

EVALUATION OF EGG QUALITY PARAMETERS OF TURKEY (*MELEAGRIS GALLOPAVO*) EGGS AT NATIONAL AVIAN RESEARCH PROGRAM, KHUMALTAR, LALITPUR

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ABSTRACT

Turkey (Meleagris gallopavo) is an important avian species in Nepal contributing in the nutrition security and income generation. Present study was carried out in the National Avian Research Program (NARP), Lalitpur, Nepal from August to November 2021 to evaluate selected morphological characteristics of turkey eggs. A total of forty eggs from 45-48 weeks hens were examined for different internal and external egg quality parameters. Further, the effects of different egg quality parameters on egg weight in Turkey were examined. The data were recorded in MS-Excel and analyzed through Statistical Package for the Social Sciences (SPSS) 25. The mean egg weight, length, breadth, fresh shell weight, shell thickness, albumin height, yolk diameter, yolk weight and yolk height of turkey was 72.32 ± 3.29 g, 6.36 ± 0.20 cm, 4.70 ± 0.12 cm, 9.68 ± 0.33 g, 0.47 ± 0.03 mm, 6.88 ± 0.73 cm, 5.62 ± 0.19 cm, 25.15 ± 1.87 g and 0.98 ± 0.20 cm, respectively. There was significant difference in almost all traits of external and internal traits of egg weight, fresh eggshell thickness, albumen height, yolk diameter and yolk height. This research provides important information about the egg quality parameters of Turkey raised in Nepal and serves as a reference for further investigation.

Keywords: Turkey, Avian species, Egg quality parameters

INTRODUCTION

Turkey (*Meleagris gallopavo*) is an important poultry species reared mainly for meat production around the globe. The egg and meat production per turkey bird has doubled during the last four decades, mainly due to the high selection pressure imposed on economically important traits such as body weight, meat quality, and

egg production (Anna Anandh et al., 2012). The domesticated turkey, *M gallopavo*, which originated in North America, is raised throughout the world, but its wild progenitor descends from the Eastern and Southern United States and central and northern Mexico (Thornton et al., 2012). Turkey is popular in Western countries for those who love white meat and is also associated with Christmas and Thanksgiving among the Christian population. The breeds reported include commercial and industrial strains, local types, and recognized breeds in many countries. The American Standard of Perfection has recognized eight distinct varieties: Beltsville small white, Black turkey, Bourbon Red, Bronze, Narragansett, Royal palm, slate, and white Holland. The present domesticated turkey has been developed by crossbreeding and line-breeding programs and is characterized as a single breed with eight distinct varieties based on the plumage colour (Kennamer et al., 1992).

History of turkey breeding in Nepal goes back to January 2001, with import of 200 embryonated eggs from the Central Avian Research Institute, Izantanagar, India. Performance of these turkeys was 11.34 ± 1.30 kg and 5.99 ± 0.83 kg for male and female, respectively at 43 weeks of age in Khumaltar of Nepal (Karki et al., 2002). Commercial turkey farming is becoming more popular in Nepal because of demands and farmer's interest. The bird is suitable for the upliftment of small and marginal farmers as it can be easily reared with little investment in housing, equipment, and management. One of the main objectives in turkey breeder production is to increase the number of poults.

Egg yield in turkeys is lower than that of other poultry species. In addition to low egg yield, unsatisfactory egg fertility and hatchability constitute a major problem for turkey breeding enterprises (Ozcelik et al., 2009). The age of the first puberty of Tom and Hen was 198.95 ± 7.3 and 200 ± 3.1 days, respectively. Similarly, the average weight of the tom and hen at puberty was 7.6 ± 0.67 and 5.3 ± 0.36 kg, respectively. The hatchability of eggs ranged between 10 and 90%, with an average of $52.4 \pm 6.9\%$ (Bhattarai et al., 2018). Quality has been defined by Kramer (1951) as the properties of any given food that have an influence on the acceptance or rejection of this food by the consumer. Egg quality is a general term that refers to several standards that define both internal and external quality. External quality is focused on shell cleanliness, texture, and shape, whereas internal quality refers to egg white (albumen) cleanliness and viscosity, size of the air cell, yolk shape, and yolk strength. The proportions of components for fresh eggs are 32% yolk, 58% albumen, and 10% shell (Leeson, 2006). The egg yolk from a newly laid egg is round and firm. As the egg gets older, the yolk absorbs

water from the egg white, increasing its size. This produces an enlargement and weakness of the vitelline membrane; the yolk looks flat and shows spots. As soon as the egg is laid, its internal quality starts to decrease, the longer the storage time, the poorer the internal quality. It is believed that the chemical composition of the egg (yolk and white) does not change much.

There are few studies that are focused on factors affecting egg weight of Turkey. Egg weight is an important parameter that will affect the resulting fertility, and optimum egg weight increases fertility and hatchability. Further, a small number of studies are focused on egg quality parameters of Nepalese turkey. Therefore, the main objective of this research is to evaluate the external and internal egg quality parameters of the egg weight of a turkey. Further, the correlation between different egg quality parameters will be studied to find out their association.

