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Growth Rate and Feed Conversion Rate of Ostriches Fed Ration with or Without Grit in Botswana

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Abstract: The objectives of this study were to investigate the effect of grit on the growth rate, feed intake and feed conversion efficiency of ostrich chicks which were given grit and those not provided with grit. Six female and four male ostrich chicks aged nine (9) weeks were randomly assigned into two feeding groups using completely randomized experimental design. In each feeding group there were five young birds raised in a pen. All the young birds were fed with ostrich grower's mash and water *ad libitum*. One group had access to grit during the study while other group did not. At week 18 weeks feed given to both groups of young ostriches and leftover were weighed on daily basis. Body weights were recorded on a monthly basis throughout the study. Average daily feed intake and average daily weight gain were determined. Feed conversion efficiency was calculated using average daily feed intake and average daily weight gain. The data was analyzed using Student - t analysis at $P<0.05$. Average daily weight gain was higher (0.38 ± 0.03 kg/d) in ostrich chicks that had access to grit as compared to ostrich chicks (0.37 ± 0.04kg/d) that had no access to grit. Average daily feed (dry matter) intake was higher (1.95 ±0.27kg/d) in ostriches that had no access to grit than those (1.94 ± 0.20kg/d) access to grit. Feed conversion efficiency of ostriches with access to grit was higher (5.11 ± 0.93) than those (5.27 ± 1.30) without access to grit. Giving grit to young ostriches should be recommended both to improve growth rate and feed conversion efficiency and to reduce feed intake.

Key words: Ostriches, grit, ration, feed intake, growth rate

Introduction

Ostriches (*Struthio camelus)* are the world's largest living birds which belong to the family of flightless birds known as Ratitae or the running birds. The growth and live weight development of ostriches depend on feeding and management and the feed intake of ostriches depends mainly on their current live weight and the energy contents or energy density of the feed ration (Kreibich and Sommer, 1995). When fed an all mash ration (concentrate) ad libitum the daily feed intake of growing ostriches amounts to 3-4% of their live weight and only at the end of their growing period the feed intake of the birds diminish (Kreibich and Sommer, 1995). Young ostrich chicks less than two months have high feed conversion to body mass ratio of 2:1, which requires very accurate and careful management of chick nutrition (Cooper, 2005*)*. The water usage of the ostrich is similar to that of the other large savannah and desert animals such as antelope and camel although the partitioning of water loss differs. The ratio of water intake to dry matter is relatively constant at about 2:3 (Aganga *et al*., 2003).

Male ostriches have to be raised separately because they grow faster than the females and they require a higher protein diet. They are also more efficient feed converters for longer periods than hens (Cooper, 2005*)*. The early rate of growth of ostrich chicks is important in establishing the birds for subsequent growth up to slaughter mass. Hatching weight is dependent on the initial egg mass from which the bird emerges. After hatching ostrich chicks lose up to 20% of their mass within five to seven days (Deeming, 1999). Adequate nutrition is essential for good ostrich productivity and an effective way of providing the required nutrients is by mixed feed formulations with green feed plus grit for efficient digestion (Cooper and Horbanczuk, 2004).

Ostriches have very efficient feed conversions during the first 210 days of their life but after 330 days, they become inefficient and their feed conversion drops (Aganga *et al*., 2000). The ostrich chick has the highest feed conversion to the body mass ratio at hatching to two months old is 2:1 at two to four months old and 3.8:1 at four to six months (Cooper, 2005). In the wild, ostriches ingest pebbles and coarse sand in order to assist the gizzard in its grinding action on the food, but if the birds are kept indoors or in a fenced paddock and have no access to such materials, additional grit must be fed and small pebbles are quite suitable for this purpose (Kreibich and Sommer, 1995). Grits are used to grind the feed into smaller particles and these grits are usually worn down gradually and never excreted whole. These small stones offered to ostrich chicks should be round in shape and not angular stones to prevent damage of the gastro-intestinal tract by the sharp edges (Aganga *et al*., 2000). Some ostrich farmers offer grit or coarse sand freely to their ostrich chicks, others fear possible losses by

stomach or intestine impaction and strongly reject this practice and prefer to add suitable materials to the chicks feed (Kreibich and Sommer, 1995). Limestone grit or seashell are just as suitable and provide an extra source of calcium. When the birds are grazing regularly, additional grit is required only to meet demand for calcium (Kreibich and Sommer, 1995).

