

Feeding and Management of Spotted Deer at Dhaka Zoo

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Abstract: In this experiment the feeds and feeding, production and reproduction profile and herd management of spotted deer were studied in captive condition at Dhaka zoo. Data collected from forty deers, ten deers of each group consisting of adult male, adult female, juvenile and infant were studied January 15th to April 15th 2004 for a period of three months. Available feeds supplied to the spotted deer were maize fodder, para and bucksha grass, poi shak, cabbages, carrot, papaya, wheat bran and soybean meal. Amount of CP and metabolisable energy were 9.8% and 14.24 MJ ME per day, respectively. The average birth weight of males and females were 3.0 and 2.5 kg, adult males and females' weights were 80.44 and 57.6 kg, males and females weaning weights were 19.98 and 18 kg, respectively. It was also observed that the average weaning age, length of estrous, age at first fawning and gestation lengths were 5.02 months, 17.74 days, 14.32 months and 230.74 days, respectively. From the study it may be suggested that keeping balanced nutritive status the productive and reproductive parameters of the spotted deer at Dhaka zoo, recommended rations needs to be followed similarly efficient management systems needs to be developed.

Key words: Feeds and feeding, management, spotted deer, Dhaka zoo

INTRODUCTION

The natural distribution of spotted deer (*Axis axis*) is limited to the Indian sub-continent, although successful introductions occurred elsewhere^[1]. In Bangladesh spotted deer is found throughout the Sundarban forest but the population density seems to be higher in the South and particularly concentrated in the marine grassland areas^[2]. The total population estimate of spotted deer ranges between 52,000^[3] and 80000 individuals^[2]. The availability of drinking water, trees for shade, grass for forage and an absence of high rugged terrain are four factors that influence the spotted deer to concentrate in certain areas. Deer have been morphophysiologicaly classified as ruminants, their main fodder in the forest are the leaves and fruits of keora, new leaves of passur, gewa and various grasses, but they supplement their calcium requirement by chewing fallen deer antler and eating crab, shrimp etc. In Dhaka zoo, there are 150, 14, 7, 1 numbers of spotted deer, barking deer, sambar deer and impala, respectively. For keeping them nutritionally balanced, supply of green fodders (Maize fodder, para grass and bucksha grass), vegetables (Cabbage, poi shak and carrot) along with concentrate feeds (Soybean meal, wheat bran, vitamin-mineral premix

and common salt) were provided. Feeding of captive deer is now greatly simplified by the development of a pelleted ration, which seemingly provides the essential nutrients for optimum growth and maintenance. In future it could become expedient to supply complete pelleted ration for free roaming deer that are faced with acute browse shortage and severe environmental pressure.

The world deer industry is growing about 20% annually and about five million deer's currently being farmed^[4]. In 2002, the estimated deer numbers in New Zealand was 2.25 million, produce 24,400 tonnes of venison with 90% venison being exported to Europe, mainly to Germany^[5]. China has the second largest farmed deer (500,000 mainly sika deer). Australia has about 200,000 animals on around 1,200 farms and red deer and fallow deer form the great majority of the herd^[6]. Other countries, such as United Kingdom (UK), Denmark and United States of America (USA), also have a significant number of deer. At present, the number of sika deer being farmed is the highest in the China and that of red deer is the highest in the New Zealand. In Japan, about 3 tonnes velvet is annually imported from China and Taiwan and about 300 tonnes venison from New Zealand^[7]. The main species of farmed deer in Korea, Wapiti, red deer (*Cervus elaphus*) and spotted (sika) deer, are classified as

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intermediate farming types according to Hoffman's morphophysiological criteria^[8]. The main products produced from deer are venison and velvet antlers. Venison is low in calories, fat and cholesterol but high in protein and iron, making it suitable for low fat diets. The major consumer of venison in the world is Germany with 40-50,000 tonnes of venison consumed annually. New Zealand is the world's largest producer and exporter of farmed venison. Australia produces 1,000 tonnes of venison annually, 80% being exported^[6]. Velvet antler is mainly used in Asian market as an ingredient of traditional medicine^[9]. China has increased its capacity to produce over 400 tonnes of antlers per year but quantities available vary from year to year^[10].

