



A Study on the Productivity and Diseases of Camels in Eastern Ethiopia

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ABSTRACT

A study concerning performance traits of the Ethiopian camel indicated that, in the camel herds examined, there was one active bull camel for 25 females. The bull camel was 5 years old at puberty; it reached rutting vigour at the age of 9 years, the number of mountings per day was 8 during the breeding season, and the reproduction span was 10 years. The female camel reached puberty at 4 years of age; the age at first calving was 5 years, and the lactation period was one year; the calving interval was 2 years, the calving rate was 50%, and the reproduction span was 10–15 years. The survival rate of the newborn calves was 50%. The average milk yield was 2.5 L per day; the price of camel's milk was higher than that of cow's milk at US\$0.5. Adult camels weighed around 500 kg; the dressing-out percentage was 52%. Mutton was preferred to camel meat, which came second in popularity, costing US\$2/kg. Owing to their poor reproductive performance, camels are not efficient for producing meat. The camels worked for 16 h per day, covering 60 km. Animal health problems encountered were trypanosomosis, camel pox, camel pustular dermatitis, camel cephalopsis, dermatomycosis, mange mite, tick infestation and balantidiosis, most of which mainly affected the young animals.

Keywords: camel, disease, meat, milk yield, productivity, reproduction, transport animals

INTRODUCTION

The Ethiopian lowlands comprise 61% of the national land area (Coppock, 1994). The climate in the lowlands is arid and, owing to the unreliable rainfall, the ecosystem in these dry ranges never achieves equilibrium between grazing and a fixed number of settled livestock. Thus, traditional pastoralism constitutes the only efficient means of exploitation. Camel pastoralism is the most sustainable livestock production system, as the camel (*Camelus dromedarius*) is a species well adapted to a hot and arid environment. It is capable of thriving on poor pasture and resists considerable drought, but otherwise its status *vis-à-vis* disease and productivity does not differ greatly from that of other farm animals. While the improvement of its natural habitats to provide adequate feed for camels is not easy and would take a long time to achieve, a functional short-term disease control programme might be designed and instituted with resultant gains in productivity. However, the pathology of the dromedary is not well understood

(Richard, 1979), and data on camel productivity under pastoralist conditions are limited (Mukasa, 1981). This is especially true of the Ethiopian camel (Schwartz and Doli, 1992), even though the country has about one million camels and ranks third in the world for the numbers of this animal (FAO, 1987). Thus our objective was to collect baseline data for future research.

MATERIALS AND METHODS

Area surveyed: The study was carried out in Dire Dawa, Harar Zuria, Jijiga and Gewane Administrative Zones. These are located in the eastern corner of Ethiopia at 5°–12°N latitude and 40°–48°E longitude. The area is part of the rift valley (Awash plains) and is classed as lowland, lying at 500 to 1500 m above sea level (Figure 1A). The average annual rainfall is 500–600 mm per year and the mean daily temperature is 34°C. The vegetation consists mainly of acacia, thorn trees, chat (*Catha edulis*), cactus, scattered bushes and tufts of grass. There are no horses or mules in the area (Figure 1C), which is considered as part of the camel belt (Figure 1B) and coincides with the distribution of Islamic society (Figure 1D). The area is inhabited by pastoralists, the main ethnic groups being Issa, Afar and Somali.

