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Cheese-making ability of dromedary camel milk: comparison with cattle, buffalo, goat and sheep milk

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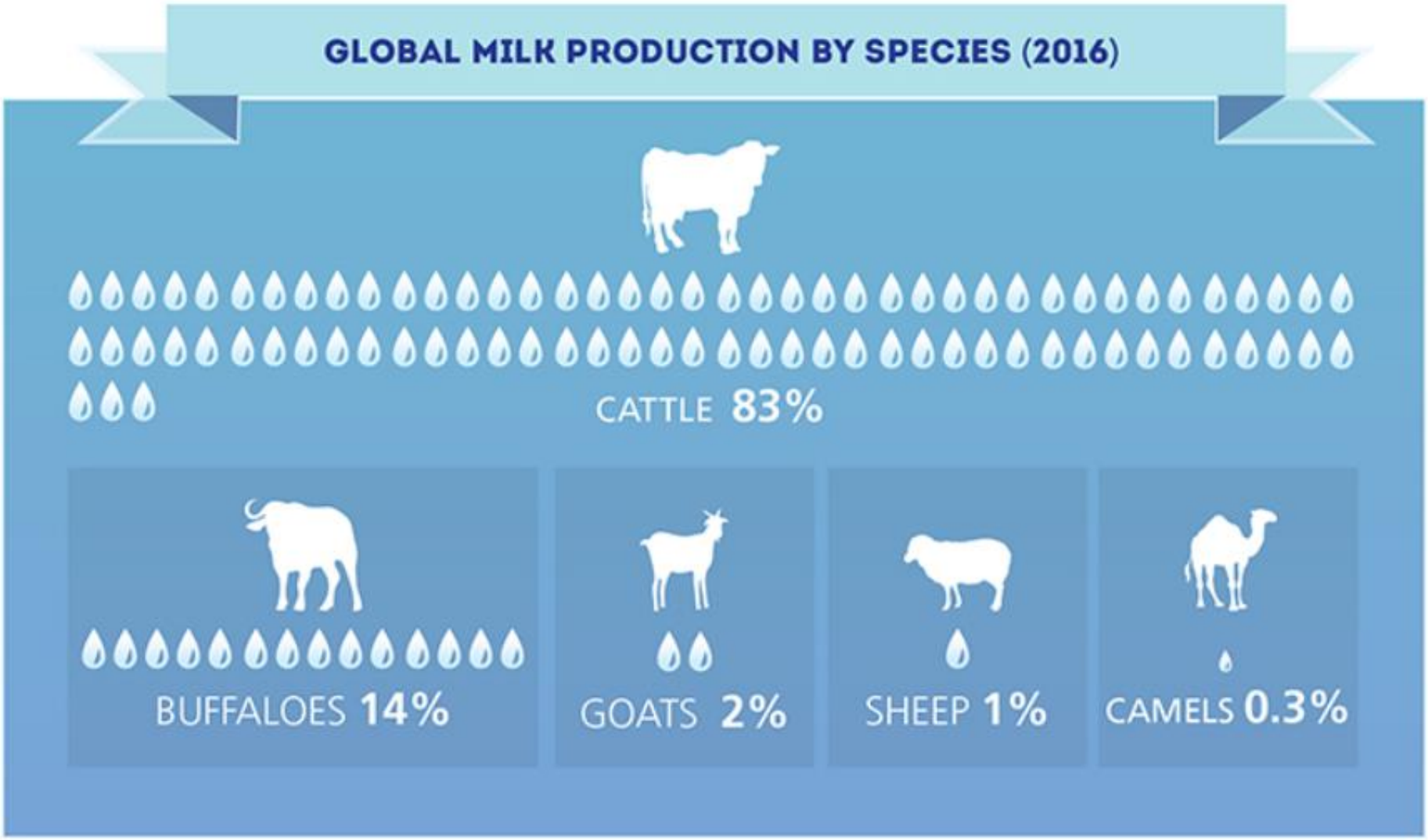

GLOBAL MILK PRODUCTION BY SPECIES (2016)
CATTLE 83%
BUFFALOES 14%
GOATS 2%
SHEEP 1%
CAMELS 0.3%

FAO (2016)

