egg quality traits of Kadaknath poultry birds in intensive system of rearing in hot and humid coastal climate of Orissa. A total of 104 day old straight run chicks of Kadaknath breed were taken for this study and divided into 4 replicates each comprising of 26 chicks which were randomly selected and reared in deep litter system at Central Poultry Development Organization, Eastern Region, Bhubaneswar. The age at sexual maturity, egg production upto 40 weeks recorded at weekly interval, fertility, hatchability and egg qualities traits were determined at 40 weeks of age. Age at sexual maturity was 183.50±0.70 days, mean egg production at 40th week of age was 46.50±0.16 and fertility, hatchability on TES and FES basis were, 80.00±4.08 %, 62.50±2.50% and 78.37±2.50%, respectively. The mean values of egg weight was 42.90±0.56g, shape index, shell percentage, albumen index, yolk index, yolk to albumen ratio and Haugh unit were, 74.67±0.22, 10.18±0.06 %, 7.20±0.003, 35.56±0.11 0.475±0.0004 and 76.46±0.25, respectively. It may be concluded that the performance like age at sexual maturity and egg production performance of Kadaknath Chicken reared in intensive system in the coastal climatic condition of Odisha is comparable to that of other parts of country. Further study is required to exploit and improve the genetic potentiality of this breed through selective breeding and to conserve this native germplasm.

Key words: Egg, Intensive, Kadaknath, Reproduction

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Introduction

A significant feature of India's poultry industry has been its transformation from a mere backyard activity into a major commercial activity in just about four decades. This transformation has involved sizeable

investments in breeding, hatching, rearing and processing. Farmers in India have moved from rearing non-descript birds to today rearing hybrids which ensure faster growth, good livability, excellent feed conversion and high profits to the rearers. There is a tremendous development in the poultry industry in last few decades, but little attention has been paid for indigenous chicken, due to its poor producing ability. Back yard poultry farming is a part and parcel of typical rural/tribal household, touching social, cultural and economic aspects in India. The Kadaknath bird is very popular among the tribals of Madhya Pradesh mainly due to its special capabilities such as adaptability to local environment, resistance to certain diseases, meat quality and many other criteria specific to breed type (Rao and Thomas, 1984). Although the meat of this breed has an unattractive appearance, it has a delicious flavour (Panda and Mahapatra, 1989). This Kadaknath breed is unique in the sense that its meat is black colur, meat and eggs are considered rich source of protein and iron having aphrodisiac effect (Mohan *et al.*, 2008). Although the Kadaknath breed has many unique characteristics, it has been neglected because of its poor production potential. Of late, there is renewed interest among consumers and farmers in native germplasm because of the unique hardiness of the breeds, their ability to thrive under adverse climatic conditions, and the desirable taste and flavour of eggs and meat. Hence, a significant demand exists for the products of native chickens, breeds. However, to increase the productivity of backyard or rural farming, improved or exotic birds are being introduced in rural areas or in their breeding tracts, leading to a dilution of the genetic purity of the breeds or a complete replacement of the native germplasm. Hence, these breeds are under threat of extinction (Singh, 2009). However there is very little information available regarding the performance of Kadaknath birds in intensive system of rearing. This breed, due to pressure from high yielding genetic stock is on the verge of extinction. The conservation and systemic study of this breed using modern technologies is essential for assessment of its productive and reproductive potential along with other traits as a pure breed.

Most of the research works have been conducted on Kadaknath in free range system of management. Continuous efforts are to be made for the improvement of this breed through better nutrition, management condition and breeding. The objective of this study was to determine the production and reproductive performance and egg quality traits of Kadaknath poultry birds under intensive system of rearing in hot and humid coastal climate of Orissa.

