INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 12, No. 3, p. 220-225, 2018
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Effect of summer and winter seasons on egg abnormalities of outdoor rearing some native chicken strains

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Article published on march 30, 2018

Key words: Native chicken, Strains, Egg abnormalities, Outdoor, Season, Iraq

Abstract

This study aimed to identify the effect of season on egg abnormalities of some native chickens (Native strains: brown, barred and white). These chicken strains were outdoor reared. A total of 600 eggs of native chicken (300 eggs in summer and 300 eggs in winter), 200 eggs per strain were freshly laid collected from different traditional poultry farms west of Baghdad city during 2017. All collected egg of each strain were separated according to shape, size and shell structure. Results revealed that significant chicken strains differences ($P<0.05$) were found in the percentage values of egg shape abnormalities. White chicken strain had the highest percentage of egg shape abnormalities (11%) whereas Barred and Brown chicken strains were low (9 and 5% respectively). No significant chicken strains differences were found in the percentage values of egg shape and egg structure abnormalities. Significant differences ($P<0.05$) were found in the percentage values of egg abnormalities due to season. For all studied chicken strains abnormalities were high in summer compared with winter season and all were classified in the categories of minor abnormalities (+).

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Introduction

Table egg abnormalities or egg quality defects are classified as external and internal defects, these defects in commercial layers are about 10% of the total eggs produced which are downgraded due to external defects while 1% is due to internal defects. External defects include egg shape, texture shell quality and cleanliness. Internal egg quality defects are occur in the yolk and albumen, which are blood and meat spots, double yolks, mottled and discolored white or yolks, rotten eggs, watery white and round worms in eggs (King'ori, 2012a).Many egg abnormalities appear to have no specific cause, but the incidence is much higher in hens subjected to stress and bad management conditions, rough handling and vaccination during production. A significant increase in the number of soft-shelled eggs is also common as a result of some viral diseases such as infectious bronchitis, egg drop syndrome, and Newcastle disease (Stadelman and Cotterill, 1995; Al-Shadeedi and Al-Hilfi, 2016; Rosales, 2018).

Most ridged (rough), flattened (slab-sided), soft-shelled and double-shelled eggs are the result of eggs colliding in the shell gland region of the oviduct when an ovum (yolk) is released too soon after the previous one, the two full-sized eggs can be found in the shell gland pouch. As the second egg comes in contact with the first, pressure is exerted, disrupting the pattern of mineralization. The first egg will be white and chalky appearance, while the second egg is flattened on its contiguous surface. Ridged eggs may have been retained too long in the shell gland region (Bennett, 1992; Roque and Soares, 1994; Stadelman and Cotterill, 1995).

Commercially about 5-7% of table eggs produced are damaged and do not reach the consumer, 2-3% of the damage is due to problems during laying whereas 3-4% of the damage will occur during the process and handling after laying. No single factor is usually responsible for egg defects. Many factors related to egg quality defects include nutrition, health, flock management, environmental conditions and breeding.

It is therefore important for the egg value chain players to understand the various types of egg defects and their causes. This will enable them device ways and means to minimize them, hence improve egg quality (King'ori, 2011; King'ori, 2012b; Al-Shadeedi and Al-Hilfi, 2016).

Native chickens in Iraq had always preferred by Iraqi consumers over that of commercial poultry egg and meat due to its unique egg and meat taste, flavor and texture. Being free ranged, native chicken is generally perceived as free from antibiotics and other synthetic chemical residues. The global trend of shifting consumer preferences toward organic and naturally produced products in recent years justifies the premium price offered for native chicken over that of its commercial hybrid counterpart. Native chickens in Iraq are outdoor reared in small flocks, it grow in low level of nutrition and may suffering of high environmental condition or heat stress (Al-Hadeethi, 2002, Al-Obaidi, 2017), and egg abnormities may occur in high percentages. This will downgrade the egg production and may cause high economic loss (Stadelman and Cotterill, 1995). No accurate available data about this loss and no other native studies carried out with native chicken egg abnormalities, so this study aimed to identify the effect of season on the percentages of egg abnormalities of some native chicken strains in Baghdad city, Iraq.

