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Synchronized Natural Hatching in Backyard Chicken and Challenges to Survival Rate in Gonder Town, Ethiopia

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Abstract: An experimental study was conducted on backyard chickens in a selected peri-urban village of Dabrika, Gondar town from October 2011 to June 2012 to evaluate synchronized hatching rate in backyard chickens and also to identify major constraints for chicken loss. In this study, a total of 32 broody hens were synchronized on-farm by random selection of chicken owners. The overall hatchability, fertility, chick survivability, embryonic death and mortality rate recorded was 76.2%, 74.7%, 74.8%, 23.8% and 25.2% respectively. Statistically significant difference ($p<0.05$) among the egg number groups were occurred in the hatchability, fertility and chick survivability rate. The overall infestation rate of gastro-intestinal helminthes in the present study was 81.8%. The study indicated that there was statistically significant difference ($p<0.05$) in the infestation rate of GIT parasites. The major parasites recorded include nematodes (56.4%), cestodes (18.2%) and protozoa (7.3%). The present study indicated that synchronized hatching make the most efficient use of broody hen for improved production and productivity of backyard chicken. However, some constraints like predators and GIT helminthes were causes for high production losses and death of backyard chicken in the study area. Therefore, synchronized hatching technology should be well adapted with appropriate husbandry and disease management.

Key words: Backyard chicken · Broody hens · Gastro-Intestinal parasites · Gondar town · Synchronized hatching

INTRODUCTION

The total poultry population of Ethiopia is estimated at 42.1 million, of which about 98% are raised under the traditional backyard system of management, while 2% is exotic breed maintained under intensive management system [1]. Chicks, laying hens and cocks and roosters account 39%, 33% and 11% of the flock composition, respectively [2].

Poultry play an important economic, nutritional and socio-cultural role in the livelihoods of poor rural households in many developing countries, including Ethiopia, where scavenging poultry are an integrated part of the smallholder production systems and play a significant role in the alleviation of poverty, hunger and malnutrition through provision of supplementary food and employment [3, 4].

Most of technologies which are used to improve the productivity of native chickens require financial and technical inputs that are far beyond the capacity of poor farmers. The synchronized natural incubation technique for native chickens does not require any sophisticated equipment, or even electricity rather it allows rural farmers with only a few hens to hatch 50 or more chicks at one time and enables them to make the most efficient use of broody hens, labor, vaccines and other [5].

The incubation period for chicken eggs is 20 to 21 days and increases up to 30 days for other poultry chicks. Proper incubation requires the right combination of temperature, humidity and time [6-8].

The broody hen chosen for natural incubation should be large (To cover and thus keep more eggs warm), healthy and preferably vaccinated, with a good brooding and mothering record [9]. The major constraints in village

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poultry which results in low production and productivity are not limited to low genetic potential of local poultry, but also lack of knowledge in animal husbandry, poor feeds in quality and quantity; poor housing, disease, improper veterinary services, predators and thefts, lack of planned breeding and poor marketing structures [10]. Chickens in backyard production are at constant risk of infestation by both ecto and endoparasites since they get little to no feed supplementation thus, resorting the scavenging and foraging for feed to meet their nutritional requirements [11].

Absence of appropriate hatchery technology is one of the problems for improving production and productivity of backyard chickens. Synchronized natural hatching is a process of making a number of broody hens to start incubation of eggs at the same time. Synchronized hatching helps to increase the egg production of backyard chicken and to increase number of chicks hatched at a time. Small-scale farmers in Philippines and Bangladesh are adopting this technology because it is simple to apply and does not require any additional materials or financial inputs [12, 13]. The importance of synchronized hatching is not well known by the livestock owners and animal husbandry professionals. There was no such a study conducted before either in North Gondar Administrative Zone or other part of the region. Therefore, this study was initiated to test the effect of synchronized hatching in improving backyard chicken production through raising large number of chicks with specific objectives of determining hatching rate of synchronized backyard chicken for increased chick production and identify major constraints for chicken loss in Gondar town, Ethiopia.

