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Fecal progesterone metabolites and ovarian activity in cycling and pregnant mountain gazelles (*Gazella gazella*)

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Abstract

Fecal reproductive progestagen monitoring in the mountain gazelle (*Gazella gazella*) provided a non-invasive method for tracking reproductive cycling, estimating age of sexual maturity and diagnosing pregnancy in this species of gazelle. Fresh fecal samples were collected from eight female mountain gazelle (*Gazella gazella*) for a period of two months. Two of the animals were pregnant while the other six were not. Using the progestagen profile the luteal phase, interluteal (follicular) phase and estrous cycle in adult female gazelles were determined to be 12.5 ± 1.2, 5.9 ± 0.59 and 18.8 ± 0.98 days respectively. Significant inter-animal differences in fecal progestagen concentration were observed in both the luteal and follicular phases. Significant differences were observed in the levels of fecal progestagen between cycling females and females in late pregnancy. Low concentrations of fecal progestagen in females aged less than 18 months old indicated that sexual maturity in captivity is not attained before that age.

Keywords: Gazelle; Cycles; Estrus; Pregnancy; Progestagens; Non-invasive monitoring

1. Introduction

Classified as Vulnerable (VU) on the IUCN Red List 2008 [1], the mountain gazelle (*Gazella gazella*), locally known as idmi, inhabits the mountainous areas of the Arabian Peninsula, Jordan, Lebanon and Syria. At present, mountain gazelles remain along the Red Sea coast and in the Asir Mountains in Saudi Arabia. Six subspecies are currently recognized, with five of these listed on the IUCN Red List. The Arabian mountain gazelle (*G. g. cora*) and Farasan gazelle (*G. g. farasani*) are classified as Vulnerable (VU), the Palestine mountain gazelle (*G. g. gazella*) is classified as Endangered (EN), the Muscat gazelle (*G. g. muscatensis*) and the Acacia gazelle (*G. g. acaciae*) are classified as Critically Endangered (CR) on the IUCN Red List 2006. *G. g. erlangeri* has not been classified by the IUCN [1]. The taxonomy of *Gazella gazella* has been extensively debated in the past, with some populations having been described as independent species, later being renamed as subspecies of the mountain gazelle, and then later being re-described as independent species. To complicate matters, a number of gazelle populations in the Arabian Peninsula are not considered pure, but rather the result of cross-breeding between two or more unknown species or subspecies [2]. Though scientists currently describe six subspecies for mountain gazelles [1], recent genetic research has demonstrated that the

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taxonomy of this species has to be changed considerably [2]. Wronksi et al [3] based on the analysis of mtDNA sequences (cytochrome *b* and Control Region) of mountain gazelles collected from the wild in the Arabian Peninsula, and from other captive breeding programmes, have indicated that there are at least two reciprocally monophyletic genetic lineages within the presumed species "*Gazella gazella*". One 'northern clade' on the Golan Heights (Israel/ Syrian border) and one genetically diverse larger clade from the rest of the Arabian Peninsula including the Arava Valley (Negev, Israel).

The two major threats to these gazelles include habitat loss (human induced) and direct loss. Other threats include hunting and collecting, trade, alien invasive species, and hybridization. Stricter laws in most areas have reduced poaching of these species, but habitat loss and exploitation continue to threaten populations [2].

It has been reported that in the Golan Heights, the first fawn of a mountain gazelle is normally born when the dam is two years old, but near agricultural areas many one-year old females give birth [4]. In such areas, and in captivity, nursing females may become estrous and become pregnant, thus producing two fawns in one year. Only one instance of twins is known in Israel [5]. Under favourable food conditions (in captivity and in agricultural areas) females may conceive at five to seven months and males may impregnate at 15–20 months. Under natural conditions, however, females first conceive at 18 months and males are able to occupy territories when they are three years old. Life expectancy is 13 years in captivity, but rarely more than eight years in nature. In several cases, captive females give birth up to the age of 15 years, but most could not withstand the stress of pregnancy and lactation; their condition deteriorates after parturition and they die (Unpublished data).

Sizeable herds of the mountain gazelle and sand gazelle (*Gazella subgutturosa marica*) are kept at King Khalid Wildlife Research Centre (KKWRC) for breeding, research and later reintroduction in the protected areas declared by the Saudi Wildlife Commission. The mountain gazelle was the first to be reintroduced in Saudi Arabia as it has been released into the Ibex Reserve some 200 KM south of Riyadh. The released gazelles have initially shown population growth but later showed steady decline in numbers due to several factors [6].

Fecal reproductive hormone analysis has been useful in determining the cyclic characteristics and has been widely used to document ovarian cycle lengths in a number of ungulates e.g., Mohor gazelle (*Gazella dama mhorr*), black rhinoceros (*Diceros bicornis*), Okapi (*Okapia johnstoni*), Scimitar horned oryx (*Oryx dammah*) and many other ungulates [7,8,9–11].

The objective of the present study was to document the cycle length and hormonal changes around puberty and to characterize pregnancy of captive mountain gazelle (*Gazella gazella*) at KKWRC in Saudi Arabia using the non-invasive technique of determining fecal progesterone metabolites. The animals of this species are not seasonal breeders either in captivity (in Saudi Arabia) or in the wild, which is partly why they were selected for this study.

2. Materials and methods

Fecal samples were collected from eight mountain gazelles (*Gazella gazella*) living under KKWRC conditions at Thumamah, Saudi Arabia (25°07′N, 46°49′E). KKWRC is located within the Thumamah fenced area, where the temperature can vary between 55 °C during the summer months (July-August), and 2–3 °C during the winter season (December–February). Rainfall occurs in the spring (March–May) and can sometimes be as high as 30 mm. The animals are aseasonal breeders and are kept in breeding groups, each containing an adult male and five adult females. The animals were captive born at KKWRC and their breeding records are regularly updated through the Animal Records Keeping System (ARKS) database. For collection of fecal samples, animals were maintained individually in separate pens (4 × 4 m area) that were adjacent to each other so that the animals retained social contact. Only one person was allowed access to the animals for cleaning and feeding. Animals were left for a period of two to three weeks to settle and then daily collection of fecal samples started for a period of two months (March to May). Animals had access to fresh water, mineral blocks and fresh or baled alfalfa as well as concentrate ration of gazelle pellets Superlac 16% protein provided by Arasco, Saudi Arabia.

Of these eight female mountain gazelles raised at KKWRC, six were more than two years old and two females were less than two years when sampled (Table 1). Two of the females were pregnant when samples were collected. Three of the six non-pregnant female gazelles investigated were nulliparous whereas the other gazelles had given birth to between one and seven offspring before they were sampled.

Fresh fecal samples (15–20 g wet weight) were collected from each individual on a daily basis early in