Survey on camel husbandry in Qassim region, Saudi Arabia: Herding strategies, productivity and mortality

B. Abbas[1*] A.A. Al Qarawi[1] A. Al Hawas[1]

Key words

Camelus dromedarius - Livestock management - Animal production - Ecology - Saudi Arabia.

Summary

A small survey was carried out on 38 camel herds in Qassim region of Saudi Arabia to study production and reproduction parameters, herding strategies, offtake and constraints to camel production. The study also recorded the rate and causes of mortality in the surveyed herds over one year. Four distinct herding strategies were discovered. Type one herders were companies or merchants who kept large herds (mean = 1260 camels) in semi-intensive operations and who marketed milk, meat and young camels on a regular basis. Type two herders were unspecialized merchants who kept medium-sized herds (mean = 86 camels) for family use without apparent commercial benefit. The third type of herders consisted of pastoralists or agropastoralists who kept smaller herds (mean = 14 camels) always with other animals (mainly sheep and goats, and occasionally cattle). Type four herders were classical camel merchants who also kept a relatively small group of camels (mean = 17 camels) in a feedlot for sale at a profit at the first opportunity.

The calving rate was 68%, the mean age at first calving was four years and four months and the mean intercalving interval was 20 months. The highest mortality was recorded in the period from birth to one year of age and averaged 17% in all the data. In large commercial herds, an additional age group with high mortality was the two- to three-year-old females in which up to 9% mortality was recorded. Most of the male camels were sold for meat at around one year of age and only 4.3% males remained in the herds.

■ INTRODUCTION

Camel breeding is a vital means to exploit unproductive lands in arid zones. Without this practice, most of the arid and marginal areas in northern and eastern Africa, Arabia and Asia will be abandoned (1, 12, 18). There is very little published information on camel ecology in Saudi Arabia (3, 4, 8) despite the antiquity of camel husbandry in this country (11, 15).

The present study was undertaken to generate base-line data on camel ecology and breeding in Qassim region, an area where most of Saudi camels are raised. The objectives of the study were: a) to describe the major herding strategies and camel breeds; b) to record production parameters of camels in the area; and c) to record the main constraints to camel production and define research priorities. In this paper the authors present information on herd structure and herding strategies, female reproductive performance, offtake and mortality.

1. Department of Veterinary Medicine, King Saud University, PO Box 1482, Buraydah, Saudi Arabia

* Corresponding author

■ MATERIALS AND METHODS

Two data sheets were used to collect information from cooperative camel breeders as described previously (1, 10). Briefly, the first sheet gathered general information on herd composition, nutrition, management, offtake and mortality. The second sheet recorded details of the reproductive performance of selected individual females, which included their age at first calving, the number of calvings, intercalving interval and fate of offspring.

The herds were selected randomly and the survey questions were asked of the most informed person available, usually the owner or the herdsman. Both sheets were only completed when the herd was actually in view, and information on females was solicited from the interviewee about the females he knew best. Small herds and herds managed by pastoralists were visited once, while large herds were visited two or three times in order to complete the survey sheets. The study lasted three months (September-November 1999). All information was obtained retrospectively and the recorded events concerned the year previous to the study.

The survey covered six districts, namely, Muzneb, Nefud, Tirag, Gibah, Butain and Buraydah (figure 1). The data were analyzed by

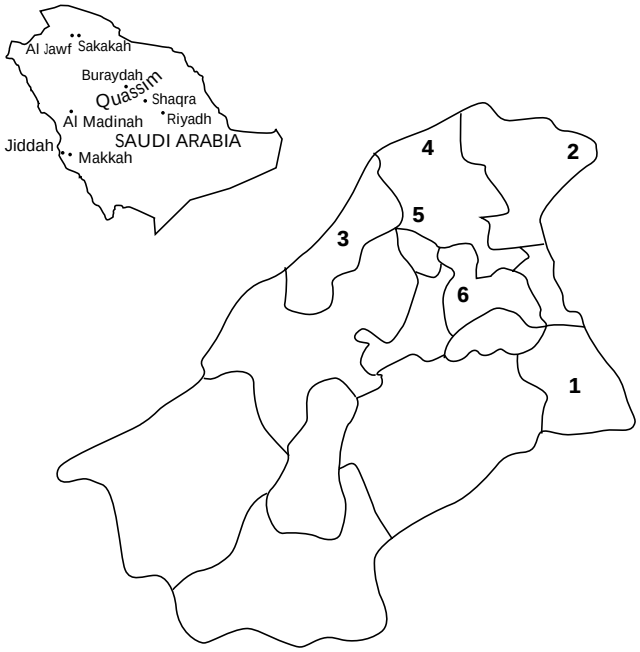

Figure 1: *Survey locations in Qassim region, Saudi Arabia: 1. Muzneb; 2. Nefud; 3. Tirag; 4. Gibah; 5. Butain; 6. Buraydah.*

