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Digestibility and Economic Evaluation of Some Agro-Industrial By-Products

[1]C. Augustine, [3]A. Kibon, [2]M.S. Yahaya, [1]A Midau and [2]A.O. Udoyon

[1]Department of Animal Production Adamawa State University Mubi, P.M.B. 25, Nigeria
[2]Department of Animal Science and Range Management, Federal University of Technology Yola, Nigeria
[3]Department of Animal Science University of Maiduguri, Nigeria

Abstract: Six weeks feeding trial was conducted to assess the digestibility and economic potentials of maize offal, rice offal and brewers dried grains as feed stuffs for Japanese quail. Sixty Japanese quail chicks were randomly allocated to four dietary treatments with three replications of five birds per replicate. The result of nutrients digestibility showed significant differences. Treatment one however, had the best dry matter, crude protein, crude fibre and fat digestibility followed by treatment four. Treatment three however, recorded the lowest dry matter, crude protein, crude fibre and fat digestibility. The cost of feed per kilogram gain were significantly different ($P<0.05$). Cost of feed per kilogram and feed cost per kilogram gain decreases with 10% inclusion levels of the offals in all treatments. Treatment one recorded the highest cost of feed per kilogram and feed cost per kilogram gain.

Key words: Digestibility % Economic evaluation % Maize offal: Rice offal % Brewers dried grain

INTRODUCTION

High cost of livestock feeds and the increasing rate of competition between humans and livestock on feed resources suggest that alternative energy sources such as agro-industrial by-products of milling and brewing industries be used as substitutes or replacement for maize.

The cost of feeding poultry in Nigeria has been on an increase, which has affected the development of poultry industry in Nigeria. Olerede and Longe [1] reported that feed alone account for about seventy percent (70%) of the total cost of poultry production.

Maize offal, rice offal and brewers dried grains have been successfully used in feeding poultry and other monogastric animals. The ingredients are also available and cheap in the area of study.

A major limitation to the use of some agro-industrial by-products is their high fiber content. Digestibility measurement is therefore a vital step in the evaluation of feed stuffs and has become an important way of measuring the potential value of feed ingredients to animals. Little or no work has been done on nutrients digestibility of these agro-industrial by-products by Japanese quail. These research evaluated the digestibility of maize offal, rice offal and brewers dried grains and there economic benefit as feedstuffs for Japanese quails.

MATERIALS AND METHODS

Location of the Study Area: The research was conducted in Yola south local government area of Adamawa state Nigeria. The research area is located within Guinea Savannah Zone and lies between latitude 12°15°N and 9°15°S. The area has an annual rainfall of about 900mm-1100mm and average minimum and maximum temperatures of 15.2°C and 39°C respectively, Adebayo and Tukur [2].

Experimental Diets and Treatments: Four experimental diets for both starter (23% crude protein) and finisher (21% crude protein) phases were compounded with maize offal, rice offal and brewers dried grains included at 10% levels in diets two, three and four , while diet one had zero replacement and served as the control (Tables 1 and 2).

Experimental Design and Management: Sixty Japanese quail chicks were allocated to four dietary treatments in a completely randomized design and were replicated three times with five birds per replicate. The birds were reared in a cage made of wooden floor covered with saw dust. Measured quantity of starter and finisher diets were offered at both phases of growth. Clean drinking water was given to birds at all times. No vaccination program

Corresponding Author: C. Augustine, Department of Animal Production, Adamawa State University, Mubi, P.M.B. 25, Nigeria, E-mail: augustine.clement@yahoo.com.

Table 1: Composition of experimental starter diet.

Ingredients (%)	T_1	T_2	T_3	T_4
Maize	57.00	48.00	46.00	48.00
Maize offal	0.00	10.00	0.00	0.00
Rice offal	0.00	0.00	10.00	0.00
Brewers dried grains	0.00	0.00	0.00	10.00
Soya bean meal	36.00	35.00	37.59	35.99
Fish meal	3.39	4.39	2.80	2.40
Premix	0.25	0.25	0.25	0.25
Lysine	1.25	1.25	1.25	1.25
Methionine	0.45	0.45	0.45	0.45
Bone meal	1.41	1.41	1.41	1.41
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis Metabolizable ener-gy (kcal/kg)	2924.39	2830.16	2700.38	2762.96
Crude protein (%)	23.17	22.77	22.99	22.52
Crude fibre (%)	3.51	4.47	4.75	4.50
Calcium (%)	0.78	0.69	0.76	0.74
Phosphorus (%)	0.58	0.56	0.58	0.63

T1=0% offal; T2=10% maize offal; T3=10% rice offal; T4=10% brewers dried grains

Table 2: Composition of experimental finisher diet.

Ingredients (%)	T1	T2	T3	T4
Maize	62.00	52.00	52.00	55.00
Maize offal	0.00	10.00	0.00	0.00
Rice offal	0.00	0.00	10.00	0.00
Brewers dried grains	0.00	0.00	0.00	10.00
Soya bean meal	31.19	32.19	30.89	29.29
Fish meal	2.20	2.20	3.50	2.10
Premix	0.25	0.25	0.25	0.25
Lysine	1.25	1.25	1.25	1.25
Methionine	0.45	0.45	0.45	0.45
Bone meal	1.41	1.41	1.41	1.41
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysisMetabolizable ener-gy (kcal/kg)	2974.16	2830.16	2764.18	2832.48
Crude protein (%)	21.38	21.37	21.05	21.41
Crude fibre(%)	3.36	4.37	4.67	4.31
Calcium (%)	0.75	0.69	0.79	0.71
Phosphorus (%)	0.55	0.53	0.58	0.59

T1=0% offal; T2=10% maize offal; T3=10% rice offal; T4=10% brewers dried grains

was observed, however, amprolium and keproceryl were administered at preventive doses to guard against any protozoa and bacterial infection that may occur, respectively. Daily records of feed intake were taken while weight gain was recorded on weekly basis. Feacal collection for measurement of nutrients digestibility was done during the last seven days of the trial. The daily feacal output was stored in a deep freezer and later dried properly for analysis.

