Comparative Performance of Indigenous Uttara Chicken with Three Well-Established Breeds under Rural Farming

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ABSTRACT

The present study aimed to estimate juvenile body measurements in indigenous Uttara (U) chicken and comparisons of their estimates with Rhode Island Red (RIR), Kadaknath (K) and Australorp (A) breed of chickens using 400 day-old chicks. The parameters were estimated for juvenile body weight was recorded on an electronic balance in the morning before feeding on 0 to 20 week at 2 weeks intervals. The growth rate of Uttara is higher than that of Kadaknath and Australorp but at certain stages similar to that of RIR. Further, an investigation aimed to evaluate body conformation characteristics at 12 and 20 weeks of age. Conformation traits are higher in RIR in comparison to other chicken breeds, but at certain stages, Uttara shows a similar trend as that of RIR. Furthermore, data on adult body weight and egg production measurements were estimated. Egg production of Uttara is better than other breeds. Thus, early body measurements of the Uttara chickens can be used for prediction of the size of the adult Uttara. These research-outcomes may serve as base information to the breeders and academicians for chalking outbreeding strategy in the concerned aspect.

Key words: Body conformation; body weight; egg production; Uttara chicken

A native chicken population from Uttarakhand, named “Uttara” is a distinctive bird with rich black plumage and feathered Shank which has recently been identified. It has medium egg production, medium growth rate, medium body size, medium-sized egg weight as well as moderate sexual maturity. It is found in high hills of Pithoragarh, Almora, and Nainital districts and kept by mostly tribes in the interior parts of Uttarakhand and adjoining Nepal and Tibet border. This germplasm has many desirable characters such as hardiness, adaptability to the wide agro-climatic variability, disease tolerance, and rich flavor of meat and eggs. Despite a drastic increase in the import of high yielding strains from across the world, the indigenous birds still retain preference in its native environment mainly due to its special capabilities i.e., being good foragers, mothering ability and low cost. The birds require no extra care and housing which makes them suitable for landless laborers and marginal farmers. The Uttara have an appreciable degree of resistance to diseases compared with other exotic breeds of fowl in its natural habitat in free-range.

Body conformation, which constitutes body proportions as decided by the bone size and degree of fleshing, is considered a better measure of body capacity of birds. The external appearance which reflects physiological changes related to egg production may also have bearing on the genetic potential of pullets for egg-laying. Shank and keel lengths are indicators of skeletal

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growth and may be associated with egg production in laying hens. The amount of meat derived from a chicken increase as it grows. Breeders are interested in increasing the meat yield of the chicken and in improving the appearance of the carcass. Many of the body measurements that have been studied are good indicators of skeletal size. These include keel and shank length, breast angle, leg circumference, and body depth, etc.4.

Recently, there has been increasing interest in studying indigenous chicken breeds for eggs and meat production5. The objective of this study was to estimate body weight, conformation characteristics and eggs production of Uttara (U) raised in the Uttarakhand, India and its comparison with Rhode Island Red (RIR), Kadaknath (K) and Australorp (A) breeds of chickens.

MATERIALS AND METHODS

The present study was carried out utilizing four different breeds at the Agriculture Research Station Majhera and nearby villages of Betalghat blocks which are situated in the hilly region of District Nainital. Data were recorded from June 2018 to April 2019 on 400 birds consisting of four breeds viz., RIR, Uttara, Kadaknath, and Australorp. The population under the present study were raised under uniform farm conditions. Bodyweight was recorded on an electronic balance in the morning before feeding starting from day old to 20 weeks at 2 weeks intervals. Furthermore, body weight at the age at first egg (BWA FE), body weight at 32 weeks and 40 weeks also recorded.

Conformation traits: The body conformation traits were measured at 12 and 20 weeks in the morning before feeding as discussed below:

Shank length (cm): Shank length was measured by placing the jaw of the Vernier calliper between the hock and tarsal-metatarsal joints.

Keel bone length (cm): It was measured with the help of Vernier calliper. The length of keel bone was measured between anterior and posterior ends of the keel bone.

Breast angle (degree): A breastometer was used to measure the breast angle in degree. Breastometer was placed at the point of 10-12 mm posterior to the anterior edge of the keel bone for measuring the breast angle.

Production Traits: Age at first egg was recorded in days. The first egg weight in g was measured on an electronic balance. Egg weight at 32 and 40 weeks in g was measured on an electronic balance. Total egg productions up to 40 weeks of age were recorded in number to know the production potential of Uttara under field conditions.