Dromedary camel

Found in desert and semi-desert areas

More persistent lactation than cow

Raised for milk, meat, fiber, transport

Less affected by heat, scarcity of water and feed

High feed efficiency

The aim of the present work was to compare the dromedary camel with other dairy species in terms of:

- chemical composition
- coagulation ability, curd firming pattern and syneresis
- cheese yield
- recovery of milk nutrients in curd

Experimental design

- **6** dairy species
- **10-12** samples (from different farms) of **2-2.5L** per species:
  - dromedary camel milk from two grazing areas of the Province of Constantine (Algeria)
  - cow, buffalo, goat, ewe and donkey milk from Italy

Chemical composition

- ✓Total solids
- ✓Fat
- ✓Protein
- ✓Casein
- ✓Lactose

Milk coagulation properties

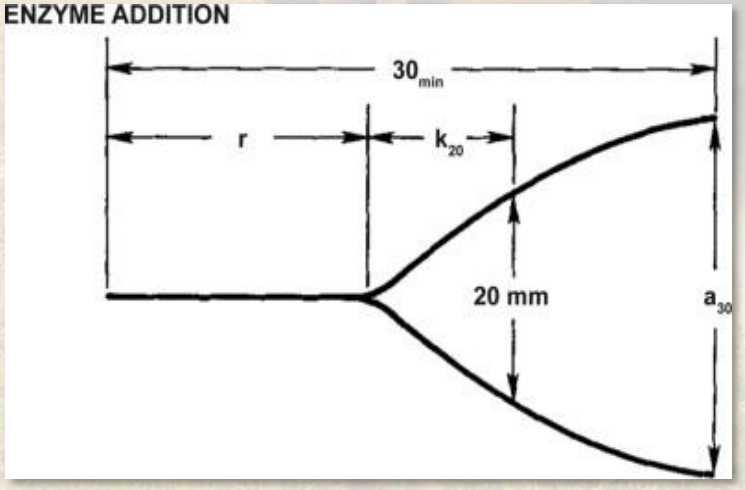
10 mL of milk

+

Bovine rennet solution (51 IMCU/ L of milk)

