World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 3.347

THE EFFECT OF EGG HOLDING TIME ON HATCHABILITY OF FAYOUMI CHICKENS UNDER DEBRE ZEIT AGRICULTURAL RESEARCH CENTER

Shibabaw Bejano[1]*, Wendimu Bireda[2], Gebeyehu Goshu[3] and Womdmeneh Esatu[3]

[1,2]Assosa University, Department of Animal Science, Assosa, Ethiopia.

[3]Addis Ababa University, College of Veterinary Medicine and Agriculture.

[4]Debre-Zeit Agricultural Research Center, Debre-Zeit, Ehiopia.

Article Received on 25/05/2016 Article Revised on 16/06/2016 Article Accepted on 05/07/2016

***Corresponding Author**
Dr. Shibabaw Bejano
Assosa University, Department of Animal Science, Assosa, Ethiopia.

ABSTRACT

This study was designed to investigate the of effect of egg holding time on hatchability of the Fayoumi breeds at Debre Zeit Agricultural Research center poultry farm .For this study a total of 1442 hatching eggs were incubated for 21 days in three different treatment groups for egg holding period of < 7, 7- 14 and >14 days respectively. The eggs were randomly collected, incubated and the data on egg weight, fertility, hatchability and embryonic mortality were analyzed by the General Linear Model procedures. Means were separated using Duncan's Multiple Range Test. Weight loss egg for holding periods of < 7, 7-14 and > 14 days were 10.7 % 12.1% and 15.5%, respectively. Hatchability of total and fertile eggs was decreased in a time dependant manner with increased length of storage. Hatchability per total eggs and hatchability per fertile eggs were 79.7%, 76.7%, 37.0% and 88.7%, 86.0% and 46% with the holding period of < 7, 7- 14 and >14 days, respectively(significance). Highest embryonic mortality (11.7%) for storage period of above 14 days and lowest (0.5%) for storage period of less than 7 days were observed in late and middle embryonic mortality respectively. It was recommended than to improve fertility and hatchability eggs should be handled properly collected as frequent as possible, cleaned, disinfected and incubated. Better fertility and hatchability could be achieved if the holding periods of eggs are less than seven days.

KEYWORDS: *Debre zeit, egg holding period, embryonic mortality, fayoumi, hatchability.*

INTRODUCTION

The term poultry applies to a rather wide variety of birds of several species and it refers to them whether they are alive or dressed. The term applies to chickens, turkeys, ducks, geese, swans, guinea, fowl, pigeons, pea fowl, ostriches, pheasants and quail and other game birds.[1] There are about 600,000 species of animals in the world of which 10,000 species are birds. Among these, chickens are the most important species, adapted globally to different ecological conditions.[2] Ethiopia has 65 million poultry population, comprising 37% of chicken population of east Africa[3,4] of which more than 0.5 million(< 2%) are exotic breeds maintained in large and small scaled commercial farm using relatively advanced management system and about 99% are of indigenous chickens.[5] The poultry production systems may be classified as back yard, small scale and large scale intensive poultry production systems. The main reasons of rearing chickens in all production systems are for egg, meat productions, for income generation and home consumption.[6]

Poultry production is becoming one of the most highly developed segments of food animal Production globally, as the chief sources of cheaper protein of animal origin .[7] Many nutritionists agree that large proportions of the world population today have an insufficient amount of high quality protein in its diet and this is particularly true for large segments of the population in Ethiopia. [8] Thus, it is considered important to improve and to produce animal like chickens, which provide superior food elements through a relatively cheap means of production.[9] Their ability to adapt to most areas, rapid growth rate and short generation time make poultry an ideal starting point for beginning animal agriculture and rich sources of animal protein to human food.[8,10] The successful production of high quality chicks begins with the selection of breeders, hatchery management and egg handing.[11,12] Chicks that will be used for production of eggs or poultry meat should be derived from breeding flock selected on the basis of desired characteristics of egg or meat production.

