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The Effect of Cock: Hen Ratio on Reproduction Performance of Koekoek Chickens in the Lowlands of Lesotho

S.M. Molapo* and P. Kompi

Department of Animal Science, National University of Lesotho, Roma, Australia.

**Corresponding author: sm.molapo@nul.ls*

ABSTRACT

The objective of the study was to investigate the effect of cock: hen ratio on the reproductive performance of Koekoek chickens. Fifty seven hens and nine cocks were randomly allocated to three cock: hen ratio treatments in a Completely Randomized Design (CRD). The cock: hen treatments were 1:3, 1:6 and 1:10 at 37 weeks of age. The birds were allocated into nine pens and each treatment was replicated three times. Thirty eggs were incubated from each replicate hence 270 eggs were used. Data was collected and analyzed using SPSS (17.00). The results revealed that the chickens that were assigned to cock: ratio of 1:10 performed similar to the ones in the sex ratios of 1:3 and 1:6 in terms of fertility. Cock: hen ratio did not have any effect on hatching percentage and embryo mortality. Therefore, when looking at the cost of raising cocks and the level of infighting among the cocks, it would be advisable for the farmers to rear one cock for every ten hens. Koekoek chickens, egg size, fertility rate, hatchability, embryo mortality

Keywords: Koekoek chickens, egg size, fertility rate, hatchability, embryo mortality

Chicken play an important socioeconomic role in developing countries (Alders, 2004). Provision of animal protein and income generation are amongst the major reasons for keeping chickens by rural communities (Alders and Pym, 2009 and Amos 2006). Majority of farmers in the rural villages rear indigenous chickens. The lower production efficiency of indigenous chickens in Lesotho has triggered the Department of Livestock Services of the Ministry of Agriculture in Lesotho to

introduce Koekoek chickens (Molapo, 2011). The supply of day old chicks is very important for the success and sustainability of this native strain of chickens which are locally adaptable to the rural conditions. Most Koekoek chickens farmers depend on hatcheries for the supply of day old chicks while a small number of farmers hatch their chicks by natural incubation. Fertility is very important in poultry production. Fertility refers to the percentage of incubated eggs that are fertile. The profitability in hatchery enterprise is mainly determined by fertility of eggs (Peters *et al.,* 2008). Sex ratio is also an important factor affecting fertility, too many males and few males lead to reduced fertility, therefore it is recommended to have for commercial mini-leghorn, standard leghorn and medium size pullets raised on litter 8 males per 100 females, for commercial mini-meat-type broiler and for standard meat-type pullets 10 per 100 female (North and Bell, 1990). However, Wilson (2003) suggested sex ratios of 1:12 to 1:15 for light breeds and 1:10 to 1:12 for heavy breeds. Hatchability is the percentage of fertile eggs that hatch (Kingo'ri, 2011). Improving fertility will positively increase the hatching percentage since only the fertilized eggs will hatch (Wilson, 1999). The study of Bobbo *et al.* (2013) revealed that hatchability is usually around eight percent points lower than fertility. The lack of information poses a problem to most small holder farmers since they are not aware of the cock: hen ratio in Koekoek chickens and as a result, the reproductive performance of these chickens is low. Therefore, this study was conducted to determine the effect of cock: hen ratio on the reproductive performance of Koekoek chickens in Lesotho.

Materials and Methods

The study was conducted at the Department of Animal Science Experimental Farm of the National University of Lesotho located 35 km from Maseru, the capital of Lesotho. Fifty seven hens and nine cocks were randomly selected at 30 weeks of age. They were obtained from the poultry of the Department of Animal Science Experimental Farm. The birds were fed at the flat rate of 120g per bird in a day. The chickens were fed egg laying meal commercially formulated by Lesotho Farm Feed Manufacturer. Nutrient composition of the diet is shown in Table 1.