=

Lacto-dynamographic curve

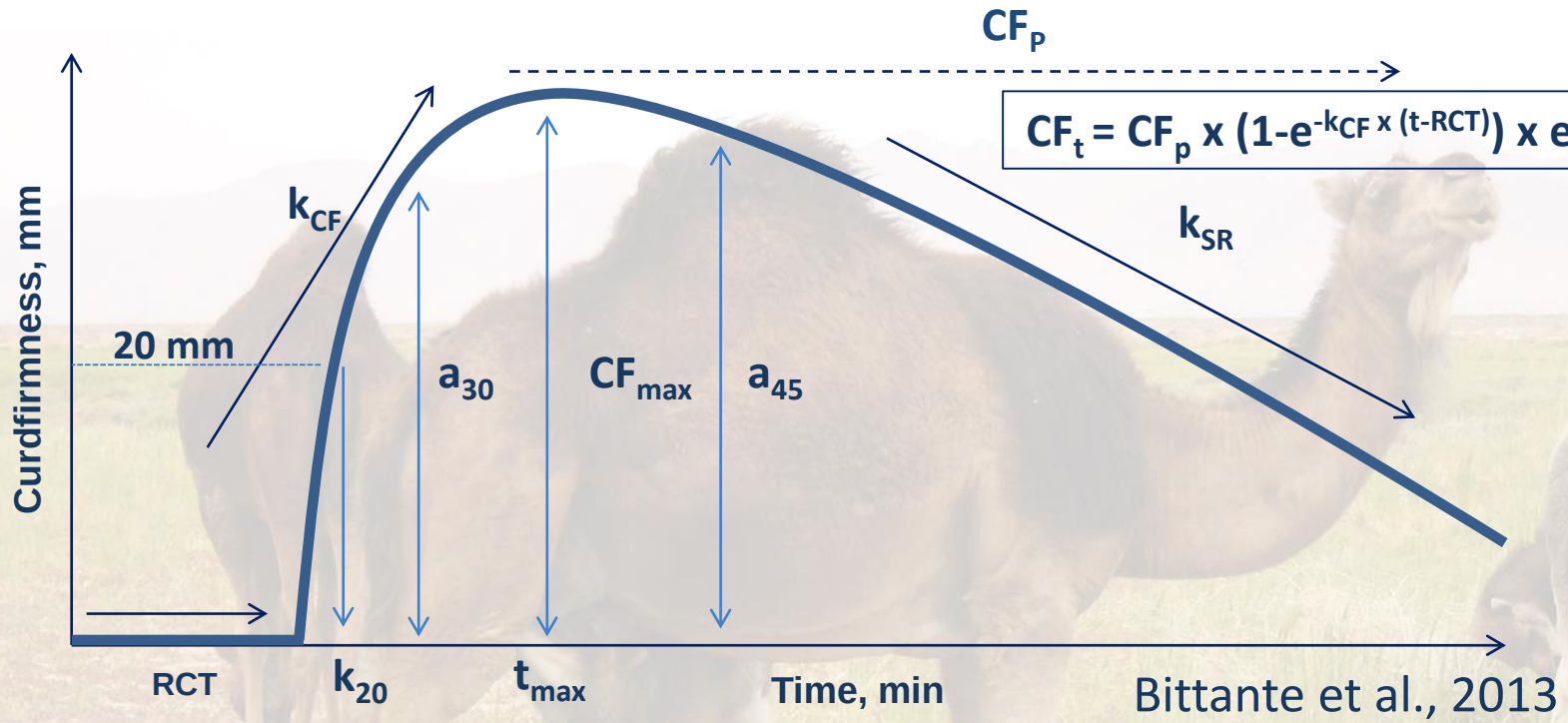


McMahon and Brown (1982)

Traditional MCPs:

- **RCT**: rennet coagulation time (min)
- **k_{20}**: time to curd firmness of 20mm (min)
- **$a_{30,45}$**: curd firmness at 30 and 45 min (mm)

Modelling of milk coagulation, curd firming, and syneresis



Bittante et al., 2013

RCT_{eq}: rennet coagulation time (min)
CF_p : potential asymptotical CF in absence of syneresis (mm)
k_{CF} : curd-firming rate constant (% × min^{-1})
k_{SR}: syneresis rate constant (%× min^{-1})
CF_{max}: maximum curd firmness (mm)
t_{max}: time to reach the CF_{max} (min)

Model Cheese-making process

1)Heating and rennet addition	2)Curd cooking and cross cut	3)Curd separation from whey
		
4)Curd draining	**5)Curd pressing**	**6)Curd salting**
		

Model Cheese-making process

Cheese yields

$$\%CY_{CURD} = \frac{\text{curd weight (g)}}{\text{milk weight (g)}} \times 100$$

$$\%CY_{SOLIDS} = \frac{\text{milk TS (g) - whey TS (g)}}{\text{milk weight (g)}} \times 100$$

$$\%CY_{WATER} = \frac{\text{milk WT (g) - whey WT (g)}}{\text{milk weight (g)}} \times 100$$

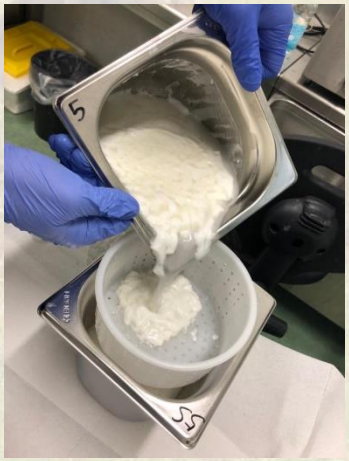
Nutrients recoveries

$$REC_{PROTEIN} = \frac{\text{milk prot (g) - whey prot (g)}}{\text{milk prot (g)}} \times 100$$

$$REC_{FAT} = \frac{\text{milk fat (g) - whey fat (g)}}{\text{milk fat (g)}} \times 100$$

$$REC_{SOLIDS} = \frac{\text{milk TS (g) - whey TS (g)}}{\text{milk TS (g)}} \times 100$$

$$REC_{ENERGY} = \frac{\text{milk En (g) - whey En (g)}}{\text{milk En (g)}} \times 100$$



