Performance of Vanaraja and Kaveri poultry birds in tribal villages of Jharkhand

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Abstract
To improve the socio-economic status of the traditional farmer, backyard poultry is a handy enterprise with low-cost initial investment, but high economic return along with guarantee for improving protein deficiency among the poor. A study was conducted to find out the performance of backyard poultry viz. Vanaraja and Kaveri in tribal villages in Jharkhand. In total 117 (76 male and 41 female) tribal backyard poultry farmers were purposively selected for the present study from four villages of Ranchi district. These farmers procured improved variety of egg from institute farm for hatching in traditional method by deshi broody hen during 2015 to 2019. The data were collected for growth, feed intake, egg production, egg weight, egg consumed, egg sold, live bird sold including rearing cost and return on back yard poultry farming. The socioeconomic data reveals that 63.24 % farmers depended on crop and livestock for their livelihood and 24.79 % on a combination of crop, livestock and non-farm sources whereas, a small proportion (11.97 %) depended solely on livestock. The day old body weight of Vanaraja and Kaveri birds were 36.43±2.72 g and 30.32±4.85 g whereas, body weight at 240 days were 1974.35±43.14 g and 1885.12±47.35 g, respectively. The average age of sexual maturity, annual egg production and egg weight at 280 days age was 172.36±2.23 and 190.11±5.25 days, 156.15±15.6 and 144.33±13.14 numbers and 55.85±5.53 and 50.21±3.54 g for Vanaraja and Kaveri, respectively. The comparative benefit-cost (B/C) ratio (gross return/ gross cost) was 2.02 and 1.89 for Vanaraja and Kaveri birds, respectively. The economics of rearing Vanaraja and Kaveri poultry birds at farmer’s house was found to be beneficial for income generation and can contribute to rural livelihoods.

Keywords: Backyard poultry, benefit cost Ratio, Kaveri, tribal village, Vanaraja

Introduction
Backyard poultry production is an age old practice in rural India. Most of the backyard poultry production is confined to rearing of indigenous birds with poor producer range of live weight of 1.0-1.5 kg and laying 50-60 numbers of small size eggs (35-40 g) annually in free range farming system [2]. To improve the socio-economic status of the traditional farmers, backyard poultry is a handy enterprise with low-cost initial investment, but high economic return along with guarantee for improving protein deficiency among the poor[3,10]. Poultry population has grown spectacularly throughout the world comprises 23 percent in developed and 76 percent in developing countries. Nowadays many researchers and development agents are making a strong consensus that the smallholder chicken production plays a major role in poverty alleviation and food security at household level. Rajkumar et al., (2020) [27] opined that rural poultry farming with improved chicken varieties is fast growing with its proven potential to improve the livelihood and nutritional security in the country. It provides off-farm employment and income generating opportunity as well as source of gifts and religious sacrifices [11, 37, 38, 39]. Scavenging chickens also help in waste disposal system by converting leftover of grains and human foods and insects into valuable protein foods-egg and meat [10].

There is evidence that investments in small-scale poultry farming generate handsome returns and contribute to poverty reduction and increased food security in regions where a large share of the population keeps some poultry birds [15, 21, 26]. In an average, landless/marginal/small-scale Indian poultry keeping household, keeps an average flock size of 8 to 12 birds. In India, it is estimated that over 50 % of landless and marginal farmers depend on poultry and small ruminant rearing. The majority of farmers in rural areas of Jharkhand rely on rain-fed agriculture. This has led to the food insecurity in the tribal areas due to the lowering of agricultural output.
The investments in back yard poultry farming can generate handsome returns and contribute to increased food and nutrition security among rural population. There is enormous possibility of improvement in back yard poultry to provide employment, livelihood and food security in rural areas. The backyard poultry production can be easily boost up with improved breed of poultry and can promise a better production of meat and egg [17]. Considering the above mentioned facts the present study was undertaken to find out the production performance and economic return from Vanaraja and Kaveri poultry birds raised in tribal villages of Jharkhand.