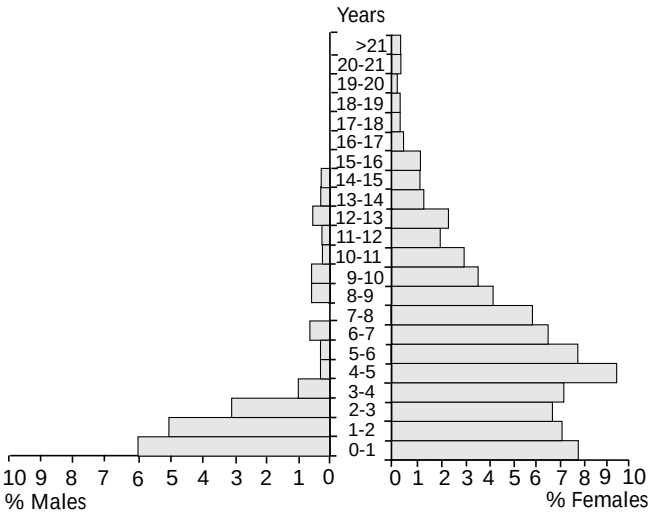

Figure 2: *Global distribution of the camel herds in Qassim region, Saudi Arabia (n = 3288).*

commercially available computer software (SPSS 9.0, Maxell). The purpose for keeping camels was utilized as the main criterion for an *a priori* classification of the surveyed herds into herd types, and ANOVA was used to test for differences ($p < 0.05$) in the recorded parameters.

■ RESULTS

Herd structure

Details were obtained from a total of 3490 camels belonging to 38 different herds giving an average herd size of 92 camels. Two of the herds were large company herds, one with 2100 camels and the other with 420. This left a total 968 camel distributed among 36 herds giving an average herd size of 27 camels per herd for the majority of breeders, who operated under the traditional husbandry system (see below). Eighty-six percent of the camels were born in the herd at the time of survey, and 14% had been purchased. Of the total number of surveyed camels (n = 3490), 2897 (83%) were females while 593 (17%) were males (figure 2). Seventy percent of the males were up to one year old. When female to male ratio was computed for breeding herds alone, i.e. neglecting herds of market-oriented herders (type four, see below), there were 92% females and 8% males.

Camel breeds

Table I presents a summary of the camel breeds encountered in the study area and their relative frequencies in the data. Camel breeds in Saudi Arabia are known by the color of their coat. The Mugaheem breed (black camel) was the most commonly encountered breed (67%) and appeared to be the first choice of breeders who commended it for its higher milk yield and faster weight gain. Wadha (white camel) was the second most frequently encountered camel breed (19%). This breed, also known as Maghateer, was commended for its mild temper, agility and fastness. It is the main riding and racing camel in the region. The Sufr breed constituted 6% of the sample. This breed, or perhaps sub-breed, is a short rather stocky brown-coated animal, with attributes similar to those of the Wadha, which it surpasses in body weight but not in riding or racing performance. Another notable breed of camels encountered in the area was the Humr breed (3%). It is light brown, tall, and can attain a remarkable body weight. It is also a good rider and a load bearer, but it is not well known in Qassim region. The rest of the surveyed camels (5%) could be divided into three breeds, which could be best described as variable crosses between Mugaheem and the other breeds, particularly Wadha and Sufr.

Herding strategies

The pattern of ownership, notably the purpose for keeping camels, implied four distinct herding strategies or herd types for the husbandry of camels in the area and are described below.

