THE PRACTICE OF REARING SMALL RUMINANTS AND CAMELS TOGETHER BY NOMADS IN NORTH WESTERN NIGERIA: IMPLICATION AND CONSEQUENCE

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SUMMARY
Camels are animals with unique behavioral, physiological, anatomical, and immunological systems, which allow them to thrive under rugged climate and extremes of temperature and weather. Today camels are reared together with small ruminants by the nomads in some parts of northwestern Nigeria and the tendencies of being involved as reservoir to emerging diseases in the environments need to be studied. Possibly because of the unique nature of camels’ IgG, they can not come down with certain diseases while small ruminants that roam about with this animal will come down thereby serving as carriers. Therefore, there is urgent need to extensively study this animal as its production is becoming more important in the Arid and semi-arid environments.
INTRODUCTION
The Arabian one-humped camel (*Camelus dromedarius*) is primarily an inhabitant of northern half of Africa, the Middle East, Pakistan, India and some parts of West Africa including Nigeria (Fig. 1), while the two humped camel (*Camelus bactrianus*) is found primarily in central Asia. Today Camels are found in almost all continents of the world (FAO, 1999). World Camel population was estimated at about 18.7 million with Africa having 80% of the world population and Somalia and Sudan having 70% of the African herd. In Asia, about 70% are spread over Indian sub-continent (Wilson *et al*., 1990). In Nigeria most of the camels are owned by pastoral farmers in Kano, Katsina, Sokoto and Borno States (Ribadu 1988), although due to recent state creation we can physically see camels in Sokoto, Kebbi, Zamfara, Katsina, Kano, Jigawa, Borno and Yobe States, and were estimated by FAO in 1999 to be about 18,000 heads.

In zoological taxonomy, camelids are classified in the sub-order Tylopoda (Pad-footed animal) that represents with the sub-orders Suiformes (pig-like) and ruminantia (ruminants) in the order Artiodactyla (Even-toed ungulates). This makes obvious the camelids (family Camelidae) as ruminating animals are classified in proximity to ruminants but developed in parallel and are not part of the order ruminantia. Some differences as foot anatomy, stomach system and absence of horns underlined this fact (Schwartz and Dioli, 1992; Fowler, 1998; Wernery, 2003).

The family Camelidae is divided into three genera; the old world camel (Genus Camelus) and the new world (Genus Lama with species *L. glama*, *L. guanicoe*, *L. pacos* and Genus Vicugna with species *V. vicugna*) Wilson and Reeder, 2005). Two domesticated species of the old world camel exist the dromedary or one humped camel (*Camelus dromedarius*) that has it distribution in the hot deserts of Africa and Asia and the bactrianus or the two humped camel (*Camelus bactrianus*) that can be found in the cold deserts and dry steppes of Asia. In the desert Gobi there is still a population of wild two humped camels classified as *Camelus ferus* (Rao *et al*., 1970; Peters, 1997; Fowler, 1998).

The Bactrian camel was named after the area of Bactriana in central Asia. The name of the dromedary is derived from the Greek word “dromeus” which means runner or “droma” running (Jassim and Naji, 2002). The one humped camel was probably domesticated in the region of todays’ Yemen and Oman about 3,000-4,000 years ago (Fowler, 1998). Camel breeds are not as differentiated as breeds in other livestock; systematic selection for production has never been done in Camels, except for racing animals (Kappeler, 1998). Nevertheless, there are different breeds used for different purposes like riding, meat, or milk production. Dromedaries for riding are daintier compared to burden dromedaries whose body can vary from small to tall, but is always of
heavy weight (Burgemeister, 1974). The breed most common in the united Arab Emirate (UAE) is the “Al-Khawar” breed. It is mainly known for racing or light burden dromedary with approximately 400kg (Farah, 2004).

**Figure 1:** Showing herd of *Camelus dromedarius* at Sokoto Kara market, North western Nigeria (Snap shot by Dr. J.A. Garba on 24th March, 2008)

**Physiology of the reproduction in camels**

The sexual cycle of the dromedary camels begins at 24 months (Puschmann, 1989). Different from ruminants, camels are seasonal polyoestrous animals. Usually the ovulation of the female dromedary is induced by copulation or the presence of a male (Wilson, 1984). Camel bulls show their sexual cycle during 3-4 months in winter season, beginning in December (Rao et al., 1970; Fazil and Hofman, 1981). The mean gestation period is reported to be between 315-360 days (Rao et al., 1970; Fazil and Hofman, 1981; Arthur, 1992). Generally, camels are mated for the first time at the age of 3-4 years leading to 8-10 calves in a life time. In most countries, it is customary to breed female camels in alternate years only (Hassan, 1967, Rao et al., 1970; Arthur, 1992; Farah, 2004)

**Attribute of the camel**

Camels are animals with unique physiological systems, which allow them to thrive under rugged climate and extremes of temperature and weather. Physiologically, they adapt well to high temperature. Blood volume is
maintained partly by water diversion from the skin to other body tissues and organs. Water conservation is assisted by highly efficient renal mechanism which is perhaps related to long nephron found in camels, nitrogen retention and re-use, production of dry faeces and flexible diurnal body temperatures which can vary up to 6°C in 24hrs period. Additionally, water is re-circulated continuously in the gut from the duodenum and colon and in the fore-stomach via the blood (Allen et al., 1992). The camels’ exceptional ability to tolerate heat and water and feed deprivation are well known and admired (Payne and Wilson, 1999). This tolerance is associated with many aspects of its individual and group behaviour and anatomy. Principal among these is the preference to feeding at night and in the early mornings. Others include tucking of both limbs beneath the body in order to reduce contact with the ground and clustering together, if condition is hot which reduce contact to the total surface area subjected to radiation (Fig. 2). The long thin legs and neck of the camels are further adaptations to desert conditions. Another anatomical feature is the large pad-like feet, which reduces pressure when walking and allow easy progress over sand (Payne and Wilson, 1999). The hump does not serve as water reservoir, nor solely as energy, but its greatest use is that being a concentration of body fat, it leaves the subcutaneous tissues virtually fat-free, thus allowing for an efficient cooling to a relatively cooler environment (Payne and Wilson, 1999).

