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Comparative study on nutritional composition of egg in different breeds of chicken

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Abstract
The present experimentation was conducted at Animal farm, Department of Animal Production, Rajasthan College of Agriculture Udaipur. One hundred eighty eggs was collected from four different chicken breeds (40 week old) were used in 4 treatments with 3 replications, each consisting of 45 eggs. The treatments were (T_1) Kadaknath, (T_2) RIR, (T_3) Mewari, (T_4) Pratapdhan. In this experiment nutritional composition of egg quality traits were measured to comparison of indigenous and improved chicken breeds. Results showed that the The dry matter was higher (p<0.05) in Pratapdhan (26.65%) followed by Kadaknath (26.31%), Mewari (25.91%) and lowest dry matter was found in RIR (25.31%). The crude protein (%) was found to be higher in Pratapdhan (11.59), followed by RIR (11.57), Mewari (11.47) and minimum crude protein was found in Kadaknath (11.33). Maximum ether extract percent (%) was found in RIR (11.30) followed by Pratapdhan (11.28), Mewari (11.26) and lowest value was observed in Kadaknath (11.17). Highest gross energy (kcal) was found in Pratapdhan (167.53), while lowest was found in Mewari (166.82). Though the differences in crude protein, ether extract, and gross energy values among different breeds were found to be non- significant. The ash percentage (%) was higher (p<0.05) in Pratapdhan (1.21) and Kadaknath (1.17) as compared to RIR (1.11) and Mewari (1.08). While moisture percentage (%) was found to be higher in RIR (74.68) and Mewari (74.08) as compared to Kadaknath (73.68) and Pratapdhan (73.35). The difference in moisture per cent between RIR and Mewari as well as between Kadaknath and Pratapdhan was found non- significant. In this study it was found that improved breeds RIR and Pratapdhan was better than desi breeds in egg quality traits.

Keywords: Nutritional composition, improved chicken, indigenous

Introduction
Poultry farming is one of the fastest growing segments of the agriculture sector. Egg production in India is around 122.11 billion in 2020-21. The hen's egg has been conventionally believed as a good source of nutrients for human beings. Poultry products constitute an important component of human diet. Eggs contain all the essential amino acid, several vitamins and minerals required for human. As far as egg consumption is concerned it has been accepted worldwide as a staple food and included as an important ingredient in a balanced human diet. It is generally agreed that all characteristics of egg quality have a genetic basis. Egg quality has been defined by Stadelman (1977) [20] as the characteristics of an egg that affect its acceptability to the consumers. Egg quality is the more important price contributing factor in table and hatching eggs. Among many quality characteristics, external factors including cleanliness freshness, egg weight and shell weight are important in consumers acceptability of shell eggs (Song *et al* (2000) [17]. Quality of chicken eggs may vary due to several factors like rearing temperature, season, relative humidity and also a breed difference.

Materials and Methods
This research work was carried out with four chicken genotypes Kadaknath, Rhode Island Red, Mewari and Pratapdhan maintained at Poultry farm, Department of Animal Production, Rajasthan College of Agriculture Udaipur. The birds of each breed were reared in different pens separately on deep litter system under optimum temperature, humidity and other management conditions.

Nutritional composition of egg in different breeds of chicken

A) Determination of dry matter

The eggs were broken, the yolk and albumin were separated and then mixed separately. The sample were taken in pre-weight petri dish and kept in hot air oven at 60 ˚C for 24 hours. Weight of petri dish dry sample taken after 24 hours. Dry matter was calculated using following formula:

$$\text{Dry matter (\%)} = \frac{b}{a} \times 100$$

Where,
a = Fresh sample weight (g)
b = weight of sample after oven dry (g)

B) Determination of Crude protein

The crude protein was determined by Kjeldahl method. The Kjeldahl method was performed according to method of the AOAC. The three steps of the Kjeldahl method were carefully carried out in sequence as follows:

1. **Digestion:** About 0.2 g sample (moisture free) was taken into the flask and added 4g of catalyst mixture of Potassium Sulphate (K_2SO_4): Copper Sulphate ($CuSO_4$) in 5:1 ratio and then added 10ml concentrated H_2SO_4. The mixture was heated in a fume cupboard slowly to prevent excessive frothing and the digestion was continued at 400 °C for 1.5-2 hours until the colour of the sample changed to light blue colour. The solution was left to cool down and diluted with distilled water to 30ml.
2. **Distillation:** The digested solution was carefully added to 40ml NAOH (40%) and fixed to the distillation device. In the ammonia receiving flask, 10ml of boric acid (4%) was added with three drops mixture of methyl red and Bromocresol dye. Distillation is done for nine minutes.
3. **Titration:** The collected solution in the receiving conical flask was titrated with 0.1M of HCL. Nitrogen value is displayed on the desktop of Titroline. Crude protein percentage calculated as under:

Crude protein (%) = Nitrogen (%) × 6.25

C) Determination of Ether extract

Soxhlet method was used for the determination of Ether extract. In this method 2 g dry and crush sample was transferred into thimble and taken weight of empty oil flask. Thimble was placed in Soxhlet's apparatus and refluxed with petroleum ether for eight hours in straight position. Petroleum ether (boiling point 40-60 °C) used as a solvent for the evaporation. After eight hours thimble was taken out of the oil flask containing ether extract and put on hot air oven for evaporation of ether and thereafter removed from hot air oven and keep for cooling in desiccator and taken weight. Ether was calculated used following formula:

$$\text{Ether extract (\%)} = \frac{b}{a} \times 100$$

Where,
a = weight of sample
b = (weight of oil flask after extraction) – (weight of oil flask before extraction)

D) Determination of total Gross energy (kcal)

Bomb calorimeter was used for the determination of gross energy. 1 g sample was taken and pellet was made and weighed again. 10 cm of ignition wire was connected with the wire across the two electrodes. One end of strand of 50 mm length of cotton was inserted between the coils of the firing wire and dipped the other end into centre of the sample in the crucible. Bomb was filled with oxygen keeping the pressure maximum up to 360-400 kg/m^3 and set the bomb in this machine and press and release the firing button. The gross energy of the sample was estimated as per Sibbald, (1979) [15].