The modern (intensive) poultry production is very much dependant on being able to produce uniform quality stock of high status. This in turn relies on quality management at the breeding hatchery, egg handling and incubation stages of the production chain as this can greatly influence the quality of hatching eggs and the chick they yield.[13] As the hatching egg is highly perishable commodity, it must be stored under specific condition if its hatchability and qualities are to be retained. The average egg has between 8000 and10, 000 pores. The pores are the means by which the egg breathes, losing water by evaporation (lead to loss of

egg weight) and taking up oxygen than is transported to embryo. The egg starts losing weight from the time it is laid with the loss of its moisture, egg vitality is also lost and this affects not only the hatchability but also chick quality.[14] The hatching weight of chicks followed the egg weight pattern in the parental population.[9,15] A more recent study at the Asela livestock farm revealed that the average egg weight of local chickens in Ethiopia is 38g under scavenging conditions [16] and the average egg weight of Fayoumi chicken was reported to be 46g.[17]

Hatchability of egg is the major concern of hatchery men. Hatchability refers to either the percentage of fertile eggs hatched or percentage of chicks hatched from all eggs set.[1] There are several factors that influence hatchability of eggs, like pre incubation storage time, fertility and incubation conditions such as temperature, humidity, ventilation, position of egg, turning of egg and candling. Apart from these other factors can have considerable influence on the ability of the eggs to hatch. These include nutrition of the breeding hen, genetic constitution of the embryo, disease, egg size and shell quality.[11]

It is important to handle hatching eggs properly and carefully before incubation to achieve maximum hatchability with viable and strong chick. Hatching eggs should be collected as frequent as possible, particularly in severe weather condition and it should be set in incubator immediately to reduce storage problem and optimize hatchability, but it may not be practical to place the eggs in an incubator immediately after collection. The hatching eggs stored for less than seven to ten days remains high with proper storage conditions. Eggs held longer experience reduce hatches. After three weeks of storage the hatchability is near zero percent.[18] It is not only the duration of storage, but storage temperature and humidity have great influence on hatchability during storage. A hatching eggs storage room requires a uniform temperature and relative humidity level. The longer the storage period the most critical these two factors become. For storage up to seven days a temperature of 16 to 17°C and 18% relative humidity are recommended.

For a longer period of storage a lower temperature of around 12°C and higher relative humidity of 85% would be desirable.[14] For an even longer storage period, enclosing eggs in plastic bag and placing the small end of egg up ward would be beneficial.[14] Prolonged storage lead to reduced hatchability and also produces longer incubation time, an increase in various morphological abnormalities of the embryo and poorer chick quality and performance.[19]

Hatchability problems have long been major concern of hatchery men, since it causes large financial losses. Therefore immediate solution to the problem has to be found to ensure profit ability. In order to pin out the problem methodical and through monitoring of situations at breeder and at hatchery level is essential. It must be understood that the problem is not caused by single factor; rather the problem is the result of many factors went wrong in the processes of hatching. Therefore, the approach must be detailed analysis of all inter- relating factors from breeder flock to completion of hatch including genetics, flock management, health care, nutrition and disease status complete hatchery work flow from receiver of egg, their fumigation, storage, setting, incubating machine and handling chicks literally every link in the chain of hatching should be realized.[11] There was little researches attempt so far made in Ethiopia to asses factors influencing the hatchability of poultry. Therefore; the objectives of this study were.

