Final Lecture 1: LM 404

ADAPTATION TO HOT ARID ENVIRONMENT

Significant aspect of camel adaptation

The ability of the dromedary to adapt to extreme aridity of the habitat is unique amongst large herbivores. The most significant aspect of this adaptation is economic use of water in almost all metabolic functions. The metabolic functions fall into two major categories, the intermediary metabolism and the maintenance of body temperature. Along with physiological mechanisms, behavioural and anatomical adaptations also play their role.

Preferred browsing times of the camel under natural conditions or unrestricted rangeland

The camel has preference for feeding at night, in the early morning or late evening or when the sky is clouded or just before and just after sunset. At very hot times camels tend to avoid feeding around midday. Under restricted herding conditions where camels are confined at night, behaviour cannot be described as natural since nutritional requirements have to be met in a shortened period and rumination and rest take place for the most part during the hours of darkness.

A few concrete examples of the camel's behavioural adaptations to hot environment

If the camel is allowed to feed at night, it settles on the ground early in the morning before the sun has warmed the ground, thus reducing heat absorption by conduction from the earth to its body. Further, it tucks both its fore and hind legs beneath it to reduce contact with the ground, unlike buffalo and cattle, which lie in closer contact with the ground . This method of couching eliminates yet another conductance path.

Standing or sitting, the camel gradually keeps shifting its position throughout the day to keep in line with the sun, thus reducing the area subject to direct radiation.

When herded in groups and allowed to rest, camels invariably cluster together if conditions are hot, which again reduces the total area subject to radiation. Sheep also adopt this strategy under hot conditions, but unlike sheep which cluster with their heads central to the unit, camels prefer to orient (as they do as individuals) to the sun and move position as the earth rotates.

Anatomical advantages favor the camel to adapt hot environment

The large size of the camel is an evident advantage to it to adapt to hot conditions, allowing a smaller relative surface area to total body mass. The relationships of body weight to energy expenditure and the required water loss to preserve a constant body temperature are well known, with heavier weights providing enormous advantages.

The long thin legs and neck of the camel are further adaptations to desert conditions, as is the hump. Fat concentrated in the hump and not distributed over the whole body surface allows rapid dissipation of heat through the skin when required.

The large pad-like feet of the camel reduce ground pressure when walking and allow easy progress over sandy surfaces. The massive supra-orbital processes protect the eye from the direct rays of sun.

The split upper lip, which is very prehensile and mobile, allows the camel to select the most succulent and nutritious feed portions from the total on offer.

Dehydration tolerance, efficiency of use of water and capacity of camel to drink water

A reduced water supply can be tolerated by a number of species of desert-adapted animals and under these conditions its use becomes more efficient. Efficiency of use and dehydration tolerance vary among species. Among domestic animals kept under the same conditions, cattle lose water three times faster than camels (equivalent to 6.1% of body weight per day at day/night temperatures of 40°C/25°C) and sheep two to two and a half times faster (4 to 5% of body weight). Bedouin goats are capable of sustaining reductions in body weight up to 35% but lose water much more rapidly than camels. Cattle die in four days at a total weight loss of 28%, sheep in about seven days and camels would survive for 15 or more days, mainly because camels do not lose appetite with dehydration. In the real life situation, camels do survive long periods without access to free water. Generally quoted figures, however, are four to five days.

Under free ranging conditions, the frequency of drinking water by camel depends on a number of factors such as the ambient temperature, the water content of the feed and the physiological status of the animal. Lactating females obviously require more water than dry cows, bulls or castrates. It is said that throughout the winter period, camels may not have access to free water. There is an historial record held by camels in Sudan where it was noted 86 years ago that a large herd of camels at a well on May 11, 1917 were drinking free water for the first time since October of the previous year. Water intake is related to the period of deprivation.

After long periods of dehydration camels can rehydrate extremely rapidly. As much as 25 to 30% of body weight can be taken in. Some scientists consider that camels drink, immediately, that amount of water required to replace the lost volume but others are of the opinion that they imbibe only about 60% of the lost volume at the first opportunity. There is a record of a camel who drank in 24 hours 186 litres in two separate bouts of 94 and 92 litres after a period of five days without water.

Presented by:
Muhammad Sajjad Hussain
Student of DVM
(2007-ag-1638)

Up To Date: 13 Dec 2010, Monday