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EFFECT OF EGG SIZE ON HATCHABILITY OF GUINEA FOWL KEETS

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Abstract:An experiment was conducted to determine the effect of egg size on hatchability of Guinea fowl keets. Three different egg size groups (treatments): small (<39 g); medium (39-42 g) and large (>42 g)] were used in the experiment. Each treatment had three replicates of 10 eggs each. A complete randomized design was used for the experiment. Eggs were incubated with their sharp ends pointing downwards at 37.5-37.8 ^{o}C and 60% relative humidity for 28 days.Thereafter, incubation parameters including hatchability (number of eggs that successfully hatched), dead in shells (DIS), clears, pips and keets with deformities evaluated. Data were analyzed using General Linear Model (GLM) of SAS. Medium sized eggs had significantly (P<0.05) higher hatchability than small eggs. Also, medium sized eggs had lower pips. Egg size did not have effect on DIS, clears and deformities. The results of the present study showed that medium sized eggs (39-42 g) hatched best in comparison to both small and large categories.

Keywords:Dead in shells, deformities, egg size, guinea fowl, hatchability, incubation

I. INTRODUCTION

Although Guinea fowl are indigenous to Africa they are still farmed at subsistence level in most African countries including Botswana. Nsoso *et al.* (2003) [1] stated that guinea fowl are adaptable to harsh climatic conditions of Botswana and survive well with limited feed resources for most part of the year. Previous study by Kusina *et al.* (2012) [2] in Zimbabwe reported that extensive (scavenging) and semi-intensive rearing systems were the two types of rearing systems practiced, with the former being the most predominant. Furthermore, egg production was reported to be 89±50 (range: 0 to 200 eggs/hen) and hatchability 64% (range: 0 to 100%). This indicates that hatchability is poor under scavenging and semi-scavenging systems.

Guinea fowl breeding hens produce thicker shelled eggs in comparison to that of a regular chicken. An eggshell makes up 15 % of the total weight of the guinea fowl egg which is 9% of that of a regular chicken egg [3]. Guinea fowl eggs exhibit low hatchability than chicken eggs mainly because of their thicker eggshells. According to Nwagu (1997) [4], the main factors that affect hatchability are egg size, shell quality and variation in brooding temperature [4]. King'ori (2011) [5] stated that fertility and hatchability are two major parameters that highly influence the supply of day-old chicks. Fertility refers to the percentage of incubated eggs that are fertile while hatchability is the percentage of fertile eggs that hatch.

Very little research has been done on guinea fowl in Botswana [1] as guinea fowl farming is in its infancy in the country [6, 7]. This has inspired the authors to undertake investigations aiming to determine the effects of egg size on hatchability of guinea fowl keets.

II. MATERIALS AND METHODS

A. Bird management and egg collection

Guinea fowl (the Pearl and Lavender) were housed in one pen and fed commercial layer diet. Feed and water were given *adlibitum* [6]. A total of 90 eggs were obtained from Botswana College of Agriculture Guinea Fowl Unit and were individually weighed and subjected to three weight groups: small (<39 g); medium (39-42 g) and large (>42 g). The three egg weight groups served as treatments. Each treatment was replicated three times with each replicate having

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10 eggs (*i.e.*, each treatment had 30 eggs). Prior to incubation eggs were stored at room temperature up to seven days as this is the normal practice in the field.

B. Egg collection, Management and Incubation

Eggs were collected in the morning in containers which were cushioned to avoid breaking or shaking [8]. Dirty eggs were discarded during egg collection. Each egg was individually marked with a pencil before incubation and thereafter weighed using an electronic weighing scale. Each batch of eggs was separated from each other so that there was no mixing of different sizes in the incubator (setter). Eggs were incubated at 37.5-37.8 ^{o}C and 60% relative humidity for 28 days [9]. During egg transfer from setter to the hatcher (*i.e.*, 3 days prior to hatching) hatching egg trays were partitioned using hardboards to allow placing of eggs into three treatment groups, *i.e.,* eggs from replicates were combined to make a treatment. At 28 days of incubation keets were removed from the hatching trays and counted. The number of dead in shells (DIS) was determined by breaking the unhatched eggs, number of keets that successfully hatched was determined by the number of keets that emerged from the eggs, whereas the number of pips was determined by checking for those eggs that cracked but the keets did not emerge [10]. Weak and leg deformed keets were also recorded.

C. Experimental Design and Statistical Analysis

The experimental design used was Completely Randomized Design (CRD). Data were analysed using General Linear Model procedure of Statistical Analysis System [11]. Treatment means were separated using Student t-test at $P<0.05$ significant level.

