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Research Paper

Economic Use of Fat and Oil to Preserve Chicken Egg by Shell Coating

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ABSTRACT
This study was conducted to determine the effect shea butter fat, palm kernel oil and ground nut oil on the shell strength and internal quality attributes of freshly laid eggs during storage at tropical ambient temperature. A total of 90 eggs were used. The eggs were collected from 72 weeks old black harco fed 3.75% calcium and 16.50% protein. The eggs were candled, divided into three (3) treatments groups. (including the control), the eggs were treated with the fat and the oil within 24 hours of lay. The result showed significant difference (P<0.05) between eggs treated with shea butter fat and ground nut oil and the control. There was no significant difference (P>0.05) the treatment of eggs treated with shea butter fat, palm kernel oil and ground nut oil, in respect to shell strength, haugh unit, yolk index, and albumen pH of eggs.

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I. INTRODUCTION

FAO report (1992) stated that the protein intake should be about 70% of which about 35% should be animal origin. But unfortunately the animal protein intake of most Nigerian is as low as 3% . The problem of protein deficiency may be overcome by the inclusion of adequate animal protein in the diets. One of the cheap way of meeting this animal protein deficiency is through the consumption of poultry eggs. Poultry Eggs have been shown to be the most acceptable means of rapidly increasing protein levels of sub-standard diets. Poultry egg is a very useful source of animal protein. It is complete, highly nutritive and relatively cheap to afford because of their small units.

The need for a cheap, indigenous and adequate storage for poultry egg because the production is on increase in Nigeria. The egg consist of largely of water and are therefore highly perishable even with natural protection provided by the shell and shell membrane.

There is great need to improve the shell strength and preserve the shelf-life of poultry eggs.(Y.S Parker et al). The refrigeration of poultry eggs below 13^{o}C have been the most adequate. However, in many less developed countries of the world like Nigeria, the following problems have made the use of refrigeration almost impossible.

(i) The refrigeration facilities may be non- existent
(ii) Flock of most small farmers , may be too small to make refrigeration feasible.
(iii) The electricity may not be available in many areas .

Another method of preserving poultry eggs is the coating of egg with paraffin based, colourless, odourless, and tasteless mineral oils. This method have been used in Canada and other part of America. It is rather unfortunate that these mineral oil are not accessible and if present may be too costly for our local farmers in Nigerian.

This single factor has prompted this research work to look for a cheap, non-toxic and adequate vegetable fats and oils which can maintain both the exterior and the interior quality of eggs.

OBJECTIVES OF STUDY

The study was carried out with the following objectives in mind

(i) To access the efficacy of different coating agents in extending the shelf- life of egg.
(ii) To evaluate the effectiveness of the different coating agents in enhancing the shell strength of the coated egg.

II. LITERATURE REVIEW

Egg quality can be said to consist of all characteristics of an egg that influences it acceptability to the consumers (N.N.A Al-Hajo et al 2012). These eggs characteristics consist of the shell quality, the organoleptic property such as the sensory qualities such as flavor and taste and the functional properties like coagulant and the foaming properties of the eggs used in food processing. Egg quality as seen from the layman's perspective is the eggs characteristics which make consumers to like or dislike a given type of egg. These characteristics are refered to as quality evaluation factors of the shell eggs, which is divided into two general groups, the external shell quality and the internal quality of the egg. The former having to do with, shell strength, shell cleaniness, shell soundness and soon. While the latter is referring to the organoleptic and functional properties of the content of the egg.

The factors that influence the shell strength; they include

Physiology; the functioning of various organs in the hen, can lead to variation in the shell strength of a egg (O.T Owolabi et al 2016) have showed that longer the interval between oviposition the more shell is deposited on the egg, thus higher shell strength.

Egg characteristic; the egg characteristics such as shape, colour, membrane, and shell deformation (N.D Makeish et a 2012) and (Richard et al 1965) have reported a correlation of 0.3 between shape and strength of egg.

