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Effects of Groundnut oil and Palm oil on Egg Preservation

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Abstract: *This trial was conducted to investigate the effects of groundnut oil and palm oil on egg preservation. A total of 192 freshly laid eggs from commercially-bred Lohman brown layers were used to determine the effect of coating of fresh eggs with oil on egg quality and shelf life. The eggs were randomly assigned into three (3) groups of 64 eggs each; Group 1 was coated with palm oil, Group 2 coated with ground nut oil and Group 3 was uncoated (control). This work was carried out for a period of 35days during the hot wet rainy season months. The eggs were stored on bench top at room temperature. The quality of eggs from 3 groups was periodically monitored on days 0, 1, 3, 7, 14, 21, 28 and 35. On each day of evaluation, the eggs were assessed for weight loss, physical appearance and microbiological quality. A record of room temperature readings (^{o} C) at mid-day was kept for the 35 days using a conventional thermometer.*

The result of the experiment revealed that coating of eggs did not stop microbial multiplication within the eggs but was effective in preventing deterioration, maintaining interior quality, the yolk height and physical appearance of the eggs compared to the uncoated eggs. It was also observed that coating of eggs was able to reducing the egg weight.

Keywords: *Groundnut oil; Palm oil; Egg preservation*

I. Introduction

Poultry industry has in recent years occupied a leading role among agricultural industries in many parts of the world. Africa, Asia and South America show the greatest increase in egg production of 35.2%, 46.9% and 32.5% respectively, while North and Central America, Europe and Oceanic show very little increase and in some cases a decrease in egg production [1]. Poultry eggs are among the highest quality human foods. It serves as an important source of animal protein in those areas of the world that have protein insufficiencies. Eggs are beginning to make a substantial contribution in relieving the protein insufficiency in many African countries. Adegbola [2] reported that only 44 eggs were produced in the African continent per person per year. The top egg-producing countries of Africa (Nigeria, South Africa, Egypt and Algeria) have increased their production from 4.2 billion in 1960 to 16.5 billion in 1990 [3]. In 1999, total egg production in the USA was almost seven (7) billion dozen. Half of the world's output of eggs is produced in Asia with China accounting for 40% of the world production [4], over 26 million eggs are produced in the UK daily [5] and poultry production in Nigeria is increasingly common with many households having backyard poultry. Eggs remain an important component of the human diet, consumed by people throughout the world. They are recognized by consumers as versatile and wholesome and they have a natural balance of essential nutrients [5]. . Eggs are used for other purposes aside their use as food. They are used in the production of vaccines fertilizers, animal feeds, vanishes, shampoos, paints, etc [6].

Deterioration in egg quality is attributed to moisture loss and a decline in interior egg quality during extended storage [7]. There are pathogenic bacterial that could cause egg contamination and the most notable amongst is *Salmonella* that could endanger public health [6]. Contamination of eggs by *Salmonella species* could occur either on the surface of the egg shell or in the contents of the egg [8]. Several methods of altering the environmental condition of the egg have been used to prolong its storage life. Refrigeration, cold storage and freezing of egg and egg products are widely practiced. However, these methods are expensive and hence are not suitable in developing countries largely due to lack of constant electric power, particularly in the rural areas [9]. To retard the deteriorative changes in the internal quality of eggs, various shell treatments such as coating with vegetable and mineral oils, water glass and lime sealing have been suggested. Oil coating of the shell has been documented as a method of preserving quality and is an accepted practice. In coating the shell pores are sealed reducing evaporation and carbon-dioxide escape, thus much of the original carbon dioxide is retained and albumen pH increases less rapidly [9]. The carbon dioxide content is at its peak in freshly laid eggs but tends to equilibrate with the surrounding atmosphere, unless the egg is oiled [10]. Therefore, oiling of eggs have been advocated for preserving the quality of eggs. Hence, this study investigates the efficacy of groundnuts and palm oil in preventing egg deterioration during the hot wet season in Nigeria.

