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## Evaluation of Dietary Protein Intake by Growing Ostriches

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### ABSTRACT

The protein requirements of growing ostriches have not been established. In an effort towards more understanding of the animal's needs for this nutrient two trials were carried out to evaluate the intake of protein (CP) from complete feeds by growing ostriches. In trial I, the comparative response of ostriches to diets containing High Protein (HP, 22.5% CP), Medium Protein (MP, 17.5% CP) or Low Protein (LP, 12.5% CP) protein content was determined, while the preference of these birds to the same three diets offered simultaneously in a free-choice feeding situation was investigated in trial II. Ostriches in trial I fed on HP or MP consumed more feed, gained more weight and were more efficient in converting feed to body weight than birds fed on LP. Differences in growth performance between the HP and MP groups were not significant. Birds on HP consumed more protein than those offered MP but this was not translated into superiority in growth. In trial II, where ostriches were offered either a sole MP feed or a free-choice of HP, MP and LP given simultaneously, birds on the single complete feed were more efficient in converting feed and protein into body weight than choice-fed animals. In choice feeding, MP was consumed at a significantly higher amount and proportion than that of either HP or LP which, between themselves was consumed in similar amounts. It was concluded that among the three diets studied, a medium protein feed with a CP content of 17.5% was most economical and optimum for growing ostriches. When presented with a choice of feeds with varying protein contents these birds were not able to select well for optimum growth performance.

**Key words:** Dietary protein, growing ostriches, choice feeding, growth performance

### INTRODUCTION

Protein and energy are two dietary components required in relatively large amounts by all animals. Being the most expensive nutrient, protein is a major concern for producers since feed accounts for 65-75% of the cost of raising agricultural animals including ostriches (Brand *et al.*, 2000). The inclusion of protein in feeds needs to be optimized for optimum performance as well as to minimize wastage. Unlike for other popular poultry such as the chicken, duck or turkey whose nutrient requirements have been determined (NRC, 1994), such requirements for the ostrich have yet to be established although Scheidele and Sell (1997) have offered some suggestions on their nutritional needs. Reports on the influence of dietary protein and energy on growth of the ostrich have been limited (Farrell *et al.*, 2000; Brand *et al.*, 2003; Cornetto *et al.*, 2003). Insofar as protein is concerned Scheidele (1996) suggested a dietary Crude Protein (CP) level of 16-20% for growing ostriches. These levels of requirement for optimum growth however can only be ascertained after more exhaustive research has been conducted.

When offered a feed choice, growing ostriches have been reported to exhibit selectivity rather than randomness. These have been exemplified by their preference for low-fibre over high-fibre feed (Azahan *et al.*, 1995) and high energy over low energy diet when both were offered simultaneously (Farrell *et al.*, 2000). The selectivity of the ostrich towards feed nutrients was further shown in a recent report (Azahan *et al.*, 2008) where growing ostriches given choices of various common feed ingredients managed to choose and consume similar amounts of protein from the array of ingredients on offer as those animals given a single complete feed. These choice-fed animals however did not perform as well as those on the complete feed.

To further understand dietary protein needs of the growing ostriches two approaches were investigated and reported in this study.

## **MATERIALS AND METHODS**

Two trials were carried out in 2005 on locally-hatched ostriches of the African Black crosses reared in confinement at the MARDI (Malaysian Agricultural Research and Development Institute) Experimental Station in Serdang, Malaysia. Trial I utilized 18 growing ostriches aged between 10 and 14 weeks. The animals were divided into nine equal groups of two birds each with each group having similar total body weights. Three groups were provided a low-protein feed (LP, 12.5% CP), another three on a medium-protein feed (MP, 17.5% CP) while the last three groups received a high-protein feed (HP, 22.5% CP). All experimental feeds were calculated to contain 11.2% crude fibre. There were therefore three dietary treatments, each treatment being replicated three times. The trial was carried out over a period of six weeks. All animals were individually weighed at the beginning and at the end of the trial while the intake of feed over the duration of the study was measured by replicate. At the end of the trial, the gain in body weight was calculated by replicate and from the amount of feed consumed, feed conversion ratio, intake of crude protein and protein efficiency ratio were calculated for each replicate.

