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Studies of the Effects on Ostrich Growth, of Silage, Altering Feed Levels and Some Nutritional Supplements in Feed

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Abstract: In this study we tested the effect of altering ostrich feed, by adding silage to feed in the ratio 2:1, by reducing feed levels to 90% and 75%, by adding antimicrobial growth promoter Zinc bacitracin and flavoumycin and presenting probiotics as liquid and powder. For each trial a control was set up with only normal prescribed feed supplied. All the birds used were health kept under high hygiene and vaccinated and dewormed to remove interference from pathogens. The results indicated that silage improved palatability and food intake. Reducing feed levels did not significantly alter the FCR or the performance of the birds. Growth promoters increased FCR but mortality was high. Probiotics were more effective when presented in liquid form than powder. The results show that data on effectiveness of feed supplements should be extrapolated to ostriches with caution.

Key words: Ostrich, probiotics, growth promoters, silage, feed

INTRODUCTION

In South Africa commercial ostrich farming began approximately 150 years ago, initially for feathers only, much later for the leather as well and only relatively recently for the meat (Mukaratirwa *et al.*, 2004). Ostrich meat is characterized by an extremely low intramuscular fat content, the meat has low cholesterol and is highly favoured by those very particular about fatty foods (Djarova, 1996). Domestic ostrich production in Zimbabwe began in 1985 and is still considered to be a new industry compared to well established operations in South Africa (Cooper *et al.*, 2004; Mukaratirwa *et al.*, 2004). The population of breeder birds stood at 6446 by the end of 2001 compared with an estimated population of 2000 wild birds in 1999. Zimbabwe ostrich population has been growing steadily and is now above 45000 birds (Mukaratirwa *et al.*, 2004). There is little scientifically based information on nutrient requirements and efficiency of nutrient utilization by ratites. Nevertheless, successful feeding programs have been developed by using basic physiological and historical information available about ostriches, combined with knowledge about the nutrient requirements of poultry and other species (Vaugh *et al.*, 2006; Page, 2003; Dzoma and Dorrestein, 1998). The ostrich is considered to be monogastric herbivore, with an ability to utilize substantial amounts of dietary forage. Ostriches have a relatively large true stomach (proventriculus) and gizzard, which have considerable food storage capacity. The small intestine of ostriches is relatively short and the large intestine is very long. Ostriches also possess relatively small ceca (Cooper and Mahroze, 2004; Aganga *et al.*, 2003; Jongbloed, 1998; Swart *et al.*, 1993). The objective of modern ostrich production is to

convert feedstuffs such as lucerne meal and cereal grains to skin, meat and feathers in the growing ostrich (Cooper, 2005; Cooper, 1999; Swart *et al.*, 1993). The natural diet of ostriches is mainly green grasses, berries, seeds, succulent plants and small insects. Silage may lack the nutritional value of commercially prepared formulas but its ability to enhance palatability makes it an important component of ostrich feed (Swart *et al.*, 1993; Aganga *et al.*, 2003). Ostrich's microbial population has been established in the intestines (Page, 2003). Research has shown that ostriches can digest up to 60% of the plant cell wall material in their diet (Swart *et al.*, 1993; Aganga *et al.*, 2003). Probiotics are dietary supplements of live microorganisms thought to be healthy for the host organism. According to the currently adopted definition by FAO/WHO, probiotics are: "Live microorganisms which when administered in adequate amounts confer a health benefit on the host" Lactic acid bacteria and bifidobacteria are the most common types of microbes used as probiotics; but also certain yeasts and bacilli are available. Probiotic bacteria also produce substances called bacteriocins, which act as natural bactericides (Wikipedia on line).

The aim of this study was to determine how effective silage, altered feed levels, growth promoters and probiotics were on the performance of farmed ostriches.

MATERIALS AND METHODS

All the birds used for the experiments were healthy, kept under high hygiene and vaccinated and dewormed to remove interference from pathogens. G2 which was the normal feed during these trials was constituted according to the recommendations of Cooper and

Horbanczuk (2004). Fresh water and feed were provided daily. All unused feed was removed and weighed daily to provide an estimate of daily feed intake. The pens were under full sun light and pens were cleaned daily. Results obtained were subjected to a statistical evaluation with the two-way analysis of Variance and Student's t test to examine statistical significance of differences in performance between the controls and the birds on treatment.

