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Assessment of the health status of wild ungulate based on body condition evaluation technique in Manipur zoological Garden, Iroisemba, Manipur (India)

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Abstract
There are many methods for evaluating the health condition of the ungulate species where body condition scoring is one such method under veterinary and wildlife morphometrics, which help to evaluate and judge the animals physical appearance condition based on visual examination of the degree of protuberance of bony processes on the body surface and condition of the skin. The present study is carried out in Manipur Zoological Garden to assess the health condition of six ungulate species by body condition evaluation technique from a safe distance without much disturbance to them. Ungulates are then graded as good (0-5), average (6-8) and poor (9-12) body condition by using point scale based on their body appearances. Total 114 ungulates body condition are evaluated and reported that maximum (42.98%) ungulates are in average body condition, followed by (36.84%) in good and (20.18%) in bad body condition. The higher number of ungulate species per enclosure can lead to the declined of body condition appearance and lack of fodder species inside the enclosure can also lead to it. Minimizing the numbers to the optimal number and planting of fodder species around the paddock can help in improving the body appearance of the ungulates.

Keywords: body condition scoring, evaluation techniques, point scale, minimizing and planting

Introduction
In order to maintain a large collection of wild animals in a state of good health it is necessary to provide suitable sanitary buildings, a wholesome and hygienic food supply and expert medical supervision so as to successfully combat diseases, especially those of contagious nature, a most complete and efficient quarantine system is absolutely necessary (Blair, 1932) [2]. No vegetation should be destroyed/ damaged for constructing an enclosure as the landscape around every animal enclosure should be comprised with different type of shed trees and fodder trees so as to stimulate naturalistic behavior and also to feed preferably (CZA, 2014) [10]. Condition can be defined as the temporary physical state of an animal in relation to its nutrition, health and capacity to deal with diseases and environmental strain or tension (Pedrotti and Fraquelli, 2001) [11]. The body condition of an animal can be measured in terms of the amount of fat depots and muscle in its body in which diet and nutrition are of great importance (Kie, 1988) [7]. The body condition of an animal is the reflection of the health status of an animal as well as availability of fodder species in the paddock area. In order to achieve the most accurate estimation of an animal's physical condition, a number of different scoring methods have been developed such as the kidney fat index, bone marrow fat index (Jakob *et al*. 1996; Cook *et al*. 2007) [6, 5], bioelectrical impedance analysis, and morphometric measurements such as weight, size, circumferences and ratios from these values (Pitt *et al*. 2006; Barthelmess *et al*. 2006) [12, 1]. The physical status and general health condition of wild animals can be judged by evolution of their body condition, which can be done from safe distance without much disturbance to the animals (Chitariya *et al*., 2018) [4]. A non-invasive visual body condition index for deer exists which evaluates nutritional condition based on visibility and angle of the tail, pelvic gridle, tuber ilium, the lateral process of the backbone vertebrate and the ribs although there is some subjectivity in scoring ocularly, the method was valid for deer in different habitats. The body condition of live deer has also been assessed visually in the wild (Riney, 1960, 1982, 1995) [13, 14]. The body condition of free ranging wild herbivores can be judge and evaluate using point scale (Singh *et al*., 2009) [16].

Moreover, body condition scoring systems are used extensively by ecologists investigating wild populations and their interaction with restricted resources or changing environments (Lane *et al*. 2014; Carpio *et al*. 2015) [9, 3].

Material and Method

Study area

Manipur Zoological Garden, Iroisemba is one of the most attracting placed to be visited as it is often called 'the Jewel box' of the northern eastern state, Manipur, India. It is located at the Imphal-Kangchup road which is 7 km off the west of capital city, Imphal near the foot of Langol Reserved Forest. The zoo was set up on 2nd October, 1976 on the advised of the then State Wildlife Advisory Board, Manipur and it was recognised by the Central Zoo Authority as a medium zoo covering an area of 8.17 hectare and an additional area of 2.13 hectares which is maintained at Langol Reserve Forest. It exhibit total 44 species of birds and animals that include 13 endangered species including mammals, reptiles and birds. It served as a home to total around 356 animals that belonged to all Schedule (I -IV), un- scheduled and exotic. The precious state pride animal 'Sangai or Brow antlered deer' and also the almost extinct state bird 'Nongin or Hume's pheasant' which belong to the Schedule-I under Wildlife Protection Act 1927 are also exhibited in the zoo. The zoo is bordered by the paddy fields of Games Village in the north, Central Agricultural University in the south, the Campus of Manipur Polo/Horse Riding Association in the west and more paddy field along the east.

Area description and climatic condition

Manipur Zoological Garden has an elevation of 780m to 910m above mean sea level and lies between 24º48'50" to 24º48'2" north latitude and 93º53'34" to 93º53'42.6" east longitude. The climate is warm and temperate. When compared with winter, the summers have much more rainfall. The average annual temperature is 21.1^{0}C / 69.9^0 F with annual rainfall of 1581 mm/ 62.2 inch.

