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RESEARCH ARTICLE (Open Access)

Physical, Chemical and Performance Evaluation of Different Commercial Brands of Layers, Broilers Starter and Finisher Feeds.

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Abstract

In completely randomized design that comprised two studies, physical, chemical and performance evaluations were conducted to determine the quality of commercial four layers feeds, three broiler starter and three broiler finisher feeds. In study 1, eighty 20-week in–lay black harco hens were used in four replicate groups to evaluate the effects of the selected layer feeds on their laying performance for twelve weeks. While in study 2, seventy two broiler chicks were used (0-8 weeks) in three replicate groups to evaluate the broiler feeds. All feeds were packaged in standard polyethylene woven bags with no presence of insects or mould. All feeds were in mash form except two layers feeds in crumbled form and one pelleted feed. There were also variations in crude protein, crude fat and crude fibre contents of the various feeds as analyzed. There were no significant differences in Hen Day Production and egg diameters($P>0.05$). However, total number of eggs laid and egg weight were significantly reduced among hens on two treatments($P<0.05$). The highest cost of producing a dozen eggs was recorded with the pelleted feed($P<0.05$). There were significant differences in feed intake, weight gain and feed conversion ratio among broilers on the different treatments($p<0.05$), with the poorest performance recorded among broilers fed starter and finisher feeds from same producer. Percentage mortality was however not significant ($p>0.05$). It was concluded that none of the feeds investigated met all the requirements of an ideal feed either for broilers or layers.

Keywords: Harco hens, layers feed, hen day production, egg weight, broilers, weight gain

1. Introduction

In animal husbandry, good feeding is normally used to augment breeding, health and management of livestock species. Poultry farming is a developing industry in Nigeria. This is accompanied by feed production units ranging from small units here and there to commercial feed millers who produce on a large scale. This development is however not without its attendant problems.

For example, while feed production ethics of practices and assurance schemes are established features of livestock industries in developed countries, this is not quite so in developing countries. In Nigeria for example, there is no defined system of evaluating the quality and quantity of animal feeds being sold to poultry farmers. Poor quality feeds results in high mortalities, low productivity, product condemnation and as a consequence produce a low rate of return on investment [9] and [1] stated that income in livestock production is highly dependent on feed utilization which accounts for 60 – 80 % of the total production cost. Therefore, the need to ensure adequate and quality feeding for livestock cannot be overemphasised. Unfortunately in Nigeria, there exist a tri-petal competition between humans, animals and agro based industries for high quality protein and energy ingredients. This factor makes it difficult to use high proportion of these conventional ingredients to manufacture animal feeds. The current observation is that, many feed manufacturers in Nigeria, in their efforts to save cost, are not very particular about the nutritional qualities required of their products, hence, they use all sorts of ingredients in their feed formulations. However, we do know that nutritional value is a function of digestibility, biochemical composition and the presence or absence of anti nutritional factors [2]. Also, the nutritive values of animal feed and feedstuffs could vary as a result of factors such as time and age of feed materials and processing methods [8]. Other factors include seasonal variations and method of conservation [7], as well as presence of toxic substances [6] and [4]. Many feed manufacturers take little or no consideration of these factors before embarking on feed production. The overall result is that poultry farmers in Nigeria most of the time get less value for their investment in terms of the quality and quantity of the commercial feed purchased. As most poultry farmers in Edo state depend on commercial feeds for their farm operations,

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this study was designed to investigate the physical, chemical and performance evaluations of selected commercial layers and broiler feeds they frequently use.

2. Materials and Methods

2.1 Feed Sampling and Collection:

Non formal random survey of commercial poultry feed outlets was conducted in at least one local government of the three senatorial zones of Edo state, that is; Edo south, Edo North and Edo central. The brands of commercial layers, broiler starter and finisher feeds available were listed out of which four (4) layers feed coded LFe, TFe, RFe and GFe most frequently used were selected for the purpose of this study. Also three (3) frequently used broiler starter feeds coded LFs, TFs and RFs were selected. Finally the three (3) commercial broiler finisher feeds selected were coded LFq, TFq and RFq. Feeds used throughout the duration of the experiment were purchased from batches not more than two weeks in stock to minimise quality deterioration due to long storage. Selected commercial feeds were also purchased from different outlets. Feed samples for analysis were collected in this manner. For a particular brand of commercial layer feed, 25g of feed was collected from each bag bought at different times during the course of the study. The samples were then pooled together and properly mixed prior to chemical analysis. This was done for each of the brands of commercial feeds.