MATERIALS AND METHOD

Study site

The study was carried out under the National Avian Research Program (NARP) Khumaltar, Lalitpur, Nepal, during the months of August till November 2021. The poultry unit at NARP lies at a mean elevation of about 1350 masl. The yearly average temperature in Khumaltar is 15-20 °C, and it receives a yearly average rainfall of 2000–2400 mm.

Experimental birds and their management

Turkeys were reared in deep litter pens and fed conventional starter, grower, and layer rations. A lighting schedule of 16 hours per day was applied during the laying period. Standard procedures with respect to preventive vaccination and medication were followed during the study period. Altogether, 150 eggs were evaluated, and the eggs of 45, 46, 47, and 48 weeks were taken as samples. The eggs were collected in the early hours of the day, placed in the egg tray, and stored at room temperature until parameters were measured.

Measurement of external egg parameter

The individual egg was weighed using an electronic digital balance to the nearest 0.00 gm accuracy. The length (L) and breadth (B) of the egg were measured with the help of digital Vernier calipers, and the shape index was calculated as the ratio of breadth to length times 100, as suggested by Anderson et al. (2004). The fresh shell was weight by digital balance in gram. The thickness of eggshell was measured to the nearest of 0.01 mm with the help of screw gauze micrometer and averaged record.

Measurement of internal egg parameter

The length and width of the albumen and yolk were measured in mm with the help of vernier caliper (least count 0.01 mm). The height of yolk and albumen were measured with the help of triphoid spherometer. The yolk index percentage was calculated as the ratio of the yolk height to yolk diameter times 100.

Statistical analysis

All the egg quality data was entered in MS-Excel sheet. Least square means with standard errors (LS±SEM) were analyzed through Statistical Package for the Social Sciences (SPSS) 25.

RESULTS AND DISCUSION

The results on comparative of mean value of internal and external parameters of turkey eggs is presented in Table1 and Table 2, respectively.

External quality traits

Egg weight

The mean egg weight of turkey was observed 72.32±3.29 gm on weekly basis, egg weight of turkey on 45 weeks was 70.12±0.74 gm. The egg weeks in succeeding weeks of 46, 47 and 48 were 71.71±0.46 gm, 71.79±0.47 gm and 75.67±1.35 gm respectively. Egg weight differ significantly (p< 0.001) at different weeks of recording.

Table 1. Comparison of Mean value of different parameters of Egg weight, length, breadth, fresh shell weight and shell thickness of Turkey birds in different age (N=40)

Week s	No .	Egg Weight (g)	Length (cm)	Breadth (cm)	Fresh shell weight (g)	Shell thickness (mm)
45	10	70.12±0.74	6.31±0.05	4.64±0.03	9.53±0.19	0.46±0.016
46	10	71.71±0.46	6.38±0.07	4.65±0.02	9.65±0.024	0.48±0.006
47	10	71.79±0.47	6.32±0.05	4.68±0.02	9.69±0.029	0.47±0.010
48	10	75.67±1.35	6.43±0.06	4.85±0.03	9.86±0.072	0.48±0.013
Mean	10	72.32±3.29	6.36±0.20	4.70±0.12	9.68±0.33	0.47±0.03
P value		0.000**	0.532	0.408	0.000**	0.182

** p value significant at 1% level of significance and No. refers to the number of eggs taken for observation

Salgado *et al.* (2020) observed the egg weight of 75.54 ± 8.07 gm for Mexican native turkey, which were higher than our present finding. Our finding agrees with finding from (Rodrigo *et al.* 2020), who observed egg weight of Mexican turkey to be 75.54 ± 8.07 . Mroz *et al.* (2014) was observed egg weight of turkey to be 101.40 gm, higher than this study. However, Yahaya *et al.* (2021) observed egg weight of Turkey to be 69.12 ± 8.4 gm, which was lower than the present study.

Egg length

The overall mean of egg length of turkey was observed to be 6.36 ± 0.20 cm. Results of this study indicated that mean egg length of turkey was 6.31 ± 0.05 cm at 45 weeks of age and 6.38 ± 0.07 cm, 6.32 ± 0.05 cm, 6.43 ± 0.06 cm and 6.43 ± 0.06 cm respectively in 46, 47 and 48 weeks. There were non-significant differences in egg length of turkey in different weeks. Our finding corresponds to the research from previous researcher, who observed egg length of black strain of Nigerian turkey to be 48.0 ± 1.02 mm and white strain 54.1 ± 1.02 mm (Yahaya *et al.*, 2021), which was lower than the present study.

Egg breadth

Mean egg breadth of turkey egg in our present study was observed to be 4.64 ± 0.03 cm, 4.65 ± 0.02 cm, 4.68 ± 0.02 cm and 4.85 ± 0.03 cm, respectively. There were significant increments ($p < 0.001$) in egg breadth across weeks. Egg breadth of turkey egg at 48th week of egg was significantly higher than preceding weeks. This could be due to more mature hen, which facilitates egg laying of higher weight. Yahaya *et al.* (2021) observed egg breadth of 31 ± 0.91 mm for turkey egg at early stage of production in Nigeria.

