EFFECT OF CASSAVA LEAF-BASED FEED ON THE CHOLESTEROL CONTENT OF CHICKEN EGGS FOR HUMAN CONSUMPTION

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ABSTRACT

This study was conducted to determine the effect of cassava leaf-based feed on the cholesterol content of chicken eggs. One hundred and twenty, ten-week-old pullets were randomly allotted to four dietary treatment groups of 30 birds each with three replicates of ten birds each in a Completely Randomized Design. Four diets that consist of 0%, 20%, 40% and 60% levels of substitution of soybean meal with cassava leaf meal (CLM) were used from the grower phase of age ten weeks to the laying phase of age fifty-two weeks. The feeding trial was carried out for 42 weeks at Ajegunle Farm Settlement in Obafemi Owode, Abeokuta, Ogun State. The data collected were analyzed using ANOVA of SAS with the significant means, separated using Duncan's Multiple Range Test. Twelve eggs which comprised three eggs per treatment were collected from the experimental birds. The cholesterol content of the eggs was analyzed using the commercial test kit. The cholesterol content of eggs from diet T1 was the highest (1300.20mg/dl) while diet T2 had the lowest (1233.10mg/dl). This indicates that the cassava leaf-based diets did not adversely affect the cholesterol content of the laying birds' eggs. The study therefore recommends the inclusion of cassava leaf-based meals in the diet of laying birds in the study area and beyond.

Keywords: Cassava leaf-based feed, Cholesterol, Eggs, Laying birds, and Pullet

INTRODUCTION

The importance of poultry eggs in human nutrition cannot be over-emphasized. Among the various kinds of food, egg is special as it contains all essential food nutrients (Maryam and Judith, 2012). Balanced nutrition does not necessarily have to do with eating expensive food. Apart from being inexpensive, egg is a wholesome food which contains a balanced amount of essential nutrients like protein, vitamins and minerals. These nutrients are in highly protected form. Eggs provide a means through which the animal protein requirement of the populace can be met (Dudusola, 2009). It has various uses and contains many essential nutrients; it supports life during embryonic growth, and it is one of the most nutritious and complete foods known to man (Scolt and Silversides, 2001). Eggs have a biological value of 93.79 % comparable values are 84.5 % for milk, 76 % for fish and 74.3 % for beef. Chicken egg is one of the most common foods all over the world.

The yolk or yellow portion makes up about 33% of the liquid weight of the egg. The egg lipid is classified into; Triacylglycerols (65%), Phospholipids (28.3%), Free Cholesterol (5.2%), Cholesterol ester and free fatty acids (traces). The yolk weight of a typical chicken 60g egg is 20g, of which 50% is solid matter and 50% is water; it contains 6g of lipids and 3g of proteins. Yolk fatty acids have a central role in egg nutritional properties evaluation (Zaib Ur Rehman and Ahsan ul Hag, 2011). The yolk of a large egg contains about 59 calories. It also serves as a precursor to produce steroid hormones by the adrenal glands and gonads. It is also the key substance in the wall of every cell and the starting material from which the liver produces bile acids, necessary for the digestion of fats. In addition, it is essential for brain and nerve development and aids in hormone production (Zaib Ur Rehman, 2015).

The term “cholesterol” refers to a group of chemicals containing both protein and fat components (lipoproteins) that are present in every living cell and perform various functions.
Cholesterol and its esters are found in egg yolk, where they form an emulsion of LDLs, very low-density lipoproteins (VLDLs) and HDLs which account for 8 % of dehydrated yolk of chicken eggs. Its content in eggs is influenced by genetic factors, diet composition, laying intensity, layer age and medical treatment (Vorlová et al., 2001). Egg consumption is believed to raise the risk of cardiovascular disease by increasing blood serum cholesterol levels (Jung et al., 2011). Consumer awareness of the correlation between high blood serum cholesterol levels and obesity or cardiovascular diseases has stimulated the demand for food products with very low or no cholesterol content. This study was therefore carried out to investigate the effect of cassava leaf-based feed on the cholesterol content of the eggs of laying birds.