The rearing house was divided into nine pens of 3.6 × 1.1 metres. The poultry house was 2.4 metres high so as to have enough ventilation. The birds were raised under deep litter system. Dry grass of about 3 centimetres was used as a litter for the birds. The birds were vaccinated against Mareks and Newcastle diseases. In each pen there was one drinker and one feeder and the provision of feed was at the daily rate of 120 grammes per bird. The study was arranged in a Completely Randomized Design (CRD). Fifty seven hens and nine cocks were

Table 1: Chemical composition of feeds that were fed to Koekoek chickens

Nutrient	Percentage
Protein	13
Moisture	12
Crude fat	2.5
Crude fibre	7.0
Calcium	4.5
Phosphorus	0.5
Lysine	0.5

randomly allocated into three experimental treatments (cock: hen ratios) of 1:3, 1:6 and 1:10. Each treatment was replicated three times. Collection of eggs started four days after the birds were subjected to their respective treatments. Eggs were collected three times a day to avoid dirtiness and they were stored in trays at room temperature before incubation. Eggs collected within eight days were taken to a sure hatch machine for incubation. Dirty, cracked and irregular shaped eggs were not selected for incubation. A 0.01 g sensitivity level electronic scale (RADWAG) was used to weigh the eggs. Eggs were fumigated with formalin potassium permanganate in a ratio 1:2 for 15 minutes before they were placed in an incubator. The temperature and humidity were set to 37.5°C and 82.5%, respectively for incubation and 37.0°C and 85% for hatching. During the incubation period, the eggs were not turned for the first three days. From the fourth day to the eighteenth day, egg turning was done three times a day. The eggs were candled on 7th day of incubation period in a dark room with the eggs held before a light. The infertile eggs were determined by the appearance of clear interior of the eggs and the fertile eggs were determined by presence of blood vessels. The numbers of infertile eggs were recorded. At the 18th day, the eggs were removed from trays and placed into the hatching trays until hatching time. The incubator was not disturbed for the last three (3) days of incubation. The chicks were removed from the incubator on the morning of the 22nd day. The fertility rate and hatching percentage of eggs were calculated as follows:

$$\text{Fertility rate} = \frac{\text{Total number of fertile eggs}}{\text{Total number of incubated}} \times 100$$

$$\text{Hatching percent} = \frac{\text{Total number of eggs hatched}}{\text{Total number of incubated eggs}} \times 100$$

$$\text{Hatching of fertile egg percent} = \frac{\text{Total number of eggs hatched}}{\text{Total number of fertile eggs}} \times 100$$

Eggs that failed to hatch were broken to determine the developmental stage of an embryo. The embryo mortality rate was measured by assessing at the developmental stage at which the unhatched chick died using Hamburger and Hamilton (1992) method. An incubator was opted for instead of natural hatching due to the fact that it would be difficult to control the experiment since it would be difficult to get hens of the same age, size and behaviour. Above all, it would not be practical to assume that the hens would brood at the same time. Data was recorded in excel spreadsheet and averages were calculated. Data was tested for normal distribution. The analyses were done on transformed data. ANOVA was used to separate the effects of cock: hen egg fertility, hatching percentage and embryo mortality. If significant, treatment effects were analysed and differences between treatments were tested by Duncan's new multiple-range test. The General Linear Models Procedure; SPSS (17.00) was used. Threshold for significance was $p< 0.05$.

Results and Discussions

Egg fertility

The obtained results showed no significant ($p<0.05$) difference in egg fertility between Koekoek chickens with cock: hen ratios of 1:3, 1:6 and 1:10. The fertility in chickens with sex ratio of 1: 10 was similar to those in ratios of 1:3 and 1:6 as reflected in Table 2. The egg fertility from chickens with lowest cock: hen ratio (1:3) only exceeded the ones from 1: 6 and 1:10 by 2.22% and 3.56% respectively. Orunmuyi et al. (2013) suggested that Birds mated in the ratio of 1:6 had the highest values for percent of fertile eggs but not significantly different from ratio 1:8. Alsobayel and Albadry (2012) also reported that lower sex ratio might enhance hens' ability to be fertilized. The differences observed in the percentage of fertile eggs though not significant due to mating ratios 1:3, 1:6 and 1:10 may be attributed to differences in the reproductive ability of the cocks. This is supported by McGary et al. (2003). This suggests that the sex ratio of 1:10 can yield satisfactory results in terms of fertile eggs as long as the cock is staying sexually competent. It is not only important to maintain proper cock: hen ratio but also to frequently test cocks for fertility as the fertility is generally an outcome of the successful copulation and the quality of semen produced (McGary *et al.,* 2003). Chotesangasa (2001) reported the lowest egg fertility in chickens with the cock: hen ratio of 1:16 as compared to those in 1:8 and 1:12. This shows that Koekoek chickens are not

different from other native breeds of chickens since in the current study the sex ratio of 1:10 still gave acceptable results.