Cipolat-Gotet et al., 2013

Statistical analysis

General Linear Model (GLM):

$$y_{ij} = \mu + Species_i + e_{ij}$$

Fixed effect

y_{ij}= Composition, CYs and RECs

Mixed Model:

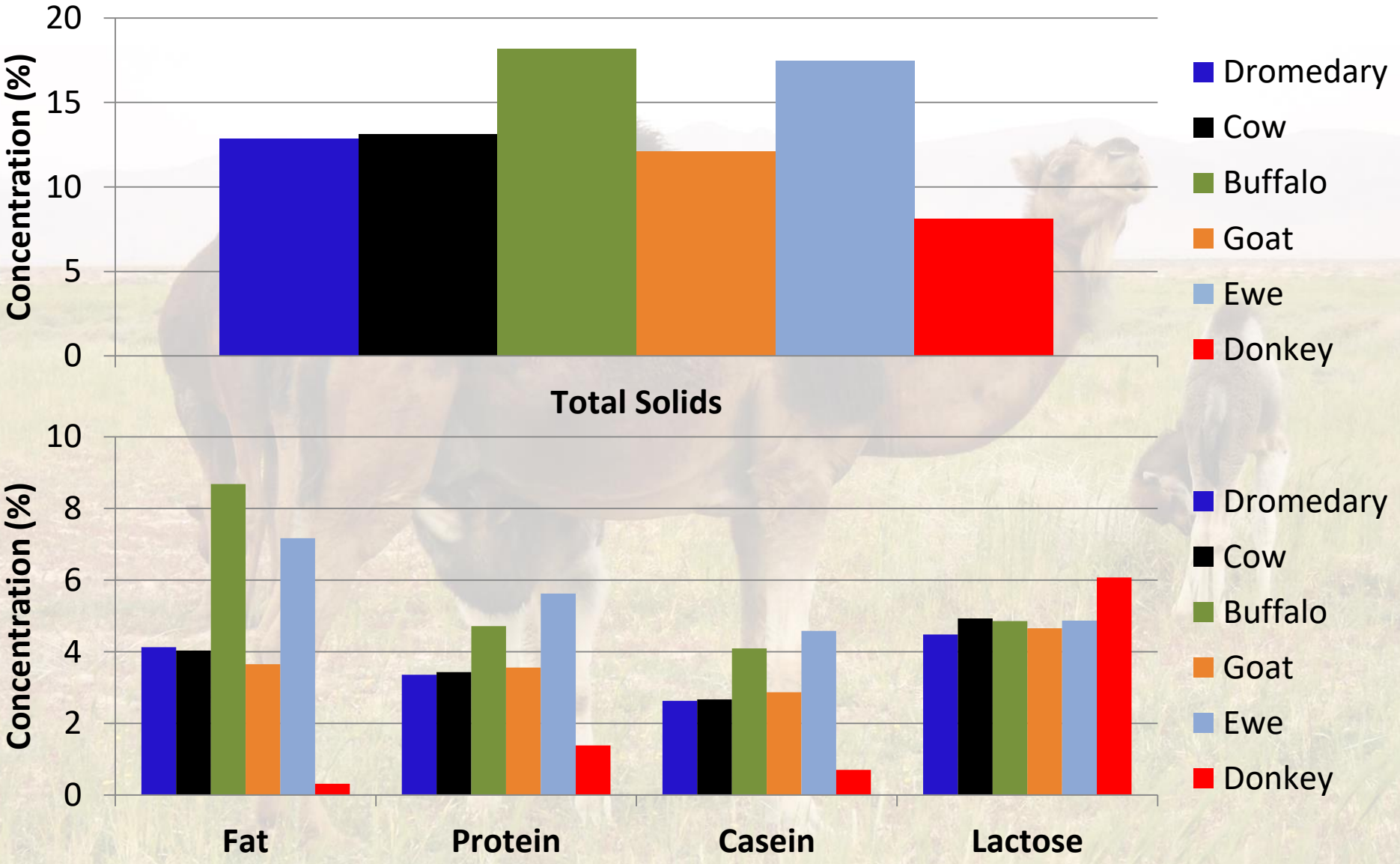
$$y_{ijk} = \mu + Species_i + Sample_j(Species_i) + e_{ijk}$$

