Online Journal of Animal and Feed Research

Volume 5, Issue 5: 138-141; Sep 25, 2015 ISSN 2228-7701

EFFECT OF FLOOR TYPE ON BEHAVIOURAL ACTIVITIES OF INTENSIVELY MANAGED OSTRICHES

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ABSTRACT: Effects of providing grit on daily behavioural activities of intensively kept ostriches were investigated at the Botswana College of Agriculture. Two groups of ostriches were each housed in a 30 x 6m pen. Each group had seven ostriches in it. Each member of the group was identified by a number tag attached to its neck. Activities studied were feeding, picking objects, walking about, sparring, standing rest, sitting rest, grooming self, and grooming others. The study lasted 30 days. The results of the study show that during the mornings and afternoons, ostriches without access to grit allocated significantly ($P<0.05$) greater proportion of their activity time to feeding than did those with access to grit. The proportion of time allocated to morning feeding by the non-grit group was 23.1% as opposed to 13.9% for the grit group. In the afternoon, the non-grit group of ostriches continued allocating significantly more time (13.3 %) to feeding than the grit group which only allocated 4.8% of their activity to the same activity. This trend in apportioning activity time by the two groups of ostriches was maintained with regards to the proportion of time allocated to walking about in the pens. The non-grit group allocated significantly ($P<0.05$) greater proportions of time to walking than the grit group. In the morning, non-grit ostriches allocated 25.8% of their daily activity to walking about in the pen while their grit counterparts allocated 19.9% to the same activity. The grit-fed group of ostriches rested more as they allocated significantly higher proportion (28.1%) of their afternoon time to resting while standing than the proportion (17.7%) allocated to the same by the non-grit group. Both treatment groups allocated higher proportions of their activity times to morning feeding. The group with access to grit spent 35.2% of the morning time feeding while allocating only 22.5% for the same activity in the afternoon feeding. The non-grit group allocated 24.7% and 8.4% of their daily activity time to morning and afternoon activities, respectively.

Keywords: Ostrich, Activity, Grit, Non-Grit

ORIGINAL ARTICLE
pii: S222877011500022-5
Received 05 Sep. 2015
Accepted 18 Sep. 2015

INTRODUCTION

The ostrich (*Struthio camelus*) is the only living member of its family, *Stuthionidae* and its genus, *Struthio*. It is a large flightless bird native to Africa and formerly the Middle East (Davies, 2003). The ostrich has a long neck and legs which enable it to escape danger at an average speed of more than 70 km/h. Although in the same order, Struthioniformes, with the emu, kiwis and other ratites (Dehorty, 1974), the ostrich commonly associated with the savanna ungulates such as the zebras and antelopes who benefit from the ostrich's acute senses of sight and hearing that alerts them of pending danger in time so that they can timeously escape (Donegan, 2002). Ostriches are diurnal, but may be active on moonlight nights. They are most active early and late in the day (Davies, 2003).

In their natural habitat, the ostriches are nomadic, wandering to wherever food is most readily available. They are dietary indiscretive; their diet consisting typically of seed and leaves of both woody herbaceous plants, as well as animals such as insects and lizards (Best, 2003). Ostriches can go without water for several days, living off the moisture in the ingested food. When water is available, ostriches drink as much as 4-5L/day and hardly stray away from it. Since ostriches do not have teeth, they pick and swallow pebbles that aid as *gastroliths* to grind the swallowed food in the gizzard. The amount swallowed varies by age, but an adult ostrich typically carries about one kilogram of stones in its gizzard (Maclean, 1996).

Additional grit is required only to meet demand for calcium when birds graze regularly (Kreibich and Sommer, 1995). Farming ostriches date as far back as the Roman time when there was demand for products which were use in venation games and in cooking. In the 19th century when ostrich feathers were fashionable and popular ornamentation, ostriches were hunted and farmed. Their skins were valued for making leather goods. They were therefore hunted extensively during that period, resulting in drastic reductions in their numbers. Due to limited stock in the world, farming for feathers began toward the end of the 19th century (Maclean, 1996). However, the market for feathers collapsed after the First World War, but commercial farming for feathers and later for skins

To cite this paper: Seabo D, Waugh E, Tsopito Ch and Cooper F. 2015. Effect of floor type on behavioural activities of intensively managed ostriches. *Online J. Anim. Feed Res.*, 5(5): 138 141.
Scienceline/Journal homepages: http://www.science-line.com/index/; http://www.ojafr.ir

become fashionable and widespread again during the 1970s and thereafter (Best, 2003). Young ostrich chicks require very accurate and careful management of chick nutrition (Cooper, 2005). Dietary concerns of the modern society have ensured that ostriches are also farmed across the globe for their lean meat from very cold to very hot climates (Clark 2007), including in Botswana and in the rest of southern Africa. The methods of farming range from semi-intensive to intensive. Intensive ostrich farming requires providing commercial feeds *ad-libitum*. This feed may be provided with or without grit. The effect of the dietary grit on the daily activities of ostriches is not understood. As a result, this study was conducted to assess the effect of providing grit on the diurnal activities of intensively managed ostriches. The objective of the study was to assess the effect of floor type on activities of intensively reared ostriches.

