

**BODY WEIGHT GAIN, DRESSING PERCENTAGE, ABDOMINAL FAT AND
SERUM CHOLESTEROL OF BROILERS SUPPLEMENTED WITH A MICROBIAL
PREPARATION**

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ABSTRACT

A study was conducted to study the effects of supplementation of a microbial preparation, Effective Micro organisms (EM), on body weight gain, dressing percentage, abdominal fat and serum cholesterol content of broilers. The EM was added to drinking water at a rate of 1 part EM to 1000 parts of water. The two treatments were control (0 EM) and 1 EM. Final body weights, serum cholesterol and abdominal fat pads were determined at day 42. Dressing percentage was determined using carcass weight as a proportion of body weight. Abdominal fat was used as an indicator of the carcass' fat content and was calculated as percentage of body weight. Birds supplemented with 1 EM had significantly ($P < .05$) higher weight gains ($2094 \pm 11g$) than the control ($2057 \pm 15 g$). Control birds had significantly ($P < .05$) higher feed intake ($3785 \pm 9 g$) than the birds supplemented with 1 EM ($3748 \pm 13 g$). However, feed efficiency, measured as feed: gain ratio, was better for the EM supplemented birds (1.79 ± 0.03) than the control (1.84 ± 0.02). Although not significantly different, serum cholesterol content was lower for 1 EM birds (3.15 ± 0.21 mmol/l) than in 0 EM birds ($3.38 \pm 0.17g$ mmol/l). Dressing percentage was not significantly different between the two treatments, but numerically higher for the 1 EM birds than the control. Abdominal fat pad was lower for the 1 EM treated birds than the non-EM treated birds. The results of this study suggest that microbial preparations such as EM, can be used to improve weight gain, feed utilisation and reduce abdominal fat pads, hence fat content of birds. Although not significant, the present study has shown that use of microbial preparations may have some potential to improve dressing percentage and lower serum cholesterol. However, further studies such as use of different EM concentrations are required to ascertain the results found in this study. To assess potential health benefits, research is also required to assess the effect of using EM on total cholesterol content in tissues.

Key words: Effective microbes, broiler performance, cholesterol

French

GAIN DE POIDS VIF, RENDEMENT DE LA CARCASSE, GRAISSE ABDOMINALE ET CHOLESTÉROL SÉRIQUE DE POULETS À GRILLER QUI ONT REÇU COMME SUPPLÉMENT UNE PRÉPARATION MICROBIENNE

RÉSUMÉ

Une recherche a été menée en vue d'étudier les effets d'une préparation microbienne, une supplémentation effective de micro-organismes (EM), sur le gain de poids vif, le rendement de la carcasse, les graisses abdominales et la teneur en cholestérol sérique des poulets à griller. L'EM a été ajouté à de l'eau potable dans une proportion d'1 part d'EM à 1000 parts d'eau. Les deux traitements étaient le groupe témoin (0 EM) et 1 EM. A la fin le poids vif, le cholestérol sérique et le coussinet adipeux abdominal ont été déterminés au 42^{ème} jour. Le rendement de la carcasse a été déterminé en utilisant le poids de carcasse

comme proportion du poids vif. La graisse abdominale a été utilisée comme un indicateur de la teneur en graisse de la carcasse et a été calculée comme un pourcentage du poids vif. Des oiseaux qui ont reçu un supplément de 1 EM avaient des gains de poids ($P0 < 05$) beaucoup plus élevés ($2094 \pm 11g$) que le groupe témoin ($2057 \pm 15 g$). Les oiseaux témoins avaient ($P0 < 05$) une prise alimentaire beaucoup plus élevée ($3785 \pm 9 g$) que les oiseaux qui ont reçu un supplément de 1 EM ($3748 \pm 13g$). Toutefois, l'indice de consommation, mesuré comme une proportion entre la consommation et le gain, était meilleure pour les oiseaux qui ont reçu un supplément de EM ($1,79 \pm 0,03$) que le groupe témoin ($1,84 \pm 0.02$). Tout en n'étant pas très différente, la teneur en cholestérol sérique était numériquement inférieure chez les oiseaux qui ont reçu 1 EM ($3,15 \pm 0,21 \text{ mmol/l}$) par rapport aux oiseaux avec 0 EM ($3,38 \pm 0.17g \text{ mmol/l}$). Le rendement de la carcasse n'était pas très différent entre les deux traitements mais il était numériquement plus élevé chez les oiseaux avec 1 EM que chez les oiseaux du groupe témoin. Le coussinet adipeux abdominal était moins élevé chez les oiseaux traités avec 1 EM que chez les oiseaux non traités avec EM. Les résultats de cette étude suggèrent que des préparations microbiennes telles que EM peuvent être utilisées pour accroître le gain de poids et comme aliment et pour réduire le coussinet adipeux abdominal et donc la teneur en graisse chez les oiseaux. La présente étude a montré que, tout en n'étant pas considérable, l'utilisation des préparations microbiennes peut avoir quelque potentiel d'améliorer le rendement de la carcasse et réduire le cholestérol sérique. Cependant, des études plus approfondies s'imposent en vue de vérifier le résultat trouvé dans la présente étude telle que l'utilisation de différentes concentrations d'EM. Pour évaluer les avantages possibles sur le plan sanitaire, des recherches devraient être également encouragées en vue d'étudier l'effet de l'utilisation d'EM sur le total de la teneur en cholestérol dans les tissus.