MATERIALS AND METHODS

Study Area: The study was conducted in peri-urban village of Dabrika, Gondar town, North Gondar Administrative zone, Ethiopia. The town is located at 742 Km from Addis Ababa at an elevation of 2220 m.a.s.l. Rain fall varies from 880-1172mm with the maximum temperature of 44.5°C and the average annual temperature of 19.7°C. The area is characterized by two seasons, the wet season from June to September and dry season from October to May [14]. The human population of the town is 2, 896, 873 of which 1, 569, 205 are males and 1, 327, 668 are females and the poultry population of the area is 1, 186, 839 [13].

Study Population and Management: The study was conducted in backyard chicken of peri-urban village in the study area. In the selected group of chicken, owners feed adequate and appropriate grinded grains (Corn, maize and wheat) and supply water for their chickens ad lib. Chickens were watered through the use of plastic containers and broken clay materials. On top of this chicken owners were advised to keep their chicken in safe place to protect them from predators and also they were taught to give chickens to foster hens up to 2 months. The chickens were vaccinated for Newcastle disease in the study area.

Study Design: An experimental type of study design was used for the on-farm study. In the on-farm trial, farmers with broody hens and willing to participate in the study were selected. Those 32 broody hens were synchronized for incubating eggs. The farmers having 2-3 broody hen were selected and broody hens synchronized for incubating eggs. Broody hens were grouped in to three by weight class and egg numbers for incubation. The egg number grouping of broody hen for incubation was 10, 12 and 14 eggs. A total of 32 broody hens were selected and incubated naturally after selecting those farmers who were interested to participate in the experiment. On top of this for the identification of worm infestation, about 110 apparently healthy chickens were examined in the study area by taking faecal sample of the poultry to University of Gondar veterinary parasitology laboratory.

Broody hens were made free from external parasites by using Ivermectin and vaccinated for Newcastle diseases. Owners were advised to provide supplementary feed and water during incubation period.

Study Protocol

Egg Setting: Chicken owners were advised to store eggs in a clean and dried place to prevent rotting. Those owners who got fertile local poultry egg were engaged to set their own eggs and being advised to store eggs with the broad end facing upwards, as at this end there is an air sack, through which the egg breathes. Whereas for those chick owners who did not have a capability to produce fertile eggs; commercial poultry eggs from university of Gondar were supplied.

Candling the Eggs: To examine the development of embryo, infertile eggs and dead embryo in shell, eggs were candled on the 7th and 14th day of incubation using candle box with torch lightThe fertile eggs were seen to be densely clouded and opaque with network of veins indicating development of embryo within the eggs while the unfertile eggs were translucent under the light. Infertile and other eggs with dead embryo were removed on the 14th day.

Worm Identification: Chicken in the households involved in the synchronization study was sampled for the study of parasitic infestation rate in the area. A total of 110 chicken were sampled, about 2-5 birds per household. Faecal sample was used to identify and quantify the parasitic infections. The principles that were used for identification of parasite eggs in the study were sedimentation and flotation [15].

Statistical Analysis: The data collected was first entered into a computer on a Microsoft Excel spreadsheet and analyzed by descriptive statistics using STATA software. Descriptive statistical analysis such as table was used to summarize and present the data collected; whereas the t-test was applied to determine mean hatchability of incubated egg and $p<0.05$ held for statistically significant value.

RESULTS

Egg Fertility, Embryonic Loss and Hatchability: A total of 32 broody hens were synchronized by grouping in three incubated Egg Numbers Group (ENG); 10, 12 and 14. The mean number of hatched eggs, non fertile eggs and dead embryos were 6.7+3.1, 3.0+2.1, 2.1+2.3 respectively (Table 1).

In this trial, there was significant differences ($P<0.05$) among the egg number groups (ENG) in the hatchability rate, fertility rate and embryo mortality rates. Fertility rate for 10 ENG was 72.5%, whereas, 12 and 14 ENG was 68.1 % and 85.7% respectively. However, the overall fertility rate observed in this study was 74.7 %. True hatchability rate (On fertile eggs) was 76.2 %. The embryonic mortality rate for 10 ENG and 14 ENG was 11.5% and 14.6%, respectively whereas for 12 ENG was 43.9% (Table 2).