Material and Methods
The tribal backyard poultry farmers of 117 (76 male and 41 female) were purposively selected for the present study from four villages namely Malti, Tetri, Kutiyatu and Pindorkom in Ranchi district. These farmers procured improved variety of Vanaraja and Kaveri poultry bird’s egg from ICAR Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region, Ranchi for hatching of eggs in traditional method by deshi broody hen during 2015 to 2019 (Fig.1). An interview schedule was developed based on objective of the study and pretested in adjoining areas of selected villages. Necessary modifications were made in the schedule to facilitate accurate and reliable data collection. The selected farmers were interviewed individually through prestructured schedule. While collecting data, sufficient time was given to the farmers to arrive at values by the memory recall method. The data for observations on growth, feed given, egg production, egg weight, egg consumed, egg sold, bird live weight sold during farming were collected. The data was analyzed by adopting the standard technique prescribed by Snedecor and Cochran (1994) [16].

Results and Discussion
The findings of socio-economic profile of tribal backyard poultry farmers, bird’s growth, their production performance and economic details were tabulated, analyzed and inferences were made.

Socio-economic profile
The education level of the tribal backyard poultry farmers indicated that 24.79 % of farmers were illiterate whereas, who could read and write were 44.44 %, those who studied up to primary level were 12.82 % and 17.95 % studied up to secondary level (Table 1). The small family (up to 4 members) was 62.39 % followed by medium (5 to 6 members) 22.22 % and large family size (more than 6 members) 15.39 %, respectively. More than three-fourth (80.34 %) of the farmer was living in joint families and only 19.66 % lived in nuclear family. About 17.95 % of tribal backyard poultry farmers possessed a land holding of up to 0.25 ha, 25.64 % had 0.25 to 0.50 ha of land, 35.04 % had 0.50 to 1.0 ha and 21.37 % had a land holding of 1.0 ha and above. The highest proportion of farmers (63.24 %) depended on crop and livestock for their livelihood and 24.79 % on a combination of crop, livestock and non-farm sources whereas, a small proportion (11.97 %) depended solely on livestock. Most of the farmers (47.86 %) lies in medium income group (Rs. 72,000 to 120,000/-), where as 41.03 % of them came under high income group and 11.11 % farmers were found in low income group. Chakrabarti et al., (2020) [4] also reported 8.56 % pig farmers were illiterate whereas, who could read and write were 33.69 %, those who studied up to primary level were 32.62 % and 25.13% studied up to secondary level in village of Jharkhand. Riedel et al., (2012) [29] observed about 50 % of small holder pig farming household members in China had finished primary school. In another study, Haldar et al., (2017) [12] observed that the majority of the beneficiaries (57.87%) were either illiterate or officially just literate who could only read and write his/ her name. Similarly, Devendra and Thomas (2002) [9] reported integrated farming systems being practiced in South East Asian countries with crop and livestock components. Haldar et al., (2017) [12] and Chakrabarti et al., (2020) [4] also reported similar findings of medium income group.

| Sr. No. | Profile                  | Total number =117 | M(N=76) | F(N=41) | Percentage of total farmers |
|--------|--------------------------|-------------------|---------|---------|----------------------------|
| 1      | Education                |                   |         |         |                           |
|        | Illiterate               | 12                | 17      | 10.26   | 14.53                      | 24.79                       |
|        | Can read and write       | 34                | 18      | 29.06   | 15.38                      | 44.44                       |
|        | Primary level            | 11                | 4       | 9.40    | 3.42                       | 12.82                       |
|        | Secondary Level & above  | 19                | 2       | 16.24   | 1.71                       | 17.95                       |
| 2      | Family size              |                   |         |         |                           |
|        | Small (up to 4           | 73                |         |         |                            | 62.39                       |
|        | Medium (5 to 6           | 26                |         |         |                            | 22.22                       |
|        | Large (more than 6       | 18                |         |         |                            | 15.39                       |
| 3      | Family type              |                   |         |         |                           |
|        | Nuclear                  | 23                |         |         |                            | 19.66                       |
|        | Joint                    | 94                |         |         |                            | 80.34                       |
| 4      | Land holding pattern (in ha) | Up to 0.25 | 21      |         |                            | 17.95                       |

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Fig 1: Egg procured by farmers from ICAR- FSRCHPR, Ranchi for hatching

