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IJSR
2,2

CAPTIVE BEHAVIOURAL PATTERNS OF THE RED-NECKED OSTRICH

155

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Abstract

Purpose: This study was conducted to evaluate captive ostrich behavioural patterns during the laying season.

Design/methodology/approach: The parent red-necked ostrich (*Struthio camelus camelus*) flock (5 males and 7 females) was stocked from the wild (Dindir National Park) and accommodated in one breeding pen. The feeding plan was 14% crude protein and 09.23 MJ ME/ Kg. Behaviour was



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observed during one laying season of eight months (November–June). Behavioural patterns were observed during three randomly selected consecutive days of each month. Observations were done for 6 hours of daylight periods, morning (6:00–8:00 am), mid-day (10:00–12:00 pm) and evening (2:00–4:00 pm) on either males or females. The three categories of behavioural patterns observed were mobility (standing, walking, sitting, running and sandy bath), nutritional (feeding, drinking, pecking, urination-defecation and coprophagy) and reproductive (dancing, fighting and mating).

Findings: The mean daylight overall time budget for mobility was 64.74% for females and 67.44% for males. Standing time for both sexes was greater in the mid-day period, being 43.18 ± 13.14 min. for females and 47.20 ± 14.79 min. for males. Males morning walk (30.42 ± 8.62 min) exceeded the females (29.33 ± 7.76 min) with mid-day and evening walk time similar for either sex. No sitting was recorded for males during the morning period but both sexes were similar in sitting times during the other two periods. Males exhibited longer times in running during the three periods compared to females. No sandy bath was performed by either sex during the morning period but only the female bathed during the mid-day period (5.00 ± 2.68 min.) and evening (2.25 ± 2.28 min.). The mean daylight overall time budget for nutritional behaviours was 35.66% for females and 29.92% for males, with the female time values being higher than the male. The mean daylight overall time budget for reproductive behaviour was 8.88% for females and 13.11% for males. Mating was more common in the morning and evening than in the mid-day period.

Originality/value: It was concluded that the wild red-necked ostriches reared in captivity assume similar behavioural patterns to those remaining in the wild, although some captive circumstances impose minor differences. In this study, the percentage time spent in feeding was higher than that recorded by Berendsen (1995). The time spent feeding in captivity or searching for food in the wild depends on the availability and destiny of feed sources. Hot weather usually decreases the resting time compared to damper weather. The birds were seen during rains at sternal rest close to each other and this observation is the same as that cited by Deeming (1997).

Keywords: Red-necked, Ostrich, Behaviour, Laying season, Sudan

Paper type: Research study

INTRODUCTION

The name *Struthio camelus camelus*-Linnaeus, defines the North African ostrich, which inhabits a wide zone from the southern regions of Morocco and Mauritania in the west to the Ethiopian plateau in the east. Egyptian southern boundaries are the northern limits to the Red Sea and the Sudan-Uganda boundaries are the southern limits. The wild ostrich existing in the Sudan is the red-necked type, *S. c. camelus*. Until the early 1980s, Ostriches could still be seen in northern Sudan in the Bayyuda Desert (Obeid, 1981). The subspecies *S. c. camelus* and *S. c. massaicus* belong to the red-necked ostriches (Kreibich and Sommer, 1995). These two subspecies are difficult to keep and need strong fencing due to their shorter history of domestication compared to the African blacks.

Ostrich farming in the Sudan has only recently been known. Some ostrich collection farms were established for export purposes before the first intensive ostrich farm was granted a permit in 1992 (WCA, 1996). Natural behaviours may be replaced by abnormal or modified ones in captivity due to several changes of the home range, critical areas, rivals and predators, beside other physiological stresses, all of which vary with the flock environment. Hence natural behaviours are likely to be somewhat disrupted in captivity (Deeming and Bubier, 1999). It is necessary first to characterize and understand these normal wild behaviours and then to analyze the effect of captivity in a commercial production environment that imposes behavioural changes.

The behavioural patterns of the ostrich in its natural habitat have been the subject of several studies (Sauer and Sauer, 1966a) while the farming environment is relatively recent and has received less attention and focus. This study was planned to observe the behavioural patterns of the captive red-necked ostrich (*Struthio camelus camelus*) during the laying season, for comparative evaluation with the open literature cited for red-necked ostriches in the wild.

MATERIALS AND METHODS

The breeding flock of the commercial red-necked ostrich (*Struthio camelus camelus*) was maintained in El Rajaa Agricultural Scheme, El Gitaina Province, 70 km south of Khartoum, White Nile State. The flock individuals (5 males and 7 females; of male to female ratio 1:1.4) were at the same age (5 years old) and were in the third year of production. The

parent flock was originally stocked in from the wild (Dindir National Park, Dindir Province, Sinnar State).

