School of Agriculture, Policy and Development
Department of Animal Sciences

University of Reading

MINERAL COMPOSITION OF RETAIL GOAT MILK IN THE UK

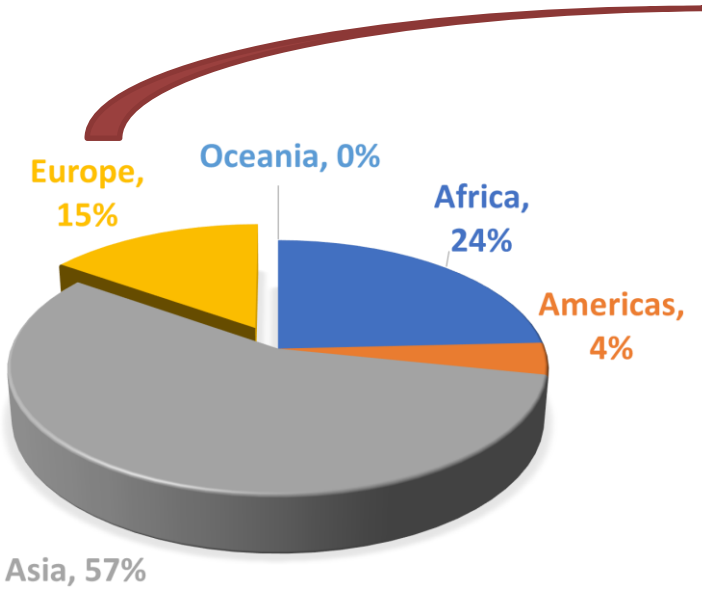
***Sokratis Stergiadis*[1] & *Michael R.F. Lee*[2,3]**

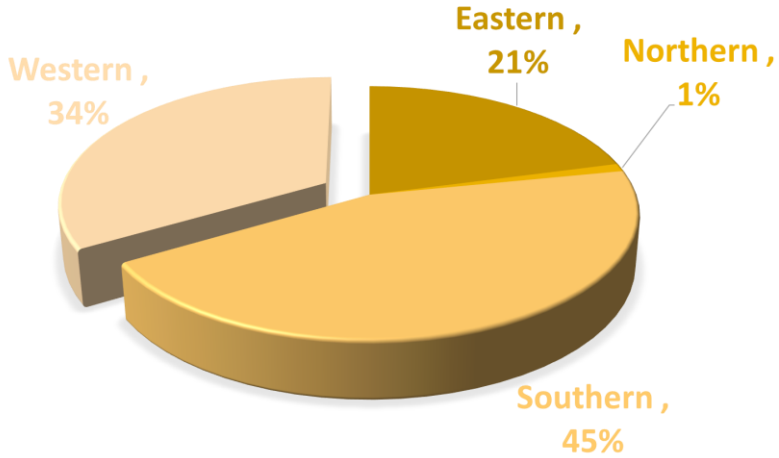
[1] University of Reading, School of Agriculture, Policy and Development, PO Box 237, Earley Gate, Reading, RG6 6AR, United Kingdom
[2] University of Bristol, Bristol Veterinary School, Langford, Somerset, BS40 5DU, United Kingdom,
[3] Rothamsted Research, North Wyke, Devon, EX20 2SB, United Kingdom

s.stergiadis@reading.ac.uk

INTRODUCTION

The dairy goat industry





(FAOSTAT, 2017)

The UK Dairy Goat industry :

