



Effect of Storage Method on the Quality, Proximate Composition and Microbial Loads of Guinea Fowl Eggs (*Numida Meleagris*)

¹Saidu, S.S, ¹Balarabe, A.B, ²Sunusi A.Z, ¹Tamburawa, M. S, ¹Ashiru R.M, ¹Khaleel A.G, ¹Ibrahim U, ³Ghali N.M, ³Abba H, ⁴Rano N. B, ⁵Abubakar S. ⁶N. Salisu.

¹Department of Animal Science, Kano University of Science and Technology, Wudil, P.M.B 3045, Wudil Kano.

²Department of Animal Science, Federal University Dutsinma, Katsina State.

³Department of Biology, Faculty of Science, Kano University of Science and Technology, Wudil, P.M.B 3045, Wudil Kano.

⁴Department of Animal Science, Bayero University Kano, P.M.B 3011, Kano Nigeria.

⁵National Agricultural Extension and Research Liaison Services (NAERLS), ABU, Zaria

⁶Department of Animal Health and Production Bunyaminu Usman Polytechnic Hadejia, Jigawa State P.M.B 013. Hadejia Jigawa.

Abstract

*The Study was conducted at Kano University of Science and Technology, Wudil to determine the effect of different storage methods on the quality, proximate composition and microbial loads of Guinea fowl eggs (*Numida meleagris*). Egg Quality Indices, measured were Albumen height, Yolk height, Yolk diameter and Yolk index. A Total of 108 eggs were used for this experiment. The different storage methods used were Room Temperature, oiling and earthen pot methods. The results obtained showed that egg quality indices were significantly ($P<0.05$) affected by the different storage methods. Results also showed that colony forming units were absent in oiling method of eggs storage throughout the period of the experiment but present in eggs stored in earthen pot on day 28 (1.7×10^3 CFU/ML). This also increase at room temperature as the storage duration increases having 2.16×10^3 CFU/ML as the highest at day 28. The ease at which eggs peel was also affected by storage method; for hardness Earthen pot storage method was 0.839, oiling storage methods was 0.995 and room temperature storage was 2.158 whereas earthen pot and oiling storage methods was ranked first. Eggs that were stored in the oiling and earthen pot were able to keep the shelf life of eggs for a longer period compared to Room Temperature storage method which lost quality rapidly after extended storage. Regarding the thickness of egg shell Earthen pot was 0.030mm, Room Temperature was 0.054mm and oiling storage method was 0.016mm. A significant ($P<0.05$) decrease was recorded for moisture % in Room Temperature and Oiling storage methods at week 4. A significant ($P<0.05$) decrease was recorded for dry matter % at week 4 in the Earthen pot storage method. A significant ($P<0.05$) decrease was recorded for ash % at week 1 and 2 of Oiling storage method. The duration at which eggs stored under the different storage methods are as follows; Room temperature 14 days, Earthen pot 21 days and oiling 28 days. It is concluded that in the absence of refrigeration storage or constant power supply, the use of oiling method of storage is recommended. Also, earthen pot method is recommended to be used as a substitute for refrigeration method of eggs storage.*

Keywords: Effects, Storage Methods, Proximate Composition, Microbial Load, Guinea Fowl, Eggs

Introduction

Eggs are important components of the human diet, consumed by people throughout the world. They are versatile wholesome and have a natural balance of essential nutrients (MAFF, 2006). Poultry production in Nigeria is spreading and

increasing, with many households having backyard poultry farms. Egg gluts occur from time to time, during which many poultry farmers incur enormous economic loss including those attributable to spoilt unsold eggs. Similarly, eggs also spoil in homes due to inability to

refrigerate the eggs as a result of electricity failure which is common in Nigeria.