Fig 2: Deshi hen with chicks at farmers house

Table 1: Socio-economic status of the tribal backyard poultry farmers

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“1961”
Body weight gain
In present study the day old body weight of Vanaraja bird was 36.43±1.27 and Kaveri 30.32±0.85 (Table 2) (Fig. 2). Deka et al., (2014) [7] observed the day-old body weight of Vanaraja male and female chicks were 34.36 g and 31.36 g, respectively whereas, Ramana et al., (2010) [28] reported comparatively lower body weight in Vanaraja chicks and this might be due to difference in managerial practices. The total body weight gain at 140 days in Vanaraja bird was 1425.17 g and for Kaveri 1384.64 g, respectively. Daida et al., (2013) [6] recorded body weight of 1160.7 g for male and 1006.9 g for female in Vanaraja chicken at 20th week. Deka et al., (2014) [14] observed that at 24 weeks of age Vanaraja male and female attained an average body weight of 1991.96 and 1489.57 g, respectively. Vanaraja adult female weighed 2070.00 g and 2990.33 g at 40 and 72 weeks of age and the corresponding weight of male was 2603.33 g and 3736.67 g, respectively. Banja et al., (2017) [1] noticed average body weight at sexual maturity (20-24 weeks) in Vanaraja 2100 g and in Kaveri 1875 g, respectively. Singh et al., (2018) [15] observed at 20th week body weight of 1652.55 g (Male) and 1242.30 g (Female) in Vanaraja birds.

| Particulars            | Vanaraja (g) | Kaveri (g) |
|------------------------|--------------|------------|
| Day old                | 36.43 ± 1.27a| 30.32 ± 0.85b |
| 7 days                 | 97.37 ± 1.80b| 69.45 ± 1.70b |
| 15 days                | 155.53 ± 1.95a| 139.25 ± 4.46b |
| 30 days                | 263.42 ± 2.15a| 222.83 ± 5.82b |
| 60 days                | 410.11 ± 6.78a| 360.12 ± 6.32b |
| 75 days                | 749.33 ± 19.54a| 680.32 ± 12.35b |
| 90 days                | 1132.37 ± 27.49a| 1070.47 ± 21.54b |
| 140 days               | 1425.17 ± 37.49a| 1384.64 ± 34.25b |
| 280 days               | 1974.35 ± 43.14a| 1885.12 ± 47.35b |

a & b means with different superscripts are significantly different at p<0.05.

Sexual maturity
In present study, Vanaraja attained sexual maturity at an average age of 172.36±2.23 days compared to the 190.11±5.25 days of Kaveri birds (Table 3). Banja et al., (2017) [1] also reported sexual maturity of Vanaraja at 190 days and for Kaveri 185 days. This might be due to differences in feeding management practices. Similarly, Deka et al., (2014) [8] observed an average age of 178.13 days as sexual maturity in case of Vanaraja birds and corroborating with the present study as results of Sharma and Hazary (2002) [33]. Whereas, Niranjana et al., (2008a) [23] reported age at sexual maturity was 164.79 days for Vanaraja birds.

| Particulars            | Vanaraja | Kaveri |
|------------------------|----------|--------|
| Age at Sexual Maturity (Days) | 172.36 ± 2.23a| 190.11 ± 5.25b |
| Egg Production at 280 Days | 75.91 ± 5.51a| 64.13 ± 0.18b |
| Egg Production at 365 Days | 156.13 ± 15.6a| 144.33 ± 13.14b |
| Egg Weight at 280 days (g) | 55.85 ± 5.53a| 50.21 ± 3.54b |
| Mortality 0 to 30 days (%) | 8.13 ± 1.79 | 8.11 ± 1.37 |
| Mortality 31 to 140 days (%) | 1.43 ± 0.71 | 1.41 ± 2.37 |
| Mortality 141 to 280 days (%) | 1.24 ± 0.773 | 1.23 ± 0.373 |
| Mortality above 40 weeks | 0.07±0.01 | Nil |
| Colour of egg          | Brown or creamy white | Light brown |
| Broodiness             | No       | No     |
| Egg consumed at home(No.) | 76.44 ± 2.31 | 70.46 ± 3.05 |
| Egg sold in village/ market(No.) | 79.71 ± 2.89 | 73.87 ± 2.78 |

a & b means with different superscripts are significantly different at p<0.05.

