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# Effect of Hen Oviposition Time on some Egg Characteristics

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## ABSTRACT

Ovulation in chicken is the process of emergence the egg yolk by controlling the steroid hormones, which is followed by oviposition that influence by several factors. Egg yolk is a huge oocyte contains fat in water emulsion with about 50% dry weight, its rounded and centrally located. The experiment was carried out to investigate the effect of oviposition time on egg external traits (egg weight, egg length, egg breadth), yolk characteristics (yolk weight, yolk high, yolk diameter, yolk index, and the proportion of yolk weight to egg whole weight), and investigate the correlations between these characteristics by using Ross 308 hybrid. When the flock was 30 weeks age, 150 fertilizes egg was used, which collected in three times, Period (1) = 9:30 am, Period (2) = 11:30 am, and Period (3) = 1:30 pm, which supplied from KOSAR company. The results reveal significant differences between the times of collection for all the yolk characteristics and egg external traits. It does conclude the yolk characteristics were differs significantly between the oviposition times and the yolk weight was highly correlated with yolk diameter, egg breadth, and proportion of yolk weight to the whole egg weight.

**Keywords:** Egg, yolk, chicken, dimension, and shape index

## INTRODUCTION

Ovulation in chicken is the process of emergence the egg yolk by controlling the steroid hormones, which is followed by oviposition that influence by several factors (Tumova & Ebeid, 2005; Tumova *et al*., 2007; Hrncar *et al*., 2013). Egg yolk is a huge oocyte contains fat in water emulsion with about 50% dry weight, its rounded and centrally located. It's contains proteins, lipids, carbohydrates, vitamins, antibodies and minerals, which differ depending on genetic, and environment factors (Radu-Rusu *et al*., 2014; Yenice *et al*., 2016). These contains are necessary for development of the embryo during the hatching (Ho *et al*., 2011). It's observed that the heritability of yolk characteristics was ranged between low to moderate (Alipanah *et al*., 2013; Rath *et al*., 2015; Sreenivas *et al*., 2013). Yolk characteristics differ between avian species (Popoola *et al*., 2015), breeds (Sola-Ojo & Ayorinde, 2011; Adomako *et al*., 2013; Bobbo *et al*., 2013; Abdullah & Shaker, 2018), egg storage (Dorji, 2014), rearing system (Sokolowicz *et al*., 2018), age (Zita *et al*., 2009), and physical apperence (Shaker & Aziz, 2017). This experiment was carried out to investigate the effect of oviposition time on egg external traits (egg weight, egg length, egg breadth), yolk characteristics (yolk weight, yolk high, yolk diameter, yolk index, and the proportion of yolk weight to egg whole weight), and investigate the correlations between these characteristics by using Ross 308 hybrid.

## MATERIALS AND METHODS

Current experiment was done in the animal production department laboratories, Directorate of agricultural research in Slemani providence. When the flock was 30 weeks age, 150 fertilizes egg was used, which collected in three times, Period (1) = 9:30 am, Period (2) = 11:30 am, and Period (3) = 1:30 pm, which supplied from KOSAR company. Flock were fed commercial feed mixtures with (15 % Crude protein), and (2800 Kcal). After collection eggs were weighted by using sensitive electronic balance (0.01 g). Egg axes (Length and Breadth) were measured by using vernier caliper, all reading was recorded in millimeter (mm). Egg shape index (ESI) were estimated by using equation (Reddy *et al*., 1979) below:

**Egg shape index (ESI) = breadth/length * 100**

While eggs were broken, yolk for each egg was separated from the albumin, five parameters were measured as below:

**Yolk Weight (YW):** yolk weight was measured with sensitive electronic balance to the nearest 0.01g.

**Yolk Diameter (YD):** Yolk diameter was estimated as the average of yolk length and width.

**Yolk High (YH):** yolk high was determined by using of Spherometer.

**Yolk Index (YI):** yolk height (YH) and yolk width (YD) was determined with the use of vernier calipers and measurements were in millimeter by the method of (Funk, 1948).

**Yolk index = (YH/YD)* 100**

**Yolk percentage ($Y_p$):** was estimated by divided the yolk weight to the whole egg weight multiple 100

**Yolk percentage = ($Y_w$ / $WE_w$) * 100**

Data were analyzed by using SPSS/PASW for windows version 20 (SPSS, 2011). One-way analysis of variance was used to test the effect of oviposition time on the yolk characteristics. Duncan's multiple range test (Duncan, 1955) was conducted to test the significant differences between the means of the groups. Pearson's correlation coefficients were also estimated between egg yolk (EY), egg yolk characteristics and egg external traits.

