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Effect of Multi-Enzyme Supplementation on Growth Performance of Rabbits

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Abstract— The aim of this study is to determine the effect of enzyme supplementation in diets of rabbits on their growth performance, carcass, and organ characteristics as well as hematological profile of rabbits. The rabbits were fed commercial diets containing 15% crude protein and metabolizable energy of 2650 kcal. The treatment diets were formulated by adding the enzyme (Kemzyme Plus) to the diets at 0mg/kg, 250mg/kg, 500mg/kg and 1000mg/kg respectively. Twenty (20) weaner rabbits were divided into four groups of five rabbit per group. Each group represent a treatment with 5 replications in a Complete Randomized Design (CRD). The results of growth performance indicated that rabbits fed diets containing 1000mg/kg of Kemzyme had a significant higher ($P<0.05$) feed intake than those rabbits fed 250 and 500mg/kg of the Kemzyme, which had a comparable feed intake but higher ($P<0.05$) than those rabbits fed the control diet. The control group had the lowest ($P<0.05$) weight gain and those rabbits fed the diet containing 1000mg/kg of Kemzyme had the highest ($P<0.05$) weight gain. Rabbits fed diets containing 250 and 500mg/kg of Kemzyme had the highest ($P<0.05$) feed conversion efficiency than those rabbits fed diets containing 1000mg/kg of Kemzyme. The control group had the lowest ($P<0.05$) feed conversion efficiency. Rabbits fed diets containing 1000mg/kg of Kemzyme had a significantly higher dress weight than those rabbits fed diets containing 250 and 500mg/kg of Kemzyme which were comparable but higher ($P<0.05$) than those of the control group. All those rabbits fed diets containing the Kemzyme had significantly higher carcass dressing than those of the control group, but those rabbits fed diets containing 250mg/kg of Kemzyme had similar ($P>0.05$) carcass dressing with the control. There was significant difference ($P<0.05$) among the treatment groups in terms of lung weight. In both the kidney and the liver, those rabbits fed the control diet had the highest kidney and liver weights and those rabbits fed diets containing 250mg/kg of Kemzyme had the lowest ($P<0.05$) weights. All those rabbits fed diets containing Kemzyme had superior ($P<0.05$) quality of blood in terms red blood cells, packed cell volume and haemoglobin than those rabbits fed the control diet. However, mean corpuscular volume was high ($P<0.05$) in the control group than those fed diets containing Kemzyme. Mean corpuscular haemoglobin concentration and white blood cells were not affected ($P>0.05$) by the inclusion of Kemzyme in the diets of the rabbits. In conclusion, supplementing diets with multi-enzyme (Kemzyme Dry-Plus) in increasing levels of 250mg/kg, 500mg/kg, and 1000mg/kg improved the growth performance of the weaner rabbits.

Keywords— **Enzyme, Rabbit, Growth, Blood.**

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INTRODUCTION

Rabbit production has been identified as one of the ways of solving the ever-increasing problem of animal protein shortage in developing countries (David, 2018) including Ghana. This is because rabbits possess numerous good potentials and attributes such as high growth rate, high prolificacy, and high protein forage conversion to meat efficiency and relatively low production cost.

Dietary enzyme supplementation is used widely in mono-gastric diets in attempts to improve nutrient utilization and health. It is used also to improve product quality and to reduce pollution as well as to increase the choice and content of ingredients which are acceptable for inclusion in diets (Acamovic, 2001). Enzymes could be used to maximize the efficiency of feed utilization by reducing the effects of anti-nutritional factors. Enzyme cocktails (e.g., Kemzyme Dry Plus) containing more than one enzyme will often improve the response.

There is little information on how the supplementation of kemzyme Dry Plus in diets of rabbits will influence their growth performance.

