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National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ngUrl:journals.napri.gov.ng

EFFECT OF EGG SIZE ON HATCHABILITY AND EGG QUALITY CHARACTERISTICS OF TURKEYS IN GOMBI, ADAMAWA STATE, NIGERIA

***Bobbo, A. G., Garba, S. and Barkindo, A. A.**
Department of Animal Science, Modibbo Adama University of Technology Yola, Adamawa State, Nigeria
**Author's E-Mail: bobboaminu@mautech.edu.ng*

ABSTRACT

The study was undertaken to determine the effect of egg size on hatchability and quality characteristics on natural incubation at Tripod Agro-Vet farm Gombi, between April-July 2014. A total of 120 turkey eggs comprising of three different size groups that is small (> 60g), medium (60-69g) and large (>70g) were used in the study. The eggs were product of natural mating from 40 turkey layers reared in deep litter system. Eight broody turkey hens were trained and used as biological incubators. All the data obtained were analysed with the aid of Statistical Package for Social Science (SPSS) software version 13.0 in a complete randomized design (CRD). Hatching eggs had a significant ($p<0.01$) effect with egg size being 50.98, 64.77 and 76.21 for small, medium and large size eggs respectively. Hatchability of set eggs also differ ($P<0.05$) significantly with 47.50, 62.50 and 77.50 respectively for small, medium and large size eggs. Dead in shell and poult hatch weight also differ ($P<0.01$) significantly being 30.41, 7.50 and 0.00: 33.98, 45.24 and 56.39 for small, medium and large size eggs respectively (Table 1). The average egg weight, egg width and egg length differ significantly ($p<0.001$) with 51.620, 64.813 and 76.231; 3.958,4.248 and 4.545 and 5.513cm, 6.035cm and 6.325cm for small, medium and large size eggs respectively. Similarly the mean egg shape index had significant ($p<0.01$) effect with 72.254, 70.137 and 71.989 for small, medium and large size eggs respectively. It could therefore be concluded that turkey eggs that weighed above 70g would be suitable for setting in order to get better reproductive performance and best quality poults, followed by medium sized turkey egg (60-69g). It could therefore be recommended that in order to obtain higher hatchability and better Day-old poults quality on natural incubation, large eggs size should be used and also biological incubators could replace mini modern incubators with minimum cost

INTRODUCTION

Turkey production in Nigeria has largely remained at the small holder level due to many reasons ranging from management problems to lack of awareness, encouragement and information on specific requirement for turkey production (Udokainyang, 2001). Only few farms rear turkeys at a lower level and consequently the production of Day- old is not fully established. Poultry production in Nigeria generally is practiced at levels ranging from subsistence to large scale commercial operators. The supply of day old chicks is very important for the success of the poultry production chain. Commercial operations depend on hatcheries for the supply of day old chicks, while the subsistence farmers hatch their chicks by natural incubation (Stromberg, 2005).

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 hatched out. The most influential egg parameters that influence hatchability are: egg weight, shell thickness and porosity (French,

1991), egg size and age of breeders, season of the year and nutrition, temperature and humidity throughout the incubation period, egg handling and storage (Wilson 1997). In addition, it has been observed that hatchability, chick weight and subsequent growth performance of chicks are closely related to the weight of the egg. In general, chicks hatched from excessively small or large eggs exhibit low growth rates (Uluocak *et al., 1995*). In broiler chickens, Wilson (1991) and Kalita (1994) reported a higher hatchability for intermediate sized eggs compared to too small or too large eggs. In another study with broiler chickens, Abiola *et al*, (2008) reported that egg size typically affects hatching size in birds because the main effects of egg size lies in the mass of the residual yolk sac that the chick retains at hatching. Kitalyi (1998) suggested that the egg production level of turkeys are generally low with only 40-60 small sized eggs produced per bird per year under small holder management conditions. So far there is dearth of information on mass production of day-old poults through biological incubators in this environment

The research is strictly designed therefore, to study the effect of hatchability and some physical egg quality characteristics of turkey eggs using other turkeys as biological incubators in order to save cost and improve the productivity of turkeys in Adamawa State.

MATERIALS AND METHOD

Location of the Study Area

The study was conducted at Tripod Agro-Vet Farm Gombi, Gombi Local Government Area Adamawa state, Nigeria. Gombi is located at latitude 10^{o} 09′ - 10^{o} 16′ North, longitude 12 ^{o} 44′ - 12 ^{o} 74′ East and attitude 596 – 751 meters above sea level. Gombi is sharing boarders with Borno State from the North, Hong Local Government from the East, Song Local Government from the South and Shelleng Local Government from the South-West. It is about 120km North-East of Yola, the state capital of Adamawa (Google Browser, 2016). It has a tropical climate marked by rainy and dry seasons; maximum temperature can reach up to 40^{o}C particularly in April, while minimum temperature can be as low as 16^{o}C between December and January. The mean annual rainfall is less than 1,000mm.