Materials and Methods

The study was carried out at the Central Poultry Development Organization (CPDO), Eastern region, Bhubaneswar from September 2016 till June 2017. A total of 104 day old straight run thrifty and healthy chicks of Kadaknath breed were taken for this study and divided into 4 replicates each comprising of 26 chicks. All chicks were vaccinated with Marek's vaccine and wing banding was done at hatchery before transfer of chicks to the experimental pen. The experimental birds were placed in the naturally ventilated

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house and raised in the deep litter system with a provision of 1 sq ft floor space per bird. The birds were then differentiated as male and female at 14th week by observing their comb pattern then shifted to layer house at 21st week of age. The male to female ratio of 1:3 was maintained for optimum fertility.

Age at First Egg and Sexual Maturity

Age at first egg in the flock was the day on which the first egg was laid. The average age at sexual maturity was calculated by recording the age at first egg production of all the birds. The average egg production from age at sexual maturity to 40 week of age was recorded at weekly interval. Trap nest method was followed to record the egg production of individual hen. There was provision of one nest box with three compartments for every 20 laying hens in the layer house for ensuring clean egg production from the farm.

Fertility and Hatchability

A total of 200 eggs were taken for the study. Eggs were collected daily during 40th week (over 7 day's period). Surface cleaning of eggs was done with sand paper to remove dirt. Disinfection of eggs was done by fumigation with 1X strength (20g potassium permanganate and 40 ml of formalin per 100 cft area for 30 sec). Eggs were stored in a room with a temperature of 54^0F dry bulb thermometer reading and 62-65^0F wet bulb thermometer reading. Maximum 7 days storage was done prior to setting of eggs in incubator. The eggs were set vertically with broad end up. The eggs were incubated under standard conditions in the incubator with a temperature of 99.5^0F to 100^0F dry bulb thermometer and 86^0F wet bulb thermometer reading with relative humidity of 70 percent. Turning of eggs was done at the rate of one turning in an hour automatically in the incubator. After 9 days of incubation the eggs were candled to determine fertility of the developing embryo. If there was no evidence from candling on day 9 that the embryo was alive, then that embryo was classified as dead. Fertility was determined as the ratio of number of fertile eggs to the number of total eggs set. Egg hatchability was determined by considering the ability of the developed embryo to emerge from the egg over a 48-hour interval of time, *i.e.* days 21 or 22 after the initiation of the incubation process. For determining the percent hatchability, only the population of embryos that were judged to be alive on day 18 of candling was included in the calculation. On 19th day eggs were transferred to the hatcher. No turning was done in hatcher and eggs were kept horizontally. The temperature in hatcher was 99^0F dry bulb thermometer and 85^0F wet bulb thermometer reading relative humidity of 60 percent. At the end of 21st day the hatched chicks were taken out, counted and the number was recorded.

$$Fertility\ \% = \frac{Number\ of\ fertile\ eggs}{Total\ number\ of\ eggs} \times 100$$

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$$Hatchability\ \%\ (TES) = \frac{Number\ of\ hatched\ eggs}{Total\ number\ of\ eggs} \times 100$$

$$Hatchability\ \%\ (FES) = \frac{Number\ of\ hatched\ eggs}{Total\ number\ of\ eggs} \times 100$$

Egg Quality Traits

Twenty freshly laid eggs were taken for the study to determine internal and external egg quality traits. Following egg quality traits were studied-

i) External Egg Quality Traits

a) Egg weight (g): Egg weight was recorded by a physical balance.

b) Shape index (%): The maximum length and breadth of eggs were measured by digital slide callipers. The shape index of each egg was calculated as per Shultz (1953).

$$Shape\ Index = \frac{Maximum\ width\ of\ egg}{Length\ of\ egg} \times 100$$

ii) Internal Egg Quality Traits

The eggs were broken and the contents were poured over a levelled glass plate placed on a table to measured the following characteristics-

a) Shell thickness (mm): Four pieces of shell, one each from narrow end, broad end and from two sides were taken after removing the shell membrane and the thickness of the shell pieces were measured by screw gauge.

b) Albumen width (mm): The albumen width was measured by slide callipers at three different locations and the mean value was calculated.

c) Albumen height (mm): The albumen height was measured by a spherometer at the highest point.

d) Albumen index: The albumen index was calculated as per Heiman and Carver (1936).

