Ghana Journal of Science, Technology and Development
Vol. 5, Issue 1. November, 2017
Journal homepage: www.gjstd.org
ISSN: 2343-6727

Effects of season and housing system on mortality in commercial flocks of Hy-Line Brown layers - a case study of a commercial farm on the Accra plains

Abdul-Rahman I. I.

Department of Veterinary Science, Faculty of Agriculture, University for Development Studies, P. O. Box TL 1882, Tamale, Ghana.

Author: ibniddriss@uds.edu.gh

ABSTRACT

There is a general paucity of information on the difference in mortality levels between the manual and automated battery cage housing systems used in commercial settings in Sub-Saharan Africa. Data was obtained from a commercial farm on the Accra plains to determine the effects of housing system on mortality in Hy-line brown birds during eight (8) year period. Thirteen thousand, nine hundred and eighteen (13,913) chicks, 346, 015 growers and 1,195, 538 layers were involved. The effects of season and type of housing on monthly mortality rates were determined using 2 - tailed t- test. No differences ($p > 0.05$) were found in seasonal mortality rates between chicks, growers and layers. Similarly, no difference ($p > 0.05$) was found in mortality rates between birds kept in automated and those kept in manual housing. Monthly mortality rate was, however, higher ($p<0.05$) in the year 2004 than all the years studied. Mortality tended to be lower in automated than manual housing systems, and good husbandry practices on commercial farms may be responsible for these lower figures.

Keywords: *Mortality, Hy-line brown, season, chicks, grower*

INTRODUCTION

Poultry are birds such as the domestic fowl, guinea fowl, turkey, geese, and ostrich, among other birds which serve as a source of food to man. Their production makes significant contribution to human food (Demeke, 2004). Domestication of poultry is said to have started in Asia. The earliest record dates back to about 3200 BC in India. Chickens have been bred in captivity in Egypt since about 1400 BC. The red jungle fowl, an Asian breed, is assumed to be ancestor of the modern poultry breeds (West and Zhou, 1989). Recently, there is some evidence indicating that the first domestication of fowl took place much earlier and not in Southeast Asia but in China (Ketelaars and Saxena, 1992). Poultry were kept by farmers in China, India and East Asia long before they were known to the Europeans and Americans (Van Wulfeten Palthe, 1992).

Studies have shown that the level of performance of poultry does not only depend on inherited capacity, but also to a great extent upon the environment (Campbell and Lesley, 1975). The environmental conditions affecting the performance, health and productivity of a chicken include: temperature, relative humidity, light, housing system and ventilation. High temperatures and humidity for instance, have some negative effects on poultry such as an increase in poultry body temperature and a decrease in feed consumption (Cowan and Michie, 1978). High temperatures also result in a reduction in poultry live weight (Mowbrary and Sykes, 1971) growth rate and high mortality (Arjona *et al*., 1988), and decrease in productivity and quality of eggs (Ozbey and Ozoelik, 2004). Temperature is an important bio-climatic factor affecting the physiological function of layer chickens (McDowell, 1972), though the effect on egg production rate depends on age of laying hens. Most highly productive poultry are kept in temperate zones where the effect of cold stress is likely to be more important than the effect of high ambient temperature (Smith, 1990). Disease outbreak, increased mortality and higher percentage of cull birds could adversely affect profitability of layers. Farooq *et al.* (2001) reported a significant and negative association of mortality with net profit, suggesting that increase in mortality would result in a decrease in net profit.

Varying mortality rates have been reported in birds of difference age groups and categories. A mortality rate of 50 % and 60 % has been recorded in chicks and growers, respectively (Awuni, 2001). Mortalities observed in birds kept under the free-range system are in the range of 80 – 90 % within the first year after hatching (Matthewman, 1977; Wilson *et al*. 1987). However, Veluw (1987) reported 75% mortality rate in birds in the dry season. Birds kept under the extensive system of management are subject to high mortality resulting from accidents, predation or diseases (Guèye, 1998). Even though mortality rates and pattern in flocks of chicken has been established in temperate regions, there is very little documentation of mortality rates and pattern of temperate breeds of chicken in tropical regions, particularly, in commercial setting in the Sub-Saharan Africa. The objective of the present work, therefore, was to determine the mortality rates in the Hy-line Brown breed of layers as affected by season and type of housing.

