

# RELATIONSHIP BETWEEN EGGS SHAPE INDEX AND EMBRYONIC MORTALITY

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✉ Supporting Information

**ABSTRACT:** The study was conducted to assess the effect of eggs shape on hatchery parameters. The eggs shape (SI) is a critical tool to investigate the outcome from eggs during incubation. In this experiment three groups of good quality intact eggs (each n= 500) having thick shell without any kind of contamination were collected from three different broiler breeders' farms SP117 (Ross), SSF (Ross) and SP 118 (Ross). The management and incubation conditions were same for all three groups. The SI was measured and maximum deviation from standard was found for SP117 (80.94±0.04<sup>a</sup>, 78.46±0.07<sup>b</sup>, 76.57±0.04<sup>c</sup>) then SSF and SP118 respectively. Due to SI deviation hatchability % (78.25±0.01<sup>a</sup>, 81.17±0.09<sup>b</sup>, 91.35±0.07<sup>c</sup>), candling% (8.67±0.02<sup>a</sup>, 9.36±0.06<sup>b</sup>, 4.71±0.09<sup>c</sup>), dead in shell % (13.08±0.10<sup>a</sup>, 6.94±0.03<sup>b</sup>, 3.94±0.07<sup>c</sup>), chick yield % (67.31±0.09<sup>a</sup>, 68.24±0.01<sup>b</sup>, 69.10±0.05<sup>c</sup>), hatch window hrs (28-30±0.03<sup>a</sup>, 24-26±0.07<sup>b</sup>, 22-24±0.03<sup>c</sup>) were significantly different for SP117, SSF and SP118 respectively. Water loss was significantly higher (P<0.05) for SP117 (12.01±0.03<sup>a</sup>) as compare to SSF and SP118 (11.89±0.04<sup>b</sup>, 11.87±0.04<sup>b</sup>). The effect of eggs shape index was also found on mal-position and mal-formations. The maximum dead and cull chicks 0.5% were found for SP117 as compare to SSF or SP118. Similarly mal-position head in small of eggs and feet over head were found maximum for SP117 0.3% and 0.8% respectively. The maximum mal-formation ectopic viscera 0.7 % and excess albumin 0.5% was found for SP 117 as compare to SSF or SP118. The maximum dead in shell, mal-position and mal-formation were found for SP 117 due to maximum deviation from SI as compare to SSF or SP118. Eggs shape Index is a good tool to access the quality of eggs.

**Keywords:** Dead in shell, Hatchability, Mal-Position, Mal-Formation, Shape Index

## INTRODUCTION

Several studies have been conducted to investigate the effect of egg quality characteristics on hatchability parameters and significant relationship between fertility rate and late embryonic mortality was found in the shape index of different group's eggs (Aci et al., 2015). Eggs shape depends upon anatomical structure of hen, particularly of the oviduct, internal organ distribution and shape of pelvic bones (King'ori, 2012). The egg shape index is the ratio between maximum egg width with maximum egg length (Narushin and Romanov, 2002), and represents a numeric value of egg shape (Alasahan and Copur, 2016) conducted experiment to investigate the effect of egg shape index on hatchability and found that egg shape index has effect on early embryonic mortality and there is no influence of egg shape index on mid or late embryonic mortality, chick weight and body weight during 1-5 weeks. There is no influence of egg shape index on embryonic mortalities (middle and late), chick weight, and body weight during 1-5 weeks. King'ori (2012) suggested that hatchability parameters are achieved when normal shape eggs are greater than abnormal shape eggs. This is due to change of axial position of embryo in normal shape eggs during advance stages of embryonic development. In chicken eggs, the head of embryo moves towards the blunt end of the egg on day 14 and acquire a position parallel to the egg axis. According to Duman et al. (2015) the eggs can be classified with respect to shape index (SI) namely as sharp egg (SI<71), a normal (standard) eggs (SI= 72-76) or a round eggs (SI>76). The present study aimed to evaluate the effect of egg shape index (SI) on mal-position, mal-formation including hatchability parameters.

## MATERIALS AND METHOD

### Ethical approval

This experiment was a routine field work in hatchery considering all rules and regulations regarding animal rights and ethic, university of veterinary and animal sciences, Lahore, Pakistan.

### Eggs Collection

Fertile eggs from three different breeders farms SP117 (Salman Poultry Flock no.117 Ross n=500), SSF1 (salmansadiq Flock no.1 Ross n=500) and SP 118 (Sadiq Poultry Flock no.118 Ross n=500) were collected.

### Measurement of Eggs Shape Index

Eggs shape index (SI) was measured as described by [Duman et al. \(2015\)](#) and Measurements of egg length (L) and width (W) were taken with a Vernier Caliper to the nearest 0.01 mm. The eggs shape index (SI) was determined from these measurements according to [Reddy et al. \(1979\)](#) and [Anderson et al. \(2004\)](#) as given with the following formula,

$$SI = \left( \frac{W}{L} \right) \times 100$$

According to this formula eggs were classified with respect to shape index (SI), namely as a sharp egg (SI < 72), a normal (standard) egg (SI = 72–76) or a round egg (SI > 76).

