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# Comparative Evaluation of Fertility and Hatchability of Horro, Fayoumi, Lohmann Silver and Potchefstroom Koekoek Breeds of Chicken

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## ABSTRACT

Hatchability is important parameter that should be studied before distributing hatching eggs. A study was therefore conducted to compare hatching parameters of four breeds of chickens at Research Center using standard method. A total of 6000 hatching eggs; 1500 from each parent stock namely Local Horro, Fayoumi, Lohmann silver and Potchefstroom Koekoek were collected in 3 batches and hatched. Egg weight showed significant difference among 4 genotypes at ($p<0.01$). Fertility was highest in Fayoumi, followed by Lohmann silver and lowest for Potchefstroom Koekoek and Horro at ($p<0.01$). Hatchability from eggs set was highest for Fayoumi and Potchefstroom Koekoek, followed by Lohmann silver and least for Horro at ($p<0.01$). Hatchability from fertile eggs was highest for Fayoumi followed by Potchefstroom Koekoek, Horro and least for Lohmann silver ($p<0.01$). Dead in germ was highest for Horro followed by Fayoumi and least both for Lohmann silver and Potchefstroom Koekoek ($p<0.01$). Dead in Shell was highest for Horro followed by Lohmann silver and Potchefstroom Koekoek and least for Fayoumi ($p<0.01$). Normal chicks count was highest for Fayoumi and Potchefstroom Koekoek followed by Horro and Lohmann silver and the opposite for Abnormal chicks ($p<0.01$). Average chick weight was higher for Lohmann silver and Potchefstroom Koekoek and lower for Horro and Potchefstroom Koekoek ($p<0.01$). Generally breed had a significant effect ($p<0.01$) on all parameters considered in this study unlike Batch which did not show any effect ($p>0.05$). Genetic difference results in difference in fertility and hatchability.

**Key words:** Local ecotype, dead in germ, relative humidity, incubation condition, embryo

## INTRODUCTION

Fertility and hatchability are the major determinant of profitability in the hatchery enterprise (Peters *et al*., 2008). These parameters appear to be very important as far as parent stocks are kept to produce final hybrids. Hatchability is a complex age dependent trait. Egg production and hatchability of broiler eggs can be influenced considerably by age of the flock (Elibol *et al*., 2002). It comprises of several sub-traits which are susceptible to genetic and environmental factors arising from various sources (Wolc and Olori, 2009; Orunmuyi *et al*., 2007). There are several factors that influence hatchability of eggs like pre-incubation storage time, fertility and incubation condition such as temperature, humidity, ventilation, position, egg turning and candling. Variation in feed

composition resulted in variation in hatchability (Mussaddeq *et al*., 2002). According to Al-Bashan and Al-Harbi (2010) the egg production and hatchability of broiler hatching eggs were the parameters most influenced by the flock, environmental temperature and laying hens stock. They also suggested that husbandry programs of layers in different climatic conditions may be economic fact. However, Zelleke *et al*. (2005) concluded that both sexes are responsible for the poor fertility in Rhode Island Red but the female is responsible for poor hatchability and this poor performance is mainly due to greater egg weight loss during incubation. Apart from these, other factors that can have considerable influence on hatchability include nutrition of the breeding hen, genetic constitution of the embryo, disease, egg size, age and shell quality King'ori (2011). Egg weight, fertility, hatchability and late embryonic mortality varied greatly between feed regimes (Lariviere *et al*., 2009). Similarly, the fertility of an egg is affected by factors directly related to the laying hen such as her ability to mate successfully, store sperm, ovulate an egg cell and finally produce a suitable environment for the formation and development of the embryo Brillard (2003). Fertility also depends on the ability of cock to mate successfully, quantity and quality of semen deposited (Wilson *et al*., 1979; Brillard, 2003). It was also reported by Gheisari *et al*. (2011). Fertility and hatchability were not affected by hen age. In line with this, in Ethiopia, different breeds of chickens are being imported to avail egg and meat to feed the growing population. Most of the hatcheries in the country are known to face depressed hatchability as far as the number of hatch out from the set egg is considered. Little has been done on comparative fertility and hatchability of available breeds including local ecotypes Mebratu (1997). At the same time, newly introduced breeds should be studied as they will be used in the production system for the years to come. This study was therefore conducted to compare the fertility, hatchability and associated traits among Horro, Fayoumi, Lohmann silver and Potchefstroom Koekoek breeds of chicken.

