RESEARCH ARTICLE

Production Performance, Phenotypic and Carcass Quality Sensory Evaluation of Kadaknath, Rhode Island Red Chicken and their Reciprocal Crosses

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Abstract

The performance of reciprocal crosses of Rhode Island red (RIR) and Kadaknath was studied for comparison with the performance of purebred RIR and Kadaknath. A total of 292 birds comprising of purebred RIR and Kadaknath and reciprocal crosses were divided into four groups, *viz.,* 74 birds of purebred Rhode Island red (R), 70 birds of purebred Kadaknath (K); and 72 birds of Rhode Island Red x Kadaknath (R x K) and 76 birds of Kadaknath x Rhode Island Red (K x R) as reciprocal crosses. The body weight (BW) at day-old, 4, 8, 12, 16, 20, 28, 36, and 40 weeks of age, age at first egg (AFE) and total egg number (TEN) up to 40th week of age were recorded for each group. The phenotypic characteristics of birds and their egg quality parameters were recorded at the 40th week of age. The phenotypic and carcass qualities were recorded at the 28th week of age for male and female birds. The results of the study indicated that the body weight (BW), egg weight (EW), TEN, and dressed weight (DW) for purebred RIR were significantly ($p < 0.05$) higher than purebred Kadaknath. The EW of both the reciprocal crosses was significantly ($p < 0.05$) higher than the purebred Kadaknath. Use of RIR female in a cross with Kadaknath males significantly ($p < 0.05$) increased TEN and BW. The use of RIR male in crosses with purebred Kadaknath female resulted in higher DW for their crossbred male. Use of either male or female purebred RIR in crosses with Kadaknath did not affect crossbred female DW. Red-breasted black plumage, white skin, and mixed-colored ear lobe were observed in R x K crosses. Silver laced black breast, black plumage color, black colored skin, and black ear lobes were observed in K x R crosses. The results of the study indicated that reciprocal crossing between RIR and Kadaknath breeds improved egg shape index (SI), albumen index (AI), yolk weight (YW), albumen weight (AW), shell weight (SW), shell thickness (ST). The overall acceptance of crossbred birds' meat was higher when RIR female was used in a cross with Kadaknath. It was concluded that using K x R cross would help improve the production performance, egg quality, and consumer demand for rural and backyard poultry farming in India.

Keywords: Carcass quality, Kadaknath, Performance, Phenotype, Reciprocal crosses, Rhode Island Red.

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Introduction

Native birds for the rural economy are of immense importance in different countries as they are being used for rural and backyard poultry farming to improve the nutritional status of rural families. Though these birds are being used for rural and backyard farming, their genetic potential has not been fully exploited. Native fowls are natural reservoirs of major tropical genes and have adaptive qualities (Egahi *et al.,* 2013). Native chicken breeds like Aseel and Kadaknath are gaining importance over the years due to their unique attributes. Kadaknath breed is one of them, which is available in a tribal tract of Madhya Pradesh, Gujarat, and Rajasthan of India. Kadaknath breed having fibromelanosis character is commonly used both for meat and egg production. Kadaknath breed is considered a delicacy with distinctive taste. Although Kadaknath breed is significantly less in performance compared to Assel (Haunshi *et al.,* 2011), its black flesh is very delicious, popular among tribal people, and used for the treatment of many diseases by tribals, which needs proper scientific intervention (Thakur *et al.,* 2006).

Genetic improvement through selection may take a long time; thus, crossbreeding coupled with selection can speed up the genetic gain by utilizing heterotic effects. The growth and egg production of Kadaknath birds are less compared to their crossbreds which can be improved by crossing with RIR. The quality of the poultry products can be assessed by several attributes, primarily the sensory (color, tenderness, flavor, juiciness), physical (muscle yield, water-holding capacity, cooking loss) and chemical (proximate analysis of different

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portion) attributes of chicken carcases and meat, which vary with growth rate and body composition (Alonso *et al.,* 2009; Chen *et al.,* 2016). As native chickens are being focused by researchers for rural and backyard poultry production in India, the present study was undertaken to compare the production performance, phenotypic, carcass, and sensory evaluation of reciprocal crosses of Kadaknath and RIR exotic chicken.