Survival Rate and Challenges to Chicken Loss: The overall survival rate of chicken in this study was 74.8% with about 25.2% died chicks due to various reasons

The survival rates for 10, 12 and 14 ENG was 83.1%, 60.0 % and 76.8%, respectively. Chicks surviving under different ENG did vary significantly ($P<0.05$) (Table 3).

About 25.2% chicks lost by various reasons of which 53.7 % were predators, 29.2 % accidents and 16.7% were diseases (Fig. 1).

The present study focus on identification of gastrointestinal parasites among diseases causes chicken production loss in the area. The study revealed high infestation of gastrointestinal parasites 81.8% (90/110) in examined chickens. Nematodes were the most predominant parasites recovered in 56.4% (62/110) chicken in present study followed by cestodes which is observed in 18.2% (20/110) and protozoa 7.3% (8/110) but no trematode parasite recovered in examined chickens. There was a statistically significant differences among parasites occurrence ($p<0.05$) (Table 4).

Table 1: Mean hatchability, infertile eggs and dead embryos of incubated egg numbers

Group of broody hen	Incubated Egg number Group	No. of broody hen	Mean no. of hatched eggs	No. of infertile eggs	No. of dead embryos
Group 1	10	12	6.4±2.1	2.8±1.9	0.8±1.3
Group 2	12	12	4.6±2.0	3.8±2.0	3.6±2.7
Group 3	14	8	10.3±2.9	2.0±2.1	1.8±1.9
Total		32	6.7±3.1	3.0±2.1	2.1±2.3

*Mean + Standard deviation; P=0.013

Table 2: Egg fertility, hatchability and embryo mortality rates

Egg numbers group	No. of eggs incubated	Number of fertile eggs	Fertility rate (%)	True hatchability rate (%)	Embryo mortality rate (%)
10	120	87	72.5	77 (88.5)	10(11.5)
12	144	98	68.1	55 (56.1)	43(43.9)
14	112	96	85.7	82 (85.4)	14(14.6)
Total	376	281	74.7	214 (76.2)	67(23.8)

Table 3: Chick survivability rate in the study group

Egg numbers group	No. of day-old chicks	No. of chicks survived (8wks of age)	Survival rate (%)
10	77	64	83.1
12	55	33	60.0
14	82	63	76.8
Total	214	160	74.8

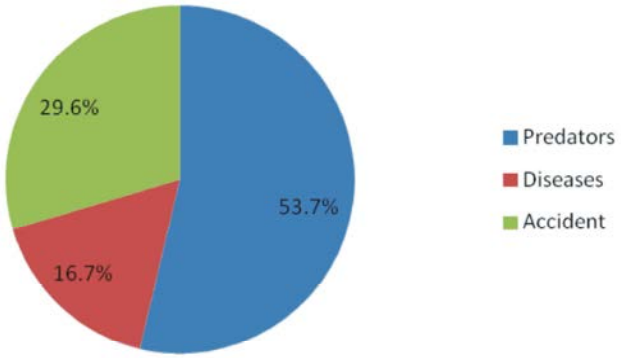

Fig. 1: Causes of chick loss after hatched fertile eggs

Table 4: Infestation of gastrointestinal parasites in village chicken (n=110)

Parasite	No. positive	Infestation rate (%)
Nematodes		
Heterakis gallinarium	26	23.6
Ascaridia gallinarium	20	18.2
Trichostrongylus tenuis	10	9.1
capillaria spp	6	5.5
Total	62	56.4
Cestodes		
Raillietina spp.	12	10.9
Davainea spp	3	2.7
Amidostomum spp	5	4.5
Total	20	18.2
Protozoa		
Coccidia spp	8	7.3
Overall total	90	81.8

DISCUSSION

In the present on-farm trial, there was no good uniformity in the hatchability, fertility and chick survivability rate as well as dead embryo mortality rate among the egg number groups in backyard chickens. The study revealed a moderate fertility rate (74.7%). This finding is lower than that of Kicka *et al.* [16] and Farooq *et al.* [17] who reported the highest fertility rate of 92.3% and 95.5%, respectively. The fertility rate varies with group (ENG) and this variation has come mainly due to variation in number of fertile eggs from total number egg set for natural incubation of each group.

