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Original Article

Comparative efficacy of lysure-H vis-à-vis synthetic lysine on growth performance and cost benefits in broiler chickens

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Abstract

The trial was conducted for a period of 35 days to assess the comparative efficacy of Lysure-H (Lys-H) and synthetic lysine (L-Lysine HCL 98.5%) on the growth performance and cost benefits in broiler chickens. A total of180-day-old Arbor-Acre Plus breed of broiler chicks were assigned to three (3) dietary treatments, each replicated six (6) times with ten (10) chicks per replicate in a Completely Randomized Design. Diet I (Control) had 100%L-Lysine HCL 98.5% and 0%Lys-H, Diet II (50%L-Lysine HCL 98.5% and 50%Lys-H), and Diet III (0%L-Lysine HCL 98.5% and 100%Lys-H). At the end of the trial, two (2) birds per replicate were slaughtered for their carcass yield and relative organ measurement. All data collected were subjected to analysis of variance. The results shows that all the growth performance parameters, final weight, weight gain, feed intake, and feed conversion ratio were not significantly ($P>0.05$) influenced by the dietary treatments. For the carcass characteristics, only the breast muscle was significantly ($P<0.05$) influenced by the dietary treatments, with the highest breast muscle weight (675.43g/kg body weight) observed in birds fed diet I. None of the parameters under the relative organ weights were significantly ($P>0.05$) influenced by the dietary treatments. The cost per kg of feed varied between N639.00 andN656.00, with the highest recorded in diet I. Based on the results obtained in this trial, it could therefore be concluded that the inclusion levels of 50%L-Lysine HCL 98.5% + 50%Lys-H (Diet II), and 100%Lys-H (Diet III) supported the bird performance in terms of growth, carcass yield, organ weight, and also led to a reduction in feed cost per 1kg feed as the levels of the Lys-H increased.

INTRODUCTION

Due to an increase in the population and in the demand for poultry products (meat), poultry nutritionists are looking for natural alternatives to the synthetic feed additives due to the emergence of drug resistance, residues, and other side effects. Herbal extracts can play a role in supporting the growth performance of poultry birds (Kumar, *et al.,* 2020). Efficient feed utilization, weight gain, low mortality, and disease prevention are crucial factors contributing to the success of poultry production. Ingredients used in producing poultry feeds, typically do not contain an appreciable quantity of lysine to meet the

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nutrient requirement of poultry birds. Thus, it is necessary to add synthetic lysine to the nutritional combination to meet the nutritional requirements of broiler diets (Dey *et al.,* 2024). Lysine, an essential amino acid, must be included in poultry feeds as poultry birds cannot synthesize it in sufficient quantities for their growth and development. Lysine facilitates growth performance, feed efficiency, feed utilization, livability, calcium absorption, and antibody production in broilers (Sharma and Ranjan, 2016; Kumar *et al.,* 2024).

Lysure-H is developed from selected botanicals with a high lysine activity and contains lysine in conjugated dipeptide and oligopeptide forms and other lysine conjugates. The conjugation and encapsulation of lysine and its conjugates within the micropores of phytosomes present in Lysure-H not only protect the integrity of lysine from forming interactable products through the heat-induced Maillard reaction, but the system is also able to maintain the correct stereochemistry of lysine, optimizing its bioactivity when ingested by birds and animals. Lysure-H provides optimal lysine activity for proper protein synthesis and other functions in poultry and animals, enabling them to reach their maximum growth and production performance potential. Thus, this trial was conducted to ascertain the efficacy of Lysure-H vis-à-vis synthetic lysine on growth performance and cost benefits in broiler chickens.

MATERIALS AND METHODS

Ethics

The experimental procedures in this study were approved by the Institutional Animal Care and Use Committee (IACUC), and Centre for Research and Development (CRD) of the Federal University of Technology, Akure (FUTA), Nigeria, with the assigned number: FUTA/ETH/25/287. All animal handling procedures were adhered strictly to according to the guidelines outlined in the ethical poultry and the bioethics of poultry production (Macer, 2019). Appropriate measures were taken to minimise stress and discomfort during the trial. The experimental birds (broiler chickens) were housed and managed under conditions designed to ensure their welfare, and humane slaughter protocols were followed during bird slaughtering and sample collection.

Test ingredients

Lysure-H, an herbal product, was manufactured by Veesure Animal Health, Gujarat, India, and imported to Nigeria by Peak Feed Limited, Ibadan, Nigeria. The product was in a sanitary storage facility within Peak Feed Limited's warehouse prior to use.

