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L'élevage dans les régions aride et semi-aride face aux défis du changement climatique

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Dromedary camels : Potential dairy animal in a changing climate

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Introduction

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- Climate changes have occurred at an alarming rate during the past few decades and have started to impact on human and natural ecosystems (IPCC, 2014)

- Changes have been manifested :

  - Increase in land surface temperatures

  - Changes in precipitations pattern : increasing risks of floods and extended periods of droughts

  - Changes in the range and distribution of vegetation

Introduction

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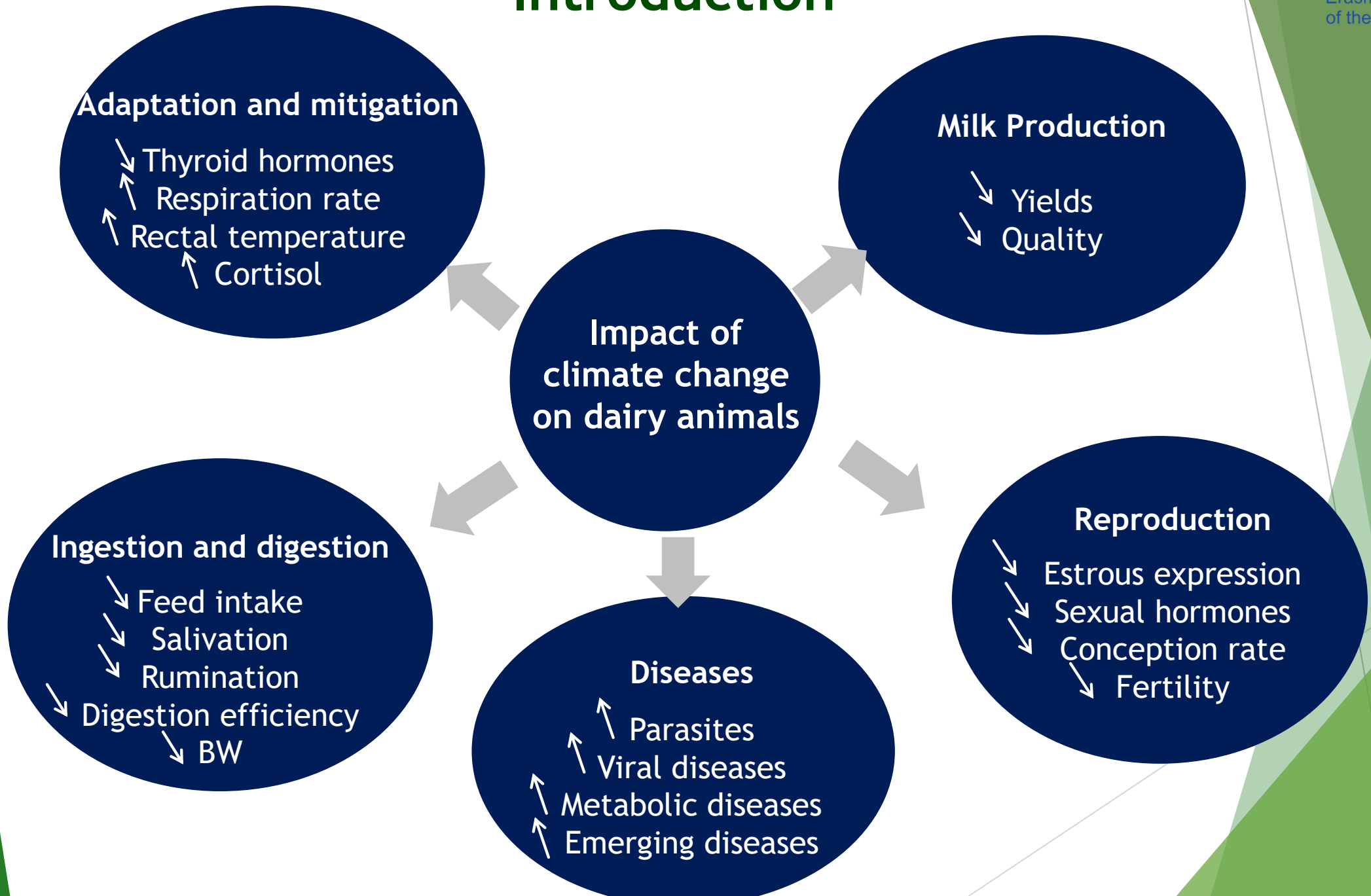

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Why camels ?

1. Adaptive capacity for extreme weather conditions
   Briefly, camels Tolerate :
   Heat stress
   Scarcity of water
   Water with high salinity
   Shortage of feed

