Effects of Setting Eggs Small End up on Hatchability and Embryo Mortality in Japanese Quail (*Coturnix coturnix japonica*)

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Abstract: It was reported that the hatchability of chicken eggs incubated with their small ends up was 16 to 27% lower than eggs set with their large ends up. The aim of this study was to investigate the effect of setting eggs with small end up on hatchability and embryo mortality in Japanese quail. A total of 240 fertile quail eggs was collected from commercial Japanese quail flock at the same age. Eggs were divided into two treatments in four replicate: 1) Group1 or setting eggs large end up 2) Group2 or setting eggs small end up. Eggs were incubated under usual conditions. Incubation results showed 86.6 and 84.4 % total hatchability for group1 and 2, respectively. Early, mid or late embryo mortalities were 3.3, 2.7 and 7.3% for group1 and 3.3, 3.3 and 8.9% Group2, respectively. In this study, small end up eggs had lower hatchability ascompared with large end up eggs. Mid and late embryonic mortalities were higher in small end up eggs. It was concluded that setting eggs small end up, has significant effects on hatchability and cause higher embryonic mortality at late incubation period in Japanese quail without any effects on body weight of hatched chicks.

Key words: Embryo mortality · Hatchability · Japanese quail

INTRODUCTION

The egg shell permits respiration by allowing oxygen to pass through tiny pores in its surface. Until the chick is able to crack the shell, respiration can only occur with the help of oxygen that passes through these pores. During incubation, after the egg has been laid, an air cell will form at the large end as a result of the separation of the two membranes [1]. Tiwary and Maeda [2] reported that egg stored with the small end up (opposite position) had significantly higher hatchability ascompared with large end up eggs (Normal position), They attributed this condition to little water losses that can affect hatchability indirectly.

In poultry, the embryo is normally oriented with its head in the large end of the shell. When an embryo is not situated correctly, reduced hatchability and lower chick quality are common problems that may occur. Sometimes a chick embryo is unable to locate the air cell and accidentally pips the small end of the shell, which causes the chick to hatch too early [1].

It was found that hatchability is reduced by approximately 17% when broiler breeder eggs are set small end up. An increase in mortality occurred during last week of incubation after day-nineteen when the embryo is normally poking its beak into the air cell or what is called "internal piping" [3]. It is suggested, the egg cannot properly provide an environment for the developing embryo to hatch and become a high quality chick in the case of setting eggs small end up [1,3].

Quail rising has become an important poultry business in the world. Incubation procedures are important for maintenance and improvement of quail egg production. Many factors can interfere with the success of incubation or the quality of hatched chicks, such as egg position during artificial incubation. It is clear that the turning of avian egg during incubation is necessary for success of process. Lack of egg turning results in poor chick hatch and delays hatch for a few days [4, 5]. Elibol and Brake [6] found increase mortality in malpositioned embryos with a complete absence of turning during first week of incubation.

The avian embryo progresses through a series of positions throughout incubation and ends in a normal position for hatching [7]. Egg position changes the exposed surface area, changed the loss of water from the egg and finally, affect hatchability indirectly [2]. Information about the effects of egg position during incubation for Japanese quail eggs is lacking [8].

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Therefore, this study was conducted to investigate the effect of setting eggs small end up on hatchability and embryo mortality in Japanese quail.

MATERIALS AND METHODS

Experimental Grouping and Conditions: A total of 80 fertile quail eggs was collected from commercial Japanese quail flock at the same age. The eggs stored at control storage condition (12°C and RH: 70%) for 48h and divided into two treatments in four replicate:

1) Group1 or setting eggs large end up
2) Group2 or setting eggs small end up

Next, eggs were incubated in standard hatchery (SAM® – Iran) by 37.6°C dry bulb temperature and RH: 60%. For exact observation and determination of incubation results, egg set of each treatment was enclosed with wooden boxes (for avoiding any error in counting or weighting of chicks at hatching time).