However, the non-significant ($p>0.05$) effect of cock: hen ratio on egg fertility do not tally with the findings of Alsobayel (1992) who reported that lower sex ratios seem to enhance hens ability to be fertilized since the cock will then have the opportunity to successfully mate all the females in the flock. Blohowiak *et al.* (1980) also reported that keeping a large flock of hens with a single cock tend to reduce fertility because the cock will develop a tendency of showing female preference and will court some individual females than others in the flock.

Egg hatchability

The results in Table 2 indicated that fertile eggs that were obtained from Koekoek chickens with the cock: hen ratio of 1:10 hatched (94.60%) more than those from cock: hen ratios of 1:3 and 1:6 with the hatchability scores of 88.98% and 91.67% respectively but they were not significantly ($p>0.05$) different from one another. The hatchability in sex ratio of 1:10 was 5.62% and 2.93% insignificantly ($p>0.05$) higher than those in sex ratio 1:3 and 1:6. In support of these results Wilson (1997) indicated that a sex ratio of 1:10 can give more fertile eggs that will hatch. However, Insiko et al. (1947) reported a positive correlation between fertility and hatchability thus suggesting that cock: hen ratio with high percentage of fertile eggs will also have high hatching percentage. Alsobayel and Albadry (2012) also suggest that sex ratio may affect other reproductive parameters but not fertile hatchability.

Embryo mortality

The results on the effect of cock: hen ratio on embryo mortality in Table 2 showed the early embryonic mortalities (EEM) of 5.07%, 3.01% and 2.39% for the cock: hen ratios of 1:3, 1:6 and 1:10 respectively. The highest mortality rate was observed in Koekoek chickens with the lowest cock hen ratio while the lowest was in chickens with the highest sex ratio. The mortality in sex ratio of 1:6 was neither significant ($p>0.05$) to 1:3 nor 1:10 sex ratios. The significant difference in the embryonic mortality of chickens contradicts the findings of Fairchild and Christensen (2005) who indicated that cock: hen ratio does not play any part in embryonic mortality. Alsobayel and Albadry (2012) also emphasized that early embryonic mortality, late embryonic mortality and total embryonic mortality for the different sex ratios were not significantly different though the 1:6 tended to have the best early embryonic mortality and total embryonic mortality values. In

addition, Suthar et al. (2012) explained that increasing number of hens for one cock produced relatively weaker chicks and hence higher mortality.

Table 2. The effect of cock: hen ratio egg fertility, hatchability, embryonic mortality

Treat-ment	Fertility	S.E	H%	S.E	HF%	S.E	EEM	S.E	LEM	S.E
1:3	87.78^{a}	2.61	78.11^{a}	6.21	88.98^{a}	6.27	5.07^{a}	0.02	5.95^{a}	0.05
1:6	85.56^{a}	1.63	78.44^{a}	3.96	91.67^{a}	3.82	3.01^{ab}	0.01	4.51^{ab}	0.02
1:10	84.22^{a}	2.54	79.67^{a}	1.89	94.60^{a}	2.94	2.39^{b}	0.03	2.46^{b}	0.02

Means within a column with similar superscripts do not differ significantly ($p<0.05$)

Footnote: S.E- Standard Error, H%- hatchability of incubated eggs, HF%- Hatchability of Fertile eggs, EEM- Early Embryo Mortality, LEM- Late Embryo Mortality, %-Percentage

Conclusion

From the results reported herein cock: hen ratio did not affect the percentage of fertile eggs, and hatchability. The sex ratio of 1:10 reduced the embryonic mortality in Koekoek chickens. Therefore, it is recommended that the cock: hen ratio of 1:10 would be more economical for Koekoek chickens kept under intensive system.

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