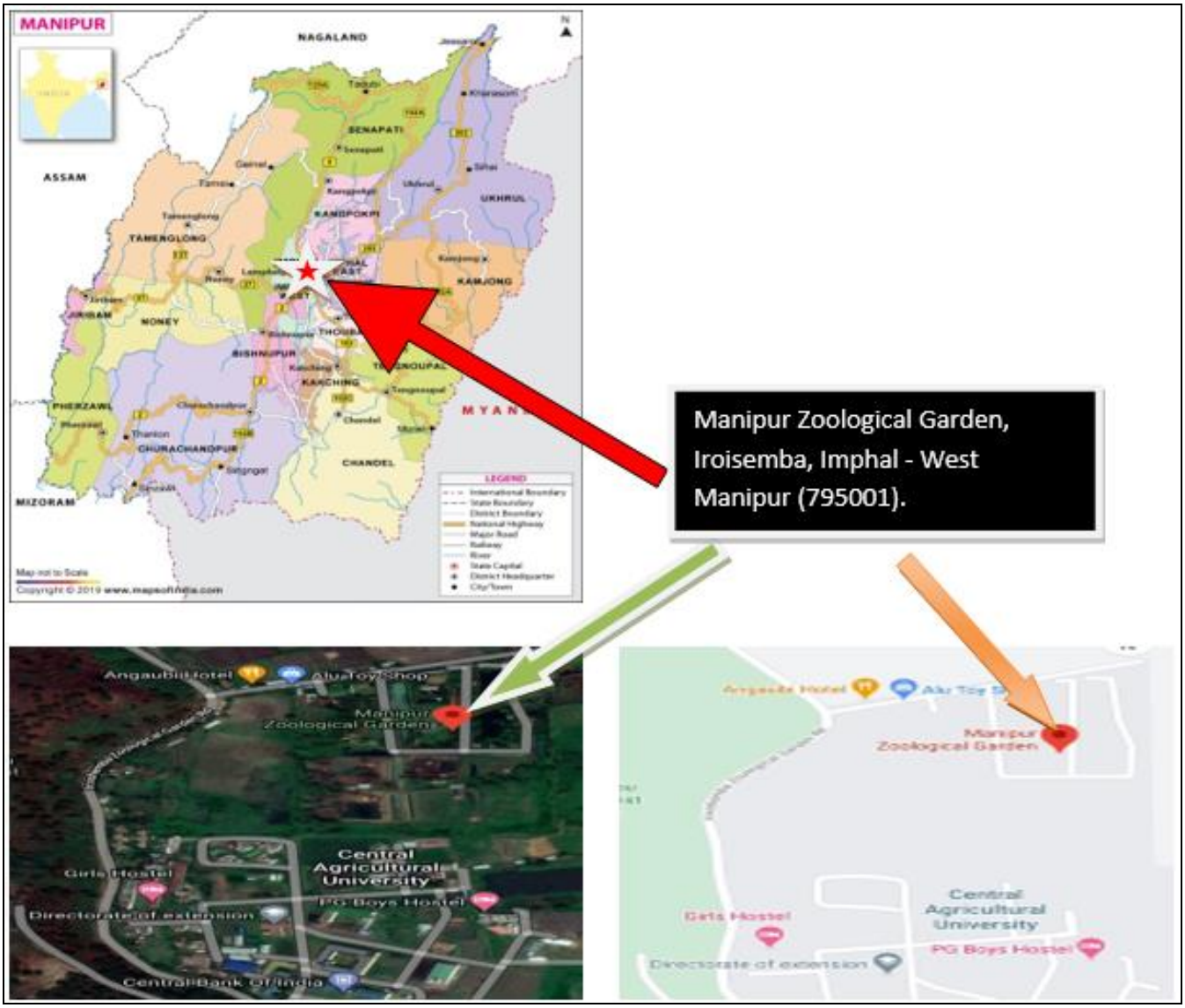

Fig 1: Geographical map view of Manipur Zoological Garden, Iroisemba, Manipur (India)

Methodology

The present study was performed during the duration of January 2020 – May 2020 in the zoo from morning 7 a.m. to 10 a.m. The Body Condition Evaluation technique was used to evaluate the health condition of the ungulates from a safe distance without any disturbance to them. The Body condition of the wild herbivores will be evaluated on point scale, as suggested by Riney (1960) [13] and modified Shrivastav and Sharma (2000) [15]. Body condition evaluation involved judging the animals physical appearance condition based on

visual examination of the degree of protuberance of bony processes on the body surface and the condition of the skin coat. The point will be allotted to each animal by seeing its key areas such as skin coat, flank, ribs, pelvic girdle, vertebral column and lumbar shelf. The recommended scores for the corresponding condition quality of different body parts are given in Table 2. Animals scoring 0-5 were graded in poor, 6-8 in fair and 9-12 in good condition.