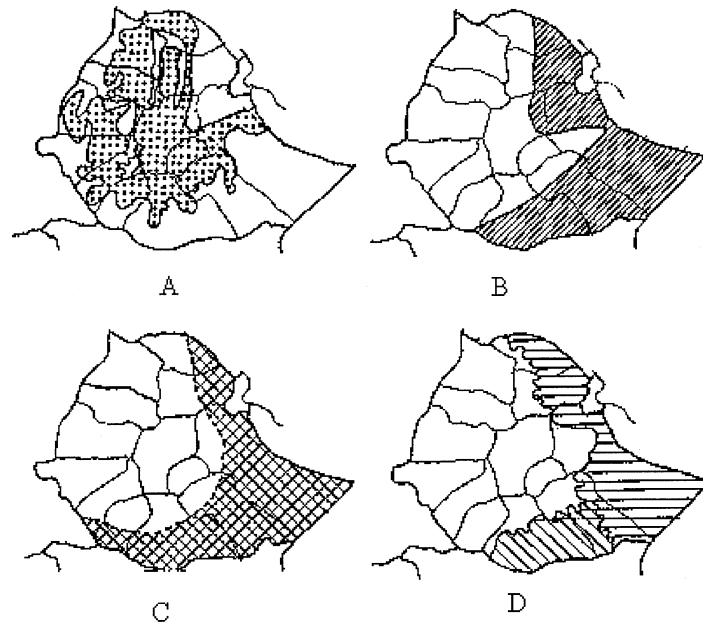


Figure 1. Outline maps of Ethiopia. The unshaded area in (A) shows the lowlands (< 1500 m above sea level). The shaded area in (B) shows the distribution of camels, that in (C) shows the absence of horses and mules, and that in (D) shows the area in which Islam is the predominant religion

Animals: The total camel population of the study area is estimated at 100 000. It was difficult to define breeds, although variations exist in colour, size and production. The camels are named after the owners' tribe. Some of them had identification brands. More than 100 herds were visited during the survey.

Clinical and laboratory examinations: Three hundred and fifty individual cases were brought to Dire Dawa veterinary clinic or to a mobile clinic in the field. Blood samples were taken and wet, Giemsa-stained, thick and thin blood smears were made for microscopic examination for trypanosomes. Skin scrapings were treated with 10% KOH and examined for mange mites or for fungus after treatment with a few drops of KOH and staining with Giemsa. Faecal samples were examined using direct smear and flotation methods. Ticks were collected from the body of the camel. All parasites were identified according to Soulsby (1968).

Abattoir study: The abattoir study was conducted at Harar Zuria slaughterhouse, where six camels are slaughtered each week. Twelve animals were available for post-mortem meat inspection. The dressing-out percentage of four camels was estimated after determining the live weight using the formula: Live weight (kg) = SH (m) × TG (m) × HG (m) × 50, where SH is shoulder height, TG is thoracic girth and HG is hump girth (Schwartz and Doli, 1992). The carcass weight was determined using a spring balance.

Field investigation: The investigation was carried out using Participatory Rural Appraisal (PRA) (Waters-Bayer and Bayer, 1994; Catley and Aden, 1996), by direct observation, with a semistructured interview, both individually with three clan leaders and in a group meeting, asking about ethnoveterinary knowledge, husbandry practices, reproductive and zootechnical parameters. Whenever quantitative information was sought, direct matrix scoring designed to define the lowest value, highest value and modal value was used.

RESULTS

Reproduction and production

The reproductive parameters are summarized in Tables I and II. The ratio of males to females in a breeding herd was usually around 1:25 but might go up to 1:50. Traders kept caravans of male camels only. Sometimes the breeders handmated the camels. Mating takes place while the female is in sternal recumbency.

The most valuable camel products and/or uses were milk, meat, skin and investment. Milking started one week after calving. Three quarters were milked and one quarter reserved for the calf. Camel's milk was consumed fresh. Unlike cow's milk, it is not suitable for butter production by traditional churning. However, if marketed, camel's milk attracted a higher price (US\$0.5/L) than cow's milk. Most female camels were milked three times per day, with a mean total yield of 2.5 L/day, ranging from 0.5

TABLE I
Some reproductive parameters for female camels under pastoral husbandry in eastern Ethiopia

| Reproductive parameter | Mode | Range |
|------------------------------|------|-------|
| Age at puberty (years) | 4 | 3–6 |
| Age at first calving (years) | 5 | 4–7 |
| Calving interval (years) | 2 | 2–3 |
| Calving rate (%) | 50 | 50–70 |
| Calf mortality (%) | 50 | 10–70 |
| Reproductive span (years) | 15 | 10–20 |
| Lifetime calf production | 8 | 5–10 |