Materials and Methods

Experimental Birds and Design

The Control and Supervision approved this study of Experiments on Animals (CPCSEA) and Institutional Animal Ethics Committee (IAEC) regulated by Govt. of India. A total of 292 numbers of day-old chicks of purebred Rhode Island Red (RIR), Kadaknath (K) and their reciprocal crosses (R x K and K x R) were generated at Poultry Research Station, AAU, Anand, Gujarat, India. One-hundred hatching eggs each of Kadaknath, RIR, and their reciprocal crosses were collected during 40th week of age and stored at 18.3^{o}C before setting into an incubator to generate the chicks. After hatching, chicks were wing-banded, weighed individually and distributed randomly into four treatments. The birds were reared up to age of 40th week. Brooding was carried out during 0 to 8 weeks age in the deep litter housing system and then transferred to individual cages at the age of 9th week until the end of the experiment. The birds were reared using standard management and health care practices. The chick mash, grower, and layer mash feed were offered during 0-8, 9 to 16, and 17 to 40 weeks of age, respectively. Feed and water were offered *ad libitum*.

The experimental birds were divided into four groups comprising of 74 birds of purebred Rhode Island Red (R), 70 birds of purebred Kadaknath (K); 72 birds of Rhode Island Red x Kadaknath (R x K), and 76 birds of Kadaknath x Rhode Island Red (K x R) as their reciprocal crosses.

Parameters Studied

Growth and Production Performance

Individual body weights (BW) were recorded at day-old, 4, 8, 12, 16, 20, 28, 36, and 40th weeks of age. Age at sexual maturity was recorded as age at first egg (AFE) in days. The TEN was recorded for all groups up to 40th week of age.

Phenotype

The individual birds from each group were observed at 40th week of age for the recording of plumage color, skin color, and ear lobe color, and the data was presented as a percentage per group.

Egg Quality

The egg quality parameters were recorded at the end of 40th week of age. Two eggs per group were randomly selected for recording egg quality parameters. Egg weight was recorded at 28, 32, 36, and 40th weeks of age, and average egg weight (EW) was calculated for each group. The egg shape index (SI) and yolk index (YI) were calculated according to standard formulae. After breaking the egg on the smooth surface, the height (mm) of thick albumen was measured with the help of a spherometer, width of thick albumen by Vernier caliper, and the albumen index (AI) was calculated. Shell membrane was separated from the shell, and shell thickness (ST) was measured using a digital micrometer screw gauge in mm. The individual egg yolk, albumen, and shell were weighed, and average yolk (YW), albumen (AW) and shell (SW) weights were arrived at per group. The color of individual yolk (YC) was compared with color comparator (Roche Yolk Color Fan).

Carcass Parameters and Sensory Evaluation

From each group, three males and three females were slaughtered at 28th week of age for carcass characteristics and sensory evaluation of meat. The carcass parameters, *viz.,* pre-slaughter weight, dressed weight (DW), and giblet weight (GW) [that included liver, heart, and gizzard weight], breast weight (BSTW), and thigh weight (THW) were recorded for each group. The sensory evaluation of meat was carried out on the basis of 9 points descriptive hedonic scale as given by Schilling *et al.* (2015). Meat cooking and sensory evaluation were carried out as per Wang *et al.* (2019).

Statistical Analysis

The data was analyzed statistically using descriptive statistics and ANOVA using completely randomized design.

