NUTRIENT DIGESTIBILITY OF BROILER CHICKENS FED LARVACIDE AND YOHIMBE BARK POWDER SUPPLEMENTED DIETS

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ABSTRACT
Herbal feed additives help improve health and performance of livestock without the bane of chemical residues. A 56-day study was conducted to compare the influence of Yohimbe (Pausynistalia yohimbe) and Larvacide on the nutrient and energy digestibility of broiler chickens at the starter and finisher phases. Two hundred and twenty five 14-day old broiler chickens were randomly assigned to five treatment groups comprising of forty five chicks each. The groups were made in triplicates. The five treatment groups consist of Basal (control), Larvacide (5mg/Kg), three levels of Yohimbe bark powder supplementation at 60, 120, and 180 mg/Kg of the diets. During the digestibility trial, two chickens with same live weights were selected from the replicates groups at 28 and 56 day old to test the starter and finisher diets respectively. Formulated feeds were supplied and data on feed intake and droppings were collected and data were subjected to One-way analysis of variance. The inclusion of Yohimbe powder at 180mg/Kg reduced (p<0.05) feed intake at the finisher phase but increased ash, carbohydrate, crude fibre and energy digestibility. It is concluded that inclusion of Yohimbe at 180mg/Kg improved crude protein, energy and ash digestibility at the finisher phase.
Keywords: Yohimbe, Broiler chicken, Nutrient digestibility, Energy digestibility, Larvacide

INTRODUCTION

The incorporation of feed additives in poultry production has played a pivotal role in enhancing industry outcomes by fostering growth rates and mitigating disease risks (El-Sabrout *et al*. in 2023). Synthetic feed additives, exemplified by larvicides containing the active ingredient cyromazine, have, however, raised concerns in livestock production due to the deposition of potentially harmful residues, such as melamine, a known carcinogenic compound, in chicken meat. Recognizing these concerns, there is a growing interest in exploring alternative, plant-based products containing natural compounds that can exert positive effects on animal systems. *Pausinystalia yohimbe,* a tree of about 18m in height, and 1.2m in girth; native to southwestern Nigeria, has drawn attention for its potential benefits. Yohimbe's active ingredient, an indole alkaloid known as Yohimbine, and its stereoisomers (Chen *et al*. 2008) have been associated with various physiological effects, including increased testosterone production, enhanced body weight gain, and lipolytic influences that could contribute to the production of lean meat in livestock (Berlan *et al*.1991). Moreover, Yohimbine, being an alkaloid, has demonstrated growth-regulating effects on insect larvae (Soon-II and Young-Joon, 2017).
Previous studies have shown that the inclusion of Yohimbe extracts in drinking water significantly increased protein accretion and decreased lipid content in chicken carcasses at 21 days, particularly with a Yohimbine dosage of 120 ppm (Metin and Ahmet, 2016). However, the poor solubility of Yohimbine in water (Iciek *et al.* 2023) raises concerns about its effectiveness when administered through this medium, as the compound may not be efficiently ingested by the birds. In light of these considerations, our study aims to assess the impact of Yohimbe supplementation in feed at both starter and finishing phases, while key parameters, such as feed intake, apparent nutrient digestibility, and body weight gains. This investigation seeks to contribute valuable insights to the ongoing discourse on optimizing poultry production practices with a focus on natural alternatives to synthetic additives.

MATERIALS AND METHODS

Apparent nutrient digestibility

Metabolic trial was conducted when the chickens were 28 and 56 days old respectively. To determine the apparent nutrient digestibility and energy metabolizability of the diets at the starter and finisher phases. Two chickens per replicate (6 chickens/treatment) were randomly selected and housed separately in appropriate metabolic cages fitted with individual feed troughs, water trough and facility for separate droppings collection. The chickens were acclimatized for 3 days prior to the commencement of 4 days metabolic trial. Known weight of feed (slightly above the respective daily requirements) was fed to the birds housed in individual metabolic cages. Droppings collected per bird per day (for four days collection period) were oven dried (60ºC) until a constant weight is reached and used for subsequent laboratory analyses. Proximate compositions of feed and dried dropping samples were determined using the method described by (AOAC, 2005). Nutrient digestibility was estimated as stated below.

$$\text{Apparent nutrient digestibility} = \frac{\text{Nutrient in feed intake} - \text{Nutrient in excreta output}}{\text{Nutrient in feed intake}} \times 100$$