Apart from some surveys, systematic studies have never been conducted on the feeding, reproduction and management operations etc. of spotted deer in captivity at zoo in Bangladesh. Information on population of this species *in situ* and *ex situ* are available from some studies conducted by the Sundarban Biodiversity Project^[11]. Both *in situ* and *ex situ* conditions, spotted deer abundance makes it one of the most conspicuous attractions for tourism, takes place significant ecological role in the ecosystem, being the most important link between primary production and the tiger and tiger densities are positively correlated with the bio-mass of prey species. To ensure tiger's survival we must not only find out more effective ways to protect this cat and its habitat, but we should also explore all avenues to protect, maintain and increase cervid populations^[12]. To establish deer farming which is economically promissory industry for the production of venison and other by-products, there is a need to understand and develop effective ex-situ management systems of spotted deer in Bangladesh. Conservation of nature and natural resources is now a global concern. Without proper scientific knowledge on conservation management, natural resource utilization is very difficult. Therefore, the present study was undertaken with the following objectives:

- I. To find out feeding practices of the spotted deer at Dhaka zoo.
- II. To explore the production and reproduction profile of the spotted deer at Dhaka zoo.
- III. To evaluate herd management practices of the spotted deer at Dhaka zoo.

MATERIALS AND METHODS

The necessary data collected from forty deers, ten deers, of each group consisting of adult male, adult female, juvenile and infant were studied January 15th to

April 15th 2004 for a period of three months. Parameters studied were feeds and feeding, production and reproduction profile and herd management. Feeds and feeding includes the following aspects such as feed sources, chemical composition of feed, water sources, supplemental feeding and seasonal effect on feed intake. Production and reproduction includes mainly the following aspects such as male birth weight, female birth weight, adult male weight, adult female weight, male weaning weight, female weaning weight, weaning age, length of estrous and age at first fawning, gestation length and sex ratio. Herd management includes the following aspects such as capturing procedure and provision for shelter.

Data recorded for different parameters were compiled and tabulated for statistical analysis of Mean, Standard error of mean; Standard deviation and variance were done with the help of computer package MSTAT^[13].

RESULTS AND DISCUSSION

From the Table 1 it was observed that the total amount of feed intake was 8.051 kg as fresh basis and 1.99 kg as DM. The experiment was conducted during winter and beginning of summer. During the experimental period maize fodder (*Zea mays*) and poi shak (*Basella alba*) as leafy vegetables, carrot (*Daucus carota*) and papaya (*Carcia papaya*) as vegetables and soybean and wheat bran as concentrate feeds were supplied to the deer. The percentage of Crude Protein (CP) and amount of metabolisable energy of the supplied ration for an adult deer were 9.80% and 14.24 MJ per day.

Spotted deer that are free browsers intake a various types to grasses, creepers, shrubs, tree leaves, vegetables etc. Deer at Dhaka zoo that are confined cannot take any feed other than supplied (Table 2). A little amount of grasses was given to these deer per day. Dhaka zoo authority used to supply green fodders, leafy vegetables and succulent vegetables in the various seasons depend of availability in the market. Khira (*Cucumis sativas*), Sasa (*Saha Senanensis*), Misty Cumra (*Cucurbita moschata*), Cabbage (*Brassica oleracea*) were supplied in the various seasons of the year. The metabolisable energy is more or less near to the requirement but crude protein was far below than the requirement. DMI intake around 2.0% in winter, increasing to 2.3% in summer for adult spotted deer^[14]. DMI intake around 2.7 to 3.8% for fallow deer^[15]. In autumn, winter, spring and summer DMI intake 1.7, 2.0, 2.3, 3.0 kg/d/hinds where as 1.4, 1.3, 2.0, 2.2 kg/d/growing calves, respectively^[16]. An adult spotted deer require only for maintenance energy was 16-18 MJ^[17] where as a

Table 1: Chemical composition of feed, fed to the spotted deer

Name of feed		DM	CP	ME
Local name	Botanical name	(%)	(%)	(kcal kg ⁻¹)
Maize fodder	<i>Zea mays</i>	18	9.7	230
Para grass	-	15	8.3	200
Cabbage	<i>Brassica oleracea</i>	10	1.3	260
Poi shak	<i>Basella alba</i>	8	2.1	270
Carrot	<i>Daucus carota</i>	15	1.2	570
Papaya	<i>Carcia papaya</i>	14	1.9	420
Soybean meal	-	88	45.0	2500
Wheat bran	-	88	14.0	1600
Common salt	-	90	-	-

Table 2: Nutrient intake by the spotted deer

Name of feeds		Amount supply	DMI	% CP intake	ME
Local name	Botanical name	(kg)	(kg)	(kg)	(kcal kg ⁻¹)
Maize fodder	<i>Zea mays</i>	3.0	0.54	3.61	690.00
Para grass	-	3.0	0.45	3.01	600.00
Cabbage	<i>Brassica oleracea</i>	0.25	0.03	0.04	65.00
Poi shak	<i>Basella alba</i>	0.25	0.02	0.07	68.00
Carrot	<i>Daucus carota</i>	0.30	0.05	0.05	171.00
Papaya	<i>Carcia papaya</i>	0.20	0.03	0.05	84.00
Soybean meal	-	0.30	0.44	1.68	750.00
Wheat bran	-	0.70	0.44	1.22	980.00
Common salt	-	0.05	0.05	-	-
Vitamin premix	-	0.001	-	-	-
Total		8.051	1.99	9.80	14.24 MJ