Domesticated Guinea fowl, sometimes called pin dates or gleanies, are poultry originating from Africa. They are the domesticated form of the helmeted guinea fowl (*Numida meleagris*) and are related to other game birds such as pheasants, turkeys and partridges. Although the timing of their domestication is unknown, there is evidence that domesticated guinea fowl were present in Greece by the 5th century BC (Blench *et al.*, 1999). They lay 25-30 eggs in deep, tapering nest. Their eggs are small, and extremely thick-shelled. The incubation period is 26-28 days, and the chicks are called “Keets”. As domestics, they are valuable pest controllers, eating many insects. They are especially beneficial in controlling the lyme disease-carrying deer tick (Ayorinde *et al.*, 1989).

Deterioration in egg quality is attributed to moisture loss and a decline in interior egg quality during extended storage (Wong *et al.*, 1996). The shelf life of shell eggs, during which they are of good quality and safe to consume, is a function of carbon dioxide content (Keener *et al.*, 2001). Factors associated with decline in quality are storage time, temperature, humidity and handling (Samli *et al.*, 2005). Eggs with intact shells are relatively free of bacteria, and this is because egg shells and their membranes provide a barrier against bacterial invasion. The main risk of massive bacterial contamination occurs if the egg shell is broken, cracked or if there is excreta contamination of the shell (Rose, 1997; Ricketts, 1981).

Poultry industry has occupied a leading position in recent years among agricultural industries in many parts of the world. Africa, Asia and South America showed the greatest increase in egg production of 35.2%, 46.9% and 32.5%, respectively, while North and Central America, Europe and Asia showed very little increase and in some cases a decrease in egg production (USDA, 2000). During the past decade, the

production of eggs continued to increase rapidly in the underdeveloped regions, which included most of the hot regions of the world. With the exception of a few countries like Saudi Arabia and Israel, the hot regions of the world have probably the greatest potential for further growth since the level of consumption is still very low. The poultry industry is highly developed in South Africa and has seen a great deal of development in other African countries during the past two decades (Daghir, 1995). Eggs are among the high in quality human foods. Eggs are beginning to make a substantial contribution in relieving the protein insufficiency in many African countries.

MAFF (2006) reported that only 44 eggs were produced on the African continent per person per year. The top egg-producing countries of Africa (Nigeria, South Africa, Egypt and Algeria) increased their production from 4.2 billion in 1960 to 16.5 billion in 1990 (Saxena, 1992). Every day, over 26 million eggs are produced in the UK (MAFF, 2006). The egg is a complex entity having four main parts; the shell, shell membranes albumen and yolk. The dry matter of a domestic fowl's egg contains approximately 64% albumen, 27% yolk, 9% chalazae and 0.75% shell membrane (Rose, 1997).

The aims of this study were to determine the effect of different storage method on egg quality parameters, proximate composition and microbial loads of guinea fowl eggs (*numida meleagris*).

Materials and Methods

Experimental site

The study was conducted at Kano University of science and technology teaching and research farm, Wudil, Kano State. The experimental location was Wudil Local Government Area Kano state, Nigeria. It is head quarter is in the town of Wudil on the A237 high way. Coordinates; 11° 49' N 8° 51' E. It has an area of 362 km² and a population of 185,189 at the

2006 census. The annual rainfall is between 800 mm to 900 mm; and variations about the annual means values are up to $\pm 30\%$. The mean annual temperature is about 26°C (Olofin, 2008).

Source of eggs

Eggs were purchased from local market that operated every Friday in wudil local government area of Kano state, Nigeria.

Experimental Materials

Guinea fowl eggs, groundnut oil, earthen pot, sand, distilled water, hand glove, soap/sodium hypo chloride, Petri dish, tray, cotton wool, Pasteur pipette, Vernier calliper, electronic weighing balance, white cotton cloth and ruler.

Experimental treatments

The experiment which consisted of 3 storage methods, namely: Room Temperature, Oiling and Earthen pot lasted for a period of four (4) weeks (28 days).

Room temperature

Room temperature storage entailed collecting eggs and storing them on paper pulp egg trays on a table in a well-ventilated room with an average temperature of 31.75°C .