Fixed effect *Random effect*

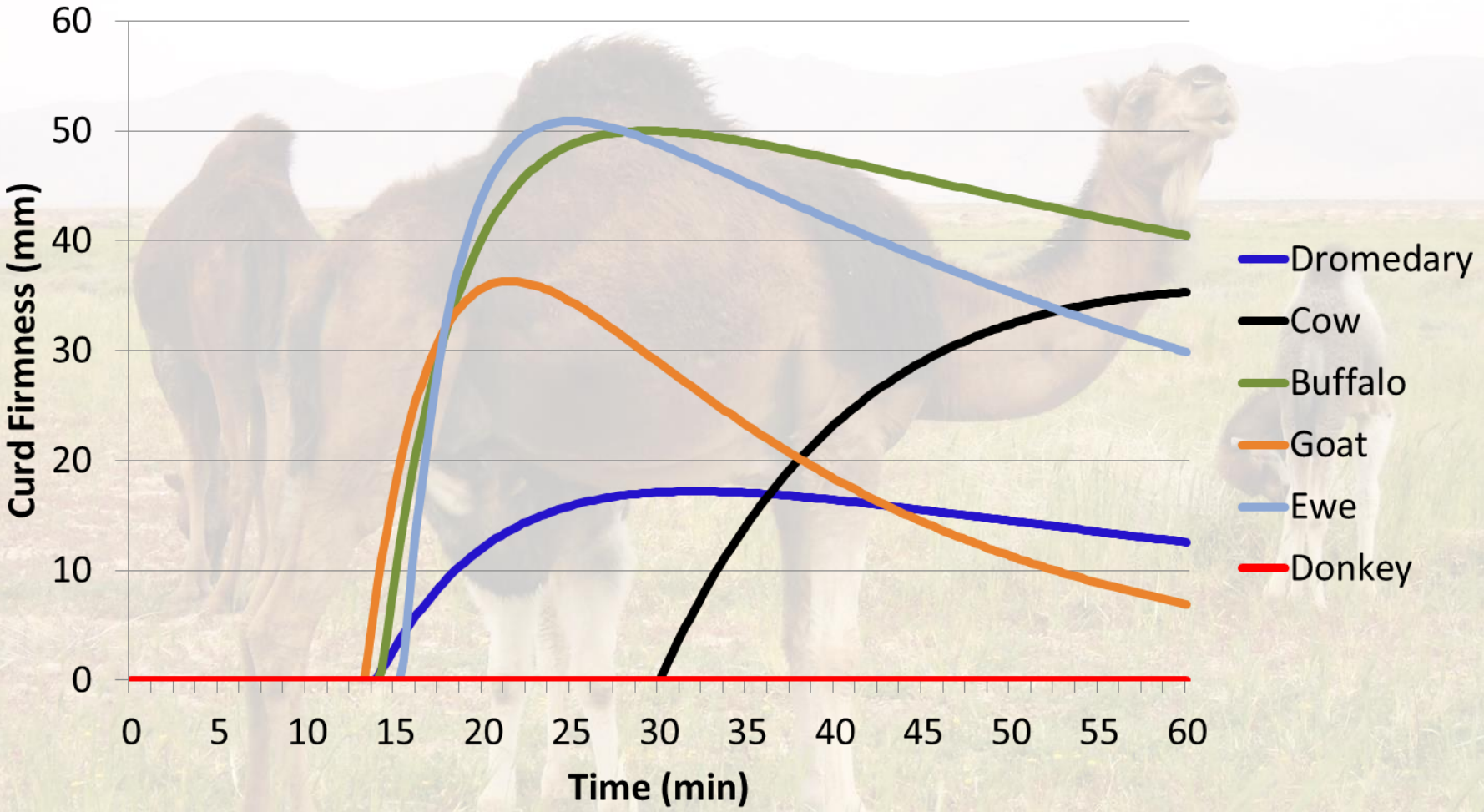
y_{ijk}= Coagulation, curd-firming and syneresis traits


