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Original Research Article

Hatchability traits of normal feathered and naked neck *Tswana* chickens reared under intensive system

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A B S T R A C T

An experiment was carried out to compare hatchability traits of naked neck and normal featheredindigenous *Tswana* chickens reared under intensive system. A total of 108 eggs (54 naked neck and 54 normal feathered) were used to study hatchability traits of the two genotypes. Eggs were collected at least two times in a day and stored at room temperature with their broad ends up for ≤7 days. Thereafter, eggs were incubated at 37.5-37.8 ^{0}C and 60% relative humidity for 21 days. At the end of day 21, chicks were removed from the hatcher and counted. All unhatched eggs were broken and dead in shell embryos, clears, alive in shell counted. Abnormal and normal chicks were also counted. All parameters were expressed as percentages of eggs set. Data were analysed using General Linear Model procedure of Statistical Analysis System (SAS). The results showed that percentage hatchability, clears and normal chicks were significantly ($P<0.05$) affected by genotype. Hatchability was significantly ($P<0.05$) higherfor normal feathered chickens (74.074%) than naked neck chickens (48.148%). Again, normal feathered chickens had significantly ($P<0.05$)higher percentage of normal chicks (74.074%) than naked neck chickens (46.296%). On the other hand, naked neck chickens had significantly ($P<0.05$) higher clears (24.074%) than normal feathered chickens (3.074%). Dead in shell embryos, alive in shell and abnormal chicks were not significantly ($P>0.05$) affected by treatment. The presentresults indicated that generally normal feathered chickens performed better than naked neck chickens.

Introduction

The term `hatchability` refers to the percentage of eggs hatched, reported as either a percentage of fertile eggs hatched or percentage of chicks hatched from all eggs incubated (Peters *et al*., 2008). In addition, hatchability denotes the percentage of fertile eggs that hatch successfully following an appropriate

incubation (Deeming, 1995; Dzoma, 2010). Hatchability is a trait of economic importance in the chicken industry because it has a strong effect on chick output (Wolc *et al*., 2010). It is influenced by a number of factors such as egg weight, turning of eggs, storage, humidity, shell strength, egg size and genetic factors within the chickens kept. According to Peters *et al*. (2008), the gene make-up of an individual chicken is fixed at fertilization and hence fertility and hatchability are generally considered as traits of two parents.

A previous study by Yakubu *et al.* (2008) in Nigeria reported that hatchability of naked neck and normal feathered chickens did not differ. Similar observations were made by Ahmed *et al*. (2012) in Bangladesh. Ajayi (2010) in Nigeria compared the hatchability of normal feathered and naked neck chickens and found that naked neck chickens had better hatchability (93.1%) than normal feathered chickens (45%). On the contrary, Adeleke *et al.* (2012) studied the effect of crossbreeding on fertility, hatchability and embryonic mortality of Nigerian local chickens and found that naked neck chickens had lower hatchability compared to normal feathered chickens. The authors also found that naked neck chickens had the highest dead in shell embryos than normal feathered chickens.

There is limited information on the hatchability traits ofnormal feathered and naked neck *Tswana* chickens in Botswana. Therefore, a study was undertaken to compare the hatchability traits of normal feathered and naked neck chickens under intensive system.

Materials and Methods

Study area

The experiment was carried out at Botswana College of Agriculture guinea fowl unit located at 24^{o} south, latitude and 25^{o}east, longitude. The site is located on latitude 24o 33 S' and longitude 24o 54' E with an altitude of 994 m above sea level. The average rainfall is 450 mm and mean daily temperature 30^{o}C (Aganga and Omphile, 2000).

Bird management

Twenty six birds (13 naked neck and 13 normal feathered) were obtained from Sefhare, Mahalapye, Oodi and Sebele villages following a survey of their availability in these areas. Each genotype was kept in a pen measuring 1.6m x 1.6m (2.56 m^{2}). Each pen consisted of one cock and 12 hens of each genotype. Each pen was provided with a laying nest made of hard board. All birds were treated with Karbaryl (Karbadust powder) to control external parasites (mites). Birds were exposed to normal hours of day light. All birds were fed layer diet. Feed and water were provided *adlibitum*.

