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Innovation in dairy products: use of donkey's milk as a functional food, preliminary results.

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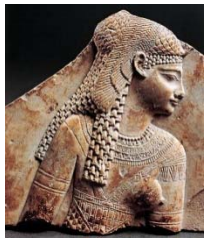
Introduction



Cosmetic

Therapeutic

- Virtues recognized since antiquity
- Strong resemblance to human milk
- Interesting properties for human health (Salimei and Fantuz 2012)

XIXth

-hypoallergenic substitute (Carrocio et al., 2000)
-prevention of atherosclerosis (Chiofalo et al., 2006)
-stimulation of the immune system of healthy elderly consumers (Jirillo et al., 2010)
-*in vitro* anti-proliferative and anti-tumour activity (Mao et al., 2009)
-*in vivo* anti-oxydant and anti-inflammatory effects (Lionetti et al., 2012)

Current use

Cosmetic

Diet

Donkey's milk powder

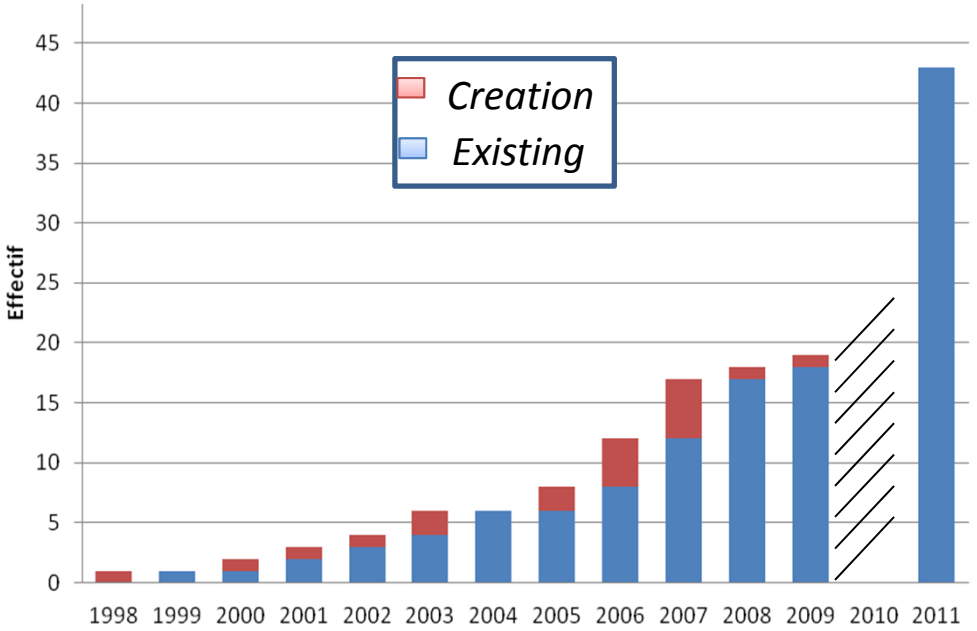
Fermented beverages using bacterial strains *(Chiavari et al., 2005; Coppola et al., 2002)*

Context of the study

- French production:
  - under development
  - artisanal production
  - global competition
- need to increase and diversify products

Natural attributes of donkey's milk described in the literature

Development of a functional food for human consumption

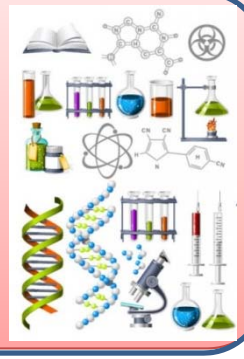


Evolution of the number of donkey's farms in France since 1998
(MESNILDREY, 2009)