Type 1: Commercial dairies

These were herds owned by an individual owner or a company. They consisted of two herds, comprising 420 and 2100 camels, respectively. Both owners managed other animals (poultry, horses, sheep and ostrich), but the camels were managed separately by contracted labor and technical staff (veterinarians, technicians, accountants, drivers, etc.). Both herds were managed rather intensively. Camels were grazed on irrigated pasture for about 6-8 hours a day and pen-fed on purchased or farm-grown fodder (alfalfa, Rhodes grass, Sudan grass) with feeding of concentrates to the lactating females and male studs. Dry camels and heifers relied on natural grazing with very little supplementation. The company-operated herd specialized in commercial sale of pasteurized and packed camel milk. The other herd sold fresh camel milk, but was more actively involved in the finishing of young male (and occasionally female) camels for slaughter. This latter herd was also a well-known source of racing camels.

Type 2: Prestige herders

The herds were owned by wealthy merchants, who apparently kept them for family prestige. They were rather large, established since

Table I

Distribution of surveyed camels according to breed in Qassim region (1999-2000)

Breed	%	Remarks
Mugaheem	67.0	Large black camels; mainly bred for milk and meat
Wadha	19.0	White camels; very docile; good riders and racers
Sufr	6.0	Brown or cocoa colored, stocky and rather short; poor milkers
Humr	3.0	Light brown or sand colored; can be very large and tall camels; good riders
Zarga	2.5	Black and white-haired camels; probably a Mugaheem-Wadha cross
Shagha	1.6	White and red-haired camels; probably a Wadha-Humr cross
Shaala	0.9	Reddish brown-haired camels; probably a Humr-Sufr cross

at least one generation, and continued to grow to their present size. There were no commercial activities associated with the herds. Young male camels were sold immediately after weaning, offered as gifts or slaughtered during ceremonies or family occasions. The survey included six herds of this type, which ranged between 25 and 220 camels with a mean herd size of 86 camels. The camels were managed alongside commercial herds of small ruminants, mainly sheep, which ranged in size between 400 and 3280 with a mean of 756 head. The owners of these herds usually cultivated large fields of barley, wheat, alfalfa and date palm. The camels were grazed on natural pasture for most of the day and were offered barley or wheat stalks and occasionally alfalfa hay in the pen. Milking females were sometimes offered barley grains, dates or pelleted feed.

Type 3: Pastoralist and agropastoralist herders

The herds were managed by pastoralists as well as by an emerging group of recently settled agropastoralists, who kept small herds of camels consisting chiefly of adult females and stud camels. The herd size ranged between 5 and 28 with a mean of 14 camels. The owners were individuals who adopted transhumance, moving into central Saudi Arabia in late winter to make use of the winter and spring pasture, especially during good years. Then, they moved back into the settlements in the northern parts of the Kingdom, where they spent the summer and the early part of winter. However, some of the herders in this category had recently settled and, at the time of the survey, were cultivating small plots of barley, alfalfa and date palm. Camels were grazed exclusively on natural pasture or on crop residues from other families or tribal kin who had settled. These herders always kept large flocks of sheep and goats (mean = 160; range 148-488 animals). The settled herders also kept a few cattle (mean = 3; range 2-8).

Type 4: Peri-urban feedlots

The camels were bred to be marketed in the shortest possible time and were managed by individual owners in the vicinity of major towns, sometimes close to the livestock markets. They consisted chiefly of young male camels one to three years of age with an occasional late pregnant or recently calving female intended for sale to another breeder or family who needed a milking camel. In 18 surveyed herds, the herd size ranged between 5 and 52 with a mean of approximately 17 camels. The herds were managed directly by the owner; a laborer was hired by the owners of larger herds to assist in feeding.

Reproductive performance

To study female reproductive performance, only females for which exact information could be obtained were included. The survey was conducted on 106 females from type 1 herds, 45 females from type 2 herds and 26 females from type 3 herds. It was therefore also possible to compare the performances in the three herd types. The survey was not applied to type 4 herds because they consisted chiefly of male camels; also, the herders of this type had a poor knowledge of the history of the few female camels they occasionally dealt with.

The reproductive life of each female camel was divided into age categories and each reproductive event was ascribed to one of the age groups (figure 3). The average age at first calving was four years and four months. Thirty-six percent of the females had calved by the time they were four years old. Of these 9% calved for the first time at three years of age. When all the females were included and the number of births was related to the number of females, the calving rate was 68%. The abortion rate was 3.8%. The mean intercalving interval was 20 months for the compound data; this interval was 18 months in 44% and 24 months in 28% of the females in type 2 herds. Most (83.4%) of the calvings took place between November and March, while the rest of them occurred between May and August.