TABLE II
Some reproductive parameters for male camels under pastoral husbandry in eastern Ethiopia

| Reproductive parameter | Mode | Range |
|------------------------------|------|-------|
| Age at puberty (years) | 5 | 4–6 |
| Peak rutting vigour (years) | 9 | 7–10 |
| Mountings/day ^a | 8 | 2–15 |
| Duration of copulation (min) | 7 | 2–10 |
| Reproductive span (years) | 10 | 10–15 |

^aDuring the breeding season

to 4 L per milking, The lactation length was one year. Lactation ceased if a camel became pregnant, so camels were bred at the end of their lactation. As a routine procedure, the calf was kept close to the dam during each milking, to stimulate milk secretion. The camel's milk ceases sooner if the calf dies, so breeders kept the dried calf skin and produced it to the dam at every milking.

Camel meat was eagerly consumed in the region, being second in preference to mutton; the camel's hump and liver were the most preferred parts. Adult weight (post puberty) ranged between 350 and 500 kg in camels that had access to drinking water every 3 days. The dressing-out percentage was 52%. A kilogram of camel meat cost US\$2/kg in Dire Dawa. Ninety per cent of the slaughtered animals were adult males. Some breeders slaughtered young males, believing that the female would not again give birth to a male calf if the calf is slaughtered at an early age. Females were slaughtered only if they were unproductive. The method of slaughter was a floor system. The neck was severed at the thoracic junction and the animal flayed in the sitting position, the body being opened from the back, not from the abdomen as with cattle.

All males except the breeding bull were used for packing in a line caravan. The camels were trained before they were set in a line caravan, starting when they were 5 years old. In the area of our study, the camel was not ridden or used for wheeled transport or draught. In addition, camel racing and leisure activities, which have recently become a tourist attraction, had not been introduced in the area. As camels have high endurance, they were worked for 12–16 h, covering 60 km a day, without food or water, carrying 100–300 kg, depending on their bodily condition. Camel hiring was common, costing US\$1/day per camel. A camel saddle is called *kabalka*; it consists of four sticks attached together to form a 'V' on each side of the camel.

Camel hide was used to prepare carpets and straps for making shoes. According to local manufacturers, camel hide is inferior in quality owing to its unevenness and it is very thin and hard when processed. Camel wool or hair had no use in the region.

There are several camel markets in the region, with 2–150 camels available on each market day. The price ranged from US\$200 to US\$800/head, depending upon size, breed, age and sex. Some camels were exported to Djibouti, Aden and Jeddah and, as contraband, via Somalia.

Diseases

The animal health problems encountered are summarized in Table III. The epidemiology and clinical signs observed are described below.

Trypanosomosis: All the blood samples were negative. The area surveyed is not infested with tsetse flies, but the most common and serious form of trypanosomosis in camels is that caused by *Trypanosoma evansi*, which is mechanically transmitted by other flies. The fly *Tabanus* is known to the breeders as *Adale*; when they saw such flies, they usually took their camels to the veterinary clinic for prophylactic treatment. In affected animals, the breeders had observed a marked thinning of the hump and a sharp decrease in milk production. The camels became weak but might continue eating.

Camel pox: The disease was observed in three camel herds, with the typical pox lesions of papules, pustules and crusts. We did not undertake a laboratory differential diagnosis from camel pustular dermatitis, but pustular dermatitis is clinically benign. Lesions typical of pustular dermatitis were seen on some camels, mostly on the lips. The breeders call camel pox *ajaro-awsa*, while pustular dermatitis is called *ajaro*, referring to clinically similar diseases with differing degrees of severity.

Dermatomycosis: Out of 13 scrapings, three revealed fungal spores and mycelia. The agent was tentatively identified as *Trichophyton*. The breeders diagnose this disease on the basis of the lesions of alopecia and an asbestos-like crust.