MATERIALS AND METHODS

Experimental Location

The study was conducted at the Rabbit Unit of the Department of the Animal Science of the University for Development Studies, Nyankpala, located in the Guinea Savanna Zone. The Zone is characterized by a wide diurnal temperature variation (28-45°C) with low day-time humidity (17-42%) during the dry season from November to April. Nyankpala has a tropical climate with an average annual temperature of 28.2°C and about 1091mm of rainfall annually (Kasei, WWW).

Composition of the enzyme preparation (Kemzyme Dry Plus)

Kemzyme Dry Plus is a preparation of five (5) enzymes (4 hydrolases and 1 protease). The composition and proportions include

1. Endo-1, 3(4)-beta-glucanase (1.5%)
2. Endo-1, 4-beta-glucanase (0.5%)
3. Alpha-amylase (1%)
4. Bacillolysin (0.5%)
5. Endo-1, 4-beta-xylanase (1%)

Experimental animals and design

Table 1. Composition of Experimental Diet

NUTRIENTS	AMOUNT
Protein	15%
Fat	4%
Fibre	6%
Calcium	1.2%
Available phosphorus	0.38%
Sodium	0.15%
Lysine	1.8%
Methionine	0.4%
Vitamin A	2000mg
Vitamin D	20mg
Vitamin E	100mg
Vitamin K	3mg
Vitamin B1	1mg
Vitamin B2	4mg
Vitamin B6	3mcg
Vitamin B12	15mg
Choline chloride	220mg
Manganese	30mg
Zinc	25mg
Energy (ME)	2650 Kcal

Data collection

Feed intake was measured with the use of electronic scale (Jadever JPS-1050). Feed intake was calculated by subtracting the remaining feed after a week from the quantity of feed supplied for the previous week per each rabbit. Daily mean feed intake was calculated by dividing the quantity of feed consumed per rabbit per week by seven, to get feed intake per rabbit per day.

Live-weight of rabbits in each replicate was measured weekly by weighing them in using a digital electronic scale (JADEVER JPS-1050), and daily live weight gain calculated by dividing total weekly live-weight gain by the number of days in a week. The answer was then multiplied by 1000 to get live-weight gain per rabbit per day in grams.

Feed conversion efficiency was computed as weight gained per unit feed intake. At the end of the experiment, two rabbits from each treatment unit were randomly selected and slaughtered by severing the carotid arteries and the jugular veins with a sharp knife and then singed to remove the fur. Afterward the carcasses were washed and eviscerated for carcass evaluation. The heart, kidney, liver and lungs were weighed individually. Carcass dressing percentage (CDP) was determined by CDP= CW/LW×100% where LW=live weight, CW=carcass weight. At the end of the eight weeks of feeding trials, two rabbits from each treatment were selected for blood sample collection. About 5mls of blood from selected rabbits was emptied into vacutainer tubes that contained ethylenediaminetetra acetic acid (EDTA), the parameters evaluated include; Packed cell volume, Haemoglobin, Red Blood Cells, White Blood Cells, Mean Corpuscular Volume, Mean Corpuscular Haemoglobin, Mean Corpuscular Haemoglobin Concentration, Lymphocytes, Monocytes, Neutrophils, Eosinophils and Basophils. The blood was analysed using Haemo- analyser (Sysmex Hematology Analyser, XS-500i, Sysmex Europe GmbH, Norderstedt, Germany).

Data Analysis

All variables measured are subjected to one-way Analysis of Variance (ANOVA) in GENSTAT (Version3, edition 8). Means with significant difference were separated using Least Significant Difference.

RESULTS

Growth performance

There was significant ($P<0.05$) variation among the treatment groups in terms of feed intake. Rabbits fed diets containing 1000mg/kg of Kemzyme had a higher ($P<0.05$) feed intake than those rabbits fed 250 and 500mg/kg of the Kemzyme, which had a comparable feed intake but higher ($P<0.05$) than those rabbits fed the control diet (Table 2).

The weight gain of the experimental rabbits followed similar pattern as in the feed intake results. The control group had the lowest ($P<0.05$) weight gain and those rabbits fed the diet containing 1000mg/kg of Kemzyme had the highest ($P<0.05$) weight gain (Table 2).