Chemical Analyses: Proximate analysis of the experimental diets and feacal samples were carried out using the procedure described by AOAC [3].

Digestibility Measurement: Nutrients digestibility was determined using the relationship below:

$$\text{Nutrients Digestibility} = \text{nutrients in diet} - \frac{\text{nutrients in feaces}}{\text{nutrients in diet}} \times 100\%$$

Statistical Analysis: Data obtained were analyzed using analysis of variance of the completely randomized design as described by Steel and Torrie [4]. Duncan multiple range test was used to separate the treatment means.

Economic Analysis: This was determined by calculating the cost of feed per kilogram, cost of total feed intake and feed cost per kilogram weight gain.

RESULTS AND DISCUSSION

The proximate composition of the experimental diets is presented in Tables 3 and 4. The result of the nutrients digestibility is presented in Table 5. while the economic analysis is given in Tables 6 and 7. The result of the nutrients digestibility revealed a significant ($P<0.05$) difference. Diet with fairly high fibre content had low nutrients digestibility. This is consistent with the report of Balagopalam *et al.* [5] who pointed out that the fibre content and quality of diet is a contributory, factor to the reduced digestibility and utilization of nutrients by monogastric animals. Nwoko *et al.* [6] also reported that high crude fiber in broiler starter diet tend to mask the availability of minerals and depress nutrients digestibility.

The result of the economic analysis showed significant difference ($P<0.05$) among the treatment means of the feed cost per kilogram (N/kg), cost of total feed consumed (N /kg) and feed cost per kilogram gain (N /kg). The result however, showed that there was a reduction in cost of feed per kilogram (N /kg), feed consumed and feed cost per kilogram gain (N /kg), with ten (10%) inclusion of maize offal, rice offal and brewers dried grain.

In conclusion, the significant variability of nutrients digestibility recorded among treatments have been primarily attributed to the differences in terms of crude fibre content of the test ingredients. The economic analysis indicated cost effectiveness at 10% level of inclusion due to reduction in cost of feed per kilogram and feed cost per kilogram gained at both phases of growth. This study further revealed that maize, rice offal and brewers dried grains can be used at 10% level in the diet of Japanese quails without detrimental effect.

Table 3: Proximate composition of experimental starter diets.

	T1	T2	T3	T4
Crude protein (%)	23.14	21.57	21.96	23.42
Crude fibre(%)	5.04	6.01	8.11	7.01
Metabolizable energy (kcal/kg)	2914.60	2812.73	2745.43	2994.84
Fat	8.97	7.22	5.02	9.04
Calcium	1.03	1.10	0.96	0.89
Phosphorus (%)	0.31	0.24	0.26	0.37

Table 4: Proximate composition of experimental starter diets.

	T1	T2	T3	T4
Crude protein (%)	20.37	19.47	18.97	20.24
Crude fibre(%)	7.53	8.55	9.07	8.75
Metabolizable energy (kcal/kg)	2994.84	2895.61	2794.21	2843.57
Fat	8.88	7.00	6.03	7.67
Calcium	1.02	0.98	1.26	1.31
Phosphorus (%)	0.23	0.17	0.24	0.33

Table 5: Nutrient digestibility of Japanese quails fed maize offal, rice offal and brewers dried grains

	T1	T2	T3	T4	Sem
Dry matter %	80.33^{b}	76.99^{b}	68.49^{a}	74.97^{b}	10.15
Crude protein %	63.75^{b}	48.40^{a}	47.01^{a}	56.67^{ab}	7.8
Crude fibre %	63.21	63.12	58.80	64.24	2.42NS
Crude fat %	76.99^{b}	60.10^{ab}	52.84^{a}	63.61^{b}	10.12

Means in the same row with different superscripts are significantly ($p<0.05$) different

Table 6: Economic analysis of performance of Japanese quails fed maize offal, rice offal and brewers dried grain at starter phase (1-4 weeks).

parameters	T1	T2	T3	T4	Sem
Total feed intake (g)	364.24	350.58^{b}	336.33	365.25	10.37NS
Feed cost per kg (N/kg)	36.42^{c}	16.35^{b}	16.83^{c}	15.64^{a}	8.10
Cost of total feed intake(N/kg)	13.27^{c}	5.73	5.61^{b}	5.71^{b}	0.2
Feed cost per kg gain (N/kg)	58.87	80.42	79.58	83.25	8.23

Different super script a,b,c within same row are significantly ($P<0.05$) different

Table 7: Economic analysis of performance of Japanese quails fed maize offal, rice offal and brewers dried grain at starter phase (1-4 weeks).

parameters	T1	T2	T3	T4	Sem
Total feed intake (g)	635.17	576.67	613.17	599.17	28.06NS
Feed cost per kg (N/kg)	36.97^{a}	15.51^{c}	15.36^{b}	14.75^{a}	9.08
Cost of total feed intake(N/kg)	23.38^{b}	8.95^{a}	9.42^{a}	8.84^{a}	0.32
Feed cost per kg gain (N/kg)	131.61^{b}	58.52^{a}	54.58^{a}	56.35^{a}	17.54

Different super script a,b,c within same row are significantly ($P<0.05$) different

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