MATERIAL AND METHODS

The study was conducted at the Botswana College of Agriculture farm (S24°34.832 and E025°58.394), Gaborone. The climate is semi-arid with an average annual precipitation and temperature ranging, respectively, from 450 to 500mm and 5 to 36°C (Field, 1978). Rainfall during the study period amounted to only 56mm while the average temperature ranged from 2.6 to 34.9°C. The 30 days old ostriches were purchased from an ostrich farm operating an intensive production some 60km away and were randomly allocated to the pens to two feeding groups using a Completely Randomized Design and reared intensively in those groups. Each birds was identified by a neck tag. Two weeks were allowed for the birds to adjust to the pens before data collection commenced. The pens were constructed of treated poles and chicken mesh. Each pen measured approximately 30 x 6m and housed five birds each. One pen had concrete floors while the other had normal earth or range floor which provided access to natural soil. The pens were roofed with corrugated iron sheets. Feed and water troughs were provided in both pens. The troughs (1.0m long x 0.5 wide x 0.2m deep) were made from fiber-glass. Both water and grower concentrate were supplied *ad-libitum* to both treatment groups. Data on ostrich activities were recorded hourly every day for four successive weeks. The period from 06:00 to 12:00 hours represented the morning while 14:00 to 18:00 represented afternoon. The length of the observation time was 15 minutes each hour. During each observation, the amount of time (minutes) spent on each activity were recorded by two researchers who randomly allocated observation pens between themselves. The observed activities were feeding, picking objects, walking between feeds, sparring, standing rest, lying rest, grooming self, grooming others and sitting rest. A t-test statistic was used to compare the main effects of floor type on ostrich activities. The response variables were the proportions of time allocated to each activity while the floor type was the determining variable. The statistic was also used to test the within treatment effects of time of the day on the proportion of time allocated to each activity by the ostriches. The analysis was done via the General Linear Model of SAS (2005).

RESULTS AND DISCUSSION

Influence of time of day on activities of ostriches intensively reared on earth and concrete floors

Depending on time of the day, floor type influenced some of the activities of ostriches while having no effect on others (Table 1). During the mornings, ostriches kept in concreted floored pen allocated a significantly ($P<0.05$) greater proportion (23.1%) of their daily activities time to feeding while those in earth floored pen allocated only 13.9% for the same activity. The same pattern of apportioning time persisted into the afternoons. The ostriches in concrete floored pen spent 13.3% on their daily activity time feeding while those in earth floored pen only spent 4.8% of their on the same activity. Since soil particles or pebbles are required by ostriches to help grind food in the gizzard (Waugh et al., 2006), it is likely that the access to soil of the one group of ostriches allowed ostriches associated with that treatment to allocate a greater portion of their daily activities to feeding, implying that the concrete group consumed more feed than their earth floor or soil exposed counterparts. This meant that the concrete floor ostriches spent more of their daily activity time budget feeding. The implication of this is that they may have consumed more feed than their earth floor counterparts. Interestingly, the higher proportion of activity time budgeted to feeding by the ostriches kept in concrete floored pen translate into higher daily weight gains; neither did it allow this group a higher feed conversion rate as observed by Waugh et al. (2006) in a related study using the same groups of ostriches. They subsequently recommended that grit be fed to intensively kept ostriches to minimize excessive feed intake that did not proportionally influence weight gain. The greater proportion of daily activity time allocated to feeding by ostriches in the concrete floored pen may be indicative of the fact that soil pebbles, once consumed, takes up space available for feed in the gizzard. This would result in, as observed in this study, less time spent on feeding by ostriches kept earth floored pen. Observations made in ostriches under natural conditions (Donegan, 2002) have shown that adult ostriches can carry as much as one kilogram of pebbles in their gizzards. The pebbles are part of the soil under those conditions. Pebbles consumed by ostriches in the earth

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floored pen reduced the potential volume in the gizzard that would have been occupied by feed; hence the lower proportion of time allocated to feeding by the earth floor group. Based on the assumption that the less the proportion of time spent feeding, the less the amount of feed eaten, the likely possibility would be that the group of ostriches kept on earth floored pen consumed less feed than those in concrete floored pen. The grit stimulated the secretion of digestive enzymes hence, good for management practices (Ryan, 2002).