Apparent and true metabolizable energy

At the end of starter (28 days) and finisher (56 days) phases, three birds were randomly selected from each replicate and moved into a metabolic cage. The birds were fasted for 24 hours to empty their digestive tracts and a known quantity of feed was fed. Another group of birds were randomly selected, moved into the metabolic cage and fasted for 24 hours, but unlike the former group of birds only water was administered to this group of birds so as to determine the endogenous losses. At the lapse of 24 hours, excreta were collected quantitatively from the two groups of bird and weighed, oven dried at 60 ºC until a constant weight is attained and weighed again. The samples of the excreta were pooled together, for each bird, milled and assayed for gross energy. The apparent and true metabolizable energy were calculated as follows:

$$AME = \frac{(Fi * GEFi) - (Ee * GEe)}{Fi}$$

$$TME = \frac{(Fi * GEFi) - (Yf - Ye)}{Fi}$$

$$AMEn = \frac{(Fi * GEFi) - (Ee * GEe) - (NR * K)}{Fi}$$

$$TMEn = \frac{(Fi * GEFi) - (Yf - Ye) - (NR * K)}{Fi}$$

Where:

AME = Apparent metabolizable energy, AMEn = Apparent metabolizable energy corrected for nitrogen

TME = Total metabolizable energy, TMEn = Total metabolizable energy corrected for nitrogen

Fi = Feed intake (g/DM), GEFi = Gross energy of feed (MJ/kg), Ee = Excreta output (g/DM)

Gee = Gross energy of excreta (MJ/kg), Yf = Energy and gross energy of fed bird

Ye = Energy and gross energy of fasted bird, NR = Nitrogen retained (g)

K = 34.4 (constant)

Results

Table 1: Effect of diets containg larvacide and *P. yohimbe* on the nutrient and energy digestibility of broiler chickens at starter phase

Parameters	Control	Larvacide 5mg/kg	Concentration of Yohimbe (mg/kg diet)			SEM
			60	120	180	
Dry matter (%)	79.641 ^{a}	80.285 ^{a}	78.422 ^{b}	77.822 ^{b}	77.794 ^{b}	0.304
Ash (%)	55.975 ^{a}	37.023 ^{c}	47.292 ^{b}	31.672 ^{d}	39.109 ^{c}	2.330
Fat (%)	74.773 ^{c}	92.402 ^{a}	90.279 ^{b}	91.988 ^{a}	90.016 ^{b}	1.772
Crude protein (%)	81.931 ^{b}	83.989 ^{a}	81.005 ^{b}	73.887 ^{c}	81.814 ^{b}	0.936
Crude fibre (%)	22.782 ^{c}	32.097 ^{b}	22.619 ^{c}	37.903 ^{a}	36.461 ^{a}	1.823
Carbohydrate (%)	82.971 ^{ab}	83.300 ^{ab}	82.345 ^{b}	83.717 ^{a}	79.814 ^{c}	0.396
TME (kcal/kg)	3282.343 ^{ab}	3644.848 ^{a}	3104.129 ^{b}	2918.357 ^{b}	3254.149 ^{ab}	84.877
TMEn (kcal/kg)	3278.305 ^{ab}	3640.119 ^{a}	3099.769 ^{b}	2914.807 ^{b}	3250.770 ^{ab}	84.829
AME (kcal/kg)	3100.842 ^{ab}	3267.505 ^{a}	2863.315 ^{ab}	2727.958 ^{b}	3099.228 ^{ab}	77.123
AMEn (kcal/kg)	3096.805 ^{ab}	3262.777 ^{a}	2858.955 ^{ab}	2724.409 ^{b}	3095.849 ^{ab}	77.129
TME (kcal/kg)	3282.343 ^{ab}	3644.848 ^{a}	3104.129 ^{b}	2918.357 ^{b}	3254.149 ^{ab}	84.877

^{a,b,c,d} Means on the same row with different superscripts differ significantly (P<0.05)
SEM = Standard Error of Mean
TME = True Metabolizable Energy, TMEn = True Metabolizable Energy corrected for Nitrogen
AME = Apparent Metabolizable Energy, AMEn = Apparent Metabolizable Energy corrected for Nitrogen

