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THEME

**IMPACT OF EMERGING CAMEL BREEDING SYSTEMS ON ANIMAL WELFARE IN
THE ALGERIAN NORTHERN SAHARA.
- CASE OF A BREEDING FARM IN THE OUARGLA REGION-**

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strategies for natural resource management and marketing.***



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Dedication

First of all, I thank ALLAH the Almighty for giving me the privilege and the chance to study and follow the light of knowledge, as well as the courage and the will to carry out this work

*To my dear **parents**, for all their sacrifices, tenderness, support and their Duaa throughout my studies.*

*To my beloved sisters "**Malika, Naima, Zina, Nada, Souad, Samiha, Louiza**" for their constant encouragement and moral support.*

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*Great thanks to my best friend "**Khelifa Rima**" for standing beside me all this time*

May this work be the fulfillment of my supported people long-standing wishes, and the proof of your support.

Thank you for always being there for me.

KADDAD AMIRA.

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List of Acronyms

ASD	Agricultural Services Direction
DCP	Digestible Crude Protein
FAO	Food and Agriculture Organization
FAWC	Farm Animal Welfare Committee
NAFD	National Agricultural Development Fund
NBRCD	National Bureau of Studies for Rural Development

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INTRODUCTION

Introduction

Dromedary camel (*Camelus dromedarius*) considered as one of the most adapted and sustainable animals, the camel population has been increasing regularly since 2000. This growth is mainly due to the increased use of dromedary camels as a production animal worldwide thanks to the high level of sustainability of camel farming and the ability of camels to cope with heat stress (**El Harrak et al., 2011; Hoffmann, 2010; Wako et al., 2017**).

However, this is leading to a shift from extensive to intensive farming systems of those animals which often have shown difficulties in coping with those changes (**Fatnassi et al., 2014 ; Padalino et al., 2014; Zappaterra et al., 2021**).

According to FAO statistics there are about 38654378 heads in the world of which 435214 heads are found in Algeria (**FAO, 2022**). Majority of them are stationed in the northern Sahara, on where Ouargla includes about 40 765 heads of camels (**ASD, 2022**).

In this context (**Godard, 2010**), signaled they are well adapted to drought and widespread resources, the question of its adaptation to climatic changes. In the context of climate change, camels also represent a viable option for socio-ecosystems that are facing drier climate scenarios (**Faye, Chaibou and Vias, 2012**). In addition camels able to go without water for a long time (generally thought to be 4-5 days) (**Wilson, 1998**). Also desert adapted camels have evolved physiological adaptations that reduce the amount of water lost.

The one-humped Camel has a unique ability to survive for a very longer period without drinking and replenish that loss in a short time as compared to other livestock animals (**Farah et al., 2004**). Furthermore, the camel can deal with rigid structural plant components. In addition, the faeces in which the seeds are deposited and dispersed provide favorable conditions for preservation and seed germination (faeces represent a significant source of organic matter that promote seedling growth). Also they play an important role in preserving the fragile desert's ecosystem and maintain a reasonable vegetation of plant types that are most suited for the harsh environment.

When given the opportunity to them, selects a diet, which is higher in quality than the average of what is available, making the camel a 'concentrate selector'. When allowed free choice, its preferred diet comprises mainly browse. A diet on browse consists on average of about 35% of leaves of leguminous and other trees and 65% of seeds, pods, flowers and twigs. And Moving while grazing no matter how rich or poor the vegetation (do not degrade desert flora), moreover recognize

poisonous plants growing in the area and will not eat them (May eat poisonous plants in new unfamiliar area) Can eat sharp, thorny plants other animals can't eat.

They are multipurpose animals raised for their milk, meat, hair, wool and hides. Camels are also kept for racing, tourism and used as a means of transport in some parts of the world (**Faraz et al, 2013**)

Socio-economic importance of camel is closely associated with existing production systems. These systems are generally determined by climatic conditions, topography, plant phonology, water resources, socio-cultural norms etc. (**Jasra and Mirza, 2005**).

After the northern Algerian desert region benefited from a series of development programs, this led to a decrease in nomadism and the selection of camel breeders for semi-intensive breeding of the peri-urban type.

Beside to all of this, there is still very little attention and knowledge about its welfare, these shortcomings concerns both the scientific and legislative aspects. Recent bibliometric research pointed out that, although the scientific interest in regards to the camel species has grown, little attention has been paid to camel welfare issues. There are still serious gaps of knowledge in camel physiology and behavior, in the impact of different breeding systems on its welfare.

The main objectives of this study are to determine the trends in the specialized camel breeding systems and their impact on animal behaviors by identifying the nature of practices in these systems applicable in the Peri-urban areas in the Algerian northern Sahara, specifically the region of Ouargla. In an attempt to identify practices that negatively affect camels and this in order to find Effective alternative solutions by proposing development prospects that ensure the achievement of three basic elements for animal welfare: Good surrounding conditions, good nurture, good sanitary and hygiene conditions.

Part One: Methods



CHAPTER I: INVESTIGATIVE APPROACH

I.1.Objective:

The present study whose objective lies in the establishment of diagnosis relating to camel breeding practices and more specifically to what appeals to the living conditions of the animal in the terms of well-being.

I.2. Bibliographic research:

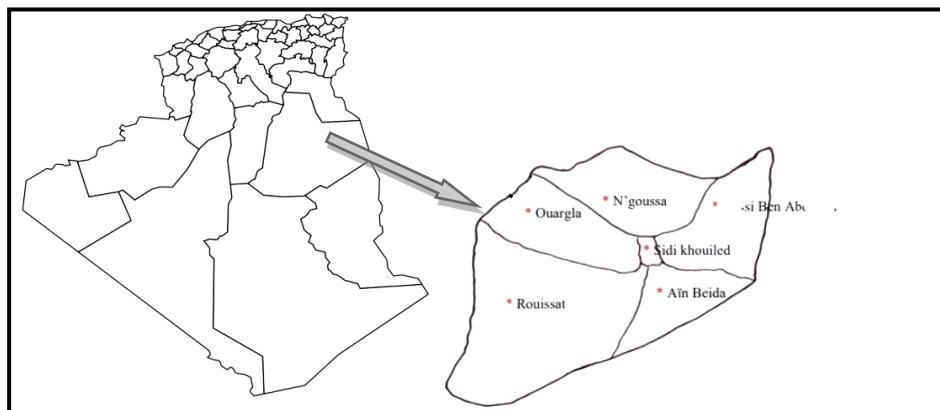
Basic information has been collected through bibliographic research (books, reports and statistics, also cartography and article, theses, webography& sites) .in addition to obtaining statistics on camel numbers from FAO and ASD to create a comprehensive questionnaire to peruse the study zone.

I.3. Survey framework development:

The questionnaire was created based on the specific objectives of the study which are three basic elements for animal welfare: Good surrounding conditions, good nurture, good sanitary and hygiene conditions.

I.4.Choice of the region:

This study was conducted on a herd of camels in the northern desert of Algeria, specifically the Ouargla region, because of its social and economic role, Zatout farm represents a good example for monitoring the practices applied in camel breeding.



Map 1: Geographical location of the study area (Google, 2022)

I.5. Data analyses:

While collecting the necessary data from the survey, we will convert the data into tables and charts using Microsoft Excel 2007 for the purpose of analyzing and diagnosing the results.

The following diagram explains the methodology of work:

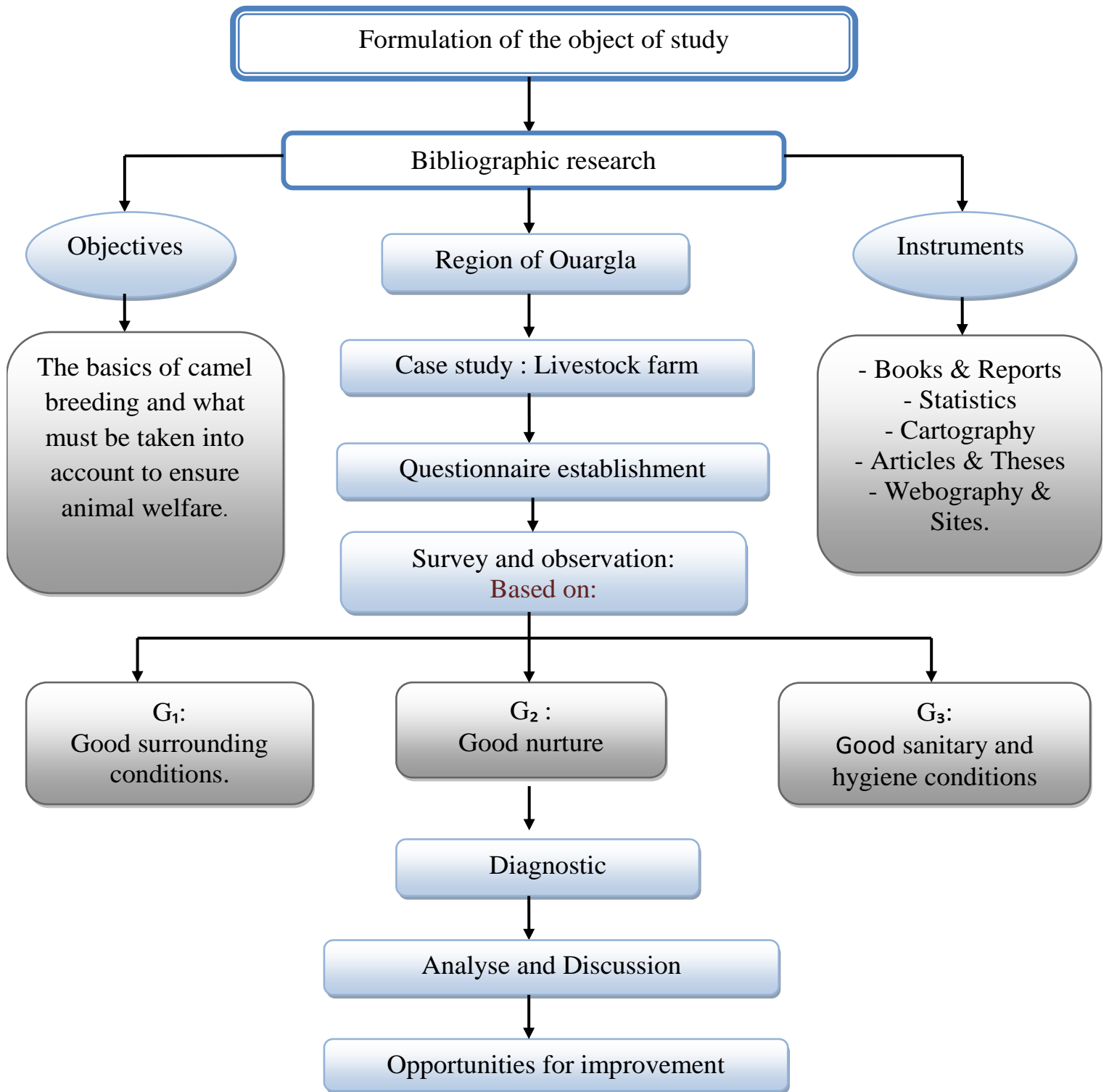


Figure 1: Methodology adopted

CHAPTER II: CAMELS IN ALGERIA

II.1. Typology of Camel breeding systems in Algeria:

With increasing human population pressure and declining per capita production of food in Africa there is an urgent need to develop previously marginal resources, such as the semi-arid and arid rangelands, and optimize their utilization through appropriate livestock production systems, of which camel production is certainly the most suitable one. (**Schwartz and Dioli 1992**).

Camel systems are undergoing adaptive changes and transformations associated with emerging demographic, political, environmental and socio-economic factors (**Hashi et al., 1995; Wilson, 1998; Farah et al., 2004**).

In this context, **Faye (1997)** notes that the dromedary is capable of yielding to the demands of modern animal husbandry, and of undergoing an intensification of its production to satisfy the growing demands of urban populations in desert and semi-desert areas. These systems are: extensive and semi intensive system.

Currently new trend towards commercialization of camel milk is starting in Algeria. It is adopted by group of camel herders who keep few of their lactating herds in open fences at the peri-urban area.

