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SHORT COMMUNICATION

Assessment of Wild Asiatic Elephant (*Elephas maximus indicus*) Body Condition by Simple Scoring Method in a Tropical Deciduous Forest of Western Ghats, Southern India

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Keywords

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Abstract

The individual based body condition assessment is the most meaningful method when applied as an early indicator of the impact of management actions and health status of wild elephants. The body condition evaluation of wild Asiatic elephant (*Elephas maximus*) was studied within 107 km^2 area covering deciduous forest of Mudumalai Tiger Reserve, Western Ghats from February 2008 to December 2009. Overall vehicle drive of 3740 km yielded 1622 body condition assessments. A higher percentage of adult male and female were either in poor or medium condition during the dry season compared to the wet season. The proportion of adult female body condition was found to be poor compared to adult males. This might be due to less availability of nutritional food during the dry season and since elephant calving occurred throughout the year in Mudumalai, nutritional stress in lactating females could have resulted in their poor body condition. The aging factor could also be one of the reasons where either medium/poor condition was noticed mainly in adult elephants. It is suggested that long-term monitoring of body condition evaluation should be carried out not only in Asiatic elephant but even for several other wild ungulates.

Introduction

The condition of an animal is primarily a reflection of its fat reserves which in turn are generally assumed to determine an individual's reproductive potential [1], food availability and/or presence or absence of diseases/disorders. Body condition scoring is a reasonable alternative to direct measurement of chemical composition. It provides an index of the energy stored as fat and muscle and is a quick reliable means of identifying extremes in nutritional status [2]. A general estimate of the condition of a population can be valuable as one measures the response of a population to a given ecosystem [3]. Asian elephants live in seasonal environments, and almost all populations moving between wet and dry seasons differ in availability of food, water and nutritional quality [4, 5]. Because the physical condition of an elephant is

responsive to nutrition and habitat conditions, assessment of body condition should prove to be useful for ecological studies as it has in other wild species [6, 7].

In the livestock industry, condition scores have been widely applied as measures of nutrition, reproductive potential and herd health or productivity [8, 9, 10, 11] and the same has been found applicable in wild ungulates [1,3,12], domestic Asian elephants [7] and free ranging African elephants *Loxodonta africana* [13]. Ideally this technique could be applied at any time of the year, to any sex or age group [3, 14]. Since no body condition scoring of wild Asiatic elephant is available across their entire range, we present the first attempt to examine the body condition of wild Asiatic elephant in Mudumalai Tiger Reserve, Western Ghats using the simple scoring method.

Methods

The Mudumalai Tiger Reserve (11º 32'-11º 43' N; 76º 22'-76º 45' E) is situated at the tri-junction of Tamil Nadu, Karnataka and Kerala states at an elevation ranging from 960 to 1266 m. This 321 km^2 Tiger Reserve includes 100 km^2 of National Park. The reserve is bounded with Wayanad Wildlife Sanctuary on the west, Bandipur Tiger Reserve in the north and Nilgiri North Forest Division in the south. According to Champion and Seth [15], vegetation types are classified into Southern Tropical Dry Thorn, Southern Tropical Dry Deciduous, Southern Tropical Moist Deciduous, Southern Tropical Semi-Evergreen, Moist Bamboo Brakes and Riparian Fringe Forests. The present study was carried out in the deciduous habitat of Mudumalai Tiger Reserve covering 107 km^2 (Fig. 1). The Wayanad-Nagarhole-Bandipur-Mudumalai complex in Western Ghats constitutes one of the most extensive strongholds of viable elephant population in India [16, 17]. In the study area elephant population estimate (per sq. km) was found to be 5.5 ± 0.99 [18]. This Reserve has a long wet season and a short dry season and receives rainfall from south-west and north-east monsoons. The south-west monsoon starts by May and ends by August while the north-east monsoon starts by September and ends by December. Based on the climate of the area, there are distinct seasons recognized; dry season (January to April) and a long wet season (May to December). The rainfall has a marked east-west gradient with the eastern areas getting the least amount of the heaviest rains (1000 to 2000 mm). Temperatures range from 8ºC in December to 35ºC in April.