Diet formulation and production

The experimental diets were formulated and prepared in the Nutrition Laboratory of Animal Production and Health, Federal University of Technology, Akure, Nigeria, in conjunction with Peak Feed Limited, Ibadan, Nigeria. The production and packaging of the feeds were done at Peak Feed Ltd, Ibadan, Nigeria. The experimental starter diets were produced in such a way that the synthetic lysine (DL) was replaced at the following ratios: 100% L-Lysine HCL 98.5%:0% Lysure-H, 50% L-Lysine HCL 98.5%:50% Lysure-H, and 0% L-Lysine HCL 98.5%:100% Lysure-H, and designated diets I, II, and III, respectively. The same procedure was followed for the finisher phase. All the

formulated diets were proximately analyzed (AOAC, 2003). The gross compositions of the starter and finisher diets are presented in Table 1.

Experimental Site

The experiment was carried out between July 1 and August 26 2024, and the trial lasted for five (5) weeks. The experimental site was the Poultry Unit, Livestock Section of the Teaching and Research Farm, The Federal University of Technology, Akure, Nigeria. The farm is located on Latitude 7018" N and Longitude 5010" E, Ondo State, Nigeria (NIMET, 2014). The ambient temperature range was between 19^{0}C and 31^{0}C with a relative humidity of 60 – 90% (WeatherSpark, 2024). The temperature and relative humidity during the time of the study ranged between 23^{0}C and 27^{0}C, and 90% and 95% respectively, while the daylight was around 12 hours.

Experimental Layout and Feeding Trials

A total of two hundred (200) Arbor-Acre Plus breed of broiler chicks were procured from a reputable hatchery in Ibadan, Nigeria, out of which one hundred and eighty (180) were randomly assigned to three (3) dietary treatments of sixty (60) chicks per treatment, in a Completely Randomized Design. The chicks were housed in a deep litter system partitioned into different units that served as replicates. The chicks were raised in a traditional open-sided deep litter pen. Wood shaving was

Table 1: Gross composition of the Lysure-H experimental starter and finisher diets (%)

	Starter Diets			Finisher Diets		
Ingredients	**Diet I (100%DL)**	**Diet II (50%:50%)**	**Diet III (100%LH)**	**Diet I (100%DL)**	**Diet II (50%:50%)**	**Diet III (100%LH)**
Maize	52.00	52.00	52.00	55.50	55.50	55.50
Soy oil	0.50	0.50	0.50	0.50	0.50	0.50
Toxin binder	0.10	0.10	0.10	0.10	0.10	0.10
Wheat offal	4.00	4.00	4.00	3.00	3.00	3.00
Soybean meal	34.50	34.50	34.50	33.00	33.00	33.00
Methionine	0.30	0.30	0.30	0.30	0.30	0.30
Lysine	0.45	0.23	0.00	0.45	0.23	0.00
Lysure-H	0.00	0.23	0.45	0.00	0.23	0.45
Limestone	0.30	0.30	0.30	0.30	0.30	0.30
Premix	0.40	0.40	0.40	0.40	0.40	0.40
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Enerzyme	0.06	0.06	0.06	0.06	0.06	0.06
Corn bran	6.00	6.00	6.00	5.00	5.00	5.00
DCP	0.70	0.70	0.70	0.70	0.70	0.70
Enzyme	0.04	0.04	0.04	0.04	0.04	0.04
L-Threionine	0.10	0.10	0.10	0.10	0.10	0.10
Kingphos	0.02	0.02	0.02	0.02	0.02	0.02
Pellet binder	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated						
Crude Protein (%)	23.00	23.00	23.00	19.80	19.80	19.80
Fat (%)	5.80	5.80	5.80	5.50	5.50	5.50
Crude fibre (%)	4.20	4.20	4.20	4.00	4.00	4.00
Calcium (%)	1.30	1.30	1.30	1.28	1.28	1.28
Av. Phosphorus (%)	0.50	0.50	0.50	0.48	0.48	0.48
Methionine (%)	0.55	0.55	0.55	0.50	0.50	0.50
Lysine (%)	1.30	1.30	1.30	1.23	1.23	1.23
Energy (Kcal/kg)	3050.00	3050.00	3050.00	3100.00	3100.00	3100.00

used as bedding (litter) material. Among the routine management practices are daily observation of the birds, weighing of the leftovers feeds, and general sanitation of the pen and the environment.