II.1.1. Peri-urban camel system:

The peri-urban system of camel breeding is adopted in many areas around the city due to the important economic activity in the region, which is the increasing demand by urbanized population as source of food and /or medicine for many diseases and disorders.

According to **Mammeri (2016)**, peri-urban camel farming is a new variant used for marketing camel milk on the main roads also, Many nomads now wish for themselves or their children the benefits provided by urban cities, including medical services and education (**Yagil, 1994; Wilson, 1998**).

We mention, the peri-urban system It is considered the most prevalent system for camel breeding in the region due to its easy access to modern amenities.

II.2. Evolution of camels in Algeria:

The most recent data available in 2020 the total number of camels recorded in Algeria is 435214 heads (FAO, 2022). Back to (Faye, 2020) has classified Algeria as one of the countries with a medium proportion of camel livestock.

After 1999 camel population increased suddenly such a change was associated with the launching of NADF during that year and including the provision of subsidies for newborn camels and carrying out a camel herd census. Therefore, Algerian camel breeders redirected their camels to grazing beyond the border (Faye, 2020).

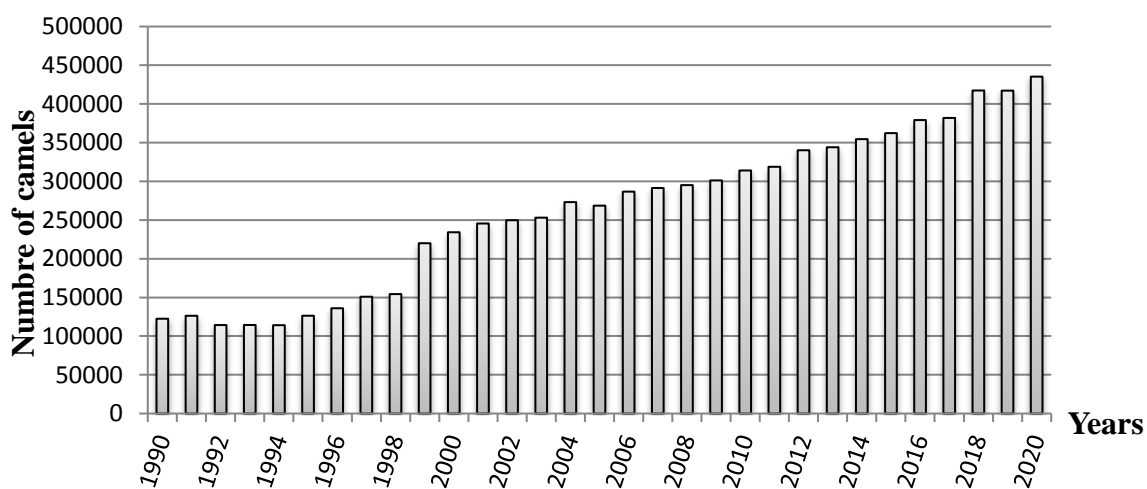


Figure 2: Evaluation of the camel herd during (1990-2022) in Algeria (FAO,2022).

II.3. The camel populations:

The national camel population belongs to two major genetic groups: Châambi and Tergui. It has eight inventoried sub-types: the Reguibi, the Sahraoui, the Aftouh camel, the Ajjer, the Aït Kebbach, the Ouled SidiCheikh, and the steppe camel. This distribution was confirmed by studies carried out in Algeria by several authors (Boué 1952; Lasnami 1986; Ben Aissa 1989; OuladBelkhir 2013, Harek et al. 2017)

Clear phenotypic difference between Sahraoui and Targui populations. The first appearing smaller, skinny but relatively long (the spiral turn appears relatively long in some individuals) with a smaller head and a neck less developed. The coat color parameter, whitish in the Targui

population (Figure 3), brown to dark brown in the Sahraoui(Figure 4) (OuladBelkhir et al.,2012).

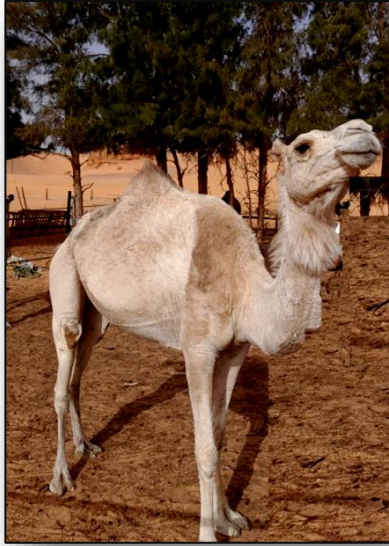
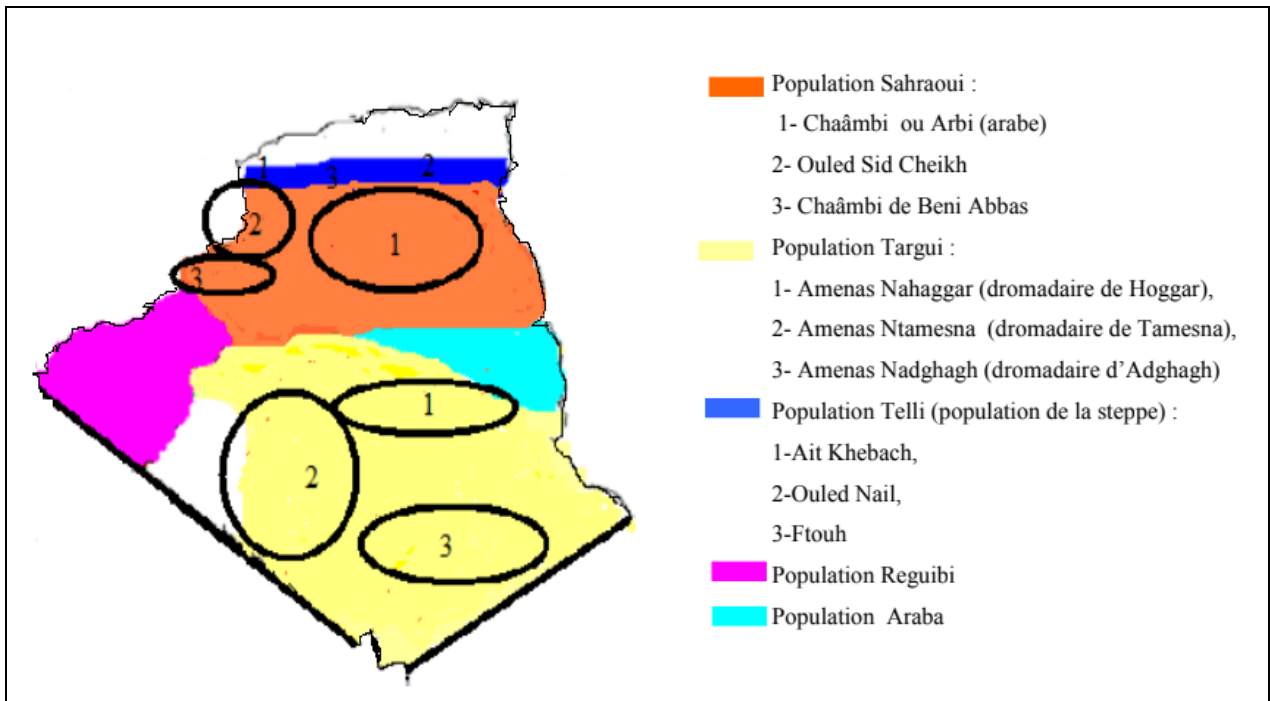


Figure 3: Dromedary of population Targui



Figure 4: Dromedary of population Sahraoui



Map 2: Geographical distribution of the camel population in Algeria (Ouladbelkhir, 2018).

II.4.Evolution of camel population in Ouargla:

According to the statistics provided by the ASD - Ouargla- for the number of camels during the period (2012-2021) there are comparative stability in which the average number of camels over the last decade is 37541 head.

Table 1: Evolution of the camel population in Ouargla during (2012-2021) (ASD, 2022)

Year	Numbers of camels
2012	30858
2013	31787
2014	32558
2015	33313
2016	40765
2017	42161
2018	41571
2019	41503
2020	40134
2021	40765

II.4.1.Peri-urban camel breeders in the Ouargla region:

For socio-economic reasons, we are now witnessing the emergence and development of a peri-urban camel breeding system.

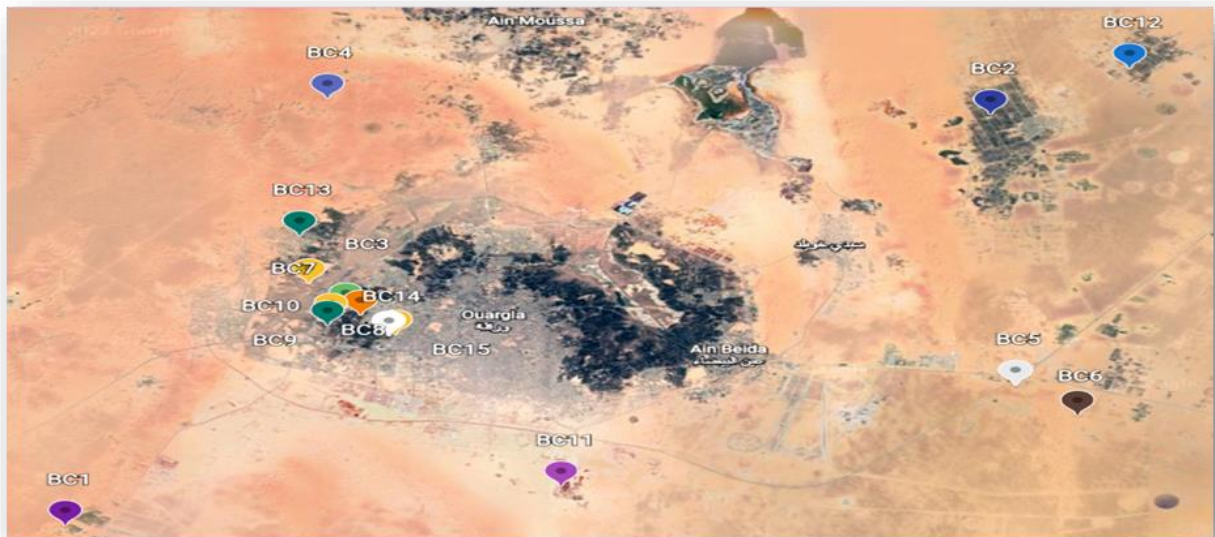
In this system the animals are left to graze during the day and then penned at the end of the day inside "wire" pens. The raw milk is sold on the spot to passers-by. These are some of the available data about camel breeders from the national bureau of studies for rural development (**Table 2**).

Table 2: Summary table of peri-urban camel breeders in the Ouargla region(NBSRD.2022)

Breeding of camel	Locality	Number of camel (Heads)	Vocation(*)	GPS position coordinates
BC1	<i>EL-Goléa Road</i>	13	Mix	31.875661684508923,5.226704942612349
BC2	<i>Hassi Ben Abdallah</i>	12	Mix	32.02919828045119, 5.458744745972743
BC3	<i>Bouaamer</i>	38	Mix	31.9660898404156, 5.287597545008532
BC 4	<i>HassiMilloud</i>	28	Mix	32.03515589856529, 5.292306248049953
BC 5	<i>Ain-Baida</i>	22	Mix	31.928095158331445, 5.464915089451562
BC 6	<i>Ain-Baida</i>	11	Mix	31.9167487915313, 5.480494654760093
BC 7	<i>SidiAmranne</i>	15	Mix	31.956946866181276, 5.296913139622905
BC 8	<i>SidiAmranne</i>	21	Mix	31.954228255467978, 5.300581093708567
BC 9	<i>Mekhadema</i>	10	Mix	31.950379374356014, 5.292317670766123
BC 10	<i>Mekhadema</i>	52	Mix	31.953137177858892, 5.293185970325616
BC 11	<i>Rouissat</i>	22	Mix	31.890368489938986,5.350964306620123
BC 12	<i>Mekhadema</i>	12	Mix	32.04643776159629, 5.493684029795322
BC 13	<i>Bamenddil</i>	13	Mix	31.983876331755113,5.2852764962644425
BC 14	<i>Bamenddil</i>	8	Mix	31.946541624723366,5.3077471861844066
BC 15	<i>Bamenddil</i>	8	Mix	31.94690318644693, 5.309428337878011

* : Milk / Meat / Mix

A satellite photo (GPS) made it possible to identify 15 peri-urban camel farms in the Ouargla region, while the farm studied was identified by BC 1 (Map 3).