2. Multipurpose animal with wide range of productions

Introduction

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Anti-diabetic

Sboui et al., 2009
Ejtahed et al., 2015
Ayoub et al., 2018

anti-cancer

Korashy et al., 2012
Yousef et al., 2012

Antibacterial & antiviral

Jrad et al., 2013
Yassin et al., 2015

Source of probiotic

Fguiri et al., 2017
Edalati et al., 2019

Intolerance to bovine milk

Cardoso et al., 2010
Ehlayel et al., 2011

Autism

Ayadhi et al., 2015

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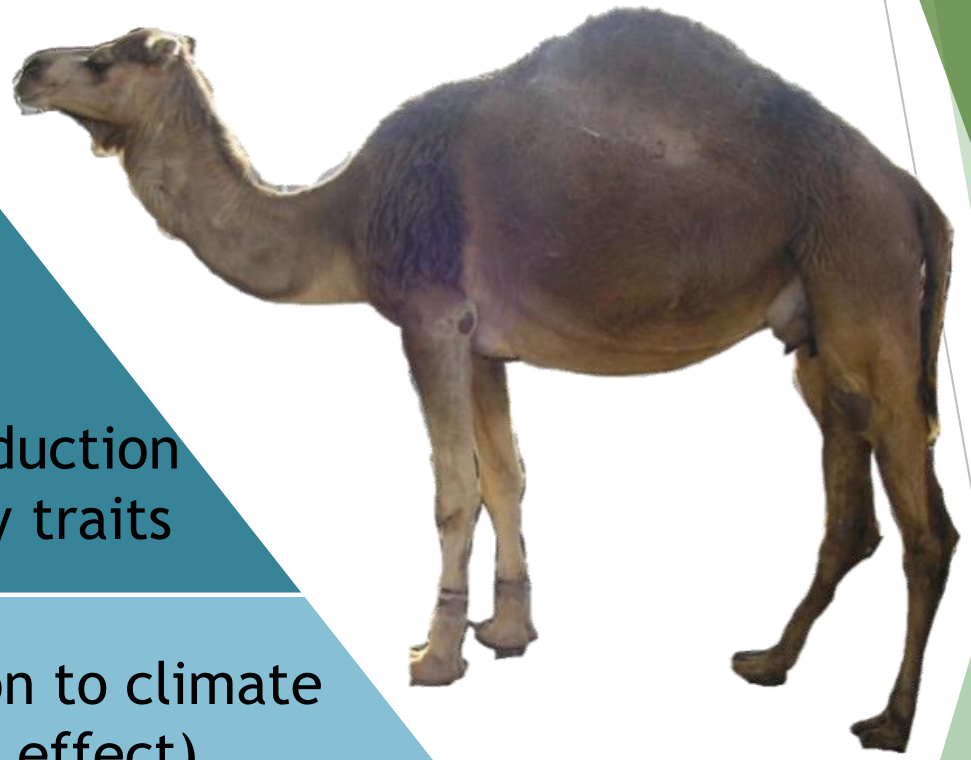
Assets of the camel as a dairy animal



Good milk production and milkability traits

Lower contribution to climate change (GHG effect)

Higher resistance to heat stress

Camels *vs.* cows tolerance to heat stress

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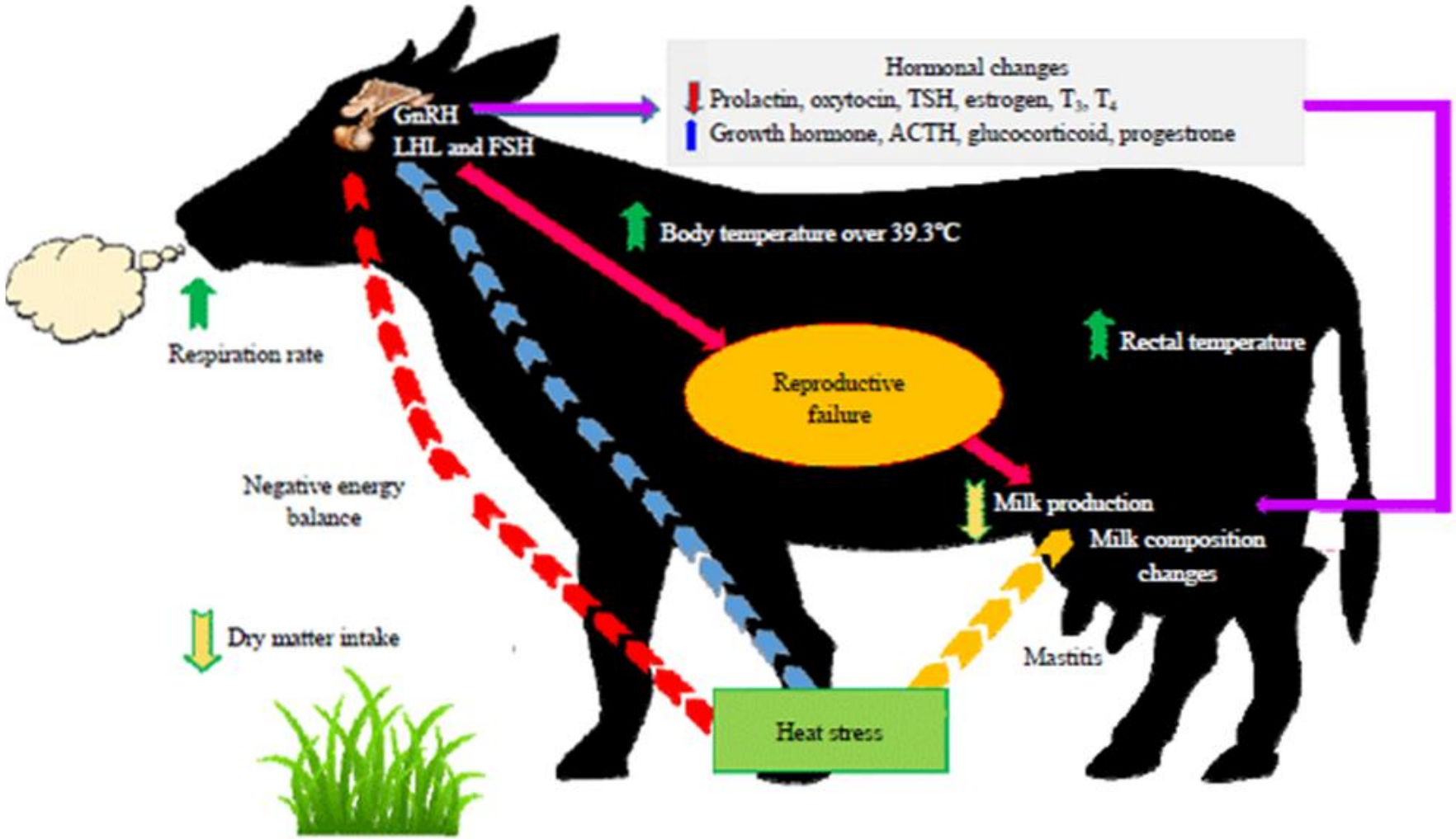

Heat stress impacting milk production in dairy cattle

(Pragna et al., 2017)