### Incubation Profiles

Eggs from all three flocks were incubated separately in single stage incubator with age wise incubation profile. Similar incubation conditions were provided to all eggs in hatchery to minimize the effects of hatchery conditions ([Jabbar et al., 2017](#)).

### Dead in Shell Analysis

The incubation duration and hatch pulling and dead in shell analysis were performed as described by [Jabbar et al. \(2017\)](#). The unhatched eggs were broken initially dead embryo were classified into early, mid or late embryonic mortality then further classified to mal-position and mal-formation according to ([Jabbar et al., 2017](#); [Aviagen](#)).

### Data Assessment and Statistical Analysis

Hatching parameter data of the egg shape index groups were analyzed using the Chi-square test.

## RESULT AND DISCUSSION

The egg shape index for three flocks were significantly ( $P < 0.05$ ) different. The highest SI was found for SP117 that means it contain round or misshape eggs as compare to SSF1 or SP118. The hatchery parameters were affected. The hatchability, candling, dead in shell, chick yield and hatch window were significantly ( $P < 0.05$ ) better for SP118 which has standard SI then SSF1 as compare to SP117 ([Table 1](#)). The water loss was also significant different for SP117 as compared to SSF1 and SP118.

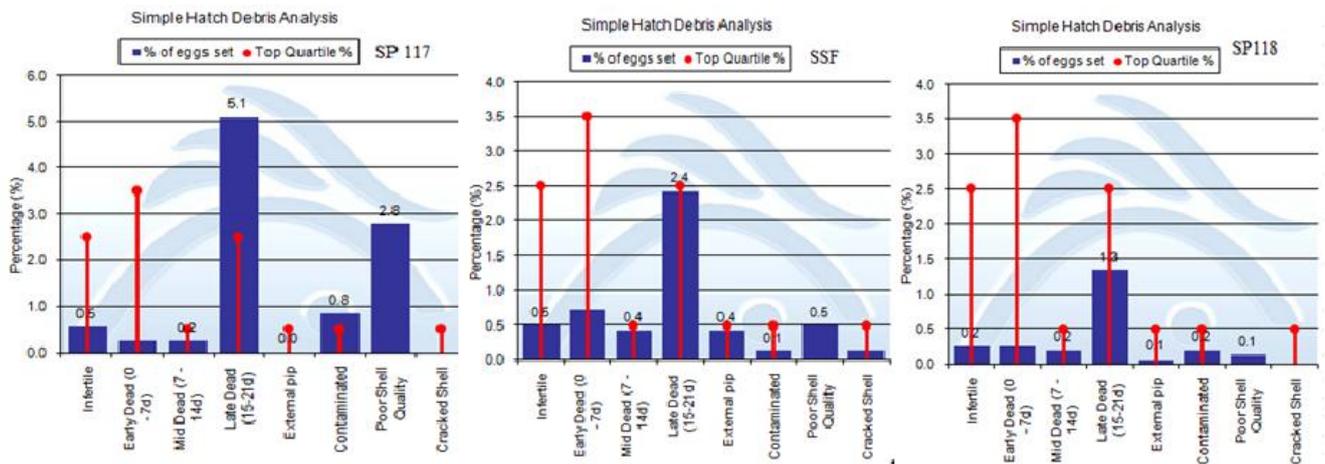
[Narushin et al. \(2002\)](#) conducted experiment to investigate the effect of eggs physical characteristics on hatchability and found that eggs with normal shape index hatches more as compare to abnormal shape index. This probably results from the fact that the embryo changes its axial orientation in the egg at the later stages of embryonic development. Due to eggs abnormal shape it's difficult for embryo to change its axial orientation in the egg results in more dead in shell. That's why SP117 has more dead in shell as compare to SSF and SP118. The maximum late embryonic mortality was found for SP117 as compared to SSF or SP118 ([Figure 1](#)). The effects of egg shape index on hatching parameters are presented in [Table 1](#). The egg shape index affected the hatchability of fertile eggs ( $P < 0.01$ ) and early embryonic mortality rate ( $P < 0.05$ ).

Deviation from standard shape index was also responsible for mal-position and malformation during late embryonic growth. The maximum dead and cull chicks 0.5% were found for SP117 as compare to SSF or SP118. Similarly mal-position head in small of eggs and feet over head were found maximum for SP117 0.3% and 0.8% respectively ([Figure 2](#)). There are lot of reasons for mal-position like eggs were set upright, with small end up, advance breeder hen age and shell quality problem, eggs turning frequency and angle were not adequate, inadequate humidity, insufficient ventilation, feed mycotoxins, exposure to lower temperature during later stages of incubation and round shape or overly large eggs ([Sumi et al., 2014](#)). That's why maximum mal- positions were found for SP117 due to maximum deviation from standard SI [Table 1](#). Studies have found that the incidence of embryos unable to hatch due to mal-positions varies from 1.2 to 1.8%, with an average of 1.5%.