Map 3: Location of peri-urban camel breeding in the Ouargla region (Google earth,2022).

II.5.The productions:

Multiple products and a single source, camels are animals whose products are considered to have economic value and health benefits, the most important of which are:

II.5.1.Meat:

It represents a significant source of protein where the camel lives in perfect harmony with its environment, which led **Leupold (1968)** to state that he saw no future for the camel other than as an animal of slaughter. The carcass weight is 55-65% of live weight and contains approximately 53-77% meat, 4-8% fat, and 16-38% bone. According to **Wilson (1984)**, a carcass is likely to provide, in addition to 40 kg of bone, 160 kg of meat, and 10 kg of fat to cover 5 days of energy requirements and 35 days of protein requirements of an adult male. From the point of view of characteristics, camel meat has a different texture from cattle: the muscle fibers are thicker and in the ambient air, it keeps a fresh appearance much longer than beef (**Senoussi, 2011**)

II.5.2.Milk:

Is the most valuable camel product and it is known as the (white gold of the desert). The camel is of significant socio-economic importance in many arid and semi-arid parts of the world and its milk constitutes an important component of human diets in these regions.

Camel milk is known for its nutritional quality, being rich in vitamins C and A and low in saturated fatty acid (SFA), its smaller fat globules, and being easy to digest and rich in many minerals and bioactive compounds.

II.5.3.Hair:

The weight of the fleece varies according to age; the calves give a better quality fleece, while in non-pregnant females it is much greater than in pregnant females. In Algeria, the weight of the fleece varies from 1 to 4 kg. The production differs in quantity, quality and color according to the different regions where the camels live. The hide from the camels of the steppe remains the most appreciated and sought after. Like sheep "s wool, it has no medullary substance, is held to the skin by a number of weedy hairs and does not acquire a certain length if left on the animal; on the contrary, it falls off spontaneously when the animal is not shorn. Shearing takes place once a year when the weather is not very cold and not very hot (late spring and early summer). The fleece of the camel is said to contain 75-85% fiber, 4-5% fat and 15-25% sand and dust. The fibers are uniform and have a diameter of between 9 and 40 microns. The nomads

find in the hide a raw material for the manufacture of various products; clothing, tapestry and the making of tents, bags and shackles. The dromedary's hair has a very good market value. (Senoussi, 2011)

II.5.4. Skin:

The skin is a complex organ that provides a protecting physical barrier between the body and the environment. It prevents the loss of water and electrolytes and protects against pathogenic microorganisms. The skin regulates body temperature and ensures immunologic monitoring (Khavkin and Ellis 2011).

The dromedary has a set of anatomical particularities (thickness of the dermis, nature of the appendages, structure of the sweat glands, blood network in the sinuses) which contribute to its resistance to thermal variations, characteristics of desert environments (Lee and Schmidt-Nielsen 1962; Faye et al, 1995).

This co-product can be exploited and valorized because of its strength and texture. It is used either salted and dried or tanned with oak or pomegranate bark. It provides both soft and strong leather used to make water containers, blankets, soles or to cover saddles. While some camel drivers use the skin to make straps, thongs or bags. (Senoussi,2011)

II.5.5.Manure:

Camels manure is used for the decomposition of organic compounds spilled within the soil/water in Sharjah (UAE) since it may be a suitable agent for filtration due to its higher fiber contents (Raziq et al, 2010). Also, it employed as a fuel, particularly among the rural communities because it is prepared to burn after a number of minutes. camel manure and its scale of production are specific in various camel varieties as a dairy camel weighing 600 kg produces 15-17 kg dry manure every day whilst the drought regular camel produce about 11kgs of manure.(Eitimad et al, 2020).

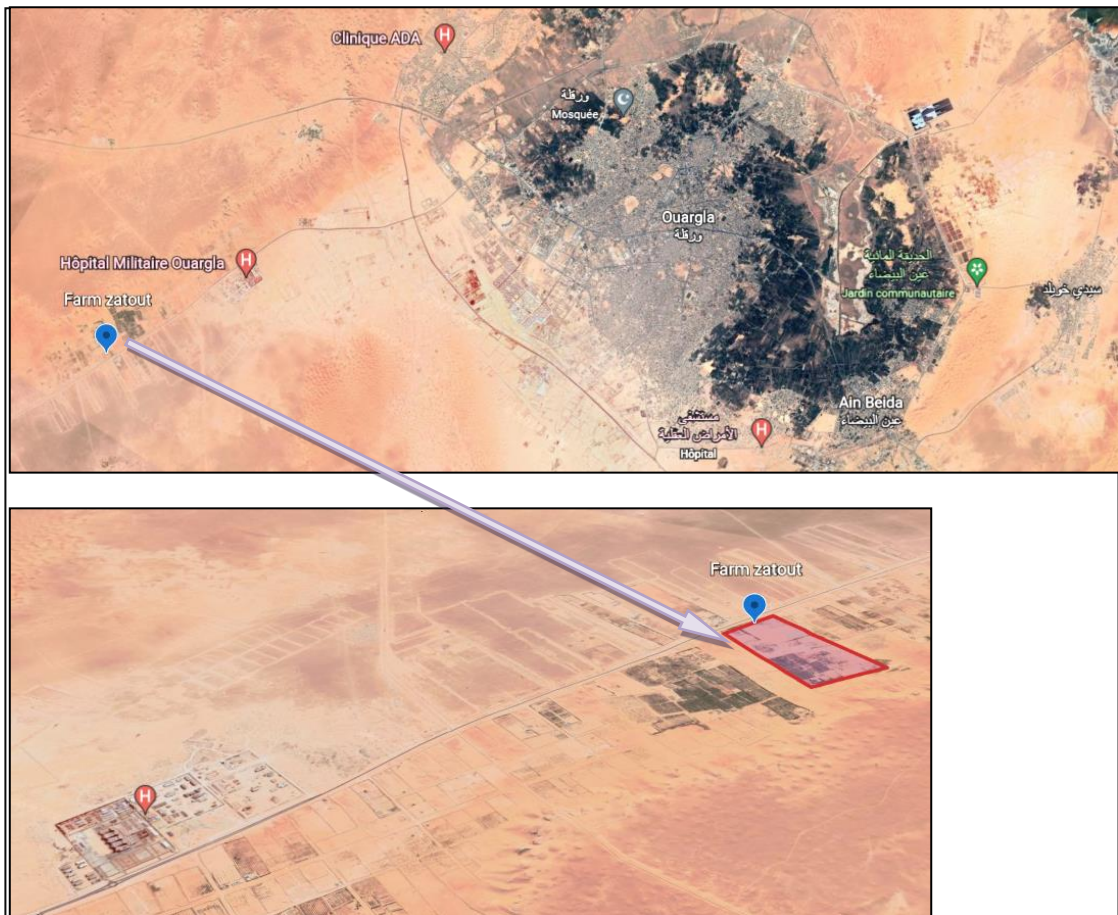
CHAPTER III: FARM PRESENTATION

III.1.Choice of farm:

The choice of the farm obeys practical considerations in terms of the availability of the owner, to be able to observe and to have credible information.

III.1.1.Geographical location:

The study was conducted in an area located in the outskirts of the city of Ouargla (South East of Algeria), where a survey related to camel breeding conditions (Google earth,2022).



Map 4: Geographical location of the survey farm (Google earth,2022)

The farm whose coordinates are 31°52'23" N latitude, 5°13'48" E longitude and altitude 162.52 m. Its total area is estimated at 40 hectares where crops are grown and animals are domesticated. (Table 3).

Table 3: Characteristics of the farm

Indication	Surface / Number Of Heads	Observation
Date palm	4000 palm	- cultivar of the date palm produce Deglat Noor
Camel	100 heads	-
Bovine	5 heads	- Raising for milk - Montbeliarde breed
Small Ruminants	20 heads	Meat and milk vocation
Other	02 dogs 06 geese Hens	The animals are put close to one another.

III.1.2. Breeding vocation:

In the opinion of **Bedda (2020)**, the induced livestock systems include:

- Dairy farms, peri-urban and peri-oasian type, for the production and informal sale of camel milk, supposedly with therapeutic virtues in relation to social convictions.
- Fattening farms, of the peri-urban, peri-oasis and inter-urban type, for fattening camels after weaning.
- And racing animal farms, of the intra-urban and intra-oasian type, for the breeding of racing meharis and fantasia.

III-1-3. The acquisition of dromedaries:

The numbers surveyed are the exclusive property of the camel breeder, who acquired them either by inheritance or sale.

III- 2- Camel herd composition:

The survey was conducted on a private farm, through double visits (20/02/2022) in order to meet the objective assigned by the study, the second visit was in (12/05/2022) to confirm and update the information. The investigations focused on the conditions of reception of the camel.

III-2-.1. Identifying of the herd:

The investigations focused on the camel herd on site. The latter is composed of 8 she-camels, 4 calves and 1 male (figure 5). In addition to 100 camel off the farm raising under extensive system

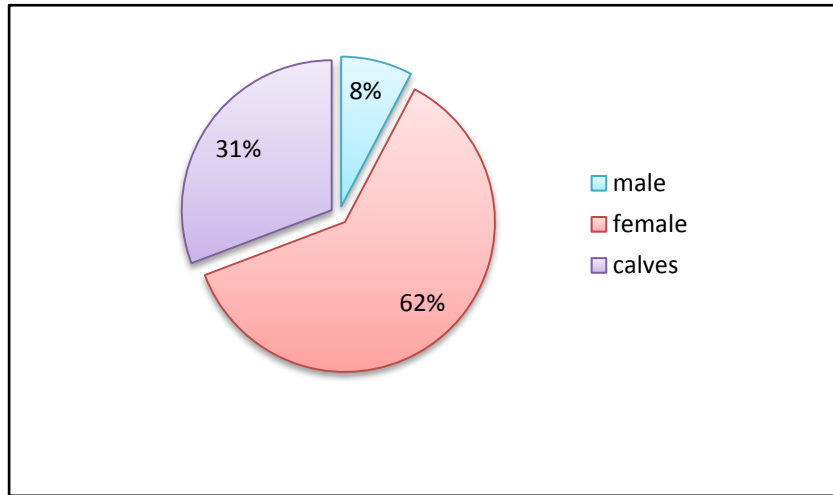


Figure 5:

Composition of the herd inside the farm

Part One: Results



CHAPTER I: THE ANIMAL COMFORT

Camel breeding must consider numerous elements, particularly in the context of housing management, due to the influence of the simplest things on the animal's health and comfort.

Generally, the camel enclosure is an open-air space where all animal categories are gathered. It is an area that does not obey any rules and is far from the standards required for breeding.



Figures 6-7 : pen of camels

I.1.Herd situation:

Successful breeding implies organizing the herd according to the needs of the different categories of animals, depending on their age, sex, physiological stage (gestation and lactation) and health status. However, during our investigations, all these elements were lacking, since it was found that there was no allotment; females with their young in the presence of males, all share the same space (**Figure 8**).



Figure 8: Male with 02 calves and she-camel.

I.2.Milking process:

The number of milking per day plays an important role in the amount of milk the camel can produce (Chaibou, 2005).

Other than from the absence of a location to milk she-camels, milk is carried out manually with the absence of a specific protocol for milking, especially since the camels in the pen are only milked when necessary. They produce 2,5 -3 liters/day.

I.3.Litter:

Earthen, mostly sand; the animals urinate and defecate in the same place and that is where the food is placed. In the absence of renewal of the litter and regular cleaning of the enclosure, this remains a source of the presence of germs, the release of bad odors and the accumulation of waste largely testify to this. (Figure 9-10)



Figures9-10: Bedding situation

I.4.Equipments:

I.4.1. Feeding trough:

In the form of old bathtubs are positioned on the ground, it was discovered that there are distinct rust lines during the first visit the feeders contained barley and dates, but, the watermelon was spread on the ground on the second visit, while the feeding trough was empty of food.