Table 1: Temperature-Humidity Index and degree of heat stress

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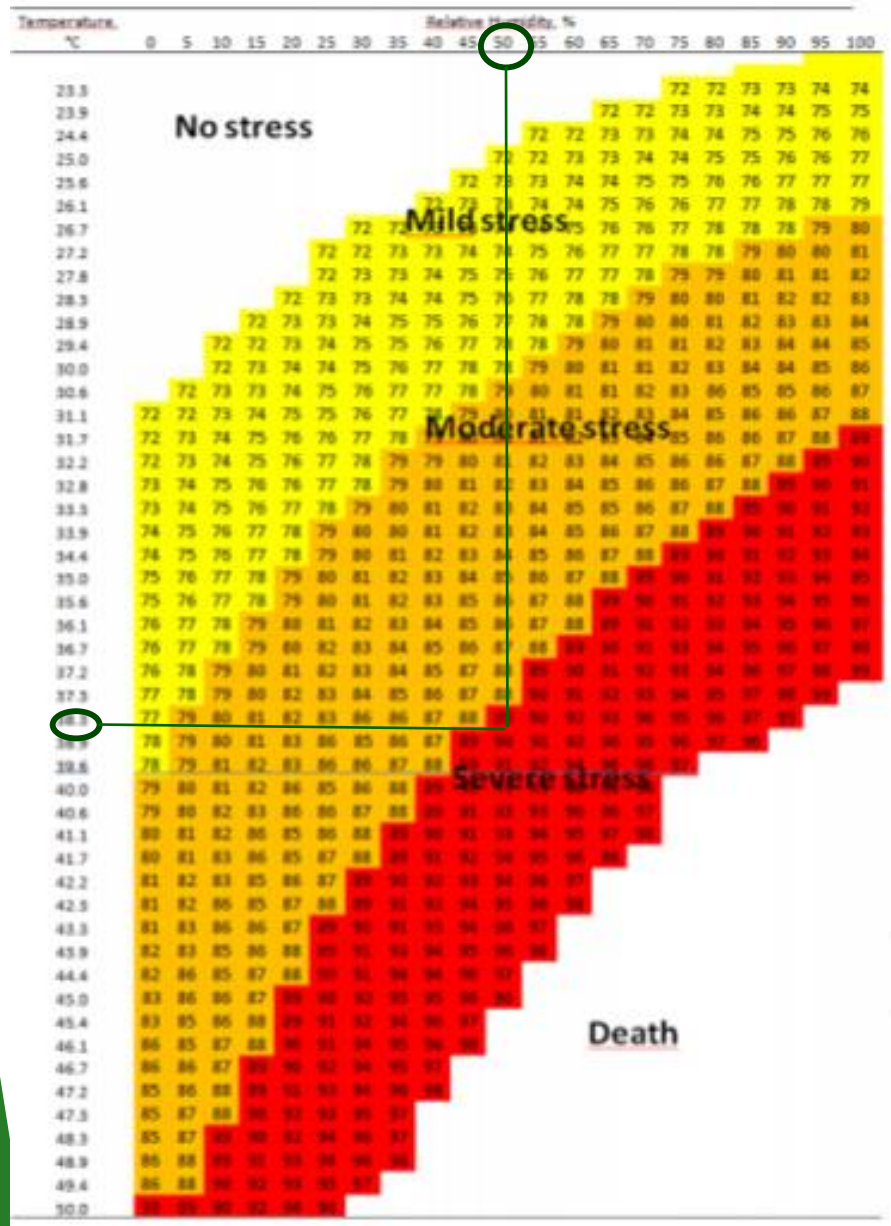

- Optimal production of a dairy cow is around 25°C and 50% RH with no signs of heat stress
- Signs of heat stress are registered when temperature reaches 35°C and RH around 40%
- At 40°C/60% or 49°C/35% cows are very uncomfortable and show a dramatic increase of body temperature. Milk yield and fertility decrease significantly

(Avendaño-Reyes, 2012)

Camels *vs.* cows tolerance to heat stress

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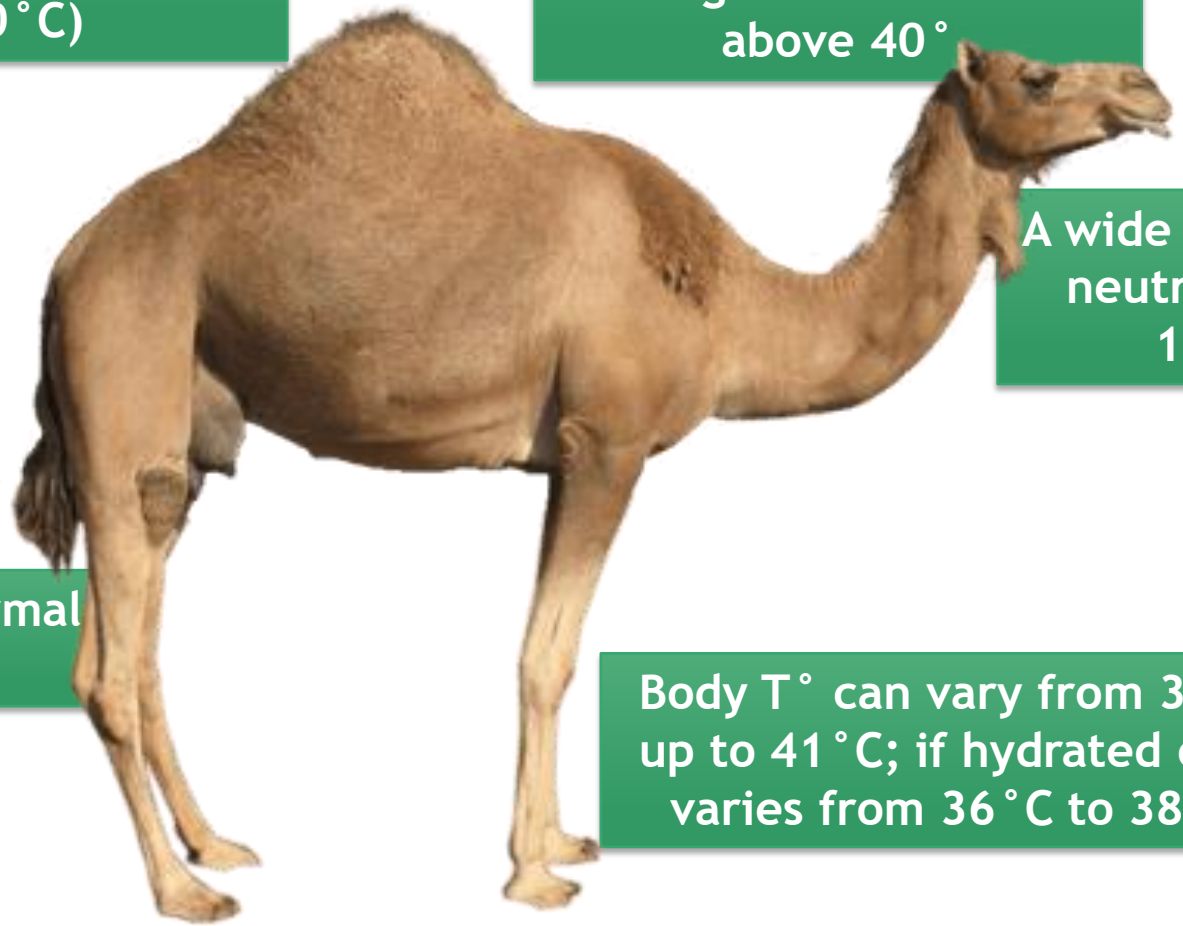
Increasing evaporative heat dissipation mechanisms at a high set of ambient T° (above 50°C)