Statistical analysis: Breed-wise economic parameters of chicken traits (body weight, conformation traits and production traits) were estimated using the following statistical model.

\[ Y_{ij} = \mu + a_i + e_{ij} \]

where,

i = 1, 2 ..........t

j = 1, 2 ..........n

\( Y_{ij} \) denotes the \( j^{th} \) observation on \( i^{th} \) treatment

\( \mu \) = is overall, mean

\( a_i \) = is the effect of \( i^{th} \) treatment

\( e_{ij} \) = is the random error associated with each \( j^{th} \) observation with mean 0 and variance \( \sigma^2_e \)

Significant mean differences between the treatments were determined at a 5% probability level (p<0.05) using Duncan's Multiple Range Test (DMRT) as modified by Kramer6.

RESULTS AND DISCUSSION

Bodyweight before sexual maturity

The average body weights at different age of chicken breeds have been presented in Table 1. The average day-old body weight (DW) were significantly (P<0.05) higher in Uttara and lower in RIR. The average body weight at 2 weeks
(BW2), 6 weeks (BW6), 8 weeks (BW8), 10 weeks (BW10), 12 weeks (BW12), 14 weeks (BW14), 18 weeks (BW18) and 20 weeks (BW20) were significantly (P<0.05) higher in RIR and lower in Uttara. The average body weight at 4 weeks (BW4) was significantly (P<0.05) lower in Kadaknath than other chicken breeds; this shows a similar trend as reported by\(^7\) in local hill fowl in average day-old body weight (DW), \(^9\) in body weight at 10 weeks (BW10) in local hill fowl, \(^7\) in local hill fowl body weight at 16 weeks (BW16), \(^9\) in Kadaknath at body weight at 18 weeks (BW18), \(^10\) in Nigerian heavy ecotype body weight at 20 weeks (BW20). The observation on Kadaknath is following the observation of \(^8\) in local hill fowl at the body weight at 6 weeks (BW6), \(^7\) in local hill fowl and \(^11\) in Kadaknath at the body weight at 20 weeks (BW20). The result of Uttara is in agreement with the observations of \(^12\) in RIR, \(^13\) in Black Australorp and \(^14\) in RIR in average day-old body weight (DW), \(^15\) in Gramapiya, \(^16\) in Kadaknath and \(^17\) in RIR and Haringhata Black at the body weight at 4 weeks (BW4), \(^18\) in Aseel at the body weight at 8 weeks (BW8), \(^7\) in local hill fowl body weight at 14 and 18 weeks (BW14 and BW18), \(^9\) in Kadaknath at body weight at 16 weeks (BW16) and \(^15\) in Aseel at the body weight at 20 weeks (BW20). The present finding on Australorp is in close agreement with the finding of \(^12\) in RIR at the body weight at 6 weeks (BW6) and \(^8\) in local hill fowl at the body weight at 8 weeks (BW8) and \(^7\) in local hill fowl body weight at 10 weeks (BW10) and BW 12. The present finding on RIR is in close agreement with the finding of \(^19\) in Aseel in the body weight at 6 weeks (BW6) and body weight 8 weeks (BW8). The finding on Kadaknath is following the observations of \(^20\) in RIR, \(^21\) in crown variety of Uttara fowl and \(^22\) in Rajasri at the average day-old body weight (DW), \(^12\) in Kadaknath body weight at 10 weeks (BW10). The result of Australorp is in close agreement with the findings of \(^23\) in Dahlem Red and \(^24\) in Aseel in the average day-old body weight (DW). The present findings are higher than the observations of \(^25\) in Kadaknath, \(^19\) in Aseel and \(^16\) in Aseel and Kadaknath at the average day-old body weight (DW), \(^8\) in local hill fowl; \(^22\) in Rajasri and \(^9\) in Kadaknath at body weight at 2 weeks (BW2), \(^16\) in Kadaknath and Aseel, \(^26\) in local hill fowl, \(^22\) in Rajasri and \(^19\) in Aseel at the body weight at 4 weeks (BW4), \(^22\) in Rajasri and \(^9\) in Kadaknath at the body weight at 6 weeks (BW6), \(^27\) in Kadaknath and \(^24\) in Aseel in the body weight at 8 weeks (BW8), \(^27\) in Kadaknath and \(^24\) in Aseel in body weight at 12 weeks (BW12), \(^27\) in Kadaknath in body weight at 14 weeks (BW14). The present results of Kadaknath and Australorp are higher than the finding of \(^28\) in Kadaknath in the body weight at 16 weeks (BW16). The findings on RIR and Uttara fowl are slightly higher than the finding of \(^8\) in local hill fowl at the average body weight at 12 weeks (BW12). The present results are lower than the finding of \(^29\) in local Tunisia chicken at the average day-old body weight (DW) and at the body weight at 4 weeks (BW4), \(^17\) in Vanaraja and Divyayan Red body weight at 2 weeks (BW2), \(^30\) in Kadaknath at the body weight at 4 weeks (BW4), \(^16\) in Aseel and Kadaknath at the body weight at 6 weeks (BW6), \(^26\) in local hill fowl at the body weight at the 8 weeks (BW8), \(^9\) in Kadaknath at body weight at 10 weeks (BW10), \(^26\) in local hill fowl, \(^9\) in Kadaknath and \(^17\) in RIR, Vanaraja, and Divyayan Red at body weight at 12 and 16 weeks (BW12 and BW16), \(^6\) in Kadaknath in body weight at 14 weeks (BW14), \(^8\) in local hill fowl at body weight at 18 weeks (BW18). The finding on Kadaknath is slightly lesser than the finding of \(^7\) in local hill fowl at the body weight at 8 weeks (BW8) and \(^9\) in local hill fowl, \(^26\) in Aseel and Kadaknath and \(^31\) in Vanaraja at the body weight at 20 weeks (BW20). The result of Australorp is slightly lesser than the finding of \(^23\) at BW20.