METHODOLOGY

The study was carried out at Ajegunle and Ago-Iwoye farm settlements in Ogun State, Nigeria. One hundred and twenty (120) pullets at 8 weeks old were randomly selected and used for the on-farm feeding trials at the study locations respectively. The pullets were kept in the cage and fed growers mash until they were 10 weeks old before the commencement of the experimental feed. The brooding, feeding and medication of the birds were carried out by the farmers on their farms. At 10 weeks old, the birds were weighed and divided into four groups (treatments) of thirty birds each. Each group was further divided into three replicates of ten birds. The thirty birds in each group known as the treatment were randomly assigned to one of four diets (T1, T2, T3 and T4) in a completely randomized design (CRD) respectively. Feed and water were offered *ad libitum*.

The experimental diets were aimed at replacing soybean meal (SBM) with cassava leaf meal (CLM) in the diet of the laying chicken (layers). Four diets that consist of 0, 20, 40 and 60% level substitution of SBM with CLM were used as the experimental diets. Thirty birds per treatment were placed on a diet each and diet 1(T1) is the control diet in which there is no processed CLM (0%).

Diet 2 (T2) consists of 20% processed CLM while diet 3 (T3) consists of 40% processed cassava leaf meal and diet 4 (T4) consists of 60% processed CLM respectively. The cassava leaf-based feed was given at the grower phase of the birds (age 10 to 17 weeks) up to the laying phase of the birds (from 18 weeks to 52 weeks). The birds were fed *ad libitum* daily. Feed remaining at the end of each week was measured and used to calculate average daily feed intake (ADFI). The initial and the final weights of the birds were taken during the experiment to obtain the data for the body weight gain of the birds. Data for the feed intake and the weight gain were used to compute the feed conversion ratio. The feeding trial lasted for 42 weeks. These diets were formulated according to the NRC (1994) requirements. The composition of the experimental diet is given in Tables 1 and 2.

Table 1: Growers mash experimental feed formula for the study area

	Ajegunle Farm				**Ago-Iwoye Farm**			
Ingredients	**T1 (0)**	**T2 (20)**	**T3 (40)**	**T4 (60)**	**T1 (0)**	**T2 (20)**	**T3 (40)**	**T4 (60)**
Maize	45	45	45	45	48	48	48	48
Soybean meal	13.5	10.8	8.1	5.4	13.5	10.8	8.1	5.4
Processed Cassava Leaf meal	Nil	2.7	5.4	8.1	Nil	2.7	5.4	8.1
Palm kernel cake	4	4	4	4	10	10	10	10
Wheat offal	25	25	25	25	17.35	17.35	17.35	17.35
Bone meal	4	4	4	4	3	3	3	3
Oyster shell	7.35	7.35	7.35	7.35	Nil	Nil	Nil	Nil
Limestone	Nil	Nil	Nil	Nil	7	7	7	7
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Toxy binder	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total weight (in Kg)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Field Survey Data, 2023 Figures in parentheses are percentages

Table 2: Layers mash experimental feed formula for the study areas

	Ajegunle Farm				Ago-Iwoye Farm			
Ingredients	**T1 (0)**	**T2 (20)**	**T3 (40)**	**T4 (60)**	**T1 (0)**	**T2 (20)**	**T3 (40)**	**T4 (60)**
Maize	56	56	56	56	52	52	52	52
Soybean meal	24	19.2	14.4	9.6	20	16	12	8
Processed Cassava Leaf meal	-	4.8	9.6	14.4	Nil	4	8	12
Palm kernel cake	-	-	-	-	5	5	5	5
Wheat offal	8.85	8.85	8.85	8.85	11	11	11	11
Bone meal	3	3	3	3	8	8	8	8
Oyster shell	7	7	7	7	_	_	_	_
Limestone	_	_	_	_	2.8	2.8	2.8	2.8
Premix	0.25	0.25	0.25	0.25	0.3	0.3	0.3	0.3
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Toxy binder	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total weight (in Kg)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Field Survey Data, 2023 Figures in parentheses are percentages

