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Short Communication

Effect of Seasonal Swings and Age Specific Variations on Body Weight of Indian Gerbille (*Tatera indica)*

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Authors' Contributions
MA and SN designed and conducted the study. MI did statistical analysis, WA collected samples and helped in paper writing. MAB designed the study and supervised the work.

Key words
***Tatera indica,* Age classes, Seasons, Body weight.**

ABSTRACT

Two hundred and eight specimens of Indian gerbille were captured from the fields and farmhouses of the croplands of the Central Punjab. The collected animals were segregated into five age classes, *i.e.* I (immature), II (sub-adults), III (adults), IV (middle aged), V (old), on the basis of tooth wear, mandibular length, and condition of reproductive organs. In the winter samples, most of the animals belonged to the middle body weight classes, while in the spring sample majority of specimens belonged to the heaviest weight classes. The comparison of age to body weight resulted in considerable overlap. Age Class I animals never exceeded 70g weight limit. Majority of Age Class II animals weighed less than 86g. Most of the Age Class III animals weighed more than 100g. As compared to Age Class III, small proportion of Age Class IV weighed 100g or less, and Age Class V animals comprised largely of heavy animals. In the winter sample, animals of Age Class III, IV and V were dominant, while in the spring sample, animals of Age Class IV and V were predominant. Animals of Age Class I were represented for the first time in the summer sample. It was also observed that the seasons influenced the body weight of the gerbille at a statistically significant level ($P < 0.01$). Sex did not seem to be an important factor in this respect. However, interaction of age and sex was statistically significant ($F= 6.94$; d.f.= 3, 112; $P< 0.01$).

Indian gerbille *(Tatera indica)* is one of the largest species in the murid subfamily Gerbillinae. Body mass ranges from 100 to 227g and body length from 15 to 17 cm. Colour ranges from reddish brown to fawn. Thick fur covers the body but the tail hair is sparse. A small tuft of black hair is found at the tip of the tail. The tail is approximately one half the body length of the animal and has a light brown band on each side. The soles of the feet are hairless and pigmented, as in other members of the genus *Tatera*, while the ears are also naked and elongated (Prakash and Gosh, 1975; Prater, 1980; Vaughn *et al*., 2000). This genus has phylogenetically been known as more primitive than to be specialized (Roberts, 1997; Mirshamsi *et al*., 2007).

T. indica prefers extensive burrows with chambers with a depth depending upon the surrounding soil composition and season. These gerbilles are generally not found in areas with very low rainfall or cold temperatures (Goyal and Ghosh, 1993; Prater, 1980). It is a widespread species ranging right from the North Eastern countries through Arabian Peninsula to Iran expanding to the South Asian region (Kryštufek, *et al*., 2008). It is mostly found in the dry, arid, uncultivated barren areas preferable with soft soils dry river slopes (Molur *et al*., 2005). Their existence in cultivated lands has also been reported where they have been the cause of heavy losses (Colangelo *et al*., 2005). The relationship between the sexes is currently not known (Prater, 1980). Young Indian gerbilles are independent as early as 21 days of age and reach sexual maturity as early as 10 weeks of age. Females attain sexual maturity earlier than males (Prater, 1980; Thomas and Oommen, 1999). Mott (2003) reported that a captive *T. indica* lived for seven years. In the wild, however, most individuals don't survive their first year of life and adults probably live only a few years.

The diet of Indian gerbilles consists of grasses, leaves, roots, and grains. They also eat grubs, insects, and nestling ground birds. This species has also been known to kill and eat smaller rodents and other mammals. Cannibalism on young is common in both captivity and the wild (Prater, 1980).

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Body weight and body length have traditionally been used for grouping the small mammals (Leslie *et al*., 1952) as they provide a simple index of age for both, live as well as dead specimens. Since last two to three decades, body size has been proposed as an alternative to age as a demographic variable (Kirkpatrick, 1984; Sauer and Slade, 1985, 1986, 1987a, b). So, this paper describes scientific information regarding the influence of seasons and age on the body weight of Indian gerbille (*T. indica*) which could be use as a demographic character.