Egg production
The egg production performance at 280 days, 365 days were 75.91±5.51, 156.15±15.6 for Vanaraja and 64.13±6.18, 144.33±13.14 for Kaveri birds (Table 3) (Fig 3 & 4). Niranjana et al., (2008b) [24] reported almost similar egg production of 149.47 numbers for Vanaraja up to 72 weeks of age. Whereas, Banja et al., (2017) [1] noticed egg production performance of Vanaraja and Kaveri birds was 150 and 163 eggs/bird/year. The annual egg production of Vanaraja ranged from 119 to 190 weeks (Table 3). Banja et al., (2014) [30] observed that at 24 weeks of age Vanaraja male and female attained an average body weight of 1991.96 and 1489.57 g, respectively. Vanaraja adult female weighed 2070.00 g and 2990.33 g at 40 and 72 weeks of age and the corresponding weight of male was 2603.33 g and 3736.67 g, respectively. Banja et al., (2017) [1] noticed average body weight at sexual maturity (20-24 weeks) in Vanaraja 2100 g and in Kaveri 1875 g, respectively. Singh et al., (2018) [15] observed at 20th week body weight of 1652.55 g (Male) and 1242.30 g (Female) in Vanaraja birds.

| Particulars                          | Vanaraja | Kaveri |
|--------------------------------------|----------|--------|
| Income sources                       |          |        |
| Livestock only                       | 14       | 11.97  |
| Crop + livestock                     | 74       | 63.24  |
| Crop + livestock + non-farm          | 29       | 24.79  |
| Low (up to Rs. 72,000/-)             | 13       | 11.11  |
| Medium (Rs. 72,001 to 120,000/-)     | 56       | 47.86  |
| High (above Rs.120,001/-)            | 48       | 41.03  |

Between 0.25 to 50 | 30 | 25.64
From 0.50 to 1.0 | 41 | 35.04
More than 1.0 | 25 | 21.37

Table 2: Growth Performances of improved Breed of Vanaraja and Kaveri

Table 3: Production Performances of improved Breed of Vanaraja and Kaveri poultry birds

“1962“
and nutritional status of the birds under different agro-climatic conditions. Further, difference in egg production among different genotypes might be due to difference in their genetic makeup, adoptability, availability of scavenged and supplemental feed resources. However, there was no broodiness observed in Vanaraja and Kaveri birds. Deka et al. (2014) also could not find broodiness in Vanaraja birds in their study.

Egg weight
The egg weight at 280 days was found 55.85±5.53 g for Vanaraja and 50.21±3.54 g for Kaveri birds (Table 3). Deka et al., (2014) also found egg weight of Vanaraja 51.08 g and 59.06 g at 40 and 72 weeks of age. Niranjan et al., (2008b) also observed egg weight at 40th week 57.06 g and at 72nd week 62.35 g, respectively in Vanaraja birds. Banja et al., (2017) observed egg weight at 40 weeks in Vanaraja and Kaveri were 62 and 56 g, respectively whereas, at 52 weeks, the egg weight was recorded as 58.37 g in Vanaraja and Kaveri were 62 and 56 g, respectively whereas, at 52 weeks, the egg weight was recorded as 58.37 g in Vanaraja and Kaveri birds, respectively. Banja et al., (2017) observed up to 10 weeks 15%, 20 weeks 18% for Kaveri birds and for Vanaraja 24% and 30%, respectively at village condition in Odisha. Saikia et al., (2017) reported lower mortality rate than Sarma et al., (2018) in Vanaraja under backyard system up to 5 weeks of age. Singh et al., (2018) also noticed lower mortality (5%) in Vanaraja birds up to 6 weeks. However, up to 6 weeks of age the much higher mortality rates were recorded in Vanaraja (14.40%) by Choudhary et al., (2019) in Bihar. The mortality rate reduced with the advancement of age of the birds. They also found lower mortality in Vanaraja during 7 to 32 weeks of age. Similar trends of mortality rates were observed by many workers during 32 to 52 weeks of age in different dual type backyard chicken under different agro-climatic conditions. The higher mortality rate might be attributed to different agro-climatic condition and due to inferior management practices.

