

The influence of female:male ratio of Fayoumi layers on fertility, hatchability of eggs and chicks livability

Influencia de la relación macho:hembra de ponedoras Fayoumi sobre la fertilidad, eclosión de huevos y viabilidad de los polluelos

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ABSTRACT

To examine the effect of male:female ratio on the fertility and hatchability of eggs and chicks livability in Fayoumi layers, three groups were managed where each of 8, 9 and 10 hens were offered 1 cock for mating. Study was carried out at the Poultry Experimental Station, Sindh Agriculture University Tandojam during 2005. Average initial egg weight in group C (10 layers) was significantly ($P<0.05$) higher (29.33 g) as compared to group A (28.29) and group B (26.45g). Eggs in group C (1:10), had higher fertility rate (91.11%) as compared to group A (1:8) and B (1:9), where egg fertility percentage was 89.13 and 83.33%, respectively. The hatchability was remarkably higher (73.17 %) in group A (1:8) which followed a diminishing trend in group B (1:9) where hatchability was lowest (47.50%), while 60.98% hatchability was recorded in group C (1:10). Inverse trend was recorded for chicks livability rate of Fayoumi and in group A (1:8) chicks livability rate was highest (86.67%), followed by group B (1:9) and group C (1:10), where chicks livability rate was 84.21 and 80.00%, respectively. The trend of mortality suggested that increasing number of hens (1:10) produced relatively weaker chicks and thus highest mortality (20.00%) was recorded, followed by B (1:9) and A (1:8), where 15.79 and 13.33 percent mortality was recorded, respectively. It was further seen that increasing hen:cock ratio from 8:1 to 10:1 did not produce positive results, because egg hatchability and chicks livability rate was poor in group C, where 10 hens were offered one cock. Thus, for getting better egg hatchability and higher chicks livability rate, hen:cock ratio of 8:1 in Fayoumi poultry breed would be more profitable.

Key words: liveability, hatchability, fertility, poultry

RESUMEN

Para examinar el efecto de la relación macho:hembra sobre la fertilidad, eclosión de huevos y viabilidad de los polluelos en ponedoras Fayoumi, se manejaron tres grupos donde a cada 8, 9 y 10 gallinas se les ofreció un gallo para apareamiento. El experimento se llevó a cabo en la Poultry Experimental Station, Sindh Agriculture University Tandojam durante el año 2005. El peso promedio inicial del huevo en el grupo C (10 ponedoras) fue significativamente ($P<0,05$) mayor (29,33 g) en comparación con el grupo A (28,29 g) y el grupo B (26,45 g). Los huevos en el grupo C (1:10) tuvieron mayor tasa de fertilidad (91,11%) en comparación con el grupo A (1:8) y B (1:9), donde el porcentaje de fertilidad del huevo fue 89,13 y 83,33%, respectivamente. La eclosión fue notablemente mayor (73,17%) en el grupo A (1:8), la cual siguió una tendencia decreciente en el grupo B (1:9), donde la eclosión fue menor (47,50%), mientras la eclosión fue 60,98% en el grupo C (1:10). Se registró una tendencia inversa para la tasa de viabilidad de los polluelos de Fayoumi y en el grupo A (1:8), la tasa de viabilidad de los polluelos fue mayor (86,67%), seguido por los grupos B (1:9) y C (1:10), donde la tasa de viabilidad de los polluelos fue 84,21 y 80,00%, respectivamente. La tendencia de la mortalidad sugirió que un número mayor de gallinas (1:10) produjo polluelos relativamente más débiles y así la mayor mortalidad (20,00%) se registró en este grupo, seguido por B (1:9) y A (1:8), donde se registró un porcentaje de mortalidad de 15,79 y 13,33%, respectivamente. Se observó adicionalmente que el aumento de la relación gallina:gallo de 8:1 a 10:1 no produjo resultados positivos, porque la eclosión de los huevos y la tasa de la viabilidad de los polluelos fue pobre en el grupo C, donde 10 gallinas se les ofreció un gallo. Por lo tanto, para obtener una mejor eclosión de huevos y una mayor tasa de viabilidad de los polluelos, la relación gallina:gallo de 8: 1 en la raza avícola Fayoumi sería la más rentable.