The birds were housed in a pen of 80x30 m dimensions, surrounded by a mesh-wire fence of two meters in height with a fine mesh (5x5 cm) and metal pipe supports. Sandy ground was laid under the shaded area (36x6 m), and there was a scattering of trees inside the pen. Longitudinally-cut oil barrel halves were used as feeders and drinkers. The laying flock was maintained on a laying ration for two weeks before the beginning of lay for adaptation. The ration was formulated to meet the breeding ostrich nutritional requirements (Kreibich and Sommer, 1995) as shown in Table 1. Feeding was *ad lib.*, offered at 8.00 am daily with water always available. Temperature was recorded during each of the three periods under study.

Three sets of behavioural attributes were observed for three daylight periods, morning (6.00–8.00 a.m.), mid-day (10.00–12.00 a.m.) and evening (2.00–4.00 p.m.) throughout three consecutive days selected randomly during each of the eight months of the laying season (November–June).

The behavioural attributes included three sets of behavioural patterns in both males and females. The first set covered mobility time spent during standing, walking, sitting, running and sandy bathing. The second set covered the nutrition time spent in feeding, pecking, drinking, coprophagia, urination-defecation times per period and average times of urination-defecation per bird. The third set covered reproduction time spent in fighting, dancing, average number of dances, average number of dancing/bird and mating numbers through the period of study.

Ingredient	Percentage	Component	Percentage
Sorghum	30.00	Dry matter	94.00
Groundnut meal	08.50	Crude protein	13.62
Molasses	05.00	Crude fiber	16.99
Wheat bran	10.00	Ether extract	02.78
Groundnut hay	28.00	Nitrogen – free extract	47.61
Groundnut hulls	07.00	Ash	13.00
Concentrate	04.00	Ca	03.06
Oyster shell	07.00	P	00.46
Common salt	00.50	Energy (MJME/kg*)	09.23
Total	100.00		

Table 1. Per cent composition (as fed basis) and analyzed chemical composition (dry matter basis) of the parent flock laying ration

* Calculated according to Lodhi et al. (1976).

All observations for behavioural attributes during each period were recorded as continuous time activity, entity or discrete. Data collected were expressed as absolute, mean \pm s.d. or per cent values.

RESULTS AND DISCUSSION

Mobility behaviour

The time spent in standing was greater during the mid-day period for both males (47.20 ± 14.79 min.) and females (43.18 ± 13.14 min.) with the males spending greater time in standing than the females (Table 2).

Bertram (1980) reported captive ostriches standing with the head held up as observed in wild ostriches during the breeding season. Males were more vigilant than females in all group sizes, presumably watching for predators or potential rivals.

The walking time of the females was greater in the morning (29.33 ± 7.76 min.), while mid-day and evenings had similar waking times (26.18 ± 7.70 and 26.63 ± 7.22 min. respectively). Total time in the three consecutive periods spent by the male in walking (23.95%) was greater than that of the female (22.82%). Burger and Gochfeld (1988) found that both males and females spent significantly more time walking if solitary or in a unisexual group compared to mixed-sex groups.

Table 2. Average (mean \pm s.d.) mobility behaviours time budget (min.) of captive red-necked ostrich during the season of lay

Items	Day period			Total	%	
	Morning	Mid-day	Evening			
Average temp. (0C)	27.73 ± 5.07	35.36 ± 4.21	33.31 ± 7.62			
Standing (min.)	Female	25.38 ± 7.58	43.18 ± 13.14	25.31 ± 7.62	93.87	26.08
	Male	27.10 ± 8.20	47.20 ± 14.79	27.72 ± 09.80	102.02	28.34
Walking (min.)	Female	29.33 ± 7.76	26.18 ± 7.70	26.63 ± 7.22	82.15	22.82
	Male	30.42 ± 8.62	28.09 ± 23.41	27.72 ± 33.10	86.22	23.95
Sitting (min.)	Female	7.00 ± 2.83	18.65 ± 12.39	14.67 ± 10.87	40.32	11.20
	Male	00.00	15.64 ± 13.03	14.08 ± 19.97	29.74	08.26
Running (min.)	Female	8.56 ± 3.60	2.70 ± 1.60	5.41 ± 2.76	16.70	04.64
	Male	12.28 ± 2.31	4.48 ± 2.71	8.04 ± 4.65	24.80	06.89
Sandy bath (min.)	Female	00.00	5.00 ± 2.68	2.25 ± 2.28	07.24	02.01
	Male	00.00	00.00	00.00	00.00	00.00

As the group size increased the vigilance time declined variably for either sex. Sambraus (1994a) reported that in a group of 24 ostriches, standing and walking combined averaged 62.90% of the time activities budget, with these behaviours, increasing towards dusk. These were greater than the standing and walking combined average (50.50%) in the present study. The difference here may be due to the small group size. In contrast, McKeegan and Deeming (1997) reported that males generally paced and walked significantly more than females.