MATERIALS AND METHODS

Experimental site

Data was collected from a commercial farm on the Accra plains, Sydals limited. Sydals is located at Tema in the Greater Accra region of Ghana. Tema municipality is a coastal city situated 25 Kilometers east of Accra, the national capital. The Greenwich Meridian (00 longitude) passes through the city of Tema. The metropolis shares common boundaries with the Accra Metropolis on the West, the Ga District Assembly on the North West and the Dangbe West District on the Northern and Eastern borders. Tema is characterized by a dry equatorial climate. It is driest part of southern Ghana with an annual rainfall of about 790 mm. The rainfall pattern is bimodal with the dry season beginning from November to March, the major rainy season extending from April to June. There is a break between July and August and the minor rainy season begins from August to October.

System of management

Birds are kept under the intensive system of management. feed and water are given *ad* libitum and a strict vaccination schedule is followed. Feeding is done in four parts, chick starter, grower, pre layer and layer mash. Chick starter of 7 g/bird/day to 14 g/bird/day for the 1st and 2nd week, grower mash of 21 g/bird/day to 38 g/bird/day from the 3rd to the

6th week of age and a layer mash of 100 to 116 g/bird/day is given to the birds. The feed contained 2653 Kcal/kg metabolizable energy, 15% crude protein, 0.72% lysine and 4.5% calcium as the major nutrients present. When birds are fourteen weeks old they are given New Castle vaccine because of previous cases of New Castle outbreak on the farm. Table 1 shows the vaccination schedule carried out on the farm.

Table 1: Vaccination schedule

Age (weeks)	Vaccine	Mode of application
3 – 5 days	New Castle (HB1)	Oral
2 weeks	Gumboro	Oral
	2nd New Castle (lasota)	Oral
4 weeks	2nd Gumboro	Oral
6 weeks	1st Fowl pox	Parental
12 weeks	2nd Fowl pox	Parental
14 weeks	New Castel (lasota)	Oral
16 weeks	New cavac. 3rd castle disease vaccine	Injectable is given before laying

Source: Sydals Limited

Experimental birds

The Hy-line brown breeds of birds were used for the study. A total of 73, 918 chicks, 346 015 growers and 1, 195, 538 layers were involved. One million, six hundred and fifteen thousand, four hundred and seventy-one (1, 615, 471) birds were kept in manual battery cage houses, while 543 856 were kept in automated battery cage houses.

Parameters measured

Data was obtained on monthly mortality of chicks, growers and layers from farm records kept between the year 2008 and 2015. Birds ranging in age between day old and 4 weeks were classified as chicks; those between over 4 weeks to 16 weeks of age were classified as growers, while those over 16 weeks old were categorized as layers. Season of mortality were also categorized into wet and dry seasons based on the climatic season during which the particular mortality were recorded. Mortality figures were also categorized into two based on type of housing used. Those kept in battery cage without environmental control and those kept in automated battery cage housing where temperature and humidity are always maintained between 20-24 °C and 60-70 %, respectively, based on the time of the day.

Data analysis

The t-test (2-tailed) was used to determine the effect of season on mortality in chicks, growers and layers, as well as the effect of type of housing on mortality in Hy-line brown layers. Anova for completely randomized design was used to ascertain the effect of year of production on mortality rate, and means separated using Tukey's test. All comparisons were done at 5 % level of significance.

RESULTS AND DISCUSSION

The result obtained from the present study showed that there were no significant differences ($p > 0.05$) in mortality rates between wet and dry season in chick, grower and layer flocks (Table 2). Goodger *et al.* (2002) reported high chick mortality in the wet season and attributed their findings to high incidence of New Castle disease in the wet season. Similar observation was made by