Materials and methods

Chickens

Some native chickens (Local strains: brown, barred and white). These chickens were outdoor reared at farms in Abu-Graib west of Baghdad city, Iraq during two seasons, winter and summer 2017.

Chicken Management

Chickens (hens and cocks aged 30–50 weeks) were fed in the morning 50g/chicken/day concentrated ration as mentioned in Table (1) in the same time were outdoor ranged and grass feed were available.

Egg collection

A total of 600 eggs of native chicken (300 eggs in summer and 300 eggs in winter), 200 eggs per strain freshly laid (exclude cracked eggs) were collected from different traditional poultry farms in Baghdad city.

Egg shape index determined using the micrometer according to Stadelman and Cotterill (1995) and Al-Obaidi and Al-Shadeedi (2015) using the equation:

$$\text{Egg shape index} = \frac{\text{egg breadth (short circumference) mm}}{\text{egg length (long circumference) mm}} \times 100$$

Egg weight determined using a very sensitive digital Sartorius balance according to Stadelman and Cotterill (1995).

Table 1. Analysis and percentage composition of the diet used for feeding chicken strains.

Ingredient	(%)
Corn	60.54
Soybean meal	25.95
Soybean oil	3.00
Calcium carbonate	8.33
Calcium phosphate	1.28
Salt	0.30
Mineral premix[1]	0.25
Vitamin premix[2]	0.35
Total	100.0
Calculated analysis	
Metabolic Energy (Kcal)	2857
Crude Protein (%)	17.00
Lysine (%)	0.77
Methionine (%)	0.30
Methionine + cysteine (%)	0.59
Ca (%)	3.50
P Available (%)	0.35

[1]Vitamin premix supplied diet the following: vitamin A: 12,000 IU; vitamin D3: 2500 IU; vitamin E: 30 IU; vitamin K3: 2 mg; thia- mine: 2.25 mg; riboflavin: 7.5 mg; pyridoxine: 3.5 mg; cobalamine: 0.02 mg; niacin: 45 mg; D-pantothenic acid: 12.5 mg; biotin: 0.125 mg; folic acid: 1.5 mg.

[2]Mineral premix supplied diet the following: zinc: 50; copper: 12; iodine: 0.3; cobalt: 0.2; iron: 100; selenium: 0.1.

Egg abnormalities

All collected egg of each strain were separated according to shape, size and shell structure and shell color, all eggs round shape (74 or higher) and elliptical shape (70 or lower) were collected as shape abnormal (shape index not 72). Eggs below 40gm or higher than 65gm were collected as abnormal in size. Ridged (rough), flattened (slab-sided), soft-shelled and not regular calcium deposited were collected as abnormal structure (Romanoff and Romanoff, 1949; Stadelman and Cotterill, 1995; Al-Shadeedi and Al-Hilfi, 2016).

The number of abnormal eggs and its percentages from total collected eggs were calculated according to Al-Shadeedi and Al-Hilfi (2016). The degree of abnormalities of each character (shape, size and shell structure) were classified in two categories minor abnormalities (+) and major abnormalities (++) as described by Al-Shadeedi and Al-Hilfi (2016).

Statistical analysis

Data were analyzed by using the General Linear Model Procedure of SAS (2012). Means were compared by the Duncan's Multiple Range test at 5% probability (Steel and Torrie, 1980).

Results and discussion

Fig. (1) Shows some collected egg abnormalities of outdoor rearing native chicken strains during summer and winter seasons in Baghdad city, Iraq. Significant chicken strains and season differences ($P<0.05$) were found in the percentage values of egg shape abnormalities (Table 2), White chicken strain had the highest percentage of egg shape abnormalities (11%) whereas Barred and Brown chicken strains were low (9 and 5% respectively). For all studied chicken strains egg shape abnormalities were high in summer compared with winter season and all were classified in the categories of minor abnormalities (+).