Results and Discussion

Growth and Production Performance

The growth and production parameters of four classes of birds are depicted in Table 1. The purebred RIR was significantly higher at all intervals until the 40th week of age than the purebred Kadaknath chicken. Rahman *et al*. (2019) also reported a higher growth rate in RIR chicken. Day-old weights of RIR were heaviest ($p < 0.01$) among genotypes studied by Haque *et al.* (1999). The difference in day-old chick weight primarily would be due to the difference in egg size of these two genotypes since the chick weight is the function of egg weight (Sharma *et al.,* 1971). Among the reciprocal crosses (R x K and K x R), the BW was found to be significantly ($p < 0.05$) higher in K x R cross as compared to R x K cross in straight run birds up to 12 weeks and at all ages after 16th week of age and was at par at 16th week of age in females. Rahman *et al.* (2019) also reported that the male line of indigenous chickens crossed with females of other breeds was significantly ($p < 0.05$) heavier than the female line of indigenous chicken crossed with male of their breeds. In the present study, the improved BW of K x R compared to R x K indicated that the use of RIR females with native male fowls may help improve BW of the resultant crossbred. In contrast to the present findings, Pal *et al.* (2019) reported higher BW

Table 1: Body weight, age at first egg (AFE), egg weight and total egg number (TEN) up to 40 weeks of age of purebred and crossbred birds

Parameter	*Age*	*R/RIR*	*K*	*R x K*	*K x R*
Body weight (g)	0 day*	$33.71^{a} \pm 0.26$	$25.81^{b} \pm 0.24$	$25.14^{b} \pm 0.34$	$33.98^{a} \pm 0.34$
	4th wk*	$234.76^{a} \pm 4.43$	$157.86^{c} \pm 3.26$	$196.28^{b} \pm 3.95$	$231.36^{a} \pm 3.38$
	8th wk*	$624.77^{a} \pm 11.85$	$341.42^{d} \pm 11.87$	$425.05^{c} \pm 11.9$	$514.95^{b} \pm 19.83$
	12th wk*	$912.62^{a} \pm 17.01$	$558.82^{c} \pm 21.62$	$730.13^{b} \pm 23.3$	$851.36^{a} \pm 26.72$
	16th wk**	$1177.69^{a} \pm 40.22$	$799.36^{c} \pm 24.84$	$989.80^{b} \pm 24.1$	$1000.12^{b} \pm 22.9$
	20th wk**	$1704.58^{a} \pm 41.19$	$1247.07^{d} \pm 30.31$	$1389.19^{c} \pm 33.6$	$1549.87^{b} \pm 31.40$
	28th wk**	$1654.33^{a} \pm 28.72$	$1372.34^{c} \pm 26.66$	$1340.64^{c} \pm 25.6$	$1470.52^{b} \pm 18.69$
	36th wk**	$1895.5^{a} \pm 39.7$	$1476.64^{d} \pm 43.5$	$1599.50^{c} \pm 42.6$	$1736.44^{b} \pm 41.9$
	40th wk**	$1944.5^{a} \pm 55.09$	$1520.44^{b} \pm 39.85$	$1618.19^{b} \pm 46.3$	$1809.96^{a} \pm 48.44$
AFE (Days)	-	$137.06^{c} \pm 2.10$	$195.22^{a} \pm 3.62$	$152.13^{b} \pm 6.22$	$154.16^{b} \pm 2.40$
Egg weight (g)	28th wk	$49.09^{a} \pm 0.65$	$41.06^{c} \pm 1.83$	$46.39^{b} \pm 0.62$	$46.24^{b} \pm 0.55$
	32nd wk	$50.85^{a} \pm 0.69$	$42.58^{c} \pm 0.69$	$46.17^{b} \pm 0.56$	$45.70^{b} \pm 0.5$
	36th wk	$54.92^{a} \pm 0.76$	$47.07^{c} \pm 0.89$	$51.64^{b} \pm 0.62$	$51.57^{b} \pm 0.55$
	40th wk	$56.00^{a} \pm 0.98$	$46.68^{c} \pm 0.71$	$51.92^{b} \pm 0.74$	$52.70^{b} \pm 0.78$
TEN	40th wk	$109.30^{a} \pm 4.35$	$42.08^{c} \pm 4.81$	$90.28^{b} \pm 6.12$	$97.11^{ab} \pm 3.74$

