

# INCIDENCE OF BLOOD AND MEAT SPOTS IN EGGS FROM A COMMERCIAL POULTRY FARM

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## ABSTRACT

A study was conducted in two phases simultaneously in a commercial poultry farm to ascertain whether egg weight, temperature variation in pens and proximity of birds to a noise source had an influence on the incidence of blood and meat spots in chicken eggs. Phase one involved the random sampling of 60 eggs per week for 15 weeks, making a total of 900 eggs from the pens of a 50-week-old layer strain. Phase two determined the effect of noise from a 3.3 kW electrical gasoline generator on the incidence of blood and meat spots. It lasted for 14 weeks and involved the random sampling of 10 eggs per week directly from two pens (i.e., A & D). Pen A and D were 4.7 m and 68 m away from the noise source respectively. A Chi-square test was conducted to establish the relationship between the parameters, whilst a Cramer's V test was used to determine the extent of association where differences were deemed significant ( $p < 0.05$ ). Out of the 1040 eggs collected, 63% of the eggs had spots (32% blood spots and 31% meat spots). No association was observed between the occurrence of spots and egg weight, temperature variation and proximity of birds to a generator.

**Keywords:** Blood spots, chicken egg, egg weight, layer birds, meat spots.

## Introduction

An egg is generally considered as a complete food and is an excellent source of digestible protein, vitamins, minerals, carotenoids and fatty acids that are required for proper nutrition (Song & Kerver, 2000). Egg consumption differs widely among countries, with per capita consumption being high in the developed countries (Akonor & Akonor, 2014). Mingle *et al.* (2021) stated that the estimated egg consumption per person per day in Ghana is 211g. In Ghana, egg production has seen a steady increase, although not at the same rate as poultry meat; they are utilized as an ingredient in several culinary and industrial applications including baking and the production of ice cream and other desserts (Akonor & Akonor,

2014). It is common knowledge, based on interviews with wholesalers, retailers and consumers, that chicken eggs may, upon breakage, have what is usually described as blood or brown spots in the albumen which may tend to affect their acceptability and/or intake. Many egg consumers have complained about these spots which may even discolour the egg yolk in some instances. Interestingly, some have described these as fertilized eggs with developing embryo hence they discard them (Boateng *et al.*, 2019). It has been generally assumed that blood or meat spots in eggs are the result of haemorrhaging from small blood vessels of the stigma which are ruptured at the time of ovulation (Feng *et al.*, 2019). According to Tamiru *et al.* (2019), eggs

with blood and meat spots are unappealing to consumers and therefore are usually of low market value. Such eggs are not appropriate for sale (Campo & Gil, 1998). Blood and meat spots may be one of the considerable hindrances to the sales of otherwise, quality eggs. Quite a number of consumers, after observing these blood or meat spots, based on interviews, have stopped buying eggs and this then affects the market share of the retailers. Some consumers have been accusing retailers and wholesalers of giving them eggs with developing embryos and some have suggested that they have been supplied rotten eggs because there was blood or meat spots in them (Boateng *et al.*, 2019). The incidence of blood and meat spots in chicken eggs has been one of the potential threats affecting the marketing of eggs; this, in turn, will affect the profitability and sustainability of any commercial poultry layer.

The objective of the study was to determine the incidence of blood and meat spots in eggs from a commercial layer farm and the effects of factors such as egg weight, temperature variation and noise on the occurrence of these spots.

## Experimental

### *Study area*

The experiment was conducted in a commercial layer farm that deals with the production and sale of table eggs. The farm is located at Kubease, in the Juaben Municipality in the Ashanti Region of Ghana. It lies within latitude 1°15N and 1°45N and longitude 6°15W and 7°W.

### *Background, housing system and management practices at the farm*

The production capacity of the farm was 56,000 layers which consisted of Lohmann Brown, Novogen Brown, White Leghorn and Hyline strains. The housing system was

a deep litter system with a total number of 10 buildings and 48 individual pens. The dimension of each pen was 12 m x 12 m with a stocking density of 1000 birds per pen. Apart from fencing, disinfection, routine vaccination and some medication programmes practised, no other biosecurity measure was undertaken at the farm. The farm used automatic drinkers to provide water to the birds but the feed (layer mash) was manually compounded and given to the birds in metal feeders.

### *Feeding*

The birds were fed and watered *ad libitum*. Ingredients used in compounding diets at the farm were purchased from Aduse-Poku Farms Ltd., Premium Foods Ghana Limited and other reputable outlets in the open market in Kumasi. The diet used at the farm is presented in Table 1.

