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Efficacy Evaluation of Poultry Feed Emulsifier on Performance and Nutrient Metabolism in Broiler Chicken

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

The study was conducted in broiler chicken to evaluate the efficacy of a feed emulsifier AV/PFE/15 (M/s Ayurvet Limited, India) at improving their performance and nutrient metabolism. 240 one day-old, unsexed Vencobb broiler chicks were purchased from a local hatchery and were randomly allocated to one of four treatment groups, T1-T4, each having three replicates of twenty birds. The chicks were fed *ad libitum* with standard starter mash and thereafter with finisher mash. Treatment groups were fed on a diet with 2.5 percent lesser metabolic energy for evaluation of feed emulsifier efficacy. Parameters *viz.* body weight, feed intake, feed conversion ratio, and mortality were recorded. At 3 weeks of age, nutrient digestibility trial was conducted for 3 days in all groups. The birds in the group T3 had better body weight, production index, and lowest feed conversion ratio as compared to other groups. Feed intake and mortality were not affected by the diets and mean nutrient digestibilities of dry matter, organic matter, nitrogen-free extracts, neutral detergent fiber, cellulose and hemicelluloses were found to be statistically significant. The results show that the addition of AV/PFE/15 (M/s Ayurvet Limited, India) @ 250 g/tonne of feed improved the broiler performance as well as nutrient intake and digestibility.

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Keywords: Broilers; feed emulsifier; nutrient metabolism; performance.

1. INTRODUCTION

Lipids are an important source of energy for animals, and the amount of energy that an animal can obtain from dietary fat is determined by the digestibility of fats [1]. The digestibility of fat is affected by the age of birds and absorption can be poor in very young birds. Due to low levels of natural lipase production and low rates of bile salt generation in young animals, fat absorption is physiologically restricted [2]. Such physiological limitations of the digestive system of poultry can be overcome by using exogenous and endogenous strategies to maximize feed assimilation [3].

Supplementation with emulsifiers, especially in the early stages of growth, allows chicks to improve fat digestion and absorption, which increases metabolic energy and growth performance [4]. The mode of action of emulsifiers is to extend the active surface of fats, permitting the action of enzymes, which hydrolyse glyceride molecules into fatty acids, and favor the formation of micelles, consisting of lipolysis products. This is an important step in lipid absorption as it creates a diffusion gradient that boosts absorption. The present experiment was conducted to study the efficacy of emulsifier AV/PFE/15 (M/s Ayurvet Limited India) on broiler growth performance and nutrient intake and digestibility.

2. MATERIALS AND METHODS

The experiment was undertaken at the poultry house LRIC (Deoni) Hallikhed, Department of Veterinary Pharmacology and Toxicology, Veterinary College, KVAFSU, Bidar, India (17.91° N Latitude and 77.53° E Longitude, 710 MSL). The study protocol was approved by the institutional ethics committee (approval number IAEC 03/2019/VCB).

2.1 Experimental Birds and Management

240 one day-old unsexed Vencobb broiler chicks were purchased and randomly allocated to one of four treatment groups, each having three replicates of twenty birds (Table 1). The brooder house and equipments were thoroughly disinfected before the arrival of the chicks and maintained as per the Cobb Broiler Management guidelines. The animals were fed *ad libitum* with a starter mash for the first three weeks of age, thereafter with finisher mash, and had unlimited access to water throughout the period of the experiment. The composition of the starter and finisher mash offered to the birds is shown in Table 2 and Table 3.

2.2 Performance Parameters

Performance parameters such as body weight, feed intake, feed conversion ratio (FCR), and mortality were recorded and calculated daily, weekly, and after the trial.

2.3 Nutrient Digestibility

After completion of 3 weeks of age, nutrient digestibility trial was conducted for 3 days in all groups. Data on daily feed intake and feces voided was recorded. The feces voided by each bird were collected in the polythene bag after 24 hours and weighed the next morning at 9:30 am daily. Digestibilities of dry matter (DM), crude protein (CP), crude fiber (CF), and ether extract (EE) were measured. One-fifth ($1/5^{th}$) of total collection was sub-sampled and dried at $100^{o}C$ overnight for DM estimation. One-hundredth ($1/100^{th}$) of another sub-sample was stored at $-20^{o}C$ for nitrogen estimation. Each day's birds-wise collection was pooled for 3 days to have one composite sample for DM and nitrogen analysis, separately. The pooled dried faecal samples were ground in a Wiley mill to pass through 1 mm sieve and stored in air-tight polythene bags until analyzed. The pooled and ground faecal samples of individual birds were subjected to proximate analysis and fiber fractionation. Nitrogen in faecal samples was estimated by the macro Kjeldhal method. The digestibility of nutrients was calculated as the difference between nutrient intake and nutrient excretion.