$$Albumen\ index = \frac{Height\ of\ albumen}{Width\ of\ albumen} \times 100$$

e) Haugh unit: The Haugh unit was calculated according to Haugh (1937).

$$HU = 100 \log (H+0.57- 1.7W^{0.37})$$

Where, HU = Haugh Unit, H = Average height of albumen in mm, W = Average weight of egg in g

f) Height of the yolk (mm): After measuring the height and breadth of the albumen, the thick and thin albumen were completely separated from the yolk and removed. The height of the yolk was measured by a spherometer at maximum height.

g) Yolk width (mm): The width of the yolk was measured by slide callipers at three different sides and mean width was calculated.

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h) Yolk index (%): The yolk index was estimated as per Heiman and Carver (1937).

$$Yolk\ Index = \frac{Height\ of\ yolk}{Width\ of\ yolk} \times 100$$

Statistical Analysis

The data obtained from the study were statistically analysed according to Snedecor and Cochran (1994). The data were subjected for t- test to test the difference between means, wherever necessary.

Results

Age at First Egg, Sexual Maturity (ASM), Egg Production, Fertility and Hatchability

The age at laying of 1st egg was 175 days and average age at sexual maturity was 183.50±0.79 days. The numbers of eggs laid per bird in 30th, 35th and 40th weeks periods were 10.36 ± 0.06, 26.55 ± 0.11 and 46.50 ±0.16, respectively (Table 1). The fertility % was 80.00±4.08 and hatchability % on TES and FES basis of the flock were, 62.50±2.50 and 78.37±2.50 respectively.

Table 1: Fertility, hatchability, age at sexual maturity and egg production

Traits	Mean±SE
Fertility%	80.00±4.08
Hatchability % (TES)	62.50±2.50
(FES)	78.37±2.50
Age at first egg(days)	175
Age at sexual maturity(days)	183.50±0.70
30 weeks part period egg production(no)	10.36±0.06
35 weeks part period egg production (no)	26.55±0.11
40 weeks part period egg production(no)	46.50±0.16

Egg Quality Traits

The eggs collected randomly for evaluation of external and internal egg characteristics at 40th week age are presented in Table 2 and Table 3.

Table 2: External egg quality traits of Kadaknath birds

External Egg Quality Traits	Mean±S.E
Egg weight(g)	42.90±0.56
Egg width(cm)	3.37±0.01
Egg length (cm)	4.51±0.01
Shape index(%)	74.67±0.22
Shell thickness(mm)	0.33±0.003
Shell weight(g)	4.36±0.04
Shell percentage (%)	10.18±0.06

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The average egg weight was 42.90g, egg length and width were 4.51±0.01 cm and 3.37±0.01 cm respectively. The shell thickness, weight and percentage were 0.33±0.003 mm, 4.36±0.04 g and 10.18±0.06 respectively. The albumen height (mm), albumen width (mm) and albumen weight (g) were 5.05±0.003, 70.026±0.01and 26.38±0.02 respectively. Similarly the yolk height (mm), yolk width (mm), yolk weight (g) 15.01±0.04, 42.21±0.037 and 12.53±0.006 respectively.

Table 3: Internal egg quality traits of Kadaknath birds

Internal Egg Quality Traits	Mean±S.E
Albumen height(mm)	5.05±0.003
Albumen width(mm)	70.026±0.01
Albumen index (%)	7.20±0.003
Albumen weight(g)	26.38±0.02
Albumen %	61.58±0.80
Yolk height(mm)	15.01±0.04
Yolk width(mm)	42.21±0.037
Yolk index (%)	35.56±0.11
Yolk weight(g)	12.53±0.006
Yolk %	29.25±0.40
Yolk to albumen ratio	0.475±0.0004
Haugh unit	76.46±0.25