**TABLE 1**  
*Ingredients and their respective inclusion levels in feed*

Ingredients	Inclusion level (%)
Maize bran	49.8
Maize	0
Wheat bran	0
Soybean meal	14.2
Layer concentrate (5%)*	14.2
Fishmeal	2.8
Oyster shell	9.5
Palm kernel cake	9.5
<b>Total</b>	<b>100</b>

\*Layer concentrate-5%, Analysed composition: crude protein, 30%; crude fat, 2%; calcium, 4%; Phosphorus (total), 4.1%; phosphorus (available), 2.1%; Lysine, 2.0%; Methionine, 3%; Methionine + cysteine, 3.5%; Sodium, 2.9%; metabolizable energy, 2280 Kcal/kg. Vitamins per kg of concentrate: Vitamin A, 200000IU; Vitamin D3, 40000IU;

Vitamin E, 300mg; Vitamin K3, 40mg; Vitamin B2, 80mg; Vitamin B12, 0.5mg; Folic acid, 15mg; Niacin, 500mg; Pantothenic acid, 180mg; Choline chloride, 8000mg. Added minerals per kg of concentrate: Mg, 1200mg; Zn, 1000mg; Cu, 120mg; I, 10mg; Se, 4mg. Enzymes: phytase and Ronozyme NP added.

#### *Experimental birds, procedure and data collection*

A total of 9000 fifty-week-old birds were used for the study. The study was conducted in two phases simultaneously and for 105 (Phase I) and 98 (Phase II) days. Data was collected using random sampling in both phases of the experiment.

#### *Phase I*

The phase I was to determine the incidence of blood and meat spots in eggs and to establish whether there is a relationship between the weight of egg and temperature variations in pens on the occurrence of blood and meat spots. A total of 60 eggs were selected at random every week from egg trays and broken. The total number of eggs used for this phase was 900.

#### *Phase II*

This phase was to determine whether a noise generated by a 3.3 kW electrical power output gasoline generator can have an influence on the occurrence of blood and meat spots in eggs of layer birds in a pen labelled "Pen A" which is 14ft (4.7 m) away from the gasoline-electric generator (3.3 kW) and a pen labelled "Pen D" which is 204ft (68 m) away. Eggs were picked at random directly from the two pens. Total eggs collected per week were 10, that is, 5 eggs from each pen, making a total of 140 for a 14-week experimental period.

#### *Parameters measured*

Egg weight was taken using an electronic precision balance (HRB Series Balance, HRB203), thereafter which the presence and/or absence of blood and meat spots was determined. The average daily temperature of the pens at 6 am, 12 pm and 6 pm was also measured using a thermometer (Thermo Fisher Scientific Inc., Massachusetts, USA). Eggs were categorized by weight i.e., large (>60 g), medium (50-60 g), small (45-49 g) and peewee (<45 g) and the average temperatures in pens were categorized as either high (>29 °C), moderate (20-29 °C) or low (<20 °C). Blood spot (Fig. 1) was determined by the presence of blood on the yolk and/or in the albumen. Meat spot (Fig. 2) was determined by the presence of brownish tissue in the albumen.



Fig. 1. Blood spot on a yolk



Fig. 2. Meat spot in an albumen

#### *Statistical analysis*

Using Statistical Package for Social Sciences, SPSS (v 20), all data were analysed by descriptive statistics. A Chi-square test was conducted at 5% probability level to ascertain whether there is a relationship between variables namely; egg weight, the temperature in pens, the proximity of birds to gasoline generator (3.30 kW) and the occurrence of blood and meat spots and Cramer's V test was used to determine the strength of association where differences were considered significant ( $p < 0.05$ ).

## Results and discussion

### Phase I

#### Egg weight and spots (blood and meat)

It has been documented that the weight of an egg depended on the age of the laying hen (Samiullah *et al.*, 2016). The weight of egg increases linearly as the laying hen grows

older. Meanwhile, it has also been reported that there is an increase in the incidence of blood and meat spots as the laying hen aged (Saribas *et al.*, 2019). However, there is a dearth of information on the occurrence of spots (i.e., meat and blood) and egg weight. Table 2 shows the occurrence of the spots in eggs with differing weights.

TABLE 2

*Spots occurrence in a commercial poultry farm and how they relate to the weight of eggs*

Spots	Egg grade*				p-value
	Large (>60 g)	Medium (50-60 g)	Small (45-49 g)	Peewee (<45 g)	
Blood spot (288)	48	143	43	54	0.400
Meat spot (273)	33	134	46	60	0.351
No spot (339)	50	162	68	59	0.363

It can be seen that no association ( $X^2 = 0.505$ ,  $df = 6$ ,  $P > 0.05$ ) existed between the occurrence of blood and meat spots and the weight of eggs; indicating that blood and/or meat spots occurrence in the four egg categories did not differ from one another (Table 2). According to Travel *et al.* (2011), the average weight of an egg of a commercial layer strain at 50 weeks old is 65.5 g and this implies that most of the weight of the eggs collected in this study was below the mean egg weight of a 50-week-old commercial layer strain.