A global project

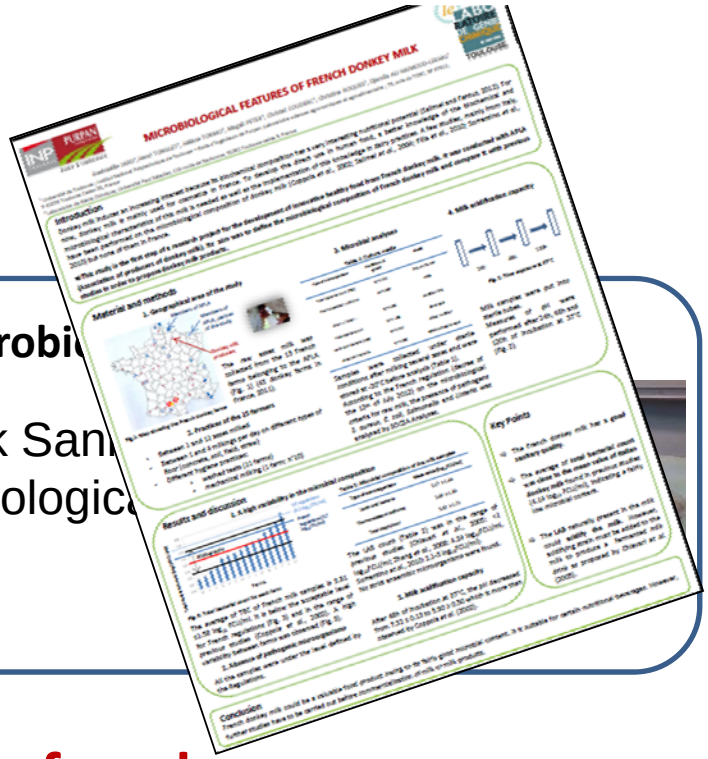
2. Biochemical composition

Nutritional quality
Functional and bioactive components



1. Microbi

Check San
Technologic



Are there possibility to use french donkey's milk as a functional food?

3. Health effects

Mice *in*

Work in progress

Alleged health claims

4. Food engineri

Work in progress

Materials and methods

n = 4

1 time per week over 4 months

2 Farms

Farm 1 : organic (n= 12)

Farm 2 : traditionnal (n= 20)

Biochemical composition characterization

Variability of the functionnal components content: rearing conditions, ANOVA

- **Major components** (standard methodoly)

Dry matter, fat, protein, lactose, ash

- **Functionnal components**
  - Fatty acids composition (GC)
  - Lysozyme content (RP-HPLC)

Involved in potentially human health effects

Results ➡ Major Components

Biohemical composition of donkey's milk
(g.100g-1 of milk)

	Mean	Min	Max
Dry matter	9.29 ± 0,92	7.69	10.9
Fat	0.86 ± 0,33	0.33	1.59
Protein	1.42 ± 0,15	1.14	1.65
Lactose	7.14 ± 0,72	5.87	8.15
Ash	0.35 ± 0,05	0.24	0.42