Awuni (2001) in local chicken. The high mortality observed in the local chicken was attributed to the fact that these animals are kept on free range and only find a place to roost at night. They are, therefore, largely exposed to harsh environmental conditions, such as extreme cold, high temperatures, and also conditions which will promote the growth of bacteria and fungi, which causes disease and an increase in pest populations (Awuni, 2001). Some of the diseases are contracted when birds come into contact with sick ones and this prevails mostly in the free range system of keeping birds. Birds in the free-range system are exposed to predators which are active during the dry season due to shortage of food, and these birds, especially, chicks serve as alternate food source. Low mortality levels recorded in the present study may be attributed to the ability of commercial producers to purchase vaccines and vitamin supplements (Veluw, 1987), and these birds are not allowed to come into contact with sick birds, therefore, the medium of transfer of deadly diseases is eliminated. IFAD (1991) and UNOPS (1995) reported that in the intensive system of housing, the medium of transfer of diseases is largely eliminated, unlike the extensive and semi-intensive system where birds are more susceptible to high mortality due to the absence of appropriate technical follow-up. Veluw (1987), however, observed higher mortality rate in the wet than the dry seasons. The monthly mortality rate in the year 2012 was significantly higher ($p<0.05$) than the rates observed during all the years under study. Similar monthly mortality levels were, however, noted in 2009, 2010, 2013, 2014 and 2015. The least (1%) mortality level was in 2011, and this was similar to those recorded in 2008 and 2009 (Fig 1). The high mortality rate recorded in the year 2012 could be due to the fact that 19.73 % and 12.22 % of the birds died out of cachexia in the months of July and August, respectively, on the farm. Lower monthly mortality rate during the other years is attributable to good husbandry practices, as commercial farms employ good husbandry managers, and are able to afford vaccines to prevent infections (Veluw, 1987) and consequently death.

No difference ($p > 0.05$) was found in mortality rates between birds raised under the automated system and those in the manually operated houses (Table 2). Mortality in the manual houses, however, tended to be higher than in the automated housing systems. The slightly higher mortality rate observed in the manual housing system could be attributed to the fact that in the manual battery cage system, faeces are not collected regularly as is done with the automated ones, and this brings about heat generation from the faeces which increases the temperature, Carbon dioxide and Ammonia concentrations of the house, making it stuffy. This builds up pathogens in the surrounding atmosphere, which causes diseases to these birds, and ultimately, death. It has been shown that heat stress has detrimental effects on the performance of 4 – 8 week old broiler birds reared in the open-sided poultry houses; principally through reducing feed intake and growth rate, negatively affecting feed efficiency and carcass quality, as well as health (Carmen *et al*., 1991; Yahav *et al.,* 1996; Temim *et al.,* 2000; Har *et al*., 2000; Oskan *et al*., 2003). Moreover, chronic heat stress increases the time to reach market weight and mortality rate (Ozbey and Ozoelick, 2004). A higher incidence of mortality has also been reported in floor-reared laying hens than in laying hens reared in conventional cages (Weitzenburger *et al*., 2005). Similar observation was made by Petermann (2003) in deep litter houses. Voslarova *et al*. (2006) reported that the number of laying hens is also decreased as a consequence of higher incidence of mortality in the deep litter system due to the manifestations of cannibalism recorded in the system. Tauson *et al*. (1999) detected mortality of laying hens kept under the deep litter system at the level of 21 to 27%, caused mainly as a result of bacterial infections due to the pecking at naked skin by more aggressive laying hens. Also, Abrahamsson and Tauson (1998) reported 4 – 20.9% mortality rate, while Sommer and Vasicek (2000) reported a level of 0 – 32% in laying hens. The yield of laying hens, particularly, in terms of number of eggs laid, can also be influenced by the incidence of mortality in laying hens.

Table 2: Effects of season and type of housing on monthly mortality rate in chick, grower, and layer flocks

Category of Bird	**Seasonal mortality**		**Probability**	**Type of Housing**		**Probability**
	Dry (%)	Wet (%)		Automated (%)	Manual (%)	
Chicks	1.9 ± 0.6	4.5 ± 1.4	0.12	-	-	-
Growers	1.9 ± 0.6	3.0 ± 1.7	0.51	-	-	-
Layers	3.0 ± 0.8	1.6 ± 0.2	0.10	1.6 ± 0.3	2.4 ± 0.3	0.19
Overall	2.6 ± 0.6	2.2 ± 0.4	0.50	-	-	-

Mortality = mean ± SEM, where SEM = Standard error of difference of means.
*Chicks and growers were kept only in manual battery cage houses.