#### Spots occurrence and temperature variation

As can be observed from Table 3, the occurrence of spots (blood and meat) was not dependent ( $p > 0.05$ ) on temperature variation even though differences occurred. It's noteworthy that, even the high temperatures ( $> 29^\circ\text{C}$ ) did not influence the occurrence of meat and blood spots. Travel *et al.* (2011) reported that the environmental temperature

can influence the laying hen's physiological status and as a result affects the quality of eggs produced. The thermal neutral zone for laying birds is in the range of  $22\text{--}24^\circ\text{C}$  and therefore when laying hens are kept in temperatures of  $29^\circ\text{C}$  and above, there is a change in their metabolism leading to a decrease in feed intake. This, according to Mardsen & Morris (1987), leads to a decline in egg production and egg quality. On the contrary, our findings did not collaborate this assertion as the incidence of blood and meat spots found in eggs collected from layer chickens exposed to high temperature ( $> 29^\circ\text{C}$ ) were lower in percentage terms than their "low temperature ( $20\text{--}29^\circ\text{C}$ )" counterpart. Earlier, Wilson *et al.*, (1964) found fewer blood spots in the eggs from Leghorn raised at  $32^\circ\text{C}$  compared to those raised under temperature of  $21^\circ\text{C}$  or variable temperatures of  $7.9$  to  $23.1^\circ\text{C}$ .

**TABLE 3**  
*Temperature variations and occurrence of spots in both strains*

Temperature in pen (°C) *	Blood spot	Meat spot	No spot	p-value
High temperature (>29 °C)	144 (30%)	151 (31.5%)	185 (38.5%)	0.160
Moderate temperature (20-29 °C)	131 (36.4%)	99 (27.5%)	130 (36.1%)	0.647

\*No pen had temperature recording below 20 °C throughout the experimental period

### Phase II

#### *The proximity of birds to generator and spots occurrence*

Table 4 shows the occurrence of blood and meat spots in eggs and the proximity of birds to the generator. It was realized that no association occurred between the incidence of spots (blood and meat) and the proximity of birds to a noise (generator) source although there were

differences in frequency. The difference could be due to chance and the fact that birds in pen “A” may have adapted to the effect of the noise from the 3.30 kW electrical power gasoline generator. Lordelo *et al.* (2020) had recently reported that environmental factors such as sudden loud noises may induce the occurrence of blood and meat spots in eggs, but this was not the case in our study.

**TABLE 4**  
*Proximity of birds to the generator (noise) on the incidence of spots*

Spots	Pen*		P-value
	Pen A (n=70)	Pen D (n=70)	
Blood spot (42)	18	24	0.357
Meat spot (53)	29	24	0.486
No spot (45)	23	22	1.000

\*Pens A and D were 4.7m and 68m respectively from the noise (generator) source

### Both Phase I and Phase II

Table 5 shows the occurrence of blood and meat spots, in numbers and percentages respectively, in eggs collected from the commercial poultry farm irrespective of egg weight and proximity of birds to a noise source.

**TABLE 5**  
*Blood and meat spots occurrence in eggs from the commercial poultry farm*

Total number of eggs	Blood spot (%)	Meat spot (%)	No spot (%)
1040	330 (32%)	327 (31%)	383 (37%)

#### *Blood and meat spots in eggs*

Out of 1040 eggs (Table 5) collected from the Farm, 330 (32%) eggs had blood spots while 327 (31%) had meat spots. A total of 383 (37%) eggs were classified as normal (no spot). The total of 657 eggs with either blood or meat spots represents 63% of all the eggs (1040) examined and this is higher than what was documented by the United States Department of Agriculture (USDA, 1987) that blood and meat spots occurrence in brown eggs was 18% while the rate in white eggs was only 0.5% per group. Although Saribas *et al.* (2019) had reported that the number of meat and blood spots in eggs increased as hens grew older, the 32% blood spots and 31% meat spots recorded in this study is very high and some factors such as heat stress and nutrition may have caused

these high defects. Lordelo *et al.* (2020) also reported a higher percentage of meat spots (31.34%) and blood spots (23.88%) of Preta Lusitânica breed, when they compared the quality of eggs from indigenous chicken breeds and that from commercial layers.

### Conclusion

The occurrence of spots (blood and meat spots) in eggs from the commercial poultry farm was high (63%); blood spot alone was (32%) whilst meat spot occurrence was (31%). Blood and meat spots occurrence did not seem to be dependent on egg weight, temperature variation and noise source (generator).

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Received 22 Jun 20; revised 08 Jul 22.