Respiratory, heart, and sweating rates started to change at ambient T° above 40°



A wide range of thermo-neutral zone (TNZ) : 10°C - 40°C

Higher body thermal insulance

Body T° can vary from 34°C up to 41°C; if hydrated only varies from 36°C to 38°C

Camels *vs*. cows tolerance to heat stress

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Studies on heat stress effect on camels are very limited

It’s generally accepted that the camel possess extreme thermo-tolerance capability

Heat stress is commonly combined to water deprivation for camels reared under extensive system

Camels produce more milk for longer periods during drought than any other domestic animal adapted to arid habitats

Total solids in milk decrease during drought and hot season

Camels *vs*. cows tolerance to heat stress

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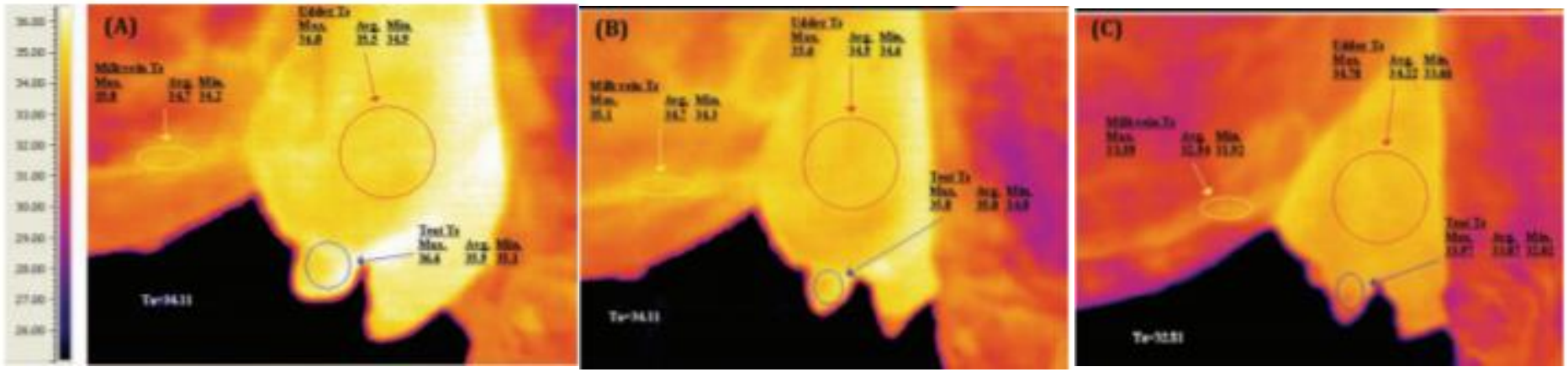
Before milking | Immediately after milking | 1h Post-milking



Effect of machine milking on biothermal measurements of the udder of lactating camels under heat stress conditions (Aljumaah et al., 2012)

Contribution of camel to climatic change

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- Livestock contribute to GHG emission either directly from enteric fermentation and manure management or indirectly from feed production activities and conversion of forests to pasture

3.1% of total GHG emission

2nd largest emitter of CH_4

Animal manure 3rd biggest source of N_20

Contribution of camel to climatic change

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- Camels were considered as ruminant animals and therefore enteric emissions were resulting by extrapolation from main livestock categories. Thus, it was estimated around 46 kg of CH_4/year for an adult camel (IPCC, 2006).

- Comparing CH_4 emission from dromedary camels and Holstien cows, authors found that Methane emission from camels was **1/3** that from cattle (17.4 vs 50.6 kg/year) (Guerouali and Laabouri, 2013).

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Dairy cattle's need much more care and particular measures to ensure cooling during heat stress (higher water and energy consumption)

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Good milk production and milkability traits