Table 1: Ungulate body condition evaluation score with respect to their body part:

Body Part	Point = 0	Point = 1	Point = 2
Skin coat	Rough and thick with folds	Dull, without or with lustre	Smooth with lustre
Flank	Depression concave and tucked in	Slightly concave and outline visible	Depression is barely visible, outline is distinct
Ribs	Ribs clearly visible within coastal depression	Ribs are visible but all are not countable	Thoracic surface is smooth, ribs not visible
Pelvic girdle	Bony projection are clearly visible	Slightly visible	Bony projections are barely visible
Vertebral column	Lateral processes prominent	Lateral process of the lumbar are visible	Laterally it is smooth without any break, lumbar process visible
Lumbar shelf	Depression deep and concave	Slight depression on either side	Areas almost round from behind without any depression

Secondary data were also collected. And standard statistical procedures were used in the study (Snedecor & Cochran, 1994) [19].

Result and Discussion

The body condition evaluation of the six ungulate (Sambar, Spotted deer, Barking deer, Hog deer, Sangai and Himalayan Goral) was performed in order to assess the health status. Out of total 114 ungulates 42 (36.84%) was in good body condition, followed by 49 (42.98%) in average body condition and lastly 23 (20.18%) are in poor body condition.

Table 2: Body condition evaluation of the wild ungulate species of Manipur Zoological Garden

Sl. No.	Names of the Species	Number of animals evaluated	Body condition		
			Good	Average	Poor
1	Sambar (*Rusa unicolor)*	24	8 (33.33%)	11 (45.83%)	5 (20.83%)
2	Spotted deer/Chital *(Axis axis*)	25	6 (24.00%)	14 (56.00%)	5 (20.00%)
3	Barking deer *(Muntiacus muntjak)*	8	5 (62.50%)	2 (25.00%)	1 (12.50%)
4	Hog deer (*Axis porcinus)*	51	18 (35.29%)	21 (41.18%)	12 (23.53%)
5	Sangai/brow antlered deer (*Rucervus eldi eldi*)	5	4 (80.00%)	1 (20.00%)	0
6	Himalayan Goral	1	1 (100%)	0	0
Total		114	42 (36.84%)	49 (42.98%)	23 (20.18%)

And species wise data are given below:

1.The body condition evaluation of Sambar deer shows that out of total 24 Sambar deer maximum 11(45.83%) was in average body condition, followed by 8(33.33%) in good body condition and 5(20.83%) in poor body condition; 2. Spotted deer shows that out of total 25 Spotted deer maximum 14(56.00%) was in average body condition, followed by 6(24.00%) in good body condition and 5(20.00%) in poor body condition ; 3. Barking deer shows that out of total 8 Sa Barking deer maximum 5(62.50%) was in good body condition, followed by 2(25.00%) in average body condition and 1(12.50%) in poor body condition. 4. Hog deer shows that out of total 51 Hog deer maximum 21(41.18%) was in average body condition, followed by 18(35.29%) in good body condition and 12(23.53%) in poor body condition; 5. Sangai deer shows that out of total 5 Sangai deer maximum 4(80.00%) was in good body condition, followed by 1(33.33%) in average body condition and non in poor body condition; and 6. Himalayan Goral deer shows that out of total 1 Himalayan Goral deer maximum 1(100%) was in good body condition, non in average body condition and also non in poor body condition.

It is clear that the body condition of Sangai deer was in better body condition followed by Barking deer, than by Hog deer, than by Sambar deer and lastly by Spotted deer. The Sangai deer was in better body condition as compare to other deer. As Himalayan Goral species has only 1 animal so it can't be counted as better body condition than Sangai deer.

Similarly, Singh *et al*. (2009) [16], Singh *et al*. (2012) [17], Singh (2013) [18], Upadhyay (2015) [20] and Chitariya *et al*. (2018) [4] also studied about the body condition evaluation of the different ungulate species in different area according to climatic, topographic, nutritional and genetic factors.

Conclusion

In the present studies for the assessment of the health status of wild ungulate based on body condition evaluation technique in Manipur Zoological Garden, Iroisemba, Manipur, India, it can be concluded that the health status of the six ungulate species exhibited in Manipur Zoological Garden were in average body condition which might be due to over-numbered of deer available in per enclosure for medium zoo which lead to competition of food between the deer and also as there was lack of fodder species and shed trees inside the paddock area. It can be improved by proper maintaining of the enclosure by planting more plant sapling inside the paddock area that can be act as a secondary source of food. And also minimizing the number of deer to the optimum number per enclosure can help in improving the body condition of the ungulate species.

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