Materials and methods

Two hundred and eight specimens were collected through metallic snap traps from human dwellings in rural areas with fields at Central Punjab. The trapping was done on monthly basis in randomly selected villages for 12 months starting from April. Each trapping period lasted for five successive nights, while 140 traps, each equipped with a piece of chapati, were set everynight. Each specimen was weighed and standard body measurements (body weight, body length, tail length, length of hind foot and ear) were measured to 0.1 cm (Hall, 1962). The dead bodies were autopsied for reproductive data. However, skulls of only 93 specimens were prepared. Thoroughly dried skulls were separetely kept in paper bags provided with complete data of the specimen. All the samples were segregated into five classes designated as immature, subadult, adult, middle-aged, old, on the basis of body weight, body length (head and body), toothwear, mandibular length, as well as condition of reproductive organs.

The 10 cranial measurements taken during the course of this study were as occipito-nasal length, palatal length, zygomatic breadth, mastoid breadth, height of skull, length of the upper molar row, length of M^1, diameter of auditory bulla, nasal length and mandibular length.

Results

Season wise body weight information is given in Table I where only 9.4 % of the specimens collected in winter, weighed 85g or lesser. The bulk of specimens belonged to 101-115g (33.9%) and 116-130g (30.4%) weight ctatagories. In the spring samples, there was no specimen weighing lesser than101g. Majority of specimen in this sample belonged to weight class 131-145g (21.2%) and ≥ 146g (66.7%). In the summer sample, the body weight composition greatly changed when majority of the animals (34.1%) weighed lesser than 71g. In the fall sample, the proportion of light-weight animals *i.e.* animals weighing lesser than 71g (16.2%) decreased and the sample was more homogeneous than that of the summer sample.

Considerable overlap resulted when molar age calsses were compared with weight classes. The animals of age class I never exceeded 70g weight limit (Table II). Abut 59.3% of the age class II animals weighed less than 86g. Only 23.7% of the specimens, in this age category, weighed more than 100g. In age category III, 88.3% of animals weighed more than 100g. As compared to this, only 50% of the specimens in age category IV weighed 100g or less. In age category V, only 5.6% of the animals weighed lesser than 101g, and about 66.6% belonged to weight catagories 131-145g (19.4%). Thus, in age class III, IV and V, the proportion of animals of higher weight catagories progressively increased.

Table I.- Season wise body weight classes of *T. indica*.

Body weight (g)	Seasons			
	Winter (n= 53)	Spring (n= 33)	Summer (n= 85)	Fall (n= 37)
≤ 70	-	-	34.1 (29)	16.2 (6)
71-85	9.4 (5)	-	9.4 (8)	16.2 (6)
86-100	5.6 (3)	-	10.9 (9)	10.8 (4)
101-115	28.3 (15)	9.1 (3)	11.8 (10)	19.0 (7)
116-130	30.4 (16)	3.0 (1)	10.6 (9)	10.8 (4)
131-145	11.2 (6)	21.2 (7)	9.4 (8)	13.5 (5)
≥146	15.1 (8)	66.7 (22)	14.1 (12)	13.5 (5)

Table II.- Distribution of body weight of *T. indica* specimens in different age classes.

Body weight(g)	Age class				
	I	II	III	IV	V
≤ 70	100 (13)	35.6 (21)	-	-	2.8 (1)
71-85	-	23.7 (14)	5.0 (3)	2.5 (1)	-
86-100	-	17.0 (10)	6.7 (4)	2.5 (1)	2.8 (1)
101-115	-	15.2 (9)	21.7 (13)	20.0 (8)	13.9 (5)
116-130	-	8.5 (5)	23.3 (14)	12.5 (5)	13.9 (5)
131-145	-	-	15.0 (9)	25.0 (10)	19.4 (7)
≥146	-	-	28.3 (17)	37.5 (15)	47.2 (17)

Table III.- Age composition (%) in the seasonal samples. Mean body weight is given in parenthesis.

Age class	Season			
	Winter (n=53)	Spring (n=33)	Summer (n=85)	Fall (n=37)
II	24.5 (100.8)	6.1 (114.2))	32.9 (66.6)	37.9 (79.3)
III	26.4 (123.1)	18.2 (155.8)	32.9 (124.4)	35.1 (129.8)
IV	26.4 (128.4)	33.3 (152.6)	14.1 (138.9)	13.5 (124.9)
V	22.7 (133.5)	42.4 (179.2)	4.8 (141.6)	13.5 (107.9)