Discussion

Age of First Egg, Sexual Maturity and Egg Production Performance

Age at first laying of the Kadaknath birds under intensive system of rearing was 175 days which was in accordance with Haunshi *et al.* (2011). Biswas *et al.* (2010) observed lower age of 158.2 days at first egg. The average age at sexual maturity of the birds were 183.5 days in present study which was more or less comparable with the reports of Jha *et al.* (2013) of 196.12 days, Valavan *et al.* (2016) of 210 days, Haunshi *et al.* (2011) 200.61 days where as Singh *et al.* (2000) reported that the age of sexual maturity in Aseel bird was 200.58 days. The lower age at sexual maturity is desirable which may lead to the increased laying period, thus improving the total egg production. The number of eggs laid per bird in 30 week, 35 week and 40 week part periods were 10.36, 26.55 and 46.50 respectively which was comparable with Thakur *et al.* (2009) who reported a 40 week part-period egg production in the range of 39 to 42 for Kadaknath breed under an intensive rearing system. On the other hand, Singh *et al.* (2000) reported an average egg production of 33.17 eggs/hen/year under field conditions for the Aseel breed. The lower egg production in the Aseel birds was due to the broodiness condition observed in this breed. Haunsi *et al.*(2011) found higher 40 week part- period egg production of 49.40 in the Kadaknath as compared to 36.23 in Aseel. This black coloured, short statured Kadaknath basically used by the tribal community of Madhya Pradesh for egg production and this birds attain early sexual maturity leading to better 40 week part period egg production.

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Fertility and Hatchability

In this study the fertility, hatchability (TES and FES basis) were found superior to work carried out by Bhardwaj *et al.* (2006). They reported the values of 70.44, 44.75 and 57.75% for fertility %, hatchability (TES and FES basis) respectively in Kadaknath birds maintained under intensive management, whereas the corresponding values obtained in present study were 80.00, 62.50, and 78.37%. However the fertility and hatchability (FES) were 83.14 and 80.24% as reported by Biswas *et al.* (2010) where the sex ratio of 1:1 was maintained in cage housing in contrast to the sex ratio of 1:3 in the present study and reared in deep litter system of housing. The higher percent of fertility in both the cases might be due to higher male-female ratio maintained throughout the experimental study.

Egg Characteristics

The egg weight at 40thweek of this breed of chicken was 42.9g. Haunsi *et al.* (2011) and Valvavan *et al.* (2016) reported the weight of the egg of this breed ranged from 40.31-41.3g .Where as higher weight of 46.23g was reported by Jha *et al.* (2013). Similar shell thickness and shape index was found as reported by Jha *et al.* (2013). But higher value of shape index of 76.39 to77.23% was reported by Haunsi *et al.* (2011) and Valvavan *et al.* (2016). The albumen index of an egg which is an indication of egg protein content. In the present study the albumen index of the Kadaknath breed was found 7.2 which was similar to the findings of Haunsi *et al.* (2011), Jha *et al.* (2013) and Valvavan *et al.* (2016). While in Aseel the albumin index was 6.25 in intensive condition of rearing (Jha and Prasad, 2013). Similar value of yolk index was also reported by Haunsi *et al.* (2011), Jha *et al.* (2013) and Valvavan *et al.* (2016) in the range of 35.2-36.7. Lower yolk index value of 37 was observed by Parmar *et al.* (2016) in field condition. Haugh unit which is an indication of albumin height of an egg that signifies the protein content of egg. In the present findings more than 76 was recorded in Kadaknath breed whereas Jha *et al.* (2013), Haunsi *et al.* (2011) and Valvavan *et al.* (2016) reported the Haugh unit in the range of 72.57-74.99. Parmar *et al.* (2006) in an extensive system rearing observed wide variation in Haugh unit values for these birds, ranging from 62.58 to 90.00. Higher value of Haugh unit in Kadaknath is a very good nutritional characteristic of this breed.

Conclusion

It may be concluded that the performance of Kadaknath Chicken with respect to age at sexual maturity and egg production performance reared in intensive system in the coastal climatic condition of Odisha is comparable to that of other parts of country. Further study is required to exploit and improve the genetic potentiality of this breed through selective breeding and to conserve this native germplasm.

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