In addition, the feeders are not at all adapted to the nature of the animal; they are very insufficient with regard to the number of heads inside the enclosure.

I.4.2.Watering trough:

The feeder is based on recovered tires connected by an irrigation pipe intended for watering the crops installed. Full of algae and traces of very visible biofilms which can be sources of nuisance to the health of the animal. Moreover during our second visit, it was found that this type of drinking trough is completely devoid of water. This finding reveals the equipment as well as the distributed watering and the rate of watering are not subject to any required standard.

(Figure 11)



Figure 11: Watering trough in the second visit

I.4.3.Fence:

The enclosure is delimited by iron wire to inhibit the movements of the animals by preventing them from approaching the cultivated surfaces. In addition, the animals are restrained by tying their legs with a rope (1.5 m). **(Figure 12)**

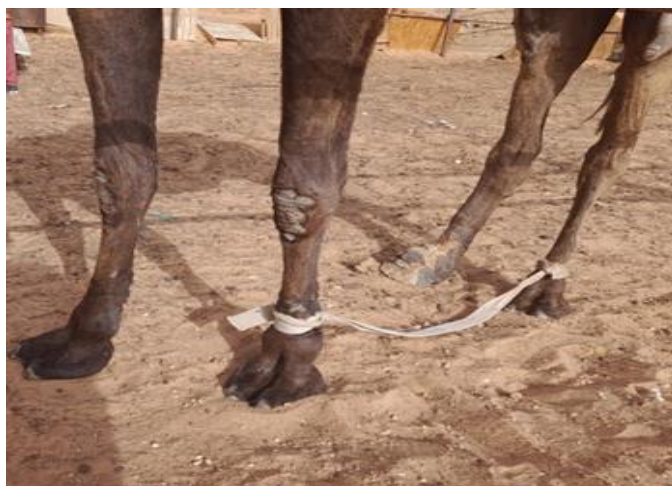


Figure 12: Tethering rope.

The fence made anyhow and of any material posts made of pointed iron bars supported by steel and concrete columns nearly two meters long (**Figures 13-14-15**).



Figures 13-14-15: Fence samples.

In some places, it is likely to harm the animal (**Figure 16**).



Figure 16: The back leg of a she-camel struck by the fence's edges.

CHAPTER II: NUTRITION PRACTICES

Nutrition is the backbone of livestock management because of its impact on camel productivity. Understanding vulnerabilities in feed intake management would improve the functioning of critical animal functions, resulting in improved productivity. In other words, feed guides the major biological functions of the animal.

II.1. Feeding management:

The herd was divided into two batches by the breeder. He retained the newly born she-camels and her calves, as well as one male in the "wire" pens (Batch 01). The grazing herd is made up of females and males immature and she-camels in gestation, in addition to reproductive males (Batch 02).

II.1.1. In pasture:

Camel's feed intake depends primarily on its selective feeding of a wide variety of vegetation and different parts of forage browse which differ in quality (**Hashi, 1995**).

In this case of "batch 02" the herder decides where and when the animals go for grazing because the food of camel is related to the place where the amount of rainfall is high, According to the owner, the herd is currently located around Al-Bayad.

II.1.2. In the pen:

The breeder keeps the all dromedaries (she camel – male – calves) in the pen all day and feeds them in the food listed below:

- Barley (*Hordeum vulgare*).- Dates (*Phoenix dactylifera*). -Watermelon (*Citrullus lanatu*)



Figure 17-18 : Food ration

Likewise, the camel consumes the sticks of wood put in front of it.



Figure 19-20: Camels eat sticks of wood

This food intake is the remaining dates and fruits from the farms that are not fit for human consumption or selling.

II.2. Watering management:

Camels are well-known for their ability to tolerate the region's tough weather conditions this made breeders are eager to find and track down water sources. As for the Water distribution varies depending on the breeding system employed as well as the location and season.

II.2.1. In pasture:

It is distributed on a regular basis as follows:

In winter: 3-4 times a month (every 7 days).

In summer: It can be up to 10 times a month (every 3 days).

II.2.2. In the pen:

The breeder utilizes ordinary water (DWS) for irrigation and delivers it to a single spot for drinking.

In winter: 3-4 times a month (every 7 days).

In summer: the watering of camels is ad-libitum.

CHAPTER III: HYGIENIC AND ANIMAL HEALTH CONDITIONS

To accomplish breeding objectives many hygienic and prophylactic factors associated to camels must be followed in order to minimize the spread of diseases and, as a consequence, minimize economic loss.

The breeding condition was evaluated at the farm level, and the study depended on the examination of a set of factors to evaluate the sanitary and hygienic management.

III.1. Pen Hygiene:

In the absence of preventive measures, assessed by the state of the pen (nature, no internal partitions or shelters, non-renewed soil), there are frequent pathological threats, such as mastitis and scabies. The enclosure is an inappropriate and dangerous place for the camels and is a source of germs and the spread of disease. All of these elements call into question the well-being of the animals.

III.2. Animal Hygiene:

In any type of breeding, the preventive aspect cannot be overlooked.

III.2.1. Diseases:

Health problems of the camel herd severely limit its productivity, A well-known disease :

III.2.1.1. Scabies:

It is caused by *Sarcoptes scabiei* var. *camelli* and is transmitted directly and indirectly .the direct transmission occurs through contact between animals Scabies is easy to diagnose in the acute phase with the combination of the following three symptoms: pruritus, hair loss, scabby patches. **(Figure 21).**

It is treated using Ivermectin **(Figure 22)** solution subcutaneous injection using needles by the breeder. Usually , breeders will use cade oil as a traditional remedy.



Figure 21: Camel with scabies



Figure 22: Scabies treatment medication.

III.2.1.2. Mastitis:

It can be defined as inflammation of parenchymal tissue of the mammary gland, regardless of cause, it is therefore characterized by a range of physical and chemical changes in milk and pathological changes in the glandular tissue, there are swelling, heat, pain, and edema in mammary gland (**Figure 23**).

In clinical cases, the most important changes in milk include discoloration (**Khudhair and Alrodhan , 2011**). Females that are ill are treated with an ointment (**Figure 24**) administered by the farmer.



Figure 23: Clinical mastitis



Figure 24: Udder ointment.

III.2.1.3. Case of overfeeding:

It happens as a result of overeating the concentrated feed (Barley – Dates). Causes anorexia, bloating and indigestion .The breeder handles this issue by providing her two liters of soft drink or coffee dissolved in water.

III.2.2. Marking :

As soon as a camel reaches the age of one year (after weaning), identification by fire (cauterization) is resorted to, by affixing the tribal seal that allows easy recognition. This is a painful technique that requires a lot of care because of the difficulty of looking at the animal.

III.2.2.1. Cauterization:

Using an iron bar, the farmer dabs the neck (**figure 25**) or thigh (**figure 26**) of the camel via a well-defined mark. The hot iron is applied to the target area for a maximum of 3 minutes. This procedure leaves wounds that are not followed by a specialized method to healing them in a healthy manner, increasing the chance of infection the wound. Also the tribal fire seal affects the aesthetics of the animal and depreciates the quality of the skin leaving indelible scars.



Figure 25: Mark in the neck



Figure 26: Mark in the back leg

III.3. About precautions:

In order to keep camels healthy, the breeder employs the following measures:

- Gives Multi-tonic at random intervals (**Figure 27**).
- ASD has a program that involves obtaining blood samples twice a year and doing brucellosis analyses.
- Veterinary consultation is indicated when therapy is complicated and the affliction is advanced.
- There is currently no vaccination program in existence



Figure 27: Multi-tonic used

Part One: Discussion



CHAPTER I: CAMEL WELFARE

In accordance with the 'Five Freedoms' principle, an animal's welfare is ensured when the following five conditions are met (FAWC, 1992):

- The animal is free from hunger, thirst and malnutrition, because it has ready access to drinking water and a suitable diet.
- The animal is free from physical and thermal discomfort, because it has access to shelter from the elements and a comfortable resting area.
- The animal is free from pain, injury and disease, thanks to suitable prevention and/or rapid diagnosis and treatment.
- The animal is able to express most of its normal behavioral patterns, because it has sufficient space, proper facilities and the company of other animals of its kind.
- The animal does not experience fear or distress, because the conditions needed to prevent mental suffering have been ensured. (Manteca *et al.*, 2012)

I.1. Scope on the camel species:

Animal welfare refers to how an animal is handled and how its requirements are met that it does not suffer from hunger and thirst, discomfort in addition to be freedom from pain, injury or disease, fear and distress ,and able to express normal behavior by depending on three principles: **Good nutrition, Good surrounding condition, and Good sanitary and hygienic conditions.**

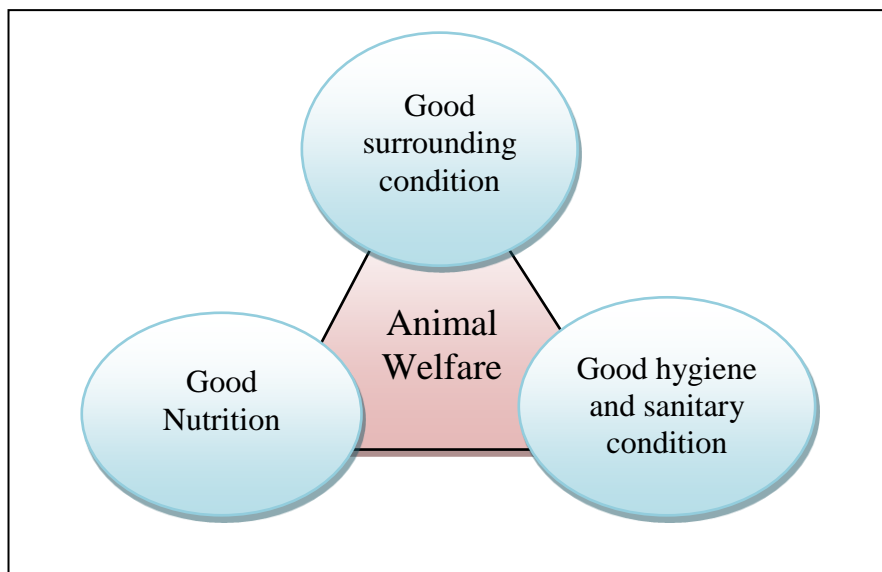


Figure 28: The principal components of camel welfare

The assessment of camel welfare is the ability to quantify how well an animal has adapted, based on three previously stated components (good nutrition - good surrounding conditions - good health and hygienic conditions). Any flaw in any component jeopardizes the animal's welfare.

I.2.Surrounding conditions:

Camels are creatures who like their natural space and walking vast distance as it is affected by the system used to raise it this may be reflected in the quality of its products. So, putting them all in one location without standard separations increases the risk of miscarriage in pregnant she-camel and perhaps injuries among young camels.

Furthermore, the location's fence restricts his movement and puts the animal under stress, which is reflected in his acts. The fence's quality also plays a part in its protection, as any fractures might cause injuries that are difficult to cure.

The bedding is a crucial component since not keeping it clean renewed systematically, it would be favorable to the installation of pathogenic germs because it is where the camel conducts all of his biological functions.

The number and nature of water and feed troughs are of paramount importance in terms of the facilities to be used to enjoy the welfare of the camels. Lack of breeding equipment can lead to aggressive behavior by camels (survival of the fittest) and consequently to deficiencies in meeting the animals' needs.

In terms of quality, the iron feeding troughs were exposed to the sun for lengthy periods of time due to the pen's lack of shade, traces of rust were observed.

Regarding to the watering trough, which was constructed of plastic, the lack of keeping the water clean and changing it on a regular basis revealed indications of algae and traces of biofilms.

I.3.Feeding assessment:

For good production, the animal must be well fed. Nutrition plays an important role in the proper breeding of animals, since providing food in accordance with the physiological condition would enable production performance to be achieved.