Oiling method

The eggs were dipped in groundnut oil and allowed to drain before placing on egg trays. Before the oil was used, it was freed to prevent introduction of microorganisms then stored in a well-ventilated room with an average temperature of 31.79°C .

Eggs preserved in the Oiling

Earthen Pot

Eggs were kept in a wide-mouthed earthen pot placed in a plastic basin at room temperature. The bottom of the basin was filled with sand to a height of 15cm while the side was filled up to half the height of the pot. The inside of the pot was lined with a thin layer of grass to prevent the eggs being soaked in excess moisture. The eggs were placed in the pot as soon as they are collected and the top covered with a thin white cotton cloth to facilitate the exchange of air. 1

liter of water was sprinkled on the sand inside the basin surrounding the earthen pot at intervals of 2 days so as to provide optimum moisture and cool the earthen pot.

Experimental Eggs and Their Distribution

A total of 108 eggs were used for the experiment, and they were distributed randomly to the experimental treatments (3 treatments) with 36 eggs / treatments and three times, and each twelve (12) eggs/replicated eggs. Three (3) eggs were picked at random in 7 days intervals for determination of egg quality parameters. The experiment lasted for a period of four (4) weeks.

Microbial analysis

One (1) egg was picked at random from each of the storage methods at day 7, 14, 21 and 28days (7days interval) throughout the 28 days period of the experiment for determination of microbial loads in the Food science and technology Departmental Laboratory of Kano University of Science and Technology, Wudil.

The ease of peeling is a measure of the ease which the egg shell can be removed. Ease of peeling was determined during the experimental period at 7 days interval. Firstly, water was boiled at 100°C , three (3) eggs were picked from each storage method and cooked, and then the egg was placed in to the boiling water for 10 minutes. The boiled eggs were allowed to cool for 10 minutes and then peeled. The ease of peeling was scored on a scale of 1-4, Hardness (%), Softness (%), Color (%), and Taste (%).

Statistical Analysis

Data collected were subjected to Analysis of variance (ANOVA) using the SAS (2001) statistical software. Least significant (LSD) was used to separate means at 5% in a Completely Randomized Design (CRD).

Results

Effect of Storage Methods on Egg Quality Indices, Egg weight, Shell weight (g), Albumen weight (g) and Yolk weight (g).

Table 1 shows that there was no significant ($P>0.05$) differences for Egg weight (g) among storage methods. There was no significant ($P>0.05$) differences for Shell weight (g) among storage methods. Significant ($P<0.05$) difference was observed for Albumen weight (g) mean values among the Treatment studied at week 1, highest mean value (18.57) was recorded under Oiling method whereas (17.75) was the lowest mean value obtained in eggs under Room Temperature storage method, at week 2 there no significant ($P>0.05$) difference among storage methods, at week 3 there was significant ($P<0.05$) difference in which highest mean value (18.27) was recorded under Earthen pot method whereas (17.82) was the lowest mean value obtained under Oiling method. Also, at week 4 there was significant ($P<0.05$) difference, highest mean value (19.09) was recorded under Oiling method whereas (17.82) was the lowest

mean value obtained in eggs under table 1 shows that storage method has significant ($P<0.05$) effect on Albumen and Yolk weight but did not have any effect ($P>0.05$) on egg and shell weight. After 4 weeks of storage, Albumen weight was significantly higher for oiling. Room Temperature storage method. For Yolk weight (g) there was Significant ($P<0.05$) difference in mean values at week 1, highest mean value (12.91) was recorded under Oiling method whereas (12.30) was the lowest mean value obtained in eggs under Earthen Pot storage method, at week 2 there was no significant ($P>0.05$) difference among storage methods, at week 3 there was significant ($P<0.05$) difference in which the highest mean value (13.36) was recorded under Oiling method whereas (12.82) was the lowest mean value obtained under Room Temperature method. Also, at week 4 there was significant ($P<0.05$) difference, highest mean value (13.74) was recorded under Oiling method whereas (12.92) was the lowest mean value obtained in eggs under Room Temperature storage method.