## RESULTS AND DISCUSSION

### Results

Egg weight, yolk characteristics parameters (yolk weight, yolk diameter, yolk high, yolk index YI and proportion of yolk weight to the whole egg weight) were present in table 1. No significant difference was observed in egg weight (EW) between the three-oviposition times ($p>0.05$). Yolk weight was exceeding in period 2 (16.64 g), followed by period 1 and 3 (15.57 g, 15.99 g) respectively. Yolk diameter (YD) was significantly difference between

the three periods; it was higher in period 2 and period 3 (39.59 mm, 39.68 mm) respectively, and lowers in period 1 (38.81 mm). Yolk high (YH) was differing significantly ($p<0.05$) between the three periods; it was higher in period 1, and period 2 (15.65 mm, 15.81 mm) respectively, and lowers in period 3 (15.18 mm). Yolk index (YI) was significant between the groups ($p<0.05$), period 1 and 2 was higher (40.41, 39.92) respectively, and lower in period 3 (38.19). (The proportion of yolk weight to the whole egg weight was significantly differences ($p<0.05$) between the three periods. It was higher in period 2 (29.45%) and lowers in period1 and period 3 (27.97 %, 28.32 %) respectively.

**Table 1. yolk characteristics parameters of three oviposition times.**

| Traits | Period 1 = 9:30 | | | Period 2= 11:30 | | | Period 3 = 1:30 | | | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Min. | Max. | Mean | Min. | Max. | Mean | Min. | Max. | |
| EW (g) | 55.95±.66 [a] | 46.19 | 66.09 | 56.56±.45 | 49.11 | 63.87 | 56.60±.48 [a] | 50.01 | 64.54 | 0.630 |
| YW (g) | 15.57±.22 [b] | 11.76 | 18.13 | 16.64±.15 | 14.10 | 19.37 | 15.99±.18 [b] | 11.83 | 18.63 | 0.000 |
| YD (mm) | 38.81±.22 [b] | 34.56 | 41.97 | 39.59±.20 | 36.78 | 43.17 | 39.68±.19 [a] | 36.20 | 42.78 | 0.005 |
| YH (mm) | 15.65±.12 [a] | 14.03 | 17.35 | 15.81±.20 | 13.65 | 18.93 | 15.18±.14 [b] | 13.02 | 17.74 | 0.013 |
| YI (%) | 40.41±.40 [a] | 34.86 | 44.76 | 39.92±.59 | 33.06 | 48.28 | 38.19±.40 [b] | 31.22 | 44.96 | 0.003 |
| Y/W (%) | 27.97±.34 [b] | 23.89 | 38.69 | 29.45±.25 | 26.19 | 33.27 | 28.32±.27 [b] | 21.72 | 31.55 | 0.001 |

**EW= egg weight, YW= yolk weight, YD= yolk diameter, YH= yolk high, YI= yolk index, EL=egg length, EB= egg breadth.**
**[a-c] indicate significant differences between the times.**

Egg external traits (egg length, egg breadth, and egg shape index) were present in table 2. Both length and breadth of egg were differing significantly between the periods ($p<0.05$). Egg length was higher in period 2 and period 3 (54.25 mm, 55.02 mm) respectively and lowers in period 1 (49.28 mm). And also egg breadth was exceed in period 2 and period 3 (40.97 mm, 42.66 mm), and lowers in period1 (37.55 mm). Egg shape index was significantly differences between the three periods ($p<0.05$). It was higher in period 3 (77.71%), intermediate in period 2 (79.32%), and lower in period 1 (76.29%).