III. RESULTS AND DISCUSSION

A. Hatchability and pips

The effect of egg size on hatchability of guinea fowl eggs is illustrated in Table I. Hatchability for small and medium size eggs was significantly different ($P<0.05$) from each other. Small eggs had significantly ($P<0.05$) lower hatchability (20.0%) compared to medium-size eggs (69.23%). However, hatchability for small eggs did not differ significantly ($P>0.05$) with that of large eggs (50.85%). Also, the hatchability for medium-size and large eggs was not significantly different. These results are consistent with Abiola *et al.* (2008) [12] who reported 96.67% hatchability for medium size eggs from broiler breeders, while large eggs had the lowest value of 82.88% hatchability. Similarly, Wilson (1991) [13] found that within the flock of guinea fowl, ducks, chickens, turkey, intermediate size eggs hatch better than small or large eggs. The author attributed lower hatchability and fertility for all the egg categories to long storage (6 days after collection) of eggs before being set in the incubator. Also, Gonzalez et al. (1999) [14] found that medium size (1450-1650 g) ostrich eggs had significantly higher hatchability than small eggs (<1459 g). In disagreement with the present findings, Naadam and Issah (2012) in Ghana reported higher percentage hatchability of 72.8% and 73.6% for guinea fowl eggs that weighed on average 31.4 and 31.8 g, respectively, which were not significantly different from each other. The previous study used eggs with lower weight than the current study. No explanation could be given for the lower hatchability (20.0%) for small eggs (<39 g) [15]in the current study compared to the higher hatchability values (72.8% and 73.6%) reported by Naadam and Issah (2012*)* [15]. Mbajiorgu (2011) [16] in South Africa determined the effect of hatching egg size on hatchability and hatch-weight of indigenous Venda chickens (*Gallus gallus domesticus*)and found that large-sized eggs (60-69 g) had higher ($P<0.05$) hatchability than medium (<50-59 g) and small-sized eggs (<49 g). However, medium-sized eggs produced chicks with higher ($P<0.05$) hatch-weight than small and large-sized eggs.

TABLE I: Means and standard errors for incubation parameters

Treatment	Hatchability	Dead in shells	Pips	Clears	Deformities
Small (<39 g)	0.2000(0.1999)^{b}	0.2000(0.1999)^{a}	0.2000(0.1999)^{a}	0.2000(0.1999)^{a}	0.2000(0.1999)^{a}
Medium (39-42 g)	0.6923(0.0923)^{a}	0.1538(0.0721)^{a}	0.0000(0.0000)^{b}	0.1154(0.0639)^{a}	0.0385(0.0385)^{a}
Large (>42 g)	0.5085(0.0656)^{ab}	0.1525(0.0453)^{a}	0.0678(0.0291)^{ab}	0.1186(0.0428)^{a}	0.1525(0.0679)^{a}

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

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Percent hatchability among the three egg size groups were much lower than the near 100% reported for Nigerian local chickens [17]. A number of factors including age of flock [18], species used, sample size, experimental conditions and storage conditions [19], incubation relative humidity and egg turning angle [20] have been shown to influence the hatchability of poultry eggs. As such, the low hatchability values recorded for the three egg size groups in the current study may, however, not be a true reflection of the genetic potential of the Pearl and Lavender breeds used.

In this study, the pips for small and medium sized eggs were significantly different ($P<0.05$) from each other. Small eggs had significantly higher pips (20.00%) in comparison to medium size eggs which had no pips (0.00%). However, pips for small eggs did not differ ($P>0.05$) with that of large eggs (6.78%). Also, the pips for medium sized eggs and large eggs were not significantly different. No reason could be given for this result. Previous study by Wilson (1991) [13] reported high pips for large eggs and attributed this to the fact that larger eggs consume more yolk during embryonic development and produce heavier hatchlings which experience difficulties in moving out of the egg shell.

B. Dead in shell, clears and deformities

Egg size had no effect on DIS, clears and deformities (Table I). However, in this study small eggs had numerically higher DIS, clears and deformities than other egg sizes. As shown in Table I, the results obtained on the number of DIS did not follow any particular trend. However, DIS values ranged from 15.25 to 20%. The result on DIS in the current study is inconsistent with Abiola *et al*. (2012) [12] who reported that large eggs had the lowest egg weight loss hence resulting in the likelihood of embryos drowning thus increasing embryo mortalities than both small and medium sized egg categories.

Clears (infertile eggs) in this study followed no particular trend. The clears for small, medium and large sized eggs were 23%, 11.5% and 11.9%, respectively. Medium sized eggs had numerically lower clears compared to other egg sizes. The study by King'ori (2011) [5] attributed infertility of eggs to a number of factors including lethal genes, insufficient nutrients in the egg and exposure to conditions that do not meet the needs of the developing embryo. Although small, medium and large sized eggs showed no significant difference in terms of keets' deformities (Table I), medium sized eggs had significantly lower keets deformities compared to other egg sizes.

IV. CONCLUSIONS

The range of egg size used in this study had a significant effect ($P<0.05$) on hatchability and pips of guinea fowl keets of Pearl and Lavender strains. The study showed that for optimum hatchability, medium size eggs (39-42 g) should be used instead of large (>42 g) and small eggs (<39 g) which had less hatchability percentages. Egg size had no effect on DIS, clears and deformities. It is concluded from the present results that medium size eggs resulted in higher hatchability compared to small and large egg sizes.

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