Egg collection, management and incubation

Eggs were collected in egg paper trays twice a day, *i.e*., in the morning and afternoon. Each egg was individually marked with a pencil. Dirty, misshapen and cracked eggs were discarded. Eggs were stored at room temperature with their broad ends up for ≤7 days according to genotype. A total of three replicates of 18 eggs each were incubated at 37.5- 37.8 ^{o}C and 60% relative humidity (Moreki and Mothei, 2013) for 21 days. This means

that a total of 54 eggs per genotype (treatment) were incubated. Eggs were individually weighed using a digital electronic scale (set at 0.001 g) and thereafter set. Only eggs that weighed 42 to 57 g were incubated.

Prior to transfer of eggs from the setter to the hatcher (*i.e.,* at day 18), hatcher trays were partitioned using hard boards to prevent chicks from mixing during the hatching process. At the end of 21 days chicks were removed from the hatcher and counted. Chicks from replicates within a genotype were combined to make one treatment.All unhatched eggs were broken and dead in shell embryos, clears and alive in shells counted and recorded. Also, normal and abnormal chicks were counted and recorded. Deformed chicks were considered abnormal. Hatchability for each treatment was calculated using the following formula:

Hatchability = total number of hatched eggs/total number of eggs set x 100
Other parameters such as dead in shell embryos, alive in shells, clears, normal and abnormal chicks were calculated and expressed as a percentage of set eggs.

Experimental design and statistical analysis

The design for the experiment was Complete Randomized Design (CRD). Data were analysed using General Linear Model procedure of Statistical Analysis System (SAS) 2008. Treatment means were separated using Student t-test at P<0.05 significant level.The statistical model given below.

$Yij=\mu+\alpha i+\square ij$
Where: Yij = trait observed on i^{th}treatment for j^{th}replicate
μ = general mean effect on the trait
αi= effect of the i^{th}treatment
□ij = random error

Results and Discussion

Hatchability

Data on hatchability traits of naked neck and normal feathered chickens are presented in Table 1. Significant(P<0.05) differences were recorded regarding hatchability for naked neck and normal feathered chickens. Normal feathered chickens had higher hatchability than naked neck chickens. These findings are in agreement withBobbo *et al.* (2013) in Nigeria who reported that hatchability parameters such as egg weight, hatchability of set eggs, dead in shell embryos, normal and abnormal chicks were significantly different. Similarly,Adeleke*et al.*(2012) and Peters *et al*. (2008)in Nigeria found that naked neck chickens had lower hatchability than normal feathered chickens.Higher hatchability values were recorded in the study byPeters *et al*. (2008) compared to the present study. The differences in the results could be ascribed to the differences in insemination methods. Birds in the study by Peters *et al*. (2008) were artificially inseminated, whereas in this study birds mated naturally. Artificial insemination ensured that all birds were inseminated and this improved fertility of laid eggs resulting in higher hatchability. Heier and Jerp (2001) stated that hatchability is influenced significantly by genetic factors acting directly or indirectly through the egg.

The finding on hatchability in this study is in disagreement with Ahmed *et al.* (2012) in Gazipur and Mymesingh (Bangladesh) and Yakubu *et al.* (2008) in Nigeria. In the

current study, hatchability values for naked neck and normal feathered chickens are lower compared to the values reported by Ahmed *et al.* (2012). The authors reported hatchability values for naked neck and normal feathered chickens to be 87.40% and 86.98%, respectively compared to 48% for naked neck chickens and 74% for normal feathered chickens in this study. The differences in the results of the present study and that of Ahmed *et al*. (2012) could be ascribed to the differences in rearing conditions/systems. Birds in the study by Ahmed *et al*. (2012) were reared under extensive/scavenging system and under intensive systemin the present study. It is therefore possible that permanent confinement of *Tswana* chickens could have imposed stress on them, thus resulting in less mating activity; hence lower fertility of eggs and lower hatchability. Compared to the high yielding commercial chickens, indigenous chickens are not used to permanent confinement. Okeno *et al*. (2004) stated that confined birds do not have free access to green pastures which are rich in vitamins during scavenging, and vitamins play a significant role in fertility of animals. The unusually high ambient temperatures (33 ^{o}C) and low relative humidity (35.7%) experienced in Botswana in the last quarter of the year 2013 could have also contributed to low hatchability in this study. According to van Wageningen and Meinderts (1990), eggs should be stored at 20 ^{o}C and at relative humidity of 70-85% for ≤7days prior to incubation.