Data on body condition of Asian elephant was collected between February 2008 and December 2009 (Dry season-February to April; wet season-May to December) within 107 km^2 of deciduous habitat (dry and moist) in Mudumalai Tiger Reserve. Five vehicle transect routes ranging from 15 to 23 km were monitored to record elephant sightings (Fig. 1). Total length of 93.5 km was monitored twice a month during early morning and late afternoon resulting in a total effort of 3740 km. A total of 1622 body condition assessments were carried out within a distance of 50-100 m using binoculars whenever necessary. Asian elephants were classified into various age-sex categories based on relative height and morphological characteristics [19, 20]. Young elephants (< 15 years) were compared to the oldest adult females in the group (Eisenberg and Lockhart 1972) based on their height,

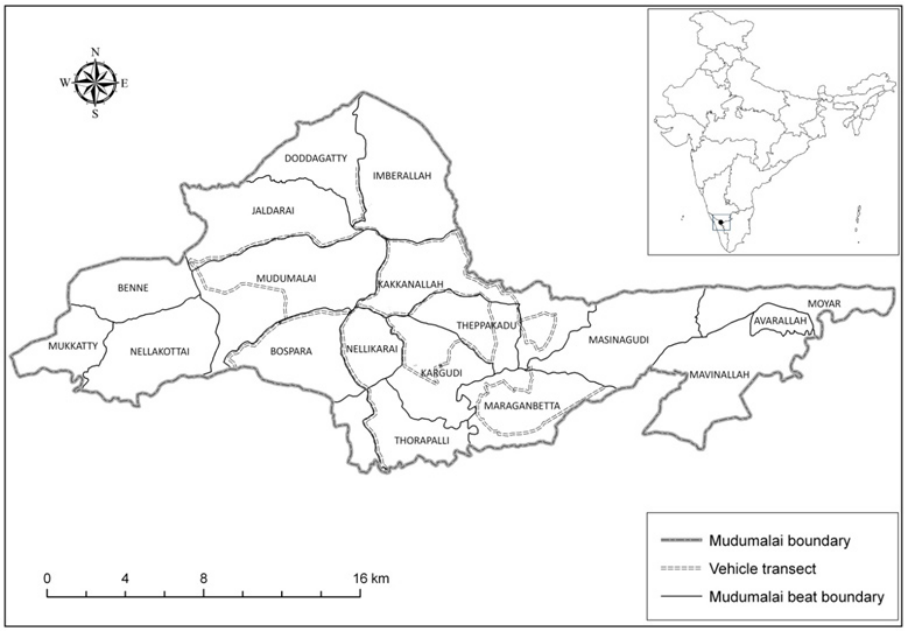

Fig. 1: Location of intensive study area showing vehicle transect routes in Mudumalai Tiger Reserve, Western Ghats.

while older elephants were classified based on morphological characteristics like degree of ear fold, depression of buccal cavity, forehead and with the aid of camp elephant age classes with tribal mahout's field experience. Asian elephants were placed in broad age-classes; calves (< 1 year old), juveniles (1-5 years old), sub-adults (5-15 years) and adults (> 15 years). Males were identified by the presence of tusks while females were tuskless and 'Makhna' (tuskless sub-adult and adult males) was identified using morphological characters [21] such as trunk musculature, absence of tusks and presence of penis sheath. We applied Wemmer *et al*. [7] method with some modification and Riney [3], an index of body condition evaluation for wild Asiatic elephant that relies on visual assessment of mass (muscle and fat) associated with skeletal structures, such as the head, shoulder, rib cage, lumbar depression, tail and pelvic girdle. The following points were used to score body condition of elephant:

a, Head – temporal depression (0 - Full and convex in outline when viewed and frontal ridge vaguely outlined at best, 1 - Moderately concave and defined frontal ridge, 3 - deeply concave; frontal ridge forms a crater-like rim around the temporal depression);

b, Flank area - immediately in front of the pelvic girdle (0 - No depression visible and flank bulges outwards in front of the pelvis, 1 - Moderate depression visible, 3 - Depression visible as a sunken area immediately in front of the pelvis);

c, Lumbar vertebrae-behind ribs and in front of the pelvis (0 - Not visible, lower back smooth and rounded, 1 - Visible as a ridge, 3 - Visible as a knife-like blade);