II. Materials And Methods

One hundred and ninety two freshly laid eggs from commercially-bred Lohman brown layers were used to determine the effect of coating of fresh eggs with oil on egg quality and shelf life. The laying birds were raised on deep litter and of ages 65weeks at Area C, A.B.U., Zaria were collected and used for this work. This work was carried out for a period of 35days during the hot wet rainy season months. The eggs were stored on bench top at room temperature. The quality of eggs from 3 groups was periodically monitored on days 0, 1, 3, 7, 14, 21, 28 and 35. On each day of evaluation, the eggs were assessed for weight loss, physical appearance and microbiological quality. A record of room temperature readings (^{o} C) at mid-day was kept for the 35 days using a conventional thermometer. The environmental/ambient temperature and relative humidity readings for the Samaru environment was obtained from the weather station of the Institute for Agricultural Research, Samaru, A. B. U. The eggs were randomly assigned into three (3) groups of 64 eggs each; Group 1 was coated with palm oil, Group 2 coated with ground nut oil and Group 3 was uncoated (control). The oils were initially heated for 10 minutes and then allowed to cool before use. The coating was done by spraying with these differently using a sprayer. The eggs were sprayed while in the crates thoroughly covering all exposed parts of the eggs. After coating, the eggs were left on the bench in the laboratory at room temperature. Another batch of 64 eggs untreated was used as controls for a period of 35 days from where 24 eggs were collected on each day of the experiment until the 35th day. Prior to the treatment of the eggs, a paper towel dipped in a solution of dilute sodium hypochloride was used to disinfect the surface of the eggs. The crates in which the eggs were collected and kept were also sterilized by washing and dipping them in a solution of concentrated sodium hypochloride. All the 192 eggs were measured using an electronic weighing balance (Mettler CH-8606 Greifence-Zurich, Switzerland), the initial weight of the eggs were determined and recorded. Eight eggs (8) were taken from each group, each day of the experiment and weighed for change in weight. The eight (8) eggs were then divided into 2 groups. Four (4) were used for the evaluation of the physical appearance of the internal contents of the egg as well as the measurement of the height of the egg. The surface of the eggs was cleaned with cotton wool soaked in 70% ethanol to disinfect the surface after weighing. The eggs were now cracked using sterile forceps into a sterile petri dish. The egg was observed for changes in colour, odour, presence of blood stains and other abnormalities. A 19G sterile needle was then inserted directly into the centre of the yolk to measure the yolk height, the markings on the needle were placed against a 15 cm ruler to read the height, while the other four (4) were used for assessing the total aerobic bacterial counts.

Nutrient agar (Oxoid, Basingstoke, UK) for plating and normal saline solution for serial dilution and homogenizing of the eggs were prepared aseptically according to the manufacturer's recommendations. Egg surfaces were cleaned and disinfected with cotton wool soaked in 70% ethanol. The eggs were cracked using a sterile forceps into a sterile polythene bag; sterile normal saline solution was then added and homogenized using a stomacher (Seward Medical UAC House, Blackfriars RD London). Using a graduated 1millilitre pipette, 0.1millilitre of the homogenate was pipetted into a universal bottle containing 9.9mls of sterile normal saline solution to make it up to 10mls (1/100 fold dilution). This sample solution was further diluted to 10^{-6}, 0.1ml of this dilution was dispensed unto the surface of a nutrient agar plate and spread with a sterile hockey stick. The plates were incubated at 37^{0}C for 24 hours after which the colonies (growth) on the plates were counted. Measurement of egg weight were recorded for each group and day of the study. Data was enter into a MS Excel workbook. Loss in weight was expressed as percentage weight loss. The mean percentage weight loss for the 3 groups were compared using student t-test. (ANOVA). Similarly, the weight measurement and yolk height measurement were used for computing (formula) of the Haugh unit (R). Difference between groups were also assessed using the student T-test.