- To assess effect of egg holding time on egg weight, fertility and hatchability of eggs collected for Fayoumi chickens kept at Debre Zeit Agriculture Research Center.
- To estimate embryonic mortality of Fayoumi birds kept at Debre Zeit Agriculture Research Center.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in Debre Zeit Agriculture Research Center poultry farm of East Shoa district of Oromya region located 45 km South East of Addis Ababa, which is situated at 9°C N latitude and 4°E longitudes at an altitude of 1850 meters above sea level. It has an annual rainfall of 866mm of which 84% is the long rainy season (June to September). The dry season extends from October to February. The mean annual maximum and minimum temperature are 26°C and 14°C, respectively with mean relative humidity of 61.3%.[20]

Farmers in the vicinity of Debre Zeit town follow a mixed crop – livestock farming system. The heavy block clay 'Koticha' and light soil 'Goborie' of Debre Zeit represent the two major soil types on which 'teff' wheat and high land pulse are grown. Moreover, Debre Zeit and its surrounding (within 50 km radius) have variable and yet representative agro ecologies of the country. These agro climatic zones are inhabited with different plant and animal species.[21] Two types of poultry production systems are found on this area, the back yard and commercial poultry production system.[21]

Study Animals

A total of 350 layers and 25 cocks of Fayoumi breed with intensive management in 12 pens were used in this study with a male to female sex ratio of 1:12 to 1:15 was used.

Housing

The housing system practiced in the farm is deep litter production system. The layers house is made from brick with mesh wire opening in the two sides with floor area of 308m² and sub divided into 12 pens. The floor is made of concrete was filled with teff (Eragrostis teff) straw of 7 cm thickness. The roofing material used is corrugated iron sheet. Ventilation was natural. Birds received 14 hours of light per day. The hatchery was constructed from concrete wall and plastered with materials that withstand outside environmental fluctuations with well-drained concert floor with an area of 41m². The roofing material used is corrugated iron sheet. The hatchery has incubators, display chicks, display equipment, feed and chick sorting and other room.

Bio-security Measures

The bio-security measures employed to protect the birds from health hazards. Vaccines were administered at different ages of the bird according to the vaccination plan designed to the farm earlier. HB1 at day 1 and Lasota day 21 for New Castle disease; Gumboro 7th and 21st day; at 14th weeks fowl pox. There was strict control of movement of personnel. Throughout the experiment, footbath was placed at the gates of layer and hatchery house. The farm personnel also sanitize eggs with warm wet cloth and perform routine pre-incubation fumigation of eggs and incubator. Antibiotics were given when disease was suspected.

Feeding and Watering

Layers ration was composed of 48% corn, 22% wheat bran, 25% noug cake,3.5% limestone, 0.5% salt and 1% vitamin premix. The compounded feed was given at a rate of 120g per bird per day spitted two times. Clean water was given adlibittum.

Egg Collection, Storage and Incubation

There were around 100 nests arranged for egg laying. Eggs collected twice a day at 10 am and 4pm from laying nest. Eggs were stored in the workers room on the metallic tray until to the second turn collection (4pm). The total collected eggs were cleaned by wet warm cloth and transported from the layer house to the egg storage room. The collected eggs were incubated in three storage period of < 7 days, 7-14 days and > 14 days, respectively. Storage

condition of temperature ranging between 12-14°C, relative humidity 78% and days incubation condition of temperature 37.8°C and relative humidity ranging between 89.92% for the final four days and proper ventilation, fumigation, positioning and turning of eggs (except for the final four days of incubation) in all three of the above conditions.

Data Collection and Analyses

A total of 1442 eggs were randomly collected from Fayoumi breed female mated with Fayoumi breed males in the farm. The eggs were incubated for 21 day in three different treatment groups. About 523 eggs, 439 eggs, 480 eggs, for different eggs holding periods of <7, 7-14 and> 14 days respectively with the same pre incubation conditions.

Dependant variables studied were fertility and hatchability. Egg holding time was considered as independent factor. The collected eggs groups in to pre incubation storage periods <7, 7-14 and > 14 days respectively. Hatchability refers to either the percentage of fertile eggs hatched or percentage of chicks hatched from all eggs set. It is calculated in either ways as percentage of chicks hatched from all eggs set or as percentage of chicks hatched from the fertile eggs. Candling at 7^{th} and 18^{th} day of incubation and hatchability analysis at the time of removing the chicks from the hatchers, break out analysis was conducted to determine percentage apparent fertility, percentage of embryonic mortality [early (0 to 6 days), middle (7 to 17 days), late (18 to 21 days plus piped*)], (REferance*) and percentage of hatchability fertile and total eggs. Data were analyzed by the General Linear Model procedures.[22] Means were separated using Duncan's Multiple Range Test when treatment effects were significant for the variance analyses.