Effect of Storage Methods on the Egg Quality Indices; (Albumen height (mm), Yolk height (mm), Yolk diameter (mm), and Yolk index).

Table 2 shows that there was no significant ($P>0.05$) difference at Albumen height (mm) under Oiling and Earthen Pot storage methods except for Room Temperature which differs significantly ($P<0.05$) with highest mean value 6.33g whereas 6.00 was the lowest mean value obtained. There was no significant ($P>0.05$) difference for Yolk height (mm) among the storage methods. There was no significant ($P>0.05$) difference for Yolk diameter (mm) and yolk index among the storage methods. There was also no significant ($P<0.05$) difference for Yolk index (%) among the storage methods.

Effect of Storage Methods on Ease of Peeling.

Table 3 shows Significant ($P<0.05$) difference for Softness (%) among the storage methods with highest mean value 80.77 % whereas 48.33 % was the lowest mean value obtained. There was Significant ($P<0.05$) differences for Hardness (%) among the storage methods with highest mean value 86.67% whereas 50.67% was the lowest mean value obtained. Significant ($P<0.05$) differences for Color (%) among the storage methods with highest mean value 84.67 % whereas 47.33 % was the lowest mean value obtained. Also significant ($P<0.05$) differences exist for taste (%) among the storage methods with highest mean value (85.33) whereas (48.33) was the lowest mean value obtained.

Table 1. Effect of Storage Method on Egg Quality Characteristics; Egg weight (g), Shell weight (g), Albumen weight (g), Yolk weight (g).

Parameters	Weeks	Storage Methods			SEM
		Room Temperature	Oiling	Earthen Pot	
Egg Weight (g)	1	40.79	41.43	41.40	0.463
	2	41.93	42.53	40.50	0.675
	3	42.13	41.82	43.74	1.190
	4	41.18	42.02	41.500	0.946
Shell weight (g)	1	7.46	7.41	7.50	0.103
	2	7.48	7.35	7.31	0.185
	3	7.40	7.66	7.59	0.151
	4	7.33	7.73	7.26	0.137
Albumen weight (g)	1	17.75 ^b	18.57 ^a	17.96 ^b	0.130
	2	17.74 ^a	18.82 ^a	17.79 ^a	0.352
	3	17.36 ^b	17.34 ^b	18.27 ^a	0.221
	4	17.82 ^b	19.09 ^a	18.06 ^b	0.228
Yolk weight (g)	1	12.50 ^{ab}	12.91 ^a	12.30 ^b	0.122
	2	13.28 ^a	13.60 ^a	12.93 ^a	0.255
	3	12.82 ^b	13.36 ^a	13.07 ^{ab}	0.130
	4	12.92 ^b	13.74 ^a	13.44 ^a	0.308

Silverside and Scott, (2001).

^{abc}Means within the same row with different superscript are significantly ($P < 0.05$) different. SEM: Standard Error of mean.

Table 2. Effect of Storage Methods on the Egg Quality Indices,

Parameters	Weeks	Storage Methods			SEM
		Room Temperature	Oiling	Earthen Pot	
Albumen height (mm)	1	6.33 ^b	7.17 ^a	7.00 ^a	0.136
	2	6.67 ^a	6.83 ^a	6.83 ^a	0.167
	3	6.17 ^b	6.50 ^a	6.50 ^a	0.100
	4	6.00 ^a	6.00 ^a	6.17 ^a	0.096
Yolk height (mm)	1	13.00	13.00	12.83	0.096
	2	12.83	12.83	13.00	0.136
	3	12.67	12.50	12.50	0.192
	4	12.00	12.17	12.00	0.096
Yolk diameter (mm)	1	32.33	32.50	32.33	0.136
	2	31.67	31.33	31.67	0.289
	3	31.17	31.33	31.00	0.136
	4	31.00	31.00	31.00	0.138
Yolk index (%)	1	0.40	0.40	0.39	0.004
	2	0.41	0.41	0.40	0.005
	3	0.40	0.39	0.40	0.007
	4	0.38	0.39	0.38	0.003

Silverside and Scott, (2001).