Results consistent with data in literature

LITTERATURE

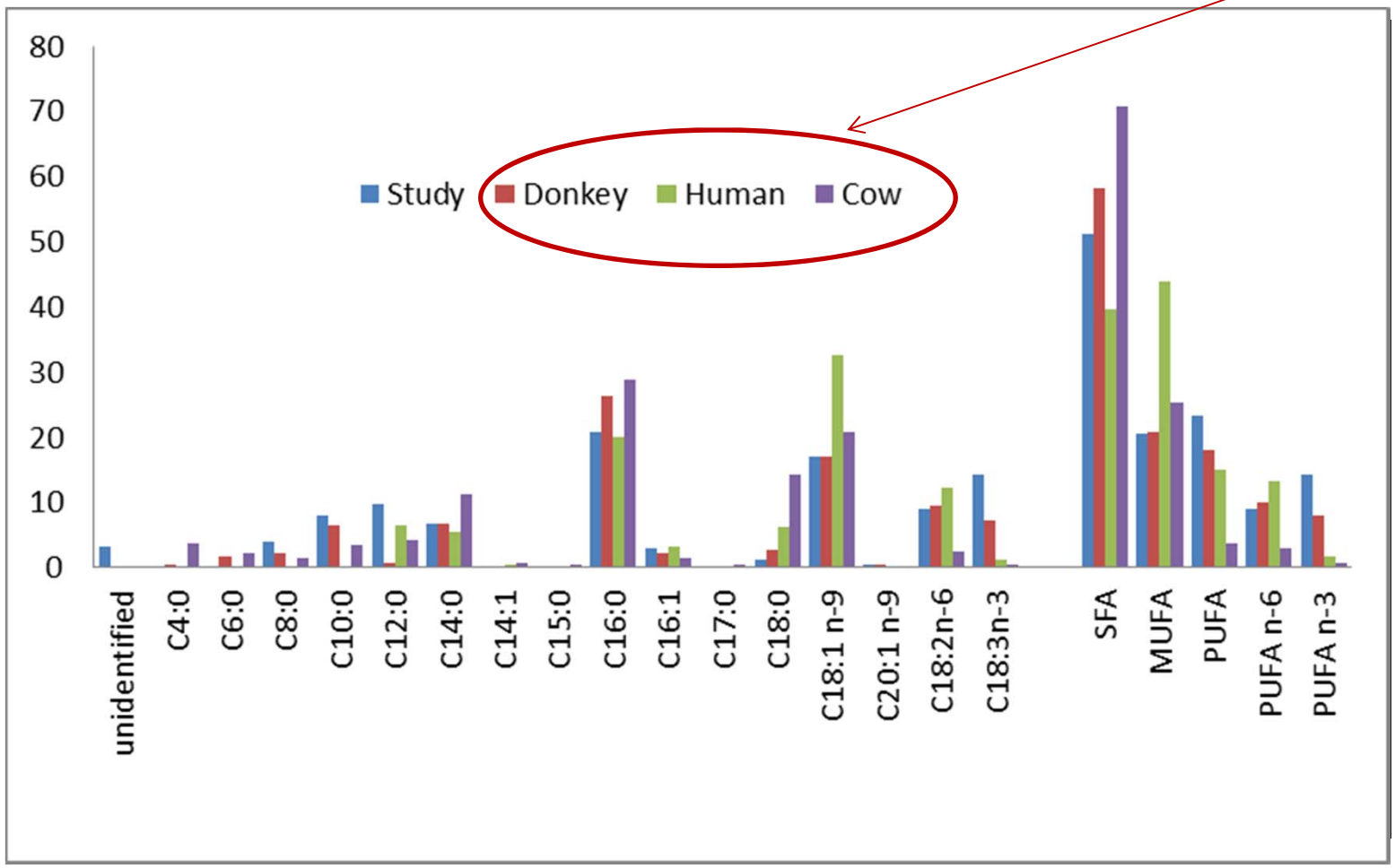
Donkey's milk [1]	Human milk[2]	Cow milk[3]
9.53	12.5	
0.76	3.46	3.4
1.65	1.25	3.2
6.58	6.44	4.7
0.41	0.19	0.72

1: Salimei et al., 2012
2: Hosoi et al., 2005
3: Michel and Wattiaux 2000

Results ➡ Functionnal Components

Fatty acid composition of donkey's milk
(% of fatty acids)

