HATCHABILITY PERFORMANCE OF JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*) EGGS INCUBATED IN HORIZONTAL AND NARROW - END UP POSITIONS USING A LOCALLY FABRICATED KEROSENE INCUBATOR

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Abstract

Hatchability performance of Japanese quail (Coturnix coturnix japonica) eggs incubated in the horizontal and narrow end up in a kerosene incubator were investigated in Vom, Plateau State. Six hundred (600) quail eggs divided into four (4) experimental groups of 150 eggs per group and five replicates per unit were used. Results obtained on hatchability were statistically significant ($P < 0.05$). Eggs incubated in the horizontal position without turning showed lower hatchability compared with eggs subjected to regular turning in all the units studied. On egg weight loss, eggs incubated in the vertical position with narrow end up had the highest weight loss (11%), accounting for the poor hatchability reported in this group (13%). Similarly eggs incubated in the horizontal position without turning indicated higher weight loss (8%) compared to its counter-part subjected to regular turning (7%). Highest value of late embryonic mortality (70%) was observed in eggs incubated vertically with narrow end up, while 9% (lowest value) was recorded in eggs incubated in the horizontal position and subjected to regular turning. The low late embryo mortality was considered the main reason for the high hatchability reported in eggs incubated in the horizontal position with regular turning (80%). It was concluded that egg position using the kerosene incubator significantly ($P<0.05$) influenced hatchability. Quail eggs should be set in the incubator conventionally with their narrow end down to permit free gaseous exchange during embryonic development via the “air space” located at the broad end.

Key words: Hatchability, Kerosene incubator, Incubation positions and Quails

Introduction

Quail rearing has become a very important aspect of poultry industry in Nigeria following the importation of 450 quail eggs from Benin Republic in 1992 by the National Veterinary Research Institute, (NVRI), Vom. Out of the 450 imported quail eggs, 377 were suitable for incubation and 141 with an average weight of 4.5g per chick successfully hatched (Musa *et al,* 2008). Quails mature early, as they begin to lay eggs when 5weeks old. Okpala, (2003) and Musa *et al,* (2008) reported that quails have short generation interval, hardy and relatively withstand most poultry diseases compared to chickens (Naveen and Arun, 1992; NVRI, 1996). Consumers are now more aware of the benefits of food products high in unsaturated fats and low in saturated fats and cholesterol (Castor and Leeson, 1990; Musa *et al,* 2008). Consequently the demand for quail meat and eggs is on the increase as they have gained more consumer attraction. Nigeria with over 140 million people must intensify efforts in livestock and poultry production to meet the Food and Agriculture (FAO) minimum recommended animal protein intake of 65g per head per day for Nigerians. Because of its inherent advantages, quail production would greatly enhance the realization of the 7 point agenda of the Nigerian Government, which is a fulcrum to the nation’s development vis-à-vis food security. Previous studies on hatchability were based on eggs incubated in the conventional position and in automatic electric incubator (NVRI 1996, Elibol *et al*, 2002, Okpala 2003,). Many factors can interfere with the success of incubation and/or quality of hatched chicks, such as egg position and turning as well as incubator parameters. Many studies on hatchability and post hatch performance of chicks have been carried out with chicken eggs. There is however limited information on quail eggs’ hatchability in a kerosene incubator, set horizontally and with narrow end up.

Materials and Methods

Study site

Vom, the study area is a small town located South of Jos, the Plateau State capital, in Nigeria on a high altitude of 1280m above sea level. The annual rainfall ranges between 1,380 – 1500 mm extending from April to October. The months of July and August mark the peak of rainfall while the dry season falls between November and March. During this period, the temperature ranges between 13.90^{0}C to 31^{0}C (Okpala, 2003)

Management of quails and egg collection

Quail breeders from NVRI poultry farm, housed in the ratio of 1 male to 4 females were used for this study. Due to the fast growth rate and early maturity traits of quails, they were fed balanced feed containing 23% crude protein according to NRC guidelines and the average feed consumption was 20 – 25g per bird per day. Water was given *ad libitum.* Ideal management practices for optimum performance were carried out, but vaccinations were not administered, because quails are not susceptible as chickens to common poultry diseases. Eggs were collected at 8.00am and 3.00pm daily. About 90% of eggs were laid between 4.00pm and 7.00pm.

Egg selection, incubation and hatching

The 600 quail eggs used for this experiment were collected from quail breeders from NVRI poultry farm. After collection, the eggs were subjected to careful selection. Dirty, cracked and poorly shaped eggs were rejected. The eggs were divided into four experimental groups, according to their setting position during incubation. Each experimental unit was made up of 150 eggs and replicated five times. All the eggs were identified, weighed and incubated. The incubation positions studied were; narrow end down (position A), narrow end up (position B), horizontal without turning (position C) and horizontal with turning 3 times every day (position D). The incubator was left running for 24 hours at a constant temperature of 39. 4^{o}C (103^{o}F) and relative humidity of 60 – 70%.