^{abc}Means within the same rows with different superscript are significantly ($P < 0.05$) differences.
SEM: Standard Error of the mean.

Table 3 Effect of Storage Methods on Ease of Peeling.

Parameters	Weeks	Storage Methods			SEM
		Room Temperature	Oiling	Earthen Pot	
Softness (%)	1	50.67 ^c	52.33 ^c	48.33 ^d	2.158
	2	60.00 ^b	58.00 ^b	63.00 ^c	0.995
	3	73.33 ^{ab}	77.67 ^a	73.33 ^b	0.839
	4	84.33 ^a	79.67 ^a	87.00 ^a	0.934
Hardness (%)	1	86.67 ^a	84.00 ^a	82.33 ^a	2.958
	2	70.67 ^{ab}	76.00 ^{ab}	75.00 ^{ab}	2.761
	3	63.33 ^b	63.67 ^b	65.00 ^b	2.402
	4	50.67 ^c	54.00 ^c	51.67 ^c	2.476
Colour (%)	1	81.33 ^a	84.67 ^a	82.67 ^a	1.873
	2	71.67 ^b	76.00 ^{ab}	76.33 ^{ab}	2.485
	3	63.67 ^b	63.67 ^b	65.33 ^b	2.846
	4	47.33 ^b	54.00 ^c	54.00 ^c	2.907
Taste (%)	1	72.67 ^b	69.33 ^b	72.33 ^b	3.168
	2	85.33 ^a	84.67 ^a	83.00 ^a	3.641
	3	74.67 ^{ab}	73.67 ^{ab}	72.00 ^b	1.820
	4	48.33 ^c	51.33 ^c	52.33 ^c	1.234

Silverside and Scott, (2001).

^{abc}Means within the same rows with different superscript are significantly ($P < 0.05$) different. SEM: Standard Error of the mean.

Effect of Storage Methods on Thickness of Egg shell (mm), Shell shape end (mm), Shell center (mm), and Shell air end (mm).

Table 4 showed Significant ($P < 0.05$) differences were observed for Shell shape end (mm) at all the storage methods with highest mean value 0.70 mm recorded and lowest mean value 0.46 mm recorded. Significant ($P < 0.05$) difference was observed for Shell center (mm) at Earthen Pot storage method, while no significant ($P > 0.05$) difference at Room Temperature and Oiling storage methods. Significant ($P < 0.05$) differences for Shell air end (mm) at all the storage methods. Also significant ($P < 0.05$) differences was recorded for Shell thickness (mm) at all the storage methods.

Table 4 Effect of Storage Methods on Thickness of Egg shell (mm), Shell shape end (mm), Shell centre (mm), and Shell air end.

Parameters	Weeks	Storage Methods			SEM
		Room Temperature	Oiling	Earthen Pot	
Shell shape end (mm)	1	0.67 ^a	0.70 ^a	0.66 ^a	0.032
	2	0.64 ^a	0.62 ^b	0.62 ^a	0.021
	3	0.58 ^b	0.46 ^c	0.52 ^b	0.033
	4	0.52 ^b	0.53 ^c	0.54 ^b	0.674
Shell center (mm)	1	0.50 ^a	0.58 ^a	0.56 ^a	0.033
	2	0.50 ^a	0.47 ^{ab}	0.60 ^a	0.031
	3	0.47 ^b	0.52 ^{ab}	0.47 ^b	0.053
	4	0.40 ^b	0.42 ^b	0.47 ^b	0.043
Shell air end (mm)	1	0.68 ^a	0.71 ^a	0.68 ^a	0.032
	2	0.59 ^{ab}	0.60 ^b	0.57 ^b	0.030
	3	0.54 ^b	0.49 ^c	0.45 ^c	0.036
	4	0.53 ^b	0.51 ^{bc}	0.51 ^b	0.037
Shell thickness (mm)	1	0.62 ^a	0.67 ^a	0.64 ^a	0.054
	2	0.58 ^b	0.57 ^b	0.59 ^{ab}	0.016
	3	0.33 ^d	0.49 ^c	0.47 ^c	0.030
	4	0.48 ^c	0.48 ^c	0.50 ^b	0.045

Silverside and Scott, (2001).