## MATERIALS AND METHODS

This study was carried out at Debre Zeit Agricultural Research Center (DZARC), Debre Zeit, Ethiopia, located at latitude of 08044' N and longitude of 380, 38'E between October 2010 and October 2011. The altitude of the location is 1900 masl and a temperature of Max: 28.3°C and Min: 8.9°C. The Breeds of chicken namely: Horro (a local ecotype under genetic improvement), Fayoumi, Lohmann silver and Potchefstroom Koekoek hens were used in this study.

**Management of birds, incubation and experimental design:** From each breed 400 layer pullets and 40 parent cockerels were randomly selected to this study. The birds were housed in an open, concrete house filled with saw dust at 5 hens per square meter. The birds were exposed to natural day light of approximately 12 h $day^{-1}$. All birds were given *ad libitum* grower feed containing 16% crude protein and 2800 kcal Metabolizable Energy (ME) per a kg of feed till they reach 20 weeks of age. When they reach 20 weeks of age a laying nest were given with an *ad libitum* layer feed of 16.5% crude protein and 2750 Kcal Metabolizable Energy (ME) per a kg of feed. They were provided with an individual wooden laying nest filled with straw for laying their eggs. A total of Hatching eggs 6000 eggs; 1500 hatching eggs from each breed namely Local Horro, Fayoumi, Lohmann silver and Potchefstroom Koekoek were collected in 3 batches immediately after they are laid. Selection of hatching eggs was done based on their uniform size, good shape and clean shell and finally disinfected by rubbing with a wet cloth dipped in a powerful disinfectant before stored. Eggs were then stored for 7 days in a cool room at approximately 17°C and 75 Relative Humidity (RH). The hatching eggs were then fumigated with potassium permanganate

and Formalin before set. The incubator both the setter and Hatcher were washed and fumigated with Potassium permanganate and formalin. Standard relative humidity, temperature and egg turning were programmed on the setter and Hatcher. The average weight of hatching eggs was calculated after weight of all eggs was taken in gram by using digital balance. All eggs from each breed and the same batch were then set in the same incubator. Eggs were candled on the 7th and 14th days of incubation to identify and remove infertile and eggs with dead embryos (dead in germ). The rest of eggs were transferred from the setter to the hatcher on the 18th day of incubation. At the end day 21 the hatcher was opened. The number of hatched chicks including the normal, weak, abnormal chicks, dead chicks after hatch, the un-hatched eggs and pips were counted separately as dead in shell according to breeds and the batches were recorded. Very small and defective chicken on beaks, eyes, legs etc., were counted as abnormal chicks. All abnormal chicks were discarded and the rest of the chicks were counted as normal. Calculation were made of fertility, hatchability, embryonic mortality, dead in germ, dead in shell, abnormal chicks, normal chicks. The average weight of day-old chicks (gram) was calculated after their weight taken by using digital balance.

**Statistical analysis:** Completely Randomized Design (CRD) design was used and all the data were analyzed using SAS (2000). Significant differences of all parameters among the breeds were identified by using Duncan (1955) by comparing the treatment means (means along with their standard errors).

## RESULTS

**Breeds, batches and their interactions on hatchability traits:** The Analysis of Variance of hatchability traits as influenced by different breeds of hens ; Horro, Fayoumi, Lohmann silver and Potchefstroom Koekoek hens are presented in Table 1. Result from analysis of variance indicate that breed had significant effect on all of the parameters studied ($p<0.01$). However, there was no any significant effect of batch on all of the parameters considered ($p>0.05$). The interaction between the two main effect (breed and batch) was significant for hatchability from fertile eggs ($p<0.01$) followed by the rest of the parameters ($p<0.05$) except hatchability from eggs set and average chick weight where no significant interaction observed ($p>0.05$).

