MULTISUBSTRATE & MULTIENZYME COMPLEX IMPROVE APPARENT METABOLIZABLE ENERGY (AME) AND GROWTH PERFORMANCE OF BROILERS

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ABSTRACT

Following the increase in maize and soya prices, great potential is seen for the use of alternate feed ingredients in poultry diets. The effect of a multisubstrate & multienzyme complex containing NSPases, multiproteases and multiamylases in improving AME and growth performance of broilers was evaluated in separate experiments. Treatments used for the metabolic trial were (1) Positive control diet (corn-soybean), (2) Negative control diet (100 kcal/kg reduced by replacing corn and soybean using DDGS, canola meal, and wheat middlings) and (3) Negative control diet + multisubstrate & multienzyme complex (0.5 kg/t). Mash diets were fed to six replicates per cage (28-day-old birds) for 7 days and feed intake and excreta output were measured per cage during the last 4 days. Results showed significant AME improvement of enzyme supplemented low energy diets (55 kcal/kg, $P<0.01$). Diets used for the growth trial were (1) Positive control diet (corn-soybean), (2) Negative control diet (100 kcal/kg reduced by replacing corn and soybean using DDGS, canola meal, cassava, and rice bran) and (3) Negative control diet + multisubstrate & multienzyme complex (0.5 kg/t). Mash diets were fed to day-old chicks with 8 replicates and 10 chicks per replicate. Results showed a significant effect of enzyme supplementation on feed conversion ratio (3.7 points, $P<0.05$). These results demonstrated the potential of the multisubstrate & multienzyme product in improving the nutrient quality of low cost diets containing alternate feed ingredients.
KEYWORDS: multisubstrate, multienzyme, alternative raw materials, poultry

INTRODUCTION

Energy and protein sources are the major contributors to the total cost of animal feed. The most common ingredients for energy in commercial broiler diets are cereal grains such as corn, wheat and barley. Soybean meal is the most widely used source of protein. With the rise in maize and soya prices worldwide, great potential is being seen for using more alternative feed ingredients in broiler diets. However, most of these non-conventional feed ingredients contain non-starch polysaccharides (NSPs) which possess anti-nutritional properties resulting in a decrease in the metabolizable energy of diets with a concurrent increase of the feed conversion ratio. Also, a fraction of the proteins in these broiler diets cannot be fully digested and absorbed by the animal.

Enzyme supplementation helps to upgrade the nutritive value of alternative feed ingredients, thereby providing economic benefits as well as increased flexibility in the choice of feed raw materials. NSP enzymes facilitate the digestion of non-starch polysaccharides (NSP). Research has shown that the starch digestibility is incomplete even in fully grown broilers (Noy and Sklan, 1994). Starch digestibility could be maximized using a combination of exogenous amylases which could synergistically act on different types of glycosidic bonds (Wankhede and Ramteke,

1982). Protease has a vital role in animal performance and the use of a multi-protease system designed to maintain the protein digestibility at different pH conditions inside the GI tract will further increase the digestibility of protein sources and provide economic benefits. A combination of amylases, NSP enzymes and proteases working together to attack different poorly digestible segments of feed ingredients could increase the energy available for growth.
This paper summarizes the effect of a multisubstrate & multienzyme formulation (KEMZYME® MAP Dry) containing NSPases such as xylanase, cellulase, β-glucanase and pectinase, multiamylases and multiproteases in improving apparent metabolizable energy (AME) and growth performance of broilers.

MATERIALS AND METHODS

Metabolic Trial

The metabolic trial was carried out at Massey University (New Zealand). Treatments used for the metabolic trial were (1) Positive control diet (corn-soybean), (2) Negative control diet (100 kcal/kg reduced by replacing corn and soybean using DDGS, canola meal, and wheat middlings) and (3) Negative control diet + KEMZYME® MAP Dry (0.5 kg/t). The AME values were determined using the classical total collection method. Starting from day 28 post hatch, the birds were fed the assay diets for 7 days with the first 3 days serving as an adaptation period. Each diet in mash form was fed to six replicates (five 28-day old birds per cage) for 7 days. During the last 4 days, feed intake and excreta output were measured quantitatively per cage for the determination of AME.

The AME contents of the diets were calculated using the following formula:

$$AME, MJ / kg = \frac{Feed\ \ int ake \times GE_{Diet} - Excreta\ \ output \times GE_{Excreta}}{Feed\ \ int ake}$$

Growth Trial

The growth trial was conducted at Bangkok Animal Research Center (Thailand). Treatments used for the growth trial were (1) Positive control diet (corn-soybean), (2) Negative control diet (100 kcal/kg reduced by replacing corn and soybean using DDGS, canola meal, cassava, and rice bran) and (3) Negative control diet + KEMZYME® MAP Dry (0.5 kg/t). Newly hatched male broiler chicks (Arbor Acres Plus) were randomly allocated to 3 treatments with 8 replications in a randomized complete block design experiment, using 10 chicks per pen. Feeds in mash form were fed to birds and water and feed were provided for *ad libitum* intake. Feed intake, body weight gain, feed conversion and mortality were determined and subjected to analysis of variance as a randomized complete block design.

RESULTS AND DISCUSSION

Effect of multisubstrate & multienzyme complex on Apparent Metabolizable Energy (AME): Our results indicate that the use of alternate feed raw materials to replace corn and soybean meal in broiler diets reduced the apparent metabolizable energy of negative control diets. Supplementation of the multisubstrate, multienzyme complex improved the AME of low energy negative control diets by 55kcal/kg ($P < 0.01$) (Table 1)

Table 1. The effect of multisubstrate & multienzyme complex on the AME of broiler diets

Treatment	Enzyme (dosage)	AME (kcal/kg)
Positive control	None	3416.17 [a]
Negative control	None	3333.0 [b]
Negative control	Kemzyme MAP Dry* (0.5kg/t)	3387.80 [a]

[a, b,] Means with different superscripts are significantly different ($P < 0.01$)

Effect of multisubstrate & multienzyme complex on growth performance: As evident from the results, the inclusion of alternative feed raw materials produced a negative impact on broiler growth performance. Birds fed negative control diet with lower energy and amino acid content showed a decrease in body weight gain of 248g and increase in FCR by 13.3 points compared to those fed positive control diets (P<0.05). Enzyme addition to negative control diets improved the body weight gain by 119g and FCR by 3.7 points (P<0.05) respectively.

Table 4. Effect of multisubstrate & multienzyme complex on broiler growth performance

Treatment	Enzyme (dosage)	Body weight gain (g)	FCR
Positive control	None	2929.94[a]	1.707[a]
Negative control	None	2681.80[a]	1.840[c]
Negative control	KEMZYME® MAP Dry (0.5kg/t)	2801.50[a]	1.803[b]

[a, b,] Means with different superscripts are significantly different ($P < 0.05$)

CONCLUSION

In these studies, digestibility of starch, non-starch polysaccharides (NSP) and proteins were maximized through the use of an optimum combination of amylases, NSP enzymes and proteases. Results from our studies clearly indicate the negative effect of using alternative feed ingredients on the metabolizable energy and growth performance of broilers and the ameliorating effect of the right combination of enzymes in improving the nutritional quality of such diets. The observed increase in apparent metabolizable energy and the improvement in growth performance with the addition of the multisubstrate & multienzyme complex to low energy broiler diets may be attributed to the improvement in the digestibility of feed nutrients by the optimum combination of NSPases, amylases and proteases. Kocher (2003) had reported similar improvement in AME_n when a combination of pectinase, protease, and amylase was added to a corn soybean meal basal diet with lower energy and protein levels.

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