Table III documents information about age composition in the seasonal samples. In the winter samples

of age class III to V were represented in more or less similar proportions. The average weight for each age class in this seasonal sample increased progressively in higher age classes. But, the difference between consecutive age classes was little, especially between age class III and IV, and IV and V. In the spring sample, animals of age class IV (33.3%) and V (42.4%) were predominant. In the summer sample, specimens of age class I constituted 15.3% of the sample, whereas animals of age class II and III each constituted 32.9% of this seasonal sample. In the fall, specimen of age class II (37.9%) and III (35.2%) had clear cut numerical superiority over age class IV (13.5%). It is of interest to note that proportion of animals of age class V was considerably greater in the fall sample as compered to that in the summer sample. The seasons and age (Supplementary Tables S1, S2) influenced the body weight of *T. indica* at a statistically significant level ($P < 0.01$). Supplementary Table S3 shows that sex did not seem to be an important factor in this respect. However, interaction of age and sex was statistically significant ($P < 0.01$).

Discussion

The Indian gerbille was selected for comparison of body wieght- and age- based demography. Because, the gerbille is known to have a prolonged period of growth (Taber *et al*., 1967), it seemed to be very suitable choice for this study. The age classes were established on the bases of dental wear, size of ramus, and reproductive status of the animals. Age class data revealed that age class I animals were present only in the sample of the summer season. Animal of age class II were common in all the seasonal samples with the excetion of spring. This indicated that recruitment of the young to the population generally took place when the gerbilles had attained age class II, and that minimum recruitment took place in the spring season and maximum during the summer.

Adult animals which belonged to age classes III, IV and V were represented in all the body mass catagories except the ≤ 70g category. As compared to this, the age class I animals did not occur in the higher body weight classes (higher than 70g). Age class II animals were not recorded in the heaviest weight class, *i.e.* 131g or more. This suggested that the adult gerbilles were quite variable in their body mass, and could enter any of the mass classes. This meant that each body weight class was composed of several age groups.

Body mass study indicated predominance of heavier animals in the winter sample, whereas the spring sample was largley compried of animals that belonged to the heaviest body weight class. This is in accordance with the study of Brown *et al*. (2003) where he described two peaks of rat population, after the harvesting of summer and spring Rice crops, and it can easily be deducted that rats attain maximum weight in spring followed by winter seasons as more food is available to *T. indica*. Al-Mutairi *et al*. (2012) also reported the change in body weight with changing season in lesser jerboa and the animal gained the greater body weights in spring and autumn as compared to that of summer and could be attributed to the food availability. Similarly regarding age, animals of age class II to five occurred in the winter sample in approximately equal proportions, while in the winter sample age class II animals were present in relatively a small proportion. From this description it seems that animals having heavier body weight had a better survival rate than others during the winter season. Undoubtedly, predominance of heavier animals in the winter and spring samples may have been in part due to growth and better nutrient conditions in the spring (Rao, 2003).

It was also observed that male gerbilles appeared to grow to greater body weight than the females. The males predominated in the largest size classes. A similar phenomenon has been reported for the males of *Rattus rattus* by Brooks *et al*. (1989). Quirici *et al*. (2010) revealed that male body weight of degus is greater than female and attributed to greater home range of males as compared to females.

The results of the present study indicate that mass-based demographic studies can provide useful insights into survival and perhaps also into fecundity of the population. Litter size has been reported to be a function of maternal body size within populations of a variety of mammals (Farhang-Azad and Southwick, 1989; Glass *et al*., 1987; Sauer and Slade, 1987c).

As body weight can be influenced by a variety of factors, its use as a demographic character must take care to ensure that it is measured under constant conditions for all animals. Ingested food as well as trapping stress could also affect the body weight of a captured animal (Sauer and Slade, 1987b).

Supplementary material

There is supplementary material associated with this article. Access the material online at: http://dx.doi.org/10.17582/journal.pjz/2017.49.6.sc1

Statement of conflict of interest

Authors have declared no conflict of interest.

References

Al-Mutairi, M., Mata, F. and Bhuller, R., 2012. *Anim. Biodiv. Conserv.,* **35**: 119-1124.

Brooks, J.E., Ahmad, E. and Hussain, I., 1989.

Reproductive biology and population structure of Rattus rattus *in Rawalpindi, Pakistan.* Vertebrate Pest Control project, Food Security Management Post harvest Management. Technical Rept. No.21, G.O.P./USAID/DWRC. NARC, Islamabad, Pakistan, pp. 18.