Rabbits fed diets containing 250 and 500mg/kg of Kemzyme had the highest (P<0.05) feed conversion efficiency than those rabbits fed diets containing 1000mg/kg of Kemzyme. The control group had the lowest (P<0.05) feed conversion efficiency (Table 2).

Table 2. Effect of multi-enzyme (Kemzyme Dry-Plus) supplementation on growth performance of weaner rabbits

Variables	Control	250mg/Kg	500mg/Kg	1000mg/Kg	L.S.D.	P. value
Daily feed intake (g/rabbit/d)	50.16^{c}	53.14^{b}	53.18^{b}	60.27^{a}	0.499	<0.001
Daily weight gain (g/rabbit/d)	13.61^{c}	18.04^{b}	18.10^{b}	18.31^{a}	0.073	<0.001
Feed conversion efficiency	0.27^{c}	0.34^{a}	0.34^{a}	0.30^{b}	0.004	<0.001
Mortality	0.00	0.00	0.00	0.400	0.412	0.083

L.S.D. =least significant difference, P= probability, means in a row with similar superscripts are not significantly different.

Carcass characteristics

Rabbits fed diets containing 1000mg/kg of Kemzyme had a significantly higher dress weight than those rabbits fed diets containing 250 and 500mg/kg of Kemzyme which were comparable but higher (P<0.05) than those of the control group (Table 3). All those rabbits fed diets containing the Kemzyme had significantly higher carcass dressing than those of the control group, but those rabbits fed diets containing 250mg/kg of Kemzyme had similar (P>0.05) carcass dressing as compared to the control group (table 3). There was significant (P<0.05) difference among the treatment groups in terms of lung weight. The control group had the highest lung weight, followed by those rabbits fed diets containing 500 and 1000mg/kg of Kemzyme. Those fed diets containing 250mg/kg of Kemzyme had the lowest (P<0.05) lung weight (Table 3). In both the kidney and the liver, those rabbits fed the control diet had the highest kidney and liver weights and those rabbits fed diets containing 250mg/kg of Kemzyme had the lowest (P<0.05) weights.

Table 3. Effect of multi-enzyme (Kemzyme Dry-Plus) supplementation on carcass and relative organ weight of weaner rabbits

Variables	Control	250mg/Kg	500mg/Kg	1000mg/Kg	L.S.D.	P. value
Dress weight (Kg)	0.96^{c}	1.03^{bc}	1.14^{b}	1.31^{a}	0.104	<0.001
Carcass dressing (%)	64.43^{b}	68.02^{ab}	70.65^{a}	70.87^{a}	3.633	0.011
Relative organ weights						
Heart	0.26	0.24	0.31	0.27	0.069	0.273
Lungs	1.00^{a}	0.68^{c}	0.70^{bc}	0.76^{b}	0.057	<0.001
Kidney	0.36^{a}	0.29^{b}	0.31^{ab}	0.31^{ab}	0.044	0.025
Liver	5.28^{a}	2.93^{b}	3.46^{b}	3.56^{b}	0.556	<0.001

L.S.D. =least significant difference, P= probability, means in a row with similar superscripts are not significantly different.

Haematological profile

All those rabbits fed diets containing Kemzyme had superior (P<0.05) quality of blood in terms red blood cells, packed cell volume and haemoglobin than those rabbits fed the control diet. However, mean corpuscular volume was high (P<0.05) in the control group than those fed diets containing Kemzyme. Mean corpuscular haemoglobin concentration and white blood cells were not affected (P>0.05) by the inclusion of Kemzyme in the diets of the rabbits (Table 4).