Camel mange: Three clinical phases were observed in the course of the disease. In the active phase there was marked irritation with intense local itching on the head or genitalia, both areas of thin, elastic skin, manifested by scratching that resulted in secondary trauma. Then there is a generalized spread over the body, with pronounced signs of itching and secondary traumatic wounds, which is the invasive phase. Finally, the skin becomes hard, dry and hyperkeratinous in the terminal phase. Out of 27 skin

TABLE III
Common animal health problems among eastern Ethiopian camels

| Disease | Morbidity (%) | Age of the affected animals | Seasonal occurrence | Local name |
|----------------------------------|---------------|----------------------------------|---------------------|------------|
| Trypanosomosis | 0 (0/350) | – | Sept–Nov. | Dukane |
| Camel pox | 3 (11/350) | All animals > 3 mo | May–June | Ajaro-awsa |
| Camel pustular dermatitis | 10 (35/350) | 3 mo–2 y | Year round | Ajaro |
| Dermatomycosis | 3 (13/350) | 1–2 y | Dry period | Anbar |
| Camel mange | 7 (27/350) | <1 year and > 5 y, mostly female | Year round | Andad |
| Tick | 100 (350/350) | All | ? | Shiline |
| Cephalopsis ^a | 83 (10/12) | All, severe in young | Year round | Sengale |
| Balantidiosis | 74 (148/200) | All | | |
| Gastrointestinal tract helminths | 24 (48/200) | All | | |
| Saddle sores | 15 (52/350) | Adult males | | Kusel |

Numbers of animals are given in parentheses

^aOut of 12 postmortens

?, Some specific years but no particular season

scrapings: 5/6 in the active phase, 7/10 in the invasive phase and 0/11 in the terminal phase were positive for *Sarcoptes scabiei cameli*. From our observations, the most important method of transmission was from the dam to the calf and *vice versa* during suckling. Thus the disease had a higher prevalence in calves and adult females. Harnessing and packing materials were unlikely to spread the disease as each camel had its own.

Ticks: These were found on every camel examined and belonged to the genera *Hyalomma*, *Amblyomma* and *Rhipicephalus*, with *Rhipicephalus pulchellus* being the predominant species. Although commonly found among the cattle herds in the same area, no *Boophilus* ticks were observed on the camels.

Cephalopsis: In the 12 camels inspected in the slaughterhouse, the number of larvae of *Cephalopsis titilator* in the nasopharynx ranged from 7 to 56. The breeders saw the larvae dropping when the camel sneezed.

Balantidiosis: Direct smears of faecal samples revealed a ciliate protozoon, *Balantidium cameli*. In 50% of the samples we found only the ciliate, while in 24% there were ciliates and strongyle-type eggs. The consistency of the faeces of affected animals was viscous.

Saddle sores: These were the most frequent problem encountered in adult male camels, as they are used as pack animals. Although each camel has its own harness, the saddle is not adjustable and fluctuations in the size of the hump due to nutrition and disease may result in wounds caused by friction.

Miscellaneous: Disease conditions described by the breeders but not observed during the study included metritis, lameness, mastitis, other wounds, hypocalcaemia, 'downer' syndrome and plant poisoning.

DISCUSSION

Reproduction and production

Male-to-female ratios as high as 1:50 have been observed in herds of camels (Williamson and Payne, 1978). The main determining factors for this ratio are the husbandry practices of the nomads and the condition and stamina of the males. As in our study, it has been previously noted that the male camel is late maturing, achieving sexual activity at 6 years, with eight mountings per day and each copulation lasting for up to 20 minutes (Evans and Powys, 1979; Arter *et al.*, 1985; Yagil, 1985). In both our data and data from other camel breeding areas, the female is also late maturing, its age at puberty being 3 years and the age at first calving 5 years with a calving interval of 2 years (Evans and Powys, 1979; Arter *et al.*, 1985). A productive life of up to 25 years has been reported (Mukasa, 1981). Calf mortality up to one year of age of 20–40% has been reported elsewhere (Khanna *et al.*, 1992). In general, the reproductive performance of the camel is relatively poor compared to other livestock. It has been calculated that the camel population in Ethiopia is growing by 2% and it seems that an increase in offtake of 2% would cause the population of camels to decline. However,

the population of camels may also increase owing to the migratory habit of pastoralists coming from Somalia and Djibouti.