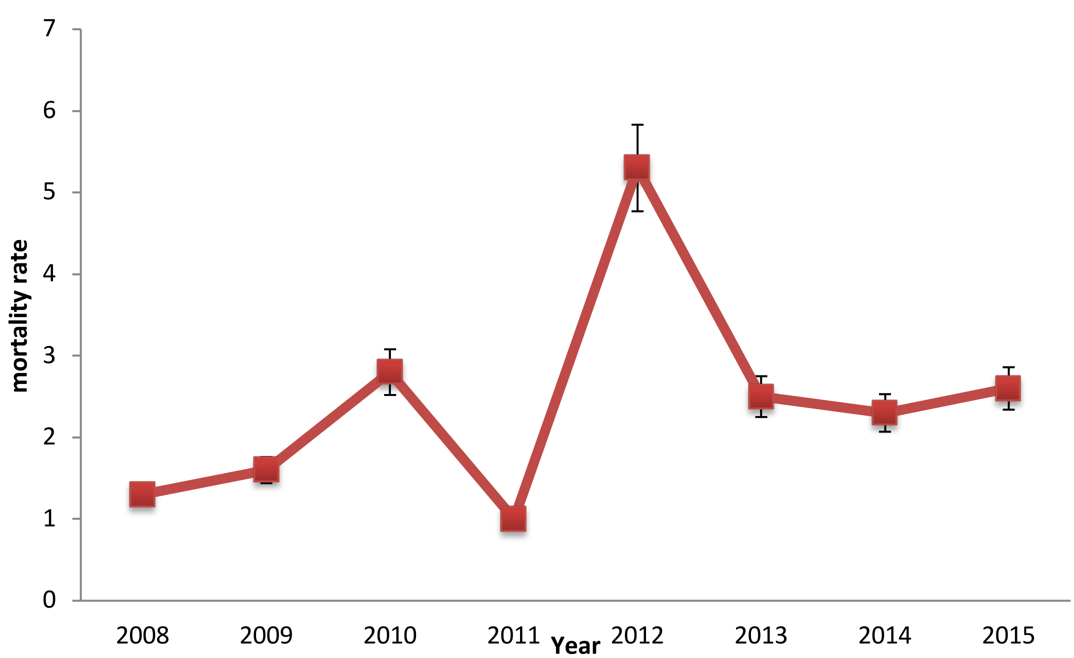

Figure 1: Yearly mortality rates in Hy-line Brown layers

CONCLUSION AND RECOMMENDATION

Climatic season has no effect on mortality in commercial flocks. There were only marginal differences in mortality levels in manual and automated battery cage houses, and good husbandry practices on commercial farms may be responsible for these lower figures.
Further studies should consider bringing on board other farms to ensure a broader application of results.

Acknowledgements
The author wishes to thank Ken Quartey, William Ahiadormey and Louis Kwawuvi, the Managing Director, Farm Manager and Assistant husbandry Manager, respectively, of Sydals Limited, for allowing the use of their facility for this work.

REFERENCES

Abrahamsson, P. and Tauson R. (1998). Performance and egg quality of laying hens in an aviary system. Journal of Applied Poultry Research 7: 225-232.

Arjona, A. A., Denbrow, D. M. and Weaver, W. D. (1988). Effect of heat stress early in life on mortality in broilers exposed to high environmental temperatures just prior to marketing. Poultry Science 67: 228-231.

Awuni, J. A. (2001). Strategies for the improvement of rural chicken production in Ghana. www.iaea.or/programmes/nafa/d3/public/4-strategies-awuni.pdf.

Carmen, A., Francis, M., Macleod, G. and Julie, E. (1991). Alleviation of acute heat stress by food withdrawal or darkness. British Poultry Science 32: 219-225.

Campbell, J. R. and Lesley, J. F. (1975). The science of animals that serve humanity. McGraw Hill Co, USA. pp 307-309.

Cowan, A. and Michie, A. (1978). Environmental temperature and broiler performance: The use of diets containing increased amounts of protein. British Poultry Science 19: 601-605.

Demeke, S. (2004). Egg production performance of local and White Leghorn hens under intensive and rural household conditions in Ethiopia. *Livestock Research for Rural Development, Vol. 16, Art. #9,* Retrieved May 26, 2016, from http://www.lrrd.org/lrrd16/2/deme1602.htm

Farooq, M., Mian, M. A. and Asghar, A. (2001) Factors affecting cost of production and net profit per broiler in the subtropics. *Livestock Research for Rural Development. Volume 13, Article #4.* Retrieved May 26, 2016, from http://www.lrrd.org/lrrd13/1/faro131.htm

Goodger, W. J., Bennett, T. B. and Dwinger, R. H. (2002). Comparative analysis of family poultry production in 12 African countries. www.fao.org/ag/againfo/themes/en/infpd/documents/Gueye.pdf.