Laboratory analyses of the cholesterol content of chicken eggs

Twelve eggs which comprise three eggs per treatment were collected from Abeokuta and Ago-Iwoye farms respectively after the feeding trials. The eggs were weighed and cooked by immersion in boiling water for 10 minutes. The yolks were removed, individually weighed and oven dried at 65^{0}C. The egg total lipids were extracted with chloroform methanol (2:1v/v) using the procedure described by Folch, Lees and Sloan, 1975. Cholesterol determination was done using a commercial test kit for cholesterol analysis (Sigma Chemical Co., St Louise, MO USA). This analysis was carried out at the Physiology and Pharmacology laboratory of the College of Veterinary Medicine, Federal University of Agriculture, Abeokuta.

Plate 1: Eggs from the experimental birds showing the internal qualities

Statistical analyses: The data obtained were subjected to a completely randomized design using the SAS 9.1 software package (SAS Institute, 2002). Duncan Multiple Range was used to compare the treatment means. Values of P<0.05 were considered significant.

RESULT AND DISCUSSION

Egg cholesterol content of the experimental birds as presented in Table 3 reveals that there was no significant (p>0.05) difference in the total cholesterol content of the eggs across the treatments in the two farm settlements. However, it was observed that eggs from diet T1 in Ajegunle had the highest (1300.20mg/dl) cholesterol content while eggs from diet T2 had the lowest (1233.10mg/dl). Meanwhile, in Ago-Iwoye, eggs from diet T3 had the highest (1276.10mg/dl) cholesterol content and eggs from diet T4 had the least (1220.20mg/dl) cholesterol content. This is a clear indication that the cassava leaf-based diets did not adversely affect the cholesterol content of the eggs of the chicken since diet T4 which contained the highest (60%) percentage of cassava leaf-based feed had the lowest cholesterol content in Ago-Iwoye farm settlement. This is in line with the findings of Bertechini (2003) who reported that yolk cholesterol content cannot be changed because it seems to be constant, independently of dietary factors. On the contrary, Hargis, Van Elswyk and Hargis, (1991) reported that inclusion of specific feedstuffs in commercial layer diets can reduce egg cholesterol content because of the nutritional content of the feedstuffs.

Table 3: Analysis of the cholesterol content of eggs after the feeding trials

Parameters	Ajegunle farm					Ago-Iwoye farm				
	T1	**T2**	**T3**	**T4**	**SEM**	**T1**	**T2**	**T3**	**T4**	**SEM**
Total Cholesterol (mg/dl)	1300.2	1233.1	1259.4	1244.6	10.36	1242.17	1243.8	1276.1	1220.2	23.41
High Density Lipid Cholesterol (mg/dl)	256.7^{ab}	239.4^{ab}	259.2^{ab}	236.5^{c}	3.82	252.2	269.0	261.8	247.6	5.06
Low Density Lipid Cholesterol (mg/dl)	783.6	735.7	746.9	758.2	9.01	738.3	718.3	768.2	720.2	22.15
Very Low Density Lipid Cholesterol (mg/dl)	259.9^{a}	258.0^{ab}	253.0^{a}	250.0^{b}	1.59	251.7	256.4	254.2	252.4	1.28

Source: Field Survey Data, 2023

CONCLUSION

Results of this study showed that the feeding of cassava leaf-based feed to chickens did not adversely affect the cholesterol content of the eggs of the chicken thereby making the chicken eggs safe for human consumption. The study therefore recommends the inclusion and increment of cassava leaf-based feed in the feeding of chicken since it does not constitute any negative effect on the health of the chicken and humans who consume such eggs.

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