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Effect Of Laying Hen Diet Nutrient Based Accumulated Waste On Egg Quality, Worker's Safety And Environmental Sustainability

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Abstract: ***Effect of laying hen diet nutrient based accumulated waste on egg quality, worker's safety and environmental sustainability was investigated in this study. Diets with high protein content can increase the level of amino acids in the manure as a result increase excretion and volatilization of nitrogen as well as emission of other organic compounds in the environment. However, nitrogen excretion and emission of ammonia from the volatilization of the end product of high protein dietary origin such as amino acids in the manure are responsible for environmental issues that have risen from the intensive poultry production. Table 3 showed that the level of amino acids in the manure (Histidine (1.60%), Valine (0.84%), Leucine (0.95%), Glycine (1.51%) were highly significant compare to the values (0.85% and 0.71%) recommended as an ideal dietary protein requirement for optimal diet and productive processes of laying hen. In layer hen houses, ammonia has been recognized as a major aerial pollutant that may have adversely affected egg quality, resident safety and environmental sustainability as well as public's attitude towards intensive egg production system.***

Keywords: ***Laying hen manure, egg quality, environmental sustainability, nitrogen excretion and Ammonia emissions.***

I. INTRODUCTION

Having a sustainable and profitable competitive egg production system that is anchored on improving egg quality, resident safety and environmental sustainability is becoming a major challenging issues facing the laying- hen industry. Maize is a major energy diet in laying birds nutrition and apart from it, are proteinaceous ingredients such as soybean meal, fish and meat meals that may have contributed relatively high levels of crude protein and excessive amount of amino acids other than the first and second-limiting amino acids usually methionine and lysine (1). Since birds do not have storage mechanisms for amino acids consumed beyond the required level for protein synthesis, the excess amino acids consumed are deaminated as amino acid – derive nitrogen is excreted in the urine as uric acid (80%), amononia (10%) and uria (5%) (2).

However, nitrogen excretion and emissions of volatile organic compounds of protein dietary origin such as ammonia are responsible for a large part of the environmental issues that have risen from the intensive poultry production. In layer houses, ammonia especially is recognized as a major aerial pollutant that may have adversely affected egg quality, resident safety and environmental sustainability as well as public's attitude towards intensive egg production systems (3,4). However, an ideal protein concept must be used to reduce both dietary protein levels and fecal nitrogen while maintaining egg production parameters, worker's health as well as resident and environmental sustainability.

Diet formulation with the ideal levels of amino acids will help reduce the cost of feed and decrease environmental N pollution (5). There has been a limited research in determining the ideal protein diet concept for laying hens.

Hence, the aim of this study was to investigate the hazardous effects of high volatile laying hen diets accumulated waste emissions on egg quality, worker's safety and environmental sustainability caused by high nitrogen (amino acids) content of dietary origin in layer manure. However, total sulfur amino acid: lysine ratio around 0.85% (ideal protein) has been recommended for Dekalb Delta layers

at 52wks of age for optimal diet (6) which was similar to that reported by (7) in Dekalb Delta hens from 40 to 60wks of age. 0.71% ideal protein was also reported by (8) for optimal egg production parameters and egg yield in early producing Dekalb Delta hens.

II. METHODOLOGY

Fresh samples of laying hens manure were collected from two layers houses in Rivers State operating battery cage and deep litter intensive system of management respectively. The manure sample were air-dried at the Animal house research unit, Department of Experimental Pharmacology and Toxicology, University of port Harcourt under room temperature for 1 week. Rivers State is found within longitude 6^{o}50E-7^{o}50E and latitude 5^{o}05N-5^{o}06N in the low land area of the Niger Delta with dense and thick tropical rainforest vegetation. The state is characterized with high ambient temperature of 27^{o}C and annual rainfall of about 2500mm. The manure samples were weighed before and after air-drying to determine the level of moisture loss, and nitrogen loss as described by Latshow and Zhao's method (2011). The air-dried manure samples were taking to the lab to determine the level of nitrogen volatilization and ammonia emissions in the environment through amino acids content of the manure. The analyzed data were represented using a descriptive statistics.