Palabras clave: viabilidad, eclosión, fertilidad, aves de corral

INTRODUCTION

Livestock is a renewable natural resource and plays a vital role in the Pakistan economy. It accounts for 46.8 percent of agricultural value added and about 10.8 percent of the GDP. The role of livestock in rural economy may be realized from the fact that 30-35 million rural population is engaged in livestock raising. Pakistan has 26.3 million buffalos, 24.2 million cattle, 56.7 million goats, 24.9 million sheep, 366.0 million poultry and 0.8 million camels. Among livestock products, the production of beef was 1,115,000 tons, mutton 740,000 tons and poultry meat 416,000 tons during the year 2004-2005 (GOP, 2005).

Rapid development of poultry sector has contributed towards filling the gap between availability and requirement of animal protein through provision of balance protein and nutritionally rich food in form of poultry meat and eggs (Anonymous, 2002). There are two poultry farming systems in Pakistan - the small scale or rural, and the large scale or commercial poultry farming. The latter did not exist till 1963. In 2004, egg production increased to 8,247 million and poultry meat to 402,000 tons. The share of meat in 2004 was 18.1 per cent of the total national meat production as compared to its nominal share of 2.46 per cent in 1971-72. In terms of animal protein source, its share was over 20 per cent. The exponential growth of poultry sub-sector varied from 15-20 per cent, annually at earlier stages and then stabilized at 10 per cent during 90s due to policy change that had negative impact on marketing, such as the ban on marriage feasts in 1997. In 1977, the government decided to improve and develop the rural poultry farming on commercial lines. New breeds like Fayoumi, Dhoki and Red were introduced as these were capable of producing 200-220 eggs per year. Fayoum breed has its origin in Egypt, where it is otherwise known as Bigawi. It's a fairly small flighty penciled chickens with long neck, almost vertical tail carriage and gold/silver plumage. It is also a fast maturing pullets that weigh 3½-4½ lbs and lays small, off-white eggs by 4 months of age (Anonymous, 2005).

The poultry industry is playing very vital role in solving the protein problem at local level through rearing commercial layer and broiler strains of exotic origin, particularly Fayoumi breed. Fayoumi has no broodiness characters so it can be kept for egg production in rural conditions. Layers produce more than 250 eggs per annum and their hatchability rate ranges from 65 to 70 percent. Live body weight of a

Fayoumi ranges from 1.2 to 1.8 kg per bird. The maximum maturity age is about 24 weeks. This breed plays a vital role in rural areas particularly among rural women in providing substantial sources of grocery money for school children and for paying hospital bills (Rind, 2003).

Fayoumi consumes 42 kg feed during egg production period. The Economic Advisor's Wing has introduced this breed for fulfilling protein deficiently in four provinces even in Azad Kashmir (Anonymous, 2003).

Eggs initially need a very controlled heat input to maintain the optimum temperature of 38°C, because the embryo is microscopic in size. As the embryo grows in size (especially after 18 days), it produces more heat than it requires and may even need cooling. Increasing the moisture level from 60 to 80 percent relative humidity during incubation is important to stop excess moisture loss from the egg contents through the porous egg shell and membranes. Hatchability of 80 percent (of eggs set) from natural incubation is normal, but a range of 75 to 80 percent is considered satisfactory. Setting of hatchings is best timed so that the chicks to be hatched are two months of age at the onset of major weather changes, such as either the rainy (or dry) season or winter/summer. A plentiful natural food supply over the growing period of the chicks will ensure a better chance for their survival. Successful poultry species instinctively lay and incubate their eggs at a time of the year when newly hatched chicks will have a better supply of high protein and energy food provided by the environment. For example, guinea fowl will only lay eggs in the rainy season. However, seasonal changes in weather patterns are also times of greater disease risk.

Keeping in view the importance of male-female ratio and consequent behaviours, an experiment was conducted to examine the effect of male-female ratios on fertility, hatchability of eggs and chicks livability of Fayoumi layers.

MATERIALS AND METHODS

A flock of Fayoumi birds was kept at Poultry Experimental Station, Department of Poultry Husbandry, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam during the period of September-October, 2005. Only one breed namely Fayoumi was used in this experiment and studied for Fayoumi breeding

flock keeping, incubation and chicks rearing. Before rearing the birds, whole house was cleaned and disinfected with potassium permanganate and 10% formalin solution and kept closed for 24 hours. All utensils were disinfected with powerful disinfectant. The water was provided to the chicks *ad libitum* and commercial layer feed was provided at 100 g/day/bird. The light was provided 16 hours/ day. Female and male Fayoumi chicks were kept together at early stage and were later kept separate till their maturity.