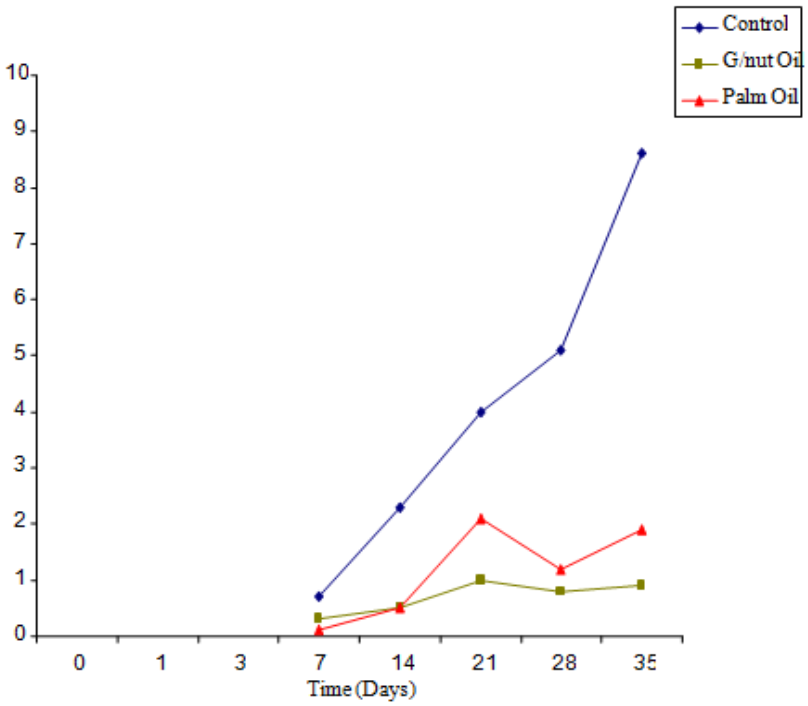
III. Result And Discussion

Table 1 shows the Mean weight loss (%) of eggs coated with groundnut oil and palm oil and controls stored at room temperature for 35days. It was observed that there was no significant change in the eggs in the three groups for the first three days. This could be attributed to the fact that the eggs were freshly laid. However significant changes were recorded in the eggs from day 7. It was observed that from day 7, the mean weight loss for all the groups was less than 1%. In the control group, there was a rapid increase in the rate of weight loss from day 7 up to day 35, while in those coated with palm oil, the weight loss increased sharply between day 14 and 21 and then decreased from day 21 to day 28 to below 2%, it increased again to about 2% from day 28 to day 35. It was also observed in the group coated with ground nut oil, that there was an increase in the weight loss from day 15, which was below 1% to about 1% on day 21. There is relatively slight increase in weight loss up to day 35 for this group.

Table 1: Mean weight loss (%) of eggs coated with groundnut oil and palm oil and controls stored at room temperature for 35days**.**

Day(s) of storage	Mean weight loss (%)		
	Groundnut oil	Palm oil	Control
0	-	-	-
1	-	-	-
3	-	-	-
7	0.3	0.1	0.7
14	0.5	0.5	2.3
21	1.0	2.1	4.0
28	0.8	1.2	5.1
35	0.9	1.9	8.6

Figure 1: Mean Weight Loss (%) of Eggs Treated with Ground Nut and Palms Oils and Controls Mean



Weight Loss (%)

Table 2 gives the mean yolk height (cm) of eggs coated with groundnut oil and palm oil and controls kept for 35days, in all the three (3) treatments, there was a progressive decrease in the yolk height (Figure 2). The control group had a greater decline in yolk height compared to the treated groups. Even though, the overall trend was negative initially within the first three days, the groundnut oil group fluctuated before finally continuing with a steady decline in yolk height.

Table 2: Mean yolk height (cm) of eggs coated with groundnut oil and palm oil and controls kept for 35days

Day(s) of storage	Mean yolk height (cm)		
	Groundnut oil	Palm oil	Control
0	1.18	1.63	1.65
1	1.40	1.53	1.35
3	1.78	1.10	1.05
7	1.18	1.23	1.18
14	1.35	1.53	1.33
21	1.35	1.80	1.37
28	1.30	1.13	0.70
35	1.15	0.93	0.40