The ostrich is an important animal in many livestock industries and in the developing world ostrich production is a valuable source of foreign currency netted from the export of meat and skins. Its successful growth and reproductive performance is dependent upon good nutrition (Cooper *et al.*, 2004). By feeding the ostrich a good balanced diets one can achieve maximum growth by ten months. The early rate of growth of ostrich chicks is important in establishing the birds for subsequent growth up to slaughter mass. Accordingly, the varying requirements of ostriches in different physiological states (growth, maintenance, reproduction) have to be taken into account for feeding. Feed palatability is important in stimulating feed ingestion by the birds. There is little scientific information on the importance of grit in ostrich nutrition and this has led to some ostrich farmers rejecting grit practices because of the fear of gastrointestinal impaction which may lead to death of birds especially ostrich chicks. The objectives of this study were to determine the growth rate of ostriches fed rations containing grit or without grit and to determine the effect of grit on feed intake and feed conversion efficiency of ostriches.

Materials and Methods

The study was conducted at Botswana College of Agriculture Notwane Farm located along Sebele-Francistown road which is north east outside Gaborone the capital city of Botswana. The altitude of the area is 3256 ft and the coordinates are S24°34.832' and E025°58.394'.The Global Positioning System marketed by Garmin was used to obtain this information. The climate is semi-arid. Precipitation averages about 450mm annually, occurs between November and April. The average daily temperatures ranged from 2.6°C as minimum to 34.9°C as maximum and the average monthly rainfall was 56.15mm during the study period. The vegetation is the mixed *Acacia/Combretum* tree savanna. Ten ostrich chicks were used for the study. Four of the chicks were male and the remaining six were female. The duration of this study was six months.

The ostrich chicks were bought from Maradu farm in Lobatse where the production system is intensive and they were bought at three weeks old. The chicks were randomly allocated to two feeding groups using a Complete Randomized Design and were reared intensively. In the two treatment pens of five birds each, one pen had concrete floor and the other one had the normal range floor, which is bare ground. The structures were rectangular enclosures made up of chicken mesh wire with wooden poles along the sides and roofed with corrugated iron sheets. The pen with concrete floor measured 26.2m by 5.1m while the other pen with earth floor measured 34.4m by 6.0m. Feeding troughs and watering troughs were provided in each pen. The feeding troughs were made from fibre-glass with 1.025m length , 0.45m width and 0.21m depth while the watering troughs measure 2.28m long by 0.5m width by 0.24m depth. The ostrich chicks in each pen were identified by numbers on their neck tags. Water was supplied on *ad libitum* basis in both treatments. Phenix stresspac which is a water soluble vitamins and electrolytes for poultry and ostriches was added to the drinking water for both groups at the rate of 100g per 200litres of water and made available for 2-6 days. The composition per kg of the phenix stresspac is as follows: vitamin A 15 000 000 I.U., vitamin E 25 000 mg, riboflavin 5000mg, pyridoxine 2000 mg, folic acid 500 mg, pantothenic acid 10000 mg, sodium chloride 150000mg, vitamin D3 1500 000 I.U., vitamin K 4000 mg, niacin 2500mg, vitamin B12 20 mg, biotin 40 mg, vitamin C 150 000mg, potassium chloride 10 000mg. The birds in both treatments were fed daily on ostrich grower concentrate with the composition shown in Table 1.

Table 1: Ostrich growers concentrate's composition

Nutrient	Composition
Protein	140g/kg(min)
Moisture	132g/kg(max)
Crude fat	40g/kg(min)
Crude fibre	175g/kg(max)
Calcium	12g/kg(max)
Phosphorus	4g/kg(max)
Lysine	8g/kg(min)

The ostrich chicks that were on the earth floor were given small stones as grit.

The feed given to birds were weighed every day and the leftovers also weighed separately. The feed was weighed with scale manufactured by Salter and calibrated to 1g accuracy with a capacity of 25kg. Using data on body weight and feed intake, the feed conversion efficiency was calculated . The growing ostriches were weighed for initial body weight and monthly thereafter, which was used for calculation of growth rate. Weight was taken using an electronic balance D28 manufactured by Teraoka with accuracy of 0.01g. SAS System was used to analyze the data.