E) Determination of total ash

Total ash in the sample of egg was determined by incineration in muffle furnace, at 600 °C. For the determination of ash percentage 1g sample was taken in pre- weighted silica crucible. The crucible with sample was kept on oven and burn till no more smoke was given off by burn mass of sample. There after the silica crucible containing charred mass of egg sample was transferred into muffle furnace with help of mental tong and inflame at 600 °C for 2 hours, the crucible containing ash was removed from the muffle furnace and then transferred into desiccator, cooled and weighed. Total ash was calculated by following formula.

$$\text{Total ash (\%) on dry matter basis} = \frac{a-b}{c} \times 100$$

Where,
a = weight of silica crucible with ash (g)
b = weight of empty silica crucible (g)
c = weight of sample taken for ashing on dry matter basis (g)

F) Determination of total moisture content

The moisture content was determined by drying at 100-102 °C for 24 hours. For this, the required apparatus were as follows.
The total moisture was determined in the following way. A metal container was dried to constant weight in the hot air oven at 100 °C. Weight of the metal container was recorded by weighing them in an analytical balance. Egg samples were put in these already weighed containers and weighed again in the same analytical balance. The weighed egg samples along with the containers were put in hot air oven at 100 °C for 24 hours till the weight of the sample became constant. The total moisture content is expressed as

$$\text{\% of moisture} = \frac{L \times 100}{W}$$

Where
L = loss in weight
W = Weight of the sample

Statistical analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) software version 16.0.

Results and Discussion

1. Nutritional composition of egg in different breeds of chicken

The data with regards to the nutritional composition of eggs in

different breeds of chicken is presented in Table 1. The dry matter (%) in different breeds of chicken ranged from 25.31 to 26.65% and the values were 26.31±0.15, 25.31±0.19, 25.91±0.10, and 26.65±0.15% in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly highest dry matter was found in Pratapdhan followed by Kadaknath, Mewari and lowest dry matter was found in RIR.

Crude protein (%) in different breeds of chicken ranged from 11.33 to 11.59% and the values were 11.33±0.06, 11.57±0.04, 11.47±0.05 and 11.59±0.15% in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly maximum crude protein was found in Pratapdhan, followed by RIR, Mewari and minimum crude protein was found in Kadaknath.

Ether extract (%) in different breeds of chicken ranged from 11.17 to 11.30% and the values were 11.17±0.05, 11.30±0.03, 11.26±0.04 and 11.28 ±0.05% in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly maximum ether extract percent was found in RIR followed by Pratapdhan, Mewari and lowest value was observed in Kadaknath.

The Gross energy (kcal/100g) in different breeds of chicken ranged from 166.82 to 167.53 kcal/100g and the values were 167.36±0.31, 167.26±0.23, 166.82±0.37 and 167.53±0.19 in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly highest gross energy was found in Pratapdhan, while lowest was found in Mewari. The difference in gross energy values between Kadaknath and RIR was small and found non- significant.

Ash percentage in different breeds of chicken ranged from 1.08 to 1.21% and the values were 1.17±0.03, 1.11±0.01, 1.08±0.01 and 1.21±0.01% in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly higher ash percentage was found in Pratapdhan and Kadaknath as compared to RIR and Mewari. The difference in Ash percentage between Kadaknath and Pratapdhan as well as between RIR and Mewari was found statistically non- significant.

Moisture percentage in different breeds of chicken ranged from 73.35 to 74.68% and the values were 73.68±0.15, 74.68±0.19, 74.08±0.10 and 73.35±0.15% in Kadaknath, RIR, Mewari and Pratapdhan, respectively. Significantly highest moisture percentage was found in RIR and Mewari as compared to Kadaknath and Pratapdhan. The difference in moisture percent between RIR and Mewari as well as between Kadaknath and Pratapdhan was found non- significant.

Table 1: Nutritional composition of eggs in different breeds of chicken

Observation	T_1 (Kadaknath)	T_2 (RIR)	T_3 (Mewari)	T_4 (Pratapdhan)	Significancy level
Dry matter (%)	26.31^{ab}±0.15	25.31^{c}±0.19	25.91^{b}±0.10	26.65^{a}±0.15	-
Crude protein (%)	11.33±0.06	11.57±0.04	11.47±0.05	11.59±0.15	N.S
Ether extract (%)	11.17±0.05	11.30±0.03	11.26±0.04	11.28±0.05	N.S
Gross energy (kcal / 100g)	167.36±0.31	167.26±0.23	166.82±0.37	167.53±0.19	N.S
Ash (%)	1.17^{a}±0.03	1.11^{b}±0.01	1.08^{b}±0.01	1.21^{a}±0.01	-
Moisture (%)	73.68^{bc}±0.15	74.68^{a}±0.19	74.08^{b}±0.10	73.35^{c}±0.15	-

Figures bearing different superscripts in a row differ significantly ($p<0.05$)

Conclusion

From the experiment it was concluded that, difference in nutritional composition was found to be non-significant among different breeds, however the values were slightly higher in RIR and Pratapdhan as compared to other breeds.

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