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Review Article

Vegetation Choice and Browsing Behavior of Camels in Different Management Conditions

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Abstract

Like other ruminants, camels are not entirely vegetarian but seem eating bones, charcoal, mummified young gazelles, head and all. Availability of acceptable plant species was an important limitation to the diet quality as well as selection process. Camels compensate the declining forage abundance by eating more grasses, leaves, litter, vines and lignified twigs by widening their dietary acceptance range in the dry seasons. Two-humped camels fed on specialized desert vegetation-halophytes, shrubs, sub-shrubs, wormwood and various thorny plants. Camels prefer to eat salty bushes with rich water contents so the salts present in such plants help to meet the physiological requirements of the animal. Irrespective of the season, the camels spend more than 80% of their total feeding time on dicotyledons and select a diet with higher protein than the other animal species. On typical grazing grounds of the arid tropics and subtropics, the dromedary prefers to browse bushes and trees while select feed which is highly digestible, especially rich in easily fermentable carbohydrates and having high water contents. Dromedaries graze a broad spectrum of fodder plants including thorny and aromatic species which are generally avoided by other herbivores on overall basis. Camels are very versatile feeders and fed on perennial grasses and dwarf shrubs having coarse texture and hairy leaves which are avoided by other livestock on the fringes of the great deserts and in dune countries. This paper will describe the grazing behavior of camel; thus, will be a useful addition in the field of camel science.

Keywords: Camel; Feeding; Behavior; Desert; Pastoral

Introduction

Camel has no competition with any domestic specie regarding feed and performance [1]. Browsing or grazing behavior of camel comprises a set of activities that are associated to the ingestion of feed including searching, choosing and absorption [2]. According to some scientists, camel grazes on tall, young and succulent grasses [3] but typically it is a browser and their feed comprises on shrubs, bushes and trees [4,5]. According to [6] camels are browsers, their tall as well as long neck and legs enable them to browse efficiently. And due to these specified attributes, they can browse that feed material which is beyond the approach of other livestock species [7-9]. They can browse on prickly plants, salty and thorny bushes due to special structure of its mouth. It's very

strong prehensile lips, papillae and narrow muzzle permits it to browse efficiently on thorny plants [10]. According to [11] camels like browsing rather than grazing. Camel is declared as browser by nature [12]. According to [13] camels prefer browsing over grazing and they spend more time in rumination. In the absence of quality forages, camel can utilize poor quality forages with much more efficiency as it can retain fiber in its fore stomach for as long as 70 hours. According to [14] in contrast with other ruminants, when it is fed with low protein forage it has the capacity and efficiency of reutilizing the urea for microbial protein synthesis. Due to these attributes, camel is considered as the animal with unfathomed potential to meet the future dietary and medical needs of human beings [15,16].

Vegetation choice

[17] identified that there are five factors that affect the selection process in grazing: (i) animal factors includes animal individuality, species, physiological condition (feeding demand), social behavior, grazing behavior and previous experience; (ii) sensory factors includes sense of sight, touch, smell and taste; (iii) physical environment includes topography (site of plant and slope aspect), distance of plants from shade or track, distance of plants from water source; (iv) plant environment including soil fertility, soil type and plant community, and (v) plant species presence, which includes their physical and chemical characteristics and their relative availability. [18] reported that a pair of three years old camel preferred forbs and shrub material (up to 70%) while pairs of various breeds of cattle and buffaloes preferred the grass material (up to 90%) as their chief dietary components. The way of feeding of camel was found entirely different from sheep and goat that graze intensively. They rarely overgraze and constantly move taking only small parts of each plant and cover very large areas.

[3] reported the diet makeup of camels which is consisted on dwarf shrubs (47.5%), trees (29.9%), grasses (11.2%), herbs (10.2%) and vines (1.1%). In their natural habitat dromedary prefer browsing for most of the year on great nutritional vegetation in arid zones as compared with the grasses, herbs and shrubs which have short growing season [19,20] reported that contrary to the normal practice, camels of all age groups preferred *Alhajicamelorum* during more humid or rainy days due to the small and soft scales of this plant. During autumn and winter the camel in desert fed on *H. aphyllum, H. persieum, S. gemmaseens,* S. *orientabs, Astragalus, A. karelinii* and *A. pennate* and in spring the desert is covered by ephemerals. In summer camels prefer salty, sour plants and shrubs and usually take a variety of vegetation that presumably provides optimal nutrition [21].