Clears

Treatment had significant (P<0.05)effecton the clears (Table 1). This finding is in agreement withBobbo*et al.* (2013) in Nigeria. In this study, naked neck chickens recorded significantly (P<0.05) higher number of clears than normal feathered chickens. The possible reason for high number of clears in this study could be that the cockerels were fat due to overfeeding resulting in some eggs laid being unfertilized. The high sex ratio (1 male: 12 females) in the present study could have also contributed to the increased number of clears. Merge *etal*. (2005) in Kenya recommended a sex ratio for indigenous chickens to be 1:5.Again, Alsobayel and Albandry (2012) in Saudi Arabia reported that higher hatchability values are achieved at a sex ratio of 1:6. As mentioned earlier, the current experiment was conducted at a time when the country was experiencing high ambient temperatures which also reduced bird mating activity. Heat stress has also been found to reduce mating activity (Ernst *et al*., 2004). vanWageningen and Meinderts (1990) reported that many clears can be due to incompatibility among birds, or eggs stored under wrong conditions (*i.e*., wrong temperature and relative humidity). Also, Ernst *et al*. (1999) stated that high number of clears could be attributable to wrong male to female ratio and preferential mating in pen mating.

Normal chicks

As shown in Table 1, normal chicks were significantly (P<0.05) affectedby treatment. This finding is in agreement with Bobbo*et al.* (2013) in Nigeria. In the current study, normal feathered chickens recorded significantly (P<0.05) higher normal chicks (74.074%) than naked neck chickens (46.296%). Similarly, Bobbo*et al*. (2013) recorded significantly higher percentage of normal chicks from eggs from normal feathered chickens (31.08%) than naked neck chickens (19.16%).

Table.1 Means and standard errors on hatchability traits of normal feathered and naked neck *Tswana* chickens reared under intensive system

Traits (%)	Normal feathered	Naked neck
Hatchability	0.74074(0.274)[a]	0.48148(0.274)[b]
Dead in shell embryos	0.2222(0.249)[a]	0.2592(0.249)6[a]
Clears	0.03704(0.193)[b]	0.24074(0.193)[a]
Alive in shells	0.0000(0.056)[a]	0.1852(0.056)[a]
Normal chicks	0.74074(0.274)[a]	0.46296(0.274)[b]
Abnormal chicks	0.0000(0.056)[a]	0.01852(0.056)[a]

Means with the same letter are not significantly different
Values in brackets are standard errors

Dead in shell embryos

Dead in shell embryos were not significantly (P>0.05) affectedby genotype (treatment). Similar observations were made by Bobbo*et al.* (2013) in Nigeria. According toKalita*et al.* (2013), various causes of high dead in shell embryos include genetic factors, breed, frequent power failures leading to incorrect turning and temperature, and lack of proper hygiene. Also, Deeming (1995) stated that high embryonic mortality in ostriches can occur due to microbial contamination. In addition, if eggs are not collected and cooled down to storage temperature, pre-incubation and embryo development will begin and this increases the number of early dead germs resulting in decreased hatchability (Cobb Breeder Management Guide, 2008). Similarly, Ernst *et al.* (1999) stated that high dead in shell embryos could be due to improper incubation temperature, unknown power failure, improper turning and infected eggs.

Alive in shells and abnormal chicks

Alive in shells and abnormal chicks were not affected (P>0.05) by genotype (Table 1). Only one alive in shell was recorded for normal feathered chickens. According to van Wageningen and Meinderts (1990),alive in shells could be attributable to incorrect turning or incorrect humidity level either too dry or too wet. Deeming (1999) stated that failure to turn poultry eggs during incubation causes problems with the formation of extra-embryonic fluids and in the utilization of albumen proteins.

In the present study, only one abnormal chick (deformed) was recorded under naked neck chickens. According to Cobb Breeder Management Guide (2008), chick deformity could be attributable to temperature variation within the incubator due to power failures.

Of all hatchability traits studied, only hatchability, clears, and normal chicks were significantly (P<0.05) affected by genotype. Under intensive management, normal feathered chickens performed better in hatchability traits than naked neck chickens. Further research is needed to investigate hatchability traits of naked neck and normal feathered chickens under extensive system.

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