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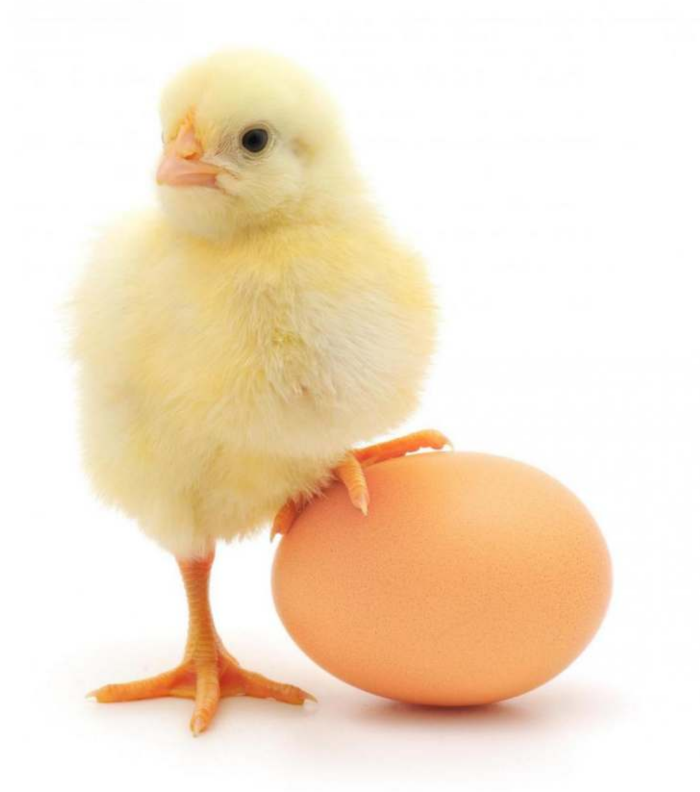

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# Performance and Carcass Characteristics of Broiler Chickens Fed Diets Supplemented with Graded Levels of Roxazyme G®

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**Abstract:** The use of exogenous enzymes as feed additives is still undergoing a lot of research. A total of three hundred and sixty unsexed three week-old Abor Acre plus strain broiler chicken were randomly allocated to four experimental dietary treatments in a completely randomized design to evaluate the effect of Roxazyme® on performance and carcass characteristics of broiler chickens. The diets 1, 2, 3, and 4 contained 0, 0.1, 0.2 and 0.3% enzyme supplementation respectively. The birds were fed the experimental diets for a 35-day period during which data were obtained on feed intake, weight gain, dry matter digestibility (DMD) and feed conversion ratio. At the end of the feeding trial, ten birds were sacrificed per replicate to evaluate carcass and meat characteristics. The inclusion of the exogenous enzyme did not significantly (P>0.05) improve the average weight gain, feed intake, feed conversion ratio and DMD. The dressing percentage of birds fed the enzyme-supplemented diets was significantly (P<0.05) superior compared to the control. There were no significant differences between all the primal cuts except the head and neck of the birds on the control diet that were significantly (P<0.05) lower in weight. The inclusion of the enzyme did not (P>0.05) affect the relative weights of the kidney, gizzard, heart and the liver of all experimental birds. The flavour, tenderness and juiciness scores of the meat of birds fed the enzyme supplemented diets were significantly (P<0.05) higher than the control while the colour, texture and the overall acceptability were not significantly affected by the inclusion of the enzyme in the diet. The Waner Braztler shear force result showed no significant increase (P>0.05) in toughness in agreement with the sensory panel result that adjudged the meat from birds fed enzyme supplemented diets as more tender (P<0.05) than that of the control. The breast muscle of the chickens had higher cooking loss than the thigh muscle while the highest (P<0.05) cooking loss was recorded for both muscle parts of birds reared on 0.2% enzyme supplementation.

**Key words:** Roxazyme®, broiler chickens, growth performance, carcass characteristics

## Introduction

Feed remains the most important cost of animal production. The need for feed ingredients, which will reduce the cost of production, is the basis for most new ingredients that are being brought into limelight in livestock feed and production research. This is because man and his livestock are in competition for basic ingredients and such ingredients are not usually produced in sufficient quantities locally (Oluyemi *et al.*, 1978). Therefore, availability of feed thus becomes the key factor limiting poultry production.

With the global increase in the demand for animal products as a result of improved living standards, many farmers tends to over stimulate their animals with various substances such as hormones and exogenous enzymes in order for such animals to reach market weight with minimum cost within the shortest possible time.