According to **Mjidou (2018)** intensively managed camels remain susceptible to acidosis due to the high concentration of concentrated food in the ration and edema due to their limited mobility.

It should be noted that keeping them in the pen for an extended period of time, it stops them from profiting from the roughages food cause the dromedary's diet is dependent on pastoral resources, the availability of which is determined by climate circumstances.

Instead the breeder gives the rotting fruit left over that it is not for sale in addition to dry dates (Back to chapter II of part two).

Alternatively, the ratio DCP/UF must be taken into account when giving a balanced ration. It is used to characterize the needs of the animals.

I.3.Sanitary and hygienic assessment:

The breeder interest to hygiene and sanitary conditions in camel breeding is still disregarded which lead to the use of rudimentary techniques that damage his health and hence his productivity, among which we mention:

- Marking with fire is harmful to the animal, leaving indelible scars in addition to the depreciation of the quality of the skin;
- The indiscriminate use of medications is hazardous to animal health;
- Placing food in the incorrect locations provides a multiplication ground for germs;
- Dirty watering and feeding troughs plus there are other animals are also a potential source for disease transmission;
- A complete lack of cleanliness while milking raises the chance of infection in the udder (mastitis);
- Lack of early veterinarian intervention causes the illness to spread and become difficult to treat.

Bedda (2014), reported that the main health problems limiting factor in camel farming and cause considerable economic losses (drop in production and mortality) reported by camel drivers in the Ouargla region these diseases are:

- External parasitosis: Scabies and Ringworm;
- Internal parasitosis: Trypanosomiasis;
- Respiratory and metabolic diseases.

Addressing these illnesses is dependent on the breeder's ability to handle this animal and create an acceptable environment for it to live in.

CHAPTER II: DEVELOPMENT OUTLOOK

Camels are between tradition and modernity, the questions raised concerning camel welfare necessitate responses that adhere to the evolutionary perspective in the realm of animal husbandry. This section provides a series of recommendations for the growth of the camel breeding sector and its practice as a significant economic and social activity, while also assuring the welfare of the camels.

II. 1. Comfort of animal in its environment:

Camels known as desert animals that can withstand harsh environmental conditions by different adaption mechanisms that help them to survive successfully in dry and arid climates where there is a shortage of water and high environmental temperature. For survival in the desert environment, camels have physiological, anatomical and behavioral adaptation mechanisms.

Camels are distinguished by their ability to move while grazing and make the best use of arid pastures. Changing their way of life may have an impact on the quality of their products. It is widely accepted that nutrition and the conditions under which the animals are produced, transported and slaughtered may influence the oxidative stability of the meat and several other physiological functions (El Khasmi *et al.*,2010).

Camel farming is changing from traditional extensive forms to modern semi-intensive or even intensive forms. This could lead to decrease the established perception of the camel farming as an environmentally sustainable production system (Faye.,2013) Yet, the current changes in the camel farming systems are modifying the traditional relationships between the camel and their environment (Faye *et al.*, 2012)

II.2. Megapark:

It is based on dedicating enormous regions (100 km x 100 km) for camel grazing without limiting them with:

- compelled to offer an agricultural strategy that ensures the recovery of devastated pastures and the planting of a group of plants palatable to camels in order to increase productivity .in addition to installing and spreading water stations homogeneously, a network of water stations has been established in Algeria (Figures29-30) and many other nations involved in camel

breeding to give the ideal environment for breeders and animals. Their application is based on the utilization of solar energy, with automatic control to fill the water trough.



Figures 29-30 :Point of water in the desert of Algeria

- A GPS tracker may be used to ensure the tracking of camels; It is worn as a camel necklace with a tracking device and global positioning system. Linked to Google Earth Maps with the solar-powered battery each camel would have its own unique code to identify. The gadget is compatible with smart phones and sends a text message, email, or phone tone to the camel official when the camels travel beyond the designated distance. To prevent the device from harm, the item is covered with a water-resistant substance and rubber.

II.3.Housing conditions:

The design of animal facilities combined with appropriate animal housing and management are essential contributors to animal welfare. Many factors should be considered in planning for adequate and appropriate physical and social environment, housing, space, and management. These include:

- Provide structures with protection from harsh environmental conditions;
- Adapted watering and feeding troughs (different requirement for different ages);
- Presence of a dung pit to avoid bad smells.
- Availability of a milking room
- Distribution of animals according to categories.

The illustrations below are examples of camel milk farm (**Figure31**) and holding pen (**Figure 32**):

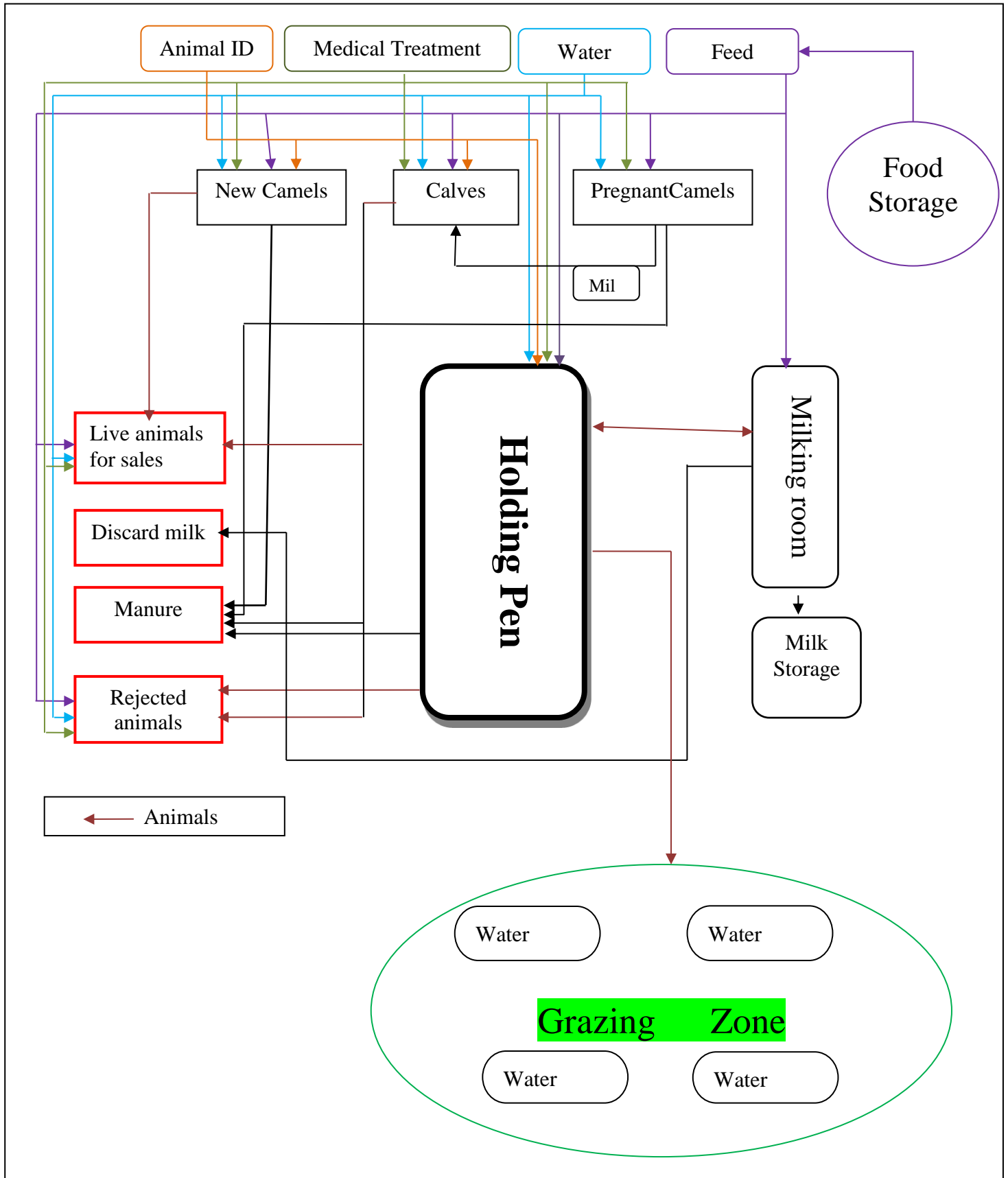


Figure 31: Organization of camel milk farm

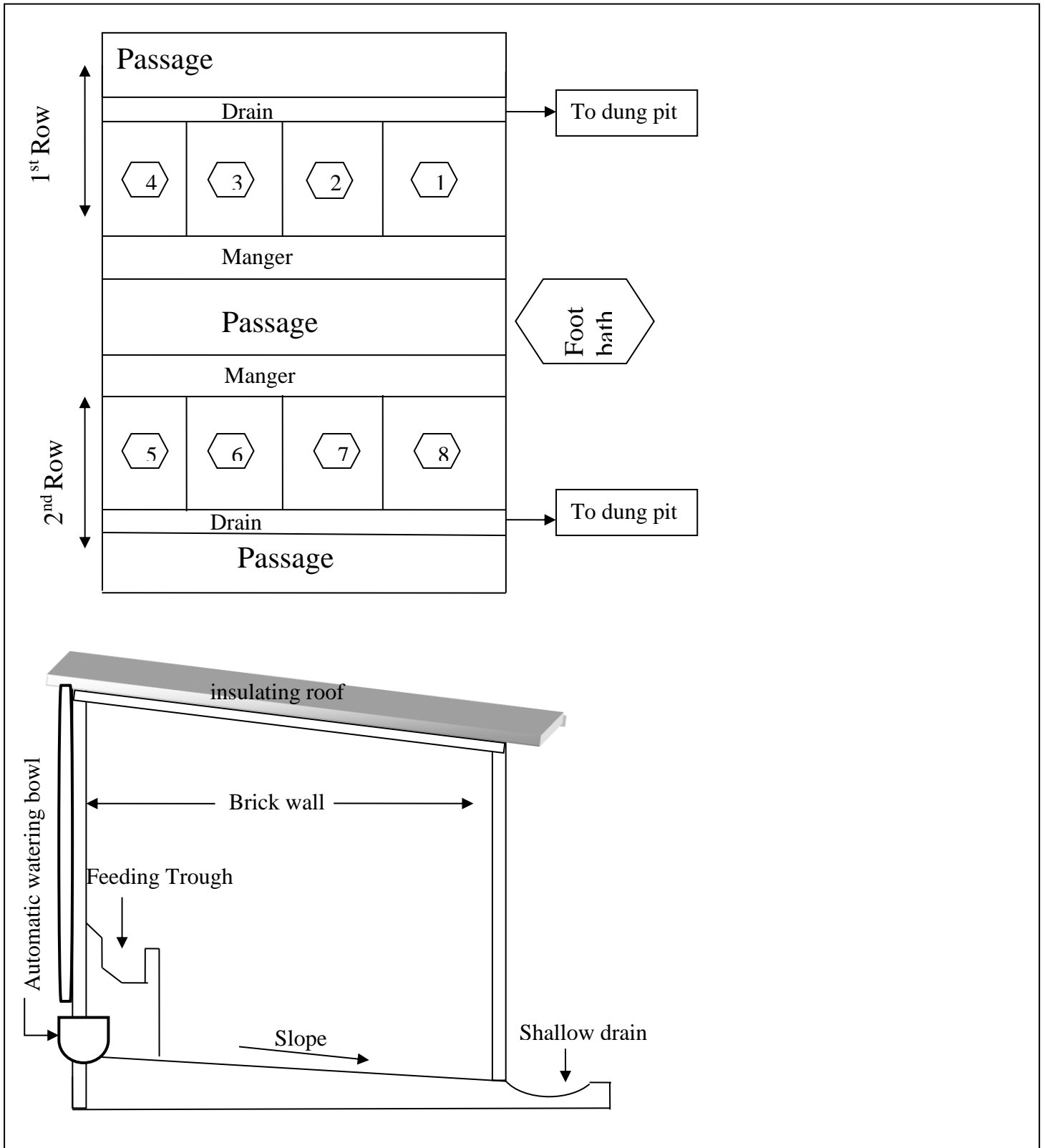


Figure 32: Plan for camel holding pen

II. 4. Health coverage:

Animal health is an essential component of animal welfare and a growing concern for many consumers. Here are several strategies for ensuring camel breeding health:

- Epidemiological disease surveys to prioritize health action on the most serious disease like Surra (*Trypanosoma evansi*), Mange, Camel pox, Ticks infestation...etc. (**Jemli et al., 2017**).
- Periodic analyzes of some diseases to prevent their spread, such as Brucellosis analyzes
- Using techniques other than cauterization to identify the camels in this instance, the microchip ID is the greatest option due to its simplicity and absence of harmful influence on the animal. The identifying mechanism is activated by a sterilized rice-grain-size microchip that is implanted permanently the chips are implanted in the nuchal ligament in the neck when the calves are 4 to 6 weeks old. The chip contains a unique 15-digit number defining the animal. The chip is coated with a special material to prevent any allergic reactions and to ensure the safety of camel products. Contained data about the camel including color, gender, age ,animal health record , breeds and surname in addition to where the camel owner could buy and sell camels. These e-chips were considered an “ownership registration document .it is read with a specialized instrument. This technology guarantees that reduced of theft operations, electronic sales, and full statistics on the number of camels - disease control.
- Courses for camel breeders on coping with sick camels and knows about veterinary intervention times.
- Some conventional practices that may be harmful to animal health should be reconsidered.