In trial II, 12 growing ostriches of similar body weights aged between 15 and 16 weeks were used. The birds were divided into two equal treatment groups with each group having similar total body weights. Each treatment was replicated three times with two birds in each replicate. Birds in treatment 1 (control) were given a complete Medium-Protein feed (MP) similar to that used in trial I (17.5% CP and 11.2% CF) while birds in treatment 2 were given a free-choice of three complete feeds of different protein contents, similar to those used in trial I (LP, MP and HP feeds). For each replicate in the free-choice group, the three feeds were provided separately and simultaneously in similar feed troughs. The positions of the troughs were randomly rotated daily to avoid possibility of bias. At the end of the four-week trial, intakes of each of the three types of feed as well as the total amount of feed consumed were recorded by replicate. The intake of each type of feed as a proportion of total intake was calculated. From the feed intake data, feed conversion ratio, protein intake and protein efficiency ratio were calculated.

In both trials, all feeds were provided *ad libitum* while fresh drinking water was made available at all times. Results were analysed statistically using Analysis of Variance (ANOVA) procedure of SAS (1991).

## **RESULTS AND DISCUSSION**

Ostriches in trial I fed on MP or HP feed consumed more feed, grew better and were more efficient in converting feed to body weight than birds fed on LP feed (Table 1). Differences in growth performance between the two higher protein groups were inconsistent and

Table 1: Effect of dietary Crude Protein (CP) level on growth performance of ostriches over six weeks

Treatment	Body weight gain (kg/bird)	Feed intake (kg/bird)	Protein intake (kg/bird)	FCR	Protein efficiency ratio
Low protein (12.5% CP)	9.49±1.91 <sup>a</sup>	30.32±6.87 <sup>a</sup>	3.79±0.86 <sup>a</sup>	3.19±0.28 <sup>a</sup>	0.398±0.035 <sup>a</sup>
Medium protein (17.5% CP)	13.76±0.98 <sup>b</sup>	38.46±2.88 <sup>b</sup>	6.73±0.50 <sup>b</sup>	2.79±0.02 <sup>b</sup>	0.489±0.004 <sup>ab</sup>
High protein (22.5% CP)	14.64±1.28 <sup>b</sup>	37.18±4.07 <sup>ab</sup>	8.36±0.92 <sup>c</sup>	2.56±0.43 <sup>b</sup>	0.576±0.098 <sup>bc</sup>

Value are as Means±SD. Means in the same column with different superscripts were different ( $p < 0.05$ ), FCR: Feed conversion ratio, SD: Standard deviation

not significant ( $p > 0.05$ ). Birds on HP feed however, consumed more protein than those on MP feed which in turn recorded significantly higher protein intake than birds given the LP feed ( $p < 0.05$ ). Over the study period of six weeks the amount of protein consumed by the LP, MP and HP groups were 3.79, 6.73 and 8.36 kg bird<sup>-1</sup>, respectively. The Protein Efficiency Ratio (PER) calculated over the 6-week trial period for the LP, MP and HP groups were 0.398, 0.489 and 0.576, respectively. Ostriches on the LP feed was more efficient ( $p < 0.05$ ) than those on HP feed in utilizing protein for growth. The reverse however was true for the capability in the utilization of total feed.

In agreement with the findings of this study, the superiority of high protein feed over one of low protein was also reported by Farrell *et al.* (2000) and Brand *et al.* (2000) on growing ostriches, and by Blake and Hess (2004) on another ratite, the emu. In their study, Brand *et al.* (2000) observed superiority for birds on 17% CP feed over those on 13% CP feed only at the age of 4 to 5 months, the age which was comparable to the birds used in this study. When the trial was extended to 11 months they reported that growth from 4 to 11 months was not significantly different between the two protein level groups implying the declining effect of protein level on growth as the birds aged. It was also noted that the feed conversion ratio values obtained with birds in the current study were lower than the values reported for birds of similar age group (9-18 weeks) fed with a 14% crude protein feed (Waugh *et al.*, 2006) but were comparable to the values observed by Cooper (2005). Probably the factor of breed, among others, could have accounted for the inconsistencies reported.

In the present study, although birds on HP consumed more protein than those on MP, growth performance between the two groups was similar. Apparently the extra protein consumed by the HP birds could not be utilised productively by growing ostriches and were probably eliminated via faecal nitrogen as reported for other animals such as the pig (Zervas and Zijlstra, 2002). The same probably occurred with the high protein birds of Brand *et al.* (2000) at the more advanced age beyond five months.