Table 3: Nutrient balances for the spotted deer

Characteristics	CP (%)	ME (MJ)
Requirement ^[10]	14.5	16
Supplied	9.8	14
Balance	-4.7	-2

Table 4: Recommended rations for spotted deer

Name of feeds		Amount supply	DMI	% CP intake	ME
Local name	Botanical name	(kg)	(kg)	(kg)	(kcal kg ⁻¹)
Maize fodder	<i>Zea mays</i>	2.50	0.45	3.44	575.00
Para grass	-	2.50	0.38	2.94	500.00
Cabbage	<i>Brassica oleracea</i>	0.25	0.03	0.05	65.00
Poi shak	<i>Basella alba</i>	0.25	0.02	0.07	68.00
Carrot	<i>Daucus carota</i>	0.20	0.03	0.03	114.00
Papaya	<i>Carcia papaya</i>	0.30	0.04	0.08	126.00
Soybean meal	-	0.25	0.22	1.60	625.00
Wheat bran	-	0.25	0.22	0.50	350.00
Protein concentrate	-	0.05	0.44	4.61	1250.00
Common salt	-	0.05	0.05	-	-
Vitamin-mineral premix	-	0.001	-	-	-
Total		7.051	1.867	13.33	15.35 MJ

protein diet having 13-16% range is required for the successful growth, antler development and reproduction^[18]. A high level of crude protein (approximately 16%) is advantageous for fallow fawns to achieve their target live weights^[19]. In calves, hinds and stags for the season of autumn, winter, spring and summer CP is required as 17, 10, 12-17; 10, 14, 17 and 10, 12%, respectively^[10]. Estimates of dietary crude protein requirements for optimum growth vary within the range

of 13 to 15%^[20]. Young male fawns (white-tailed deer) required 13 to 16% crude protein^[21]. Obtaining maximum growth on diets of 13% crude protein required for female fawns (white-tailed deer)^[22]. The energy concentration for empty body weight is 17.5 and 21.7 MJ kg⁻¹ and protein content is 150 and 146 g kg⁻¹^[23].

The standard of nutritional requirement of spotted deer, it was observed that crude protein deficiency was 4.2% and the ME deficiency was 2 MJ (Table 3) per day that were supplied to the deer^[16]. There is an imbalance of crude protein and energy supply to the deer of Dhaka zoo. Proper growth and development of both productive and reproductive parameters were retarded due to insufficient protein supply and an imbalance of CP and ME.

Table 4 has shown the recommended ration for spotted deer. Total feed, DM, CP and metabolisable energy intake by the recommended ration in 7.051, 1.87 kg, 13.33% and 15.85 MJ, respectively. It is very near to the requirement^[16].

From the Table 5 it appears that the average birth weight of males and females spotted deer fawn were 3.0±0.17 and 2.5±0.17 kg, the highest and lowest birth weights were 4.10 to 1.8 kg and 3.20 to 1.50 kg, respectively. In this study the average birth weight of males and females fawn of spotted deer were more or less similar to the findings of Mulley^[24] who reported the mean birth weights of male and female spotted deer fawn was 4.5 and 4.2 kg^[24]. The average birth weight of males and females spotted deer fawn were 3.5 and 3.0 kg^[25]. Kay and Staines^[26], Mulley *et al.*^[27] stated that fawn birth weight generally 10% of their mother's weight. Adult males and females weights were 80.44±1.79 and 57.6±1.79 kg, respectively, the highest and lowest adult males and females' weights were 89.20 to 65.20 kg and 68 to 50.20 kg, respectively. In this study the average adult males and females weights were or less similar to the findings of Ables^[25] who recorded the average adult weight of males and females about 85 and 70 kg^[25]. Young hinds weighing less than 60 kg at rutting did not produce calves^[28]. The percentage of red deer calves dropped by yearling hinds less than 65 kg in live weight was only 50%; while above 65 kg it could be about 90%^[29]. A live weight of 75 kg for hinds should give calving percentages of 80%^[30]. Average males and females weaning weights were 19.98±1.28 and 18±1.05 kg and the highest and lowest weaning weights were 27.10, 15.30 kg and 24.30, 14.30 kg, respectively. In this study, the average weaning weights of males and females were more or less similar to the findings of Mulley^[24] stated that the mean males and females weaning weights were 19.4 and 18.5 kg^[24]. Weaning generally takes place at an average weight of 18 to 21 kg^[27].