Production of an average of 8 L/day of milk was reported in the Afar region of Ethiopia (Knoess, 1979). In other studies, a range of 2–20 L/day has been recorded (Yagil, 1985). However, the data on milk volumes is confounded by differences in farming practice, such as milking frequency and suckling. A lactation length of 9–18 months has been reported (Field, 1979). Lactation in the pastoralist herds depends on husbandry practices, heredity, season, nutrition and the demand for milk. The fat in camel's milk appears to be bound to protein, and there is a high concentration of volatile fatty acids, which may partly explain why it is so difficult to extract the milk fat by churning (Yagil, 1985). There is a cultural taboo on the sale of camel milk and production is at a subsistence level. However, heavy losses of cattle and small ruminants, due to recurrent drought, have forced the pastoralists to depend on the camel and hence to sell the milk, in order to buy other necessities. The market for camel meat is better developed in our study area than in other East African countries (Schwartz and Doli, 1992). The hair is not used, despite a yield of up to 5 kg per clip having been recorded (Mukasa, 1981) in the area of our study.

Diseases

Trypanosomiasis: Contrary to our findings, prevalence rates of 8% (Ethiopian Trypanosomiasis Control Service, 1982) and 15% (Richard, 1979) have been reported in similar camel breeding regions of Ethiopia. This difference may be due to the seasonality of the fly population. The lower prevalence rate in our study suggests that the chronic form of the disease is common (Luckins, 1992); such infections are more difficult to diagnose (Boid *et al.*, 1985) and the frequent treatment of the animals will exacerbate this.

Camel pox: The aetiological agent is a camel-specific virus belonging to the *Orthopox cameli* (Munz, 1992). The five stages of vesicular eruptions were described and the disease has been reported in southern Ethiopia (Richard, 1979). The disease is one of the most important highly contagious viral diseases in East Africa (Schwartz and Doli, 1992). Camel pox is well recognized by camel owners.

Camel pustular dermatitis: This parapox has been reported in southern Ethiopia (Richard, 1979). According to this author, the lesions were hard, warty, hyperkeratotic growths, firmly adherent to the underlying tissue and difficult to detach. When they were cut off, amber-coloured liquid oozed out, followed by a small haemorrhage. We observed similar lesions, mostly localized on the lips.

Dermatomycosis: The disease has also been reported in Ethiopia by Richard (1979). The responsible agent belongs to the genus *Trichophyton* (Schwartz and Doli, 1992). Dalling (1966; cited by McGrane and Higgins, 1985) commonly found ringworm caused by *Trichophyton dankaliense* in northern Somalia.

Mange: Richard (1979) reported the existence of *Sarcoptes scabiei cameli* in southern Ethiopia. However, the infestation rate was low. According to Schwartz and Doli (1992), the disease is important in Eastern Africa. *S.s. cameli* is the only mange mite of

clinical significance in camels. Chorioptic mange is mild and occurs only rarely in camels (Higgins, 1985). In our study, the mites were not found in the chronic phase, possibly owing to cutaneous immunity. As in our observations, calves were found by Kumar and colleagues (1992) to be more prone to infection, probably because suckling is the most important method of transmission. A lower immunity in these young animals has also been suggested (Pegram and Higgins, 1992).

Ticks: As in our observations, Richard (1979) also found that camels were infested with *Hyalomma*, *Rhipicephalus* and *Amblyomma* species, but not with *Boophilus* species. Richard (1979) also reported that *Rhipicephalus* spp., particularly *R. pulchellus*, are the most prevalent camel ticks in southern Ethiopia.