Improved efficiency of feedstuff utilization and the use of a wide range of feed ingredient currently considered inferior are likely to produce the largest advances in animal feeding. Most work with exogenous enzymes were done to evaluate its effect on feed intake and growth characteristics of broilers (Brener *et al.*, 1993)

Supplementation of diets of monogastric animals (pig and poultry) with exogenous enzymes has been increasingly investigated and applied during the past decade as a means of enhancing and increasing the effectiveness of nutrient utilization (Acamovic, 2001). With the wide use of enzymes it became imperative to evaluate the effect of such additive on the final product, as this is relevant to the health and well being of the consumer. Addition of enzymes has been shown to improve weight gain and feed conversion efficiency in broiler chicks but its effect on meat quality attributes has to be evaluate hence the purpose of this research work.

## Materials and Methods

A total of three hundred and sixty (360) unsexed three week-old Abor Acre plus strain of broiler chicken were randomly allotted to four dietary treatments in a completely randomized design. The four dietary treatments were 0, 0.1, 0.2 and 0.3% enzyme supplementation respectively. Each dietary treatment

Table 1: Gross composition of experimental diets

| | Dietary level of Rozaxyme G® | | | |
|---|---|---|---|---|
| Ingredients (Kg) | 0.00 | 0.10 | 0.20 | 0.30 |
| Maize | 52.00 | 52.00 | 52.00 | 52.00 |
| Groundnut cake | 16.00 | 16.00 | 16.00 | 16.00 |
| Fish meal | 8.00 | 8.00 | 8.00 | 8.00 |
| Wheat offals | 5.50 | 5.40 | 5.30 | 5.20 |
| Palm kernel cake | 11.25 | 11.25 | 11.25 | 11.25 |
| Di-Calcium phosphate | 3.00 | 3.00 | 3.00 | 3.00 |
| Mineral Vitamin premix | 0.50 | 0.50 | 0.50 | 0.50 |
| Roxazyme G? | 0.00 | 0.10 | 0.20 | 0.30 |
| Methionine | 0.15 | 0.15 | 0.15 | 0.15 |
| Lysine | 0.10 | 0.10 | 0.10 | 0.10 |
| Common salt (NaCl) | 0.25 | 0.25 | 0.25 | 0.25 |
| Palm oil | 3.00 | 3.00 | 3.00 | 3.00 |

was replicated thrice. The growth and performance study lasted 35 days. At the end of the growth and performance study, dry matter digestibility was determined in a 7-day trial using eighteen birds of similar weight per treatment (six per replicate).

Tens birds were randomly selected from each replicate at the end of the feeding trial and were sacrificed to evaluate the carcass and meat characteristics. The birds were starved of feed for 16 hours weighed and slaughtered. The slaughtered birds were properly bled, defeathered and eviscerated. The eviscerated birds were dissected and all internal organs and external offals (head, shank and neck) were carefully removed. The hot carcasses were weighed to obtain the dressed weight and later chilled before primal cuts were made and the weight taken (Omojola *et al*., 2004)

**Percentage cooking loss:** Samples of known weight were taken from the breast and thigh muscles of each carcass and cooked in a moist-heat to an internal temperature of 72°C. The water released after cooking and cooling was manually separated and the weight of the cooked meat taken to obtain the cooking loss.

Cooking loss = [weight of sample before cooking – weight after cooking] / [Weight before cooking] x 100

**Shear force determination:** The objective evaluation of tenderness was performed using the modified Warner Braztler shear force procedure (Bouton and Harris, 1978). Meat samples from the breast and thigh muscles were cooked to an internal temperature of 72°C. The cooked samples were allowed to cool to room temperature. Three cores of 0.5cm diameter were removed from each cooked meat sample. Each core was sheared at three locations parallel to the orientation of the muscle fibre.

**Water holding capacity:** This was determined in triplicate by the press method (Tsai and Ockerman 1981). Approximately 5.0g of sample was weighed into a 9cm whatman No 1 filter paper and pressed between two 10.2 x 10.2 cm plexi glasses at approximately 35.2kg/cm$^3$ for 1 minute,. The area of free water was measured using a compensatory planimeter (Planix 5000, Tamaya Technics, Inc., Tokyo, Japan) and percentage free water was calculated based on sample weight and moisture content (Tsai and Ockerman, 1981) while percentage bound water or water holding capacity (WHC) was calculated as 100% minus free water %.