Table 5: Body weight of spotted deer

Traits wt. (kg)	No. of						
	animal	Mean	SE	SD	Variance	Max.	Min.
Male birth	10	3.00	0.243	0.534	0.591	4.10	1.80
Female birth	10	2.51	0.168	0.534	0.285	3.20	1.50
Adult male	10	80.44	2.440	7.720	59.720	89.20	65.20
Adult female	10	57.61	1.790	5.660	32.090	68.00	50.20
Male weaning	10	19.98	1.280	4.050	16.480	27.10	15.30
Female weaning	10	18.00	1.050	3.310	10.970	24.30	14.30

Table 6: Reproductive performance of spotted deer at Dhaka zoo

Traits	No. of						
	animal	Mean	SE	SD	Variance	Max.	Min.
Weaning age (Months)	10	5.02	0.23	0.71	0.51	6.10	4.00
Length of estrous (Days)	10	17.74	0.75	2.37	5.64	21.20	14.40
Age at first fawning (Months)	10	14.32	0.60	1.91	3.64	18.10	12.00
Gestation length (D)	10	230.74	1.61	5.08	25.82	238.90	223.60

Table 7: Schedule of day-to-day operations on spotted deer premises

Approximate time (h)	Farm operations
7.00-9.00 AM	<ul style="list-style-type: none"> ➤ Check all fences surrounded by deer premises. ➤ Count the total numbers of deer and adjust previous numbers. ➤ Find out or observe if any mortality occurred. ➤ Inspection within the area if any hazard happened at sight. ➤ Clean out the dumping wastage material such as cans, bottles or any plastic products, which was thrown by visitors. ➤ Cleaning all the equipment's such as feeders, waterers. ➤ Cleaning the entire Feed supply zone. ➤ Arrange the necessary vehicle to transport feed or other's ➤ Cleaning farm premises.
9.00-12.00 AM	<ul style="list-style-type: none"> ➤ Feeding of concentrate feed to deer herd. ➤ Feeding of dry/green fodder. ➤ Isolation of sick deer. ➤ Treating sick deer.
12.00-3.00 PM	<ul style="list-style-type: none"> ➤ Lunch-cum-rest period for laborers.
3.00-4.00 PM	<ul style="list-style-type: none"> ➤ Miscellaneous jobs of deer premises such as, periodical vaccinations, repair of farm fences, fittings and repair of equipment, weekly scrubbing and white washing of drinking water tank, attending to sale of deer and their transportation, periodical spraying of deer premises with suitable pesticides.
4.00 PM-7.00 AM	<ul style="list-style-type: none"> ➤ Night watchman on duty.

The average weaning age was 5.02±0.23 months (Table 6), the highest and lowest weaning age were 6.10 months and 4.0 months, respectively and the results were more or less similar to the findings of Mulley *et al.*^[25] reported that weaning generally takes place between 14-21 weeks^[27]. Deer must wean within 16 weeks of its age^[31]. Weaning age ranged between 12-20 weeks^[32]. Average length of estrous cycle was 17.74±0.75 day. The highest and lowest lengths of estrous cycle were 21.20 and 14.40 day, respectively. In this study, the mean length of estrous cycle was more or less similar to the findings of Chapple *et al.*^[33] who investigated the

mean duration of estrous cycle of chital hinds was 19.3±1.3 days with a range of 17-21 days^[33]. The mean length of estrous cycle was 18±0.7 days with a range of 12-23 days^[34]. The mean length of estrous cycle in spotted deer was 18.2 days. Average age at first fawning was 14.32±0.60 months^[35]. The highest and lowest age at first fawning was 18.10 and 12.00 months, respectively. In this study the average age at first fawning were almost similar to the findings of Ables^[25] who reported that does may first bred at an age of 14-17 months. Does may be first bred within 1.5-2 years^[35]. Average duration of gestation length was 230.74±1.61 days. The highest and lowest lengths of gestation period were 238.90 days and 223.60 days, respectively. In this study the average length of gestation period were close to the findings of Chapple *et al.*^[33] who showed the mean duration of gestation period was 234.5±3.0 days at chital hinds^[33].

Herd management: Deer rapidly adapt to the presence of man and machinery when they are enticed with palatable feeds. When deer are confined, they should not be overcrowded, allowing the handler to easy move amongst them and carry out drenching, ear tagging, vaccination and pour-on dipping.

Normally a supervisor of deer section maintains the following activities (Table 7).

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