RESULTS AND DISCUSSION

Effect storage period on egg weight

The effect of egg holding time on egg weight revealed that there is weight loss from the initial or fresh egg to 7^{th} days and 18^{th} days candling for each egg holding period. For holding period of<7 days, 7-14 and >14 days there was weight loss of 10.7%, 12. 1% and 15.5% respectively. The results of this study (table 1) show that there is a significant difference ($p<0.05$) due to losing of water through egg pores. An increased in weight loss as storage time of egg increase is may be due to losing of water through egg pores. Similarly[23] reported that there is increased loss of weight as storage time of egg increase.

Table 1: Effect storage period on egg weight at zero, 7th and 18th day of incubation.

Egg weight(g)	Egg holding period (days)			Control (g)
	< 7	7-14	> 14	
Initial	46.5[b]	45.5[b]	45[b]	60[a]
at 7th day	45.6[b]	44[b]	42[b]	59.3[a]
At 18th day	41.5[b]	40.0[b]	38.0[b]	52.7[a]
Weight loss%	10.7[c]	12.1[b]	15.5[a]	12.2.[b]

a, b, c Within treatment groups, means followed by the same letter indicates there is no significant difference.($p>0.05$)

Effect of storage period on apparent fertility and hatchability

The results of the study on hatchability per total / fertile and apparent fertility in table 2 revealed that out of 523 eggs (< 7days), 439 eggs (7-14 days) and 480 eggs (>14 days) Incubated in three cycle 417, 336 and 177 eggs were hatched respectively and the results of hatchability per total eggs and hatchability per total fertile eggs were 79.7%, 76.7%, 37.0% and 88.7% , 86.0%, 46.0% consecutively for holding period of <7, 7-14 and >14. Apparent fertility was 90.2%, 89.1% and 80.6% for the respective egg holding period.

The apparent fertility and hatchability results revealed that apparent fertility was not significantly affected for the first two treatments but there was a significant decline in apparent fertility with prolonged storage time. This may be due to incidence of difficult to discern very dead, germinal discs that were actually fertile, but had died very early during development were likely misclassified as infertile and under estimation of fertility or over estimation of infertility because of the difficulty in distinguishing between fertility germs and embryos that died at every stage of development. Similar results were revealed by.[24,25]

Hatchability of total fertile and eggs was decreased in a time dependant manner with increase storage period. It was significantly ($p<0.05$) and negatively associated with egg holding period. Holding other independent variables constant, an increase in egg holding period associated to a reduction in hatchability. The reduction in hatchability with prolonged storage period may be due to increased percentage of both in early and late dead embryos as shown in Table 3, absence of turning of hatching eggs before incubation and deterioration in the interior quality of eggs,[26] and weight loss of the egg starting from the time the egg was laid due to losing of water through egg pores.[14] Higher significant ($p<0.05$) hatchability was observed with an egg holding period of <7 days than >14 days as shown in table 2.[27] also reported improvement in hatchability when the egg holding period was reduced. The same

author recommended that eggs should not be stored for more than five days. The finding of the present study also suggested a reduction in hatchability with prolonged egg holding period.

Table 2: Effect of storage period on apparent fertility and hatchability.