3 - Depression visible as a sunken area in front of the pelvis);

d, Pelvic girdle - external angle of the ilium (0 - Invisible, rump region between the ilium and caudal vertebrae filled with tissue, 1 - Visible but not pronounced and the rump is a slightly depressed zone between the ilium and caudal vertebrae, 3 - Visible as a jutting bone; rump is a pronounced sunken zone between ilium and caudal vertebrae);

e, Thoracic region (0 - Invisible ribs, smooth barrel, 1 - Some ribs are visible, but the extent and demarcation are not pronounced, 3 - Many ribs strongly demarcated with pronounced intercostal depressions);

f, Lumbar Shelf (0 - No depression in shelf and appears almost round from behind, 1 - Slight depression on either side, 2 – depression on either side);

g, Tail contour – (0 - Deformity in the tail is invisible, 1 – Slight deformity in the cut tail with drooping hair, 2 – Prominent deformity in the cut tail with drooping hair) [7, 3]).

In wild conditions, all body regions of elephants could not always be scored due to thick vegetation cover and hence those elephants were excluded in the assessment. A score between 0 and 2 was given to each measure for every region and all the scores were added to give a total score for assessing the overall body condition. Each region was given a score like 0 – Good, 1- Medium, 2 – Poor. The total score was on a scale of 1-14. Scores ranging from 0-5 were considered as good, 6-10 were considered medium and 11-14 were considered poor. Data was examined sex and age wise as differences in body condition were likely to exist when energetic costs differed between males and females at different age groups. Mean scores for all age classes were calculated for dry and wet season. Mann-Whitney test [22] was used to determine significant differences in body condition of each age class of Asian elephant between seasons.

Results

Of the percentage of assessments made, body condition evaluation revealed 96.2% elephants in good health category, followed by 2.4% medium and 1.4% poor categories (Table 1). Adult male Asian elephants had a better body condition compared to adult females. Elephant body condition was better during wet season than dry season. Age wise the percentage of elephants in good body condition was maximum (100%) in female sub-adults, female juveniles, male juveniles and calves in both seasons. Adult female's body condition was poor (5.1%) in the dry season than wet season (1.6%). Male adults and sub-adults did not appear to be in poor health in both the seasons. Adult males (8.3%) in the dry season, wet season (2.4%) and sub-adult males in the dry season (7.4%) were observed in medium health condition. The overall elephant mean body condition score was higher in adult female as compared to other age classes (Fig. 2). Between seasons the mean score was higher during dry season than wet season in all age classes. However the overall body condition of elephant showed significant difference between seasons ($P = 0.007$) while the adult female body condition showed significant difference ($P = 0.001$) than other age classes ($P \geq 0.19$). More individuals were sighted in wet seasons than dry seasons.

Table 1: Body condition of Asian elephant in Mudumalai Tiger Reserve, India (February 2008–December 2009).

Seasons	Individuals	Male			Female			Calves	Total
		Adult	Sub-adult	Juvenile	Adult	Sub-adult	Juvenile		
Mann-Whitney test between dry and wet season (P value)		0.42	0.60	0.94	0.001	0.16	0.57	0.27	0.007
Dry	Number examined	36	27	41	294	57	67	74	596
	Good (%)	91.7	92.6	100	90.1	100	100	100	94.3
	Medium (%)	8.3	7.4	0	4.8	0	0	0	3.2
	Poor (%)	0	0	0	5.1	0	0	0	2.5
Wet	Number examined	41	48	46	509	113	124	145	1026
	Good (%)	97.6	100	100	94.7	100	100	100	97.3
	Medium (%)	2.4	0	0	3.7	0	0	0	1.9
	Poor (%)	0	0	0	1.6	0	0	0	0.8
Overall	Number examined	77	75	87	803	170	191	219	1622
	Good (%)	94.8	97.3	100	93.0	100	100	100	96.2
	Medium (%)	5.2	2.7	0	4.1	0	0	0	2.4
	Poor (%)	0	0	0	2.9	0	0	0	1.4