Table 1 - Activities (% time) of ostrich in concrete and earth floored pens under intensive management system

Activity	Morning		Afternoon	
	Earth	Concrete	Earth	Concrete
Feeding	13.9b	23.1a	4.8b	13.3a
Picking objects	32.8b	40.1a	25.0b	34.3a
Walking	19.9b	25.8a	19.1a	19.4
Sparring	3.0a	1.3a	0.0a	0.7a
Standing rest	23.8a	7.0b	14.3a	11.9a
Sitting rest	2.6a	0.5a	28.1a	17.7b
Grooming self	6.1a	2.2a	3.8a	6.1a
Grooming other	0.5a	0.0a	0.0a	0.0a

Within mornings or afternoons, figures in the same row followed by the same letter are not different at the 5% level of significance.

Ostriches on the earth floor spent significantly less proportion of their daily activity time picking at objects which are not food. During the mornings, the proportion of time spent picking objects by this group was 7.3% less than that allocated to the same activity by the concrete floor ostriches. In the afternoon, the concrete floor ostriches allocated 9.3% more time to picking objects than their earth floor counterparts. These findings imply that despite being intensively kept, ostriches still spend time attempting to satisfy their natural habit of picking on pebbles/stones and other objects not considered part of their food (Donegan, 2002 and Davies, 2003).

The concrete floor group spent significantly more ($P<0.5$) proportion (25.8%) of the morning activity time walking than the earth floor group (19.9%). The higher proportion of time spent walking during the morning by the concrete floor group of ostriches probably reflects their natural tendency of being more active in the morning than during any other time of the day. The proportion of time allocated to this activity, by the two groups, however, did not differ during the afternoon, possible implying, as observed by Davies (2003) that compared to mornings, ostriches are less active in the afternoons. The earth floor group used a greater proportion (23.8%) of their morning activity time resting on a standing posture than did the concrete floor group which allocated 7.0% to the same activity during that time. During the afternoon, the proportions of time spent stand resting did not differ between the two groups; neither was the proportion of time allocated to sitting rest which turned out to be very low compared to that allocated to standing rest. The concrete floor group allocated a lower proportion of their activity time to resting because they used a greater proportion of their morning time walking about and picking objects both of which were allocated significantly higher proportions of the morning activity time. The higher proportion of daily activity time allocated to resting by the earth floor group possibly contributed to this groups higher daily weight gains and feed conversion efficiency observed on the same birds by Waugh et al. (2006). The value of grit in ostrich feeding is to increase digestive efficiency (Gionfriddo and Best, 1995).

Influence of floor type on morning and afternoon activities of ostriches

Within group, the proportions of time allocated to most daily activities did not vary by time of the day (Table 2). The only exception concerned the proportion of time allocated to feeding. Both groups allocated significantly ($P<0.5$) higher proportion of time to morning than afternoon feeding. The earth floor group spent more than 35% of their morning activities feeding and about 22.5% to afternoon feeding. On the other hand, the concrete floor group spent about 25% of the morning activity time feeding and only 8% of the activity time doing the same in the afternoon.

Table 1 - Activities (% time) of ostrich in concrete and earth floored pens under intensive management system

Activity	Morning		Afternoon	
	Earth	Concrete	Earth	Concrete
Feeding	35.2a	22.5b	24.7a	8.4b
Picking objects	18.8a	22.1a	33.0a	39.0a
Walking	17.4a	20.5a	20.7a	27.7a
Sparring	3.0a	3.0a	1.7a	1.5a
Standing rest	16.5a	17.5a	11.3a	10.6a
Sitting rest	0.0a	3.0a	4.3a	6.4a
Grooming self	5.0a	5.2a	1.3a	3.2a
Grooming other	4.1a	5.2a	1.0a	3.2a

Within mornings or afternoons, figures in the same row followed by the same letter are not different at the 5% level of significance.

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This observation conforms to the generally held view that ostriches are more active during the morning hours than during any other time of the day or night (Davies, 2003). The contributing factor to this may be the fact that ostriches are diurnal in their natural habitats and the intensively kept ones possibly spent more time resting at night thereby minimizing feeding during that period. Should that be true of both groups, it should follow then, that they allocated greater proportion of their activity time to morning feeding.

CONCLUSION

Subjecting ostriches to the two floor types influenced some of their daily behavioral activities. During both the morning and afternoon observations, the study showed that concrete floor ostriches allocated higher proportions of their time to feeding than their earth floor counterparts. The concrete floor group also devoted greater proportions of activity time to picking non-food objects than their earth floor counterparts. The concrete floor ostriches allocated lower proportions of their activities to resting (either standing or sitting), both in the morning and afternoons.

Acknowledgements

The authors are grateful to Botswana College of Agriculture research and Publication Committee for funding the project.

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