Growth Performance

The weight of each group (10 chicks) was adjusted to be uniform (±1g). The chicks were then fed their respective experimental diets and water *ad libitum* from day 1 to day 35, during which weekly feed intake and weight changes were monitored and recorded, while the feed conversion ratio was calculated as the ratio of feed intake to weight gain. Vibra SJ-220 precision Digital balance (220 ×0.01g) was used in weighing all the parameters.

Carcass Traits Measurement:

At the end of the feeding trial (35 days), the birds were kept off feed for 12 hours in order to empty their crop to prevent carcass contamination during offal evisceration. Two (2) birds were randomly selected from each replicate and used to determine the carcass and organ parameters. Slaughtering was done by severing the jugular vein after stunning. The birds were bled and were scalded at 60^0C in a water bath for about 30 seconds before de-feathering. Thereafter, the plucked, eviscerated, and dressed weights were expressed as kg of the live weight. The following carcass cut-up parts were weighed: head, breast, drumstick, thigh, neck, back, shank, and they were expressed as grams per kilogram body weight.

Organ weights measurement

The following visceral organs (liver, kidney, pancreas, gizzard, spleen, heart, and lungs) were harvested and weighed using a sensitive weighing scale and expressed in grams per kilogram body weight.

Cost benefits

The economic and cost of producing the experimental diets were estimated based on prevailing market prices for the ingredients at the time of this trial. The final weight (Kg) was obtained from the result of the final weight of the bird at the end of the trial, while total feed intake was obtained by subtracting leftover feed from the feed given. Cost of day-old chicks, cost of medication and vaccine were based on the purchase price at the time of conducting this study (C_{Seed}). The cost of feed consumed per bird was calculated by the cost of experimental diets consumed divided by the number of birds fed (C_{Feed}). The total cost of production ($C_{Production}$) was also calculated by adding the cost of day-old chick (C_{Seed}), the cost of feed consumed (C_{Feed}) per bird, and the cost of management and vaccines/medication ($C_{Management}$). The average net profit/bird ($A_{Net\ profit}$) was calculated by subtracting the average price realized per bird (C_{Bird}) from the total cost of production ($C_{Production}$).

Data Analysis

All data generated were subjected to Analysis of Variance (ANOVA) using SPSS version 17 package, and where significant differences existed, the Duncan Multiple Range Test (DMRT) of the same package was used to separate the means.

RESULTS

Growth Performance

The growth performance of broiler chickens fed diets containing varied levels of lysure-H from day 1 – day 35 is presented in Table 2. From the table, all parameters measured were not significantly ($P>0.05$) influenced by the dietary treatments. Meanwhile, highest final weight (2493.33g/bird), and highest total feed

intake (3485.53g/bird) were recorded in birds fed diet I, while lowest final weight (2449.00g/bird), and lowest feed intake (3472.50g/bird) were recorded in birds fed diet III. The best feed conversion ratio (1.42) was recorded in birds fed diet I, while diet III recorded the highest feed conversion ratio (1.45).

levels of lysure-H from day 1 – day 35. Among all the parameters measured, only the breast muscle was significantly ($P<0.05$) influenced, while other parameters were not significantly ($P>0.05$) influenced by the dietary treatments. The highest breast muscle (675.43g/kg body weight) was observed in the birds fed diet I,

Table 2: Growth performance characteristics of broiler chickens fed diets containing varied levels of Lysure-H (Day 1 – Day 35)

Parameters	Diet I (100%DL)	Diet II (50%DL:50%LH)	Diet III (100%LH)	P-value
Initial Weight (g)	45.00	45.00	45.00	0.00
Final Weight (g)	2493.33	2472.00	2449.00	0.13
Weight Gain (g)	2448.33	2427.00	2404.00	0.13
Daily Weight Gain (g/day)	69.95	70.63	68.98	0.12
Total feed intake (g)	3485.53	3475.50	3472.50	0.14
Daily Feed Intake (g/day)	99.59	99.30	98.50	0.14
Feed Conversion Ratio	1.42	1.44	1.45	0.23

^{abcde}: means with different superscripts along the same row are significantly ($P<0.05$) different.

