EFFECT OF SOILING LENGTH ON THE PHYSICO-CHEMICAL QUALITIES OF BACKYARD POULTRY TABLE EGGS

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ABSTRACT

In a study to investigate the effect of soiling length on the physico-chemical qualities of backyard poultry table eggs, a deep litter system of egg production was simulated in a completely randomised design consisting of seven treatments (0, 6, 12, 18, 24, 30 and 36 hours) of soiling length, using freshly laid eggs from an automated battery cage system. Data was analysed using the SPSS statistical package. Results for physical and chemical analysis indicated that soiling length had significantly ($P<0.05$) affected Egg weight loss, Albumin height, Haugh unit, Moisture content, Crude protein, Ether extract and Ash. Increase in soiling length led to increase in: egg weight loss and moisture content; and decrease in albumin height, Haugh unit, crude protein, ether extract and ash. It was concluded from the study that, soiling length had significantly influenced some physical qualities of the eggs such as increase in egg weight loss and decrease in albumin height and the haugh unit. Similarly, increasing soiling length leads to the increase in moisture content of the eggs and decrease in crude protein, ether extract and ash. The study suggests that laid eggs should not be left to stay for longer hours on the floor of the backyard for the optimum conservation of quality and safety of the eggs to the consumers.

Keywords: soiling length, physico-chemical, backyard, eggs

INTRODUCTION

It was reported that producing backyard eggs can be a rewarding part of raising chickens. However, Household poultry flocks may produce a high percentage of dirty eggs and many of these eggs could be soiled because they are laid in dirty nests or are being laid on the floor (Kody *et al.*, 2007). Braun *et al.* (2001) reported that the environment that the egg encounters within the first few seconds after it is laid is critical since the egg is wet and its pores full of fluids. If the shell comes in contact with a dirty surface the film of water on its surface provides the ideal route for bacteria, viruses or fungi and chemicals to enter the pores and move inside the egg. Once the contents of an egg are contaminated, the nutrient composition could be altered. Internal egg quality involves functional, aesthetic and microbiological properties of the egg yolk and albumen (Leeson, 2006). As soon as the egg is laid, its internal quality starts to decrease: the longer the storage time, the more the internal quality deteriorates. However, the chemical composition of the egg (yolk and white) does not change much. The decrease in internal egg quality once the egg is laid is due to the loss of water and CO_2. In consequence, the egg pH is altered, resulting in watery albumen due to the loss of the thick albumen protein structure (Butcher, 2003).

Poor eggshell quality has been of major economic concern to commercial egg producers, with estimated annual losses. To maintain consistently good shell quality throughout the life of the hen, it is necessary to implement a total quality management programme throughout the egg production cycle. Exterior egg quality is judged on the basis of texture, colour, shape, soundness and cleanliness according to USDA (2000) standards. This study was designed to investigate the effect of soiling length on the physico-chemical qualities of backyard poultry table eggs.

MATERIALS AND METHODS

The experiment was conducted at Animal Science Laboratory of Kebbi State University of Science and Technology Aliero. A total of 165 freshly laid eggs from the automated cage system of Labana farm in Aliero Local Government Area Kebbi State were purchased. Three kilograms of poultry droppings was obtained from the same source belonging to the birds that laid the eggs. The eggs and poultry droppings were collected at the same time. Experimental Procedures: Twenty one eggs each were randomly allocated to 7 treatments consisting of 0hours, 6hours, 12hours, 18hours, 24hours, 30hours and 36hours representing TR1, TR2, TR3, TR4, TR5, TR6, and TR7 respectively in a Completely Randomized Design. Five hundred grams of damp poultry droppings (moisture not determine) was sprinkled on pretreated floor to simulate the deep litter system, before arranging the 21egg samples. The 21egg samples were weighed individually and put over the poultry droppings according to their treatments and there was intermittent turning. All egg samples in each treatment were carefully picked after the treatment period, cleaned to remove external residues of poultry droppings and placed back in clean sterilized plastic containers.

Physical analysis: Three eggs were randomly selected from each treatments making up a total of 21 eggs and used for physical evaluation. The external egg quality parameters that were measured include: egg weight, egg length, egg width, and egg shape index (SI) which was estimated using the following equation according to Anderson, *et al.* (2004):

Shape Index = [egg width / egg length] × 100

Measurements of the internal components were obtained by carefully making an opening around the sharp end of the egg, large enough to allow passage of both the albumen and the yolk through it without mixing their contents together. The parameters that were measured include; Yolk weight, albumin weight, albumen height and Haugh unit which was determined using the following formula.

$HU = 100 \log (H + 7.5 - 1.7W^{0.37})$

Where HU = Haugh unit; H = height of albumen
W = egg weight (grams)

Chemical analysis: Three eggs each will be randomly selected and used for chemical evaluation to measure; moisture contents, Crude Protein, Ash, Carbohydrate and ether extract (EE) According to AOAC procedures (AOAC 1990).

Data Collection and Analysis: Data collected from physical and chemical analysis were subjected to analysis of variance using the GLM univariate analysis of the SPSS 16.0. Significant means were separated by the Duncan's multiple range test (SPSS, 2007).