Means bearing different superscripts within a row differ significantly ($p < 0.05$).
*Body weight of straight run birds
** Body weight of females

in reciprocal crosses with exotic line (Cari-Red) as male line and Kadaknath as female line than their direct crosses. The superiority of crossbreds over purebreds for body weight at different ages was also reported by several workers (Lata, 2014; Laxmi *et al.,* 2009). This is indicative use of crossbreeding program to improve BW of native fowls. Haque *et al.* (1999) reported the highest body weight gain in Naked neck Desi (NaD) x RIR crossbreds followed by NaD x Fayoumi (Fy) and NaD x White Leghorn (WL) crossbreds at 17th week of age. Our results were in agreement with this report.

Age at first egg (AFE) is generally used to determine age at sexual maturity, which is considered as one of the important factors determining the overall profitability of the flocks. Egg production traits such as EN, EW, egg mass, and BW at sexual maturity are affected by age at sexual maturity (Camci *et al.,* 2002). The AFE was significantly better in RIR purebreds and significantly ($p < 0.05$) higher in Kadaknath, while the AFE was at par for reciprocal crosses (Table 1).

The egg weight (EW) at the age of 28, 32, 36, and 40th week was significantly ($p < 0.05$) higher for RIR purebred compared to Kadaknath and their reciprocal crosses (R x K and K x R). The lowest EW was recorded in the purebred Kadaknath group. Higher EW in exotic birds (RIR, Fayoumi, and WL) than in Indigenous chicken was reported by Rahman *et al*. (2019). No significant differences were found between reciprocal crosses (R x K and K x R). However, the EW of both the reciprocal crosses was significantly ($p < 0.05$) higher than the purebred Kadaknath in our study. This indicated that the use of heavy exotic breeds with native fowl helps to improve EW. Joseph and Moran (2005) reported that egg size could be increased by selecting BW of chickens, while Munisi *et al.* (2015) observed improved EW with heavy BW broiler parental stock in any crossing. This is because F_1 progeny would inherit half of their genes from each of the parents.

Significantly ($p < 0.05$), higher TEN was recorded in purebred RIR. Higher egg production in exotic birds (RIR, Fayoumi, and WL) than in Indigenous chicken was also reported by Rahman *et al*. (2019). In reciprocal crosses with RIR and Kadaknath, it was observed that the use of RIR females in a cross with Kadaknath resulted into higher TEN as compared to use of RIR males. Munisi *et al.* (2015) showed positive heterosis for EN at 80 and 90 days after attaining sexual maturity in the crosses between native fowl and broilers. Present findings also agreed with Onwurah and Nodu (2006) findings, who reported high EN for the cross between Anak broiler stocks and native birds. Thus, in agreement with previous studies, the present study also showed that crossbreeding improves EW and EN.

Phenotype

The phenotype observed in different groups is given in Table 2. Red-breasted black plumage, white skin, and mixed color ear lobe were observed in R x K crosses. Silver laced black breast and black plumage color, and black colored skin and ear lobe were observed in K x R crosses. The appearance (plumage color, type of comb), meat flavor, and meat texture are the main attributes that attract owners and consumers (Sokołowicz *et al.,* 2016). Kadaknath chicken is in demand due to its medicinal properties (Thakur *et al.,* 2006). The use of RIR with Kadaknath chicken, which resulted in different plumage patterns rather than entire black, may help attract the owners and consumers.