2.4 Statistical Analysis

Experimental data on dry matter intake (DMI), nutrient intake, body weight gain, and digestibility were analyzed by Statistical Analysis System (SAS Institute Inc., 2012, version 93.1) and results interpreted accordingly.

Table 1. Experimental design

Treatment(s)	No. of birds	Experimental diet
T1 (Control)	60	**Standard broiler ration**
T2	60	2.5% ME reduction + No supplementation
T3	60	2.5% ME reduction + **AV/PFE/15** *(M/s Ayurvet Ltd.)* 250 g/tonne of feed
T4	60	2.5% ME reduction + **Brand A**, 500 g/tonne of feed

Table 2. Composition of basal diets (%)

Ingredient	Starter phase (0-3) weeks	Finisher phase (4-6) weeks
Maize	46.00	50.00
Soybean meal	18.50	12.00
Groundnut cake	15.00	11.00
Fishmeal	2.00	2.00
Wheat bran	12.45	19.05
Bone meal	2.00	2.00
Oyster shell	3.00	3.00
Salt	0.25	0.25
Vit. Premix	0.25	0.25
Methionine	0.30	0.25
Lysine	0.25	0.20
Total	100	100
Nutrients composition		
ME (Mcal/kg)	2.90	2.96
Crude protein (%)	22.00	22.00
Calcium (%)	1.10	1.10
Lysine (%)	1.20	1.20
Methionine (%)	0.64	0.64
Available phosphorus (%)	0.48	0.48

Vitamin premix provided per kg diets: Vitamin A-10,000,000 IU; Vitamin D3-2,000,000; Vitamin E-20,000 IU ;Vitamin K-2,250mg; Thiamine B1-1,750mg; Riboflavin B2- 5,000mg; Pyridoxine B6- 2,750mg; Niacin-27,500mg; Vitamin B12-15mg; Pantothenic acid- 7,500mg; Folic acid-7500mg; Biotin-50mg; Choline chloride-400g; Antioxidant-125g; Magnesium-80g; Zinc-50mg; Iron-20g; Copper-5g; Iodine-1.2g; Selenium-200mg; Cobalt-200mg

Table 3. Composition of diets (2.5 % ME reduction)

Ingredient	Starter phase (0-3) weeks	Finisher phase (4-6) weeks
Maize	46.00	50.00
Soybean meal	20.35	13.83
Groundnut cake	15.00	11.00
Fishmeal	2.00	2.00
Wheat bran	10.60	17.22
Bone meal	2.00	2.00
Oyster shell	3.00	3.00
Salt	0.25	0.25
Vit. Premix	0.25	0.25
Methionine	0.30	0.25
Lysine	0.25	0.20
Total	100	100
Nutrients composition		
ME (Mcal/kg)	2.83	2.88
Crude protein (%)	22.00	22.00
Calcium (%)	1.10	1.10
Lysine (%)	1.20	1.20
Methionine (%)	0.64	0.64
Available phosphorus (%)	0.48	0.48

3. RESULTS AND DISCUSSION

The study aimed at evaluating the efficacy of the addition of an emulsifier, AV/PFE/15, on broiler performance, nutrient intake and digestibility.

3.1 Growth Performance

Findings on body weight (BW), feed intake (FI), feed conversion ratio (FCR) and mortality during experimental stage of broiler chicks fed with an exogenous emulsifier are presented in Table 4. FI and mortality were not affected (p>0.05) by the diets at any period. However, the birds in the group T3 had better body weight, production index and lowest FCR as compared to other groups.

3.2 Nutrient Digestibility

The nutrient digestibilities (%) are shown in Table 5. Between the groups, the differences in mean nutrient digestibilities of DM (p<0.05), organic matter (OM) (p<0.05), nitrogen-free extracts (NFE) (p<0.05), neutral detergent fiber (NDF) (p<0.01), cellulose (p<0.01) and hemicelluloses (p<0.01) were found to be statistically significant.

