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# Comparative analysis of egg quality traits of chicken and turkey

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***Abstract:*** *The aim of this report was to investigate the physical traits and chemical composition of turkey eggs in comparison with chicken egg on the basis of quality and proximate chemical composition. The eggs of turkey and chicken had an elliptical shape with having a rounded sharp ends. The shape index of turkey and chicken eggs have significant statistical difference ($P < 0.01$). It was reasonable seems that turkey eggs weighed more (76.25g) than the chicken eggs (40.20g). The relative amount of yolk to total egg weight higher in turkey egg (28.4%) than the chicken eggs (25.31%). Similarly albumin content was higher in turkey (55.48%) than in chicken egg (55.44%). The weight of turkey shell to the total egg weight (18.2%) was higher as compared to shell weight of chicken (17.7%). Similarly the turkey eggs showed much thicker shell (0.051cm) as compared to chicken egg (0.036cm). The moisture content , crude protein, crude fat, crude ash, calcium, phosphorus and cholesterol were analysed in two categories, i.e., with shell and without shell for both the species. The data obtained from the above study reveal that the physical traits and chemical composition of turkey eggs are comparatively higher over commercial chicken egg indicating the availability of more nutrients per egg, less chance of breaking during transportation and acceptability of turkey eggs for table consumption. Although these eggs have great nutrient potential, but the production of fresh turkey eggs for consumption is currently not seen in Bhubaneswar, but since they are palatable and nutritious than chicken eggs, it can be utilized for table consumption when not needed for hatching purpose . The sufficient variability observed in most of egg quality traits indicated the scope for further genetic improvement.*

***Key Words:*** *Chicken egg, Turkey egg, Physical Characteristics and Nutritive Characteristics.*

## 1. INTRODUCTION:

Eggs are highly accomplished food containing vital source of fibres useful for maintaining human health. Eggs produce a unique with well balanced nutrient for all ages. The connotation of animal proteins in plentiful as well as equitable substances considered for the human affluence with beneficial to mental and physical advancement (Ulocak et al., 1995). Between aforementioned such animal protein sources, the poultry birds have important place in the meat and egg production. The productiveness and distinctive attributes of breeding eggs have an integral implication for the progression of flocks and for an economic breeding (Sogut et al., 2001).

The nutritional composition of eggs of different species of birds may be similar in terms of nutritious composition. Nonetheless facts about the quality of eggs and its application in food and other industry are restricted mainly to hen's egg. The egg quality that influence its reliability to consumers are weight of egg, the quality of shell, the yolk and albumin index and most acceptable quality i.e. its freshness of egg as well as its proximate composition (Stadelmann, 1977; Song et al. ,2000).

Egg quality is the main price determining factor in table and hatching eggs. Chicken eggs have been very well analysed for its external and internal qualities as well as its admixtures, but the detailed particulars of turkey with respect to its internal and external egg quality and nutritional quality are not available in the literature. Hence, this study presents a comparative ana
lysis of the morphological structure and chemical composition of eggs of poultry species i.e., chicken and turkey which have economic as well as considerable nutritional value.

## 2. MATERIALS AND METHODS

The eggs of turkey and chicken used for this study were collected from the farm of Central Poultry Development Organisation (CPDO) ,Eastern Region, Bhubaneswar. The eggs were assembledon on the day of fling in the month of November, 2018. During laying time, the chicken were 275 days old and turkeys were 286 days old. These birds were nurtured under farm conditions on the chicken specific diets suitable for chickens.