All birds were vaccinated against Newcastle and Gumboro diseases with ND-Lasota and Gumboro-128, in order to protect the birds against subsequent attack of these diseases. After maturity of flock, three breeding males out of forty breeding males and twenty seven laying hens out of forty Fayoumi laying hens were randomly selected and divided into 3 groups, *viz*: group A, B and C. In groups A, B and C; 8, 9 and 10 laying hens, respectively, with one breeding male for each group were reared for natural mating because in order to check the efficiency of mating of one male. Eggs were collected every day and stored at below 70 °F room temperature.

One forced air draft incubator was used after performing cleaned and fumigation was maintained for temperature and humidity up to 24 hours. The eggs were examined physically and well graded (41, 40, 41) eggs were collected from each group and weighed by electronic weighing machine.

The eggs were placed in setter for hatching in which automatic turning of eggs was carried out by the incubator, and the following were maintained during incubation period. The candling of eggs were 10th and

18th days; the temperature for hatching was maintained at 99 °F, the relative humidity of eggs for incubation was 65% up to 18th day and it was increased up to 70% after that and the turning of eggs was carried out automatically as the machine itself has this ability.

After hatching, day old chicks were examined for their health and grading of chicks was recorded. All chicks were kept in the groups, *viz*, A, B and C. The following were recorded: chick's initial live body weights for each group and the livability of chicks was observed for four weeks.

Data analysis

The data were analyzed statistically through ANOVA and the means were compared by Least Significant Difference Test by using the General Linear Model of Minitab Micro Computer Software.

RESULTS

Production of eggs

The results indicated that hens in groups A, B and C, where 8, 9 and 10 hens were offered to one cock, produced 46, 48 and 45 eggs during the study period of 60 weeks, respectively. The above eggs were later examined for selection of eggs suitable for incubation. The results on this aspect, reported in Table 1 showed that the egg production of hens in group B (1:9) produced highest number of eggs (48) ($p < 0.05$) than hens in group A (46) and group C (45) under male:female ratio of 1:8 and 1:10, respectively. The eggs incubated was similar among the three male:female ratio ($p > 0.05$) (Table 1).

Table 1. Parameters of Fayoumi layers at the Poultry Experimental Station, Sindh Agriculture University Tandojam, 2005.

Parameters	Groups		
	A	B	C
No. of eggs produced	46 ^b	48 ^a	45 ^b
No. of eggs incubated	41 ^a	40 ^a	41 ^a
Initial egg weight at production	28.29 ^a	26.45 ^b	29.33 ^a
Initial egg weight before placed in incubator	30.64 ^a	29.18 ^{ab}	28.53 ^b
Fertility %	89.13 ^{ab}	87.73 ^b	91.11 ^a
No. of chicks hatched	30 ^a	19 ^c	25 ^b
Hatchability %	73.17 ^a	47.50 ^c	60.98 ^b
No. of chicks dead	4 ^{ab}	3 ^c	5 ^a
Mortality %	13.33 ^b	15.79 ^b	20.00 ^a
No. of chicks live	26 ^a	16 ^c	20 ^b
Chicks livability %	86.63 ^a	84.21 ^a	80.00 ^b

Means with different letters within rows are significantly different ($p < 0.05$) according to Least Significant Difference Test. Groups A, B and C: 8, 9 and 10 hens were offered to one cock, respectively.

Initial egg weight (g)

The results showed that the initial average egg weight of Fayoumi layers in groups A and C, where 8 and 10 layers were assigned to one cock for mating purpose, respectively, produces significantly ($p < 0.05$) heavier eggs (29.33 and 28.29 g/egg, respectively) as compared to the initial egg weight in group (B), where 9 Fayoumi hens were assigned to one cock (26.45 g/egg) (Table 1).

Weight of selected eggs during incubation (g/egg)

It is obvious from the data recorded for average egg weight during incubation (Table 1) that average egg weight of Fayoumi layers in smaller group (A), where 8 layers were offered one cock for mating purpose was significantly ($p < 0.05$) higher (30.64 g/egg) as compared to weight of eggs (28.53 g/egg) recorded in group C, where 10 Fayoumi hens were offered one cock for mating. It was observed that egg weight during incubation was reduced to a greater extent in groups where 10 hens were given one cock, while the egg weight during incubation period was reduced under lower hen:cock ratios.

Fertility and hatchability of eggs

The egg fertility results indicated that the eggs in group C (1:10), had higher fertility rate (91.11%) as compared to group B (1:9), where egg fertility percentage was 87.73% (Table 1). The results for egg hatchability (Table 1) were significant ($p < 0.05$) and hatchability was remarkably higher (73.17%) in group A (1:8) which followed a diminishing trend in group B (1:9) where hatchability was lowest (47.50%), while 60.98% hatchability was recorded in group C (1:10). The same trend was observed for No. of chicks hatched.