When the HP, MP and LP feeds were offered simultaneously on a free-choice basis in trial II, growing ostriches were observed to consume significantly more of the MP than either the HP or LP feed (Table 2). Of the total feed consumed, about 50% comprised the MP feed. The difference in intake between the HP and LP feeds was not significant, each contributing to some 21.5% and 27.8%, respectively to the total feed intake. Over the duration of the study period, the ostrich consumed between 216 and 248 g crude protein per bird per day, the difference between free-choice and control groups being not significant (Table 3).

Birds given a single complete feed were more efficient in converting both feed and protein into body weight than those given a choice of three feeds of different protein contents, suggesting the inability of the growing ostrich to capitalize on the luxury of feed choice by selecting the right feed combination for optimum efficiency. The protein efficiency ratio value of 0.556 (Table 3) observed for the control group in trial II was numerically higher than the mean value observed in trial I

Table 2: Amount and proportion of feed consumed by growing ostriches offered a choice of high, medium and low crude protein (CP) feeds over four weeks

Treatment	High protein feed (22.5%)	Medium protein feed (17.5%)	Low protein feed (12.5%)
Feed intake (g/bird/day)	292±23 <sup>a</sup>	710±246 <sup>b</sup>	373±78 <sup>a</sup>
Proportion of total feed intake (%)	21.5±2.8 <sup>a</sup>	50.7±10.9 <sup>b</sup>	27.8±8.2 <sup>a</sup>

Value are as Means±SD. Means in the same row with different superscripts were different (p<0.05), SD: Standard deviation

Table 3: Growth performance of growing ostriches fed on a single complete feed (control) or given a free-choice of three complete feeds of differing protein contents over four weeks

Treatment	Body weight gain (g/bird/day)	Feed intake (g/bird/day)	Protein intake (g/bird/day)	Feed conversion ratio	Protein efficiency ratio
Single feed (control)	392±58	1235±96	216±17	3.18±0.26	0.556±0.046
Choice of three feeds	334±37 <sup>ns</sup>	1442±97 <sup>*</sup>	248±21 <sup>ns</sup>	4.37±0.79 <sup>*</sup>	0.753±0.147 <sup>*</sup>

Value are as Means±SD. \*Indicates differences between treatment means were significant (p<0.05), ns: Not significantly different between treatments, SD: Standard deviation

for the same type of feed (0.489 in Table 1). Although the values were not amenable to statistical analysis, they could indicate the possible superiority of the younger birds of trial I in converting protein to body weight over the older birds in trial II. A similar indication of the probable superiority of the younger birds was observed for feed conversion ratio (2.79 in Table 1 and 3.18 in Table 3 for younger and older birds, respectively).

In a choice feeding situation, the ability of growing ostriches to choose between diets of varying nutrient contents has been shown for fibre (Azahan *et al.*, 1995; Azahan, 2004), energy (Farrell *et al.*, 2000) and protein (Azahan *et al.*, 1995; Farrell *et al.*, 2000). Insofar as protein is concerned, the preference for certain levels of dietary protein over other levels has also been shown in the broiler chicken (Cerrate *et al.*, 2007, 2008). These results suggested the ability of the growing broiler chicken to regulate protein intake under differing nutritional conditions. With the growing ostrich of the present study however, the birds preferred a medium protein feed (17% CP) over that of low (12.5% CP) or high protein (22.5%). The choice-fed ostriches were also significantly less efficient in converting feed and protein into body weight than control birds. This contradiction in response between the two avian species was probably attributed to genetics. Although both the broiler chicken and the ostrich are considered poultry, large differences exist between them, in particular in their gastrointestinal tracts and their digestive ability (Scheileder and Sell, 1997).

Whilst the present study further emphasized the ability of growing ostriches to choose between different feeds rather than consuming them at random, this selection was probably not related to the nutritional or physiological needs of their body for optimum performance. This was amply shown by the relative inefficiency of the choice-fed birds to convert feed and nutrient (protein) into body weight. There was also an indication that these birds did not gain as much weight as those fed on a single medium-protein feed.

## CONCLUSION

Results from this study, indicated that for growing ostriches under the age of 20 weeks fed on the three types of feed investigated, feed containing 17% CP was optimum. Feeding growing ostriches on higher protein feed not only could be wasteful but would probably pollute the environment through the excretion of more unutilized nitrogen. Growing ostriches exhibited selectivity rather than randomness when offered a choice of feeds of varying protein contents but they were not able to select well for optimum body needs and performance.

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