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The response in food intake and reproductive parameters of breeding ostriches to increasing dietary energy

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Abstract

Elucidating the factors affecting feed intake is important when quantifying nutrient responses in breeding ostriches. The experiment was conducted to determine to what extent dietary energy content will affect the important production parameters of breeding ostriches. Ninety pairs of breeding ostriches were divided into six groups, consisting of 15 breeding pairs per group. Six diets with increasing metabolisable energy content (8.0, 8.7, 9.4, 10.1, 10.8 and 11.5 MJ ME/kg feed) were provided *ad libitum* to birds during the breeding season. All the other nutrients were kept constant in all feeds. Responses were measured by simple linear regression. Average daily feed intake (3.7 ± 0.2 kg) was unaffected by energy content as were all the reproductive parameters measured, including total eggs produced per female (45.6 ± 5.8), number of chicks hatched (21.3 ± 4.5), number of infertile eggs (11.6 ± 3.6), number of dead-in-shell eggs (7.5 ± 1.8) and egg weight (1406 ± 31 g). However, the significant increase in live mass of both males and females indicated that energy was over-consumed as the energy content of the diet was increased. Breeding ostriches did not regulate feed intake according to dietary energy content but instead based their intake on the concentration of the limiting nutrient in the feed.

Keywords: Feed intake regulation, response to energy, egg production, chick production
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Introduction

Gaining scientific information pertaining to the nutrient requirements of breeding ostriches is much needed in order to feed breeding ostriches to optimize production. Little work has been done on ostrich nutrition, and it is not common practice to apply broiler breeder feeding strategies for breeding ostriches.

Feed intake of animals may be predicted by considering the interaction between the animal, the feed and the environment (Emmans, 1981). A common belief is that birds and animals eat to satisfy their requirement for energy (Leeson *et al*., 1996) but this is seldom the case, the controlling factor being the level of the first limiting nutrient in the feed (Emmans, 1981), although Brand *et al*. (2000; 2004) provided evidence that slaughter ostriches are able to regulate their feed intake at various dietary energy levels.

Knowledge of the effects of dietary energy on feed intake and reproduction of ostriches would prove beneficial in improving our understanding of the nutrition of ostriches.

Materials and Methods

Ninety pairs of breeding ostriches were used in the trial. They were divided into six groups, consisting of 15 breeding pairs per group, and each group was given one of the six trial feeds *ad libitum*. Two basal diets were formulated from which the six diets of increasing ME content (8.0, 8.7, 9.4, 10.1, 10.8 and 11.5 MJ ME/kg feed) were made. Dietary protein and lysine were held constant in all diets at 120 and 6.0 g/kg feed respectively. The nutrient composition of the two basal diets is given in Table 1 and their raw material composition in Table 2. The trial was conducted in Oudtshoorn (South Africa) during the 2008 breeding season. The annual breeding season in South Africa starts in June and ends in January of the following year. The age of the birds varied between 2 and 10 years. Each breeding pair (one male, one female) was kept in a separate breeding camp. Feed was allocated to each pen in the morning three times a week, and eggs were collected daily.

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The average daily feed intake/bird was calculated by subtracting the feed not consumed from the amount allocated each day, averaged over the two birds and over the whole season. The assumption is therefore that the male and female in each camp consumed the same quantity of feed. Production parameters such as egg and chick production, dead-in-shell and infertile egg production were measured at the end of each month. The change in body mass of the breeding birds over the season was also measured. Statistical analyses were performed on the data using Genstat (2008) for regression analysis. To analyze the effect of age on the data a simple linear regression with groups was used.

Table 1 Formulated nutrient composition (g/kg) of the two basal feeds used

	Metabolisable energy (MJ/kg feed)	
	8.0	11.5
Crude protein	120	120
Lysine	6.0	6.0
Methionine & cysteine	4.6	4.7
Threonine	4.5	4.5
Arginine	5.9	6.3
Tryptophan	1.5	1.3
Fat	18.0	46
Fatty acid C18:2	0	15
Crude fibre	207	70
Calcium	26	25
Phosphorus	6.0	6.0

Table 2 Raw material composition (g/kg) of the two basal feeds

	Metabolisable energy (MJ ME/kg feed)	
	8.0	11.5
Oats hulls	619	0
Maize	0	536
Lucerne meal	0	173
Canola oilcake meal	242	108
Flaxseed	0	50
Limestone	45	40
Dicalcium phosphate	28	25
Molasses meal	50	50
Salt	10	10
Vitamin & mineral premix	5.0	5.0
L-lysine HCl	0.3	0.3

Results and Discussion

Results are shown in Table 3. Average daily feed intake/bird was the same on each of the dietary treatments, with mean intake being 3.7 ± 0.2 kg and the slope of the regression against dietary ME content being -0.013 ± 0.06 kg/MJ ME. This result is in contrast to those of Brand *et al*. (2004) and Brand *et al*. (2000) for slaughter ostriches where a reduction in food intake resulted from an increase in ME content.

Previous studies revealed that a daily ME intake of 22 MJ ME/kg bird was sufficient to meet the energy needs of female breeders (Brand & Gous, 2006). At an intake of 3.7 kg the dietary ME content required would thus be only 5.9 MJ/kg, this being considerably lower than the lowest ME used in this trial. Body weight of males and females increased with dietary energy content indicating that energy in excess of requirement was consumed as dietary ME increased (see below). This principle was also described by Brand & Gous (2006). The study also revealed that the age of the females had an influence on feed intake with older birds tending to consume more feed daily, which may be ascribed to higher maintenance and egg production costs. It is of interest to note that the age of males did not influence the energy consumed.