^{abc}Means within the same rows with different superscript are significantly ($P < 0.05$) different. SEM: Standard Error of the mean.

Effect of Storage Methods on the Proximate Composition of Guinea Fowl Eggs

Table 4.5 showed that for moisture there was significant ($P < 0.05$) difference observed at week 4 with highest mean value 76.88 % recorded under Earthen Pot method whereas 74.33 % was the lowest mean value obtained under Room Temperature. For Dry matter there was significant ($P < 0.05$) difference at week 4 with highest mean value 25.67 % under Room Temperature whereas 23.12 % was the lowest mean value obtained under Earthen Pot method. For Crude Protein Ether Extract ash and nitrogen free extract there was no significant ($P > 0.05$) difference among the storage methods.

Table 5 Effect of Storage Methods on the Proximate Composition of Guinea Fowl Eggs

Parameters	Weeks	Storage Method			SEM
		Room Temperature	Oiling	Earthen Pot	
Moisture (%)	1	75.32 ^a	76.25 ^a	75.05 ^a	0.589
	2	76.22 ^a	75.74 ^a	75.82 ^a	0.246
	3	75.88 ^a	75.67 ^a	76.93 ^a	0.522
	4	74.33 ^b	75.19 ^b	76.88 ^a	0.462
Dry matter (%)	1	24.68 ^a	23.75 ^a	24.95 ^a	0.589
	2	23.78 ^a	24.27 ^a	24.18 ^a	0.246
	3	24.12 ^a	24.33 ^a	23.07 ^a	0.522
	4	25.67 ^a	24.81 ^a	23.12 ^b	0.462
Crude Protein (%)	1	11.77	10.94	11.22	0.378
	2	10.78	10.93	10.99	0.389
	3	11.10	11.28	10.85	0.533
	4	11.67	11.44	10.91	0.358
Ether Extract (%)	1	8.44	8.82	8.44	0.310
	2	8.55	8.72	8.75	0.224
	3	8.2	8.73	8.29	0.544
	4	8.93	8.44	7.77	0.349
Ash (%)	1	1.40 ^a	1.14 ^b	1.37 ^a	0.033
	2	1.46 ^a	1.15 ^b	1.36 ^a	0.051
	3	1.35 ^a	1.19 ^a	1.29 ^a	0.079
	4	1.38 ^a	1.33 ^a	1.29 ^a	0.052
Nitrogen Free Extract (%)	1	3.06	2.85	3.01	0.339
	2	2.99	3.47	3.07	0.358
	3	3.40	3.14	2.63	0.382
	4	3.68	3.58	3.14	0.229

^{abc}Means within the same rows with different superscript are significantly ($P<0.05$) different. SEM: Standard Error of the mean.

Effect of Storage Methods on Colony Forming Units (CFU)

Table 6 shows the effect of storage methods on CFU. Results obtained showed that there was no significant ($P<0.05$) increase in the CFU in day 7 and 14 of eggs stored at room temperature. As the

storage days increased the CFU also increased for eggs stored at room temperature. Eggs that were stored for 21 days had CFU of 1.4×10^{-3} followed by those stored at room temperature for 28 days which is 2.16×10^{-3} . Eggs stored under oiling method did not show any microbial growth throughout 28 days study period and for earthen pot storage method, growth was only observed at day 28.