**Taste panel evaluations:** A total of twenty trained individuals were used. The panelists were male (n=9) and female (n=11) and ranged in age from 27 to 35 years. The panelists were randomly allocated to the four treatments. The panelists were made to rate each of the three replicate of meat samples. Equal bite size from each treatment were coded and served in an odourless plastic plate. Each sample was evaluated independent of the other. The panelists rated the samples on a nine-point hedonic scale for colour, flavour, tenderness, texture, juiciness and overall acceptability.

**Statistical analysis:** All data obtained were subjected to analysis of variance procedures (SAS, 1999) and where statistical significance was observed, the means were compared using the Duncan's Multiple Range (DMR) test. The SAS computer software package was used for all statistical analysis (SAS, 1999)

## Results and Discussion

The result of the performance study is shown in Table 2. The inclusion of RoxazymeG® did not significantly (P>0.05) improve the average weight gain, feed intake, feed conversion ratio and dry matter digestibility (DMD). The highest feed intake was recorded in the treatment with 0.2% RoxazymeG® inclusion. Beyond the 0.2% enzyme level there was a slight depression in feed intake. A similar trend was observed in the average weight gain (g/day) and DMD although, in this instance the plateau was reached in the 0.1% enzyme supplemented diet. The result obtained in this study contradicted that of Iyayi and Yahaya (1999) where they used a polysaccharidase enzyme. The lack of significant improvement in performance obtained in this study might be due to the fact that the feed used was rich in nutrient composition and will therefore support maximum performance without supplementation with exogenous enzyme. In most cases, the exogenous enzymes are known to improve feed intake and utilization of high fibre diets and diets rich in non-starch polysaccharide (Fakorede, 1997) which, apart from being resistant to the digestive enzymes, also reduce the digestibility of other dietary components like proteins and hence reduce the performance of the animal.

The dressing percentages obtained in this present study were 72.83, 75.70, 77.82 and 75.97 for 0, 0.1, 0.2 and

Table 2: Performance of broiler finisher fed graded levels of Roxazyme G®

| | Dietary level of Rozaxyme G® | | | |
|---|---|---|---|---|
| Parameters | 0.00 | 0.10 | 0.20 | 0.30 |
| Average feed intake (g/day) | 101.13±7.28 | 102.15±7.04 | 103.39±6.31 | 101.38±7.33 |
| Average weight gain (g/day) | 18.79± 2.22 | 20.97± 2.34 | 20.77±2.41 | 19.04±2.15 |
| Dry matter digestibility (%) | 67.61± 3.14 | 71.03±4.01 | 69.20±1.89 | 67.55±4.11 |
| Feed Conversion ratio | 2.67± 0.81 | 2.57±0.09 | 2.65±0.11 | 2.77±0.14 |
| Dressing (%) | 72.83±1.76[b] | 75.70±0.96[a] | 77.82±0.98[a] | 75.97±4.54[a] |

a,b=Means along the same row with similar superscripts are not significantly (P>0.05) different from each other.

Table 3: Relative weight of carcass part and organs of birds fed graded levels of Rozaxyme G®

| | Dietary level of Rozaxyme G® | | | |
|---|---|---|---|---|
| Parameters | 0.00 | 0.10 | 0.20 | 0.30 |
| Dressing percentage | 72.83±1.76[b] | 75.70±0.96[a] | 77.82±0.98[a] | 75.97±4.54[a] |
| Cut up parts (%) | | | | |
| Head | 2.41±0.03[b] | 2.74±0.08[a] | 2.87±0.05[a] | 2.64±0.10[ab] |
| Neck | 4.65±0.12[b] | 5.84±0.08[a] | 5.55±0.15[a] | 5.10±0.11[ab] |
| Breast | 19.26±1.12 | 18.87±2.10 | 20.39±2.21 | 22.04±1.65 |
| Back | 13.52±0.75 | 14.63±3.61 | 14.64±2.18 | 15.26±3.12 |
| Wing | 8.02±1.10 | 8.77±0.92 | 8.43±2.41 | 8.89±2.17 |
| Thigh | 11.01±1.85 | 11.00±1.25 | 12.03±2.10 | 11.55±1.86 |
| Drum stick | 10.23±2.71 | 10.70±1.12 | 10.50±1.52 | 10.61±1.80 |
| Internal organs % | | | | |
| Kidney | 0.17±0.02 | 0.18±0.01 | 0.15±0.01 | 0.20±0.15 |
| Gizzard | 2.56±0.06 | 2.44±0.12 | 2.39±0.15 | 2.31±0.10 |
| Hear | 0.47±0.01 | 0.47±0.01 | 0.45±0.03 | 0.46±0.02 |
| Liver | 2.54±0.01 | 2.41±0.11 | 2.25±0.09 | 2.56±0.07 |

a,b=Means in the same row with similar superscript are not significantly (P>0.05) different from each other.