**Table 2. shape index and proportion of whole weight to yolk weight for three-oviposition time.**

| Traits | Period 1 = 9:30 | | | Period 2 = 11:30 | | | Period 3 = 1:30 | | | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Min. | Max. | Mean | Min. | Max. | Mean | Min. | Max. | |
| EL (mm) | 49.28±.32 [b] | 45.12 | 57.81 | 54.25±.26 [a] | 50.84 | 58.74 | 55.02±.27 [a] | 51.99 | 58.93 | 0.000 |
| EB (mm) | 37.55±.22 [c] | 34.06 | 43.14 | 42.98±.12 [a] | 40.97 | 45.11 | 42.66±.14 [a] | 40.36 | 45.08 | 0.000 |
| ESI (%) | 76.29±.44 [a] | 69.57 | 82.36 | 79.32±.42 [b] | 71.16 | 84.26 | 77.61±.43 [a] | 71.71 | 81.96 | 0.000 |

**ESI= egg shape index, Y/W= ration of yolk to egg weight. [a-c] indicates significant differences between the times.**

Pearson correlation coefficient (r) was estimated to determine the relationship between the egg yolk weight and yolk characteristics and egg external traits (table 3). In First period the highest positive significant correlation values ($p<0.000$) were observed between yolk weight and yolk diameter, and yolk high with yolk index (0.853, 0.803) respectively, intermediate between yolk weight and egg breadth and proportion of yolk to egg weight (0.584, 0.581) respectively.

**Table 3. correlation of egg weight and yolk characteristics.**

| | Traits | YW | YD | YH | YI | EL | EB | ESI | Y/W |
|---|---|---|---|---|---|---|---|---|---|
| Period 1 = 9:30 | YW | 1 | | | | | | | |
| | YD | 0.853*** | 1 | | | | | | |
| | YH | 0.229 N.S. | -0.075 N.S. | 1 | | | | | |
| | YI | -0.332* | -0.653** | 0.803** | 1 | | | | |
| | EL | 0.433** | 0.325* | 0.164 N.S. | -0.072 N.S. | 1 | | | |
| | EB | 0.584*** | 0.527*** | 0.237 N.S. | -0.159 N.S. | 0.572*** | 1 | | |
| | ESI | 0.113 N.S. | 0.191 N.S. | 0.057 N.S. | -0.080 N.S. | -0.547*** | 0.372** | 1 | |
| | Y/W | 0.581*** | 0.510*** | 0.009 N.S. | -0.284 N.S. | -0.201 N.S. | -0.161 N.S. | 0.064 N.S. | 1 |
| Period 2 = 11:30 | YW | 1 | | | | | | | |
| | YD | 0.750*** | 1 | | | | | | |
| | YH | -0.104 N.S. | -0.331* | 1 | | | | | |
| | YI | -0.338* | -0.607** | 0.953** | 1 | | | | |
| | EL | 0.307* | 0.280 N.S. | 0.058 N.S. | -0.021 N.S. | 1 | | | |
| | EB | 0.516*** | 0.399** | 0.002 N.S. | -0.118 N.S. | 0.079 N.S. | 1 | | |
| | ESI | 0.003 N.S. | -0.034 N.S. | -0.046 N.S. | -0.042 N.S. | -0.856*** | 0.446** | 1 | |
| | Y/W | 0.550*** | 0.374* | -0.126 N.S. | -0.255 N.S. | -0.378* | -0.208 N.S. | 0.230 N.S. | 1 |
| Period 3 = 1:30 | YW | 1 | | | | | | | |
| | YD | 0.822*** | 1 | | | | | | |
| | YH | 0.244 N.S. | -0.117 N.S. | 1 | | | | | |
| | YI | -0.196 N.S. | -0.554** | 0.883** | 1 | | | | |
| | EL | 0.287 N.S. | 0.205 N.S. | 0.229 N.S. | 0.082 N.S. | 1 | | | |
| | EB | 0.568*** | 0.528*** | 0.113 N.S. | -0.155 N.S. | 0.086 N.S. | 1 | | |
| | ESI | 0.091 N.S. | 0.138 N.S. | -0.129 N.S. | -0.161 N.S. | -0.810*** | 0.513*** | 1 | |
| | Y/W | 0.633*** | 0.493*** | 0.095 N.S. | 0.165 N.S. | -0.308* | -0.069 N.S. | 0.237 N.S. | 1 |

***** Correlation is significant at the 0.001 level; ** correlation is significant at the 0.01 level; * correlation is significant at the 0.05 level; ns correlation is not significant. EW= egg weight, YW= yolk weight, YD= yolk diameter, YH= yolk high, YI= yolk index, EL=egg length, EB= egg breadth.**

Also, between yolk diameter with egg breadth and proportion of yolk weight to whole egg weight (0.527, 0.510) respectively, and between egg length and egg breadth (0.572). Low significant positive correlation was observed between yolk weight and egg length, yolk diameter and egg length, and egg breadth with egg shape index (0.433, 0.325, 0.372) respectively. Negative significant correlation was observed between yolk weight and yolk index, yolk diameter and yolk index, and egg length and egg shape index (-0.332, -0.653, - 0.547) respectively.