Table 6. Effect of Storage Methods on Colony Forming Units (CFU)

Weeks	Storage Method		
	Room Temperature	Oiling	Earthen pot
1	No growth	No growth	No growth
2	No growth	No growth	No growth
3	1.4×10^{-3b}	No growth	No growth
4	2.16×10^{-3a}	No growth	1.7×10^{-3b}

^{abc}Means within the same rows with different superscript are significantly ($P < 0.05$) different. SEM: Standard Error of the mean.

Discussion

The changes observed in albumen height especially for eggs stored at room temperature is due to carbon dioxide (CO_2) loss through the shell, which makes the contents of the egg to become more alkaline, causing the albumen to become transparent and increasingly watery (Okeudo *et al.*, 2003). At higher temperatures, loss of CO_2 is faster and the albumen quality deteriorates faster. Eggs stored at ambient temperatures and humidity lower than 70% will lose 10-15 internal egg quality in a few days from point-of-lay. Storage of eggs at temperatures of 7-13°C and a humidity of 50-60% will reduce the rate of degeneration of thick albumen proteins and, consequently, egg albumen quality will be maintained for longer period. Oiling of eggs can also help to reduce CO_2 losses and thus help maintain internal egg quality (Okoli and Udedibie, 2000; Okeudo *et al.*, 2003). There were significant ($P < 0.05$) differences in albumen height for the different storage methods. The height of the albumen indicates the freshness of the egg; the thicker the albumen, the better the quality of the egg, with heights of 4-6mm being considered superior (Zeidler, 2002).

Decrease in albumen height was rapid for eggs stored in Room Temperature. Earthen pot and oiling storage also resulted in decreases in albumen height as the duration of storage increased but not as rapidly as those stored under Room Temperature attributed decrease in albumen height to rise in temperature. This indicates that temperature is one of the main factors influencing the eggs quality during storage. Yolk index decreased ($P < 0.05$) for all the storage methods. If a fresh egg of good quality is broken out of the shell, the yolk is firm and round, but as the interior quality deteriorates the yolk flattens out more and more. The decrease in yolk height and yolk index observed in the study could be attributed to degeneration of the vitelline membrane which allows water from the albumen to move into the yolk and give the yolk a flattened shape as reported by Okoli and Udedibie (2000). The decrease in internal quality of eggs was most rapid in eggs stored at room, while eggs that were oiled and those stored in the earthen pot had much slower decreases in internal quality of eggs. As the duration of storage increased, the peeling becomes easier. According to Bradley and King (2004), "fresh" eggs are more difficult to peel as properly handled eggs that are a few days old contain more carbon dioxide (CO_2) than old

eggs and consequently their albumen have a lower pH value.

The difficulty encountered in removing the shell of a fresh hard-cooked egg is associated with the low pH of the albumen. As stored eggs lose (CO₂), the albumen pH rises; when these eggs are hard-cooked, they are easier to peel (Bradley and King, 2004). In this study, Earthen pot and Oiling storage methods had a slight increase in peel index compared to Room Temperature storage. These results shows that Oiling and Earthen Pot methods were able to keep the quality of the eggs for a longer period compared to room temperature storage which lose (CO₂) rapidly and therefore peels easily after few days.

Conclusion

Eggs that were oiled had a shelf life of 28 days. Colony forming units (CFU) were absent in oiled eggs throughout the experiment. Eggs stored in earthen pot have a shelf life of 21 days, Colony forming units (CFU) were present after day 21 of the experiment. Eggs stored at Room Temperature have a shelf life of 14 days and Colony forming units (CFU) were present and increase as the storage duration increases. Oiling method of eggs storage in this study proved to be the best local method of storage as it extended the shelf life of eggs followed by earthen pot method but room temperature method should be discourage after 14 days.

Recommendations

Based on the results obtained the following recommendations were made:

- Storage of eggs on the date of purchase was recommended so that older ones can be used for boiling and fresh ones for frying respectably.
- It is recommended for egg consumers and poultry farmers to used oiling method and Earthen Pot method of egg storage as an alternative to refrigeration for preserving the shelf life of eggs.

- It's recommended that equal size or similar eggs should be used for egg storage for research or domestic used.

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