0.3 percent enzyme supplemented rations respectively. The dressing percentages were higher than the range of 66.56-68.40 obtained by Omojola *et al.* (2004). The high dressing percentage apart from the effect of enzyme supplementation might be due to the high nutritive profile of the experimental diet. The dressing percentage of the birds fed the enzyme-supplemented diets was significantly superior (P<0.05) compared to the control. It was noticed that as the enzyme level increased beyond the 0.2% inclusion there was a slight drop in the dressing percentage.

The result of the relative weight of carcass part and organs of the birds are shown in Table 3. The weight of the breast, back, wing, thigh and the drumstick were not affected significantly (P>0.05) by the exogenous enzyme inclusion in the diet. Apart from the head and the neck that were significantly affected (P<0.05) by enzyme inclusion, the weight of the other organs were not affected by the treatment. The result obtained in this study followed a similar trend that was reported by Iyayi and Yahaya (1999).

**Taste panel evaluation:** The result of taste panel evaluation is shown in Table 4.

**Colour:** Colour is an important indicator of quality of fresh or cooked meat, as such the appearance of meat influences the consumer acceptance of the meat (Van Oeckel *et al.,* 1999). The taste panel scores for colour ranged from 5.71 to 6.75 as assessed on a nine-point hedonic scale. Although, the colour rating improved as the level of enzyme inclusion increased, however, this was not significant (P>0.05).

**Flavour:** Raw meat has little odour and only a blood like taste. Cooking is necessary to develop the flavour. Mastication breaks down the fibre matrix and release flavour-juices and the volatile aroma components into the mouth. The result of this work showed that the meat harvested from diets with exogenous enzyme gave better flavour index (P<0.05) and as the level of the exogenous enzyme increased, the flavour perception increased. There was no significant difference (P>0.05) between the means of all treatments with the exogenous enzyme while the control diet gave the least (P<0.05) value. The flavour perception is a function of the cooking loss and the water holding capacity (Table 5). The lower the cooking loss the more juicy the meat tends to be. As shown in table 5, the cooking loss in both the breast and thigh meat reduced as the enzyme level increased and this bears an inverse relationship with the water holding capacity, this might probably be the reason for the trend observed in the flavour ratings.

Juiciness of meat is directly related to the intramuscular lipids and moisture content of the meat (Cross *et al.*, 1986). In combination with water, the melted lipids constitute a “brooth” which when retained in the meat is released upon chewing. Table 4 showed the mean

Table 4: Sensory evaluation of broiler meat fed graded levels of Rozaxyme G®

| | Dietary level of Rozaxyme G® | | | |
|---|---|---|---|---|
| Parameters | 0.00 | 0.10 | 0.20 | 0.30 |
| Colour | 5.67±0.04 | 6.17± 0.30 | 6.13± 0.26 | 6.38± 0.32 |
| Flavour | 5.71±0.39$^{b}$ | 5.92± 0.42$^{ab}$ | 6.71± 0.19$^{a}$ | 6.75± 0.20$^{a}$ |
| Tenderness | 5.75± 0.36$^{b}$ | 6.25± 0.25$^{a}$ | 6.42± 0.29$^{a}$ | 7.21± 0.20$^{a}$ |
| Texture | 6.00± 0.40 | 6.63± 0.25 | 6.50± 0.23 | 6.79± 0.39 |
| Juiciness | 5.21± 0.42$^{b}$ | 6.42± 0.22$^{a}$ | 6.04± 0.25$^{a}$ | 6.29± 0.39$^{a}$ |
| Overall acceptability | 6.33± 0.35 | 6.71± 0.16 | 6.67± 0.19 | 6.92± 0.22 |

a,b= Means in the same row with similar superscripts are not significantly (P>0.05) different from each other.