Camels have an unconventional immunoglobulin structure. Of the three subclasses of IgG, only 1 (IgG1) is a four-chain structure (Fig. 3). Both IgG2 and IgG3 lack a light chain and differ from each other by their binding behaviour to Protein G (IgG2 will bind only Protein A, IgG3 will bind both Proteins A and G) and by the molecular weight of the

Figure 2: Camels tucking their limbs to reduce total surface area exposed to high environmental temperature (Snap shot by M.S. Abubakar at Sokoto Kara Market north western Nigeria, 24th March, 2008)
composing H-chain (Conrath et al., 2003). This does not however prevent traits that have these molecules from binding to antigens. The small size of this molecule is appealing to scientists and it has been used in a number of experiments where both its specificity and size has allowed observation of previously “hidden” molecules (Stijlemans et al., 2004).

**Figure 3**: Camel IgG immunoglobulin. IgG2 and 3 lack the presence of a light chain as well as CH1, this is compensated for by the presence of an elongated hinge region. The blue dots shown on IgG2 represent the lack of Protein G binding sites (adapted from Conrath et al, 2003)

A comparative study of Old world Camelids (Camelus bactrianus and Camelus dromedarius) and the new world camelids (Lama pacos, Lama glama and lama vicugna) showed that the heavy-chain immunoglobulins are abundant in the sera of all species. These findings indicate that the heavy chains alone can generate an extensive repertoire and question the obligatory contribution of light chain to the useful antibody repertoire in the camelids. The Camelid γ² (Stijlemans et al., 2004) and γ³ chain are considerably shorter than normal mammalian γ and camel γ¹ (Hamers-casterman et al., 1993).

The abundance of heavy-chain immunoglobulins in the serum of the camelids has shown to provide an extensive antigen-binding repertoire examined using the IgG₁, IgG₂ and IgG₃ fraction from the serum of camels with high antitrypanosome titre. In radioimmunoprecipitation, purified fraction of IgG₁, IgG₂ and IgG₃ derived from infected camels were shown to bind to a large number of antigens present in the methionine-labelled trypanosome lysate, indicating extensive repertoire complexity for the three IgG classes (Hamers-casterman et al., 1993). It was observed that camel has single domain antibody fragment with specificity to antigenic component of microorganisms, this mechanism can be employed in the development or design of immuno-toxin for the therapy of trypanosomosis (Stijlemans et al., 2004)
Nutrient utilization in Camels
In the camels’ fore stomach the volatile fatty acids (VFAs) produced are efficiently neutralized, probably by the glandular secretions. A high concentration of VFA is found in the Camelidae rumen. The various proportions of the VFAs are similar to those found in the rumen of cattle. This suggests a great similarity in the metabolism in the fore-stomach of camels as compared with other ruminants. Motility study suggests that there is no precise similarity between the species and was verified in the comparison studies between camel and zebu. It was found that camel has lower digestive efficiency of low quality hay, assumed to be caused by a more rapid passage of food through the stomach. Camels fed on straw however, not only grow better but digest the food better than cows (FAO, 1982).
Sodium chloride and VFA were found to be rapidly absorbed from rumen of Ilama. The absorption rates in the Ilama were three times greater than the absorption in sheep and goats. Absorption occurs mainly at the glandular areas of the fore stomachs. In the compartment solubles and water are absorbed. The absorption rates of sodium, VFA and water in the turbiform compartment were found to be far greater than the absorption rate in the omasum of sheep and goats (FAO, 1982).
Another important difference with other ruminant is that camels have a significantly higher glucose level. This may be caused in part to the anatomical difference in alimentary canals, although VFA production was high in camels fore stomachs. Other metabolic factors play a role in glucose handling by camel as well as the hygroscopic properties of glucose may play a significant role (FAO, 1982).

IMPLICATION AND CONSEQUENCE OF REARING SMALL RUMINANTS AND CAMELS TOGETHER
Some of the attributes of camels highlighted above are not seen or observed in small ruminants, the unique nature of the camel IgG may be responsible for the disease resistance observed in camels, therefore highly pathogenic agents which ordinary are not/or can not cause clinical disease in camels may cause serious clinical disease condition in small ruminants thereby decreasing their productivity. So also these camels can withstand long distance travels/grazing without feed or water and can tolerate extremes of temperature and weather and small ruminants can not, these also if not properly checked can lead to decrease in productivity of the small ruminants in some parts of north western Nigeria.

CONCLUSIONS AND RECOMMENDATION
There is increasing interest in camel rearing in some parts of north western Nigeria, although information on the disease profile of this animal in this environment is sparsely reported, and with growing
demand to improved sources of animal protein, camel seems to be a better complimentary source to ruminants in this environments, this will probably justify the need to have better information especially on the disease(s) its harbour and its likely involvement in the spreads of emerging and re-emerging infectious diseases.

REFERENCES