**Bodyweight after sexual maturity**

The average body weight at first egg (BWAFE) was significantly (P<0.05) higher in RIR and lower in Kadaknath. The present result of RIR is in close agreement with the findings of \(^17\) in RIR and \(^32\) in Uttara. The finding on Uttara shows a similar trend as reported by \(^33\) in Nicobari fowl.
Table 1: Average body weight of chicken breeds at different age

<table>
<thead>
<tr>
<th>Age (Wks)</th>
<th>RIR</th>
<th>U</th>
<th>K</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>DW</td>
<td>30.23±0.37^d</td>
<td>34.72±0.33^a</td>
<td>31.13±0.32^c</td>
<td>33.90±0.31^b</td>
</tr>
<tr>
<td>BW_2</td>
<td>101.49±0.84^a</td>
<td>100.15±0.99^b</td>
<td>92.88±1.32^c</td>
<td>95.10±1.29^b</td>
</tr>
<tr>
<td>BW_4</td>
<td>176.91±1.76^a</td>
<td>168.43±2.22^a</td>
<td>160.89±2.04^b</td>
<td>168.23±2.32^a</td>
</tr>
<tr>
<td>BW_6</td>
<td>301.56±1.44^a</td>
<td>282.92±2.77^b</td>
<td>263.26±3.13^c</td>
<td>277.68±1.88^b</td>
</tr>
<tr>
<td>BW_8</td>
<td>406.81±1.74^a</td>
<td>390.53±2.29^b</td>
<td>360.43±3.57^c</td>
<td>384.25±2.77^b</td>
</tr>
<tr>
<td>BW_{10}</td>
<td>534.41±2.01^a</td>
<td>514.57±2.96^b</td>
<td>480.65±4.10^b</td>
<td>509.89±3.64^b</td>
</tr>
<tr>
<td>BW_{12}</td>
<td>658.67±1.68^a</td>
<td>638.83±1.80^b</td>
<td>560.00±4.91^d</td>
<td>594.94±3.79^c</td>
</tr>
<tr>
<td>BW_{14}</td>
<td>781.61±4.17^a</td>
<td>757.87±4.40^a</td>
<td>646.37±3.73^c</td>
<td>673.41±3.74^b</td>
</tr>
<tr>
<td>BW_{16}</td>
<td>884.73±3.88^a</td>
<td>856.60±5.36^a</td>
<td>733.08±3.71^b</td>
<td>759.45±3.92^c</td>
</tr>
<tr>
<td>BW_{18}</td>
<td>983.01±3.71^a</td>
<td>942.98±5.73^b</td>
<td>819.12±3.85^c</td>
<td>843.85±3.74^b</td>
</tr>
<tr>
<td>BW_{20}</td>
<td>1082.69±3.93^a</td>
<td>1022.14±5.81^a</td>
<td>911.98±4.24^c</td>
<td>935.48±3.50^c</td>
</tr>
<tr>
<td>BW_{AFE}</td>
<td>1392.40±8.23^a</td>
<td>1280.00±6.03^b</td>
<td>1206.17±5.92^d</td>
<td>1243.95±4.60^c</td>
</tr>
<tr>
<td>BW_{32}</td>
<td>1549.60±10.85^a</td>
<td>1473.33±10.49^a</td>
<td>1339.36±7.02^c</td>
<td>1371.16±3.45^c</td>
</tr>
<tr>
<td>BW_{50}</td>
<td>1679.20±7.35^a</td>
<td>1601.11±8.42^b</td>
<td>1511.98±4.24^c</td>
<td>1571.63±8.39^b</td>
</tr>
</tbody>
</table>