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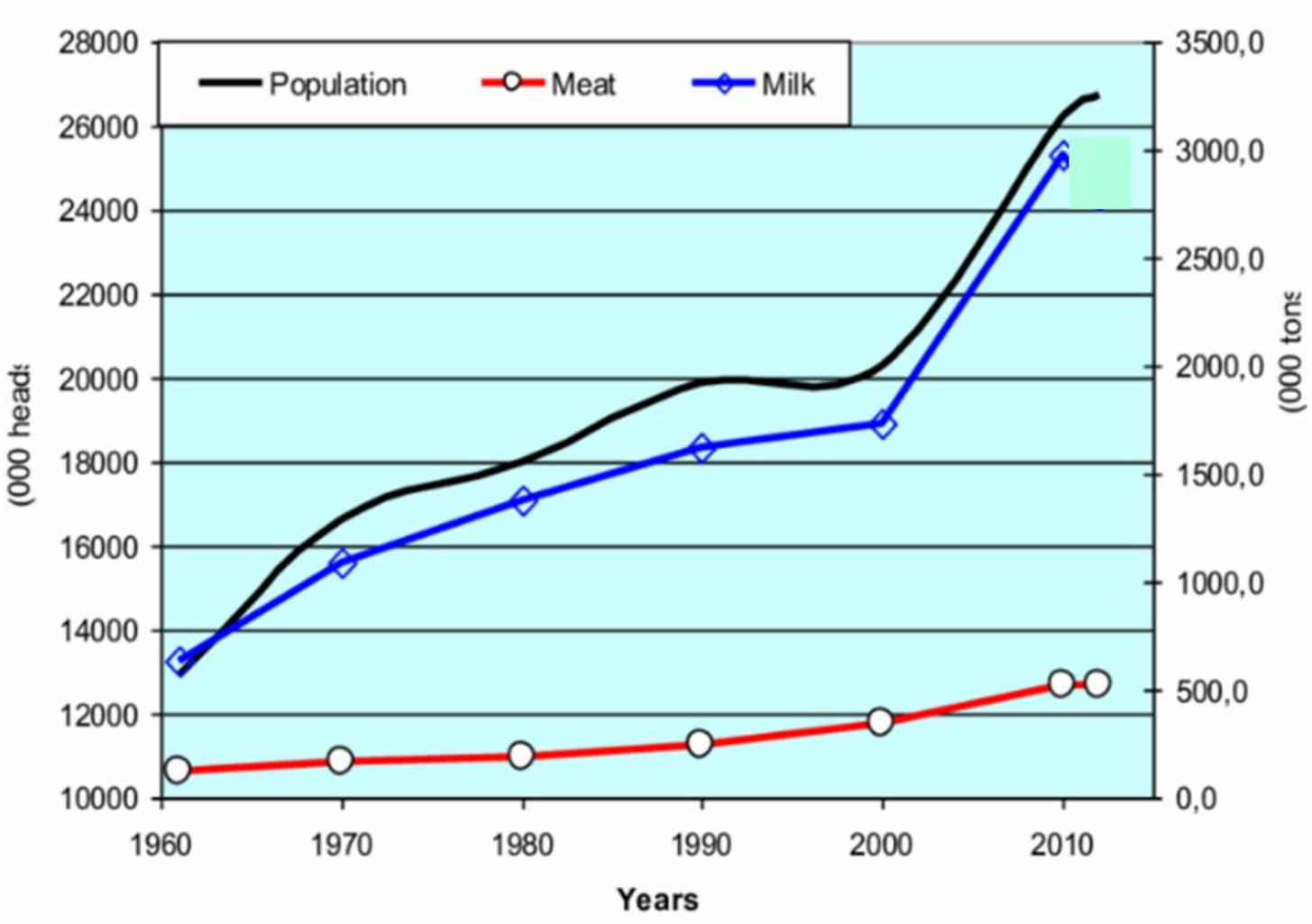

Evolution of world population, milk and meat production of camels (Faye, 2013)

Good milk production and milkability traits

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- In traditional extensive farming system, tunisian camels produce between 1.2 and 2 liters of milk/ day

Good milk production and milkability traits

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In intensive dairy farms in the oasis of southern Tunisia milk yield reached 8 l/day for a period of 8 months

The used technology and techniques are extrapolated from cattle

Good milk production and milkability traits

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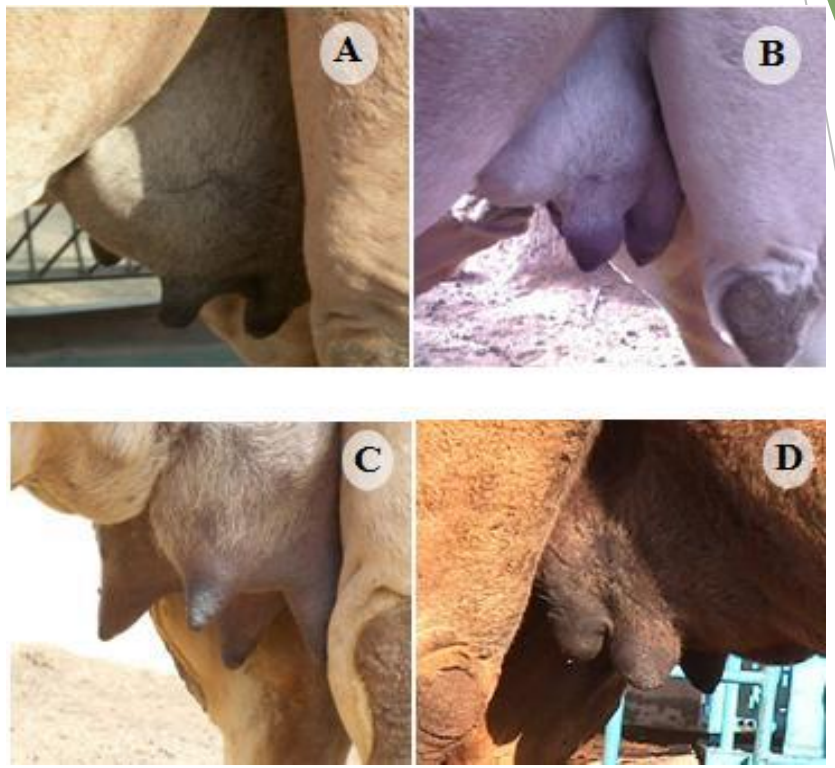
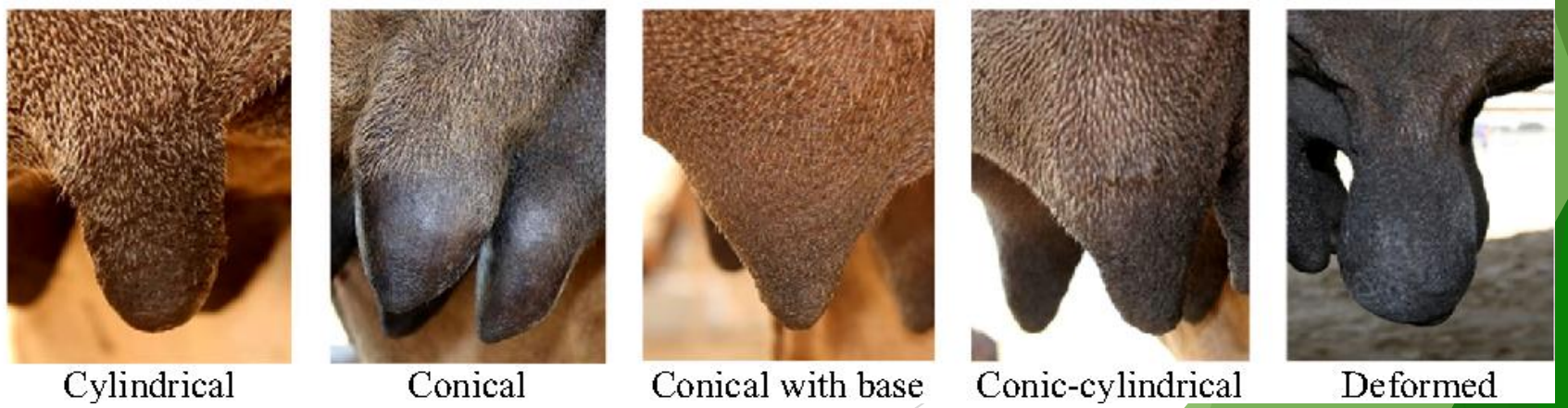
Camels and cows have apparently similar udder form with large heterogeneity of morphology, the technology used for dairy cattle are usually employed also for camels