2.2 Physical Examination of Feed;

Every bag of feed purchased for each brand of feed was weighed using a dial scale and the actual weight of the feed content was determined by subtracting the weight of empty feed bag. The nutrient contents disclosed on the bag labels were recorded. The type of bags used was also noted and recorded. Samples of feed were taken and examined for presence of insects or mould. The form in which the feed came whether pellet, mash or granular was noted and recorded for each brand.

2.3 Chemical Analysis

The proximate compositions of feed were carried out using the method of AOAC (1990). Percentage moisture content, crude protein, crude fibre, ether extract, and ash content determined were compared with the nutrient values declared on the bag label.

2.4 Performance Evaluation:

Two separate studies were conducted**.** In the first study, a total of eighty (80), 20 – week in lay black Harco hens, previously exposed to similar management and of similar live body weights were randomly distributed into four groups. Each group represented a brand of commercial layers feed. In all, each group was replicated ten (10) times. Hens were fed *ad libitum* and clean drinking water was provided to satisfaction. Records of feed intake, weight gain, eggs number, egg weight and egg diameter were taken either daily or weekly as appropriate. This lasted for 12 weeks.

In the second study, a total of seventy two (72) day old broilers were randomly distributed into three groups representing the three brands of broiler feeds selected for investigation. Each group was replicated three times consisting of eight (8) broiler chicks per replicate. Initial weights of chicks were taken. Weekly records of feed intake, and live body weights as well as mortalities were taken during the starter and finisher phases. Feed and water were offered to satisfaction.

2.5 Statistical Analysis:

The data obtained from the performance and other parameters were subjected to the Analysis of Variance (ANOVA) as described by [13]. Significant differences among the means were tested at 5% alpha level using Duncan's multiple range test [5].

3. Results and Discussion

3.1 Physical Evaluation of Feeds:

Table 1 shows the physical characteristics of the brands of commercial layers, broiler starter and finisher feeds evaluated. The average gross weights of the feeds TFe, RFe and GFe were slightly less than the 25kg declared on their bag labels. On the other hand, the average gross weights of LFs, TFs and LFq were slightly above the weights indicated on their bag labels. While feed GFe was in pelleted form, both LFe and TFe were in crumbs. All other commercial feeds evaluated came as mash feeds. None of the feeds examined had either the presence of insects or mould. They were all packaged in standard polyethylene woven bags (pwb).

Table 1: Physical characteristics of the selected commercial layers, broiler starter and finisher feeds

Brand of Feeds	*Declared wt (kg)*	*Actual wt (kg)*	*Feed texture*	*Insect*	*Mould*	*Flavour*
LFe	25.00	25.00	Crumble	NP	NP	Fresh
TFe	25.00	24.60	Crumble	NP	NP	Fresh
RFe	25.00	24.90	Mash	NP	NP	Fresh
GFe	25.00	24.80	Pellet	NP	NP	Fresh
Broiler Starter						
LFs	25.00	25.90	Mash	NP	NP	Fresh
TFs	25.00	25.40	Mash	NP	NP	Fresh
RFs	25.00	25.00	Mash	NP	NP	Fresh
Broiler finisher						
LFq	25.00	25.80	Mash	NP	NP	Fresh
TFq	25.00	25.00	Mash	NP	NP	Fresh
RFq	25.00	25.00	Mash	NP	NP	Fresh
NP-Not present						

LFe, TFe, RFe and GFe: Different layers feed investigated
LFs, TFs and RFs: Different broiler starter feeds investigated
LFq, TFq and RFq:Different broiler finisher feeds investigated
All feeds carrying same first two letters are from same feed manufacturer.