Means within a row with different superscripts differ significantly (P<0.05)

RIR= Rhode Island Red, U= Uttara, K= Kadaknath, A= Australorp

Table 2: Average conformation traits of chicken breeds

<table>
<thead>
<tr>
<th>Traits</th>
<th>RIR</th>
<th>U</th>
<th>K</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 weeks shank length (cm)</td>
<td>4.76±0.03^a</td>
<td>4.56±0.04^b</td>
<td>4.36±0.02^c</td>
<td>4.40±0.02^c</td>
</tr>
<tr>
<td>12 weeks keel length (cm)</td>
<td>7.54±0.02^a</td>
<td>7.45±0.02^b</td>
<td>7.26±0.01^c</td>
<td>7.38±0.02^b</td>
</tr>
<tr>
<td>12 weeks breast angle (degree)</td>
<td>50.01±0.15^a</td>
<td>49.05±0.14^b</td>
<td>47.89±0.16^c</td>
<td>48.74±0.14^b</td>
</tr>
<tr>
<td>20 weeks shank length (cm)</td>
<td>8.48±0.04^a</td>
<td>8.33±0.04^a</td>
<td>7.67±0.01^b</td>
<td>7.80±0.01^b</td>
</tr>
<tr>
<td>20 weeks keel length (cm)</td>
<td>9.13±0.03^a</td>
<td>9.02±0.03^a</td>
<td>8.53±0.03^c</td>
<td>8.71±0.02^b</td>
</tr>
<tr>
<td>20 weeks breast angle (degree)</td>
<td>57.95±0.13^a</td>
<td>57.28±0.12^b</td>
<td>56.23±0.11^c</td>
<td>57.09±0.10^b</td>
</tr>
</tbody>
</table>

Means within a row with different superscripts differ significantly (P<0.05)

RIR= Rhode Island Red, U= Uttara fowl, K= Kadaknath, A= Australorp

Table 3: Average production traits of chicken breeds

<table>
<thead>
<tr>
<th>Traits</th>
<th>RIR</th>
<th>U</th>
<th>K</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at first egg (Days)</td>
<td>183.50±0.30^b</td>
<td>181.27±0.38^c</td>
<td>183.26±0.38^b</td>
<td>189.26±0.36^a</td>
</tr>
<tr>
<td>First egg weight (g)</td>
<td>35.70±0.11^b</td>
<td>37.04±0.09^a</td>
<td>35.56±0.08^b</td>
<td>35.91±0.10^b</td>
</tr>
<tr>
<td>Egg weight at 32 weeks (g)</td>
<td>45.39±0.11^b</td>
<td>49.00±0.13^a</td>
<td>41.87±0.15^c</td>
<td>45.47±0.15^b</td>
</tr>
<tr>
<td>Egg weight at 40 weeks (g)</td>
<td>48.00±0.13^c</td>
<td>54.23±0.17^a</td>
<td>44.83±0.15^d</td>
<td>50.03±0.14^b</td>
</tr>
<tr>
<td>Egg production up to 40 weeks (Nos.)</td>
<td>21.40±0.26^c</td>
<td>38.78±0.34^a</td>
<td>25.72±0.24^b</td>
<td>19.49±0.23^d</td>
</tr>
</tbody>
</table>

Means within a row with different superscripts differ significantly (P<0.05)

RIR= Rhode Island Red, U= Uttara fowl, K= Kadaknath, A= Australorp
The average body weight at 32 weeks (BW32), 40 weeks (BW40), were significantly (P<0.05) higher in RIR and lower in Kadaknath. The present finding on RIR shows a similar trend as reported by\textsuperscript{5} in Uttara fowl body weight at 32 weeks (BW32). The result of Australorp is in close agreement with the finding of\textsuperscript{5} in Uttara at 40 weeks (BW40). The results of Kadaknath are in close agreement with the finding of\textsuperscript{5} in Uttara at body weight at 40 weeks (BW40). The present results are higher than the finding of\textsuperscript{27} in Kadaknath body weight at 32 weeks (BW32). The present result of RIR is slightly lesser than the finding of\textsuperscript{34} in Aseel body weight at 40 weeks (BW40). The finding on Uttara is slightly lesser than the observation of\textsuperscript{25} in Kadaknath and\textsuperscript{31} in Vanaraja.body weight at 40 weeks (BW40).