**Effect of breeds on hatchability traits:** The different hatchability traits as influenced by hens of different breeds of Horro, Fayoumi, Lohmann silver and Potchefstroom Koekoek hens is

Table 1: Analyses of variances: F-values for hatchability traits

| | Source of variation | | |
|---|---|---|---|
| Parameters | Batch | Breed | Breed×Batch |
| Average egg wt (g) | 1.48 (NS) | 1196.77** | 3.02* |
| Fertility (%) | 3.25 (NS) | 3.19** | 2.28* |
| Hatchability from set eggs (%) | 0.27 (NS) | 175.90** | 0.29 (NS) |
| Hatchability from fertile eggs (%) | 16.32 (NS) | 221.36** | 19.40** |
| Dead in germ (%) | 7.41 (NS) | 584.56** | 5.02* |
| Dead in shell (%) | 0.78 (NS) | 59.63** | 3.64* |
| Normal chicks (%) | 16.24 (NS) | 20.57** | 1.87* |
| Abnormal chicks (%) | 15.11 (NS) | 21.78** | 2.03* |
| Average chick wt (g) | 7.30 (NS) | 768.63** | 0.05 (NS) |

NS: Not significant at $p>0.05$, *: Significant at $p<0.05$, **: Significant at $p<0.01$

Table 2: The effect of breed on the different hatchability traits

| | Breeds | | | |
|---|---|---|---|---|
| Variable | Horro | Fayoumi | Lohmann silver | Potchefstroom koekoek |
| Average egg weight (g) | 41.65±0.4$^{c}$ | 44.23±0.5$^{b}$ | 52.65±0.2$^{a}$ | 53.23±0.2$^{a}$ |
| Fertility (%) | 77.00±0.1$^{c}$ | 91.35±0.5$^{a}$ | 85.56±0.5$^{b}$ | 77.70±0.5$^{c}$ |
| Hatchability from set eggs (%) | 43.80±0.9$^{d}$ | 81.98±0.7$^{a}$ | 68.80±0.9$^{c}$ | 79.88±0.5$^{a}$ |
| Hatchability from fertile eggs (%) | 62.60±0.8$^{c}$ | 86.57±0.8$^{a}$ | 77.73±0.8$^{d}$ | 83.03±0.7$^{b}$ |
| Dead in germ (%) | 17.44±0.4$^{a}$ | 7.02±0.5$^{b}$ | 4.30±0.3$^{c}$ | 4.37±0.4$^{c}$ |
| Dead in shell (%) | 21.47±0.4$^{a}$ | 5.62±0.4$^{c}$ | 12.40±0.6$^{b}$ | 12.21±0.44$^{b}$ |
| Normal chicks (%) | 91.72±0.6$^{b}$ | 95.98±0.7$^{a}$ | 89.48±1.6$^{b}$ | 96.18±0.6$^{a}$ |
| Abnormal chicks (%) | 8.27±0.6$^{a}$ | 4.01±0.7$^{b}$ | 9.62±1.5$^{a}$ | 3.72±0.6$^{b}$ |
| Average chick weight (g) | 30.15±0.8$^{b}$ | 29.73±0.4$^{b}$ | 38.89±0.3$^{a}$ | 40.04±0.3$^{a}$ |

Values with different letters within row are not significantly different at $p<0.05$