Experimental Design and Management

The study was carried between April and July 2014. A total number of 120 hatchable eggs of different sizes produced by 40 female turkey breeders aged 38weeks were used in the study in a complete randomized design (CRD).

The turkey breeders were raised in an intensive system of management. Natural mating was used in the flock ratio (1:4) of males to females. Locally formulated layers mash were fed and fresh water were given ad-libitum. The eggs for the study were collected, sorted, weighed, labelled and stored at room temperature before setting.

The broody turkeys were given routine chemoprophylaxis and dusted to prevent infections and each was placed in it woody nest box of 1.5ft by 1.5ft square, with the height of 1 foot. Feeds and fresh water were provided to them ad-libitum.

Determination of External Egg Quality Characteristics

Eggs were sorted and weighed before incubation of different egg size groups. Egg weight was determined by using Sensitive Scale (Acculation model 2001- Electric Digital Scale), while egg length and egg width were measured with a pair of Vanier calliper. Egg shape index was calculated as a ratio of egg width to egg length.

$$\text{Egg shape index} = \frac{\text{Egg Width}}{Egg\ length}\ \ x\ 100\%$$

Incubation Procedure

The stored eggs were fumigated with formalin containing potassium permanganate in ratio 1:2 for 15 minutes to kill the germs on the egg shell.

The fumigated eggs were randomly set to eight broody turkeys, 5 small size egg (below 60g), 5 medium size eggs (from 61-69g) and 5 large eggs (70g and above). Total of 15 eggs of different sizes per each clutch were used for natural incubation per turkey.

On the 13th day of incubation, all the set eggs were candled at night to prevent much disturbance and stress to the turkeys. Those eggs with evidence of living embryos (Large dark spot in the center of the egg) were replaced back to the broody turkeys and non-fertile once (Clear yolk, no black spot in the center of the egg) were removed. Hatching started on day 27 and was completed by the end of the 29th day. Hatched poults, embryonic mortalities and dead in shell were recorded, and the following parameters were taken to assess the poults quality. Total hatchability, fertile egg hatchability and fertility were also calculated using the formula below.

1. Fertility (%) = $\frac{\text{No of fertile eggs}}{\text{Total no eggs produced}} \; x \; 100\%$

2. Hatchability on set eggs (%)
$= \frac{\text{Poults hatched out}}{\text{Total no of egg set}} \; x \; 100\%$

3. Hatchability on fertile eggs (%)
$= \frac{\text{Poults hatched out}}{\text{Total no of Fertile egg}} \; x \; 100\%$

Statistical Analysis

All data generated were analyzed using the Statistical Package for Social Science (SPSS)software version 13.0. Differences between treatment means were separated using the least significant difference (LSD). The statistical model used was:

$$Y_{ijk} = \mu + T_j + \sum_{ijk}$$

Where Y_{ijk} = The overall observation (hatchability and chick weight)

μ = Population mean

T_j = Effect of different egg weight (small, medium and large)

$\sum_{ijk}$ = Residual effect

RESULTS

The results of hatchability traits of different egg size groups are presented in Table 1. Some traits were significantly affected, except fertility of eggs, hatchability of fertile eggs, dead embryo and infertile eggs. Hatching eggs had a significant ($p<0.01$) with egg size being 50.98, 64.77 and 76.23 for small, medium and large size eggs respectively. Hatchability of set eggs also differ ($P<0.05$) significantly with 47.50, 62.50 and 77.50 respectively for small, medium and large size eggs. Dead in shell and poult hatch weight also differ ($P<0.01$) significantly being 30.41, 7.50 and 0.00: 33.98, 45.24 and 56.39 for small, medium and large size eggs respectively (Table 1). The average egg weight, egg width and egg length differ significantly ($p<0.001$) with 51.620, 64.813 and 76.231; 3.958,4.248 and 4.545 and 5.513cm, 6.035cm and 6.325cm for small, medium and large size eggs respectively. Similarly the mean egg shape index had significant ($p<0.01$) effect with 72.254, 70.137 and 71.989 for small, medium and large size eggs respectively (Table2).