Fresh shell weight

Average fresh shell weight of turkey bird in this study was found in different weeks were 9.53 ± 0.19 g, 9.65 ± 0.024 g, 9.69 ± 0.029 g and 9.86 ± 0.072 g. According to the results there was not significantly different in different weeks but somehow more weight as week increases. The Nigerian Turkey shell weight was found to be 9.11 ± 1.22 gm in black strain and 9.45 ± 1.20 g in white strain which was lower than the current study. Shell weight of turkey from the current study agree with the finding from (Yahaya *et al.*, 2021), 9.11 ± 1.22 g in Nigeria.

Shell thickness

The average mean of different weeks of eggshell thickness of Turkey birds in this study was 0.46 ± 0.016 mm, 0.48 ± 0.006 mm, 0.47 ± 0.010 mm and 0.48 ± 0.013 mm respectively. The eggshell thickness is closely correlated with the deposition of calcium, which is metabolized from the skeleton of the birds and dietary sources (Melesse *et al.*, 2010). The Nigerian turkey shell thickness was found to be 0.27 ± 0.001 mm in black strain and 0.27 ± 0.002 mm in white strain which was lower than this study (Yahaya *et al.*, 2021).

Table 2. Comparison of means and standard Error (SE) of albumen weight, yolk diameter, yolk weight and yolk height of Turkey birds at different age

Wee ks	No .	Albumen height (cm)	Yolk diameter (cm)	Yolk weight (g)	Yolk height (cm)
45	10	6.38 ± 0.092	5.49 ± 0.05	24.50 ± 0.72	0.85 ± 0.03
46	10	6.70 ± 0.101	5.50 ± 0.05	25.41 ± 0.45	0.84 ± 0.05
47	10	6.73 ± 0.019	5.70 ± 0.04	24.76 ± 0.66	1.06 ± 0.06
48	10	7.70 ± 0.330	5.77 ± 0.03	25.91 ± 0.45	1.18 ± 0.070
Mean	10	6.88 ± 0.73	5.62 ± 0.19	25.15 ± 1.87	0.98 ± 0.22
P value		0.000**	0.000**	0.335	0.000**

** p value significant at 1% level of significance and No. refers to the number of eggs taken for observation

Internal quality traits

Albumen height

Albumen height of turkey eggs in this study was observed to be 6.38 ± 0.092 cm, 6.70 ± 0.101 cm, 6.73 ± 0.019 cm and 7.70 ± 0.330 at 45, 46, 47 and 48 weeks, respectively as shown in the Table 2. The internal egg quality of albumen height of Mexican native turkey hens was 5.74 ± 1.05 cm which was lower value as compared to this study. Rodrigo *et al.* (2020) observed the height of albumin to be 5.74 ± 1.05 cm, which is similar to the finding from the current research.

Yolk diameter

Results of this study reflected that the comparison of mean of different weeks egg yolk of Turkey was 5.49 ± 0.05 cm, 5.50 ± 0.05 cm, 5.70 ± 0.04 cm and 5.77 ± 0.03 cm respectively. Higher age significantly differs ($p<0.0001$) in the yolk diameter in this study. The Nigerian turkey yolk diameter was found to be 2.49 ± 0.03 cm in

black strain and 2.83 ± 0.02 cm in white strain which was lower than the current study.

Yolk weight

The average mean of the egg yolk weight of Turkey birds in 45, 46, 47 and 48 weeks 24.50 ± 0.72 g, 25.41 ± 0.45 g, 24.76 ± 0.66 and 25.91 ± 0.45 g correspondingly. The Nigerian Turkey yolk weight was found to be 22.36 ± 1.58 g in black strain and 23.24 ± 1.60 g in white strain which was lower than the current study whereas yolk weight of Mexican native Turkey hens found to be 25.44 ± 5.19 gm which was higher than this study. Yolk weight from the current study is similar to finding from (Rodrigo et al., 2020), who observed yolk weight of 25.44 ± 5.19 gm.

Yolk height

Results from the present study demonstrated that egg yolk height of turkey were 0.85 ± 0.03 cm, 0.84 ± 0.05 cm, 1.06 ± 0.06 cm and 1.18 ± 0.070 at 45, 46, 27 and 48 weeks, respectively. Results showed that yolk height increased significantly ($p < 0.001$) with the age of maturity of the birds. Rodrigo *et al.* (2020) observed the yolk height of 1.55 ± 0.23 cm for Mexican native turkey, which was lower than the present finding.

CONCLUSION

The results of this study provide support to suggest that both external and internal egg quality parameters increase with increasing age up to 48 weeks of age. We did not measure egg quality parameters before 45 and after 48 weeks and cannot extrapolate outside that window period. This study gives the ideas about the egg quality of Turkey birds available in NARP farms.

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