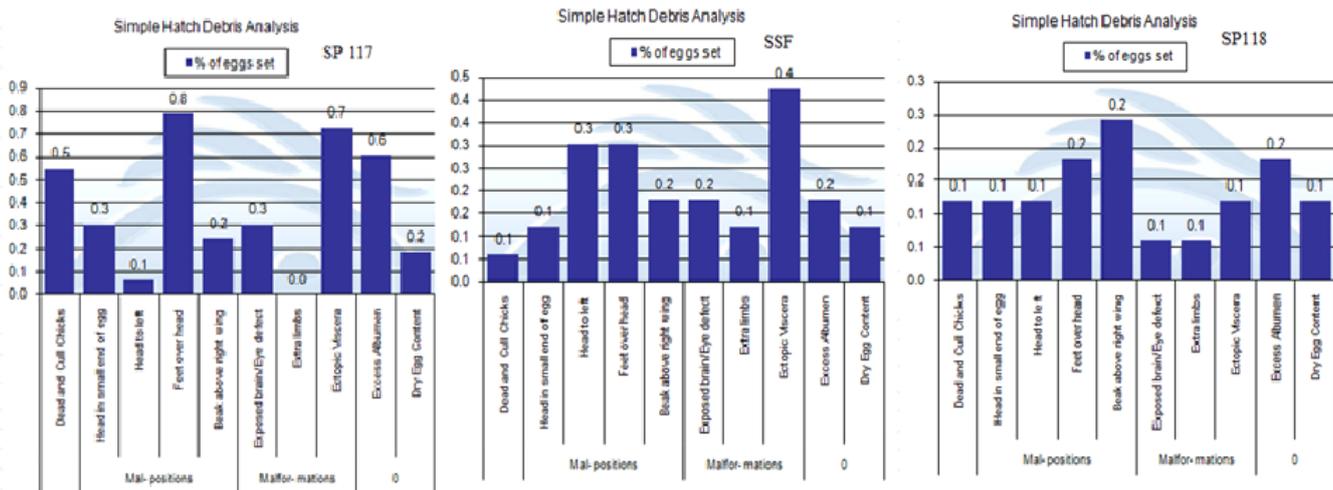
**Table 1 - Effect of Eggs shape Index on Hatchery Parameters**

Parameters	SP117	SSF1	SP118
SI %	80.94±0.04 <sup>a</sup>	78.46±0.07 <sup>b</sup>	76.57±0.04 <sup>c</sup>
Hatchability %	78.25±0.01 <sup>a</sup>	81.17±0.09 <sup>b</sup>	91.35±0.07 <sup>c</sup>
Candling %	8.67±0.02 <sup>a</sup>	9.36±0.06 <sup>b</sup>	4.71±0.09 <sup>c</sup>
Water loss %	12.01±0.03 <sup>a</sup>	11.89±0.04 <sup>b</sup>	11.87±0.04 <sup>b</sup>
Dead in shell %	13.08±0.10 <sup>a</sup>	6.94±0.03 <sup>b</sup>	3.94±0.07 <sup>c</sup>
Chick yield %	67.31±0.09 <sup>a</sup>	68.24±0.01 <sup>b</sup>	69.10±0.05 <sup>c</sup>
Hatch window hrs	28-30±0.03 <sup>a</sup>	24-26±0.07 <sup>b</sup>	22-24±0.03 <sup>c</sup>

a-bdenote difference significant difference within rows for three groups (P < 0.05)



**Figure 1. Effect of Shape Index on Early Mid and Late Embryonic Mortality**



**Figure 2. Effect of Shape Index on Mal-position and Mal-formation**

During embryonic development there is a predictable incidence of embryo that die or not able to hatch due to mal-formation or deformities. The percent of deformed embryos ranged from 0.22 to 0.30% of the total hatch (Butcher et al., 2002). The common mal-formation or deformities are exposed brain/eyes defects, extra limbs, ectopic viscera, excess albumin and dry eggs content (Figure 1) which are mostly due to improper incubation temperature or due to certain contaminations (Jabbar et al., 2017). The maximum mal-formation ectopic viscera 0.7 % and excess albumin 0.5% was found for SP 117 as compare to SSF or SP118. The maximum dead in shell, mal-position and mal-

formation were found for SP 117 due to maximum deviation from SI as compare to SSF or SP118. So, deviation from standard SI may result in increase of dead in shell, mal-position and mal-formation.

## CONCLUSION AND RECOMMENDATION

Eggs shape index is a critical factor to achieve standard hatchery parameters. Deviation from standard SI, may results decrease in hatchability and increase in dead in shell along mal-position and mal-formations.

## DECLARATIONS

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### Author's contribution

Dr. Adnan Jabbar Ansari was main author responsible for tabulation of experimental data and article writing. Dr. Yasir Allah Ditta, Dr. Abdul Hameed and Dr. Amjad Riaz helped in data collection and statistical application.

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### Conflict of interest

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article.

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