Carcass Traits Measurement

Table 3 shows the carcass characteristics of broiler chickens fed diets containing varied

while the lowest breast muscle (605.52g/kg body weight) was observed in birds fed diet III. Highest eviscerated weight (1.99kg), highest dressed weight (1.69kg), highest

Table 3: Carcass characteristics of broiler chickens fed diets containing varied levels of Lysure-H (Day 1 – Day 35)

Parameters	Diet I (100%DL)	Diet II (50%DL:50%LH)	Diet III (100%LH)	P-Value
Live Weight (kg.)	2.49	2.47	2.45	0.13
Slaughter Weight (kg)	2.39	2.37	2.34	0.16
Plucked Weight (kg)	2.30	2.22	2.20	0.19
Eviscerated Weight (kg)	1.99	1.90	1.87	0.27
Dressed Weight (kg)	1.69	1.63	1.60	0.24
Feather Weight (g)	86.70	73.30	83.30	0.04
Blood Weight (g)	103.33	86.67	70.00	0.91
Head (g/kg body weight)	59.67	57.72	57.83	0.85
Shank (g/kg body weight)	86.87	81.40	78.98	0.58
Wing (g/kg body weight)	173.93	170.73	168.83	0.36
Drumstick (g/kg body weight)	231.77	226.53	222.05	0.39
Thigh (g/kg body weight)	243.97	233.13	223.55	0.58
Breast Muscle (g/kg body weight)	675.43^{a}	634.47^{ab}	605.52^{b}	0.02
Back (g/kg body weight)	367.93	342.75	335.87	0.69
Neck (g/kg body weight)	61.43	61.10	60.82	0.53

^{abcde}: mean with different superscripts along the same row are significantly ($P<0.05$) different.

wing (173.93g/kg body weight, highest drumstick (231.77g/kg body weight) and highest thigh (243.97g/kg body weight) were observed in bird fed diet I, while lowest eviscerated (1.87kg), lowest dressed (1.60kg), lowest wing (168.83g/kg body weight), lowest drumstick(222.05g/kg body weight) and lowest thigh (223.55g/kg body weight) were recorded in bird fed diet III.

Relative Organ weights measurement

From Table 4, which shows the relative organ weights measurement of broiler chicken fed diets containing varied levels of Lysure-H, all parameters measured were not significantly (P>0.05) influenced by the dietary treatments. Numerically, highest liver (57.97g/kg body weight), highest gizzard (32.10g/kg body weight), highest spleen (6.80g/kg body weight), highest heart (12.20g/kg body weight),highest proventriculus (10.50g/kg body weight) and highest pancreas (3.70g/kg body weight) were recorded in bird fed diet I, while lowest liver (46.58g/kg body weight), lowest gizzard (30.65g/kg body weight) and lowest spleen (5.17g/kg body weight) were recorded in bird fed diet III. Likewise lowest heart (11.72g/kg body weight), lowest proventriculus (8.47g/kg body weight), and lowest pancreas (2.72g/kg body weight) were recorded in bird fed diet II. The highest lung (13.72g/kg body weight) was recorded in birds fed diet III, while the lowest lung (11.50g/kg body weight) was recorded in birds fed diet I.

Cost benefits

Table 5 presents the comparative cost benefits of broiler chickens fed varied levels of lysure-H. From the table, highest cost of 1kg feed (N656.00), highest cost of feed intake (N2289.44) and highest total cost of production (N5039.44) were recorded in bird fed diet I, while lowest cost of 1kg feed (N639.00), lowest cost of feed intake (N2227.33) and lowest total cost of production (N4977.33) were recorded in bird fed diet III. The highest profit/live weight (N1194.32) was recorded in bird fed diet II, while the lowest profit/live weight (N1147.67) was recorded in bird fed diet III. The highest profit/dressed weight (N2565.56) was recorded in bird fed diet I, while the lowest profit/dressed weight (N2354.32) was recorded in bird fed diet II.

Table 4: Relative organ weights of broiler chickens fed diets containing varied levels of Lysure-H (g/kg body weight)

Parameters	Diet I (100%DL)	Diet II (50%DL:50%LH)	Diet III (100%LH)	P-Value
Liver	57.97	53.93	46.58	0.25
Gizzard	32.10	31.08	30.65	0.13
Spleen	6.80	6.60	5.17	0.12
Heart	12.20	11.72	11.81	0.30
Proventriculus	10.50	8.47	8.73	0.72
Pancreas	3.70	2.72	3.10	0.39
Lungs	11.50	13.52	13.72	0.99

^{abcde}: mean with different superscripts along the same row are significantly (P<0.05) different.