Experiment 1: Sixty birds, five months old and weighing about 55 kg were divided in 2 lots of 30 birds each. The holding pens were 15 m² per bird. One lot was given Normal grower concentrate, manufactured by Sondelani ranch (G2) alone; the other lot was given silage + G2 in the ratio (2:1). Performance parameters that included feed intake, growth rate and feed conversion efficiency were measured throughout the trial period. The trials went on for 70 days. The birds were weighed every 14 days.

Experiment 2: One hundred and forty grower ostriches weighing about 41 kg each were used for each of the five treatments for 63 days. Each bird had an area of 7.8 m² allocated. All the five groups were give G2 concentrate. One group had flavomycin an antimicrobial growth promoter added to the feed and allowed to feed ad libitum. The next lot had Zinc bacitricin an antimicrobial growth promoter added to the feed and allowed to feed ad libitum. The next lot was given feed with no antimicrobial supplements and was used as the control. The next lot was given feed amounting to 90% of the average consumed by the control group. The next lot was given feed amounting to 75% of the average consumed by the control group. Performance parameters such as live weights, mortality and feed intake were measured. Growth curves were plotted.

Experiment 3: Fifty day old chicks had lactosym probiotic administered to them as liquid at pH 3.7 and in powder 100 g per tone of feed for 37 days. A control group with no probiotics in its feed was kept. Each treatment was performed on 25 chicks. Performance parameters such as live weights, mortality and feed intake were measured.

RESULTS

Experiment 1: Provision of fresh feed, water and high hygiene excluded interference from pathogens and environmental factors. Comparison of performance parameters between ostriches fed on normal diet and those fed on diet fortified with silage are shown in Table 1. Comparison of weight gain on a 2 weekly basis between ostriches fed on normal diet and those fed on diet fortified with silage is shown in (Fig. 1). No significant difference occurred between the normal diet and that fortified with silage (p>0.05).

Table 1: Performance parameters of grower ostriches on diet fortified with silage and a control group. Time for the trials was 70 days. n = 30 birds per treatment

	G2 Normal	G2 Normal + Silage
Initial weight (kg)	55.30±0.42	56.50±0.27
Final live weight (kg)	79.13±1.01	83.08±0.97
Total weight (kg)	23.83±0.91	26.58±0.98
Average daily gain (kg)	0.38±0.01	0.42±0.02
Food intake (kg/bird/day)	2.41±0.40	3.84±0.34
FCR	5.73±0.32	6.37±0.43

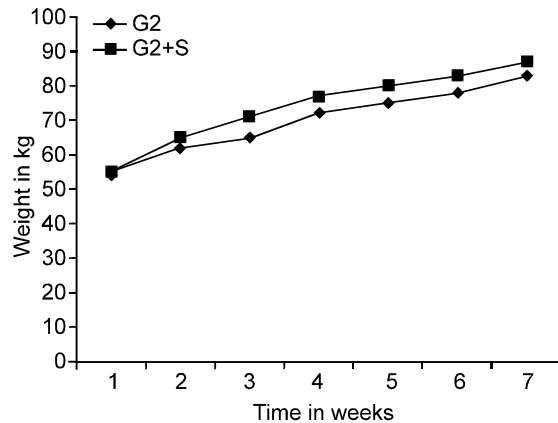


Fig. 1: Weight changes recorded weekly on growers on normal diet (G2) and that fortified with silage (G2+S)

Experiment 2: Performance parameters at 63 days for 5 month ostriches subjected to flavomycin and zinc bacitricin fortified feeds and another group given 75% and 90% feed levels and a control group given normal feed. n = 140 birds for each treatment are shown in Table 2. No significant difference occurred between the normal diet and those under treatments (p>0.05).

Experiment 3: Performance parameters at 37 days of day old ostrich chicks on diet fortified with lactosym as powder and as liquid and a control group. n = 25 birds for each treatment are shown in Table 3. Weight gains recorded fortnightly for birds fed on diet fortified with liquid and powder lactosym and the control group with no lactosym are shown in (Fig. 2). Feed intake recorded fortnightly for bird feed on diet fortified with liquid and powder lactosym and the control group with no lactosym are shown in (Fig. 3). No significant difference occurred between the normal diet and those with probiotic supplements (p>0.05).