Browsing/grazing behavior

[22] reported that the feeding habits of livestock range from the grass dominated diets of cattle (96%) to browse dominated diets of camels (95%), while goats, sheep and donkeys tend to be mixed feeders for herbaceous and non-herbaceous vegetation. While some researcher [12,23] has reported that camel is declared as browser by nature and takes a bite from one plant and then moves to other so covering a vast area each day in search of food. It is reported that camel is browser having a split upper lip which is well suited for the purpose. They are selective in their feed and consume available fresh vegetation. They reach even on remote salt lakes where preferred vegetation has a high electrolyte level and moisture content (*Calandrinia* and *Portulaeea*) while grasses is primarily eaten after rain [24].

Various scientists studied its browsing/feeding behavior in different areas and production systems. Camel browse/graze on different types of trees, plants, shrubs, including ber (*Zizyphus maritiana*), jand (*Prosopis spicigera*), kikar (*Acacia nilotica*), pipal (*Ficus religiosa*), toot (*Morus alba*), taramira (*Eruca sativa lank*), and vann (*Salvadora oleoides*) [25]. In Balochistan camels fulfill 44% of their feeding requirements from forage averaged over the whole year. Households supplements all ages of camel during December to February. In winter only weak and diseased camels are supplemented in nomadic and transhumant system. Lucerne, wheat/barley straw, grains, crop residues, maize and sorghum are the major supplement feeds. Transport animals are supplemented with 1-2 kg crushed wheat and barley mixture only in food scarcity periods [26]. Camels fulfill their dietary needs only from browsing on local vegetation having no extra supplementation. Its diet contains variety of food. Camels commonly utilized plants of genera *Atriplex*, *Acacia*, *Aristidia*, *Albizia*, *Capparis*, *Calligonum*, *Gymnocarpos*, *Prosopis*, *Parkinsonia*, *Salsola*, *Suaeda*, *Salvadoran*, *Tamarix*, *Tecoma and Zizyphus*. Camel is declared the most economical and efficient animal of different rangelands of Pakistan [27,28] worked on Kohi camel in mountainous areas of Balochistan and determined its milk production potential and described the area vegetation for browsing of Kohi camel as bararr (*Periploca aphylla*), barwazi (*Hetero-*

pogon contrutus), gorgula (*Reptonia buxifolia*), makhie (*Caragina ambigua*), palosa (*Acacia modesta*), shorie (*Haloxilon griffithii*) and showan (*Olea ferrugina*). Camel milk is generally opaque-white, of sweet and sharp taste while sometimes may be salty due to the forage composition. For example, camels fed on *Atriplex canescens* showed a salty taste while on *Schowia purpurea* gives milk having an odor very similar to that of cabbage [29]. In recent studies, [30] studied the diet preferences and choice of vegetation of camel calves and reported forage species were kikar (*Acacia nilotica*), phulai (*Acacia modesta*), beri (*Ziziphus mauritiana*), siras (*Albizia labbek*), jand (*Prosopis cineraria*), khagal (*Tamarix aphylla*), dhaman (*Cenchrus ciliaris*), persain (*Suaeda fruticosa*), khawi (*Cymbopogon schoenanthus*), kali bui (*Kochia indica*), bhakra (*Tribulus terrestris*), kari (*Capparis spinosa*), laana (*Haloxylon salincornicum*), phog (*Calligonam polygonoides*), karir (*Capparis decidua*) and khar laana (*Haloxylon recurvum*). Regarding grazing preference kari (*Capparis spinosa*), dhaman (*Cenchrus ciliaris*) and kikar (*Acacia nilotica*) got the first score (80-100% preference) among bushes, grasses and trees.

Conclusions

Camel has unique ability to graze those plants efficiently which grows well under arid conditions and is refused by other farm animals. Intake is the result of bite size, biting rate and feeding time. Major plant species which forms the diet makeup of camel are *Acacia modesta, Olea ferruginea* and *Alhaji camelorum* while likeness of *Acacia modesta* in adults may be due to its higher crude protein contents. Camel has no competition regarding feeding with other domestic species, as it can sustain life on horny bushes, thorny plants and on those feed materials which is not consumed by other species. In short, camel has special attributes; thus, a fascinated mankind.

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Declarations

Data Availability Statement

All relevant data are within the paper and supplementary materials.

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Competing Interests

There is no competing interest.

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