Table 2: Plumage, skin and ear lobe color in purebred birds and their crosses (Frequency %)

Parameter	*Criteria*	*R/RIR*	*K*	*R x K*	*K x R*
Plumage color	Red Breasted Black	0.00	0.00	92.31	0.00
	Black	0.00	100.00	7.69	44.44
	Silver laced Breast Black	0.00	0.00	0.00	48.15
	Brown	100.00	0.00	0.00	3.70
Skin color	White	100.00	0.00	100	0.00
	Black	0.00	100.00	0.00	100
Ear lobe color	White	100.00	0.00	30.77	0.00
	Black	0.00	100.00	61.54	100
	Red	0.00	0.00	7.69	0.00

Table 3: Egg quality parameters in purebred and crossbred birds

Parameter	*R/RIR*	*K*	*R x K*	*K x R*
Egg weight (g)	$57.40^{a} \pm 1.02$	$42.82^{c} \pm 0.98$	$49.11^{b} \pm 0.92$	$51.94^{b} \pm 1.11$
Shape Index	$79.44^{a} \pm 0.07$	$67.44^{c} \pm 2.01$	$73.23^{b} \pm 1.97$	$74.60^{b} \pm 1.88$
Yolk Index	0.55 ± 0.01	0.54 ± 0.01	0.52 ± 0.01	0.57 ± 0.001
Albumen Index	$0.08^{b} \pm 0.004$	$0.12^{a} \pm 0.007$	$0.08^{b} \pm 0.005$	$0.10^{a} \pm 0.004$
Yolk weight (g)	$16.70^{a} \pm 0.38$	$13.2^{c} \pm 0.36$	$15.14^{b} \pm 0.29$	$16.47^{a} \pm 0.30$
Albumen weight (g)	$33.39^{a} \pm 1.07$	$23.99^{c} \pm 0.65$	$27.67^{b} \pm 0.64$	$28.86^{b} \pm 0.87$
Shell weight (g)	$7.30^{a} \pm 0.15$	$5.64^{c} \pm 0.12$	$6.29^{b} \pm 0.16$	$6.62^{b} \pm 0.14$
Shell thickness (mm)	$0.42^{a} \pm 0.00$	$0.36^{c} \pm 0.01$	$0.34^{d} \pm 0.01$	$0.38^{b} \pm 0.26$
Yolk color	7.53 ± 0.23	7.78 ± 0.25	7.55 ± 0.26	7.22 ± 0.30

Means bearing different superscripts within a row differ significantly ($p < 0.05$).

Egg Quality Parameters

The egg quality parameters of eggs at 40th week of age from different groups are depicted in Table 3. Significantly ($p < 0.05$) highest egg shape index (SI) was observed in pure RIR, while it was lowest in pure Kadaknath. The SI of eggs of reciprocal crosses (R x K and K x R) was in-between these two pure breeds. It was found that the SI of eggs of both the reciprocal crosses was improved than the pure Kadaknath. However, eggs' egg yolk index (YI) from neither the purebreds nor their reciprocal crosses differed significantly. The albumen index (AI) of eggs of pure Kadaknath was significantly ($p < 0.05$) higher as compared to pure RIR breed. The AI of eggs of R x K crosses was similar to the pure RIR and higher than the pure Kadaknath, while the AI of eggs of K x R crosses was similar to pure Kadaknath and higher than pure RIR. The yolk weight (YW) of eggs of the pure Kadaknath breed was significantly ($p < 0.05$) lowest, while it was significantly ($p < 0.05$) highest in pure RIR breed. The YW of eggs from R x K crosses was significantly ($p < 0.05$) higher than pure Kadaknath and lowest than pure RIR while in K x R crosses, it was similar to pure RIR and lower than pure Kadaknath. The AW of eggs from pure RIR was found to be significantly ($p < 0.05$) highest, while it was lowest for pure Kadaknath. The AW of eggs from both the reciprocal crosses (R x K and K x R) was significantly ($p < 0.05$) higher as compared to pure Kadaknath. The shell weight (SW) of eggs from RIR was also significantly higher ($p < 0.05$) compared to Kadaknath, and it was significantly improved ($p < 0.05$) in both the reciprocal crosses. However, the use of reciprocal crosses had better SW than Kadaknath. The shell thickness (ST) was significantly ($p < 0.05$) lower in Kadaknath compared to RIR breed. The ST of eggs was significantly higher in K x R than R x K reciprocal crosses. The ST was improved in K x R cross than the Kadaknath breed. The intensity of yolk color (YC) did not differ significantly among the treatments. However, it was apparently higher in purebred Kadaknath. The results of the study indicated that reciprocal crossing between RIR and Kadaknath breeds improved egg SI, AI, YW, AW, SW, and ST. Similar to the present findings, Khawaja *et al.* (2013) also observed improvement in internal egg qualities in three-way crossbred chickens with reciprocal F1 crossbred chickens in a sub-tropical environment.

