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# Growth and nutrient utilization of broiler chickens fed steam treated cattle rumen epithelia scrapping meal in place of fish meal

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**Abstract**

*A feeding trial was conducted to evaluate the growth performance and nutrient digestibility of broiler chickens fed varied levels of steam-treated Cattle Rumen Epithelia Scrapings (CRESM) in replacement for fish meal at 0, 25, 50, 75, and 100% level. Two hundred and four (240), one-day old Abor Acre strain of broiler chickens used for the study were randomly divided into 5 treatments of four (4) replicates each. There were 12 birds per replicate to make a total of 48 birds per treatment in a completely randomized design. Data were collected on the feed intake, weight gain, feed to gain ratio, feed cost per kilogram weight gain at the starter and finisher phases while digestibility trial was conducted at the finisher phase. The results indicated that feed intake (44.15, 48.20, 48.87, 47.18 and 49.30g) and weight gain (20.73, 24.13, 24.63, 23.69 and 23.34g) for 0, 25, 50, 75 and 100% CRESM, respectively were higher (P<0.05) and feed: gain ratio lower in birds that received diets containing CRESM at starter phase. Feed cost and feed cost per kg weight gain decreased with increased level of CRESM at this phase. At the finisher phase, feed cost per kilogram weight gain (₦260:01) of treatment five (100% inclusion of CRESM) was the lowest (p<0.05) compared with other inclusion while the control was the highest. It was concluded that 100% fishmeal could be replaced with steam-treated CRESM in broiler diets, thus ultimately reducing the production cost and increasing the profit accruable to farmers.*

**Keywords:** Growth performance, Nutrient digestibility, CRESM, fish meal

## Introduction

It is a common knowledge that feeds constitute the most expensive input in animal production and that a reduction in its cost will vividly reduce the overall production cost which will result ultimately in increase profit margin of the farmers. Although fish meal is an excellent source of protein for broiler chickens because according to Ahmed (2006), it contains all the essential amino acids and the protein is highly digestible. However, the adulteration especially of the so- called imported fish meal is a serious pointer to seeking an alternative to its use. In addition to the adulteration, there is sharp increase in the price and demand for fish meal, the primary animal protein source in livestock especially poultry and fish (Duangrat *et al.,* 2010) in the recent years. Animal nutritionists have been utilizing agro-industrial by-products regarded as non-conventional feed sources for monogastric animals because they are abundantly produced (Fetuga and Tewe, 1985). The ever-increasing cost of livestock feeds leading to an increase in the cost of animal products such as meat, eggs and milk calls for the need to explore the use of nonconventional feed ingredients in the feeding of domestic animals (Alawa and Umunna, 1993; Ani and Omeje, 2007; Owen, *et al.,* 2009). One of the ways of solving the problem of high cost of conventional animal protein sources may be the exploitation of vast, cheap and

underutilized slaughter house wastes and animal by- products which often constitute environmental pollutants (Ogunwole, 2011).

Cattle rumen epithelial scraping (CRESM) is an abattoir by product that results from cleaning rumen for human consumption in most African countries including Nigeria and it consists mainly of papillae layer (Oladunloye *et al.,* 2013). The use of CRESM could be a way of providing cheap animal protein to livestock as well as solving the problem of waste disposal and pollution thus contributing to a clean, friendly and healthy environment.

The present study was therefore designed to evaluate the effects of the replacement of fish meal protein with varying levels of steam treated CRESM in the diet of broiler chickens on the growth performance and nutrient digestibility of broiler chickens.

## Materials and methods

***Experimental site***

The experiment was carried out at the Poultry Uint of the Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State.

***Source and preparing of the test ingredient***

Cattle rumen epithelia scraping was sourced from major abattoirs within Ogbomoso. The sample collected was sundried until it was about about 10-12% moisture. The sundried material was steam heated for 30 minutes, sun-dried again and milled to obtain what was referred to as Cattle rumen epithelia scraping meal (CRESM).