Mortality

The record for the chicks, right from the day of their hatching was maintained and chicks died during hatching due to any reasons were counted. The results regarding the total mortality (Table 1) showed that the number of chicks died was significantly ($P < 0.05$) more in group C (5) where male:female ratio was 8:1 as compared to group B (3), where the male:female ratio was 1:9. It was observed that the mortality was significantly greater in the group where one cock was offered to 10 hens. The trend of mortality suggested that increasing number of hens (1:10) for one cock

produced relatively weaker chicks and thus highest mortality (20.00 %) was recorded, followed by 1:9 (B) and 1:8 (A), where 15.79 and 13.33% mortality, respectively, was recorded (Table 1).

Chick livability

Inverse trend was recorded for chicks livability rate of Fayoumi and in group A (1:8) and Grupo B (1:9), chicks livability rate was highest (86.63 and 84.21%), respectively) ($p < 0.05$), followed by group C (1:10), where chicks livability rate was 80.00% (Table 1). No. of live chicks was higher in Group A ($p < 0.05$) with 26, followed for group C (20), the lowest value was for Group B (16) (Table 1).

DISCUSSION

The egg weight before incubation (29.40 g/egg) was reduced at the end of first week of incubation, probably it happened due to loss of moisture during incubation process in the setter. The average egg weight loss was 9.36% at the end of first week over the initial average egg weight before incubation. It was observed that egg weight during incubation was reduced to a greater extent in groups where 10 hens were given one cock, while the egg weight during incubation period was reduced under lower hen:cock ratios. Average egg weight while kept in setter was reduced with the progress of embryo development during 1st, 10th and 18th day candling.

The egg production results indicated that hens in group B (1:9) produced highest number (48) of eggs than hens in group A (46) and group C (45) under male:female ratio of 1:8 and 1:10, respectively. It was observed that average egg production was remarkably higher but no certain reason for this variation could be detected. The above results are further supported by Farooq *et al.* (2002) concluded that the cock:hen ratio was 1:10, but in a number of farms the male:female ratio was different. Fayoumi cocks were more active in mating behaviour as compared to those of Desi and Rhode Island cocks. Chowdhury (2003) found that increasing number of cocks caused a disturbance in the flock due to their aggression and fighting, while Hasnath (2003) found that the Fayoumi in smaller flocks produced better egg production and in groups where the number of cocks was more, egg production was greater than either ones.

The egg fertility results indicated that the eggs in group C (1:10), had higher fertility rate (91.11%) as

compared to group B (1:9), where egg fertility was 83.33%. However, the results for egg hatchability showed that hatchability was remarkably higher (73.17 %) in group A (1:8) which followed a diminishing trend in group B (1:9) where hatchability was lowest i.e. 47.50%, while 60.98 percent hatchability was recorded in group C (1:10). The trend of mortality suggested that increasing number of hens (1:10) for one cock produced relatively weaker chicks and thus highest mortality (20.00%) was recorded, followed by 1:9 (B) and 1:8 (A), where 15.79 and 13.33% mortality was recorded. Inverse trend was recorded for chicks livability rate of Fayoumi and in group A (1:8) chicks livability rate was highest (86.67%), followed by groups B (1:9) and group C (1:10), where chicks livability rate was 84.21 and 80.00 percent, respectively. Esonu *et al.* (2004) reported significant ($p < 0.05$) differences among the groups in hen-day egg production, egg weight, feed intake, egg size and dressed carcass weight. Increasing number of cocks for mating purpose improved the egg laying behaviour of the hens, however the egg quality varied, while Gous *et al.* (2004) used cock used at a ratio of 1:9 in the flock. On the other hand, Hafiz and Balander (2004) reported that the laying, hatchability and behaviours of Fayoumi were significantly influenced by the male-female ratio. The results of the present investigation are in concurrence with those of Rajput *et al.* (2005), overall results of Fayoumi layers kept in middle flock size eggs fertility and hatchability rates were at peak for medium (B) than small (A) and large (C) groups but, chicks from large group to become heavier (29.90) than medium (29.80) and small (29.34) g/b, respectively; while Tadelle *et al.* (2003) reported that there was a significant effect of male : female ratio on the laying performance of all the breeds, and the social and ingestive behaviours were also changed with the change of male:female ratio.

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