3.2 Biochemical Evaluation

Table 2 shows the proximate composition of the various brands of commercial feeds investigated compared with the declared values on the bag labels. Although none of the feed millers declared the moisture contents of their feeds, analysis showed that the moisture content ranged from between 10.0% in feed LFe to 13.5% in feed GFe. On proximate analysis, crude protein values in commercial feeds LFe, TFe, RFe GFe, TFq and RFq were slightly below the values declared on their bag labels. On the other hand, the analysed crude protein values for the broiler starter feeds LFs, TFs and RFs were slightly above the values on their bag labels. Similar trend was observed for commercial feed LFq.

In most of the commercial feeds evaluated, the crude fat content values declared were grossly less than the proximate analysis revealed. However, an exception was found in the commercial broiler finisher feeds LFq and TFq where the declared crude fat values were above the values derived from proximate analysis.

The calcium contents of layers feeds LFe, TFe, RFe and GFe as declared on their bag labels ranged from 3.26 to 3.7 %. The phosphorous content ranged from 0.4 to 1% except in commercial layers feed TFe where the level of phosphorous was not indicated. None of the broiler starter and finisher feeds had their mineral contents indicated. However, on analysis, the ash contents of the broiler starter feeds ranged from 5.94% in TFs to 8.98% in RFs. Similarly, the ash content in finisher feeds ranged from 6.08% in LFq to 7.96% in TFq.

Almost in all cases, the crude fibre contents of the various brands of feed investigated were higher than the values declared on their bag labels. This ranged from 5.75% in TFq to as high as 13.21% in LFq.

3.3 Performance Evaluation:

Table 3 shows the performance of laying hens fed the various commercial layers feed over a 12-week laying period. The final body weights of hens were highest in commercial layer feed RFe while the least body weight was recorded in feed GFe ($p< 0.05$). . Feed intake, egg laying percentage and egg diameters were all similar among hens on various brands of feed ($p > 0.05$).

However, there were significant differences as regards the number of eggs laid and egg weight across the various brands of layers feed investigated with the largest eggs laid by hens fed feed LFe ($p<0.05$). Although feed intake per dozen eggs were similar among hens, feed cost per dozen eggs was highest among hens fed commercial feed GFe compared with others ($p< 0.05$**)**

Table 4 shows the overall performance of broilers fed the various brands of commercial broiler starter and finisher feeds from zero to eight weeks.

Feed intake, weight gains and feed conversion ratio were all significantly affected ($P< 0.05$).

Table 2: Analyzed and declared nutrient compositions of various commercial layers, broiler starter and finisher feeds

Brand of Feeds	*Moisture (%)*		*Crude Protein (%)*		*Crude Fat (%)*		*Ca (%)*		*P (%)*			
	Decld	Anlysd	Decld	Anlysd	Decld	Anlysd	Decld	Anlysd	Decld	Anlysd	Decld	Anlysd
Layers Feed												
Fe	NA	10.00	16.00	14.83	3.00	9.45	3.26	3.54	1.00	0.69		
TFe	NA	10.20	16.50	15.33	3.50	5.96	3.50	4.17	NA	0.67	NA	NA
RFe	NA	13.33	16.50	15.35	5.00	5.96	3.50	3.37	0.40	0.68	NA	NA
GFe	NA	13.35	16.50	15.36	4.00	6.02	3.70	3.27	0.40	0.60	NA	NA
Broiler Starter												
LFs	NA	11.89	21.00	22.01	5.00	8.11	NA	NA	NA	NA	NA	8.38
TFs	NA	11.85	22.00	22.18	6.00	8.91	NA	NA	NA	NA	NA	5.94
RFs	NS	10.86	24.00	25.37	3.00	3.22	NA	NA	NA	NA	NA	8.98
Broiler finisher												
LFq	NS	11.48	18.00	18.78	6.00	4.79	NA	NA	NA	NA	NA	6.68
TFq	NS	10.39	22.00	20.38	6.00	3.73	NA	NA	NA	NA	NA	7.96
RFq	NS	10.09	20.00	18.69	3.00	3.39	NA	NA	NA	NA	NA	6.70

NA=Not Available
LFe, TFe, RFe and GFe: Different layers feed investigated
LFs, TFs and RFs: Different broiler starter feeds investigated
LFq, TFq and RFq:Different broiler finisher feeds investigated
All feeds carrying same first two letters are from same feed manufacturer.
Decld: Declared value
Anlysd : Analysed value

The highest feed intake as well as body weight gain was recorded among broilers fed feed TFs during starter phase and feed TFq during finisher phase. The best feed to gain ratio was also recorded among this same set of birds ($p < 0.05$). However, percentage mortality of broilers was not significantly affected ($p>0.05$).