Good milk production and milkability traits

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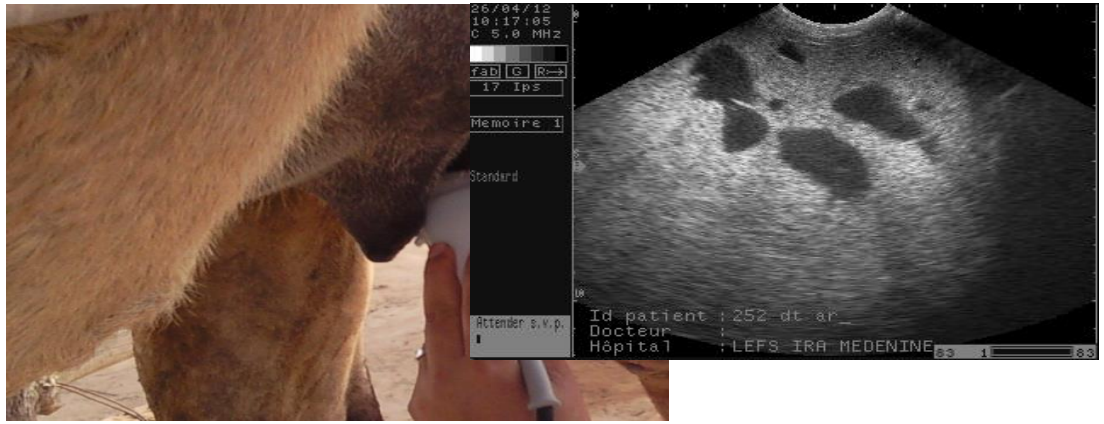
Udder internal structure and cisternal size



5 MHz sectorial probe placed directly against the lower part of the udder using the teat as scan axis

Camels have a very limited cisternal cavity

16.31 ± 2.29 cm²

6 MHz linear probe was placed on the teat parallel with the teat axis

Good milk production and milkability traits

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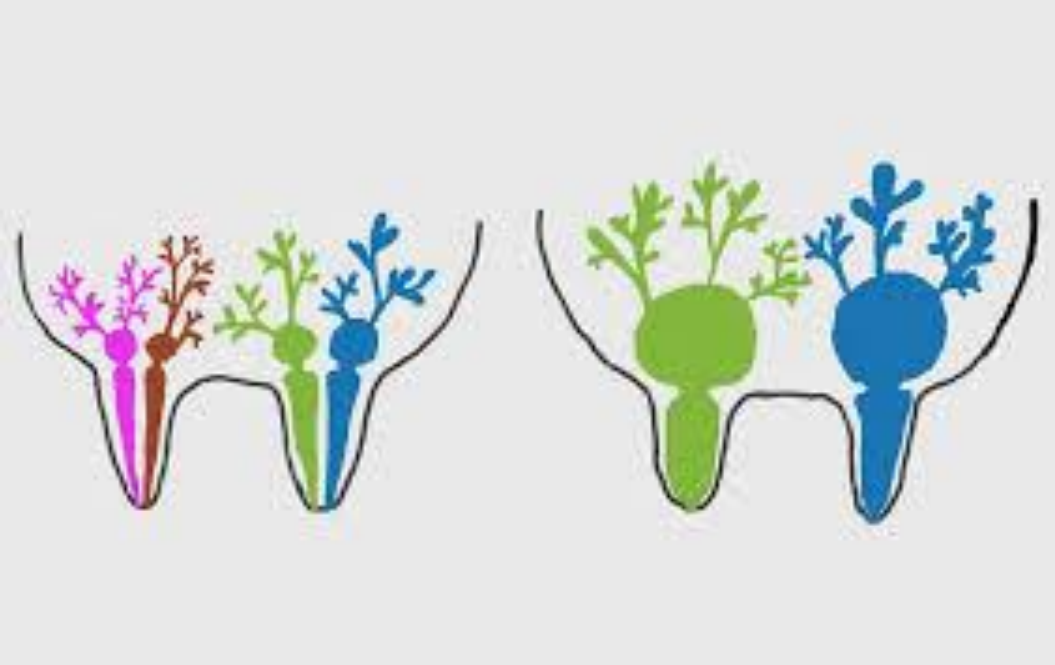
Treating mastitis ?