presented in Table 2. Average weight of egg (g) was highest for Potchefstroom Koekoek (53.23±0.2) and Lohmann silver (52.65±0.2) at ($p<0.01$), followed by Fayoumi (44.23±0.5) and least being Horro (41.65±0.4). Fertility of Fayoumi (91.35±0.5) was significantly higher followed by Lohmann silver (85.56±0.5), both Potchefstroom Koekoek (77.70±0.5) and Horro (77.0±0.1) showed similarly lowest fertility. Hatchability from Fertile eggs (%) was highest for Fayoumi (86.57±0.8), followed by Potchefstroom Koekoek (83.03±0.7), Lohmann silver (77.73±0.8) and Horro (62.60±0.8), respectively. Hatchability from set eggs (%) of Fayoumi (81.98±0.7) and Potchefstroom Koekoek (79.88±0.5) was significantly higher than the rest of the breeds followed by Lohmann silver (68.80±0.9) and Horro (43.80±0.9) respectively. Dead in germ (%) Horro (17.44±0.4) was significantly higher than the rest of the breeds followed by Fayoumi (7.02±0.5), the least was observed similarly in Lohmann silver (4.3±0.3) and Potchefstroom Koekoek (4.37±0.4). Dead in shell (%) of Horro (21.47±0.4) was higher than the rest of the breeds studied followed similarly by Lohmann silver (12.4±0.6) and Potchefstroom Koekoek (12.21±0.44) and least was observed in Fayoumi (5.62±0.4). Normal Chicks (%) of Potchefstroom Koekoek (96.18±0.6) and Fayoumi (95.98±0.7) was similarly higher than Horro (91.72±0.6) and Lohmann silver (89.48±1.6). Abnormal chicks (%): Horro (8.27±0.6) and Lohmann silver (9.62±1.5) higher than Fayoumi (4.01±0.7) and Koekok (3.72±0.6). Average chick weight (g) of potchefstroom koekoek (40.04±0.3) and Lohmann silver (38.19±0.3) higher than Horro (30.15±0.8), Fayoumi (29.73±0.4).

**The effect of batch on hatchability traits:** The different hatchability traits as influenced by batches of hatching of Horro, Fayoumi, Lohmann silver and potchefstroom koekoek hens were compared. All of the breeds were not significantly different than each other with respect to the different batches.

## DISCUSSION

**Effect of breeds, batches and their interaction on hatchability traits:** The results of this study showed that difference in breeds had significant effect on the different hatchability parameters. As these characters are genetically controlled (Merat, 1990; Froman *et al*., 1992; Islam *et al*., 2002). The finding of this study is therefore in line with the fact that Fertility and hatchability performance of eggs depend on genetic factors in addition to others. The fertility and hatchability are interrelated heritable traits and varies among breeds, variants and individuals

within breeds and variants (Islam *et al.*, 2002). However, Asharf *et al.* (2003) reported that there was no difference in the hatchability between Lyallpur Silver Black (LSB) breed with Rhode Island Red (RIR) breeds of poultry, hatches as well as their interaction. In the present study, fertility was one of the hatchability traits significantly affected by difference in genotypes. This is in agreement with the finding by Durmus *et al.* (2010) who reported fertility, late period embryonic mortality (dead in shell), hatchability of fertile eggs and early embryonic mortality differs between genotypes. Jull (1951) also reported genetic constitution had some effect on embryonic mortality. However, Asharf *et al.* (2003) reported that there was no difference ($p<0.05$) in the fertility between LSB and RIR and their interaction but between the hatches the difference was significant ($p<0.05$). In this study, there appears to be no effect of fertility on hatchability. This is in contrary to the finding by Fairchild *et al.* (2002) who reported that egg fertility and embryonic mortality are among factors that affect hatchability. This situation in the current study might be due to some problems occurred at the hatchery or during hatching process. In the current study breed also had significant effect on the day old chick weight. This is in agreement with Raju *et al.* (1997) who reported that day old chick weight increased significantly with increase in egg weight and could be due to difference in genetic makeup of the chickens. In this study, no significant difference on the different hatchability traits among batches was observed. This is of course in contrary to the finding by Jayarajan (1992) who reported significant difference in fertility between batches (in different periods). The difference in fertility in batches might have resulted from variation in feed quality, male to female ratio or any change in management of a parent stock producing eggs of successive batches.

## CONCLUSION

Breed had significant effect on the different hatchability parameters namely Fertility and hatchability. Breed also had significant effect on the day old chick weight. However, batch had no significant effect on the different hatchability traits. In this study, there appears to be no effect of fertility on hatchability. This study clearly showed that, proper consideration is required while dealing with hatching of eggs from different breeds. However, effect of fertility on hatchability should be reinvestigated before drawing to the final conclusion.

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