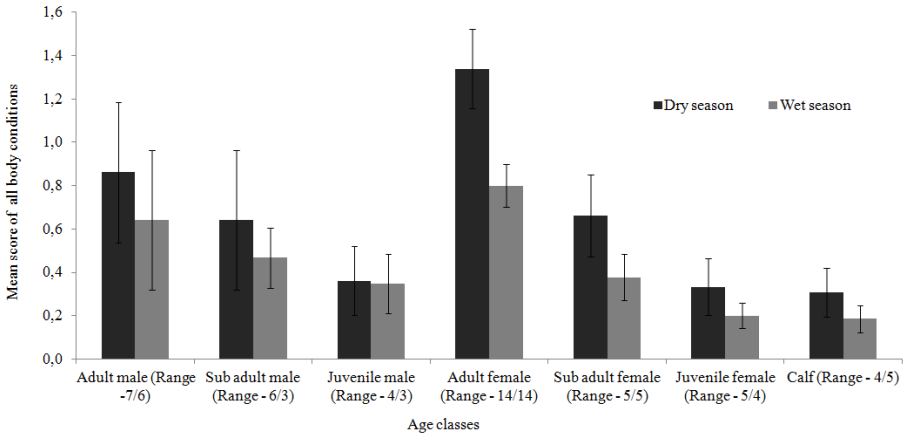

Fig. 2: The average body condition (good/medium/poor) score of different age classes of Asian elephant in Mudumalai Tiger Reserve, Western Ghats.

Discussion

Knowledge on body condition of animals within a free-ranging population can be used to assess the health and nutritional status of the particular population [23, 24, 25]. The scoring index of visual assessment of mass (muscle and fat) associated with skeletal structures was a reasonably accurate predictor of total body fat and particularly an easy index to measure in the field. Body condition scores were related to objective measures of biological change [5, 10, 26]. Our data indicated that animals, both male and female were observed to be more in either poor or medium condition during the dry season than the wet season. The mean scoring data also showed a higher score

during dry season than wet season. This might be due to less availability of nutritional food quality during the dry season. Elephants observed in poor and medium condition were observed less in the wet season due to the high availability of food resources. The availability of optimum biomass level in grasses especially crude protein was potential for elephants which might have decreased in the dry season [27]. The level of fat reserves by obtaining field measures of body fat was a useful indicator of a population's general well-being [7] wherein Mudumalai, few animals were in poor body condition. Sub-cutaneous changes in tissue mass may be sensitive indicators of body composition [7]. Body condition of animal populations is not only a reflection of health but also an indicator of other factors that affect body condition, such as breeding behaviour and fawning/calving. Since elephant calves were seen throughout the year in Mudumalai, the proportion of adult female body condition was poor compared to adult males. Nutritional stress in lactating females might have resulted in their poor body condition. Scarcity of nutritious forage during summer makes the animal more stressful resulting in a higher percentage of their poor health condition which is unlikely in the wet season. Difference in patterns of fat deposition may exist between sexes, age-groups, and sub-species [26]. This could also be one of the reasons as to why males were found in better condition than females. Evans [28] and Wemmer *et al*. [7] reported that depressions and bony appearance in elephants increased with age. The aging factor could also be one of the reasons where either medium/poor condition was noticed mainly in adult elephants. However our study had some limitation wherein no attempt was made to identify the individual elephant and thus it may lead to repeated score of the same individual. Future study can take account of individual identification during body condition scoring. This simple scoring technique was described here not only to facilitate recording body condition of Asiatic elephant but to allow its application on several other wild ungulates with slight modification. Currently there are not enough studies with information about general body conditions of wild Asian elephant populations, enabling a clear ranking about well-being and health, and thus it is important to conduct such studies over larger populations in similar and different habitats to develop reference values.

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