Egg colour
The egg colour of Vanaraja was observed brown or creamy white and of Kaveri light brown. Banja et al., (2017) reported egg colour of Vanaraja and Kaveri was brown. Deka et al., (2014) also observed the shell colour of Vanaraja chicken was brown. It was also noticed that on an average, farmers consumed half of the produced egg at home and half of them sold in the market or at home.

Mortality rate
The mortality of Kaveri chicks exhibited superiority in their live ability in the backyard system with a mortality rate of 8.11 % during the critical period of first 30 days of their life compared to the backyard improved strain Vanaraja birds (8.13%) (Table 3). Whereas, mortality from 31 to 140 days, 141 to 280 days and above 40 weeks was 1.41%, 1.23%,0% in Kaveri and 1.43%, 1.24%, 0.07% in Vanaraja birds, respectively. Banja et al., (2017) observed up to 10 weeks 15%, 20 weeks 18% for Kaveri birds and for Vanaraja 24% and 30%, respectively at village condition in Odisha. Saikia et al., (2017) reported lower mortality rate than Sarma et al., (2018) in Vanaraja under backyard system up to 5 weeks of age. Singh et al., (2018) also noticed lower mortality (5%) in Vanaraja birds up to 6 weeks. However, up to 6 weeks of age the much higher mortality rates were recorded in Vanaraja (14.40%) by Choudhary et al., (2019) in Bihar. The mortality rate reduced with the advancement of age of the birds. They also found lower mortality in Vanaraja during 7 to 32 weeks of age. Similar trends of mortality rates were observed by many workers during 32 to 52 weeks of age in different dual type backyard chicken under different agro-climatic conditions. The higher mortality rate might be attributed to different agro-climatic condition and due to inferior management practices.

Economics of raising birds
In present study the benefit cost ratio was also calculated for raising Vanaraja and Kaveri poultry birds and depicted in Table 4. Banja et al. (2017) opined that a benefit-cost ratio (BCR)/Profitability Index Rate is an indicator, used in the formal discipline of cost-benefit analysis that attempts to summarize the overall value for money of a project or proposal. The economics of rearing Vanaraja and Kaveri poultry birds at farmer’s house was found to be beneficial for income generation (Fig. 5 & 6). The comparative benefit-cost (B:C) ratio (gross return/gross cost) was 2.02 and 1.89 for Vanaraja and Kaveri birds, respectively. The gross return from a unit of 10 Vanaraja and 10 Kaveri birds were found Rs. 1135.80 and Rs. 1061.60, respectively by sale of eggs and live ability in the backyard system with a mortality rate of 8.11 % during the critical period of first 30 days of their life compared to the backyard improved strain Vanaraja birds (8.13%) (Table 3). Whereas, mortality from 31 to 140 days, 141 to 280 days and above 40 weeks was 1.41%, 1.23%,0% in Kaveri and 1.43%, 1.24%, 0.07% in Vanaraja birds, respectively. Banja et al., (2017) observed up to 10 weeks 15%, 20 weeks 18% for Kaveri birds and for Vanaraja 24% and 30%, respectively at village condition in Odisha. Saikia et al., (2017) reported lower mortality rate than Sarma et al., (2018) in Vanaraja under backyard system up to 5 weeks of age. Singh et al., (2018) also noticed lower mortality (5%) in Vanaraja birds up to 6 weeks. However, up to 6 weeks of age the much higher mortality rates were recorded in Vanaraja (14.40%) by Choudhary et al., (2019) in Bihar. The mortality rate reduced with the advancement of age of the birds. They also found lower mortality in Vanaraja during 7 to 32 weeks of age. Similar trends of mortality rates were observed by many workers during 32 to 52 weeks of age in different dual type backyard chicken under different agro-climatic conditions. The higher mortality rate might be attributed to different agro-climatic condition and due to inferior management practices.