The effect of summer and winter seasons on egg size abnormalities of outdoor rearing some native chicken strains were showed in Table (3). egg size abnormalities percentages were almost similar, which were 5, 6 and 4% for White, Barred and Brown chicken strains. No significant chicken strains and season differences were found in the percentage values of egg shape abnormalities and all were classified in the categories of minor abnormalities (+).

Brown chicken strain recorded the highest percentages of egg structure abnormalities (4%), White and Barred chicken strains were less (2 and 3% respectively) with no significant differences. The major percentages of egg structure abnormalities occurred during summer season and all were classified in the categories of minor abnormalities (+) as showed in Table (4).

The normal avian egg is the product of the coordinated function of reproductive system, any temporary or permanent impairment in the efficiency of the reproductive system may result in malformations of the egg. It was believed that abnormality in egg size due to the beginning or end of a laying period, hens oviposition small egg in the beginning period whereas hens oviposition large egg in the end period, also unusual egg size may appear unexpectedly at any point in series of normal eggs or any clutch size of a hen (Romanoff and Romanoff, 1949; Stadelman and Cotterill, 1995).

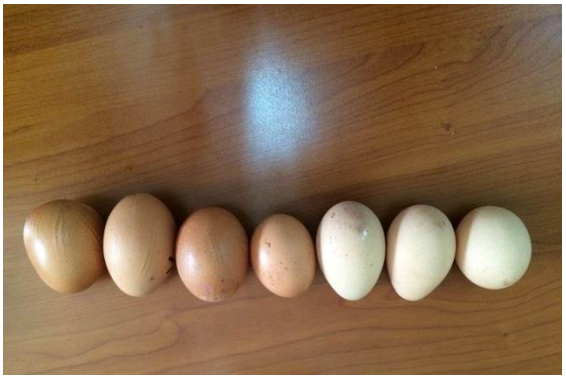

Fig. 1. Some egg abnormalities of outdoor rearing native chicken strains.

Table 2. Effect of summer and winter seasons on egg shape abnormalities of outdoor rearing some native chicken strains.

Native chicken strains	Season	No. of abnormal egg/Total eggs	Percentage (%)	Minor abnormalities (+) (%)	Major abnormalities (++) (%)
Barred	Summer	6/100	6.0^{a}	4.0^{a}	2.0^{a}
	Winter	3/100	3.0^{b}	2.0^{a}	1.0^{b}
	Total	9/200	4.5^{ab}	3.0^{ab}	1.5^{ab}
Brown	Summer	3/100	3.0^{b}	2.0^{b}	1.0^{a}
	Winter	2/100	2.0^{b}	2.0^{b}	0.0^{b}
	Total	5/200	2.5^{b}	1.5^{b}	1.0^{b}
White	Summer	7/100	7.0^{a}	5.0^{a}	2.0^{a}
	Winter	4/100	4.0^{ab}	2.0^{b}	2.0^{a}
	Total	11/200	5.5^{ab}	3.5^{ab}	2.0^{a}

Values with different superscripts in a column significantly ($p<0.05$).

Table 3. Effect of summer and winter seasons on egg size abnormalities of outdoor rearing some native chicken strains.

Native chicken strains	Season	No. of abnormal egg /Total eggs	Percentage (%)	Minor abnormalities (+) (%)	Major abnormalities (++) (%)
Barred	Summer	3/100	3.0^{b}	3.0^{ab}	0.0^{c}
	Winter	2/100	2.0^{b}	1.0^{c}	1.0^{b}
	Total	5/200	5.0^{a}	4.0^{a}	1.0^{b}
Brown	Summer	3/100	3.0^{b}	1.0^{c}	2.0^{a}
	Winter	3/100	3.0^{b}	2.0^{b}	1.0^{b}
	Total	6/200	6.0^{a}	4.0^{a}	2.0^{a}
White	Summer	2/100	2.0^{b}	2.0^{b}	0.0^{c}
	Winter	2/100	2.0^{b}	1.0^{c}	1.0^{b}
	Total	4/200	4.0^{ab}	4.0^{a}	0.0^{c}

Values with different superscripts in a column significantly ($p<0.05$).