II. 5. Organization of the camels sector:

The promotion of the dromedary sector will require is sound program which include research, training and extension component in the management of animal health and the improvement of production and commercialization of meat, milk, manure, fiber and hide.

II.5.1.Meat:

After selecting the location for slaughter, transportation is carried out by mobile slaughterhouses to the camels' location. These slaughterhouses feature a meat storage area as well as the equipment required to finish the procedure. This comes under the category of ensuring animal comfort and enhancing meat quality.

II.5.2. Milk:

The anatomical and morphological characteristics of the mammary gland and their relation with milk production, machine milk ability and manageability in dairy camel have become of greater interest to farmers and researchers. The anatomy and morphology of the camel udder has been described in earlier studies (**Saleh et al., 1971**) it proves the teat represents the interface between the mammary gland and the teat cup liner. It is worth mentioning in this sector clear contrast to the form and size of the udder teats in the dromedary camel. Sometimes small teats may be hard to milk or large bulbous teats, due to enlarged teat canal or cistern (**Tibary and Anouassi, 2000**). These abnormal conformations may hinder the use of milking machine in dromedary camels (**Kaskous and Fadlemoula, 2014**). The solution of this problem is use of camel silicone liners are approved in EU. can perfectly adjust to all different udder shapes and sizes, as well as to various teat shapes and dimensions by virtue of the specially-designed liners.

II.5. 3. Hide:

Camel hides are important products that fulfill many functions. The hides are used to roof traditional houses of pastoral communities. The hides were also used for making ropes, guards, drums, seats, sandals, praying mats and water and milk containers (**Kagunyu et al.,2013**)

II.5.4.Fibre :

Are obtained by shearing, by combing and also by collecting during the moulting season. When the camel moults it doesn't lose its hairs all at once. First, the neck hair falls off, then the mane and finally the body hair. The camel moults in late spring or early summer when the fibres form matted tufts which hang down from the head, sides, neck and legs and this moulting process takes over 6-8 weeks. The fibres are harvested by pulling or by gathering the clumps shed onto the ground. Fibres are also obtained by shearing but the hair covering the humps is not shorn as this may make the animals more susceptible to disease after harvesting, camelhair is bought directly from the herders by middlemen who in turn sell to larger merchants and dehairers. There the fibre goes through a sorting process for separating the coarse fibres from fine soft hairs, washed to remove dirt and impurities and then dehaired to remove any coarse hair, dandruff and vegetable matters. The hair is sorted according to colour and the age of the animal. It is then sold to private or state-run companies. (**Prasanta,2018**).

II.5.5.Manure:

Livestock manure can be turned into nutrients, composts and fertilizers of various kinds if properly and wisely handled still, the use of livestock manure as organic fertilizer and fuel is common in developing countries (**Santamaria et al.,2014**). in addition to cellulosic production.

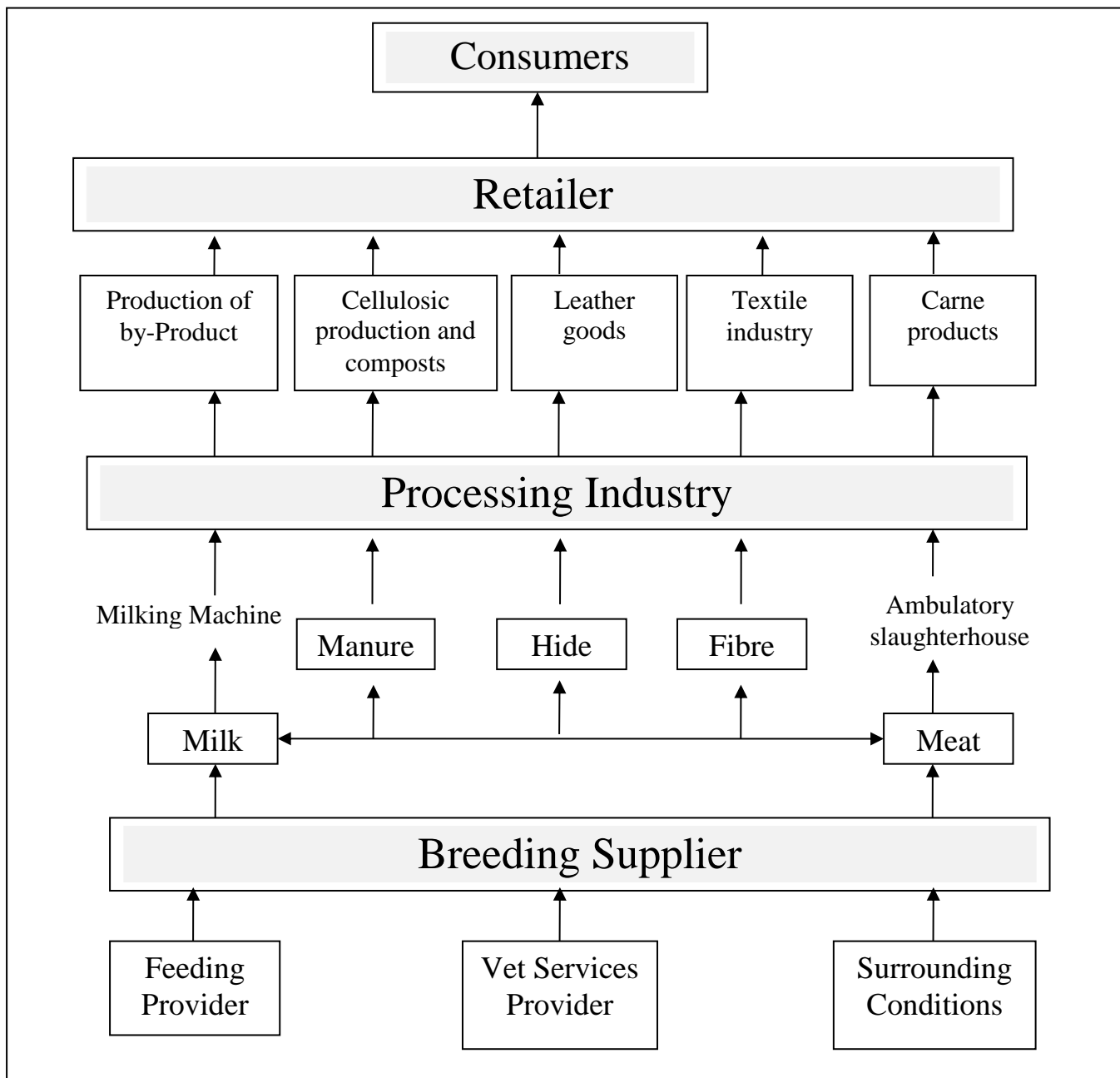


Figure 33: Plan for Organization of the camels sector

Conclusion

Conclusion:

At the end of the present study, conducted in an arid region, in this case Ouargla, where the dromedary embodies the tradition in terms of breeding. A new orientation characterizes the whole of the Algerian northern Sahara through the emergence of peri-urban livestock systems. New practices have been identified that have a direct impact on the animal and affect its well-being. Investigations carried out on a farm enabled us to establish a very restrictive diagnosis: animals confined in areas that do not meet any standards in terms of reception, breeding techniques or product quality. Animals are subjected to a diet, not to mention the lack of cleanliness and safety standards for housing facilities.

The camel endures its own discomfort and is confronted with extremely harmful conditions. Faced with such a situation, the technical support structures, as well as the development and health services, must take tangible action to ensure the supervision of camel drivers by reducing the animal's stress to a maximum. It is better to have a positive impact on the quality of the products by intervening in its natural environment and on the elements of animal's well-being which are:

- Good surrounding condition: through offering well housing.
- Good nutrition: by providing a balanced ration that ensures the animal's needs are met according to breeding vocation and category.
- Good health and hygienic conditions: by providing a prophylactic plan

Because it is a multi-service animal, it is critical to consider and develop other aspects, as well as to provide centers for:

- A racing animal is based on a specific camel (Mehari) that has been trained through a special program to compete in camelodrome races.
- Camel fantasy by holding festivals
- used for a defense animals on some countries' borders..

Bibliographic References

Bibliographic References

Bibliographical References:

1. **ASD**. 2022. Number of camels in the Ouargla region (2012-2021). Agricultural Services Directorate. Multigraphic document.
2. **Babiker I A**. 2014. Peri-urban Camel (*Camelus dromedarius*) Production System in Saudi Arabia: A note. *Journal of Animal Research*. Vol 4. Issue: 1. 5p. Available from [<http://dx.doi.org/10.5958/2277-940X.2014.00075.8>]. Accessed 07/02/2022.
3. **Barbara P** and **Laura M**. 2021. The first protocol for assessing welfare of camels. *Frontiers in veterinary science*. 16p.. Available from [<https://www.frontiersin.org/articles/10.3389/fvets.2020.631876/full>]. Accessed 09/02/2022.
4. **Bedda H**. 2020. Le déclin des systèmes de production camélins et les conditions de leur survie économique au Sahara Septentrional Algérien -cas de la Cuvette de Ouargla, le M'zab et le Ziban. Thèse de Doctorat en Sciences Agronomiques – Université de Ouargla -. 183 p.
5. **Bedda H**. 2014. Les Systèmes De Production Camélins Au Sahara Algérien . Mémoire de Magister en Sciences Agronomiques, Université KasdiMerbah Ouargla. 77 p. Available from [DOI:[10.13140/RG.2.2.10260.45440](https://doi.org/10.13140/RG.2.2.10260.45440)].
6. **Ben Aissa R**. 1989. Le dromadaire en Algérie. In : Tisserand J.-L. (ed.). Séminaire sur la digestion, la nutrition et l'alimentation du dromadaire. Zaragoza : CIHEAM, p. 19-28. (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n°2). Ouargla (Algeria). Available from [<http://om.ciheam.org/om/pdf/a02/CI000422.pdf>]
7. **Boue A**. 1952. L'originalité du chameau. *Revue d'élevage et de vétérinaire des pays tropicaux*. Vol 5. pp :109-114 . Available from [DOI : <https://doi.org/10.19182/remvt.6897>].
8. **Chaibou M**. 2005. La durée de lactation est très variable selon l'animal, la viabilité du chamelon et le système de gestion des élevages . Doctorate Thesis University of Montpellier II (Sciences and Techniques of Languedoc). 310 p. Available from [http://camelides.cirad.fr/fr/science/these_chaibou.html]. Accessed 18/05/2022.
9. **Eitimad A., Alzahrani F** and **Sulieyman A**. 2020. Potential of camel dung as promising organic manure in Saudi Arabia. *Advancements in Life Science*. 6 p. Available from [<http://www.als-journal.com/743-20/>]. Accessed 13/05/2022.
10. **El Harrak, M., Faye B** and **Bengoumi M**. 2011. Main Pathologies of Camels, Breeding of Camels, Constraints, Benefits and Perspectives. In: Recommendation No. 2. 19th Conference of the OIE Regional Commission for Africa, Kigali, Rwanda. pp. 1-6. Available from: [<https://www.woah.org/app/uploads/2021/03/2011-afr2-el-harrak-a.pdf>]
11. **El Khasmi M., Riad F., Safwate A., Tahri E.H., Farh M., El Abbadi N., Coxam V** and **Faye B**. 2010. Effects of preslaughter stress on meat quality and phosphocalcic metabolism in camels (*Camelus dromedarius*). *Journal of Camelid Science*. pp: 33-38. Available from [http://publications.cirad.fr/une_notice.php?dk=559509]. Accessed 03/06/2022.
12. **F.A.O.STAT**. 2021. Statistics from Food and Agricultural Organization of the United Nation.. Available from [<https://www.fao.org/faostat/en/#data/QCL>]. Accessed 05/02/2022.