Feeds are assessed so that nutrient requirements of animals are met. Laboratory methods have been used to help define animal feeds, assess their nutritive value and provide data for the prediction of animal's performance. Ultimately, any assessment of feed's worth must be based on its ability to support life, growth and reproduction in the animal. The overall assessment of the physical characteristics of the commercial feeds evaluated seems to suggest that all the commercial feed millers were largely truthful in terms of the actual quantities of feed declared on the feed bag labels. The little excess above 25kg as found in feeds LFs, TFs and LFq, and the little shortfalls as found in feeds TFe, RFe and GFe could be attributed to error in weighing and the differences in accuracy and sensitivity of the scales used. [14] also reported slight variations in the gross weight of the feed bags while investigating the physical characteristics of some selected growers and layers rations. It is also commendable that the physical integrity of the feeds evaluated was intact especially with the absence of insects and mould activities. As compounded feed can be better than the quality of ingredients from which it was made this result could be attributed on one hand to the quality of feedstuffs used and the storage facilities available as well as the duration of storage in the warehouse. It is also commendable that all feeds investigated were packaged in the standard polyethylene woven bag that allows for good storage.

However, this study has confirmed once again that the information provided by most commercial feed manufacturers in Nigeria with regards to the nutrient composition of their feeds is usually incomplete.

None of the feed manufacturers declared the moisture content of their feeds. However on analysis the moisture contents ranged from 10% to 13.35%. This value is slightly higher than the optimum range (10 -12%) recommended for proper storage of processed feeds and feedstuffs. Such high moisture percentage could support the growth of fungi in the feed when stored for too long [15]. Apart from such feed being a source of disease infection for birds, it has economic implications. Substantial proportion of the declared weight of such a feed or ingredient will be made up of water, thus making the farmer receive less than he paid for. Sometimes this unethical practice of feed millers may be deliberate.

On proximate analysis, the crude protein content of the layers feed were slightly below than values declared while those of the broiler feeds were slightly above the values declared. The latter observation is suggestive on the probability of feed millers being aware of the fact that farmers are always on the look out for percentage crude protein in the feed. An evidence of this is found in commercial broiler starter feed RFs where the bag label indicated a 24% crude protein above the value recommended for broiler starter. This, most of the times may be a form of bait for farmers to go for such a feed. The quality of such protein will never be disclosed by feed millers.

In most cases the crude fat percentages of the commercial feeds were much higher than the values declared on bag labels. Fat, among other functions is used as a source of energy in poultry feeds. . However, the consequence of high fat contents in feeds produced in tropical environment is that, it could lead to deterioration as a result of oxidative rancidity and possible bad odour development. Such feeds can cause serious health hazards to the birds when subjected to long storage.

Including up to 13.21% fibre in poultry feed as discovered in broiler finisher feed LFq is nutritionally unacceptable in view of the bird's digestive limitations to handle such a high fibre feed. This problem may be indicative of the fact that feed manufacturers may be using more fibrous feedstuffs such as rice bran, wheat offal, brewers 'dried grain and others instead of the conventional low fibre feedstuffs such as maize, soyabean and groundnut cake to mention a few. Grains such as maize, soybeans and other conventional feedstuffs are costly these days. Hence, unscrupulous feed manufacturers in an attempt to maximise profit at the expense of quality do engage in such practices. None of the commercial broiler feeds investigated disclosed the metabolisable energy content which is an important factor in animal nutrition. Information of such importance should not be left out since results of proximate analysis could reveal estimates of nutrient potentials of feed and feedstuffs [12]