Brown, P.R., Singleton, G.R., Norton, G.A. and Thompson, D., 2003. *ACIAR Monogr*., **96**: 264-266

Colangelo, P., Civitelli, M.V. and Capanna, E., 2005. *Trop. Zool*., **14**: 243–253. https://doi.org/10.1080/03946975.2001.10531156

Farhang-Azad, A. and Southwick, C.H., 1989. *Annls. Zool*., **15**: 1-42.

Glass, G.E., Childs, J.E., Korch, G.W. and Leduc, J.W., 1987. *Occas. Pap. Mus. Nat. Hist. Univ. Kansas* (Lawrence)., **130**:1-33.

Goyal, S. and Ghosh, P., 1993. *Acta Theriol.*, **38**: 453-456. https://doi.org/10.4098/AT.arch.93-37

Hall, E.R., 1962. *Mus. Nat. Hist. Univ. Karachi Miscell. Pub.*, **30**: 1-46.

Kirkpatrick, M., 1984. *Ecology*, **65**: 1874-1884. https://doi.org/10.2307/1937785

Kryštufek, B., Shenbrot, G., Sozen, M. and Molur, S., 2008. *Tatera indica*. In: *IUCN 2013*. IUCN Red List of Threatened Species. Version 2013.2.

Leslie, P.H., Venables, U.M. and Venables, L.S.V., 1952. *Proc. zool. Soc. London*, **122**: 187-238. https://doi.org/10.1111/j.1469-7998.1952.tb06316.x

Mirshamsi, O., Darvish, J. and Kayvanfar, N., 2007. *Iran. J. Anim. Biosys.,* **3**: 49-61.

Molur, S., Srinivasulu, C., Srinivasulu, B., Walker, S., Nameer, P.O. and Ravikumar, L., 2005. *Status of South Asian non-volant small mammals: Conservation assessment and management plan (C.A.M.P.) Workshop Report*. Zoo Outreach Org/ CBSG-South Asia, Coimbatore, India, pp. 618.

Mott, S., 2003. *Tatera indica (Indian Gerbil) animal diversity.* Available at: http://animaldiversity.ummz.umich.edu/site/accounts/information/Tatera_indica.html.

Prakash, L. and Gosh, P. (Eds.), 1975. *Rodents in desert environments*. Dr. W. Junk b.v., Publishers, The Hague, The Netherlands.

Prater, S., 1980. *The book of Indian mammals*. Bombay Natural History Society, India.

Quirici, V., Castro, R.A., Ortiz-Tolhuysen, L., Chesh, A.S., Burger J.R., Miranda, E., Cortés, A., Hayes, L.D. and Ebensperger, L.A., 2010. *J. Mammal*., **91**: 458-466. https://doi.org/10.1644/08-MAMM-A-337.1

Rao, A.M.K.M., 2003. *ACIAR Monogr*., **96**: 203-212.

Roberts, T.J., 1997. *The mammals of Pakistan.* Ernest Benn Limited, London, pp. 361.

Sauer, J.R. and Slade, N.A., 1985. *J. Mammal*., **66**: 316-328. https://doi.org/10.2307/1381244

Sauer, J.R. and Slade, N.A., 1986. *Am. Nat*., **127**: 902-908. https://doi.org/10.1086/284534

Sauer, J.R. and Slade, N.A., 1987a. *Ecology*, **68**: 642-650. https://doi.org/10.2307/1938469

Sauer, J.R. and Slade, N.A., 1987b. In: *Evolution of life historys: Theory and patterns from mammals* (ed. M.S. Boyce). Yale University Press, New Heaven Connecticut.

Sauer, J.R. and Slade, N.A., 1987c. *Annu. Rev. Ecol. Syst*., **18**: 71-90. https://doi.org/10.1146/annurev.es.18.110187.000443

Taber, R.D., Sheri, A.N. and Ahmad, M.S., 1967. *West Pak. J. Mammal.,* **43**: 392-407. https://doi.org/10.2307/1377772

Thomas, B. and Oommen, M., 1999. *Mammalia*, **63**: 341-347. https://doi.org/10.1515/mamm.1999.63.3.341

Vaughn, T., Ryan, J. and Czaplewski, N., 2000. *Mammalogy,* 4th Edition. Saunders College Publishing, Pennsylvania.