Offtake from camel herds

In this study, offtake was defined as the voluntary removal of animals from the herd, which usually meant slaughter for family use, sale or gift. Most of the males were sold between birth and two years of age (table II). This explains the low number of adult

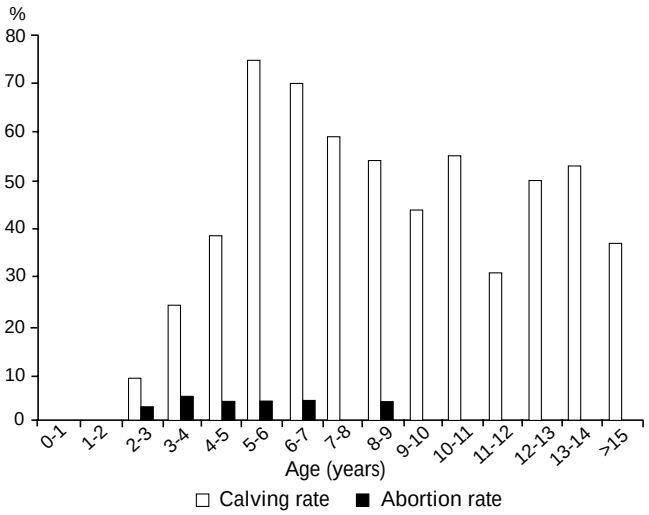

Figure 3: *Reproductive rates in relation with the age of female camels in Qassim region, Saudi Arabia (n= 177).*

Table II

Removal of camels from camel herds in relation to age in Qassim region, Saudi Arabia

	Males			Females		
Age class (years)	**Num. surveyed**	**Num. removed**	**%**	**Num. surveyed**	**Num. removed**	**%**
0-1	166	102	61	180	0	0
1-2	97	71	73.2	106	2	2.12
2-3	61	45	73.7	970	40	4.12
3-4	57	14	24.5	890	21	2.36
> 4	55	5	9.1	1440	151	7.01

male camels in the population. No females were sold at one year of age, but active female sale started at the age category 1-2 years to reach a peak at above 4 years of age. This category included most of the females in the survey. Reasons for higher sale among camels in this category included infertility, old age, abortion, mastitis and cash needs. Type 4 herders sold more female and male camels at a significantly younger age, while type 1 herders sold more 0-1 year-old males than the rest of the herds.

Mortality

A total of 593 camels had died during the year preceding the survey giving a crude mortality rate of 17%. The highest mortality rate was observed in the 0-1 year-old camels, mainly as a result of camel calf diarrhea, pox, ecthyma and starvation due to orphanage or dam rejection. Another peak of mortality was noticed in the 2-3 year-old females, particularly in the larger herds, which alone had 9% mortality in this age group (figure 4). Mortality causes included pox outbreaks, trypanosomosis, pneumonia and gastroenteritis. In older camels the main causes of death were pneumonia, trypanosomosis, snakebites, traffic accidents, pox, fractures, dystocia and poisoning due to accidental pesticide exposure.

■ DISCUSSION

The present investigation shows that, as a whole, the Saudi camel herd in Qassim region is an efficient breeding herd. This is perhaps in line with the noticeable increase in the population of camels witnessed recently in Saudi Arabia (13). In addition, camel breeding has attracted numerous wealthy families, who have acquired camels for family use, marketing only males at an early age, while the herds grow. Type 2 herds in the survey typified this practice. Camel meat and camel milk are popular items in the Saudi menu. This will no doubt encourage more investment in profit-oriented exploitation of camels. Two large herds of semi-intensively managed camels are already involved in the supply of milk and meat. However, the profitability of this type of camel management is debatable (12, 16). Management of the dairy-specialized herd described in this study expressed concern about the cost of producing camel milk. Costs of feed and management were the main sources for complaint. It was interesting to note that the price of camel milk of this dairy-specialized herd was twice as much as that of cow milk. The existence of real demand for camel milk in the country may attract new investors, particularly the owners of small herds, to enter this market in order to exploit the price margin while economizing in management.