***Formulation of experimental diet***

Five experimental diets were formulated to contain 0% CRESM + 100% fish meal (diet 1), 25% CRESM + 750% fish meal (diet 2), 50% CRESM + 50% fish meal (diet 3), 75% CRESM + 25% fish meal (diet 4) and 100% CRESM + 0% fish meal (diet 5) (Tables 2 and 3) for starter and finisher phases, respectively.

***Experimental birds and management***

Two hundred and forty (240) Abor acre strain of broiler chicks were used for the experiment. The birds were weighed and randomly distributed into 5 treatments of 48 birds each. Each treatment was replicated 4 times to give 12 birds per replicate. Each replicate was housed in experimental pens measuring 125 x 125 x 185cm. The birds were raised on deep litter and wood shaving was used as litter materials. The birds were offered adequate feed, clean and fresh water *ad-libitum* on daily basis throughout the experiment. Routine medication and vaccination programme as applicable to the environment was carried to maintain healthy flock. The experiment lasted for 8weeks.

***Data collection***

The initial weights of the birds were measured at the commencement of the experiment at day old while performance through growth rate was monitored by subsequent measurement of the live weights on weekly basis. The weights at the end of the experiment (8 weeks) were measured as the final weights, while feed intake was calculated by subtracting the left over feeds from the feed offered. Data on weight gained was obtained by subtracting the initial weights from the final weights. Feed conversion ratio was obtained by dividing the feed intake by the weigh gained. Feed cost per kilogramme was calculated as the summation of the cost of all the ingredients included in the diet. Feed cost per kilogramme weight gain was calculated by multiplying the feed:gain by the feed cost per kilogramme.

***Digestibility trial***

At the 8$^{th}$week of the experiment, 3 birds were taken from each replicate and transferred to the metabolic cages equipped with separate feeders and drinkers for

digestibility study. A 3-day acclimatization period was observed followed by 5-day faecal collection. The weights of the wet as well as the dry faeces were taken. The corresponding feed intake for five days was also recorded. The samples for each replicate for five days were bulked together and sub sample was taken for proximate analysis.

***Chemical analysis***

Test ingredients, experimental diets as well as feacal samples were analyzed for proximate composition by methods of A.O.A.C (2005).

***Data analysis***

All data collected were subjected to analysis of variance (ANOVA) using the general Linear Model (GLM) procedure of SAS (2003). Means were compared by the Duncan's Multiple Range Test Option of the same software package.

**Result and discussion**

The proximate composition of CRESM and the fish meal used for the study is presented in Table 1. CRESM had crude protein content of 59.70% while fishmeal had the crude protein content of 61.27**%.** The crude protein (59.7%) and dry matter (86.6%) of CRESM were similar to the values reported by Oladundoye *et al.* (2013) which were 56.5% and 89.3%, respectively but higher than the crude protein reported by Alikwe *et al*. (2005) could be due to techniques of processing as well as the age of animals. The crude protein content of the fish meal in this study is similar to the values reported by Fanimo *et al.* (2000), Dale (2004) and Ingweye *et al.* (2008). The crude protein obtained for CRESM is similar to 58.5% reported for fish waste by Ingweye *et al.* (2008) but higher than 48.3% the authors reported and 40.20% by Oduguwa *et al.* (2005) for shrimp waste meal.

The metabolizable energy as well as the crude protein of the diets (Tables 2 and 3) used in this study meets the requirement for boilers as recommended by NRC (1994).

**Table 1: Proximate composition of test ingredients**

| Parameters | Fishmeal | CRESM |
|---|---|---|
| Dry matter (%) | 82.80 | 86.6 |
| Crude protein (%) | 61.27 | 59.70 |
| Crude fat (%) | 10.40 | 3.01 |
| Total ash (%) | 10.99 | 15.87 |
| Crude fibre (%) | 0.65 | 2.81 |
| NFE (%) | 0.51 | 5.21 |
| Met. Energy (Kcal/kg) | 3213.57 | 2396.00 |