From the present study, it can be concluded that the growth of Uttara is higher than Kadaknath and Australorp and lower than the RIR. 

**Conformation traits at 12 and 20 weeks of age**

The average conformation traits of chicken breeds at 12 and 20 weeks of age have been presented in table 2. The mean values of shank length, keel length and breast angle were significantly (P<0.05) higher in RIR and lower in Kadaknath at 12 and 20 weeks of age. The present findings are lesser than the findings of\textsuperscript{35} in indigenous Nigerian chicken and\textsuperscript{36} in CARI-Sonali chicken for shank length. The present findings are in close agreement with the finding of\textsuperscript{37} in Fulani-Ecotype chicken for shank length. These results are lesser than the finding of\textsuperscript{38} in CARI-Sonali chicken for keel length. These findings are lesser than the observation of\textsuperscript{36} in CARI-Sonali chicken for breast angle. The average of shank length was significantly (P<0.05) higher in RIR and lower in Kadaknath. The present results are lesser than the finding of\textsuperscript{5} in Uttara. The mean value of keel length was significantly (P<0.05) higher in RIR and lower in Kadaknath. The present results are in close agreement with the finding of\textsuperscript{5} in Uttara. The mean value of the breast angle was significantly (P<0.05) higher in RIR and lower in Kadaknath. The findings are in close agreement with the observation of\textsuperscript{6} in Uttara. From the present results, we conclude that the conformation traits at 12 weeks of age are higher in RIR in comparison with other chicken breeds, but at 20 weeks of age, shank length and keel length of Uttara show a similar growth with that of RIR. On the other hand, breast angle at 20 weeks of age is more in RIR than that in other chicken breeds. Differences in conformation traits might be due to strain, line or breed studied and differences in management as well as rearing system. The higher estimates are an adaptive feature that necessitates for the survival from predation and dominance in the social order.

**Production Traits**

The average production traits of chicken breeds have been presented in table 3. The mean value of age at first egg was significantly (P<0.05) higher in Australorp and lower in Uttara fowl. The present findings on RIR and Kadaknath show close agreement with the finding of\textsuperscript{38} in RIR and Vanaraja. The present result of Uttara shows a similar trend as reported by\textsuperscript{39} in Vanaraja. The result of Australorp is in agreement with the observation of\textsuperscript{40} in Shank local hill fowl. The average first egg weight was significantly (P<0.05) higher in Uttara than the other chicken breeds. The present findings are in close agreement with the finding of\textsuperscript{23} in Dahlem Red and Dahlem Red X Desi. The present results are higher than the finding of\textsuperscript{41} in Nigerian heavy chicken ecotype. The mean value of the weight of egg at 32 weeks and 40 weeks of age were significantly (P<0.05) higher in Uttara and lower in Kadaknath. The present findings on RIR and Australorp show a similar trend as reported by\textsuperscript{28} in Aseel and\textsuperscript{31} in Vanaraja egg weight at 32 weeks and\textsuperscript{42} in Rajasri and\textsuperscript{38} in Vanaraja egg weight at at 40 weeks of age. The result of Uttara is in close agreement with the finding\textsuperscript{5} in Uttara egg weight at 40 weeks of age. The present results are higher than the finding of\textsuperscript{19} in Aseel and lesser than the findings of\textsuperscript{43} in Uttara under
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The average egg production up to 40 weeks of age was significantly (P<0.05) higher in Uttara and lower an Australorp. The present result of RIR is in close agreement with the finding of39 in Vanaraja. The result of Kadaknath is in agreement with the observation of38 in indigenous chicken. The present study shows that early egg production starts in Uttara than the other chicken breeds. The egg weight at different age is higher in Uttara than the others. The egg production up to 40 weeks is maximum in Uttara followed by Kadaknath, RIR, and Australorp, as egg-laying of Uttara fowl is better when compared to other chicken breeds, which is an added advantage for the backyard poultry farmers.

CONCLUSION

The growth rate of Uttara is higher than that of Kadaknath and Australorp but at certain stages similar to that of RIR. Conformation traits are higher in RIR in comparison to other chicken breeds, but at certain stages, Uttara shows a similar trend as that of RIR. Production traits are higher in Uttara than the other chicken breeds studied. Egg production of Uttara is better than other breeds. These results indicate that Uttara is suitable for rearing under agro-climatic conditions of hilly areas and hence can be recommended for backyard poultry farming purposes for the livelihood of poor and marginal farmers living therein.

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