The present study agreed with Al-Shadeedi and Al-Hilfi (2016) native study which revealed that egg abnormalities about 5-7% of table eggs produced in different regions in Baghdad city.

High environmental temperature (reached 50C^{o}) during summer season in Baghdad, causing hyperthermia to chickens, leads to a sequence of physiological and metabolic changes resulting from the need to cool the body temperature or a sequence of metabolic events originated from the hyperthermia.

Table 4. Effect of summer and winter seasons on egg structure abnormalities of outdoor rearing some native chicken strains.

Native chicken strains	Season	No. of abnormal egg / Total eggs	Percentage (%)	Minor abnormalities (+) (%)	Major abnormalities (++) (%)
Barred	Summer	2/100	2.0^{b}	2.0^{ab}	0.0^{b}
	Winter	0/100	0.0^{c}	0.0^{c}	0.0^{b}
	Total	2/200	2.0^{b}	2.0^{ab}	0.0^{b}
Brown	Summer	3/100	3.0^{a}	2.0^{ab}	1.0^{a}
	Winter	1/100	1.0^{c}	1.0^{b}	0.0^{b}
	Total	4/200	4.0^{a}	3.0^{a}	1.0^{a}
White	Summer	3/100	3.0^{a}	2.0^{ab}	1.0^{a}
	Winter	0/100	0.0^{c}	0.0^{c}	0.0^{b}
	Total	3/200	3.0^{a}	3.0^{a}	0.0^{b}

Values with different superscripts in a column significantly ($p<0.05$).

In the chickens, as well as other animals, one way of cooling the body is accomplished by panting and evaporative cooling, with eventual loss of carbon dioxide and development of respiratory alkalosis (Bogin *et al.,* 1996). One way for adapting to the new blood gas levels is by regulating the levels of phosphorylated intermediates such as 2-3-diphosphoglycerate or inositol-5-phosphate, which affect oxygen and carbon dioxide affinity to haemoglobin (Lehninger, 1978; Whittow, G.C. 1986).

Rosales (2018) reported that many egg abnormalities appear to have no specific cause, but the incidence is much higher in hens subjected to stress and bad management conditions. In the present study, the effect of long-term high environmental temperature on egg abnormalities (shape, size and structure) occurred during summer season. Evaluation of the effects caused by long-term hyperthermia on the various body organs by the degree and number of enzymatic changes, showed the heart muscle and kidney to be most affected.

It is possible that the hyperthermia led to a functional stress and to an increased metabolic overload (Lehninger, 1978; Sturkie, 1986).

This change could be associated with the increased load of metabolic activities required to adjust blood pH, compensating and neutralizing the developing respiratory alkalosis caused by panting and hyperventilation in the process of cooling the body (Bogina *et al.,* 1997; Kordonowy *et al.*, 2017) and that will cause deformation of egg shell and increased egg abnormalities (Stadelman and Cotterill, 1995).

Al-Obaidi and Al-Shadeedi (2014) recognized variation in collared dove egg phenotypes due to season. Summer season affect birds egg size significantly.

To our knowledge only very few studies about outdoor reared native chickens in Iraq, and no studies of egg abnormalities to estimate percentage or types of native chicken strains, so this results will provide a new data for egg producer in Iraq, and will enable them device ways and means to minimize it, and improve egg quality during summer season.

Conclusion

Summer season have significant effect on egg abnormalities of native chicken strains in Iraq reared outdoor, so this results need concern to improve egg quality and reduce economic loss.

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