- 25 years old
- 40,000-45,000 goats
- 34 million litres per year

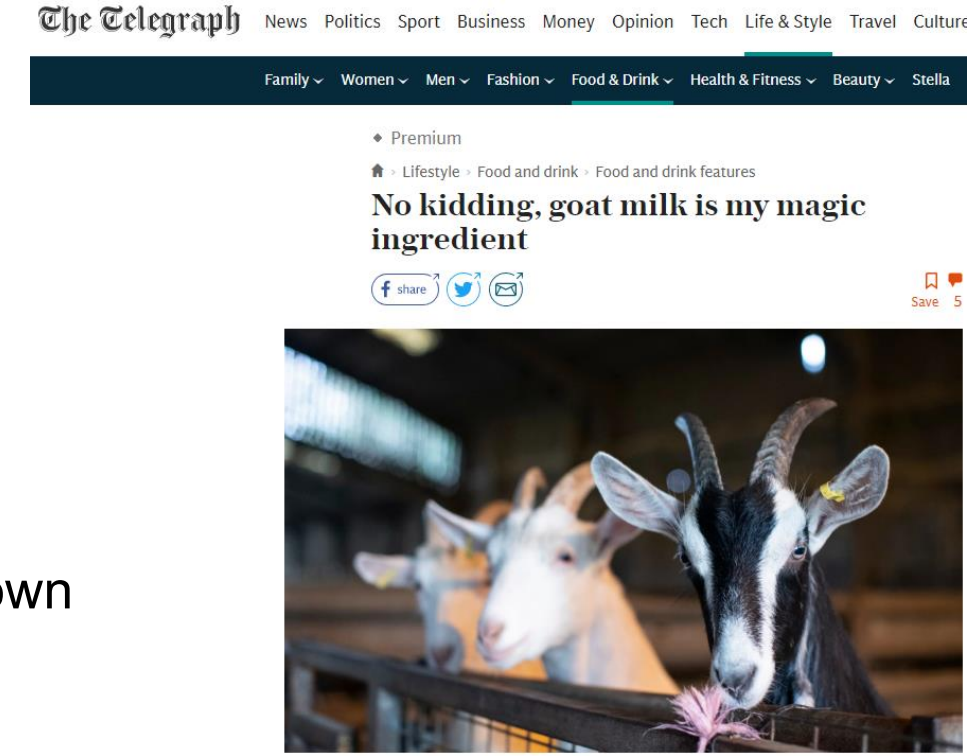
The Milking Goat Association; https://www.milkinggoat.org.uk/

Photo from: pixabay

INTRODUCTION

Goat milk and human health… in public press

From a quick search online in public press… "*It's easier to digest, good for the skin, high in Ca and minerals, boasts healing properties, contains fewer allergens, good for cholesterol and heart disease, fights inflammation, strengthens bones, lower in lactose, improves brain health, good for pregnant women, prevents anaemia, improves hair health, works for lactose intolerants…*"



- Heavy reliance in anecdotal evidence
- Country/production system differences are unknown
- Lack of human intervention studies

Screenshots from: http://home.bt.com/lifestyle/health/healthy-eating/goats-milk-health-benefits-reasons-to-switch-11364198609147 and https://www.telegraph.co.uk/food-and-drink/features/no-kidding-goat-milk-magic-ingredient/

INTRODUCTION

Objectives

The overall aim of this study aimed to:

1. investigate the differences in the nutritional profiles (basic solids composition, fatty acids (FA), minerals and phytoestrogens) between cow and goat retail milk
2. assess the seasonal effect on the observed differences
3. quantify the potential implications on the consumers' mineral intakes

As, B, Ca, Cd, Co, Cu, Fe, I, K, Mg,
Mn, Mo, Na, Ni, P, Pb, S, Se, Zn

MATERIALS AND METHODS

Experimental design

- 2 conventional milk types (species): **Cow** / **Goat**
- 4 brands/replicates for Cow + 3 for Goat
- 12 consecutive months (March 2016 – February 2017)

Measurements

- **ICP-MS:** Commercial mineral analysis, to NUvetNA

  (University of Nottingham, Sutton Bonnigton, UK)
- **FOURIER-TRANSFORM INFRARED SPECTROSCOPY** Fat, Protein, Casein, Lactose, SCC

Statistical analysis

- **ANOVA REML** Fixed: Species, Month, Species × Month, Random: Milk ID

ICP-MS = Inductively coupled plasma mass spectrometry; SCC = somatic cell count; REML = residual maximum likelihood analysis

RESULTS

Basic composition

Table 1. Means (and average SE) and ANOVA P-values for the basic composition of cow and goat retail milk collected throughout the study.				
	Cow	**Goat**		**ANOVA**
	n=48	n=36	**SE**	**P-values**
Fat (g/100g)	3.49	3.58	0.033	ns
Protein (g/100g)	3.27	2.85	0.027	**
Casein (g/100g)	2.55	2.14	0.025	**
Lactose (g/100g)	4.52	4.13	0.016	***
SCC (×10^3/ml)	38	187	18.7	†

****, P < 0.001; **, P < 0.01; *, P < 0.05; †, 0.05 < P < 0.10 (trend); ns, P > 0.10 (non-significant), SCC = somatic cell count*

