Journal of Animal Research: v.12 n.06, p. 1007-1010. December 2022

DOI: 10.30954/2277-940X.06.2022.26

SHORT COMMUNICATION

Hen Age Relationship with Hatchability and Embryonic Mortality Traits in Punjab Red

Gurpreet Kour Tulla, Prem Prakash Dubey*, Saroj Kumar Sahoo and Shakti Kant Dash

Department of Animal Genetics and Breeding, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, INDIA

**Corresponding author: PP Dubey; E-mail: prakashagb@gmail.com*

Received: 28 Sept., 2022 **Revised:** 16 Nov., 2022 **Accepted:** 21 Nov., 2022

ABSTRACT

Due to lower percentage of hatchability for various causes, the economic viability of the breeding farm reduces. Embryonic mortality or early deaths pose a greater threat to the breeders and prove to be a matter of concern from biological and economic point of view. The present study was conducted on hen belonging to five age groups with 5 weeks duration *viz.* group I (28-32 weeks), group II (33-37 weeks), group III (38-42 weeks), group IV (43-47 weeks) and group V (48-52). About 2916 eggs, along the five age groups, were examined for fertility, hatchability and embryonic mortality traits. The study concludes the significant ($p<0.05$) effect of breeder age on all the traits except for mid embryonic mortality. The fertility and hatchability (out of fertile eggs and total egg set) were found to show an increasing trend up to the peak production periods of first three age groups, followed by decrease in the values due to increased embryonic mortality. Late embryonic mortality recorded higher deaths than early embryonic mortality, revealing a biphasic pattern of embryonic deaths over the incubation period. It was concluded that the particular incubation practices may alter the embryonic mortality pattern, but the biological tendency remains conserved in the chick.

HIGHLIGHTS

- Effects of hen age on fertility, hatchability and embryonic mortality on Punjab red.
- Increased fertility and hatchability during peak production of 33-47 weeks.
- Increased embryonic mortality with the old age of the breeder flock.

Keywords: Age groups, Embryonic mortality, Hatchability, Punjab Red

Embryonic mortality and fertility are important factors contributing to the hatchability. Due to lower percentage of hatchability for various causes, the economic viability of the breeding farm reduces. Embryonic mortality, due to various causes, is one of the main reasons for lower hatchability. Embryonic mortality or early deaths pose a greater threat to the breeders and prove to be a matter of concern from biological and economic point of view. The embryonic death can be distinguished in three distinct stages: early embryonic mortality (≤ days), mid embryonic mortality (8-17 days) and late embryonic mortality (18-21 days). The frequency of early embryonic mortality has been observed to increase between 2nd and 4th day in the chicken (Kumar *et al.*, 2013) and about 65% of the embryonic mortality occurs during the early and later phase of incubation (Christensen, 2001). Factors that have been associated with embryonic mortality include prolonged egg storage, incubation conditions, season of the year, nutrition, egg size as well as genetic factors. Breeder's age is also one of the important factors that influence the hatchery production rates (Araujo *et al*., 2017).

Till date no reports are available regarding the study of embryonic mortality in Punjab Red variety of chicken.

How to cite this article: Tulla, G.K., Dubey, P.P., Sahoo, S.K. and Dash, S.K. (2022). Hen Age Relationship with Hatchability and Embryonic Mortality Traits in Punjab Red. *J. Anim. Res.,* **12**(06): 1007-1010.

Source of Support: ICAR; **Conflict of Interest:** None

The purpose of the present study was to determine the association of embryonic mortality with age of the breeder. Embryonic mortality from five different age groups was examined to determine whether hen age could be used as a model to study the embryonic mortality.

The present study was conducted at hatchery unit, Poultry Research Farm, Directorate of Livestock Farms, GADVASU, Ludhiana, Punjab. The hen age was classified into five groups with 5 weeks duration *viz.* group I (28-32 weeks), group II (33-37 weeks), group III (38-42 weeks), group IV (43-47 weeks) and group V (48-52). Eggs from hens of Punjab Red variety were collected for a period of 7 days. The eggs were then graded, marked and incubated for 21 days. The eggs were candled on 18th day of incubation, and all candling rejects were broken open to determine whether they are infertile or contain dead embryos. After 21 days of incubation, fertility, hatchability and embryonic mortality were recorded for each variety under study. The traits observed were fertility (FER), hatchability on fertile eggs (HFE; %), hatchability on total eggs set (HTES; %) and total Embryonic mortality (TEM), which further was divided into:

i. Early Embryonic Mortality (EEM; ≤ days)

ii. Mid Embryonic Mortality (MEM; 8-17 days)

iii. Late Embryonic Mortality (LEM; 18-21 days)

The proportion incidence was calculated various reproductive traits like fertility, hatchability etc. including embryonic mortality. The TEM, EEM, MEM and LEM were calculated on fertile egg basis in each age group. The variables for each age group were compared using the ANOVA test and factor affecting embryonic mortality (age groups) was analysed.