NFE:Nitrogen free extract

**Table 2: Gross Composition of Experimental Diets (Starter)**

| Ingredients (%) | Replacement of fishmeal with CRESM (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 25 | 50 | 75 | 100 |
| Maize | 56.25 | 56.25 | 56.25 | 56.25 | 56.25 |
| Fish Meal (65%) | 3.50 | 2.62 | 1.75 | 0.88 | 0.00 |
| CRESM | 0.00 | 0.88 | 1.75 | 2.62 | 3.50 |
| † Fixed ingredients | 40.25 | 40.25 | 40.25 | 40.25 | 40.25 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Analysis | | | | | |
| ME(Kcal/kg) | 2983.70 | 2958.58 | 2933.70 | 2908.83 | 2883.65 |
| Crude Protein (%) | 22.99 | 22.89 | 22.71 | 22.57 | 22.43 |
| Crude Fibre (%) | 3.72 | 3.72 | 4.06 | 4.22 | 4.39 |

? Fixed ingredients: Soybean meal 34.20, Palm kernel cake 2.00, Wheat offal 1.50, Bone meal 1.50, Limestone 0.25, Salt 0.25, Lysine 0.12, Methionine 0.18, Premix 0.25

CRESM = Cattle Rumen Epithelia Scraping

**Table 3: Gross composition of experimental diets (finisher)**

| Ingredients (%) | Replacement of fish meal with CRESM (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 25 | 50 | 75 | 100 |
| Maize | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 |
| Fish Meal (65%) | 2.50 | 1.88 | 1.25 | 0.62 | 0.00 |
| CRESM | 0.00 | 0.62 | 1.25 | 1.88 | 2.50 |
| ? Fixed ingredients | 54.25 | 54.25 | 54.25 | 54.25 | 54.25 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Analysis** | | | | | |
| ME (Kcal/kg) | 2831.00 | 2825.00 | 2816.00 | 2820.00 | 2818.00 |
| Crude Protein (%) | 20.46 | 20.38 | 20.30 | 20.22 | 20.14 |
| Crude Fibre (%) | 3.72 | 3.85 | 4.00 | 4.13 | 4.26 |

† Fixed ingredients: Soybean meal 26.50, Corn bran 15.00, Palm kernel meal 3.00, Wheat offal 5.00, Fish meal 2.50, Bone meal 1.50, Limestone 0.25, Salt 0.25, Premix 0.25
CRESM = Cattle Rumen Epithelia Scraping

The performance characteristics for starter chicken (Table 4) shows that there was no significant difference ($p<0.05$) in the final weight, daily weight gain and daily feed intake in all the diets that contained CRESM. The values obtained for those that received diet containing CRESM were however significantly higher ($p<0.05$) than the control diets which is in conformity with the report of Salami *et al.* (2013). Cost of feed reduced gradually with increased level of CRESM inclusion in both starter and finisher diets which was similar to those reported by Oladunjoye *et al.* (2013). Control diets had the highest feed to gain ratio compared to those that received CRESM in their diets which implied better feed utilization in the chickens fed diets that contained CRESM. AT finisher phase (Table 5), the final weight were similar in birds that were fed diets that contained CRESM but were significantly ($p<0.05$) higher than that of the birds on the control diet. Feed cost per kilogram as well as feed cost per kg weight gain reduced with increased level of CRESM in the diets which is a direct consequence of higher price of fish meal compared to CRESM as observed by Oladunjoye *et al.* (2013), the implication of this is that more profit can be made by replacing fish meal with CRESM at both finisher phases. The dietary treatment did not affect digestibility of nutrients (Table 6) except crude fibre and this could be due to the fact that the bulk of CRESM is made up of epithelial tissue.