Table 5: cost of production of broiler chickens fed diets containing varied levels of Lysure-H (Day 1 – Day 35)

Parameters	Diet I (100%DL)	Diet II (50%DL:50%LH)	Diet III (100%LH)	P-Value
Cost of Day-Old Chick (₦)	1700.00±0.00	1700.00±0.00	1700.00±0.00	-
Final Weight (Kg)	2.49±0.13	2.47±0.06	2.45±0.03	0.32
Weight Gain (Kg)	2.45±0.43	2.43±0.55	2.40±0.32	0.34
Total Feed Intake (Kg)	3.49±0.87	3.48±0.35	3.47±0.33	0.23
Cost of 1kg Feed (₦)	656.00±0.00	641.00±0.00	639.00±0.00	-
Cost of Feed Intake (₦)	2289.44±1.37	2230.68±1.42	2227.33±1.47	0.21
Feed Cost/Kg Weight Gain (₦ /Kg)	934.47±0.43	917.98±0.55	928.05±0.32	0.08
Other Expenses (₦)	1050.00±0.00	1050.00±0.00	1050.00±0.00	-
Total Cost of Production (₦)	5039.44±1.78	4980.68±1.90	4977.33±1.58	0.53
Sale of Kg Live Weight (₦)	2500.00±0.00	2500.00±0.00	2500.00±0.00	-
Sale Price of Live Broiler Chicken (₦)	6225.00±23.45	6175.00±24.90	6125.00±22.47	0.45
Profit/Live Weight (₦)	1185.56±2.74	1194.32±2.45	1147.67±2.03	0.31
Dressed Weight (Kg)	1.69±0.03	1.63±0.03	1.60±0.02	0.10
Price/Kg Dressed Weight (₦)	4500.00±0.00	4500.00±0.00	4500.00±0.00	-
Sale of Dressed Chicken (₦)	7605.00±3.58	7335.00±4.29	7342.20±5.25	0.12
Profit/Dressed Chicken (₦)	2565.56±2.53	2354.32±2.39	2364.87±2.19	0.47
Dollar ($) @ $1 = N1400	1.86±0.02	1.68±0.01	1.69±0.03	0.07

^{abcde}: mean with different superscripts along the same row are significantly (P<0.05) different.

DISCUSSION

From the growth performance table, all values obtained for all the parameters were significantly comparable among all the dietary treatments. The feed intake was numerically comparable among the dietary treatment which also agreed with the report of Kalbande *et al.* (2009). Consistent with earlier findings (Kumar *et al.,* 2024), the present trial observed alignment in feed intake, weight gain, and feed conversion ratio. This alignment could be attributed to the impact of balanced amino acids in the dietary treatments, promoting protein synthesis and subsequently enhancing similar weight gain, which simply means that using Lysure-H in broiler chicken diets had no negative effect on their growth performance. The overall result on growth performance of birds fed the Lysure-H was significantly similar to those fed the control diet (100% L-Lysine HCL 98.5%ine). Generally, all the dietary treatments demonstrated improved feed efficiency, which supported the fact that the efficiency of feed utilization for monogastric animals like broiler chicken is influenced by lysine levels in the feed, as indicated by the NRC (1994).

Carcass characteristics, including eviscerated weight, dressed weight, wing weight, drumstick weight, thigh weight, and breast weight were comparable by the varied levels of synthetic lysine and lysure-H and this aligned with the report of Kumar *et al.,* (2024) who obtained similar values for all the carcass traits measured using natural lysine to replace synthetic lysine in a broiler chicken diets. The breast muscle is a major interest of broiler producers, being a major portion of the protein synthesis in the body, and is very sensitive to essential amino acids of the diets (Dey, *et al.,* 2024). The breast muscle values recorded in this current trial were similar, when you compare birds fed Diet I and II suggesting equal diet compositions.

Considering the relative organ weights measurement of the bird fed varied levels of Lysure-H, all parameters measured were significantly comparable. The similarity in the values obtained on the relative organ weights in this trial indicates that there were no metabolic abnormalities among the birds fed both the control and the test diets. The values obtained for all the organs imply that synthetic lysine could be replaced with Lysure-H in the diet of broiler chickens, and the immunity of the birds against diseases is guaranteed since the spleen is the major source of lymphocytes and the storage site for the white and red blood cells (Hetland and Svihus, 2001).

The cost of feed per kilogram decreased progressively with increasing levels of Lysure-H inclusion. This reduction in feed cost can be attributed to the lower ingredient cost of Lysure-H compared with synthetic lysine, making it more economical alternative without compromising broiler chicken performance.

CONCLUSION

In conclusion, the findings of this study demonstrated that the partial (50%) or complete (100%) replacement of synthetic lysine with Lysure-H effectively maintained growth performance, carcass characteristics, relative organ weights in broiler chickens. Furthermore, increasing the inclusion level of Lysure-H progressively reduced feed cost per kilogram, highlighting its potential as a cost-effective alternative to synthetic lysine in broiler chicken diets without compromising productive performance.

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