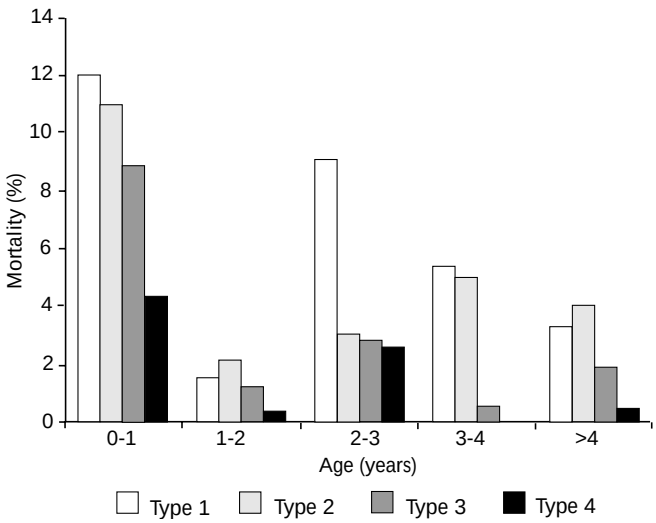

Figure 4: *Crude mortality rate in 38 camel herds in relation with the herd type in Qassim region, Saudi Arabia.*

The surveyed camels were breeding at a younger age than camels elsewhere, e.g. Sudan, northern Africa and Somalia (1, 12, 14). Not only females, but also male camels in Saudi Arabia were reported to acquire sexual maturity at an earlier age than that reported in other countries, most probably due to improved nutrition (3, 4). In this regard, most of the surveyed camels were given fodder either exclusively or after grazing, while some (herds of types 1, 2 and 4) also received concentrates or barley grains. Nutrition will perhaps constitute the biggest constraint to expansion in camel breeding (2, 4, 20) and might give a continuous advantage to the nomadic pastoralists who move their herds over large geographic areas in search of best grazing conditions (1, 11, 14). There is need for more research on camel nutrition, particularly diet composition, with emphasis on the use of crop residues to feed the notably increasing camel population.

An increasing number of camels in Qassim region were breeding annually, which led to mean intercalving intervals as short as 20 and 18 months in herd types 1 and 2, respectively. The annual calving rate was high (68%) compared to that of other famous camel keeping countries such as Sudan and Somalia (33-39%), where pastoralism dominates (10, 18, 19). However, the reproductive rates reported in this study must be considered with some reservations, since information was obtained on female camels which the owner or herdsman knew best. The purpose of this bias was to obtain reliable information, but it may have resulted in the selection of best performing camels.

The pattern of abortion as well as its rate is in line with an endemic brucellosis problem. Previous studies have indicated a prevalence of 4-7% of brucellosis reactor rate among camels in the Arabian Gulf countries (21). Brucellosis requires continuous monitoring, since in the absence of any regulation or trade restrictions on the

movement of infected camels flare-ups could occur. Several cases of human exposure to camel brucellosis have been documented in the area (7). Brucellosis can build-up in individual camel herds, leading to disastrous results with up to 25% abortions in a single season (5, 6).

The mortality rate reported in this study is within the expected range and is comparable to the rate recorded previously (1). Special attention needs to be directed to mortality among camel heifers. Pox appears to be the most common cause of mortality in this group of animals in the Gulf countries (15, 21), followed by pasteurellosis due to *Pasteurella multocida* (21), helminthosis, trypanosomosis and traffic accidents along the across-country motorways. Camel calf diarrhea is a notable cause of death among camel calves in the first few months of life (6, 19). Research should be directed towards determining the etiology of this condition, particularly the roles of Enterobacteriacae, rotaviruses and *cryptosporidia*, since there are claims incriminating all of these agents (9, 15, 17, 21).

REFERENCES

1. ABBAS B., CHABEUF N., SAINT MARTIN G., BONNET P., MUSA B.E., 1992. Camel pastoralism in Butana and northeastern Sudan, an interdisciplinary study. *Nomadic Peoples*, **31**: 64-84.

2. ABBAS B., SAINT MARTIN G., PLANCHENAULT D.D., BONNET P., 1993. Constraints to camel pastoralism in Eastern Sudan, a survey of pastoralists conceptions. *Sudan J. vet. Sci. Anim. Husb.*, **31**: 28-37.