Results

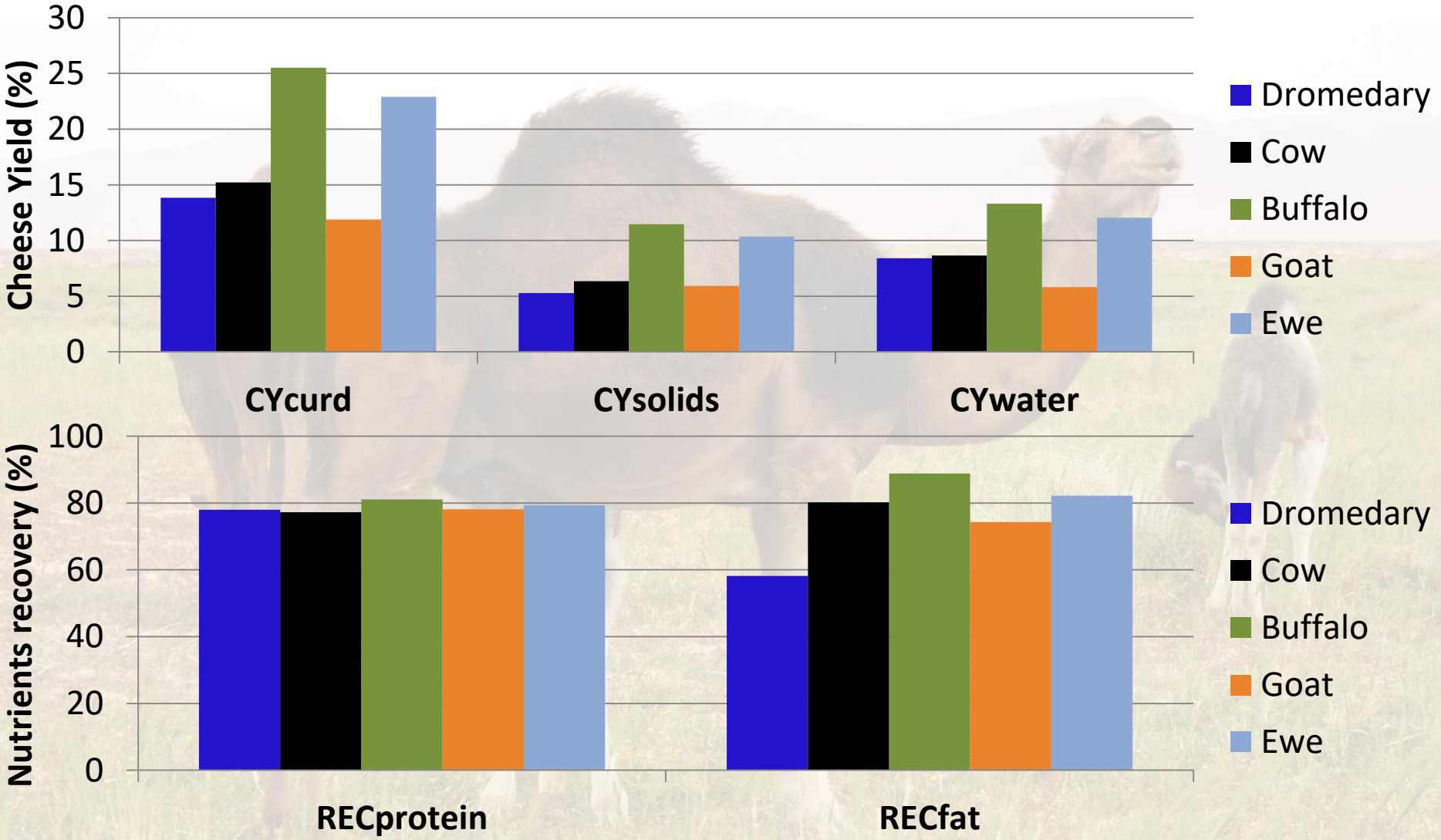
Milk Composition



Coagulation properties



Cheese-making properties



In conclusion

- Dromedary milk has similar composition to the cow and goat milk, but a weaker coagulation pattern.
- The cheese-making procedure should be optimized in order to increase the process efficiency, taking into account the large differences in coagulation, curd firming and syneresis respect to the other species.
- Camel rennet could be more efficient than cow rennet

Future Perspectives

- Milk protein fractions
- Fatty acids profile
- Minerals

Possible benefits on human health?

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Thanks for your attention

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