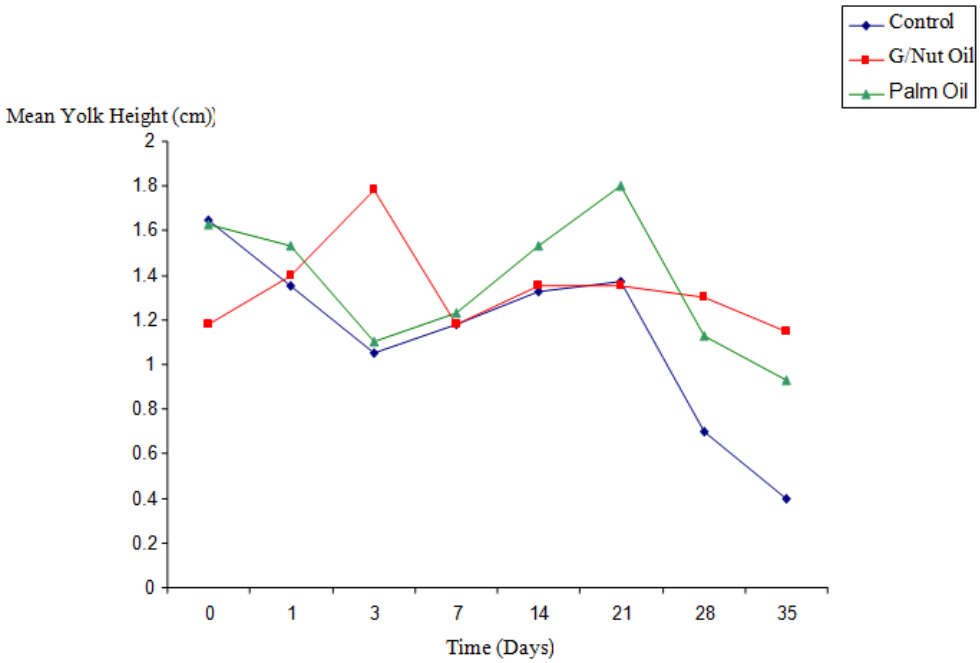


Figure 2: Mean Yolk Height of Eggs Coated with Ground nut, Palm Oil and Controls Mean Yolk Height (cm))

Table 3 shows the Number of plates with and without bacterial colonies from eggs treated with groundnut oil and palm oil and controls. From the study, it was observed that on day 0, the control group had growth on 4 plates. Growth was not recorded for this group until day 14 and subsequently all the plates for the control group had growth. For those coated with groundnut oil, three (3) out of eight (8) plates had growth on day 0, this increased to seven (7) out of 8 plates by day 1 and day 7. There after growth was recorded on all the eight (8) plates. (Figure 3) up to day 35. While for the palm oil group, growth was found only in 2 out of eight plates on day 0.By day 1 and 7, 6 and 7 plates respectively recorded growth. All the eight (8) plates for the palm oil group continued to show growth for the rest of the period of the study.
Between day 7 and 21 most of the growth recorded were between 1 – 100 CFU (Table 3). For the final two days of the study, majority of the growth recorded colony counts of >100CFU per plate including TNTCs.

Table 3: Number of plates with and without bacterial colonies from eggs treated with groundnut oil and palm oil and
controls.

Day	No growth			1-100CFU			>100CFU		
	Control	G/nut oil	P/oil	Control	G/nut oil	P/oil	Control	G/nut oil	P/oil
0	4	5	4	2	3	1	1	1	1
1	0	1	2	1	5	1	0	2	5
3	0	0	0	0	0	0	1	0	0
7	0	1	1	8	5	5	0	2	2
14	2	0	2	6	5	6	0	3	0
21	0	0	0	8	8	8	0	0	0
28	0	0	0	0	4	5	8	4	3
35	0	0	3	4	3	0	4	5	2