Egg holding period (days)	Apparent fertility	Hatchability	
		From total eggs	Form fertile eggs
<7	90.2[b]	79.7 [b]	88.7[a]
7-14	89.1[b]	76.7 [b]	86.0[b]
>14	80.6[c]	37.0[c]	46[c]
Control	96.0[a]	85.0[a]	89.0[a]

a, b, c Within treatment groups, means followed by the same letter indicates there is no significant difference ($p>0.05$)

Embryonic Mortality for Different Egg Holding Period

Breakout analysis results of unhatched eggs of late embryonic mortality for different egg holding period of <7, 7-14 and >14 days revealed 5.7%, 7.7%, and 11.7% respectively (Table -3). This shows that there was highly a significant increase in late embryonic mortality with prolonged storage time; this may be due to improper ventilation, temperature, humidity, fumigation and genetic factor.[19] There was insignificant early embryonic mortality difference for different egg holding time; this might be due to difficulty of gross evaluation to differentiate fertility and early embryonic mortality.[19] Reported that gross evaluation to differentiate fertility and early embryonic mortality become more difficult with extended period of storage. The percentage of middle dead embryo was low and shows on treatment effect.

The results of the present study revealed that the chicken in Debre- zeit Agriculture Research Center of poultry have 79.7% and 88.7% for hatchability per total hatched eggs and hatchability per fertile eggs respectively. This indicates that Fayoumi chickens have higher hatchability. Higher hatchability of Fayoumi chickens was also reported elsewhere. [28, 29] The higher hatchability of Fayoumi eggs in present study showed that the existing stock is not intensively in bred even though the selection program is not organized.

Table 3: Early, middle and late embryonic mortality for different egg holding period

Egg holding period (days)	Mortality (%)		
	Early	Middle	Late
<7	6.7 [a]	0.5 [b]	5.7 [c]
7-14	5.3 [ab]	0.7 [b]	7.7 [b]
>14	7.0 [bc]	0.6 [b]	11.7 [a]
Control	6.0 [c]	1.0 [a]	4.0 [d]

a, b , c, d Within treatment groups, means followed by the same letter indicates there is no significant difference ($p>0.05$)

CONCLUSION AND RECOMMENDATION

In developing countries like Ethiopia hatchability has a great importance in hatcheries being a supplier of chicks. Specially maintaining higher hatchability is of paramount importance in research condition. Chicks also have a great importance as a supplier of egg and meat as a source of income. However, in many situations the quality of hatching eggs and chicks are not as good as it is expected. Several factors are involved in the deterioration of hatching eggs and chick. Findings of the current study conducted on research conduction showed that there was high weight loss of egg as storage period increased above 7 days. Hatchability of eggs stored for less than 7 days showed higher hatchability of 88.7% and 79.7% for hatchability fertile /total and lower hatchability of 46.0% and 37.0% hatchability fertile /total respectively. Apparent fertility was higher for eggs stored for less than 7 days than greater 14 days. There was also high embryonic mortality for egg storage above 14 days.

Based on the current study, the following points are recommended.

- The hatching eggs should be handled properly, collected as frequent as possible and should not be stored for more than 7 days to achieve maximum hatchability with viable and strong chick.
- The eggs storage room condition should be properly cleaned, disinfected and it should not be dusty or accessible to flies.
- Further study should be conducted to figure out if factors other than holding time are involved in the poor hatchability of eggs stored for more than 14 days.

ACKNOWLEDGMENTS

The authors would like express their Special thanks to Debre Zeit Agricultural Research center poultry project which enables us to conduct this study.