3. ABDEL RAHIM E.A., 1997. Studies on the age of puberty of male camels in Saudi Arabia. *Vet. J.*, **154**: 79-83.

4. ABDEL RAHIM E.A., ABDEL RAHMAN A.E., ALNAZIER A.E., 1994. Production and reproduction of one-humped camels in Al Qassim region, Saudi Arabia. *J. Arid Envir.*, **26**: 53-59.

5. AGAB H., 1993. Epidemiology of camel diseases in eastern Sudan with emphasis on brucellosis. MVSc Thesis, Faculty of Veterinary Science, University of Khartoum, Sudan.

6. AGAB H., ABBAS B., 1999. Epidemiology of camel diseases in eastern Sudan. *World Anim. Rev.*, **92**: 42-51.

7. AL HARTHI S.S., 1989. The morbidity and mortality pattern of *Brucella endocarditis*. *Int. J. Cardiol.*, **25**: 321-324.

8. ALIM K.A., 1981. Aspects of animal production in Saudi Arabia. *World Rev. Anim. Lit.*, **8**: 9-16.

9. BENGOUMI M., BERRADA J., ROCHDI M., HIDANE K., DE LEFARGE F., FAYE B., 1998. Physiopathologie des diarrhées du chamelon au Maroc. Signes cliniques et perturbations métaboliques. *Revue Elev. Méd. vét. Pays trop.*, **51** : 277-281.

10. CHABEUF N., ABBAS B., MUSA B.E., BESHIR H., BONNET P., 1989. Survey of camel raising in Butana. In: Proc. Int. Symp. Anim. Prod. in the Sudan, Khartoum, Sudan, 3-7 January 1989.

11. CLOUDSLEY-THOMPSON J.L., 1977. Man and the biology of arid zones. London, UK, Edward Arnolds.

12. DEJELLOULI M.S., SAINT-MARTIN G., 1992. Productivity and economy of camel breeding in Tunisia. In: Proc. First Int. Camel Conf., Dubai, United Arab Emirates, 13-16 February 1992.

13. Food and Agricultural Organization of the United Nations, 1993. The FAO year book of agriculture. Rome, Italy, FAO.

14. GAUTHTHIER-PILTERS H., DAGG A.I., 1981. The camel. Its evolution, ecology, behavior, and relationship to Man. Chicago, IL, USA, The University of Chicago Press.

15. HIGGINS A.J., 1986. The camel in health and disease. London, UK, Bailliere Tindall.

16. KNOESS K.H., 1977. The camel as a meat and milk animal. *World Anim. Rev.*, **22**: 39-44.

17. MAHIN L., SCHWERS A., CHADLI M., MAENHOUDT M., PASTOREST P.P., 1983. Réceptivité du dromadaire (*Camelus dromedarius*) à l'infection par rotavirus. *Revue Elev. Méd. vét. Pays trop.*, **36**: 251-252.

18. REUSSE E., 1982. Somalia livestock economy: its response to profitable export opportunity. *World Anim. Rev.*, **43**: 2-11.

19. RICHARD D., 1980. Dromedary pathology and reproduction. In: Proc. IFS Symposium on Camels, Khartum, Sudan, 6-9 December 1979. Stockholm, Sweden, IFS, p. 409-430. (Series 12)

20. WENSVOORT J., 1992. Desert plants and diets for race camels. In: Proc. First Int. Camel Conf., Dubai, United Arab Emirates, 13-16 February 1992.

21. WERNERY U., KAADEN O.-R., 1997. Infectious diseases of the camel. Berlin, Germany, Blackwell.

22. WERNERY U., WERNERY R., 1992. Uterine infections in the dromedary camel, a review. In: Proc. First Int. Camel Conf., Dubai, United Arab Emirates, 13-16 February 1992.