Management ; management is a variable factors that influence the shell strength of a egg. The frequent disruption in the laying house, may result in the production of shell with lower shell strength. Also providing a light- dark cycle greater than 24hrs, improves shell strength.

The factors that influence the shelf-life of an egg;

The storage environmental condition. When the temperature is high , there is increased escape of carbon dioxide from the egg. The carbon dioxide maintains the albumen quality. Therefore high storage temperature causes rapid deterioration of the albumen of an egg (O.T Owolabi et al 2016)

Shell treatment;

(Y.S Parker) Observed that the oil treatment of egg, made the egg impermeasible to carbon dioxide and micro organisms. Oil treatment prevents carbon dioxide from escaping from the egg and micro organism from entering the egg. This egg coating helps in maintaining the interior quality of a shell egg.

The washing of eggs; It has been observed that washing of egg reduced the shelf-life of an egg, because this washing removes the cuticle and opens the spore that allows the carbon dioxide to escape and micro organism to enter the egg to cause the deterioration of the egg and lower the internal quality of the egg.

III. MATERIAL AND METHODS

SAMPLES

The test eggs were produced by black Harco layers. The eggs were purchased and collected within 24hr of lay from the Animal Production Department of Unilorin, Ilorin. These eggs were also treated within 24hr of lay. The Black Harco layers that layed these eggs were fed, a diet containing 3.75% calcium, 16.5% protein. They were 72 week old. A total of 150 eggs were used for this study.

EXPERIMENTAL PROCEDURES

The eggs were candled, to make sure that they were not cracked. Eggs were marked for identification purposes during the course of experiments. The initial values (week 0) for the shell strength, Haugh units, Yolk index, and PH of the albumen were determined with (5) five ramdomly selected eggs for each parameter reading. The remaining eggs were divided into three (3) treatments groups consisting of :

(1) Eggs dipped in hot shea butter fat (60oC)

(2) Eggs dipped in hot groundnut oil (60oC)

(3) Eggs not treated serving as the control.

STORAGE

All eggs were stored at ambient temperature 29.29oC . Each treatment was replicated five times .

TREATMENTS

Hot sheabutter fat dip treatment

The fat was melt by heating to 60oC and eggs were individually immersed in it for four minutes, allowed to drain and arranged in an egg crate.

Hot groundnut oil dip treatment
The oil was warmed to 60oC and eggs were individually immersed in it for four minutes, allowed to drain and arranged in an egg crate.

Control
The control eggs were left uncoated

IV. RESULTS AND DISCUSSION

THE EFFECTS OF STORAGE TREATMENTS ON SHELL STRENGTH OF EGGS

	DURATION OF STORAGE (DAYS)					
TREATMENTS	0	7	14	21	28	35
SHEA BUTTER FAT	1.0614	1.0611	1.0609	1.0606	1.0603	1.0520
GROUND NUT OIL	1.0615	1.0612	1.0608	1.0606	1.0604	1.0560
PALM KERNEL OIL	1.0613	1.0606	1.0604	1.0580	1.0575	1.0530
CONTROL	1.0606	1.0584	1.0222	1.0221	1.0196	1.0163

There was significant difference between the shell strength of other treatments and control treatment in this experiment. The shell strength of other treatment was found fluctuate at a high level, while the control treatment fluctuate at a very low level of shell strength. As eggs stay long in storage, the egg cuticle that make up the shell deteriorate. The fat and oil coating was observed in this experiment to slow down the deterioration of the egg cuticles. When the cuticle are removed more shell pores are opened, moisture and carbon dioxide are lost through evaporation. This excessive evaporation resulted in a smaller internal egg mass and reduced internal support of the shell, this led to the decline in shell strength of egg.