Mots-clés: Microbes réels, performance des poulets à griller, cholestérol

INTRODUCTION

Use of probiotics or microbial preparations is a fast growing technology finding a niche in the livestock sector. Available literature suggests that use of microbial preparations have some beneficial effects in poultry production such as improvements in growth rate and feed efficiency, prevention of intestinal infections, and improved nitrogen utilisation [1, 2, 3, 4]. In human health, there is significant evidence that probiotics such as specific types of *lactobacillus* bacteria and bifidobacteria can lower the three major risk factors for coronary heart disease and stroke: excessive cholesterol, high blood pressure, and high triglyceride levels. In a study in Argentina, lactobacillus bacteria lowered total blood cholesterol by 22 % percent and triglycerides by 33 % percent [5]. However, some research has shown no beneficial benefits of using microbial preparations or probiotics [6, 7]. Noteworthy, care should be taken with strain selection of the beneficial bacteria to get the best results since not all strains of bacteria such as *Lactobacillus acidophilus* and *L. bulgaricus* work to lower cholesterol.

Effective Micro-organisms (EM) is a microbial preparation developed by Professor T. Higa of University Of The Ryukyus in Japan. The EM is composed of different microbes that

include bacteria, yeasts and/or fungi. Some of the benefits claimed to accrue from the use of EM include improved meat and manure quality, improved animal health, reduction of foul smells and absence of toxic effects on bird growth [8, 9, 10]. Increased egg production and egg weight and improvements in gross margins by up to 28.5 % have also been reported [12]. Use of EM in Africa is a new innovation and novel idea. There is no available literature regarding use of microbial preparations in broiler production.

This study was therefore carried out to evaluate the effects of supplementing diets with water-based effective micro-organisms (1 EM) on body weight gain, feed utilisation, dressing percentage, abdominal fat pad and serum cholesterol content of broilers.

MATERIALS AND METHODS

Management

Birds

Five hundred day-old chicks were randomly selected and distributed to two treatments: 0 EM (control) and 1 EM. Each treatment had ten replicates of 25 birds each. Birds were housed in an environmentally controlled broiler house with a floor covered with wood shavings. The shavings were kept dry throughout the experimental period by replacing the spoiled litter as and when required.

Feed

Birds were fed on a commercial starter mash from 1 - 28 days of age and grower's mash from 29-42 days of age (Table 1). The diets were formulated to meet the nutrient requirements of broilers at different ages [11]. As a precautionary measure, to prevent cross-contamination of the formulated diets with the probiotics used, the two diets (with or without the EM) were handled separately using different utensils such as scoops.

Liquid EM (EM Centre, EMROSA (Pty) Ltd, Centurion, Wierdepark, South Africa), containing different types of micro-organisms (*Lactobacillus plantarum* (ATCC8014), *Lactobacillus casei* (ATCC7469), *Streptococcus lactis* (IFO12007), *Rhodopseudomonas palustris* (ATCC17001), *Rhodobacter sphaeroides* (ATCC17023), *Saccharomyces cerevisiae* (IFO0203), *Candida utilis* (IFO 0619), *Streptomyces albus* (ATCC3004), *Streptomyces griseus* (IFO3358), *Aspergillus oryzae* (IFO 5770) and *Mucor hiemalis* (IFO 8567), was mixed in water at the rate of 1 part EM to 1000 parts water [11].

Measurements

Body weight (BW) and feed intake measurements were determined at weekly intervals. Body weight gain was calculated as the difference between the final and initial bird weight during each of the weighing periods. Feed intake was calculated as the difference between the amount of feed supplied to the birds and the amount of feed that remained at the end of each feeding period. Feed conversion (feed: gain ratio) was calculated as the ratio between feed

intake and BW gain for each period. On day 42, blood was collected from five birds randomly selected from each treatment. Blood was collected through the brachial vein and drained into a polythene tube. Serum was collected by, first, allowing the blood to clot, followed by centrifugation at 5,000 revolutions per minute. Serum cholesterol was determined using an automatic Beckman Synchron CX System Chemistry Analyser¹.

For carcass determination, birds were killed by cervical dislocation. Carcass weight measurements were done after defeathering and removal of feet, head and viscera. Dressing percentage was calculated by dividing the carcass weight by live body weight. Abdominal fat pad comprised leaf fat surrounding the cloaca and abdominal muscles excluding fat surrounding the gizzard.

Statistical analyses

All the data collected were subjected to analysis of variance and Duncan's Multiple Range Test using SAS package at $P < 0.05$ level of significance [12].