Laying performance of hens in terms of egg number and egg weight was significantly reduced in commercial layers feeds RFe and GFe. The differences in laying performance could be related to the nutritional differences among other factors. [16] reported that most lipids in egg yolk is formed in the liver by using fatty acids obtained from the diets or from *de novo* synthesis and that providing dietary fat

decreases the need for hepatic fatty acid synthesis and generally increases yolk formation and the weight of the egg.. Although all the commercial layers feeds investigated indicated an average of 2250kcal/kg metabolisable on their bag labels, it is lower than the value recommended by [10]. [10], reported that dietary protein of 15% and metabolisable energy of 2800kcal/kg would give an expected egg weight average of 64.30g in the temperate region. [10] stated further that increasing the hen's intake of balance protein would result in increase in egg size when energy intake is increased.

Among the commercial broiler feeds investigated, both the broiler starter feed LFs and finisher feed LFq had the poorest performance in terms of feed intake, weight gain and feed to gain ratio. This result is not surprising, looking at the fibre level of both types of feed which are 6.25% and 13.21% for LFs and LFq respectively. Incidentally, both types of feeds were produced by the same commercial feed miller who probably used high levels of less costly, but high fibre feed ingredients at the expense of the conventional energy and protein concentrates. Chickens have limited innate ability to utilize high fibre. [11] noted that although feeds may be formulated to have identical energy, protein and mineral contents, one may be superior to the others if it contains less fibre , a higher mount of essential amino acids and more readily available forms of other nutrients.

Table 3: Performance of laying hens fed various commercial layers and fed for over 12 weeks

	Brands of feed				
Parameters	LFe	TFe	RFe	GFe	SEM
Initial Body Weight (Kg/hen)	1.78	1.76	1.71	1.70	0.11
Final Body Weight (Kg/hen)	1.83^{ab}	1.85^{ab}	1.90^{a}	1.73^{b}	0.13
Total feed Intake (Kg/hen)	9.05	8.92	9.24	9.15	0.62
Egg laying (%)	72.29	76.50	70.30	72.20	7.70
Total no. of eggs laid /hen	61^{ab}	65^{a}	59^{b}	61^{ab}	4.39
Average Egg weight (g)	62.16^{a}	59.47^{ab}	59.68^{ab}	58.00^{b}	3.38
Egg diameter (cm)	4.42	4.44	4.33	4.31	0.24
Feed per dozen eggs (Kg)	2.20	2.38	2.29	2.53	0.31
Feed cost per dozen egg N	118.50^{b}	110.70^{b}	111.00^{b}	134.00^{a}	13.53

Means within a row with different superscripts differed significantly (P<0.05)
LFe, TFe, RFe and GFe: Different layers feed investigated
SEM= Standard Error of Mean

Table 4: The overall effect of commercial broilers starter and finisher feeds on the performance of broilers (0-8weeks)

Brand of feed	*Feed intake (g per bird)*	*Weight gain (g per bird)*	*Feed/ gain ratio*	*Mortality (%)*
LFs & LFq	4079^{c}	1230^{c}	3.32^{a}	16.67
TFs & TFq	4878^{a}	1680^{a}	2.91^{c}	19.43
RFs & RFq	4460^{b}	1393^{b}	3.25^{b}	11.00
SEM	188.10	106.21	0.01	9.87

Means within a column with different superscripts differed significantly (P< 0.05)
LFs, TFs and RFs: Different broiler starter feeds investigated
LFq, TFq and RFq:Different broiler finisher feeds investigated
SEM= Standard Error of Mean

4. Recommendation and Conclusion

As a result of lack of functional quality control agencies in the feed milling industry in Nigeria, it seems feed manufacturers are less careful about meeting required standards in nutritional compositions of their feeds.Specifically from this study, the performance evaluation suggests that commercial layers feeds LFe and TFe were better than others. Also, commercial broiler feed TFs and TFq were better than the other broiler feeds.

However, it is recommended that as a matter of urgency, functional quality assurance units in feed industries should be established. Also, a special government agency mandated to monitor and sanction erring feed manufacturers.

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