Table 4. Efficacy of an emulsifier on growth parameters of broilers at 42 days of age

Parameters		Groups				
		T1	T2	T3	T4	*p*-value
Growth and feeding performance	Body wt. (g)/Bird	2338.59^{b}	1977.17^{c}	2477.37^{a}	2366.6^{b}	0.001
	Feed consumed (g)/Bird	4569.0	4239.0	4565.0	4575.0	0.433
	Feed conversion ratio (FCR)	1.95^{a}	1.98^{a}	1.84^{b}	1.93^{a}	0.001
	Mortality (%)	1.88	1.65	1.88	1.88	0.843
	Production Index (PI)	280.34^{b}	234.17^{c}	314.88^{a}	286.88^{b}	0.001

^{a,b,c} *Values bearing different superscripts within a row differ significantly*

Table 5. Mean nutrient digestibilities in experimental birds

Parameters	Nutrient digestibility (%)				
	T1	T2	T3	T4	*p*-Value
DM	77.13^{a}	71.55^{b}	71.55^{b}	73.45^{ab}	0.033
OM	80.24^{a}	75.7^{b}	75.7^{b}	77.29^{ab}	0.043
CP	77.69	73.34	73.34	75.61	0.081
EE	58.18	65.28	65.28	57.42	0.094
CF	31.98	23.08	23.08	27.97	0.152
NFE	82.30^{a}	78.32^{b}	78.32^{b}	78.90^{ab}	0.049
NDF	56.17^{a}	46.21^{ab}	46.21^{ab}	43.86^{b}	0.007
ADF	21.19	13.78	13.78	17.01	0.321
Cellulose	49.54^{a}	38.22^{b}	38.22^{b}	47.07^{ab}	0.018
Hemicellulose	78.16^{a}	70.47^{ab}	70.47^{ab}	64.75^{b}	0.002

^{a,b} *Values with different superscripts in a row differ significantly*

Table 6. Mean nutrient intake and energy intake of experimental birds

Parameter	Groups				
	T1	T2	T3	T4	*p*-Value
DMI, g/d	1051.10^{a}	1076.11^{b}	1176.21^{b}	1186.13^{ab}	0.01
per kg $W^{0.75}$	96.11	96.09	98.09	98.43	0.77
OMI, g/d	1041.67^{a}	1098.27^{b}	1157.37^{b}	1071.19^{ab}	0.01
per kg $W^{0.75}$	86.86	83.21	89.27	88.43	0.71
CPI, g/d	223.18^{a}	232.36^{b}	268.68^{b}	241.73^{a}	<0.01
per kg $W^{0.75}$	18.16^{a}	19.12^{b}	20.72^{b}	19.96^{b}	<0.01
EEI, g/d	18.33^{a}	23.07^{b}	35.01^{b}	25.15^{c}	<0.01
per kg $W^{0.75}$	1.53^{a}	1.92^{b}	2.70^{b}	2.08^{c}	<0.01
CFI, g/d	92.57^{b}	79.08^{a}	84.7^{a}	78.64^{a}	<0.01
per kg $W^{0.75}$	7.72^{b}	6.32^{a}	7.43^{a}	6.49^{a}	<0.01
DE, Kcal/d	2835^{b}	3129^{a}	3293^{a}	3158^{a}	<0.01
ME, Kcal/d	2708^{a}	3172^{b}	3159^{b}	2970^{ab}	<0.01

^{a,b,c} *Values with different superscripts in a row differ significantly*

The differences between the groups in organic matter intake (OMI), crude protein intake (CPI), ether extract intake (EEI), crude fiber intake (CFI), energy intake, and dry matter intake (DMI) were statistically significant (p<0.01), whereas differences in OMI and DMI on percent body weight and per kg metabolic body weight were not significant (Table 6).

The study was conducted to evaluate the efficacy of an emulsifier, AV/PFE/15, on growth performance and nutrient intake and digestibility of broilers. The supplementation of exogenous emulsifier provoked neither morbidity nor mortality, and did not influence the feed intake in the birds. Similar results on mortality and feed intake have been previously reported [5, 6, 7] when exogenous emulsifiers were used in broiler chicken diets.

In the present study, emulsifier supplementation improved the growth performance (body weight, production index, and feed conversion ratio) of broilers. This is in agreement with the findings of previous study [8,9]. The improved growth performance in the present study might be linked to increased crude protein and fat assimilation. Zhang *et al*. [10] also found that supplementation with emulsifiers increased fat digestion and absorption, which, in turn, boosted growth performance. According to Zhao et al. [11] emulsifiers promote the integration of micelles in the intestinal lumen, which increases fat digestibility.

4. CONCLUSION

In conclusion, the exogenous emulsifier, AV/PFE/15, when supplemented @ 250 g/tonne of feed improved growth performance and nutrient metabolism in broiler chicken fed on energy-restricted diets. Overall, the results indicate that AV/PFE/15 is an efficacious feed emulsifier for use in broiler chicken.

COMPETING INTERESTS

M/s Ayurvet Limited, India, intends to manufacture AV/PFE/15 commercially. DK, KR and BG are employees of M/s Ayurvet Limited, India. However, the nature of this affiliation did not influence the outcomes of the study in any manner.

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