RESULTS

Results on the effect of EM supplementation are presented in Table 2. Birds fed diets supplemented with EM had significantly ($P < 0.05$) higher BW gains (2094 ± 11 g) than those on the control diet (2057 ± 15 g) giving an improvement of approximately 2 %. On the other hand, feed intake was lower for the EM treated birds than the control (3748 ± 9 g versus 3785 ± 18 g). Feed conversion was also better for the EM treated birds. At 42 days of age, the dressing percentage (as % BW) was similar between the two treatments but the values for the EM supplemented birds was numerically higher (69 ± 5 g) than that of the control (67 ± 6 g).

Though not significantly different ($P < 0.05$), the level of serum cholesterol at 42 days was lower (3.15 ± 0.21 mmol/l) for the EM supplemented birds than for the control (3.38 ± 0.17 g mmol/l). Supplementation of diet using EM also reduced ($P < 0.01$) the fat content of the birds as measured by the abdominal fat content. However, it was observed that the birds supplemented with EM tended to have pasted vents during the first 21 days of growth.

DISCUSSION

Results of experiments using microbial preparations or probiotics in broilers or poultry have been inconsistent. In this study, benefits of using EM included improvements in weight gain and feed efficiency. The results agree with previous reports regarding the effect of probiotic or microbial preparation supplementation of broiler diets [3, 4, 13]. Although the feed intake for the EM treated birds was lower than that of control birds, the higher body weight gain reported could be attributed to enhancement of feed utilisation efficiency (Table 2) as reported by other researchers [3, 13]. Use of probiotics has also been shown to improve

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protein efficiency ratios and/or nitrogen utilisation in broilers [4]. The lower feed intake observed in EM supplemented birds concurs with other studies [6]. The pasted vents could be attributed to malfunction of the digestive system where the micro-fauna regime may have been disturbed.

Birds fed with EM diets had lower serum cholesterol content than the control. The ability of probiotics to depress serum cholesterol content has been reported in broilers and rats [4, 15]. The lower cholesterol levels could be attributed to the lower content of fat as measured by the amount of abdominal fat pad. However, these results are at variance with other studies that showed that probiotic supplementation had no beneficial effects on broiler performance and did not lower cholesterol levels in post-menopausal women [6, 7].

Several schools of thought exist regarding the modes of action of probiotics. These include inhibition of the proliferation of pathogenic bacteria, prevention of adhesion of pathogenic bacteria through production of hydrogen peroxide, production of metabolites that neutralise bacterial toxins, improvements in digestive utilisation of feeds through microbial enzymes, stimulation of the immune system and production of vitamins [15, 16]. In another study, it was reported that a commercial probiotic preparation (Protexin) reduced the incidence of *Salmonella* in broilers. This was attributed to the notion of competitive exclusion of pathogens [17]. On the other hand, some insignificant effects of using microbial preparations or probiotics as observed in this study could be attributed to, among others, inadequate dosing of micro-organisms and competition for available nutrients between the host and the microbes themselves.

One of the challenges facing the poultry industry is the cholesterol content of eggs. There is therefore need to explore the potential benefits of microbial preparations as a conduit for reduction of cholesterol of eggs and meat products.

CONCLUSION

This study has demonstrated that supplementation of broiler diets with a microbial preparation such as EM, may offer potential benefits to the poultry industry, such as improvements in body weight gain and feed utilisation efficiency. Due to the inconsistencies from studies conducted elsewhere, further research is required to further explore the use of probiotics in poultry diets. Only one level of concentration or dose of EM was used in this study. There may be need to evaluate the effect of different dosages in future studies.

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Table 1: *Composition of Experimental Starter and Grower Diets*

Ingredient	Starter, g/kg	Grower, g/kg
Yellow maize	492.00	568.79
Sunflower, 38% ¹	154.00	101.50
Full fat soy meal	300.00	296.76
Fish meal, 65% ¹	24.00	9.80
Monocalcium phosphate	6.80	13.81
Limestone	18.00	3.53
Iodised Salt	3.70	0.51
DL Methionine	0.90	0.29
L Threonine	0.60	0.00
Vitamin/mineral Premix	5.00	5.00
<i>Calculated Analysis</i>		
ME, MJ/kg	12.80	13.4
Crude Protein, g/kg	200.31	229.9

¹ % Quality of feed ingredient in terms of % Crude Protein

Table 2: *Effects of EM supplementation on mean (\pm standard error) body weight gain, feed intake, feed:gain ratio, dressing percentage and serum cholesterol of broilers at 42 days of age*

Parameters	Treatment	
	Control (0 EM*)	1 EM (1 part EM:1000 parts water)
BW Gain (g, 0-42d)**	2057 \pm 11 ^a	2094 \pm 15 ^b
Feed intake, g**	3785 \pm 9 ^a	3748 \pm 13 ^b
Feed: gain ratio, g:g**	1.84 \pm 0.02	1.79 \pm 0.03
Dressing percentage, % of live BW**	67 \pm 6	69 \pm 5
Abdominal Fat, % of BW***	0.95 \pm 16 ^a	0.89 \pm 0.09 ^b
Serum Cholesterol, mmol/l	3.38 \pm 0.17	3.15 \pm 0.21

^{ab}Means with no common superscripts are significantly different

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 *EM=Effective Microorganisms

**P<0.05

***P<0.01

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