Bibliographic References

13. **Farah K O., Nyariki D M., Ngugi R K., Noor I M., and Guliye A. Y.** 2004. The Somali and the Camel: Ecology, Management and Economics. *The Anthropologist*, Vol 6. Issue 1, pp: 45–55. Available from [<https://doi.org/10.1080/09720073.2004.11890828>].
14. **Faraz A., Younas M., Pastrana CI ., WaheedA ., Tauqir NA and Nabeel MS.** 2021. Socio-economic constraints on camel production in Pakistan's extensive pastoral farming. *Pastoralism*. 2021. 9p. Available from [<https://doi.org/10.1186/s13570-020-00183-0>]. Accessed 07/02/2022.
15. **Faraz A., Mustafa M I., Lateef M., Yaqoob M and Younas M.** 2013. Production potential of camel and its prospects in Pakistan. *Punjab Univ. J. Zool.* Vol 28 .Issue2. pp: 89-95, Available from: [https://www.researchgate.net/publication/327620631_Production_potential_of_camel_and_its_prospects_in_Pakistan]
16. **Fatnassi M., Padalino B., Monaco D., Aubé, L., Khorchani T., Lacalandra GM and Hammadi M.** 2014. Effect of different management systems on rutting behavior and behavioral repertoire of housed Maghrebi male camels (*Camelus dromedarius*). *Tropical Animal Health and Production*. pp: 861-867. Available from: [DOI: [10.1007/s11250-014-0577-6](https://doi.org/10.1007/s11250-014-0577-6)].
17. **F.A.W.C** .1992. updates the five freedoms *Veterinary Record* 17: 357. Available from [<http://www.fawac.ie/>]. Accessed 06/05/2022.
18. **Faye B.** 2020. How many large camelids in the world? A synthetic analysis of the world camel demographic changes. *Pastoralism*. 13 p. Available from [<https://pastoralismjournal.springeropen.com/articles/10.1186/s13570-020-00176-z>] Accessed 09/05/2022.
19. **Faye B.** 2016. The camel: new challenges for a sustainable development. *Tropical Animal Health and Production*. 4p. Available from [<https://doi.org/10.1007/s11250-016-0995-8>]. Accessed 09/03/2022.
20. **Faye B.** 2013 . Camel Farming Sustainability: The Challenges of the Camel Farming System in the XXIth Century. *Journal of Sustainable Development*. 9p. Available from [<http://dx.doi.org/10.5539/jsd.v6n12p74>]. Accessed 31/05/2022
21. **Faye B. Chaibou M and Vias, G.** 2012. Integrated impact of climate change and socioeconomic development on the evolution of camel farming systems. *British Journal of Environment and Climatic Change*. pp:227-244. Available from [<http://dx.doi.org/10.9734/BJECC/2012/1548>]. Accessed 31/05/2022.
22. **Faye B.** 1997. Guide de l'élevage du dromadaire, SANOFI. Santé Nutrition Animale, 126 p
23. **Faye B., Jouany J P., Chacornac J P and Ratovonahary M.** 1995. L'élevage des grands camélidés. Analyse des initiatives réalisées en France. *Productions Animales*. pp.3-17. hal-00896099. Available from : [<https://hal.science/hal-00896099/document>]
24. **Godard O.** 2010. Cette ambiguë adaptation au changement climatique. *Natures Sciences Sociétés*, Vol 18, pp:287-297. Available from: [<https://www.cairn.info/revue-natures-sciences-societes-2010-3-page-287.htm>]

Bibliographic References

25. **Google earth.** 2022. Geographical location of the survey farm. (31°52'32.4"N 5°13'36.1"E) .Ouargla - Algeria.1/1000. Available from [<https://earth.google.com/>]
26. **Google earth.** 2022. Location of peri-urban camel breeding in the Ouargla region. Algeria.1/5000. Available from [<https://earth.google.com/>]
27. **Haben F** and **Wondwossen D.**2020.Dromedary camel and its adaptation mechanisms to desert environment: A review. *International Journal of Zoology Studies*. Vol 5. Issue 2. 6p. Available from [\[https://www.researchgate.net/publication/340815205_Dromedary_camel_and_its_adaptation_mechanisms_to_desert_environment_A_review\]](https://www.researchgate.net/publication/340815205_Dromedary_camel_and_its_adaptation_mechanisms_to_desert_environment_A_review).Accessed 14/02/2022
28. **Hamdi I.,Benaissa A.,Babelhadj B ., Bedda H ., Aboub S** and **Loubakic R.** 2022.Composition and structure of the skin of dromedary (*Camelus dromedarius*, L. 1758) young adult from two Algerian populations. *Journal of Animal Behaviour and Biometeorology*. 7p. Available from [<http://dx.doi.org/10.31893/jabb.22017>].Accessed 13/05/2022.
29. **Harek D., El Mokhefi M., Ikhlef H., Bouhadad R., Sahel H., Djellout N** and **Arbouche F.** 2022. Gene-driving management practices in the dromedary husbandry systems under arid climatic conditions in Algeria. *Pastoralism* .pp: 6-7..Available from[<https://pastoralismjournal.springeropen.com/articles/10.1186/s13570-021-00219-z>].Accessed 05/04/2022
30. **Harek D., Ikhlef H., Bouhadad R., Sahel H., Cherifi Y A., Djallout N., Khelifa Chelhi S., El Mokhefi M., Boukhtala K., Saouar G B S** and **Arbouche F.**2017. Genetic diversity status of camel's resources (*camelus Dromedarius*. Linnaeus, 1758) in algeria. *Genetics and Biodiversity Journal*.pp:43-65.Available from: [<https://www.asjp.cerist.dz/en/downArticle/398/1/1/52402>]
31. **Hashi AM** and **Kamoun M.** 1995. Feed requirements of the camel. In :Tisserand J.-L. (ed.). Elevage et alimentation du dromadaire. Zaragoza : CIHEAM .pp :71-80 (Options Méditerranéennes : Série B. Etudes et Recherches; n. 13).
32. **Hoffmann, I.** 2010. Climate change and the characterization, breeding and conservation of animal genetic resources. *Animal Genetics*. Pp: 32-46. Available from : [DOI: [10.1111/j.1365-2052.2010.02043.x](https://doi.org/10.1111/j.1365-2052.2010.02043.x)]
33. **Issack MN.** 2013. Characteristics, feeding and marketing practices of the emerging peri-urban camel production system in Isiolo county, Kenya. Thesis of the Doctor of Philosophy Degree in Animal Science of Egerton University, Kenya.7p
34. **Jarsa AW** and **Mirza M A.** 2005. Camel production systems in Asia. FAO-ICAR Seminar on Camelids, Technical series n 11, R. Cardellino, A. Rosati and C.Mosconi (Eds), Sousse (Tunisia), May 2004, pp37-50. Available from: [https://www.icar.org/Documents/technical_series/ICAR-Technical-Series-no-11-Sousse/Wahid-Jasra.pdf]
35. **Jemli MH., Boulajfene H., Azaouzi Z., Ben Salem W** and **Khaldi S.** 2017.Camel breeding development project in Tunisia. 04p.Available from[<https://camed.cirad.fr/content/download/4402/32284/version/1/file/Jemli+al+2017+Camel+breeding+development+project+in+Tunisia.pdf>].Accessed 12/02/2022

Bibliographic References

36. **Kagunyu, A.W., Matiri, F. & Ngari, E.** 2013. Camel hides: Production, marketing and utilization in pastoral regions of northern Kenya. *Pastoralism*. Available from [<https://doi.org/10.1186/2041-7136-3-25>] Accessed 04/06/2022
37. **Kaskous S and Fadlemoula A.** 2014. The challenge of machine milking in dromedary camel. *Scientific journal of review*. Pp:1004-1017 .Available from: [https://www.researchgate.net/publication/277014900_The_challenge_of_machine_milking_in_dromedary_camel]
38. **Khavkin J, Ellis D A F.** 2011. Aging Skin: Histology, Physiology, and Pathology. *Facial Plastic Surgery Clinics of North America* .pp:229- 234. Available from [DOI: [10.1016/j.fsc.2011.04.003](https://doi.org/10.1016/j.fsc.2011.04.003)]
39. **Khudhair YI and AlrodhanM.** 2011. Study on clinical mastitis (bacteriological) in she-camels (*Camelus dromedarius*) in some areas of middle euphrates in Iraq. *Journal of Veterinary Medical Science*. Pp: 66-76. Available from [<https://www.iasj.net/iasj/article/81043>]. Accessed 26/05/2022
40. **Lasnami K** .1986. Le dromadaire en Algérie perspective d'avenir. Thèse de magister en science agronomique ; option production animale INA El Harrach. p185.
41. **Leupold J.** 1968. Le chameau, important animal domestique des pays subtropicaux. In les cahiers bleus vétérinaires. N° 15. pp. 1-6. (qtd .in Senoussi A., 2011)
42. **Lee DG and Schmidt-Nielsen K** .1962. The skin, sweat glands, and hair follicles of the camel (*Camelus dromedarius*). *The Anatomical Record* .vol 143 .issue 1 .pp:71- 77. Available from [<https://doi.org/10.1002/ar.1091430107>]
43. **Mammeri A.** 2016. Les circuits périurbains de commercialisation du lait de chamelle en Algérie : cas de la wilaya de Biskra. *Renc.Rech.Ruminants*. 93 p.. Available from [https://www.researchgate.net/publication/324530702_Les_circuits_periurbains_de_commercialisation_du_lait_de_chamelle_en_Algerie_cas_de_la_wilaya_de_Biskra_Periurban_circuits_of_she-camel_milk_sales_in_Algeria_the_case_of_wilaya_of_Biskra-Renc_Rech_Rum]. Accessed 30 /04/2022
44. **Manteca X., Mainau E and Temple D.** 2012. What Is Animal Welfare? *The Farm Animal Welfare Fact Sheet*. 2p. Available From:[https://www.fawec.org/media/com_lazypdf/pdf/fs1-en.pdf], Accessed 06/05/2022.
45. **Mjidou R.** 2018. Etude des Changements dans les Modes de Production du Dromadaire. Mémoire d'Ingénieur d'Etat en Agronomie. Option : Animal Production and Biotechnology Engineering. I.A.V. Hassan II, 100 p. Available from: [<https://mel.cgiar.org/reporting/download/hash/b916e64509ba0d34cea2663b8eda36ef>]
46. **NBSRD.** 2022. Number of camels and location of peri-urban camel breeders in the Ouargla region. National Bureau of Studies for Rural Development. Multigraphic document.
47. **OuladBelkhir A., Chehma A and Faye B.** 2012. Phenotypic variability of two principal Algerian camel's populations (Targui and Sahraoui). *Emirates Journal of Food and Agriculture*. 7p. Available from [DOI: [10.9755/ejfa.v25i3.15457](https://doi.org/10.9755/ejfa.v25i3.15457)] Accessed 13/04/2022.