Determination and Analysis of Results: Chicks from two groups were immediately weighted after hatching. At end of 17d (end of incubation and hatching proccess), total hatchability were determined. Embryo mortality (Early: 0-7d, mid: 7-14d or Late: 14-end according to Petek and Dikmen [9]) was estimated by cracking of non-hatched eggs and morphological examination of dead embryos.

All of collected data were recorded in Excell software and analyzed by SAS software (Ver.9.1) with T-test (LSD).

RESULTS

At the end of the experiment, incubation results showed 86.6 and 84.4% total hatchability for group1 and 2, respectively (Table 1). Embryo mortality was determined in non-hatched eggs and categorized into three classes,: early, mid or late mortalityas 3.3, 2.7 and 7.3% for group1 and 3.3, 3.3 and 8.9% for group 2, respectively (Fig. 1).

Table 1: Some of hatching characterizes in quail two in relation to egg setting positions

Experimental groups	Length of incubation (hours)	Embryo mortality (%)	Hatchability (%)	Weight of hatched chicks (g)
Group1 (*Large end up*)	396[b]	13.4[b]	86.6[a]	8.2[a]
Group2 (*Small end up*)	430[a]	15.6[a]	84.4[b]	8.1[a]

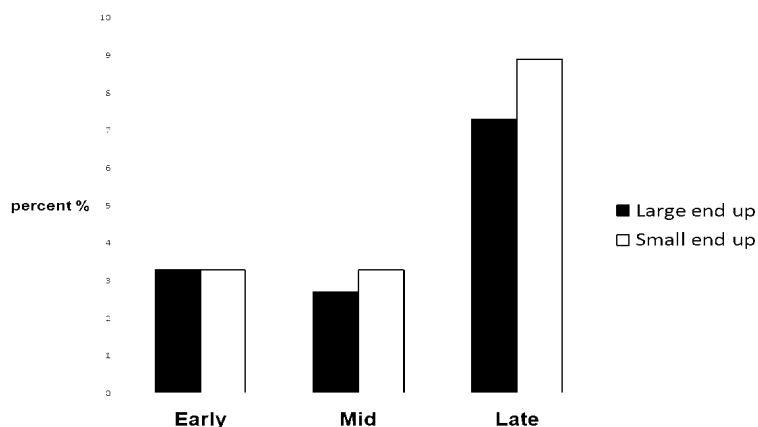☐ Different letters show significant differences (a or b)

Fig. 1: Mortality rate in different stage of quail embryo development with two egg setting positions

DISCUSSION

Yoshizaki and Saito [5] found that quail eggs incubated in vertical position with small end down and turned every two hours had 85% hatchability, while the group of eggs placed with their equatorial side down without turning had only 24%. Wilson *et al.* [7], when eggs incubated in vertical small end up position, a greater number of bobwhite quail chicks failed to hatch.

In this study, small end up eggs had lower hatchability as compared with large end up eggs. Mid and late embryonic mortalities were higher in small end up eggs. However, the body weight of hatched chick was not significantly different. Results of the present study about late embryonic mortality were in agreement with Moraes *et al.* [8]. In the present study, early embryo mortality was almost equal between two setting conditions. But, Moraes *et al.* [8] reported that the early

mortality was high, unlike to present results. The overall, results of this study about hatchability and embryo mortality was partly similar to Moraes *et al.* [8] and Bauer *et al.* [3] but at the present study, differences between two experimental groups for hatchability were less than that reported in their study. Also, the longer incubation period was observed in eggs with small end up. Unfortunately, Moraes *et al.* [8] did not estimated the length of incubation period for groups. It is suggested, in setting eggs with small end up, embryo is not situated correctly in egg and were unable to locate the air cell, especially at last 2/3 of incubation period with high environmental demands as compared with first 1/3 of incubation period. A few embryos from small end up eggs may success to hatch just after longer incubation period.

It is concluded that setting eggs small end up, has significant effects on hatchability and cause higher embryonic mortality in late incubation period in Japanese quail, because of unsuitable position and limited space.

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