RESULTS

Mineral contents

Table 2. Means (and average SE) and ANOVA P-values for the mineral concentrations of cow and goat retail milk collected throughout the study.					
	Cow	Goat		ANOVA	
	n=47	n=36	SE	P-values	
As (µg/kg)	0.249	0.232	0.0237	ns	
B (mg/kg)	0.176	0.263	0.0290	*	+0.087
Ca (g/kg)	1.128	1.066	0.0084	**	-0.062
Cd (µg/kg)	0.047	0.044	0.0088	ns	
Co (µg/kg)	0.335	0.299	0.0339	ns	
Cu (mg/kg)	0.035	0.070	0.0034	***	+0.036
Fe (mg/kg)	0.214	0.216	0.0168	ns	
I (mg/kg)	0.363	0.673	0.0346	*	+0.311
K (g/kg)	1.528	2.037	0.0133	***	+0.509
Mg (g/kg)	0.113	0.144	0.0013	***	+0.031
Mn (mg/kg)	0.020	0.049	0.0010	***	+0.029
Mo (mg/kg)	0.039	0.024	0.0023	ns	
Na (g/kg)	0.377	0.354	0.0032	**	-0.023
Ni (µg/kg)	1.151	0.826	0.2838	ns	
P (g/kg)	0.908	0.986	0.0108	***	+0.078
Pb (µg/kg)	0.583	0.374	0.1390	ns	
S (mg/kg)	0.299	0.272	0.0040	*	-0.027
Se (mg/kg)	0.016	0.017	0.0004	ns	
Zn (mg/kg)	3.416	2.889	0.0413	**	-0.527

Potential reasons

- Intensity/Grazing
- Milk solids
- Supplements
- Metabolism?

So what?

****, P < 0.001; **, P < 0.01; *, P < 0.05; †, 0.05 < P < 0.10 (trend); ns, P > 0.10 (non-significant)*

EXAMPLE

… of switching to goat milk (UK data)

Mineral	Intake	% RDI from Cow	% RDI from Goat
Children & teenagers 1-18 years old			
Ca (mg/d)	-11.2	36.5	34.5
Cu (µg/d)	+6.3	1.0	1.9
I (µg/d)	+55.9	62.4	115.7
Mg (mg/d)	+5.6	12.4	15.8
P (mg/d)	+14.1	37.3	40.6
K (mg/d)	+91.8	16.8	22.4
Na (µg/d)	-4.1	7.1	6.7
Zn (µg/d)	-95.1	8.9	7.5

- Children meet I requirements by solely drinking goat milk
- 1-3 yo should drink >350ml milk = 236µg/d = 36 µg over the Upper Tolerable Limit

Image from: pixabay RDI = recommended daily intake

EXAMPLE

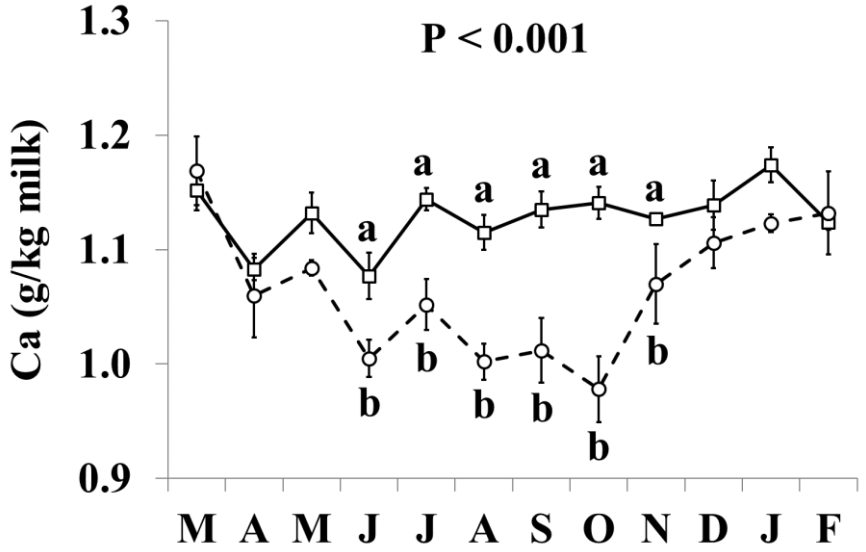
… of switching to goat milk (UK data)