RESULTS AND DISCUSSIONS

External and internal physical qualities

Result for external and internal physical qualities of poultry eggs according to soiling length are presented in Table 1. There was significant difference (P<0.05) between treatments on the initial weight of eggs before soiling. After treatment, soiling length had a significant effect (P<0.05) in the final weight of all treatments. Similarly, egg length, egg width and shell weight were significantly (P<0.05) different. Shape index and shell thickness were however not significantly affected (P>0.05) by soiling length. The initial egg weight and the weight of eggs after treatment were the determinants of EWL. Egg weight loss has increased in the order of increasing soiling length with treatments 7 and 6 loosing most weight (0.87g and 0.73g) respectively. These were significantly followed by treatments 5, 4, 3, 2, and 1 in that order with treatment one having the least EWL (0.07g. Although egg length and egg width significantly differed (P<0.05) between all the treatment and were the determinants of the shape index (SI), the SI was not significantly affected by soiling length (P>0.05). However, the result of the SI of all the treatments falls within the normal range (>72SI) of egg which determines the packaging of the eggs (Albrecht, 2011). The egg length, width and SI obtained in the current study might have been influenced by the breed and the age of the hens that laid the eggs other than the soiling length. Soiling length had significantly (P<0.05) influenced the Albumen height, albumen weight and Haugh unit but did not significantly (P>0.05) affect the yolk weight. The Haugh unit was significantly affected by soiling length in a deceasing order from treatment 1 through 7. Treatments 1 and 2 had the highest HU (92.25and 88.73) respectively followed by treatment 3,4,5,6 and 7 in that order with treatment 7 having the least HU (68.38). This trend of decreasing HU as a result of increase in soiling length agrees with the findings of Alabi *et al.* (2013).

Chemical Qualities: Result for chemical qualities of poultry egg according to soiling length is shown in Table 2. The result indicated that soiling length had significantly affected (P<0.05) all the chemical components of the eggs with a definite trend of intensity as a result of increasing soiling length. The percentage moisture content increased in the order of treatments 1, 2, 3, 4, 5, 6 and 7 as a result of increase in soiling length. This could be due to the increasing interplay of heat, moisture and microorganisms that could be present in the environments of the egg at storage which might lead to the hydrolysis of egg content hence influence the increase in moisture content of the egg. Increase in soiling length had led to the decrease in the percentage crude protein, percentage ether extract and ash in the order of treatments 1, 2, 3, 4, 5, 6 and 7. Treatment 1and2 had the highest crude protein content (12.52% and 12.37%), respectively and the least was found in treatments 6 and 7(9.45%and9.47%), respectively.

Conclusion

It was concluded from the study that soiling length had significantly influenced some physical qualities of the eggs such as increase in egg weight loss and decrease in albumin height and the Haugh unit. Also, increasing soiling length led to the increase in moisture content of the eggs and decrease in crude protein, ether extract and ash.

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Table 1: External and internal physical qualities of poultry eggs according to soiling length

Treatment	Parameter								
(Soiling length)	IEW (g)	FEW (g)	EWL (g)	EL (cm)	EW (cm)	SI (%)	AH (mm)	AW (g)	(HU)
1 (control)	58.67^{ab}	58.60^{ab}	0.07^{d}	5.57^{bc}	4.33^{b}	77.85	8.53^{a}	37.05^{ab}	92.25^{a}
2 (6 hours)	53.73^{b}	53.57^{b}	0.17^{cd}	5.47^{c}	4.27^{b}	78.09	7.67^{b}	26.37^{b}	88.73^{a}
3(12 hours)	63.77^{a}	63.50^{a}	0.27^{bcd}	5.65^{bc}	4.52^{ab}	79.95	6.77^{c}	37.51^{ab}	80.41^{b}
4 (18 hours)	67.67^{a}	67.30^{a}	0.37^{bc}	6.00^{ab}	4.47^{ab}	74.46	6.23^{cd}	35.62^{ab}	75.25^{bc}
5 (24 hours)	65.43^{a}	65.00^{a}	0.43^{b}	6.20^{a}	4.90^{a}	78.89	5.57^{de}	43.12^{a}	70.68^{cd}
6 (20 hours)	61.13^{ab}	60.40^{ab}	0.73^{a}	5.65^{bc}	4.43^{ab}	78.48	5.47^{e}	34.40^{ab}	71.73^{cd}
7 (36 hours)	65.23^{a}	64.37^{a}	0.87^{a}	5.63^{bc}	4.52^{ab}	80.36	5.27^{e}	37.55^{ab}	68.38^{d}
SEM	2.751	2.748	0.063	0.145	0.146	1.810	0.221	3.659	1.845

abcd = Means with different superscript along the same column within a subset differ significantly ($P<0.05$), IEW= initial egg weight FEW=final egg weight, EWL=egg weight loss, EL=egg length, EW=egg weight, SI=shape index, AH=albumen height AW= albumen weight HU= haugh unit

Table 2: Chemical composition of poultry eggs according to soiling length

Treatment	Parameter				
	Initial Egg Weight (g)	Moisture content (%)	Crude Protein (%)	Ether Extract (%)	Ash (%)
1 (control)	58.67	76.13^{a}	12.52^{a}	9.51^{a}	1.89^{a}
2 (6 hours)	53.73	76.68^{ab}	12.37^{ab}	9.33^{ab}	1.64^{b}
3(12 hours)	63.77	77.00^{abc}	11.97^{bc}	9.30^{ab}	1.56^{bc}
4 (18 hours)	67.67	77.10^{bc}	11.67^{c}	8.97^{bc}	1.37^{d}
5 (24 hours)	65.43	77.85^{cd}	10.55^{d}	8.52^{c}	1.36^{d}
6 (30 hours)	61.13	78.13^{d}	9.45^{e}	7.70^{d}	1.42^{cd}
7 (36 hours)	65.23	78.09^{d}	9.47^{e}	7.18^{e}	1.13^{e}
SEM	2.751	0.288	0.175	0.152	0.061

abcde = mean with different superscript along the same column within a subset differed significantly (P<0.05)