REFERENCES

1. Ensminger ME. Poultry Science (Animal Agricultural series). Interstate publishers, INC. Danvile, Illionis., 1992; 123-133.
2. Ethiopian Agriculture Research Center. animal science research strategy directorate. *Journals of poultry research strategy*., 2000; 1-33.
3. FAO. Animal production. *Journals of Technical center for Agriculture and Rural Cooperation.*, 2000; 1-25.
4. Mekonnen G, Forssido T, Gebrewold A, Dagnachew B, Anteneh A. The Ethiopian Live Stock industry, Retrosect and prospects. In: proceeding of the third National live stock improvement conference, Institute of Agriculture Research (IAR). Addis Ababa, Ethiopia, 1991; 9-19.
5. Alamargot J. First National livestock improvement. Institute of Agricultural research (IAR) conference, Addis Ababa, Ethiopia., 1987; 144.
6. Nasser M. Oral New castle disease vaccination traits and studies on Newcastle disease in Ethiopa [Thesis]. Berlin, Debre Zeit. Facuty of veterinary medicine, free university of Berlin., 1998.
7. Manson L. Domestic Fowl. Evaluation of Domestic Animals. Longman International conference, New York, USA., 1984.
8. Alemu S. Small scale poultry production. Proceedings of the First National livestock improvement conference; 1987, Addis Ababa, Ethiopia., 100-101.
9. Teketel F. Studies on the meat production potential of some local strains of chickens. In: proceeding of the First National livestock Improvement conference, Addis Ababa, Ethiopia., 1987.
10. Smith AJ. Poultry Science. The Tropical Agriculturist. Macmillan publisher Ltd, London and Basingstke., 1990; 157-158.
11. Nesheim MC, Austic RE, Card LE. Poultry Production. 12thed. Lea and Febiger, Philadelphia., 1979.
12. Harvey R. Practical Incubation. Hancock house publishers, Blaine., 1993; 1-9.
13. Mark P. The health of Poultry. Longman Singapor publisher (Pte-Ltd). Singapore., 1993.
14. Daghir NJ. poultry production in hot climates. Faculty of Agricultural science united Arab Emirates University AIA in, UAE, CAB International, in the UK at the university press, Cambridye., 1995; 255-293.
15. Shanawany HS.: Hatching weight in relation to egg weight in domestic birds. *journals of world poultry Science.*, 1987; 107–118.

16. Brannang E, Pearsons S. Ethiopian Animal husbandry, Uppsala; Sweden, 1990; 127.
17. Negussie MC. poultry production. 12th ed., Bailliere Tindall, London., 1999; 106-119.
18. Smith TW. Care and Incubation of Hatching eggs. College of Agriculture and life science, Mississippi state university., 2000.
19. Singh RA. Poultry production. 3rded. Kalyain publishares, New Delhi, Ludhiana., 2002; 86-155.
20. NMAS. Rainfall and temperature data of Debre Zeit. National Metrological service Agency. Addis Ababa, Ethiopia., 1999.
21. Zeleke A, Bizuneh T, Tesema T. Historical milestones of Debre Zeit Agriculture Research Center, DZARC in half a century (1995-2005) Bulletin of Golden Jubilee., 2005.
22. SAS. Institute Inc. SAS User's Guide statistics version 13thed. SAS Institute Inc. Cary, NC., 2008; 1993: 70-78.
23. Baker R. Effect of storage on weight loss in eggs. Poultry digest., 1987; 46: 276-278.
24. Elibol O, Peak SD, and Barke J. Effect of Flock Age, length of Egg storage, andFreguency of Turning during storage on hatchability of broiler hatching eggs. Department of Animal Science, university of Ankora, Turkey. journals of poultry Science., 2002; 945-950.
25. Fasenko GM, Robinson FE, Whelan AL, Meniuk KM, Walker JA. Education and production. Per- storage incubation of long. Term stored Brolier Breeder Eggs, effects on hatchability. Department of Agricultural, Food and Nutritional science, university of Alberta Edmarton, Canada., 2002; 1400-1471.
26. Prabakaran R, Naraharid D, Ramamurthy N, Parivllal KA, Mujeer KA, Influence of egg size and shell color on hatchability. J*ournal of poultry science*., 1984; 13(2): 72-75.
27. North OM. Egg storage and hatching. Commercial chicken production manual. 3rd ed. Aui publishing company. West port, Connecticut., 1984; 77-78.
28. Farooq M, Durrani FR, Aleem M, Chand N, Muqarrab AW. Egg traits and hatching performance of Desi, Fayoumi, and Rhode Island Red chicken. *Journal of biological science.,* 2001.
29. Mural A, Farooq M, Mian MA, Muqarrab AK.: Haching per Peorfmance of Fayoumi eggs. Sarhad. *Journal of agriculture*., 2001; 17(9): 1-6.