Results and Discussion

Average daily feed intake on dry matter basis at one to six month of the study is given in Table 2. The one month data revealed that young ostriches that had no access to grit had higher feed intake (1.70 ± 0.12) kg than those

Table 2: Average daily feed intake (kg/day on dry matter basis), average daily body weight gain (ADG) (kg/day) and the feed conversion efficiency (FE) of ostriches with access to and those without access to grit

DAYS	Feed Intake (No grit)	Feed Intake (Grit)
Day 1-30	1.70 ± 0.12	1.42 ± 0.12
Day 31-60	1.91 ± 0.15	1.90 ± 0.15
Day 61-90	1.95 ± 0.13	1.97 ± 0.02
Day 91-120	1.95 ± 0.30	1.93 ± 0.17
Day 121-150	1.94 ± 0.26	2.30 ± 0.16
Day 151-171	2.26 ± 0.23	2.10 ± 0.22
Day 1-171	1.95 ± 0.27	1.94 ± 0.20
DAYS	ADG (kg/day) (No grit)	ADG (kg/day) (Grit)
Day 1-30	0.55 ± 0.01	0.50 ± 0.06
Day 31-60	0.49 ± 0.12	0.43 ±0.03
Day 61-90	0.30 ± 0.02	0.30 ± 0.04
Day 91-120	0.29 ± 0.03	0.38 ± 0.04
Day 121-150	0.28 ± 0.05	0.33 ± 0.03
Day 151-171	0.32 ± 0.05	0.36 ± 0.03
Day 1-171	0.37 ± 0.04	0.38 ± 0.03
DAYS	FE (No grit)	FE (Grit)
Day 1-30	3.09 ± 0.27	2.84 ± 0.64
Day 31-60	3.90±1.26	4.42 ± 0.67
Day 61-90	6.50 ± 0.87	6.57 ± 0.94
Day 91-120	6.72 ± 4.80	5.08 ± 0.98
Day 121-150	6.92 ± 41.97	6.97 ± 1.15
Day 151-171	7.06 ± 15.15	5.83 ± 1.12
Day 1-171	5.27 ± 1.30	5.11 ± 0.93

that had access to grit (1.42 ± 0.12) kg . In month 2-3 of the study those which had access to grit had increased average feed intake (1.90 ± 0.15) and (1.97 ± 0.02), more than those that had no access to grit (1.91 ±0.15 kg) and (1.95 ±0.13). In the fifth month of the study, feed intake of young ostriches that had access to grit was higher (2.30 ± 0.16) than that of the chicks that had no access to grit (1.94± 0.26). The average daily feed intake during the study for ostriches that had access to grit was lower (1.94 ±0.20 kg) than those that had no access to grit (1.95 ±0.27). In months one and two of the study the body weight gain of the ostriches that had no access to grit was higher (0.55 ± 0.01 and 0.49 ±0.12 respectively) than those with access to girt (0.47 ± 0.06 kg/d and 0.43 ± 0.03 kg/d respectively).

There was no difference ($p>0.05$) observed in the body weight gain between the two groups as they both gained 0.30 kg in third month of the study (Fig. 1). From month three to the last month of the study, body weight gain of the ostriches that had no access to grit was drastically reduced from 0.29 ± 0.03kg/d to 0.28 ±0.05kg/d and in the last month it started to rise to 0.32 ±0.05 kg/d (Fig. 1). However for those that had access to grit, they gained more weight from the third month of the study (0.38±0.04, 0.33 ±0.03 and 0.36 ±0.03 kg/d) respectively (Table 2). The average daily weight gain observed between the two groups during the entire duration of the study was 0.37 ±0.04 kg/d for the no grit group and 0.38 ± 0.03 kg/d for the grit group. Ostriches that had access to grit had a higher average daily body weight gain than the group that had no access to grit.

Young ostriches that had access to grit had higher feed conversion efficiency (5.27±1.30) than those that had no access to grit (5.11±0.93) (Table 2). The growth rate of the two groups of the ostriches is given in Fig. 2 which shows that in the first month to the third month both groups grew at a relatively constant rate, but the non-grit group had a faster average growth rate about 0.50 kg per month than the group that had access to grit which grew at a rate of 0.40kg per month. At fourth month of the study, the two groups, grew almost at the same rate ($p>0.05$) which later declined on the part of non- grit group, but increased for the group offered grit (Fig. 2). In the last two months of the study the group fed grit grew at a relatively steady rate of 1.32kg per month (p, 0.05) but ostriches in the group without access to grit had reduced growth rate to an average of 0.58 kg per month. The lower feed intake in month one may be associated with the metabolic process of the birds which is high hence a more efficient digestive system when the birds are still young (Cooper, 2005). The increase in feed intake during months two and three of the grit group could be attributed to the effect of grit which meant that more feed was digested efficiently and increased growth rate. However for those ostriches that had no access to grit, there was a lower digestion hence more feed has to be ingested to compensate for poorly digested feed.