Carcass Parameters

The carcass parameters of different groups of birds are presented in Table 4. The carcass dressed weight (DW) is the main index to evaluate the meat productivity in chickens (Yin *et al.,* 2013). No significant difference was found in dressed weight (DW) of males and females from both desi (Kadaknath) and exotic (RIR) chicken as well as crossbred produced (R x K and K x R). The DW for purebred RIR was found to be higher than purebred Kadaknath. However, the use of RIR

Table 4: Carcass characteristics of purebred and crossbred birds

Sex	*Carcass characteristics*	*R/RIR*	*K*	*R x K*	*K x R*
Male	Pre-slaughter weight (g)	2177.33 ± 38.69	1799.33 ± 81.19	2002.67 ± 50.36	1900.00 ± 135.77
	Dressed Weight (g)	1571.67 ± 84.57 (72.18)	1237.33 ± 40.05 (68.77)	1381.00 ± 74.0 (68.96)	1327.33 ± 113.26 (69.86)
	Giblet (g)	78.00 ± 13.11 (3.58)	64.33 ± 4.84 (3.58)	65.33 ± 5.46 (3.26)	67.67 ± 11.05 (3.56)
	Breast (g)	341.33 ± 19.30 (15.68)	298.67 ± 27.09 (16.60)	328.67 ± 13.38 (16.41)	303.33 ± 36.19 (15.96)
	Thigh (g)	500.67 ± 27.14 (22.99)	364.67 ± 27.38 (20.27)	460.67 ± 17.29 (23.00)	400.00 ± 47.09 (21.05)
Female	Pre-slaughter weight (g)	1852.00 ± 81.41	1293.67 ± 128.95	1499.33 ± 149.85	1628.00 ± 100.18
	Dressed Weight (g)	1316.00 ± 58.35 (71.06)	904.00 ± 86.00 (69.88)	1126.00 ± 9.33 (75.10)	1069.33 ± 35.83 (65.68)
	Giblet (g)	88.67 ± 8.67 (4.79)	58.67 ± 1.76 (4.54)	62.67 ± 6.00 (4.18)	69.33 ± 6.90 (4.26)
	Breast (g)	300.67^{a} ± 13.53 (16.23)	195.33^{b} ± 12.09 (15.10)	241.33^{ab} ± 25.54 (16.10)	278.67^{ab} ± 25.83 (17.12)
	Thigh (g)	304.00^{a} ± 11.55 (16.41)	181.33^{c} ± 10.67 (14.02)	242.00^{bc} ± 18.58 (16.14)	224.00^{c} ± 21.01 (13.76)

Means bearing different superscripts within a row differ significantly ($p < 0.05$), Digits shown in parenthesis ( ) are in percentage (%).