On the 15th day of incubation, the eggs were weighed individually and the hatches were harvested on the 17th day. Un-hatched eggs were broken and assessed. They were classified as infertile, early or late embryonic mortality as described by Pedroso *et al* (2006); early dead embryos (1 – 4 days), intermediate late (5 – 15 days) and late dead embryo (15 – hatch day). Completely Randomize Design (CRD) was used for this experiment. Data generated were subjected to analysis of variance as outlined by Steel and Torrie (1980), while means were separated using student's t – test (Hayslett, 1985).

Results and Discussion

Results of hatchability and egg weight loss of Japanese quail eggs set at different incubation positions are presented in Table1.

Table 1: Hatchability and egg weight loss of Japanese quail eggs set at different incubation positions.

Parameter	Hatchability ± SD (%)	Egg weight loss ± SD (%)
Vertical, narrow end down	62.5 ± 5.6^{b}	9.2 ± 1.5^{c}
Vertical, narrow end up	13.0 ± 1.8^{c}	11.0 ± 1.8^{d}
Horizontal with turning	80.0 ± 6.8^{a}	7.0 ± 1.0^{a}
Horizontal without turning	58.4 ± 8.4^{b}	8.0 ± 1.3^{b}

A, b, c means in the column followed by different superscript differed significantly (P < 0.05)

Eggs incubated without turning (static position) in all units studied significantly had lower hatchability (P < 0.05), compared to those with regular turning. The result showed that egg turning during incubation improved hatchability. This is in conformity with the report of Elibol *et al* (2002) and Yoshizaki and Saito (2002), who reported that avian eggs need to be turned during incubation for normal embryonic development to take place. Egg incubation without turning has been reported to be detrimental to embryo development. Egg turning during artificial incubation however has some benefits, such as reduction in embryo mal-positioning (Robertson, 1961), prevention of abnormal adhesion of the embryonic membranes to the shell membrane (New, 1957) and the complete and timely closure of the chorioallantois at the small end of the egg (Deeming, 1989a, b). While Wilson *et al* (2003), reported that the avian embryo progresses through a series of positions throughout incubation and ends in a normal position for hatching. Tiwari and Maeda (2005) observed that egg turning and egg position during storage and incubation can interfere with embryo position, affecting hatchability and chick quality. This is because egg position changes the exposed surface area, changing rate of water loss by evaporation loss from the egg.

Egg weight loss is a vital parameter that indicates rate of gas exchange between the internal structures and external environment due to the embryonic metabolism and development that take place during incubation. Horizontally incubated eggs without turning had higher weight loss (8.0± 1.3) than horizontally incubated eggs with turning (7.0 ± 1.0) similarly vertically incubated eggs with narrow end up had higher weight loss (11.0 ± 1.8) as against 9.2 ± 1.5 for eggs with narrow end down Rahn and Ar (1974), explained that too low or too high water loss influences embryo development and egg weight during incubation. Egg weight loss was calculated only for eggs that hatched. Results on embryonic mortality of Japanese quail eggs set at different incubation positions are presented in Table 2. Higher infertile/early embryonic mortality was recorded in eggs set vertically with narrow end up, while the lowest was observed in eggs incubated horizontally without turning. This could be due to the occlusion of air space during incubation in eggs set with narrow end up. New (1957) gave reason for high embryonic mortality in unturned eggs as due to premature adhesion of embryonic membranes to the shell membranes.

Table 2: Result on embryonic mortality of Japanese quail eggs set at different incubation positions.

Parameter	Infertile/Early Embryonic Mortality ± SD (%)	Late embryonic mortality ± SD (%)
Vertical, narrow end down	14.0 ± 4.1^a	25.2 ± 6.2^a
Vertical, narrow end up	23.2 ± 15.5^a	70.0 ± 18.6^b
Horizontal with turning	16.6 ± 10.5^a	9.0 ± 6.9^a
Horizontal without turning	12.2 ± 4.2^a	33.6 ± 3.5^a

a, b means in the column followed by different superscripts differed significantly (P < 0.05)

Similarly highest embryonic mortality (69.5 ± 18.6) was obtained in eggs set vertically with narrow end up and lowest value (9.2 ± 6.9), was recorded in eggs incubated horizontally with turning. Deeming (1989a) reported that static incubation results in poor development of the area vasculosa which can produce a reduced rate of embryo growth.

Conclusion

Horizontal position during artificial incubation with turning three times every day, significantly influenced hatchability of Japanese quail eggs and so should be adopted. Findings from this work were specifically from the use of portable NVRI fabricated kerosene incubator which composed of thermostat, thermometer, egg tray, moisture compartments, kerosene tank, a heating unit, head chamber exit flow and ventilator.

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