III. RESULT AND DISCUSSION

The results of tables 1 and 2 showed some excess of amino acids in the manure due to high content of protein in the dietary origin which led to high nitrogen excretion in the urine as uric acid and volatization of ammonia emissions. This finding was in agreement with the report of (1) that protein dietary origin contributed relatively high levels of crude protein and excessive amount of amino acids in the laying hens manure other than the first and second-limiting amino-acids.

Composition of chemical constituents	Percentages (%)
Moisture	3.8
Crude protein	15.2
True protein	12.9
NPN (N x 6.26)	14.3
Ether extract	2.0
Crude fibre	18.5
Ash	26.1
Calcium %	8.5
Phosphorus %	2.6
Potassium %	2.0
Amino acids	
Lysine	0.58
Arginine	0.48
Glycine	1.51
Valine	0.84
Histidine	0.34
Glutamine acid	1.60
Leucine	0.95
Cystine	0.85
Serine	0.75
Aspartic acid	1.10
Isoleucine	0.65
Methionine	0.28
Treonine	0.59

Source: Ndukwu & Johnson (2017)

Table 1: Chemical analysis of air-dried deep litter sample of laying hens manure showing protein, amino acids and other nutrients

Composition of Chemical Constituents	Percentages (%)
Moisture	5.10
Crude protein	14.1
True protein	10.8
NPN (N x 6.26)	10.21
Ether extract	1.8
Crude fibre	13.1
Ash	28.1
Calcium %	8.2
Phosphorus %	2.4
Potassium %	2.2
Amino acids	
Lysine	0.48
Arginine	0.54
Glycine	1.34
Valine	0.83
Histidine	0.38
Glutamine acid	1.61
Leucine	0.84
Cystine	0.21
Serine	0.73
Isoleucine	0.60
Methionine	0.30
Treonine	0.4
Alanine	0.51
Tryptophan	0.49

Source: Ndukwu & Johnson (2017)

Table 2: Chemical analysis of air-dried battery cage sample of laying hens manure showing proteins, amino acids and other nutrients

However, table 3 showed the levels of Histidine (1.60%), valine (0.84%), leucine (0.95%), Glycine (1.51) were highly significant than the level reported by Shafer et al (6) for optimal diet (ideal dietary protein) for Dekalb Delta Layers at 52 weeks of age as total sulfur-amino acid: lysine ratio (0.85%) to regulate the amount of amino-acids in the manure.

The levels of amino acids in table 3 were also highly significant than the value (0.71%) recommended for optimal egg production and egg yield. This implies that diets with high levels of protein are directly or indirectly responsible for high levels of amino-acids in the manure that led to excretion and volatilization of nitrogen and emission of volatile organic compounds.

Amino Acid Components	Amount Recommended for optimal diet and productive processes (ideal dietary protein requirement)	Percentage of Amino acid more than Recommended	Percentage of Amino acid less than Recommended
	0.85% for optimal diet level recommended by Shafer et al (1996). 0.71% for		-

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	optimal egg production parameters recommended by Novaket et al (2004)		
Valine	-	0.84	-
Histidine	-	-	0.34
Glutamic acid	-	1.60	-
Leucine	-	0.95	-
Arginine	-	-	0.48
Glysine	-	1.51	-
Cystine	-	0.85	-
Aspartic acid	-	1.10	-
Methionine	-	-	0.28
Isoleucine	-	-	0.65
Treonine	-	-	0.59
Serine	-	0.75	-
Lysine	-	-	0.58
Alanine	-	-	0.51

Source: Ndukwu & Johnson (2017)

Table 3: Representing and comparing the level of amino acid in the manure with total amino-acid: lysine ratio (ideal dietary protein requirement for optimal diet and productive processes of laying hen to determine the excess of amino-acid in the manure that caused rising environmental issues such as high nitrogen volatilization and ammonia emissions

IV. CONCLUSION

Diets with high protein contents can increase the level of amino acid in the manure as a result increase excretion and volatilization of nitrogen as well as emission of other organic compounds in the environment. This can adversely affect egg quality, worker's safety and environmental sustainability if it is not regulated by emission reduction strategy through dietary approach.

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