DISCUSSION

While the silage provided by giving Lucerne and Brassica can never match 100% what silage ostriches get in the wild it is however close enough to be added into the requirements of ostrich feed as an induction of palatability to these birds. It is likely that the provision of

Table 2: Performance parameters at 63 days for 5 month ostriches subjected to flavomycin and zinc bacitracin fortified feeds and another group given 75% and 90% feed levels and a control group given normal feed. n = 140 birds for each treatment

	Flavomycin	Zinc bacitracin	75% level	90% level	Control
Initial live weight (kg)	40.7±0.63	41.8±0.46	40.8±0.36	41.8±0.46	41.9±0.39
Final live weight (63 days)	57.4±0.57	57±0.31	57.7±0.33	56.25±0.40	57.9±0.38
Weight gain (kg/bird/day)	16.7±0.04	15.2±0.06	16.9±0.06	14.45±0.05	16±0.05
Average growth (kg/bird/day)	0.27±0.01	0.24±0.01	0.27±0.02	0.23±0.01	0.25±0.01
Feed intake (kg/bird/day)	2±0.02	2±0.02	1.5±0.01	1.8±0.01	2±0.02
FCR	7.5±0.03	8.28±0.06	5.59±0.03	7.85±0.04	7.875±0.04

Table 3: Performance parameters at 37 days of day old ostrich chicks on diet fortified with lactosym as powder and as liquid and a control group. n = 25 birds for each treatment

	control	Lactosym liquid	Lactosym powder
Initial live weight (kg)	0.80±0.02	0.80±0.02	0.80±0.02
Final live weight (kg)(37 days)	4.60±0.03	4.65±0.03	4.48±0.02
Weight gain(kg)	3.80±0.03	3.85±0.02	3.68±0.03
Average growth (kg/bird/day)	0.136±0.01	0.138±0.01	0.132±0.01
Feed intake (kg/bird/day)	0.37±0.02	0.39±0.03	0.39±0.03
FCR	2.73±0.04	2.83±0.04	2.35±0.03
Cum Mort%	0	4	8

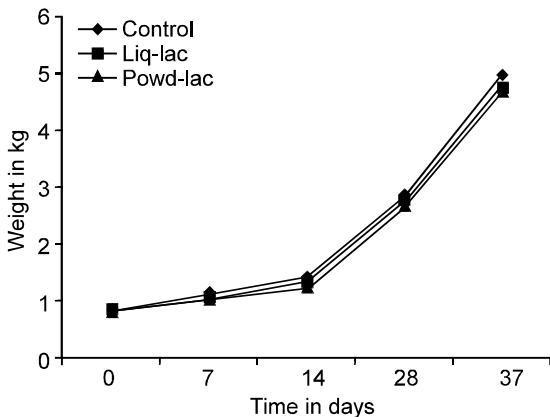


Fig. 2: Weight gains recorded fortnightly for birds fed on diet fortified with liquid and powder lactosym and the control group with no lactosym

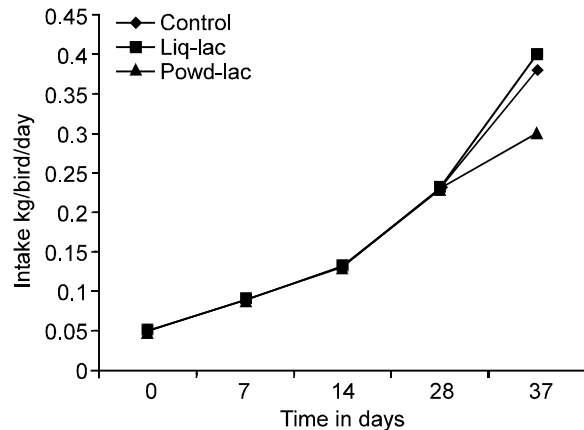


Fig. 3: Feed intake recorded fortnightly for bird feed on diet fortified with liquid and powder lactosym and the control group with no lactosym