Table 3 Average feed intake (kg) and production records of ostrich birds fed diets varying in ME content

	Dietary energy content (MJ ME/kg feed)						
	8.0	8.7	9.4	10.1	10.8	11.5	SE[2]
Average daily feed intake (kg/bird)	3.7	3.8	3.7	3.9	3.7	3.7	0.2
Egg production (eggs/female/season) (n[1] = 90)	47.2	43.9	48.3	57.1	33.6	43.7	5.8
Chick production (chicks/female/season)	20.0	18.3	18.5	32.6	16.5	21.6	4.5
Dead-in-shell eggs (eggs/female/season)	7.2	7.7	7.2	11.1	5.1	6.9	1.8
Infertile eggs (eggs/female/season)	13.7	13.9	16.7	7.7	7.8	9.7	3.6
Female start mass (kg)	119	115	111	113	117	119	3.3
Female end mass (kg)	116	117	114	111	118	129	4.0
Male start mass (kg)	118	125	121	120	120	118	3.3
Male end mass (kg)	123	128	126	131	131	134	4.9
Mass change of females (kg)	-2.1	1.6	3.2	4.9	0.9	10.0	3.4
Mass change of males (kg)	5.3	2.8	5.1	10.8	11.3	15.6	2.4
Egg weight (g)	1488	1384	1367	1396	1374	1426	31.1

[1]n = number of birds; [2]se = standard error.

By virtue of the dietary treatments used, where only the ME content of the feed was altered, it is apparent that the ostriches were supplied with adequate amounts of energy, but were regulating food intake on the basis of one or more of the essential nutrients in the feeds, the concentrations of which were the same in both basal feeds. This provides good evidence that birds eat to satisfy their requirement for the limiting nutrient in the feed (Emmans & Fisher, 1986; Burnham *et al*., 1992) and that dietary energy content is very seldom limiting when birds are offered feed *ad libitum*.

Dietary energy content did not influence the number of eggs produced per female per season (mean = 45.6 ± 5.8; regression coefficient (b) of -1.63 ± 2.04), number of chicks hatched (mean = 21.3 ± 4.5; b = 0.67 ± 1.57), number of infertile eggs (mean = 11.6 ± 3.6; b = -1.93 ± 1.22) or number of dead-in-shell eggs (mean = 7.5 ± 1.8; b = -0.22 ± 0.64). In all cases the regression coefficient reflecting the response to dietary energy content was not different from zero ($P > 0.05$). Monthly egg production per treatment is illustrated in Fig.1.

Mean change in female bodyweight over the reproductive period was 3.1 ± 3.4 kg. The composition of the gain is likely to be body lipid only. Body weight increased by 2.46 (± 1.15) kg/MJ increase in dietary ME ($P < 0.05$). It is unlikely that the body weight of females needs to increase during the laying period, so it is suggested that the observed increase on the higher ME diets can be regarded as being a waste of energy.

The increase in bodyweight of males was considerably greater than that in females, the regression coefficient being 3.37 (± 0.82) ($P < 0.01$). Pond *et al*. (2005), among others, suggested that energy intake which is more than the current needs results in a net deposition of triglycerides and the animal will consequently become fatter.

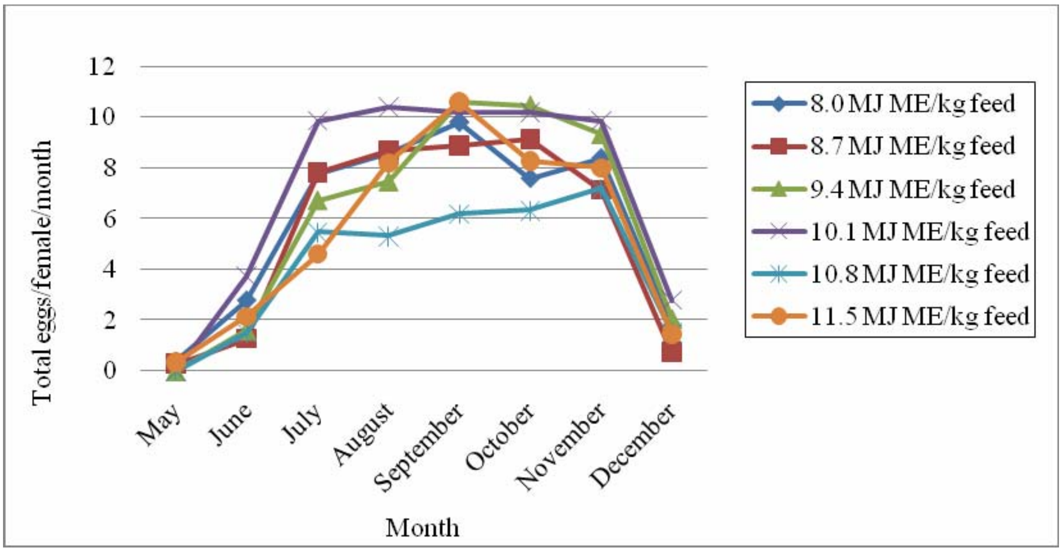

Figure 1 Egg production of breeding ostriches fed six experimental diets varying in ME content.

Although ostriches of different ages produced eggs with differing mean weights, the mean egg weight at each age was unaffected by the dietary energy content (-18.5 ± 11.2 g/MJ ME/kg feed).

Conclusion

In this study breeding ostriches did not regulate their feed intake according to the dietary energy level, in all cases consuming in excess of the minimum suggested intake of 22 MJ ME/day. Consequently, the wide range of dietary treatments had no effect on egg production, fertility or hatchability. It was evident from the increase in body weight with dietary ME content that females and males over-consumed energy as the ME content was increased. The reason for the lack of response in food intake to dietary ME content is that the birds were eating to satisfy one or more of the essential nutrients that were limiting in the feed.

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