Table 4. Effect of multi-enzyme (Kemzyme Dry-Plus) supplementation on haematology of weaner rabbits

Variables	Control	250mg/Kg	500mg/Kg	1000mg/Kg	L.S.D.	P. value
RBC	4.34^{b}	5.47^{a}	4.59^{ab}	5.27^{ab}	0.812	0.036
PCV	30.35^{b}	37.65^{a}	31.75^{ab}	34.70^{ab}	4.463	0.023
Hb	8.60^{b}	11.35^{a}	9.25^{b}	10.25^{ab}	1.219	0.004
MCV	70.20^{a}	68.35^{ab}	69.35^{ab}	66.05^{b}	2.538	0.026
MCH	19.80	20.60	20.15	19.40	1.637	0.428
MCHC	28.30	30.15	29.15	29.45	1.396	0.083
WBC	9.61	10.24	6.69	9.68	5.802	0.523

L.S.D. =least significant difference, P= probability, means in a row with similar superscripts are not significantly different.

DISCUSSIONS

Growth Performance

Naturally, the gastrointestinal tract of monogastrics produces enzymes to aid the digestion of nutrients. The rabbits fed diets containing 1000mg/kg of Kemzyme had high feed intake due to the high number of enzymes in their diet, because the enzymes help to breakdown food faster so that may be the reason rabbits fed diet with 1000mg/kg had high feed intake. Dietary enzymes supplementation in monogastric enhances the breaking down of compounds in animal feeds which may not be effectively broken down by the animals' own digestive enzyme and thereby improve the productivity of animals (Olugbenga David Oloruntola et al., 2018). Also, those rabbits fed 250 and 500mg/kg of the Kemzyme, which had a comparable feed intake but higher than those rabbits fed the control diet may be due to the presence of the enzyme in the diets. Rabbits on the control diet had the lowest weight gain because they could not feed more to gain more weight whiles those fed with diets containing the enzyme increased with the increasing levels of the enzyme in the diet.

Carcass Characteristics

Enzyme supplementation increased carcass percentage. Hajati (2019), stated that enzyme supplementation decreased the relative size of the digestive organs and increased carcass yield. The comparable effect of multi-enzyme (Kemzyme Dry-Plus) supplementation on carcass and relative organ weight of weaner rabbits suggest that the levels of inclusion of the enzyme in the diets of weaner rabbits had positive effects on dress weight and carcass dressing. The inclusion of enzymes in the diets of the rabbit did not have any effect on the heart. There was no significant effect among the treatment groups in terms of heart weight. There was significant effect among the treatment groups in terms of lung weight. The control group had the highest lung weight, followed by those rabbits fed diets containing 500 and 1000mg/kg of Kemzyme. Those fed diets containing 250mg/kg of Kemzyme had the lowest lung weight. In both the kidney and the liver, those rabbits fed the control diet had the highest kidney and liver weights and those rabbits fed diets containing 250mg/kg of Kemzyme had the lowest weights.

Haematology

Haematological indices are an index and a reflection of the effects of dietary treatments on animals in terms of the quality of feed ingested and the nutrients available to the animal to meet its physiological requirements. Aletor (1989) and Egberonbge (1992) indicates that blood variables most affected by dietary influence include red blood cell (RBC), pack cell volume (PCV), plasma protein and glucose. Looking at the values for the red blood cell it was significantly increasing as the enzyme's inclusion in diet of the rabbits increased. The PCV was significantly higher than those on those on the control diets. The MCH showed differences in the values due the physiological and nutritional status of the animal (Esonu *et al.*, 2001). MCHC was significantly affected by the diet. Higher WBC count explains the reason for the disease resistance of the animal and lower WBC suggest a greater challenge to the immune system of the rabbits. Eheba et al., (2008) reported that a decrease in WBC count, however, reflected a fall in the production of the defensive mechanism to combat infection.

CONCLUSIONS

In conclusion, supplementing diets with multi-enzyme (Kemzyme Dry-Plus) in increasing levels of 250mg/kg, 500mg/kg, and 1000mg/kg improved the growth performance of the weaner rabbits. Supplementing diets with multi-enzymes (Kemzyme Dry-Plus) also improved the dress weight and the carcass dressing of the rabbits

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