Sitting times spent by the females for the three periods of time budget were 7.00 ± 2.83 , 18.65 ± 12.39 and 14.67 ± 10.87 min. respectively, with greatest time spent in the mid-day period and a bit less than that in the evening. Least time or none spent in sitting for both sexes was in the morning period. This finding concurs with that of Sambraus (1994a), who reported that sitting occurred at a relatively low frequency during the morning but increased as the afternoon progressed to just before dusk. The time spent in the running activity budget was only 4.63% and 6.89% for females and males respectively compared to total walking time (23–24%) for both sexes. Berendsen (1995) reported greater time spent in walking and least for running in a farm in Germany. The variation may be due to the duration of breeding season, which varies with latitude and altitude, or environmental stress such as extreme climatic conditions (particularly high temperatures or cold weather).

No sandy bath was observed for the males but only for the females in the mid-day and evening periods, with time spent 5.00 ± 2.68 and 2.25 ± 2.28 min. respectively. In Britain during the summer months, McKeegan and Deeming (1997) found that preening and dust bathing represented a small part of the time budgets of adult birds < 5 and < 0.4% respectively, while Deeming (1998a) reported that during the winter months, preening took up less than 1.5% of the time budget of the adult birds and dust bathing was not observed.

NUTRITIONAL BEHAVIOUR

In Table 3, all the times spent on nutrition behaviours were higher in the morning and evening than the time spent in the mid-day period, with the female values always higher than the males.

This variation in the time spent in the nutrition behaviours between females and males is due to the high nutritional requirement of females for

maintenance and production during the laying season. Coprophagia is a phenomenon observed in equidae, lagomorphs and some aviae, of which the ostrich is the latter. Ostrich coprophagia is observed in both sexes in the morning and evening, with females pecking a greater amount of dry fecal matter than the males. These findings agree with those of McKeegan and Deeming (1997), who showed that the incidences of feeding and foraging were significantly higher in females than in males, while Berendsen (1995) reported that ostriches spend about 26% of their time in feeding or searching for food, although whether these activities were feeding on concentrates or foraging the pasture was not stated. Deeming (1998a), in a study comparing captive systems to the wild reported that intake of food was very important during the morning and the amount of time spent on feeding concentrate rations was high, whereas during the afternoon, the time spent foraging on the pasture was high, and increased in the evening in captive systems.

Although all the nutrition behaviours occupied about 35.66% of the 6 hours daylight budget, Deeming (1998a) found that same-day behaviours occupy 50% of the time in winter months. This was attributed to the need of birds for more energy for maintenance, body temperature and production needs. In hot weather, ostriches have been observed to scoop more water, and urination increases in both sexes.

Table 3. Average (mean ± s.d.) nutrition behaviours time budget (min.) of captive red-necked ostrich during the season of lay

Items	Day period			Total	%	
	Morning	Mid-day	Evening			
Average temp. (OC)	27.73 ± 5.07	35.36 ± 4.21	33.61 ± 4.00			
Feeding (min.)	Female	26.31 ± 80.8/5	14.73 ± 5.92	23.55 ± 07.32	64.59	17.94
	Male	22.92 ± 7.79	13.51 ± 07.02	22.08 ± 7.90	58.51	16.25
Pecking (min.)	Female	3.14 ± 2.39	2.01 ± 1.45	3.23 ± 2.54	8.38	02.33
	Male	2.11 ± 1.34	1.8 ± 1.19	2.69 ± 1.45	6.6	01.83
Drinking (min.)	Female	9.33 ± 4.58	9.40 ± 5.89	10.29 ± 3.37	29.02	08.06
	Male	7.22 ± 4.23	7.69 ± 5.40	9.26 ± 4.72	24.17	06.71
Coprophagia (min.)	Female	9.81 ± 6.72	5.79 ± 4.38	10.79 ± 05.50	26.39	07.33
	Male	6.00 ± 2.51	3.68 ± 2.31	8.76 ± 4.47	18.44	05.12
Urination-defecation (No.)	Female	7.54 ± 2.98	6.88 ± 4.13	8.78 ± 4.09		
	Male	4.42 ± 2.22	3.00 ± 2.03	3.92 ± 1.80		
Average urination-defecation/ bird (No.)	Female	1.89 ± 0.43	0.98 ± 0.59	1.16 ± 0.55		
	Male	1.02 ± 0.46	0.73 ± 0.40	0.93 ± 0.38		

REPRODUCTIVE BEHAVIOUR

As Table 4 shows, during the three periods, more time was spent in fighting and dancing in the morning and evening periods than the mid-day period, with males spending more time than females in fighting and dancing (17.02; 11.33 and 30.16; 20.75 min. respectively). Mating times were equal in number during the morning and evening periods. Mid-day matings were less by one third than those in the other two periods.