**Evaluation of egg quality**

The external characteristics of egg like egg weight was measured in an analytical balance of Dhona – 200 (AB-204) after washing and drying with towel to remove contaminants from shell. The egg length and width were measured with a vernier calliper in centimetre and egg shape index was obtained by the following formula.

$$\text{Shape index} = \frac{\text{Width of egg}}{\text{Length of egg}} \times 100$$

To examine the internal egg quality characteristics each egg samples were ruptured on a flat white tile by taking precautions for not breaking the vitelline membrane which encloses the yolk. The parameters examined were as follows:

a) Yolk width was measured as the widest horizontal circumferences with a vernier calliper in centimetres.
b) Yolk height was measured as the height of yolk at the midpoint with a tripod micrometer.
c) $\text{Yolk index} = \frac{\text{Height of yolk}}{\text{Width of yolk}}$ .
d) Albumin heights were measured from at least three places each with tripod micrometer (Froning and Frank, 1956).
e) Albumin width was measured as the widest horizontal circumference of the thick albumin with a Vernier calliper in centimetre.
f) $\text{Albumin index} = \frac{\text{Height of albumin}}{\text{Width of albumin}}$ .
g) Shell thickness of dry egg shell was examined with a micrometer screw gauge. The average of three points (the broad, middle and narrow) were taken as shell thickness.
h) Haugh unit was determined using the following formula.
   $HU = H + 7.57 - 1.7\, W^{0.37}$
   Where HU = Haugh Unit
   H = height of albumin (mm)
   W = weight of egg (g)
   Individual Haugh Unit (Haugh, 1937) score was calculated using egg weight and albumin height (Doyon et al., 1986). The mean values were calculates for each trait, according the Snedecor and Cochran (1994).
i) Subsequently, the yolk was segregated from albumin and measured. The weight of shell was measured after the removal of remaining albumin with water and rapid sun drying for six hours.
j) The albumin weight was evaluated by subtracting the yolk weight and shell weight from the whole egg weight.

**3. CHEMICAL ANALYSIS:**

Chemical analyses were carried out in two accredited laboratories namely the Feed Analytical laboratory of Central Poultry Development Organisation (CPDO) and Zoology Laboratory of Centurion University Of Technology and Management located at Bhubaneswar.

In the laboratories the eggs were kept in refrigerator at $4^0$C and analysed with in four days after laying. Analyses were carried out in two categories, i.e., with shell and without shell.The parameters namely energetic value, carbohydrate, cholesterol, crude protein, crude fat (lipid), moisture content, total ash, calcium and phosphorus content were determined. The cholesterol content was analysed enzymatically by using Coral Diagnostic Cholesterol Reagent as described by (Allain et al., 1974). The crude fat content was analysed by Soxhlet Extraction method as described by AOAC (1990). Similarly crude Kjeldahl method the moisture content protein was surmise by multiplying 6.25 to nitrogen content obtained by Micro- was determined by drying at 100-$102^0$C for 16 to 18 hours as described by AOAC (1990) and ash content was analysed by incineration in muffle furnace at $550^0$C.

Calcium was analysed by potassium permanganate titration method (Tee et al., 1987) and phosphorus content was determined by colorimetric method using ammonium molybdate solution as described as AOAC (1990). Energetic value and carbohydrate were calculated computationally using the following formula as followed by (Matt et al., 2009), i.e., Kcal/100gm of edible egg =( gm protein x 4.63) + (gm lipids x 9.02) + (gm carbohydrate x3.87 )and 100% - (protein% + fat% + humidity % + ash%) respectively.

**Statistical analysis**

The data were analysed as per standard statistical protocol (Snedecor and Cochran, 1994). The different egg quality traits and chemical composition of eggs of both the species were studied and the mean was analysed using the t-test. Values of nutritional parameters were compared and standard error of mean were calculated using t-test and significance of test was calculated ($P < 0.01$) at 1% level .

## 4. RESULTS:

### EXTERNAL EGG QUALITIES

Birds eggs are generally in elliptical shape with negligible difference among species. In spite for negligible difference the shape of egg is regarded to be an important factor in characterizing avian species. In present study, eggs of chicken and turkey showed similar conical shape with blunt and pointed ends. The colour of chicken ranged from white to light brown , whereas the colour of turkey eggs ranged from white to cream with brown speckles.