Table 5: Sensory evaluation of meat of purebred and crossbred birds

Parameter	*R/RIR*	*K*	*R x K*	*K x R*	*CD*	*p value*
Appearance	7.2 ± 0.18	6.7 ± 0.20	6.9 ± 0.20	7.1 ± 0.21	NS	0.374
Odour/smell	6.7 ± 0.24	6.7 ± 0.21	6.5 ± 0.26	7.1 ± 0.19	NS	0.228
Tenderness	6.5 ± 0.24	6.8 ± 0.26	6.5 ± 0.25	7.0 ± 0.25	NS	0.468
Flavour	6.9 ± 0.18	6.9 ± 0.17	6.7 ± 0.23	6.9 ± 0.22	NS	0.826
Juiciness	6.3 ± 0.27	6.9 ± 0.22	6.5 ± 0.26	7.1 ± 0.25	NS	0.133
Mouth feeling	6.8 ± 0.22	6.8 ± 0.22	6.7 ± 0.23	6.8 ± 0.98	NS	0.980
Palatability	6.8 ± 0.24	6.8 ± 0.24	6.7 ± 0.24	7.1 ± 0.26	NS	0.695
Overall liking and Disliking	6.9 ± 0.19	6.9 ± 0.23	6.9 ± 0.19	7.2 ± 0.24	NS	0.690

or Kadaknath males in reciprocal crosses resulted in higher DW for their crossbred males as compared to Kadaknath pure bred. In agreement with this, Meanawat *et al.* (1977) reported higher dressing percentage of crossbreds (desi x exotic) over pure desi breeds. There were no significant differences in thigh weight (THW) and breast weight (BSTW) of males from both desi (Kadaknath) and exotic (RIR) chicken as well as crossbred produced (R x K and K x R). The THW and BSTW of RIR purebred females were significantly ($p < 0.05$) higher than that of purebred Kadaknath, while giblet weight (GW) was found to be non-significant. In contrast to the present findings, Haque *et al.* (1999) observed higher breast meat in NaDRIR, NaDWL and NaDFy cross, when Naked neck Desi (NaD), RIR and WL were used to produce respective crosses.

Sensory Evaluation

Various attributes with respect to sensory evaluation of meat of purebred and crossbreds noted in the present study did not differ significantly (Table 5). Yin *et al.* (2013) suggested that productivity can be improved via crossbreeding while maintaining meat quality of the Erlang mountainous chicken. Although there were no significant differences in purebred and crossbreds for sensory attributes in the present study, overall acceptance for meat of crossbred birds was higher when RIR female was used in crosses with Kadaknath. Similar to the present findings, Wang *et al.* (2019) also reported that the flavor and overall acceptability were more preferred in chickens from crossbred ($p < 0.05$), particularly female chickens from SWS (Shanzhongxian) crossbred with male birds of W line, due to higher abdominal fat content that led the soup more flavor and acceptable. Meat quality characteristics are affected by genetic factors such as appropriate choice of breed/line or commercial hybrid (Dal Bosco *et al.,* 2012; Umaya, 2014). Consumer interest in flavorsome meat from slow-growing chickens is increasing in many countries. In comparison to modern broilers, native fowls and their hybrids show a lower smaller proportion of breast but their meat has many quality characteristics valued

by consumers (Sokołowicz *et al.,* 2016; Yin *et al.* (2013), and Walley *et al.* (2015) also reported that the native birds provide good-quality meat, which is more demanded in the present scenario. Połtowicz and Doktor (2012) studied meatiness in hybrids resulting from the crossing of four lines of native chickens with Hubbard male broilers. They concluded that the meat from the hybrids was juicy and tender, and the proportion of abdominal fat did not exceed 3% of carcass weight.

Conclusions

It was concluded that the purebred RIR had significantly ($p < 0.05$) higher growth and production performance than purebred Kadaknath. Use of RIR female in a cross with Kadaknath male significantly increased TEN and BW. Use of RIR male in a cross with Kadaknath female resulted in higher DW for their crossbreds, while the use of either male or female purebred RIR in crosses with Kadaknath did not affect crossbreds DW. Red-breasted black plumage, white skin, and mixed color ear lobe were observed in R x K crosses. Silver laced black breast and black plumage color, and black colored skin and ear lobe were observed in K x R crosses. The results of the study indicated that the reciprocal crossing between RIR and Kadaknath breeds improved egg quality parameters. The overall acceptance for the meat of crossbred birds was higher when RIR female was used in cross with Kadaknath. The use of K x R cross may help improve the production performance, egg quality, and consumers' demand for rural and backyard poultry farming in India.

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