Camel's udder

Cow's udder

Difference in internal structure between camel's and cow's udders

Good milk production and milkability traits

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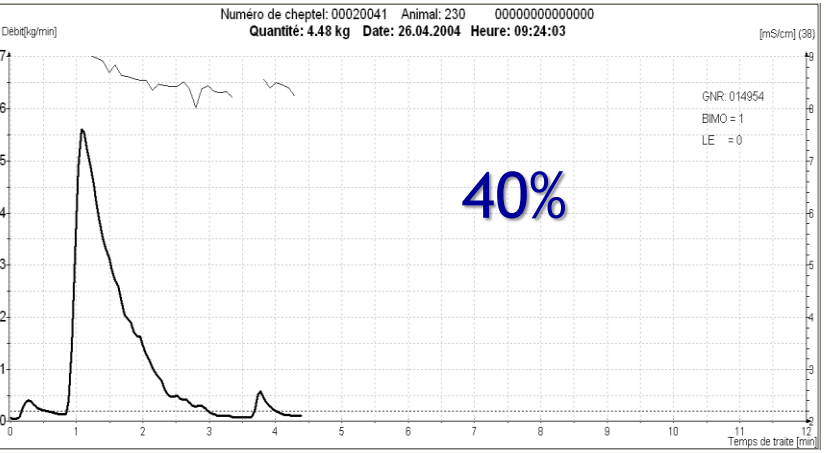
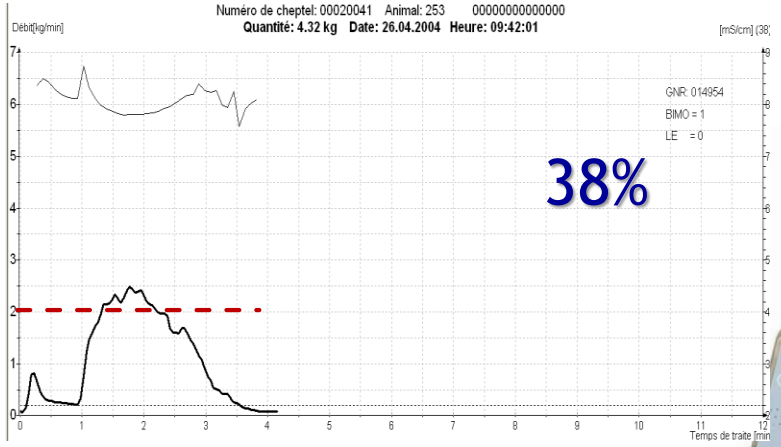
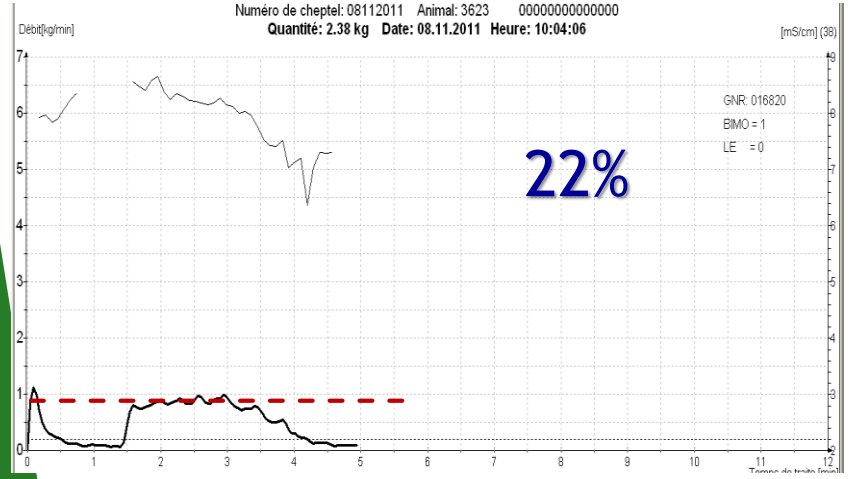
Milkingabilty of camels (milk flow evaluation)



Curve type 1



Curve type 2



Curve type 3

Mostly primiparous or stressed camels

Lactocorder

Good milk production and milkability traits

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Effect of changing milking routine on milk flow patterns and milk ejection