Table 1: Effect of Egg Weight on Hatchability Parameters of Turkeys

Hatchability Parameters	Treatments (Egg weight groups)			
	Small (g)	Medium (g)	Large (g)	SEM
Egg weight (g)	50.98^{c}	64.77^{b}	76.21^{a}	4.67**
Fertility (%)	75.00	85.00	92.50	2.7 NS
Hatchability of set eggs(%)	47.50^{c}	62.50^{ab}	77.50^{a}	5.30*
Hatchability of fertile eggs(%)	60.84	76.25	80.21	3.70 NS
Dead embryo (%)	8.75	16.25	19.79	1.99 NS
Dead in shell (%)	30.41^{a}	7.50^{b}	0.00^{b}	5.61**
Infertile eggs (%)	20.00	15.00	7.0	2.31 NS
Poult hatch weight(g)	33.98^{c}	45.24^{b}	56.39^{a}	3.96**

Key *p< 0.05, ** p<0.01 NS - non significant
Mean in the same raw with different superscript letter are significantly different

Table 2: Egg Quality Characteristics of Different Egg Size in Turkey

Parameter	Small eggs	Medium eggs	Large eggs	SEM
Egg weigh	51.620^{c}	64.813^{b}	76.231^{a}	0.62***
Egg width	3.958^{c}	4.248^{b}	4.545^{a}	0.60***
Egg length	5.513^{c}	6.035^{b}	6.325^{a}	0.03***
Egg shape index	72.254^{a}	70.137^{b}	71.989^{a}	0.44**

KEY: *** (P<0.001), ** (P<0.01)
NS - non significant
Mean in the same raw with different superscript letter are significantly different

DISCUSSION

The highest hatchability on set eggs obtained on the large egg size group in this study is in conformity with (Sachdev *et al.*1985) Similarly Altan *et al.* (1995), reported that hatchability of set eggs or fertile eggs were higher in heavy weight eggs compared to light eggs. Furthermore it has been reported that hatchability of turkey eggs is maximized with eggs weighing between 70 - 85g (Karacanta *et al.,* 1977). Javid Igbal *et al.,* (2016) reported that hatchability of set eggs were higher in small size eggs in broiler breeder flock. The mean percentage of embryonic mortalities in the small, medium and large size eggs thought is not significantly different in this study, increased as the weight of egg increased. The result is contrary to the findings of Sachdev

et al., (1985),Altan *et al.,* (1995) and Anna Anandh *et al.,* (2012), who reported that embryonic mortality rate was decreased as the egg weight increases. The percentage of dead in shell obtained in this study for all the egg size groups is in contrast to Anna Anandh *et al*., (2012), who reported that higher value in egg weighing >70g. The percentage of dead in shell decreased as the weight of egg increased in all turkey weight groups. An explanation for decreased dead in shell was due to increasing egg size because larger eggs would be expected to have more sufficient nutrient to support embryo compared to small size eggs. This finding is contrary to that of Altan *et al.,* (1995) and Anna Anandh *et al.,* (2012), who reported that the percentage of dead in shell increased as the weight of egg increased in turkey.

The percentage of infertile eggs decreased as the weight of the eggs increased in all the egg weight groups. Anandh *et al., (*2012) and Mroz *et al.,* (2010) reported that percentage of infertile egg was low in turkeys, but may reach 10% at the beginning and towards the end of the laying season. Heaviest poult weight is obtained from the heaviest eggs group recorded in this study is harmony with (Oblakova *et al.,* 2008). On the contrast Asuquo and Okon (1993) observed that egg size within the intermediate weight range of 45 - 56g hatched heavier chicks of good body conformation than smaller or larger eggs. No biological reasons were suggested for such an observation. Furthermore poult hatched weight obtained in this study is not in conformity with values reported (Anna Anandh *et al.* 2012). The reason adduced for this difference is probably due the methods employed in hatching.

The mean egg weight obtained in this study compares favourably with the values by Anna Anandh *et al.,* (2012) who reported 55.61, 65.28 and 72.55g for eggs weighing < 60g,61-69 and >70 grams respectively. Similar trend was also reported by Ozcelik *et al.,* 2009*).* Fat level, age and body weight of the hen, yolk weight and nutrient content can influence egg size in chickens (Javid Igbal *et al.,* 2016). Similarly the result of egg width and length falls within the range reported by Anna Anandh *et al.,* 2012. Malago and Baltiwake, (2009)also reported that increased egg weight increased the egg length and width in Rhode Island Red, local and cross bred chicken eggs. Furthermore, Ng'ambi *et al.,* (2012) observed similar results in indigenous Venda chickens and that the live weights of Venda chickens were optimized at different egg weight. The mean values of shape index in this study tend to agree with (Anna Anandh *et al.,* 2012). Egg shape index is an indicator of external egg quality. The values recorded in this study are slightly lower than (Bobbo *et al.,* 2013) in three phenotypes of local chickens; Protein levels, age and temperature are some of the factors adduced to affect the egg size.

CONCLUSION

It could therefore be concluded that turkey eggs that weighed above 70g would be suitable for setting in order to get better reproductive performance and best quality poults, followed by medium sized turkey egg (60-69g).

RECOMMENDATION

It could therefore be recommended that in order to obtain higher hatchability and better Day-old poults quality on natural incubation, large eggs size should be used and also biological incubators could replace mini modern incubators with minimum cost.

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