Bibliographic References

48. **Padalino B., Ziani A., Monaco D., Freccero F and Menchetti L.** 2021. Dromedary camel health care practices reported by caretakers working at a permanent market. *Emirates Journal of Food and Agriculture*. Vol 33. Issue 4. 14p. Available from [<https://ejfa.me/index.php/journal/article/view/2688>]. Accessed 08/02/2022
49. **Padalino, B., Aubé L., Fatnassi M., Monaco D., Khorchani T., Hammadi M and Lacalandra G. M.** 2014. Could dromedary camels develop stereotypy? The first description of stereotypical behaviour in housed male dromedary camels and how it is affected by different management systems. *Plos One*. Vol 9. Issue 2. 7p Available from: [<https://doi.org/10.1371/journal.pone.0089093>].
50. **Prasanta S.** 2018. Camel Fibre, Types of Camel Fibre, End uses. *Online clothing study*. Available from: [<https://www.onlineclothingstudy.com/2018/11/camel-fibre-types-of-camel-fibre-end-2.html>]. Accessd 31/05/2022.
51. **Raziq A, Younas M, Rehman Z .** 2010. Continuing education article prospects of livestock production in Balochistan.. *Pakistan Veterinary Journal*. Pp: 181-186. Available from: [https://www.academia.edu/35402086/Continuing_Education_Article_Prospects_of_Livestock_Production_in_Balochistan]
52. **Saleh M.S., Mobarak A M and Fouad S M.** 1971. Radiological, Anatomical histological studies of the mammary gland of the one-humped camel (*Camelus dromedarius*). *Zentralblatt Für Veterinärmedizin Reihe A*. pp: 347-352. Available from : [<https://doi.org/10.1111/j.1439-0442.1971.tb00587.x>]
53. **Santamaria B., Strosnider WH., Quispe MR and Nairn RW.** 2014. Evaluating locally available organic substrates for vertical flow passive treatment cells at Cerro Rico de Potosí, Bolivia. *Environmental earth sciences*. Pp:731-741 Available from: [<https://doi.org/10.1007/s12665-013-2997-4>]
54. **Schwartz H J and Dioli M .** 1992. The one-humped camel (*Camelus dromedarius*) in eastern Africa a pictorial guide to diseases, health care and management.. Available from [https://www.academia.edu/20539443/The_One_Humped_Camel_in_Eastern_Africa_A_Pictorial_Guide_to_Disease_Health_Care_and_Management]. Accessed 29/05/2022
55. **Senoussi A.** 2011. Le Camelin ; Facteur de la Biodiversité et à usages Multiples. International Seminar on : Biodiversité Faunistique en Zones Arides et Semi Arides. Université de Ouargla (Algérie). pp :265-273.
56. **Shehadeh K and Fadlelmoula A.** 2014. The challenge of machine milking in Dromedary Camel. *Scientific Journal of Review*. PP:1004-1017.. Available from [https://www.researchgate.net/publication/323114051_The_challenge_of_machine_milking_in_Dromedary_Camel] Accessed 02/06/2022
57. **Tibary A and Anouassi A.** 2000. Lactation and udder diseases. *Recent Advances in Camelid Reproduction*. Available from [<https://www.ivis.org/library/recent-advances-camelid-reproduction/lactation-and-udder-diseases>]. Accessed 02/06/2022.

Bibliographic References

58. **Trabelsi H., Chehma A., Al Jassim R and Senoussi A.**2017.Camel as seed disperser in the northern Sahara rangelands of Algeria. *International Journal of Biosciences*.Vol 10. 8p.. Available from[<http://dx.doi.org/10.12692/ijb/10.4.58-65>].Accessed 13/02/2022
59. **Wako G., Tadesse M and Angassa A.** 2017. Camel management as an adaptive strategy to climate change by pastoralists in Southern Ethiopia. *Ecological Processes*. 26p .Available from[<https://ecologicalprocesses.springeropen.com/articles/10.1186/s13717-017-0093-5>]
60. **Wilson R.T.** 1984. Quelques paramètres de la reproduction chez la chamelle de l’Air (République du Niger). Reproduction des ruminants en zone tropicale. Colloque INRA, N° 20. pp. 147-155. (qtd. in SENOUSSE A., 2011).
61. **Yagil R.** 1994. The Camel in Today's World. A Hand Book on Camel Management. Research Report I, GIFRID and Deutsche Welthungerhilfe, Bonn.
62. **Zappaterra, M., Menchetti L.,Costa LN and Padalino B.** 2021. Do camels (*Camelus dromedarius*) need shaded areas? A case study of the camel market in Doha. *Animals*.Vol 11.Issue 2 .15p . Available from [DOI: [10.3390/ani11020480](https://doi.org/10.3390/ani11020480)]

Bibliographic References

المراجع بالعربية :

1. أولاد بلخير ع. 2008. تربية الابل في الجزائر عند قبائل الشعانبة و التوارق. مذكرة شهادة الماجستير. تخصص فلاحه صحراوية. جامعة قاصدي مرباح – ورقلة. 118 ص.

Annexes

Annex:

<i>Survey about camelwelfare in Ouargla</i>

Name and Surname: **Common:****Date:**/...../..... **Farm:****Survey location:** (N°E=.....)**1- caretaker:**

1.1. How old are you?

1.2 When did you start working at the camel breeding?

1.3. How many years experience with handling camels?

 (0-5 years) (6-10 years) (10-15 years) more than 15 years.

1.4. Where have you learned to take care of camels?

 Father friends Family and nomads
2- Herd:2.1 Farming System: Extensive emi-Intensive tensive

2.2. Herd components: N° dromedary =..... N° of she- camel=.....

N°camel calves:

2.3. What populations do you have?

.....

.....

.....

2.4. How many camels are reared at the farm?

2.5. Weaning age:

 8-10 months 10-12months more than12 months.

2.6. What is the rearing purpose of your camels?

- Meat Milk others (specify:)

3-Feeding and Watering:

3.1. How often do you feed them?

- Once Twice Three times Ad-libitum

3.2. What is the food ration composition?

.....

3.3. How often do you water them?

- Once Twice Three times Ad-libitum

3.4. Feeding and watering point location?

- Sun Shade

3.5.Salt block: Yes No

4- Milking camels:

4.1. How often do you milk the camels?

- Once /day Twice/day

4.2. How Much Milk Does A Camel Produce? L/day

4.3. How do you milk them?

- Traditional way (by hand) industrial Way (using machine)

5-Housing:

5.1. Do you raise other animals species at the farm?

- Yes (specify :.....) No

5.2.Are the herd separate or together?

- Yes No

5.3. Do you change the housing according to the season?

Yes

No

5.4. Are camels exercised?

Yes

No

5.5. Do you use hobbles and tethering the camel?

Yes

No

5.6. If yes, why?

.....
.....

5.7. Restricted movements: camels in the pen:

Able to move freely and walk comfortably

Unable to move freely and walk comfortably

5.8. Fence:

Broken

Unbroken

5.9. Fence edge Sharp: Yes

No

i- Cleanliness of mangers and water place:

Clean

Partially clean

Dirty

5.10. Bedding:

Clean

Partially clean

Dirty

5.11. Rubbish:

No rubbish

small size

Medium size

Large Size

6-Health:

6.1. Who assesses the health of the camels?

Myself

veterinarian

6.2. Who treat the camel when it is sick?

Myself veterinarian

6.3. What would you do if an animal is sick?

Call a veterinarian Treat them by myself consulting an expert friend in camel raising

6.4. Do you vaccinate them?

Yes No

6.5. Do you administer treatments for ectoparasites?

Yes (treatments:.....) No

6.6. Injuries or skin wound in the camel?

Presence (N° of camels:) Absence

6.7. Lameness:

Presence (N° of camels:) Absence

6.8. Abnormal Udder:

Presence (N° of camels:) Absence

6.9. New animals:

Isolated for a certain period of time Merge with the herd directly

6.10. Camel marking method:

- The method:

With Fire Another approach (Specify :.....)

- In which part of body:

- At the age:

1 year 2 year More than 2 years

7- Behavior:

7.1. Do your camels show behavioral problems?

Yes No

7.2. If yes, what problems did the camels show?

- Aggression Kicking Escaping from the pen
 Others (specify :.....)

7.3. What standards that you rely on to identifying a camel in distress or pain?

.....
.....

Abstract:

The main objective of this study is to assess the welfare level of camels in a peri-urban farm in the region of Ouargla while focusing on their comfort through the conditions of reception, feeding and sanitary measures. The survey revealed numerous constraints that negatively impacted the animals' welfare, mainly an imbalance in the feed ration that meets the animals' needs, while water of drinking is not distributed regularly. The sequestration of the animals in a stressful enclosure, in addition to the almost total absence of hygienic measures which, making a favorable environment for the installation of pathogenic germs. The use of traditional therapy is the rule, in the absence of a prophylactic plan. Obviously, the animal is suffering a real malaise. In addition, a series of proposals in terms of feasible practices are formulated in order to place the animal in its favourable environment while organizing the camel industry according to the desired vocation. In short, it is necessary to go towards the animal by ensuring its well-being in the full sense of the term, via its three G, with a view to having products with proven qualities and presumed to be organic, which is what the consumer is always asking for.

Keywords: *Ouargla- Peri-urban breeding- Dromedary- Welfare.*

Impact des systèmes camelins émergents sur le bien-être animal dans le Sahara septentrional algérien - cas d'une ferme d'élevage dans la région de Ouargla-**Résumé :**

L'objectif principal de cette étude est d'évaluer le niveau de bien-être des dromadaires dans un élevage péri-urbain de la région de Ouargla tout en se focalisant sur leur confort via les conditions d'accueil, de l'alimentation et des mesures sanitaires. L'enquête a révélé de nombreuses contraintes qui ont impacté négativement le bien-être des animaux, principalement, un déséquilibre de la ration alimentaire qui répond aux besoins des animaux, alors que l'eau d'abreuvement n'est pas distribuée régulièrement. La séquestration des animaux dans un enclos stressant, outre de l'absence presque totale de mesures hygiéniques qui, faisant un milieu favorable à l'installation de germes pathogènes. Le recours à la thérapie traditionnelle est de règle et ce en l'absence d'un plan prophylactique. Manifestement l'animal supporte une véritable mal-vie. Par ailleurs, une série de propositions en termes de pratiques faisables sont formulées afin de replacer l'animal dans son milieu favorable tout en organisant la filière cameline selon la vocation souhaitée. En somme, il y a lieu d'aller vers l'animal en assurant son bien-être au sens plein du terme, via ses trois B, et ce, dans la perspective d'avoir des produits aux qualités avérées et présumés bio, ô combien ne cesse de revendiquer le consommateur.

Mots-clés : *Ouargla- Elevage péri-urbain- Dromadaire -Bien-être.*

تأثير الأنظمة الناشئة لتربية الإبل على الرفق بالحيوان في شمال الصحراء الجزائرية-حالة مزرعة بمنطقة ورقلة -

المخلص:

الهدف الأساسي من هذه الدراسة هو تقييم مستوى رفاهية الإبل في مزرعة شبه حضرية في منطقة ورقلة مع التركيز على راحتها من خلال ظروف الاستقبال والغذاء والتدابير الصحية. كشف المسح عن العديد من المعوقات التي أثرت سلباً على الرفق بالحيوان ، وعلى رأسها عدم توازن العليقة التي تلبي احتياجات الحيوانات ، في حين أن مياه الشرب غير موزعة بصفة منتظمة. عزل الحيوانات في مكان مجهّد، بالإضافة إلى الغياب شبه التام للتدابير الصحية الذي خلق بيئة ملائمة لنمو الجراثيم المسببة للأمراض. القاعدة المتبعة هي استخدام العلاج التقليدي في حالة عدم وجود خطة وقائية. من الواضح أن الحيوان يعيش في بيئة غير مريحة. خلافاً لذلك، تمت صياغة سلسلة من المقترحات من حيث الممارسات المجدية من أجل إعادة الحيوان إلى بيئته الملائمة أثناء تنظيم قطاع الإبل حسب المهنة المرغوبة. باختصار، من الضروري التوجه نحو الحيوان من خلال ضمان سلامته بالمعنى الكامل للمصطلح، من خلال ثلاث أساسيات. وهذا، من منظور وجود منتجات ذات صفات عضوية مثبتة، وهذا ما يستمر المستهلك في طلبه.

الكلمات المفتاحية: *ورقلة - تربية شبه حضرية - الجمل - رفاهية.*