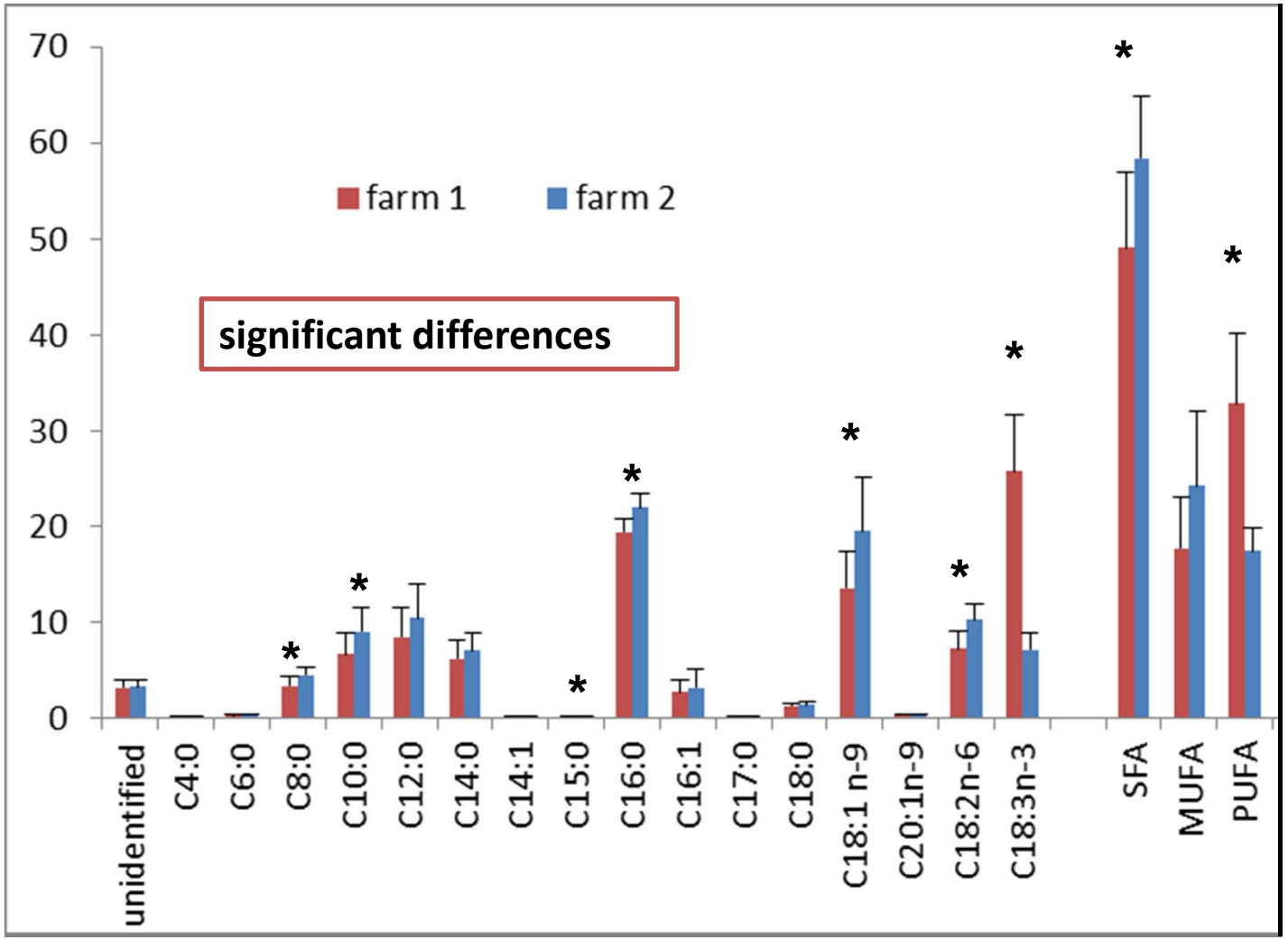
LITTERATURE



(n=32)