**Table 4: Performance characteristics of broilers fed steam -treated CRESM in place of fishmeal at starter phase**

| | Replacement of fish meal with CRESM (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 0 | 25 | 50 | 75 | 100 | SEM | P-value |
| Initial weight(g) | 43.64 | 43.68 | 43.40 | 43.43 | 43.00 | 0.27 | 0.49 |
| Final weight (g) | $624.15^{b}$ | $706.81^{a}$ | $733.31^{a}$ | $706.94^{a}$ | $696.19^{a}$ | 6.95 | 0.01 |
| Daily weight gain (g) | $20.73^{b}$ | $24.13^{a}$ | $24.63^{a}$ | $23.69^{a}$ | $23.34^{a}$ | 3.58 | 0.01 |
| Daily feed intake (g) | $44.15^{b}$ | $48.20^{a}$ | $48.87^{a}$ | $47.18^{a}$ | $49.30^{a}$ | 0.15 | 0.05 |
| Feed cost/kg († ) | $123.60^{a}$ | $118.60^{b}$ | $113.60^{c}$ | $108.60^{d}$ | $103.60^{e}$ | 0.46 | 0.05 |
| Feed:gain ratio | $2.21^{a}$ | $2.03^{b}$ | $2.00^{b}$ | $2.03^{b}$ | $2.15^{ab}$ | 0.21 | 0.05 |
| Feed cost/kg weight gain († ) | $272.04^{a}$ | $240.98^{b}$ | $227.37^{bc}$ | $220.50^{c}$ | $221.90^{c}$ | 2.64 | 0.05 |

[abcde]Means within each row with different subscript are significant different ($p<0.05$)

**Table 5: Performance of broiler fed steam-treated CRESM in place of fish meal at finisher phase**

| | Replacement of fish meal with CRESM (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 0 | 25 | 50 | 75 | 100 | SEM | P-value |
| Initial weight(g) | 624.15[b] | 706.81[a] | 703.31[a] | 706.94[a] | 696.19[a] | 7.08 | 0.20 |
| Final weight (g) | 2172.09[b] | 2420.73[a] | 2512.43[a] | 2363.08[a] | 2398.75[a] | 20.63 | 0.01 |
| Daily weight gain (g) | 55.25[c] | 60.65[c] | 63.37[ab] | 59.10[bc] | 66.28[a] | 0.80 | 0.11 |
| Daily feed intake (g) | 170.05[b] | 179.70[a] | 171.87[b] | 172.18[b] | 169.62[b] | 1.30 | 0.05 |
| Feed cost/kg († ) | 111.23[a] | 106.23[b] | 101.23[c] | 96.23[d] | 91.23[e] | 0.51 | 0.05 |
| Feed:gain ratio | 3.14 | 3.03 | 3.07 | 2.99 | 2.85 | 0.04 | 1.00 |
| Feed cost/kg weight gain († ) | 349.26[a] | 321.88[b] | 310.78[c] | 287.73[bc] | 260.01[d] | 0.03 | 0.10 |

[abcde]Means within each row with different subscript are significant different ($p<0.05$)

**Table 6: Nutrient digestibility of broilers fed steam-treated CRESM in place of fish meal**

| | Replacement of fish meal with CRESM (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 0 | 25 | 50 | 75 | 100 | SEM | P-value |
| Dry matter (%) | 76.46 | 72.94 | 73.99 | 74.63 | 75.92 | 0.39 | 0.17 |
| Crude protein (%) | 86.02 | 87.32 | 87.52 | 87.13 | 88.01 | 0.62 | 0.28 |
| Crude fat (%) | 92.78 | 91.47 | 91.57 | 91.34 | 91.22 | 0.13 | 0.05 |
| Crude fibre (%) | 42.26[a] | 35.02[b] | 37.96[b] | 34.17[b] | 41.48[a] | 0.81 | 0.08 |
| Ash (%) | 75.67 | 72.94 | 72.50 | 72.48 | 72.74 | 0.35 | 0.26 |
| NFE (%) | 83.14 | 81.56 | 82.53 | 81.79 | 84.09 | 0.24 | 0.28 |

[ab]Means within each row with different subscript are significant different ($p<0.05$)

## Conclusion

It can be concluded that stream treated CRESM can replace 100% of fish meal in broiler chicken diets without adverse effect on performance. The ultimate aim of reduction in cost of production can thus be achieved with consequential improvement in the profit margin of the farmer.

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