silage stabilizes the intestinal physiology and microbiology in a beneficial way as pointed to by (Aganga *et al.*, 2003; Swart *et al.*, 1993). Our results are in agreement with (Swart *et al.*, 1993; Aganga *et al.*, 2003) that palatability enhances feed intake and complete digestion if it closely matches that in the wild. According to (Aganga *et al.*, 2003; Cooper, 1999; Swart *et al.*, 1993) the natural diet of ostriches which is mainly green grasses, berries, seeds, succulent plants and small insects. This is not difficult to match for birds in captivity. Silage is cheaper than commercial constituted formulations which are based on extrapolations of diets that are meant for other species as ducks (Waugh *et al.*, 2006; Aganga *et al.*, 2003; Cooper, 1999; Swart *et al.*, 1993). However there is still merit in using such diets provided attempts are made to keep them close to the wild. It is known that in human diet changes have introduced diseases such as early onset of diabetes, hypertension and other maladies (Djarova *et al.*, 2007;

Virtanen and Aro, 1994). Based on what happens in man it stands to reason that drastic changes to ostrich feed that drifts from the natural could have similar consequences hence our attempt to maintain the natural diet by adding silage. The bird's selection of its diet is based on longtime adaptation which takes into account availability, palatability and the physiological effects of such a diet (Waugh *et al.*, 2006; Aganga *et al.*, 2003; Cooper, 1999; Swart *et al.*, 1993). According to Cooper (2005) ostriches have a relatively large true stomach (proventriculus) and gizzard, which have considerable food storage capacity and a relatively short small intestine and the large intestine is very long with a relatively small ceca. This arrangement is suited for fermentative digestion of plant materials as pointed in earlier work that ostriches can digest up to 60% of the plant cell wall material (neutral detergent fiber) in their diet (Waugh *et al.*, 2006; Aganga *et al.*, 2003; Cooper,

1999; Swart *et al.*, 1993). Our results lend support to the notion that silage notwithstanding its low energy component should constitute a large proportion of ostrich feed. An informed evaluation of a diet, should determine the extent to which a particular ingredient such as silage can provide essential nutrients for growth and development and enhance the potential utilization of the nutrient to improve performance outcomes (Vaughn *et al.*, 2006; Aganga *et al.*, 2003; Cooper, 1999; Cooper and Palmer, 1994; Swart *et al.*, 1993).

Alteration of feed level is another strategy that should be exploited for enhancing performance because according to (Vaughn *et al.*, 2006; Aganga *et al.*, 2003; Cooper, 1999; Swart *et al.*, 1993) when there is less food in the intestine the bowel movements are slow and this allows more enzymatic digestion, absorption and more complete fermentations in the hind gut which may release more nutrients to the birds. This accounts for maintained high FCR even when feed levels were as low as 75%.

Antimicrobial growth promoters are said to function by eliminating unprofitable bacteria and promoting growth, when they have been administered to chicken they have brought great improvements in performance (Abdulrahim, 1999; Dutta and Devriese, 1982; Griffin, 1979; Bunyan *et al.*, 1977; Bird, 1968). In our study they increased FCR but mortality was high. The results show that data on effectiveness of feed supplements should be extrapolated to ostriches with caution. In particular zinc bacitracin seems to promote growth in other birds but that it did not help improve ostrich growth is a good indicator that results of beneficial effects can not be extrapolated without intensive research whose results should support such position.

Probiotics as live microorganisms which when administered in adequate amounts confer a health benefit (Foster, 1972) and have been shown as such in studies on fowls Griffin (1979) but in our study were not effective on improving ostrich performance on the contrary there was high mortality rate in such birds. Probiotics were more potent when presented in liquid form than powder.

Nutrition is a key element in ostrich production. It is only with an adequate knowledge of nutrient requirements at each growth stage of the ostrich that the correct contents of formulating diets will be realized. In the past, nutritional results obtained for poultry have been erroneously adopted to fit ostrich diets, thus resulting in various nutrition-related problems (Vaughn *et al.*, 2006; Aganga *et al.*, 2003; Cooper, 1999; Esteve-Garcia *et al.*, 1997; Swart *et al.*, 1993).

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