The shape of the egg is expressed in terms of shape index and the shape index of chicken and turkey eggs were 72.06 and 77.82 respectively with significant statistical difference
($P < 0.01$) (Table 1).

The weights of chicken egg and turkey egg and their components are recorded (Table 1). The weight of turkey eggs was found to be much higher than that of chicken egg, which was probably due to extensive difference in size of these two species.

The proportion of yolk and albumin to the weight of whole egg are significantly higher ($P < 0.01$) in turkey egg (Table1). The shell of turkey egg was observed to be significantly thicker 0.051cm than the chicken egg 0.036cm.

### Interior egg qualities

The yolk index, albumin index and Haugh Unit of the eggs of turkey were found to be significantly higher ($P < 0.01$) than chicken egg (Table 1).

Analysis of chemical composition of eggs of first category (i.e. with shell) of chicken and turkey showed significant differences ($P < 0.01$) between the species. The moisture content, was significantly higher ($P<0.01$) in chicken egg (74.01) than in turkey egg (72.02) (Table 2). The crude protein, crude fat total ash, cholesterol calcium content and energy per K/cal/100gm of edible in turkey eggs were analysed to be 12.96, 11.35, 5.31, 741.8mg 9.40mg and 168.04 respectively which were observed to be significantly and statistically higher ( $P <0.01$) than that of chicken egg (Table 2). However, no significant differences were observed in carbohydrate and phosphorus contents in the eggs of both species.

Analysis of chemical composition of eggs of second category (without shell) of both chicken and turkey egg reveals no significant differences ($P < 0.01$) between the species in moisture content, phosphorus content and energy level (Table 3). However, the crude protein, crude fat, ash content, carbohydrate, cholesterol and calcium content were recorded to be significantly higher ($P < 0.01$) in turkey egg than in chicken egg (Table 3).

## 5. DISCUSSION:

The shape indices in the present study were higher than those reported by some authors for chicken egg ( Powrie, 1977; Baek, 1990).

The absolute weights of albumin ,yolk and shell weight were recorded to be significantly higher in turkey egg due to much higher egg weight of turkey.

The indicators of internal egg quality are yolk index and Haugh unit which were reported to be higher in turkey eggs, hence eggs of turkey are of better quality. According to ( Ihekoronye and Ngoddy, 1985; Imai et al.,1986 ; Ayorincle, 1987;Adeogun and Amole, 2004)the higher the Haugh unit and yolk index are more desirable is the internal egg quality .

The prominent chemical compositions in the present study of chicken egg were similar to those obtained by USDA, (1983) where the moisture content, crude protein ,crude fat and ash content were 74.57% , 12.14%, 11.5%, 0.99% respectively which is comparable with the present study. Regarding the cholesterol, it was observed to be significantly higher ($P < 0.01$) in turkey eggs. Cholesterol plays a major role in the development of embryo. Cholesterol is a structural component of cell membrane and is a processor for hormones, vitamin D and bile acids (Anton, 2007). The concentration of cholesterol in eggs based on breed and age of layers, management and nutrition (Foster and Flock, 1997) and partly on synthesis in liver during the lipoproteins. synthesis.According to Villa (2008) , the cholesterol content was positively correlated with egg and yolk weight and negatively correlated with egg production and dietary protein level.

## 6. CONCLUSION:

From the analyses , it is evident that performance of egg quality characteristics in turkey was much better than chicken egg. The chemical analysis of egg content showed significantly higher values of all the parameters except the phosphorous content. Since turkeys thrive well in tropical climatic condition, so more detailed and comprehensive studies are suggested to establish the impact of climatic conditions and layer nutrition on egg quality as well as chemical composition, so that it can be recommended for table consumption.