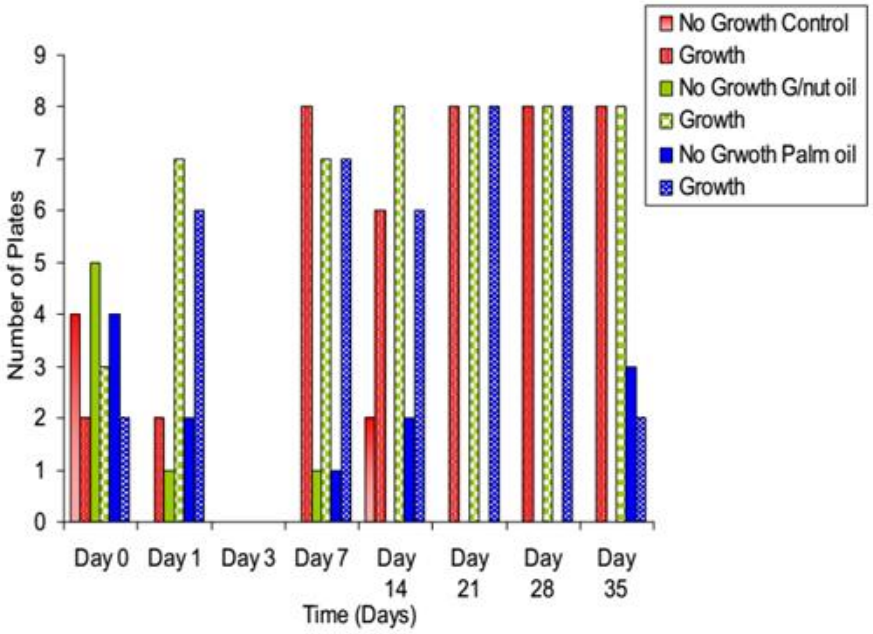


Figure 3: Number of Plates with and without Bacterial Colonies from Eggs Treated with Groundnut Oil and Palm Oil and Controls

IV. Discussion

The result of this work showed that the uncoated group (control) of eggs showed a rapid and progressive increase in weight loss up to day 35 of storage. This implies that the rate of weight loss in the uncoated eggs was much faster compared to the coated eggs. This is in line with the work of Mellet [11], which noticed a rapid weight loss in uncoated eggs stored at ambient temperature.

The eggs coated with palm oil showed a higher weight loss compared to the groundnut oil group indicating that groundnut oil is more effective in preventing weight loss. This shows that overall, the rate of deterioration is slower in coated eggs than in the uncoated eggs. This is in line with the report of Imai [12] who reported that the application of coatings on eggs reduces weight loss and maintains their internal quality. Therefore, from this work, it appears that the shelf life of shell eggs could be prolonged by coating.

For the yolk height, there was a higher yolk height values in the eggs coated than in the uncoated (control) eggs. This shows that oiling tends to have a protective effect on the interior quality of eggs. Oiling reduces the incidence of collapsed yolks during storage this support the report of Tanabe *et al.*[13]. Although, there were some eggs in all the groups with collapsed yolks but this may be attributed to extra force used in breaking of the eggs that might have ruptured the yolk membrane.

For the bacteriological counts, the number of plates with bacterial colonies was not reduced by coating. It was not possible to determine whether the ineffectiveness of the coating procedure was due to failure of the coating to prevent bacterial penetration or bacteria prior to coating.

It has been reported by some authors that *Samonella enteritidis* colonizes the tissues of the chicken ovary and oviducts, presumably contaminating eggs [14]. Also environmental conditions could be a contributing factor which may result to proliferation of microorganism within the eggs when improperly preserved.

All the eggs appeared normal but for the blood spot noticed in one of the eggs and this could probably be caused by one of the tiny blood vessels in the ovary breaking at the time when the yolk is released

V. Conclusion

In conclusion, coating of eggs with groundnut oil and palm oil reduced loss of moisture and deterioration of internal egg quality. Groundnut oil was most effective in this regard. However, oil coating did not prevent microbial multiplication within the eggs. Coating of eggs with groundnut oil is a potential method for preserving eggs in Nigeria.

VI. Recommendation

- The coating of eggs with groundnut oil or palm oil should be advocated as these are dependable means of egg preservation as compared to refrigeration.
- The can go a long way in preserving eggs during the period of abundance.

- Although the differences in the efficacy of groundnut oil and palm oil are not very distinct, more work needs to be done in order to make definite deductions.
- More work should be done in order to evaluate other coating materials that could be cheaper than using groundnut oil.

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