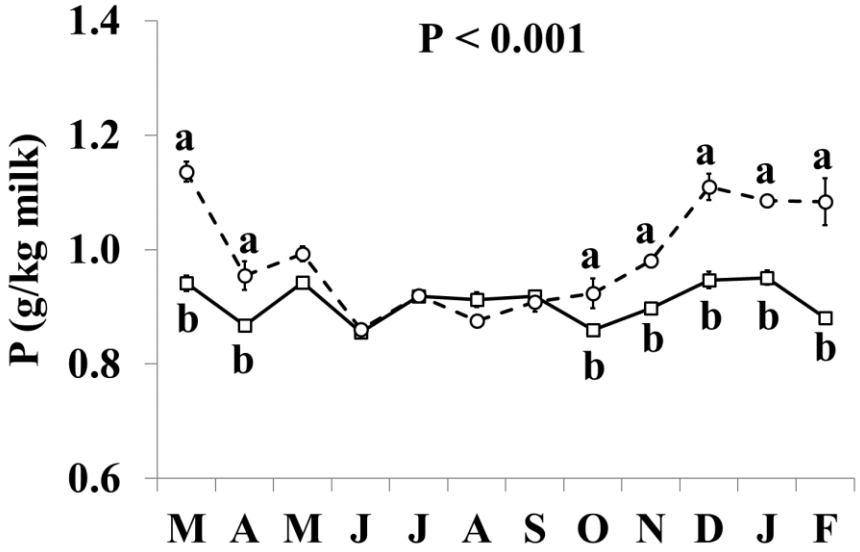
Mineral	Intake	% RDI from Cow	% RDI from Goat
Adults 19-64 years old			
Ca (mg/d)	-9.9	25.8	24.4
Cu (µg/d)	+5.6	0.5	0.9
I (µg/d)	+49.7	41.6	77.0
Mg (mg/d)	+5.0	6.4	8.1
P (mg/d)	+12.5	26.5	28.7
K (mg/d)	+81.6	7.0	9.3
Na (µg/d)	-3.7	3.8	3.5
Zn (µg/d)	-84.5	6.7	5.7

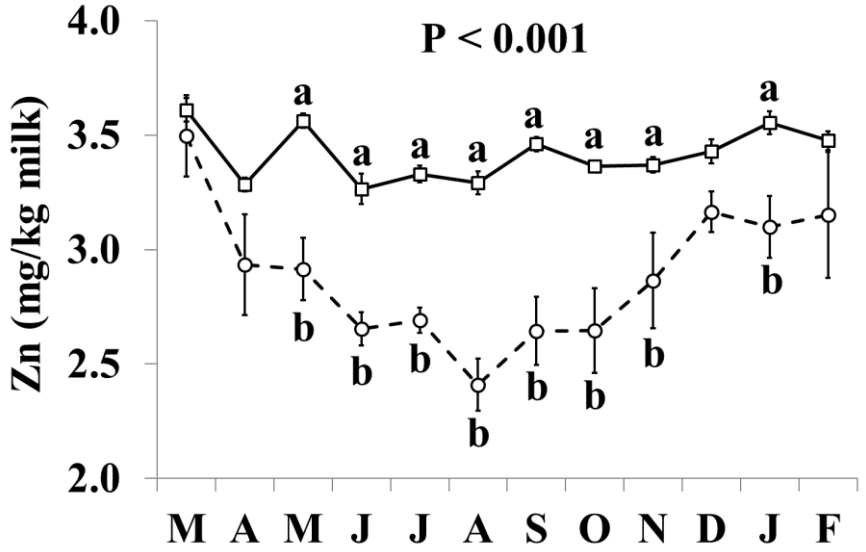
- Higher I is now preferable, as I deficiency prevails globally
- Targeted to consumer groups with high I requirements
- Preferable K:Na ratio

Image from: pixabay *RDI = recommended daily intake*

RESULTS







Seasonal variation

Cow Goat

M = March, A = April, M = May, J = June, J = July, A = August, S = September, O = October, N = November, D = December, J = January, F = February

CONCLUSION

- Goat milk contained more B, Cu, I, K, Mg, Mn, and P
- Goat milk contained less Ca, Na, S, Zn
- Differences are highly likely because of animal diet and/or genetic influence
- The higher I content may be preferable for adults, especially those with higher I requirements (e.g. pregnant women and nursing mothers).
- Due to high I content caution should be exercised in consumers with high milk intakes and/or lower I requirements (e.g. children 1-3 years old)
- The higher K:Na is desirable for consumers with high blood pressure

No studies have been carried out to assess the impact on human health

Image from: pixabay

ACKNOWLEDGMENTS

- University of Reading
- Rothamsted Research
- EIT Food

This activity has received funding from EIT Food, the innovation community on Food of the European Institute of Innovation and Technology (EIT), a body of the EU, under the Horizon 2020, the EU Framework Programme for Research and Innovation