The pattern of courtship behaviour in the captive ostrich closely resembles that observed in the wild (Bolwig, 1973; Stewart, 1994; Berendsen, 1995; Hicks-Allredde, 1996; Deeming, 1997; and Bubier *et al.*, 1998). The time males spent on dancing before mating took place was 02.5-03.5 min. The dancing in both sexes starts in the morning and evenings and takes up a lot of time. It rarely occurs during the mid-day period due to high temperature and sun radiations compared to the steady weather and temperature in the morning and evening.

Mating behaviour in the ostrich correlates with the dancing activities. Major male body parts contributing to the dancing operation include the wings and neck, with feathers erect during the dance. Two types of dancing were observed: single and group dancing. The single dance is done by either males or females to show their suitability for mating, while group dancing takes place on two occasions.

Items	Day period			Total	%
	Morning	Mid-day	Evening		
Average temp. (OC)	27.73 ± 5.07	35.36 ± 4.21	33.61 ± 4.00		
Fighting (min.)					
Female	4.50 ± 2.31	3.21 ± 1.47	3.52 ± 2.04	11.23	03.12
Male	6.99 ± 3.15	4.92 ± 2.95	5.14 ± 3.58	17.02	04.73
Dancing (min.)					
Female	9.09 ± 3.68	3.36 ± 1.57	8.3 ± 4.47	20.75	05.76
Male	13.73 ± 6.39	5.67 ± 2.61	10.76 ± 4.65	30.16	08.38
Average danc-ings (No.)					
Female	7.52 ± 4.14	4.14 ± 2.64	6.38 ± 3.35	18.04	
Male	11.03 ± 4.72	6.24 ± 2.77	9.27 ± 4.05	26.56	
Average danc-ings / bird (No.)					
Female	1.27 ± 0.55	0.67 ± .44	1.05 ± 0.51	2.99	
Male	2.73 ± 1.33	1.36 ± 0.48	2.14 ± 1.76	6.23	
Matings (No.)					
Female/ Male	2.87 ± 1.87	1.72 ± 0.8	2.71 ± 1.73	7.3	

Table 4. Average (mean ± s.d.) of reproduction behaviours time budget (min.) of captive red-necked ostrich during the season of lay

The first is when males and their females (major and minor mothers) are building or cleaning the nest to remove foreign bodies before egg laying, whereupon dancing stops other birds in the pen from troubling the female as the clutch is being laid. The second group dancing takes place after egg laying and involves shaking low-held wings and successive beak biting to sprinkle sand on the newly-laid egg. The courtship behaviour of both males and females gradually diminishes in frequency as the clutch of eggs follows its course (Bertram, 1992).

At the end of their dance, the males stand with their wings held high and their legs beating the ground in the direction of the selected female supposedly in need of mating. The female usually rejects the male by hanging the wings over the head when the male is directing attention to others. Mating will be rejected if the female needs to urinate/defaecate, lay an egg or has mated previously within a short period.

In the ostrich, production of sound is so rare that it is often called the silent bird. However, during mating, both sexes produce sounds, but with different accompanying behaviours. Dominant males produce a booming sound during the day and night or when fighting within or between groups. In contrast, females produce sounds when they require mating or when fighting with other groups by successive beak biting.

We found that the number of copulations observed during the 6 hours of daylight was 07.25, which is greater than that observed by McKeegan and Deeming (1997), who observed 20 attempts over 99 hours, i.e. one copulation/4.95 hours. However, Sambraus (1994) found that both the incidence of courtship and copulation behaviour in the group of 120 adult ostriches was higher during the first 3 hours after dawn compared with the rest of the day. The variation in the numbers of copulation attempts may be due to the time of the breeding season, with the variation in latitude and altitude; alternatively, it may be related to cold or bad weather.

OTHER BEHAVIOURS

At sunset, all birds in the pen prepared to settle down and sleep by making a circle with their rears to the outer and necks laid straight on the ground towards the centre, or hanging up. The pen guard (the dominant male) was the last to kneel down, stretch its neck and sleep. No activities were observed during the night. This finding is consistent with those of Degen *et al.* (1989), McKeegan and Deeming (1997) and Deeming (1998a),

who reported that most ostriches sit at sunset and are inactive all night during the hours of darkness. In addition, Stewart (1994) reported that sleeping in ostriches appears to occur either with the bird holding its neck raised or sitting with its neck stretched straight in front of it.

During egg collection, the dominant male should be avoided. This is best carried out via deception, dangling a long pole into the pen or distracting by drilling a tyre.

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IJSR
2,2

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167

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