

Goat's capacity to survive on seawater

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28 February 1016

Introduction and objectives

It's been known to all ancient travellers that there are goats which have been introduced in small islands and so live sometimes lacking resources otherwise found on the mainland. Thus, travellers and scientists alike have wondered how these animals could survive on small arid islands with no permanent sources of freshwater for drinking (Dunson, 1974).

Goats have been seen drinking seawater in many situations and several theories have been given to explain the reason for this phenomenon. The fact is, some of these islands have very long dry seasons where the rain falls about every four days and there isn't any other water resource available. This takes us to deduce that goats drink seawater as a source of drinking water, so they must have developed some kind of adaptation to be able to drink large amounts of seawater to obtain free water after renal salt excretion.

From prehistoric times, the goat's potential for extracting nutrients from areas which are unable to support larger livestock has been recognised and utilized (Ghosh and Khan, 1980). Most of the world's goat population lives in the tropics and subtropics, which means that many of these animals will live in a desert. Considering this, we can clearly see that goats have a great ability to adapt to harsh environments such as those islands, which present a climate as rough as the one in the African desert.

Dunson (1974) and Gould (1990) studied this phenomenon in several islands in the Pacific and Indic oceans respectively and these are the articles we will mainly work with to solve this incognita.

As matter of fact, we don't need to travel that far to see this behaviour. It has been documented too in Serra de Tramuntana, in the Mediterranean island of Mallorca. We can see in the picture below how these animals are clearly drinking seawater.



Image 1. Goats drinking seawater in Serra de Tramuntana (Seguí Campaner, Sanz Ruedo et al, 2014).

The objective of this project is to throw some light on this incognita and find a convincing explanation through the review of the scientific literature found related to this matter.

List of theories

Reduction of water requirements

- **Widespread dwarfism in desert animals**
 - Warm blood animals living in hot climates have a smaller size than their relatives from colder regions. This is an adaptation to several interrelated factors found in the deserts such as ambient temperature and plant production.
- **Reduction of water consumption**
 - Under a situation of lack of water, goats suffer less side effects than other ruminants. Furthermore, goats perform better drinking saline than nothing at all. The weight loss registered during moderated seawater drinking in goats results from a decline in food consumption and not to dehydration (Dunson, 1974).
- **Water % in faeces**
 - When goats are dinking seawater, water % in faeces decreases. This means that colon reabsorption of water is apparently an important means of water conservation (Gould, 1990).

Adaptations to seawater

- **Urine concentration**
 - During absolute water stress, the desert goat reduces its urine output drastically (Ghosh and Khan, 1980). Relative medullary thickness (RMT) indicates the ability to concentrate urine. As greater the value, greater is this ability. Goats living in these islands can indeed make a urine which is twice the concentration of seawater.
- **Reduction of the r.a.a.s. Activity**
 - After 26 hours of water deprivation, the renin-angiotensin-aldosterone system is activated to save water resources. When goats are rehydrated with saline this system reduces its activity allowing the goat to reestablish plasma volume and Na⁺ concentration faster.

Other adaptations to harsh environments

- **Water retention in the rumen**
 - Water can be stored in the rumen, both to save water in dehydration periods and to prevent a ionic unbalance during sudden rehydration.
- **Resistance to dehydration in high temperatures**
 - When exposed to high temperatures, half of the drunken water is used to cool the body but goats seem to lack the ability to rise their body temperature, so they can save water. Dehydrated desert goats sweat less than the hydrated ones (Mc Gregor, 2004).

Relation with the habitat

- **Behavioural adaptation to the diet and climate**
 - The data collected in the different articles showed that the water content in the island's vegetation was enough to compensate the lack of water. In addition, goats remained relatively inactive during the hottest part of the day, feeding primarily at dusk and dawn (Gould, 1990).

Conclusions

That goats can drink and live on seawater at least for a period of time is an irrefutable fact. But not any goat will do that. All of these animals have been through an adaptation which gives them this capacity.

We ought to think that these adaptations were even harder to achieve than the ones that the desert goats suffered. Many of the theories exposed above are both for desert and for island goats, and this is because its situation its so much alike.

We concluded then, that the key fact which allows goats to survive on these islands is, as Dunson remarked in his own conclusion, no other than the reduction of evaporation losses in high temperatures which permits the animals to not depend so badly upon the scant water resources. The vital adaptation in the isle situation is, of course, the effective urine

concentration which converts seawater into pure water. This is thanks to the larger RMT found in the goat's kidneys. All the mechanisms to reduce the water requirements and others such as the water retention in the rumen and the reduction of the r.a.a.s. are characteristics which helped these animals to adapt better to these environments.

We cannot forget the goat's behavior: their relation with the habitat is vital for their survival. They don't waste a drop of water nor energy and the vegetation plays a very important role in the maintenance of the goat's water balance.

Knowing this, we should study why our own goats are drinking seawater. Did they developed the same capacity than the goats from these studies? Do they have another reason to drink seawater, let's say for example, do they lack Na⁺?

Once more, goats have proved that they are the most adaptable livestock which has accompanied man in the most hostile environments.

Cited literature

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