Gueye, E. F. (1998). Village egg and fowl meat production in Africa. World's Poultry Science Journal 54 (1): 73-86.

Har, L., Rong, D. and Zhang, Z. Y. (2000). The effect of thermal environment on the digestion of broilers. Animal Physiology 83: 57-64.

International Fund for Agricultural Development (IFAD) (1991). Yearly report. Retrieved from https://www.ifad.org/pub/annual_report.

Ketelaars, E. H. and Saxena, H. (1992). Management of poultry production in the tropics. Benekon, Holland. pp. 11.

Matthewman, R. W. (1977). A survey of small livestock production at the village level in the Deprived Savanna and Lowland forest zones of South West Nigeria, University of Reading, Department of Agriculture and Horticulture, Study No. 24, ISBN No. 0-70490242-7. pp. 40-41.

McDowell, R. E. (1972). Improvement of livestock production in warm wet climate. W. H.

Freeman and Company, San Francisco USA. pp. 2-22.

Mowbray, R.M. and A.H. Sykes, 1971. Egg production in warm environmental temperatures. British Poultry Science 12: 25-29.

Oskan, S., Akbas, Y., Altan, O., Ayhan, V. and Ozkan, K. (2003). The effect of short – term fasting on performance traits and rectal temperature of broilers during the summer season. British Poultry Science 44: 88-95.

Ozbey, O. and Ozoelik, M. (2004). The effect of high environmental temperature on growth performance of Japanese quails with different body weights. International Poultry Science. pp. 470-488.

Petermann, S. (2003). Laying hens in alternative housing systems – practical experiences. Dtsch Tierarztl Wochenschr 110: 220-224.

Smith, A. J. (1990). Poultry, The Tropical Agriculturist Centre for Tropical Veterinary Medicine, University of Edinburg Macmillan, pp 48 – 200.

Sommer, F. and Vasicek, L. (2000). Management and state of health in free-range poultry flocks. Wien Tierarztl Monatsschr 87 (7): 202-212.

Tauson R., Wahlstrom A., Abrahamsson P. (1999): Effect of two floor housing systems and cages on health, production, and fear response in layers. Journal of Applied Poultry Research 8: 152–159.

Temim, S., Chagneau, A., Peresson, M. and Tesseraud, S. (2000). Chronic heat exposure altars protein turnover of three different skeletal muscles in finishing broiler chickens fed 20 or 25 % protein diets 1, 2. Journal of Nutrition, 130: 813-819.

The United Nations Office for Projects (UNOPS) (1995). The 1995 year report book. https://www.unops.org/.../Annual-reports.../UNOPS-Annual-Report-08-EN.p

Van Wulfeten Palthe A. W. (1992). C. S. the van Gind's Poultry Paintings. Dutch Brand of world's Poultry Science association, Beekgergen, The Netherlands. pp 10-13.

Veluw, V. K., 1987. Traditional poultry keeping in Northern Ghana. ILEIA, 3(4): 12-13.

Voslarova, E., Rubesova, L., Vecerek, V., Pistekova, V. and Malena, M. (2006). Variation in the mortality rate of turkeys during transport to the slaughterhouse with travel distance and month. Berliner und Munchener Tierarztliche Wochenschrift 119: 386–390.

Weitzenburger, D., Vits, A., Hamann, H. and Distl, O. (2005). Effect of furnished small group housing systems and furnished cages on mortality and causes of death in two layer strains. British Poultry Science 46: 553-559.

West B. and Zhou, B-X. (1989). Did chickens go north? New evidence for domestication. World's Poultry Science Journal 45: 205-218.

Wilson, R. T., Traore, A., Kuit, H. G. and Slingerland, M. (1987). Livestock production in central Mali: Reproduction, growth and mortality of domestic fowl under traditional management. Tropical Animal Health and Production 19: 229-236.

Yahav, S., Straschnow, A., Plavnik, I. and Hurwitz, S. (1996). Effects of diurnal cycling versus constant temperatures on chicken growth and food intake. British Poultry Science. 37: 43-54.