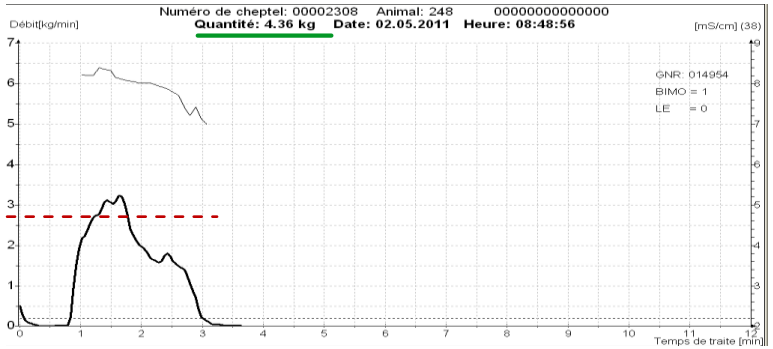

Fig.1: Routine milking

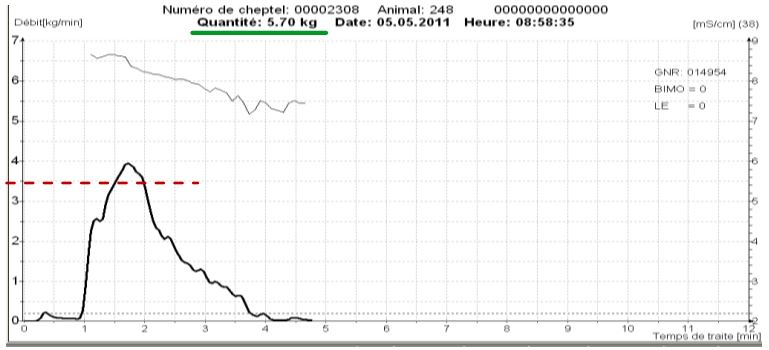

Fig. 2: Routine + prestimulation

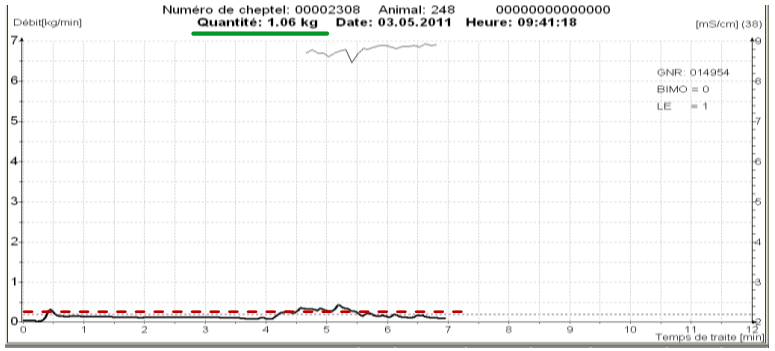

Fig.3: Routine milking + Stress from the start of milking

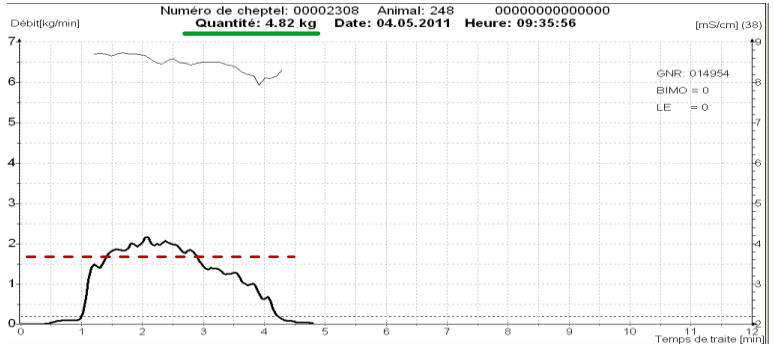

Fig. 4: Routine milking + stress after milk ejection occurs

Exemple of milk flow patterns of the same animal as a result of the traitements

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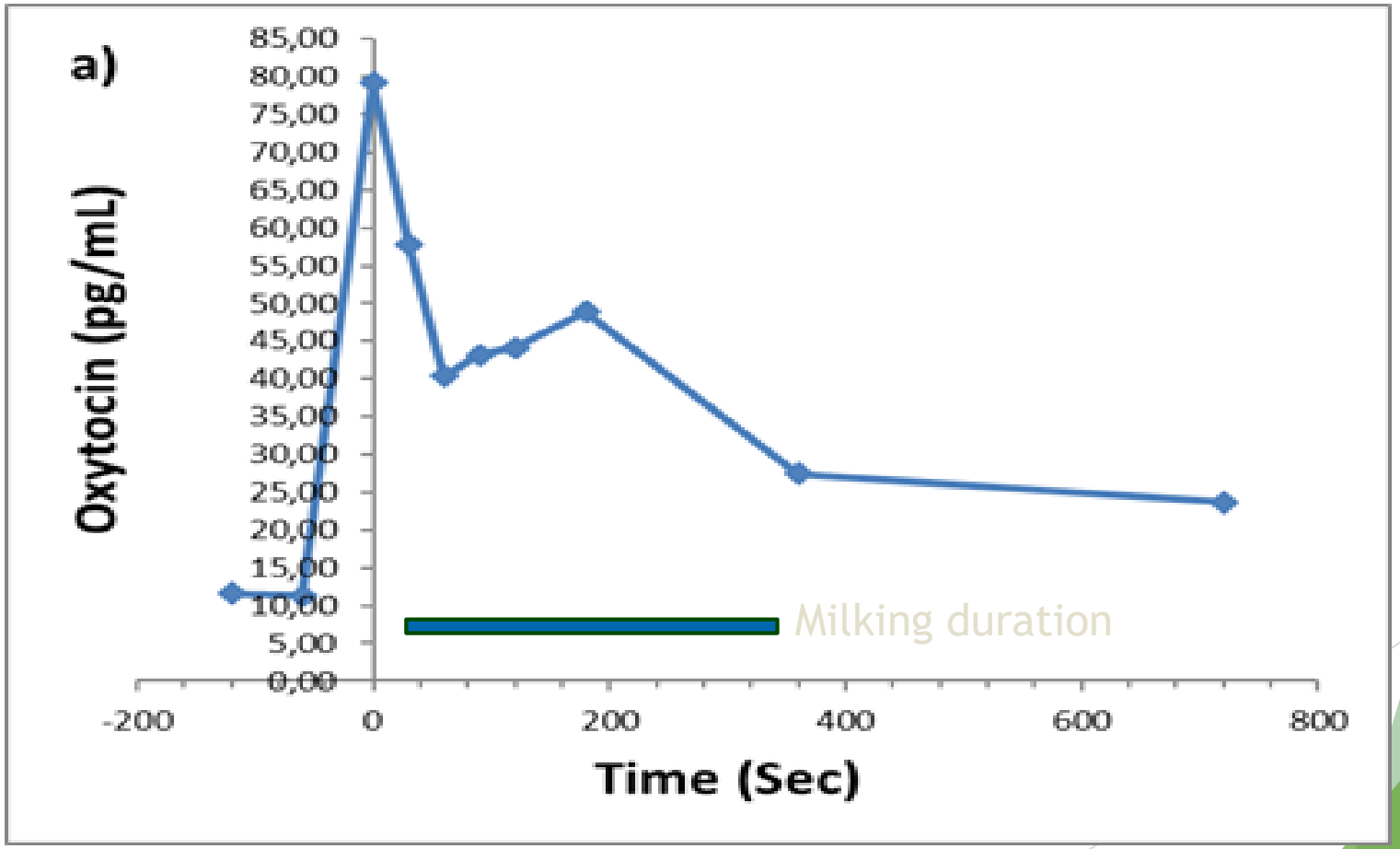
Good milk production and milkability traits

First evidence of OT release at milking in camels

- Typical oxytocin release during milking



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The first milking parlor specially designed for camels in Tunisia

Conclusion

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The camel is a unique animal and its remarkable adaptive characteristic projects it as the animal for future to face the challenges of climate change.

It has a good milk production and milkabilty without even being subjected to genetic improvement for dairy traits

Hence considerable research efforts are needed to promote development of this neglected species in the changing climate scenario.


Thank you for the attention