There was a significant difference ($p<0.05$) observed between the two groups on the feed intake during the last three months of the study, the group that had no access to grit had higher average daily feed intake (1.95 ± 0.27kg) than those with access to grit (1.94 ± 0.20 kg) (Table 2). The difference could be due to improved digestibility of ingesta as a result of improved grinding capability enhanced by the presence of grit . In contrast the group that had no access to grit had higher rate of passage of ingesta through the gut thus a higher feed intake since ingested feeds are poorly digested hence more feed was ingested to compensate for the nutrients required. In addition for those with access to grit, the grit stimulated the secretion of digestive enzymes and aided the mixing of these enzymes with the ingesta (Gionfriddo and Best, 1995). This meant that ingested feeds were efficiently digested and the body nutrient requirement was well met (Ryan, 2002). The average daily body weight gain was high in the first month for the two groups, 0.55 ± 0.01kg and 0.50 ± 0.06kg (non-grit and grit respectively). This may be attributable more to the metabolic process which tends to be high during their early stage of growth (Cooper, 2005) rather than to the presence of grits.

There was no significant difference ($p>0.05$) observed in body weight gain between the groups in the third month of the study, they both gained 0.30 ±0.02, kg. From the fourth month to the sixth month, there was a significant

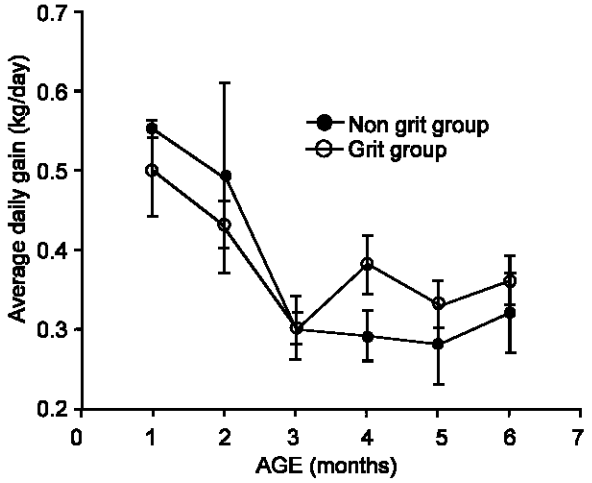

Fig. 1: Average daily body weight gain of ostriches with access those without access to grit.

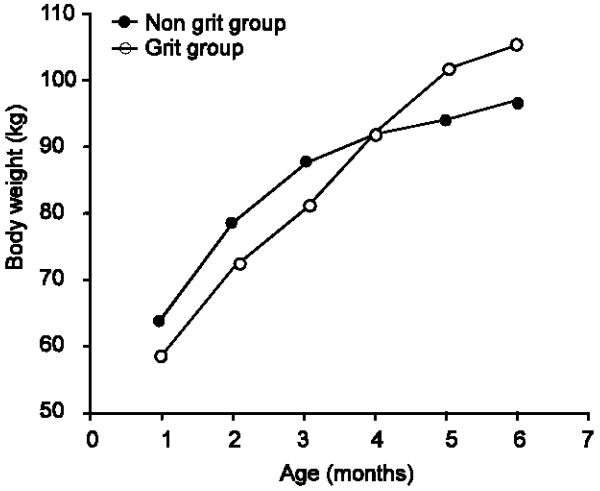

Fig. 2: Growth rate of ostriches that had access and those without access to grit.

difference in body weight gain ($p<0.05$). The weight gain of the group that had no access to grit declined while for those that had access to grit increased. This might have been due to the effect of a hemorrhagic hardware disease which affected the ostriches which had no access to grit since the ostriches ingested the wire mesh that was used in constructing their holding pen. The value of grit in ostrich feeding is to increase digestive efficiency (Gionfriddo and Best, 1995). Ostriches that had access to grit had higher (5.11 ±0.93) feed conversion efficiency than those that had no access to grit (5.27 ±1.30). Grit has physiological effect on the digestive system of ostriches and increases body weight gain and feed conversion efficiency and reduces average feed intake hence high output can be met if grit is introduced into the diet of ostriches. There was no significant difference ($p > 0.05$) in the growth rate between the two feeding groups during the fourth month. However, there was a significance difference ($p < 0.05$) between the two groups from the fifth month to the sixth month. The steady growth rate of the ostriches which had access to grit from the fourth month to the end of the study might be due to the effect of grit. Grit improved the digestive efficiency of the ostriches and an efficient digestive system means a good growth rate (Gionfriddo and Best, 1995).

Conclusion: Grit should be supplemented to the diet of ostriches which are raised intensively as they have no access to it. Inclusion of grit had a positive effect on the efficiency of the digestive system of ostriches as it increased body weight gain, feed conversion efficiency and reduced average feed intake.

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