THE EFFECTS OF STORAGE TREATMENTS ON HAUGH UNITS OF EGGS

	DURATION OF STORAGE (DAYS)					
TREATMENTS	0	7	14	21	28	35
SHEA BUTTER FAT	82.36	75.50	71.62	68.67	68.14	53.50
GROUND NUT OIL	73.16	67.74	61.23	60.24	56.49	53.40
PALM KERNEL OIL	87.20	77.33	73.67	73.51	72.38	54.86
CONTROL	82.59	65.38	61.76	57.10	34.65	34.61

There was significant difference between the haugh unit of other treatments and control treatment in this experiment. Egg with a high haugh unit has a high value internal quality. The haugh unit has to do with the weight of the egg.when the eggs are coated the glycerol in oil and fat penetrate the pores of the eggs shell and sealed the pores preventing free exist and entrance of carbon dioxide, water vapour and micro organisms tend to liquefy the albumen, thus lowering the haugh unit of the egg

THE EFFECTS OF STORAGE TREATMENTS ON YOLK INDEX OF EGGS

	DURATION OF STORAGE (DAYS)					
TREATMENTS	0	7	14	21	28	35
SHEA BUTTER FAT	0.57	0.52	0.51	0.49	0.48	0.41
GROUND NUT OIL	0.51	0.46	0.44	0.43	0.42	0.41
PALM KERNEL OIL	0.57	0.52	0.48	0.46	0.44	0.42
CONTROL	0.51	0.40	0.38	0.29	0.21	0.18

There was significant difference between the yolk index of other treatments and control treatment in this experiment. When the cuticle of the shell is removed and the pores of the shell become opened, the vitaline membrane of the egg becomes weaker and water from the albumen into the yolk, making the yolk to be flattened, this means lowering the yolk index of the eggs.

THE EFFECTS OF STORAGE TREATMENTS ON ALBUMEN PH OF EGGS

	DURATION OF STORAGE (DAYS)					
TREATMENTS	0	7	14	21	28	35
SHEA BUTTER FAT	8.20	8.40	8.24	8.36	8.46	8.81
GROUND NUT OIL	8.30	8.33	8.35	8.57	8.60	8.79
PALM KERNEL OIL	8.23	8.30	8.32	8.38	8.60	8.80
CONTROL	8.85	9.10	9.30	9.37	9.46	9.50

There was significant difference between the albumen pH of other treatments and control treatment in this experiment. The carbon dioxide is present inside the freshly laid egg. As the solubility of carbon dioxide in the albumen decreased the albumen pH increased, and as the solubility of carbon dioxide increased the albumen pH decreased. In this experiment the albumen pH of the fat and oil treatments were found to increase slightly, while the albumen pH of the control increased greatly and continuously throughout the 35 days of storage.

ON SUBJECTING THIS RESULTS TO DUNCAN MULTIPLE RANGE TEST THE FOLLOWING SIGNIFICANCE DIFFERENCES OCURRS.

PARAMETERS

	SHELL STRENGTH	HAUGH UNIT	YOLK INDEX	ALBUMEN PH
SHEA BUTTER FAT	1.062^{b}	69.53^{b}	0.49^{b}	8.44^{b}
GROUND NUT OIL	1.063^{b}	70.51^{b}	0.48^{b}	8.44^{b}
PALM KERNEL OIL	1.061^{b}	71.16^{b}	0.48^{b}	8.42^{b}
CONTROL	1.035^{a}	56.02^{a}	0.33^{a}	9.50^{a}

V. CONCLUSION AND RECOMMENDATION

CONCLUSION

In conclusion the result of this experiment have proven that the oil and the fat treatments of a freshly laid egg is quite efficient in preserving the qualities of the eggs for the storage period of at least 35days at the room temperature of 30oC in the tropics. In the experiment the treatment of shea butter and the treatment of groundnut oil proved to be most efficient in preserving all egg qualities.

VI. RECOMMENDATION

It is recommended that if eggs are to be kept for more than 14 days, they should be treated with the fat or the oil, since coating the eggs with fat and oil have proven to preserved the egg qualities for at least 35 days under the ambient temperature of the tropics.

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