Cephalopsis: A prevalence rate of 100% has been reported (Richard, 1979) in southern Ethiopia. In Saudi Arabia, 32/35 camels were found to be infested (Higgins, 1985). In Egypt, the camel is reported to be infested with *Oestrus ovis* (Soulsby, 1968).

Balantidiosis: A prevalence rate of 56% was reported in southern Ethiopia, but the agent was considered to be innocuous (Richard, 1979). However, certain stress factors may increase the pathogenicity of *Balantidium* and severe diarrhoea due to this infection has been reported in the United Arab Emirates (Boid *et al.*, 1985). We did not attempt to identify the gastrointestinal helminth parasites. However, in eastern Ethiopia, camels are known to be infested with strongyloids, *Trichuris*, *Trichostrongylus* spp. and cestodes (Bouvier, 1975).

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Étude sur la productivité et les maladies présentes chez des chameaux de l'est éthiopien

Résumé – Une étude sur les performances du chameau éthiopien indiqua chez les troupeaux étudiés qu'il y avait généralement un mâle pour 25 femelles. La puberté est atteinte chez le mâle vers 5 ans et arrive à son pic après 9 ans. Le nombre d'accouplement atteint 8 par jour en saison de reproduction, l'activité sexuelle étant étalée sur 10 ans. Les femelles atteignent leur puberté vers 4 ans, elles ont leur premier petit vers 5 ans, une lactation durant 1 an et ayant un intervalle entre 2 petits de l'ordre de 2 ans. Le taux de vélage est de 50% et la période de reproduction entre 10 et 15 ans. Le taux de survie des nouveaux nés est de 50%. La production de lait est de 2,5 litres par jour, le prix du lait de chameau étant de 0,5 dollar/litre supérieur que celui de vache. Les chameaux adultes pèsent 500 kilos et le poids de la carcasse représente généralement 52% de la masse de l'animal. La viande de mouton est préférée à la viande de chameau, classée deuxième et qui coûte 2 dollars par kilo. A cause des faibles performances de reproduction le chameau n'est pas considéré comme un bon producteur de viande. Les chameaux travaillèrent 16 heures/jour couvrant 60 kilomètres. Les problèmes majeures de santé furent la trypanosomiase, la peste des chameaux, la dermatite pustulaire, le céphalopsis, les mycoses dermatologiques, les infestations par les mites et les tiques, la balantidiose, affectant principalement les animaux jeunes.

Estudio de la productividad y enfermedades del camello de Etiopía del Este

Resumen – Un estudio concerniente a los parámetros de productividad del camello etíope indicó que, en los rebaños examinados, había un camello macho activo por cada 25 hembras. El camello macho alcanza la pubertad a los cinco años, y la plenitud sexual a los nueve. Se produjeron ocho montas al día durante la estación reproductora y el período fértil fue de 10 años. Las hembras de camello alcanzaron la pubertad a los 4 años de edad, a los 5 se produjo el primer parto, y el período de lactación fue de 1 año, mientras que el intervalo entre partos fue de 2 años. El porcentaje de partos fue del 50% y el período fértil fue de 10–15 años. La tasa de supervivencia de los recién nacidos fue del 50%. La producción media de leche fue de 2,5 L/día; el precio de la leche de camella fue de 0,5 US dólares, más alto que la leche de vaca. El peso de los camellos adultos fue de unos 500 kg; el porcentaje de rendimiento de la canal fue del 52%. Se prefirió el cordero a la carne de camello, la cual quedó en segundo lugar de preferencia, con un coste de 2 US dólares/kg. Debido a su poco rendimiento reproductivo, los camellos no son eficientes para la producción de carne. Los camellos trabajaron durante 16 horas al día, cubriendo distancias de 60 km. Las enfermedades encontradas fueron: tripanosomiasis, viruela, dermatitis pustular de camello, cefalosis, dermatomicosis, sarna, garrapatas, infestación por pulgas y balantidiosis, la mayoría de las cuales afectaron principalmente a los animales jóvenes.