Table 2: Effect of diets containing larvacide and *P. yohimbe* on the nutrient and energy digestibility of broiler chickens at finisher phase

Parameters	Control	Larvacide 5mg/kg	Concentration of Yohimbe (mg/kg diet)			SEM
			60	120	180	
Dry matter (%)	79.709 ^{a}	77.990 ^{b}	78.962 ^{ab}	79.209 ^{ab}	78.532 ^{ab}	0.227
Ash (%)	5.960 ^{c}	20.891 ^{a}	12.374 ^{b}	20.935 ^{a}	22.265 ^{a}	1.814
Fat (%)	87.958 ^{b}	89.298 ^{a}	71.743 ^{d}	88.321 ^{b}	86.715 ^{c}	1.762
Crude protein (%)	82.349 ^{b}	75.051 ^{d}	72.379 ^{e}	79.979 ^{c}	86.090 ^{a}	1.323
Crude fibre (%)	46.252 ^{c}	47.883 ^{bc}	26.527 ^{d}	50.859 ^{b}	55.252 ^{a}	2.676
Carbohydrate (%)	85.080 ^{b}	84.877 ^{b}	86.833 ^{a}	85.139 ^{b}	81.309 ^{c}	0.503
TME (kcal/kg)	3082.085 ^{b}	3093.409 ^{b}	2914.338 ^{b}	3394.580 ^{ab}	3640.233 ^{a}	88.413
TMEn (kcal/kg)	3078.752 ^{b}	3090.192 ^{b}	2912.490 ^{b}	3391.594 ^{ab}	3637.135 ^{a}	88.365
AME (kcal/kg)	2915.896 ^{bc}	2760.579 ^{bc}	2718.894 ^{c}	3224.814 ^{ab}	3488.900 ^{a}	95.810
AMEn (kcal/kg)	2912.563 ^{bc}	2757.362 ^{bc}	2717.046 ^{c}	3221.827 ^{ab}	3485.803 ^{a}	95.773
TME (kcal/kg)	3082.085 ^{b}	3093.409 ^{b}	2914.338 ^{b}	3394.580 ^{ab}	3640.233 ^{a}	88.413

^{a,b,c,d} Means on the same row with different superscripts differ significantly (P<0.05)
SEM = Standard Error of Mean
TME = True Metabolizable Energy, TMEn = True Metabolizable Energy corrected for Nitrogen
AME = Apparent Metabolizagle Energy, AMEn = Apparent Metabolizable Energy corrected for Nitrogen

DISCUSSION

In the preliminary stages of this study, focusing on the starter diet, a reduction in True Metabolizable Energy (TME) and Apparent Metabolizable Energy (AME) in chickens supplemented with 120mg of Yohimbe. This reduction was attributed to a compromised digestion of protein within the diet, considering that protein possesses the highest energy content per kilogram among the various nutrients present. The diminished carbohydrate digestion observed with the inclusion of *Pausinystalia yohimbe* is indicative of a progressive decline linked to the presence of anti-nutritional factors inherent in the herbal additive. These factors were found to interfere with the efficient digestion of the diets, as reported (Duke. 1992). Additionally, the underdeveloped digestive system of the young chickens emerged as a contributing factor. Although the fibrous nature of the additive posed a challenge for the immature digestive systems, leading to a reduction in both carbohydrate and protein digestion. Despite these challenges, there was a notable improvement in fat digestion attributed to the lipolytic properties of Yohimbine, (Galitzky *et al.*1990). Furthermore, the finisher diet, had a positive shift in TME and AME for broiler chickens at inclusion level of 180mg. This improvement in energy parameters was linked to enhanced protein digestion as the animals matured. While protein digestion showed improvement, carbohydrate digestibility did not exhibit a similar trend. The heightened protein digestion could be traced to the gastro-stimulatory properties of Yohimbe, (Bagheri *et al.*1997). In addition, positive trends were noted in the digestion of fiber and fat with the incorporation of Yohimbe.

CONCLUSION

In conclusion, our findings provide insights into the dynamic impact of Yohimbe supplementation with best results at 180mg per kg diet on energy parameters, emphasizing the importance of age-related considerations in broiler diets. This study underscores the need for nuanced dietary adjustments to optimize nutrient utilization throughout different stages of broiler development. These findings contribute to the ongoing discourse on refining poultry nutrition strategies for enhanced productivity and animal well-being.

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