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birds. This economic analysis infers that Kaveri provides better income to the rural poultry farmers and helps in augmenting the production of nutritious food products. In the present investigation, Kaveri was comparatively less performer in terms of B:C ratio than the Vanaraja birds. Jha and Chakrabarti (2017a)\textsuperscript{11} reported that rearing of Divyan Red bird under backyard system as a source of livelihood in tribal village generated net income of Rs. 232.74 per bird with a benefit cost ratio of 1.169. Singh et al., (2018)\textsuperscript{23} also reported higher net profit (Rs. 281.66) per bird with higher benefit cost ratio of 2.96 from backyard poultry farming with Vanaraja and Srinidhi birds. The net profit realized per bird up to 72 weeks of age under scavenging system of rearing was Rs. 536.21 for Vanaraja chicken with corresponding benefit cost ratio of 1.52\textsuperscript{34}. Similarly, duck farming also improved tribal people’s source of income and significantly contributed to their livelihoods in Jharkhand\textsuperscript{17}.

Table 4: Economic details of raising improved breed of Vanaraja and Kaveri poultry birds

| Particulars of Expenditure and Income (considering average 10 birds unit) | Vanaraja | Kaveri |
|---|---|---|
| **Expenditure** | | |
| Cost of 10 day old chicks @Rs.35/- per piece | Rs.350.00 | Rs.350.00 |
| a. Cost of feed up to 30 days age - 1.50 kg of Starter feed per bird @ rate of Rs. 33/kg of feed | a. 1.50 x 10 x 33 = Rs.495 | a. 1.50 x 10 x 33 = Rs.495 |
| b. Cost of supplement feed up to 280 days for male @35 g/bird/day- 7.8 kg/bird rate of Rs.30/kg of feed | b. 9.8 x 30.00 x 4 = Rs.1176.00 | b. 9.8 x 30.00 x 4 = Rs.1176.00 |
| c. Cost of supplement feed up to 480 days for female @30 g/bird/day-14.1/bird @ Rate of feed-Rs.30/kg of feed | c. 14.4 x 30.00 x 6 = Rs.2592.00 | c. 14.4 x 30.00 x 6 = Rs.2592.00 |
| Total feed cost (Rs.) | 4263.00 | 4263.00 |
| Cost of Medicine, transportation, etc. @ Rs.100/bird for 10 birds | 10 x 100 = Rs.1000.00 | 10 x 100 = Rs.1000.00 |
| Total Gross Expenditure | Rs.5613.00 | Rs.5613.00 |
| Total cost of production per bird | Rs.561.30 | Rs.561.30 |
| **Income** | | |
| Sale of egg @Rs.8/- per egg for 6 hen | 156 x 8 x 6 = 7488.00 | 144 x 8 x 6 = 6912.00 |
| Sale of male birds @Rs.250/- per kg on live weight basis (Rs.) | 1.95 x 4 x 250 = 1950.00 | 1.88 x 4 x 250 = 1880.00 |
| Sale of female culled birds @Rs.160/- per kg on live weight basis (Rs.) | 2.00 x 6 x 160 = 1920.00 | 1.90 x 6 x 160 = 1824.00 |
| Gross income (Rs.) | 7,488.00 + 1950.00 + 1920.00 = 11,358.00 | 6912.00 + 1880.00 + 1824.00 = 10,616.00 |
| Gross return per bird (Rs.) | 1135.80 | 1061.60 |
| Net income per bird (Rs.) | 574.50 | 500.30 |
| Benefit cost ratio | 1:2.02 | 1:1.89 |

Conclusions

The rearing backyard poultry as a subsidiary occupation by adopting poultry farming with one unit comprising 10 Vanaraja or Kaveri birds per family with minimum feed supply offer a good economic return. These birds has a potential to well thrive under traditional farming conditions. The natural vegetation and scavenging is an excellent source of feed supply with minimum expenditure and maintenance. It may be concluded that Vanaraja and Kaveri chicken could be effectively managed under backyard condition for egg and meat production with low expenditure. Moreover, utilizing scavenging system of feeding and with moderate night shelter, utilizing family labour with children or old member of the family can easily maintain a small flock of bird in their backyard with maximum benefit in terms of family nutrition, cash earning and employment in rural villages.

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Fig 5: Mature bird ready for sale at farmers house

Fig 6: Mature cock at farmers house
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