Reçu le 07.06.2000, accepté le 24.04.2001

Résumé

Abbas B., Al Qarawi A.A., Al Hawas A. Enquête sur des élevages de dromadaires dans la région de Qassim en Arabie saoudite : stratégies de conduite, productivité et mortalité

Une enquête a été effectuée sur 38 troupeaux de dromadaires dans la région de Qassim en Arabie saoudite afin d'étudier les paramètres de production et de reproduction, les différentes stratégies de conduite, l'exploitation et les contraintes de la production cameline. Les taux et les causes de mortalité dans les troupeaux enquêtés ont également été enregistrés sur une période d'une année. Quatre types distincts de stratégies de conduite ont pu être observés. Dans le premier, les troupeaux étaient de grande taille (en moyenne 1 260 dromadaires par troupeau), appartenaient à des sociétés ou à des marchands qui pratiquaient l'élevage semi-intensif et vendaient de manière régulière le lait, la viande et de jeunes dromadaires. Dans le type 2, les troupeaux étaient de taille moyenne (86 dromadaires en moyenne) et appartenaient à des marchands non-spécialistes qui les élevaient pour l'usage de la famille et apparemment sans but commercial. Dans le troisième type, les troupeaux étaient plus petits (14 dromadaires en moyenne) et appartenaient à des pastoralistes ou à des agro-pastoralistes qui possédaient toujours par ailleurs d'autres animaux (principalement des moutons et des chèvres et parfois des bovins). Dans le quatrième type, les troupeaux étaient aussi relativement de petite taille (17 dromadaires en moyenne) et appartenaient à des marchands de dromadaires typiques, c'est-à-dire qu'ils étaient élevés dans des lots d'engraissement et vendus avec profit à la première occasion.

Le taux de mise bas a été de 68 p. 100, l'âge moyen à la première mise bas de quatre ans et quatre mois et l'intervalle moyen entre mises bas de vingt mois. Le taux de mortalité le plus élevé a été enregistré dans la période de la naissance à un an. Pour l'ensemble, des animaux le taux de mortalité relevé a été de 17 p. 100. Dans les grands troupeaux commerciaux, une mortalité élevée (9 p. 100) a également été enregistrée chez les femelles âgées de deux à trois ans. La plupart des dromadaires mâles étaient vendus pour leur viande à environ un an d'âge et seulement 4,3 p. 100 des mâles restaient dans les troupeaux.

Mots-clés : *Camelus dromedarius* - Conduite d'élevage - Production animale - Ecologie - Arabie saoudite.

Resumen

Abbas B., Al Qarawi A.A., Al Hawas A. Encuesta sobre la cría de camellos en la región de Qassim, Arabia Saudita: estrategias de hato, productividad y mortalidad

Se llevó a cabo una encuesta en 38 hatos de camellos en la región de Qassim en Arabia Saudita, con el fin de estudiar los parámetros de producción y reproducción, las estrategias de hato, pérdidas y obstáculos a la producción de camellos. El estudio registra también la tasa y las causas de mortalidad en los hatos supervisados durante más de un año. Se descubrieron cuatro estrategias de hato distintas. Los productores tipo uno fueron compañías o mercaderes que mantenían grandes hatos (promedio de 1260 camellos) en operaciones semi intensivas y que comercializaban la carne, la leche y los camellos jóvenes en forma regular. El productor tipo dos fueron mercaderes no especializados, que mantenían hatos de tamaño medio (promedio de 86 camellos), para uso familiar sin beneficio comercial aparente. El productor tipo tres fueron pastoralistas o agropastoralistas que mantenían hatos más pequeños (promedio de 14 camellos), siempre en conjunto con otros animales (principalmente ovinos y caprinos y ocasionalmente bovinos). Los productores tipo cuatro fueron mercaderes de camellos clásicos, quienes mantenían un pequeño grupo de camellos (promedio de 17), en estabulación, para venta con beneficio a la primera oportunidad.

La tasa de parto fue de 68 %, la edad media al primer parto fue de cuatro años y cuatro meses y el intervalo entre partos promedio fue de 20 meses. La mayor mortalidad se registró durante el periodo del nacimiento a un año de edad, con un promedio de 17 % para la totalidad de los datos. En los hatos comerciales grandes, se observó un grupo adicional con alta mortalidad, el de las hembras entre dos y tres años de edad, con un registro de mortalidad de 9 %. La mayor parte de los camellos machos fueron vendidos para carne a la edad aproximada de un año, con una permanencia en el hato de únicamente 4,3 % de machos.

Palabras clave: *Camelus dromedarius* - Manejo de ganado - Producción animal - Ecología - Arabia saudita.