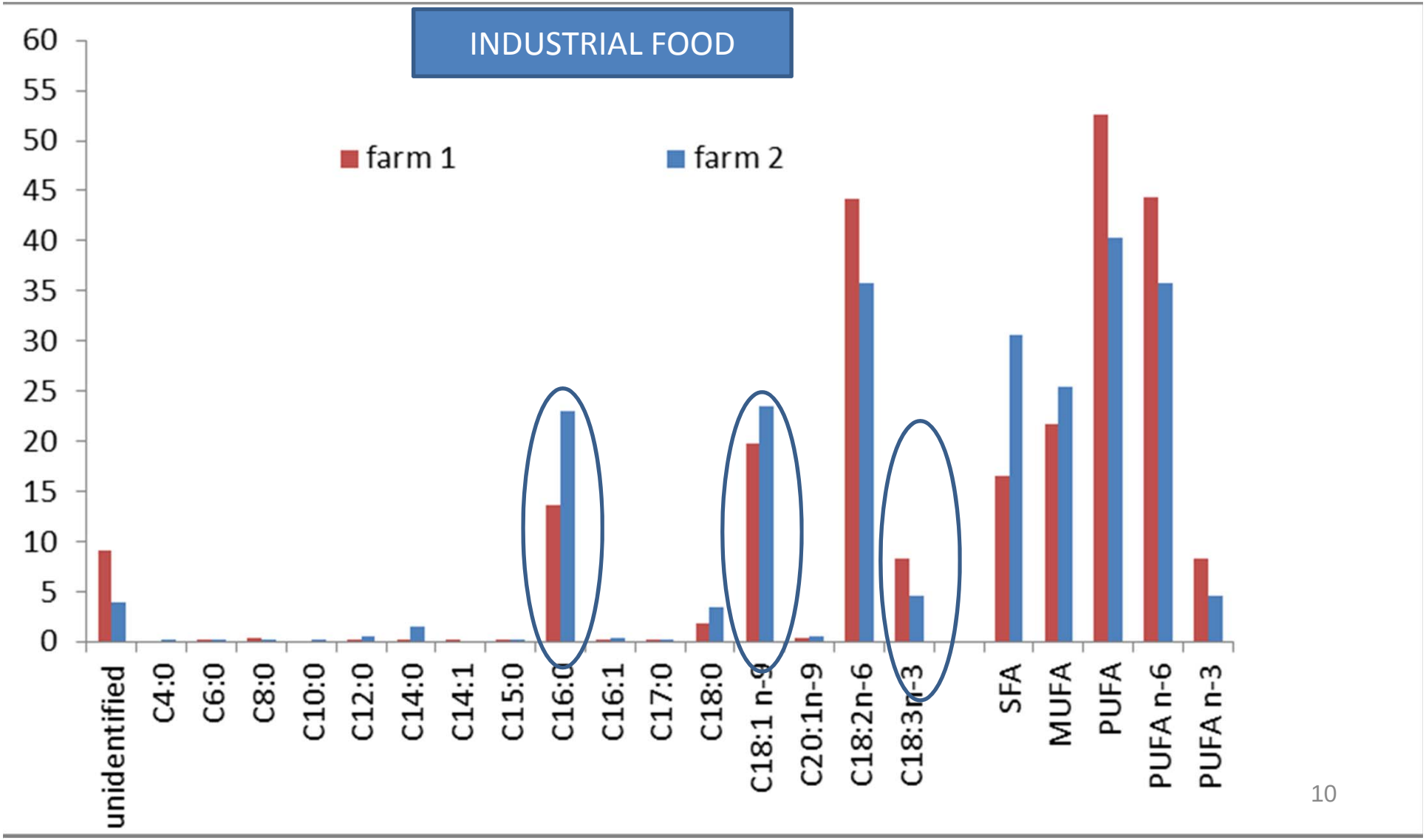
DHA and EPA were not sought

Fatty acid composition of donkey's milk : comparison between the two farms
(% of fatty acids)



Digestive properties : nutrients directly absorbed by the small intestine

Diets fatty acid composition : comparison between the two farms
(% of fatty acids)



Results ➡ Functionnal Components : lysozyme

Lysozyme content of donkey's milk
(mg.ml^{-1} of milk)

	Mean	SD
lysozyme	3.68	1.13

LITTERATURE

Donkey's milk [1]	Human milk[2]	Cow milk[2]
1 - 4	0.04-0.2	*traces*

1: Vincenzetti et al., (2011), Chiavari et al., (2005); Coppola et al (2002)
2: FAO (1998)

	Methods	Lysozyme content (mg/ml)	Ratio casein/whey protein
Chiavari et al., 2005	microbiological	3.75	1.19
Polidori and Vincenzetti ., 2010	chemical	1.00	0.88
Our study	chemical	3.68	1.56

Results ➡ Functionnal Components : lysozyme

Lysozyme content of donkey's milk : comparison between the two farms
(mg.ml^{-1} of milk) (n=32)

Lysozyme	Mean	SEM
Farm 1	4.10	1.58
Farm 2	3.41	0.65

upward trend

No significant difference

LITTERATURE

lactation stage (Vincenzetti et al., 2008)
production season (D'Alessandro et al., 2011)
Link with breeding conditions

Farm 1

Farm 2

1 : early stage of lactation
1 : late lactation

2 : late lactation

Conclusion

- First results on french milk

- Similar to those of italian or chinese results
- High PUFA n-3 and lysozyme content
- Further studies on the effect of rearing conditions are needed

- promising prospects for valuation of donkey milk as a functional food

- complementary investigations