Table 5: Physical properties of breast and thigh muscles of broiler chicken fed rations supplemented with Rozaxyme G®

| | Dietary level of Rozaxyme G® | | | |
|---|---|---|---|---|
| Parameters | 0.00 | 0.10 | 0.20 | 0.30 |
| Cooking loss % | | | | |
| Breast | 36.40±0.79$^{a}$ | 34.12± 0.70$^{a}$ | 27.89± 5.14$^{b}$ | 31.45± 2.99$^{b}$ |
| Thigh | 34.93± 5.55$^{a}$ | 32.30± 1.77$^{a}$ | 24.83± 8.36$^{b}$ | 27.03± 2.80b |
| Shear force (Kg/cm$^{3}$) | | | | |
| Breast | 1.32± 0.03 | 1.22± 0.05 | 1.14± 0.11 | 1.12± 0.03 |
| Thigh | 1.27± 0.08 | 1.16± 0.03 | 1.10± 0.05 | 0.99± 0.09 |
| Water holding capacity % | | | | |
| Breast | 63.64± 3.35$^{b}$ | 76.71± 1.15$^{a}$ | 75.24± 2.80$^{a}$ | 74.88± 3.11$^{a}$ |
| Thigh | 62.71± 2.89$^{b}$ | 74.82± 2.80$^{b}$ | 77.85± 3.01$^{a}$ | 76.71± 2.25$^{a}$ |

a,b= Means in the same row with similar superscripts are not significantly (P<0.05)different.

rating for juiciness. The least score of 5.21 was obtained in the treatment with no enzyme supplementation while values of 6.42, 6.04 and 6.29 were obtained for the 0.1, 0.2, and 0.3% enzyme supplementation respectively. Similar reasons adduced for the result obtained for flavour might be also responsible for the juiciness score obtained.

Tenderness score followed a similar trend as obtained for juiciness and flavour. The least score for tenderness was obtained from the birds on the control diet. Tenderness is regarded as the most important sensory attribute affecting meat acceptability (Cross *et al.*, 1986; Quali, 1990; Warkup *et al.*, 1995). As stated by Quali (1990) and Smulders *et al.* (1991), meat tenderization is a multifactorial process dependent on a number of biological and environmental factors. The utilization of the exogenous enzyme increased the degree of tenderness (P<0.05) as assessed by the taste panelists. The result obtained under the sensory evaluation bears a resemblance with the objective result obtained through Warner Bratzler shear force (WBSF) except that the result of the WBSF was not significantly different (P>0.05) from each other. Despite the non-significance, the values decreased as the enzyme level increased, indicating that less force was required to shear through the meat as the enzyme level increased. Texture and the overall acceptability were not affected by the exogenous enzyme supplementation. The texture rating however improved with an additional 0.1 percent enzyme inclusion in the ration while the values obtained for the control in the overall acceptability rating was the least

The result of the cooking loss, shear force, water holding capacity and the thermal shortening are reported in Table 5. The cooking loss from the thigh muscle were slightly lower than the values obtained for the breast muscle in all the dietary treatments. There was however, no statistical difference between values obtained for the breast and thigh muscle from birds on the control treatment and treatment with 0.1% enzyme supplementation. Values of 36.40,34.12, 27.89 and 31.45% were obtained for the breast muscle in treatments with 0, 0.1, 0.2 and 0.3% enzyme supplementation respectively while the values of 34.93, 32.30, 24.83 and 27.03% were obtained from the thigh muscle of similar treatments.

The shear force value is an indication of the degree of toughness or tenderness. The higher the value obtained the tougher the meat. Values of 1.32, 1.22, 1.14 and 1.12 kg/cm$^{3}$ were obtained for the breast muscles of birds from the control, 0.1, 0.2 and 0.3% enzyme supplemented rations respectively. Like in the case of cooking loss a slightly lower values were obtained for the thigh muscles from similar dietary treatments.

The WHC increased in both muscles with dietary enzyme supplementation. In the breast muscle the WHC decreased slightly as the level of enzyme in the diet increased but in the thigh muscle, a peak was reached at the level of 0.2% enzyme inclusion.

**Conclusion:** The effect of the enzyme Roxazyme G used in this study was not pronounced on the performance characteristics since the ration formulated was adequate to support the performance of the birds without the addition of such enzyme. However, traits of economic importance as the dressing percentage increased with enzyme supplementation. The carcass cuts up were not significantly affected by supplementation of the ration with exogenous enzyme. The physical properties such as the cooking loss, shear force value and WHC were affected by the dietary treatment. It was also observed that the flavour, juiciness and tenderness were among the eating qualities that were significantly improved by the exogenous enzyme inclusion in the diet. The texture, colour and overall acceptability were however not significantly ($P>0.05$) affected by the inclusion of the enzyme in the diet.

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