While in second period the highest positive significant correlation values ($p<0.000$) were observed between yolk high and yolk index, and yolk weight and yolk diameter (0.953, 0.750) respectively, intermediate between yolk weight and egg breadth and proportion of yolk to egg weight (0.516, 0.550) respectively, also between egg breadth and egg shape index (0.446). Low significant positive correlation was observed between yolk weight and egg length, yolk diameter and egg breadth, and yolk diameter and proportion of yolk weight to the whole egg weight (0.307, 0.399, 0.374) respectively. Highly Negative significant correlation was observed between egg length and egg shape index, and yolk diameter and yolk index (- 0.856, -0.607) respectively, and low value was recorded between yolk high and yolk diameter, and yolk weight and yolk index (- 0.331, - 0.338) respectively.

In third period the highest positive significant correlation values ($p<0.000$) were observed between yolk weight and yolk diameter, and between yolk high and yolk index, and between yolk weight and proportion of yolk weight to the whole egg weight (0.822, 0.883, 0.633) respectively, intermediate between yolk weight and egg breadth, yolk diameter and egg breadth, yolk diameter and proportion of yolk weight to the whole egg weight, and egg breadth with egg shape index (0.568, 0.528, 0.493, and 0.513) respectively. Highly Negative significant correlation was observed just between egg length and egg shape index (- 0.810). Intermediate negative significant was observed just between yolk diameter and yolk index (- 0.554), and lower was observed between yolk weight and yolk index (- 0.196).

**Discussion**

Egg oviposition time is an important factor influences the egg quality and characteristics. Which effected directly on the consumer and farm economics. The results reveal significant differences between the times of collection for all the yolk characteristics and egg external traits. An approximated result was described by Hrncar *et al.* (2013) founded significant differences in egg weight but not in percentage of yolk % and yolk index. Furthermore Tumova *et al.* (2005) found that yolk height were significantly affected by the time of oviposition but the yolk % was not, and egg yolk weight correlated with hen age *et al.* (2009) and the interaction between the environment, age and oviposition time (Tumova and Gous, 2012). Also, Tumova *et al.* (2014) that reported that time of oviposition play an important role in egg quality and shell minerals composition.

## CONCLUSION

It does conclude the yolk characteristics were differs significantly ($p<0.000$) between the oviposition times and the yolk weight was highly correlated with yolk diameter, egg breadth, and proportion of yolk weight to the whole egg weight.

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## تأثير وقت الاباضة في الدجاج على بعض مواصفات جودة البيض

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عملية التبويض فى الدجاج هي عملية ظهور صفار البيض عن طريق التحكم في الهرمونات الإسيترويدية، ويتبعها عملية التبويض الذي يتأثر بعوامل كثيرة. صفار البيض عبارة عن بويضات ضخمة تحتوي على دهون في مستحلب الماء بوزن جاف حوالي 50 % ، دائرية و خصائص مركزي. تم اجراء التجربة لاستقصاء تأثير وقت خروج البيض على الصفات الخارجية للبيض (وزن البيضة، طول البيضة، عرض البيضة)، وكذلك خصائص صفار البيض (وزن الصفار، ارتفاع الصفار، قطر الصفار، مؤشر شكل الصفار، ونسبة وزن الصفار الى وزن البيضة الكلي). استخدم في هذه التجربة أمهات روس ( ROSS 308) بعمر 30 اسبوع، حيث تم استخدام 150 بيضة مخصبة و التي تم جمعها في ثلاث فتراة (الفترة الاولى 9:30 صباحا ، الفترة الثانية 11:30 صباحا ، و الفترة الثالثة 1:30 ظهرا). كشفت النتائج عن وجود فروقات ذات دلالة احصائية بين اوقات التجميع و لجميع خصائص صفار البيض و صفات البيض الخارجية. و استنتج كذلك ان صفار البيض مرتبط ارتباط موجبا مع بقطر الصفار ، عرض الصفار ، و بنسبة وزن الصفار الى وزن البيضة الكامل.