The overall hatchability was 76.2% with significant difference ($p<0.05$) among ENG. This finding is comparable to previous reports; 78% in Morocco [18] and 74.5% in Combodia [19]. The finding in this study was lower than the report of Mekonnen [20] in southern Ethiopia (89.1%) and 83.4% was reported by Mwalusanya *et al*. [21] in Tanzania studied in backyard chicken. Difference in hatchability may realted to breed of chicken used [22]. The low hatchability for 12 ENG was due to high embryonic mortality which related to poor brooding capacity of the broody hen for they cannot maintain appropriate heat and humidity during incubation period and low number of fertile eggs

There is a trend to decrease the survivability with the increased number of chicks, as it is easier to take care of few chicks. The overall chick survivability rate in this study was 74.8 %. The chick survivability rate in10 ENG (83.1%) was higher than 14 ENG (76.8%). About 25.2% chickens were died due to various reasons of which 53.7 % were predators, 29.6% accidents and 16.7 % were diseases. This finding is higher than the report of Anisuzzaman and Wahid [23] the mortality of chicken was 16.67% under scavenging conditions of Bangladesh. The reason for the higher mortality rate might be scavenging or rearing system of chickens. Broody hens at lower age and mean weight are more smart, active, run first and are more clever to teach the chicks how to protect themselves from the predators than the hens of higher weight and age. High chick mortalities related to mishandling and improper rearing conditions of the chicks at an early age, Newcastle disease outbreaks, fowl pox, predation and accident [21, 24, 25]. Most of their chicken was lost due to poor management system in backyard production system in the present study area.

The present study revealed high infestation rate (81.8%) of GIT parasites. The major inflicting factor to high infestation rate of these parasitic infection was the type of production system which is basically free-ranging that allows the chicken to easily pick up infections [26]. This finding in general was comparable with the previous reports from different parts of Ethiopia; 79.62% by Haba [11] in North Gondar, 84.55% by Hellina [27] and 81.05 % by Ashenafi [28] in central parts of Ethiopia. The current finding was lower than reports in four selected districts of Eastern Amhara region, Ethiopia by Eshetu *et al.* [29] and 90.02% in scavenging chickens in central parts of Ethiopia

by Ashenafi and Eshetu [30]. The recording of relatively low infestation rate in present study might be due to relative absence of comfortable environmental conditions and intermediate hosts for multiplication and subsequent transmission of parasites in the present study areas.

The most prevalent nematode species encountered in the present study were *Heterakis gallinarium* (23.6 %), *Ascaridia gallinarium* (18.2%), *Trichostrongylus tenuis* (9.1%) and *capillaria spp* (5.5%). *Heterakis gallinarium* occurred at a infestation rate of 23.6 % which was comparable to a infestation rate of 22.8% Mungube *et al.* [31] but lower than that reported by Haba [11] 39.61% in North Gondar. Difference of infestation rate between studies could be due to relative absence of sound environmental hygiene, climatic conditions and season of the study.

The most prevalent cestodes identified in the study birds include *Raillietina spp* (10.9%) followed by *Amoebotaenia spp* (4.5%) and *Davainea spp* (2.7%). *Davainea proglottina,* the most pathogenic cestode species of poultry was recorded in this study, but this infestation was lower than that of Mungube *et al*. [31] 19.4% infestation rate in semi-arid areas zones of Eastern Kenya.

The infestation rate of coccidia in the present study was 7.3 %. This finding was lower than that reported in different parts of Ethiopia [32-34] with prevalence of 16.92%, 25.8% and 61.25% respectively. This difference might be due to variation in density of chickens kept, difference in environment of the study area and season of the year.

CONCLUSION

The present study clearly indicated that the overall improved fertility and hatchability rate in synchronized natural incubation of backyard chicken. Chick survivability is mainly affected by predators, followed by disease and the high prevalence of GIT parasites which identified in the present study. Synchronized natural hatching technology should be practiced in the area to improve poultry production through increased egg and chick production under designed prevention and control strategy of poultry parasites, with appropriate husbandry and other disease management.

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