Age of hen had significant effect ($p<0.05$) on all fertility and hatchability traits (table 1). Low fertility and hatchability (out of fertile eggs and total egg set) was recorded for breeder age of 48-52 weeks in comparison to all other age groups. Significant differences were observed in almost all the age groups for FER and HFE, whereas no significant difference was seen in age groups from 28 up to 42 weeks. An overall increased trend in all the hatchability traits was observed during 33-37 week which may be attributed to the peak production period. Although the fertility showed same trend during first and last age group considered in the study, the overall hatchability was found to decrease significantly across the age groups. This overall reduction in hatchability may be attributed to increased embryonic mortality and decreased fertility.

The lowest hatchability and fertility observed in the older flock ages were in accordance to Tona *et al.* (2001), Tona *et al.* (2004), Vieira *et al.* (2005), Dikmen and Sahan (2007) and Abudabos (2010). El-Safty (2012) reported that eggs laid by old breeders revealed higher infertility and total embryo mortality, resulting in lower hatching percentage, especially after 45 weeks of age. However, no effect of breeder age on fertility and hatchability was reported by Machado *et al.* (2020).

The high hatchability found during the middle of the production period generally accounts for the decreased egg shell thickness and increased porosity. Moreover the hatchability reduction in the eggs of old breeder stock is the outcome of several contributing factors like poor shell quality, albumen quality reduction, increased cholesterol content of the yolk and embryonic mortality. The overall reduction in hatchability in older flocks as compared to younger ones was also evidenced by Vieira *et al.* (2005). Iqbal *et al.* (2016) found the highest parameters of hatchability during 35-40 weeks old hens which were in harmony with the results of the present study.

Calculated on the fertile egg basis, the overall TEM was found to be highest (23.11±0.18%) during later stage of the breeders' age as compared to the younger flock (14.70±0.20%), with a significant difference between the two (table 2). Table 2 represents the overall significant effect ($p<0.05$) of breeders age on embryonic mortality except for MEM which showed non-significant effect. The EEM ranged from 4.71±0.29% during 33-37 weeks of age to 7.29±0.37% in the breeders of 38-42 weeks age with significant difference between the two. The TEM showed an increasing pattern over the increasing age of the hen and similar trend was observed in early and late embryonic mortalities. The LEM showed an increasing trend of mortalities from 5.17±0.31% to 9.24±0.16%. It was also evident that the old breeders showed increased incidence of late embryonic mortality as compared to the young flock. On observation of individual age groups, it was evident that majority of the total embryonic mortality occurs either at the early stages of <7 days or at the later stages of 18-21 days, showing the biphasic pattern of embryonic mortality. This may be attributed to the fact

Table 1: Effect of hen age on hatchability traits

Variety	Flock Age (in weeks)	N	FER (%)	HFE (%)	HTES(%)
Punjab Red	28-32	590	84.13^{c}±14	83.49^{a}±0.30	70.24^{a}±0.25
	33-37	573	88.77^{a}±0.32	77.34^{bc}±0.23	68.66^{a}±0.05
	38-42	645	86.90^{b}±0.14	78.38^{b}±0.55	68.11^{a}±0.59
	43-47	605	89.44^{a}±0.55	73.31^{d}±0.07	65.57^{b}±0.37
	48-52	503	84.42^{c}±0.49	75.38^{cd}±0.98	63.65^{b}±0.95
Effect of age			S**	S**	S**

^{abc} Different letters within a column of each variety denote significant differences among the flock age; S* represents significant values ($p<0.05$), S** represents highly significant values ($p<0.01$) and NS represents Non-Significant.

Table 2: Effect of hen age on embryonic mortality

Variety	Flock Age (in weeks)	TEM (%)	EEM (%)	MEM (%)	LEM (%)
Punjab Red	28-32	14.70^{b}±0.20	5.83^{a}±0.60	1.21±0.33	5.17^{b}±0.31
	33-37	19.58^{b}±0.25	4.71^{a}±0.29	1.82±0.13	8.13^{a}±0.32
	38-42	19.84^{a}±0.48	7.29^{b}±0.37	1.33±0.11	7.48^{a}±0.20
	43-47	23.11^{a}±0.18	6.96^{b}±0.59	1.79±0.17	9.24^{a}±0.16
	48-52	21.60^{c}±0.15	5.44^{c}±1.27	1.76±0.38	9.00^{a}±0.74
Effect of age		S**	S*	NS	S**

^{abc} Different letters within a column of each variety denote significant differences among the flock age; S* represents significant values ($p<0.05$), S** represents highly significant values ($p<0.01$) and NS represents Non-Significant.

that the embryos may fail to breathe through lungs while transitioning from cuticle to pulmonary form of respiration, which is a critical stage in embryonic development and survivability.

Several researchers have explained the relationship between the embryonic mortality and age of the breeder flock and the present study also determined the aspect in this evaluation. The embryonic mortality was found to be higher in old breeders by Elibol and Brake (2006); Ulmer-Franco *et al.* (2010) and Yahav and Brake (2014). Peñuela and Hernandez (2018) also found significant differences among the embryonic mortality of different age group, with higher mortality percentage found in older age groups.