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**Table 1: Means of some physical parameters of chicken and turkey eggs.**

| PARAMETER | SPECIES | | |
|---|---|---|---|
| | CHICKEN | TURKEY | T – VALUE |
| Weight of Egg (g) | 40.26 ± 0.65 | 76.25 ± 0.74 | 30.77 ** |
| Volume of Egg (ml) | 36.66 ± 0.71 | 71.75 ± 0.50 | 33.46 ** |
| Albumin Weight (g) | 22.31 ± 0.72 | 42.31 ± 0.46 | 20.07 ** |
| Yolk Weight (g) | 10.19 ± 0.26 | 21.67 ± 0.27 | 31.54 ** |
| Shell Weight (g) | 7.03 ± 0.28 | 13.90 ± 0.14 | 10.14 ** |
| Egg Shell Thickness (cm) | 0.036 ± 0.0008 | 0.051 ± 0.0002 | 17.60 ** |
| Albumin Index | 0.134 ± 0.006 | 0.166 ± 0.002 | 3.87 ** |
| Shape Index | 72.06 ± 0.61 | 77.82 ± 1.22 | 3.79 ** |
| Yolk Index | 0.267 ± 0.022 | 0.460 ± 0.007 | 8.28 ** |
| Haugh Unit | 84.13 ± 1.55 | 92.22 ± 0.41 | 4.39 ** |

Mean ± Standard error
** Mean in the same row differ significantly (P<0.01) at 1% level

**Table 2: Chemical composition (%) of egg content (with shell) of chicken and turkey eggs.**

| PARAMETER | SPECIES | | |
|---|---|---|---|
| | CHICKEN | | CHICKEN |
| Moisture Content | 74.10 ± 0.14 | 72.02 ± 0.28 | 8.95 ** |
| Crude Protein | 11.20 ± 0.11 | 12.96 ± 0.38 | 3.59 ** |
| Crude Fat | 9.63 ± 0.09 | 11.35 ± 0.17 | 8.99 ** |
| Total Ash | 3.15 ± 0.04 | 5.31 ± 0.19 | 9.90 ** |
| Carbohydrate | 1.72 ± 0.25 | 1.44 ± 0.38 | 0.87 ns |
| Cholesterol (mg) | 380.8 ± 7.97 | 741.8 ± 2.27 | 48.23 ** |
| Calcium (mg) | 2.28 ± 0.11 | 9.40 ± 0.16 | 40.83 ** |
| Phosphorous (Mg) | 178.32 ± 5.10 | 169.98 ± 0.13 | 1.60 ns |
| Energy (K/cal per 100 gm) of edible portion | 145.03 ± 1.43 | 168.04 ± 2.85 | 8.46 ** |

Mean ± Standard error
** Mean values in the same row differ significantly (P<0.01) at 1% level
ns – Mean values in the same row differ non significantly

**Table 3: Chemical composition (%) of egg content (without shell) of chicken and turkey eggs.**

| PARAMETER | SPECIES | | |
|---|---|---|---|
| | CHICKEN | TURKEY | T – VALUE |
| Moisture Content | 75.89 ± 0.18 | 75.72 ± 0.05 | 1.07 ns |
| Crude Protein | 12.45 ± 0.13 | 13.05 ± 0.09 | 4.14 ** |
| Crude Fat | 13.05 ± 0.09 | 12.16 ± 0.20 | 4.51 ** |
| Total Ash | 1.08 ± 0.05 | 0.86 ± 0.04 | 11.00 ** |
| Carbohydrate | 2.44 ± 0.22 | 1.35 ± 0.26 | 2.98 ** |
| Cholesterol (mg) | 380.8 ± 7.97 | 741.6 ± 2.27 | 48.23 ** |
| Calcium (mg) | 0.08 ± 0.044 | 5.14 ± 0.11 | 45.77 ** |
| Phosphorous (mg) | 174.34 ± 5.04 | 167.72 ± 0.30 | 1.28 ns |
| Energy (K/cal per 100 gm) of edible portion | 175.82 ± 0.71 | 174.73 ± 1.90 | 0.57 ns |

Mean ± Standard error
** Mean values in the same row differ significantly (P<0.01) at 1% level
ns – Mean values in the same row differ non significantly