In the present study the LEM was responsible for more deaths than the EEM. Similar results were reported by Payne (1919); Kuurman *et al.* (2003) and Abudabos (2010). However, many researchers found the higher amounts of deaths in early 1st week of incubation (Jassim *et al.,* 1996; Liptói and Hidas 2006; Peñuela and Hernandez 2018).

CONCLUSION

Keeping a biological point of view, the fertility of an egg depends on the factors associated with hen like, its ability to mate successfully, store sperm, ovulate and provide suitable and sustainable environment for an embryo to develop. Researches over the time have shown that the reduced fertility and hatchability in older flocks is a result of many factors like egg size, egg shell quality, albumen and yolk quality and embryonic mortality. The present study confirmed the biphasic pattern of embryonic mortality during the first and last week of incubation owing to critical developmental stages at these phases.

REFERENCES

Abudabos, A. 2010. The effect of broiler breeder strain and parent flock age on hatchability and fertile hatchability. *Int. J. Poult. Sci.,* **9**: 231–235.

Araújo, I.C.S.D., Leandro, N.S.M., Mesquita, M.A., Café, M.B., Mello, H.H.C. and Gonzales, E. 2017. Water vapor conductance: a technique using eggshell fragments and

relations with other parameters of eggshell. *Br. J. Anim. Sci.*, **46**: 896-902.

Christensen, V. L. 2001. Factors associated with early embryonic mortality. *Worlds Poult. Sci. J.*, **57**(4): 359-372.

Dikmen, B.Y. and Sahan, U. 2007. Correlations between breeder age, egg cholesterol content, blood cholesterol level and hatchability of broiler breeders. *Br. Poult. Sci*., **48**: 98–103.

El-Safty, S.A. 2012. Influence of genotype and age of egg-type breeders on some hatching traits. *Egypt. Poult. Sci.,* **32**: 711–724.

Elibol, O.K.A.N. and Brake, J. 2006. Effect of flock age, cessation of egg turning, and turning frequency through the second week of incubation on hatchability of broiler hatching eggs. *Poult. Sci., **85***(8): 1498-1501.

Iqbal, J., Khan, S.H., Mukhtar, N., Ahmed, T. and Pasha, R. A. 2016. Effects of egg size (weight) and age on hatching performance and chick quality of broiler breeder. *J. Appl. Ani. Res*., ***44***(1): 54-64.

Jassim, E.W., Grossman, M., Koops, W.J. and Luykx, R.A.J. 1996. Multiphasic analysis of embryonic mortality in chickens. *Poult. Sci.,* **75**(4): 464–471.

Kumar, A., Das, K., Bharti, A., Kumar, R. and Singh, A. 2013. Embryonic mortality pattern in Black rock, Gramapriya and Vanaraja breeds of chicken. *Progress. Res*. *J.*, **8**(1): 98-100.

Kuurman, W., Bailey, B., Koops, W. and Grossman, M. 2003. A model for failure of a chicken embryo to survive incubation. *Poult. Sci.,* **82**(2): 214–222.

Liptói, K. and Hidas, A. 2006. Investigation of possible genetic background of early embryonic mortality in poultry. *Worlds Poult. Sci. J.*, **62**(2): 326–337.

Machado, J.P., Mesquita, M.A., Cafe, M.C., Assis, S.D., Veríssimo, S., Santos, R.R., Leandro, N.S.M. and Araujo, I.C.S. 2020. Effects of breeder age on embryonic development, hatching results, chick quality, and growing performance of the slow-growing genotype. *Poult. Sci.,* **99:** 6697–6704.

Payne, L.F. 1919. Distribution of mortality during the period of incubation. *Poult. Sci.,* **6**(2): 9–12.

Peñuela, Adriana. and Hernandez, Aureliano. 2018. Characterization of embryonic mortality in broilers. *Rev. MVZ Córdoba*, **23**(1): 6500-6513.

Tona, K., Onagbesan, O., De Ketelaere, B., Decuypere, E. and Bruggeman, V. 2004. Effects of age of broiler breeders and egg storage on egg quality, hatchability, chick quality, chick weight and chick posthatch growth to forty-two days. *J. Appl. Poult. Res.,* **13**: 10–18.

Tona, K., Bamelis, F., Coucke, W., Bruggeman, V. and Decuypere, E. 2001**.** Relationship between broiler breeder's age and egg weight loss and embryonic mortality during incubation in large-scale condition. *J. Appl. Poult. Res.,* **10**: 221–227.

Ulmer-Franco, A.M., Fasenko, G.M. and Christopher, E.O.D. 2010. Hatching egg characteristics, chick quality, and broiler performance at 2 breeder flock ages and from 3 egg weights. *Poult. Sci.,* **89**(12): 2735-2742.

Vieira, S.L., Almeida, J.G., Lima, A.R., Conde, O.R.A. and Olmos, A.R. 2005. Hatching distribution of eggs varying in weight and breeder age. *Braz. J. Poult. Sci.,* **7**: 73–78.

Yahav, S. and Brake, J. 2014. Chick embryogenesis: a unique platform to study the effects of environmental factors on embryo development. *J. Stem Cells*, **9**(1): 17.