



November 2020

# BOOK OF ABSTRACTS

## 8<sup>TH</sup> IDF INTERNATIONAL SYMPOSIUM ON SHEEP, GOAT AND OTHER NON-COW MILK

Virtual event: 4-6 Nov 2020



Event sponsor:



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## Preface

Sheep, goats, and other non-cow milk producing animals are widely produced and consumed throughout the world. They contribute to nutrition and sustainable livelihoods through support of the economy, rural and peri-urban livelihoods, the empowerment of women, and food security.

The 8th IDF International Symposium on Sheep, Goat and other non-Cow Milk is an initiative of the International Dairy Federation (**IDF**). The general objective of the symposium is to share the newest science and experience on husbandry and milk production, technology, chemistry, physics, microbiology, nutrition without losing sight of the significance of markets and appropriate policies, as they evolved. The event is addressed to scientists and other professionals involved in the sheep's, goat's and other non-cow's dairy sectors including milk producers, dairy processing industry, trade associations, academia, and governments. The symposium will be a platform for knowledge exchange among international experts in the field.

To exchange on these specific commodities from our dairy sector, IDF has been organizing with its members 8 symposia.

1. Athens, Greece, 1985
2. Hersonissos, Crete, Greece, 1995
3. Nicosia, Cyprus, 2000
4. Zaragoza, Spain, 2004
5. Alghero/Sardinia, Italy, 2007 (organized by IDF Greece)
6. Athens, Greece, 2011
7. Limassol, Cyprus, 2015
8. Virtual event, Brussels, 2020, (organized by IDF Head Office)

This publication contains 73 abstracts, all of which are being presented by program representatives on the symposium days (November 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup>, 2020).

Acknowledgements go to the Scientific Committee of the symposium for assistance in organizing the program and compiling the abstracts: Dr María Sánchez Mainar, Science and Standards Programme Manager, International Dairy Federation, Prof Thom Huppertz, FrieslandCampina, The Netherlands, Prof Emerita Paula Menzies, University of Guelph, Canada, Dr Photis Papademas, Cyprus University of Technology, Cyprus, Dr Yvette Soustre, CNIEL, France, Dr Olav Østerås, TINE SA, Norway, Assistant Professor Nurit Argov, Hebrew University of Jerusalem, Israel, Dr Gerrit Koop, University of Utrecht, The Netherlands, Dr Hen Honing, Veterinary service, Ministry of Agriculture, Israel.

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8TH IDF INTERNATIONAL SYMPOSIUM ON SHEEP, GOAT AND OTHER NON-COW MILK

8TH IDF INTERNATIONAL SYMPOSIUM ON SHEEP, GOAT AND OTHER NON-COW MILK				
9:00am to 16:30pm. Wednesday, 4 November 2020				
Virtual event hosted by the International Dairy Federation Head Office				
Programme				
Time	Role	Presentation Title	Speakers	Affiliation
<b>Sustainability</b>				
9:00am	Welcome and Introductions		Caroline Emond	Director General, International Dairy Federation
	Moderator		Caroline Emond	Director General, International Dairy Federation
	Moderator		Véronique Pilet	Groupe SAVENCIA, France. Deputy Chair of the IDF SC on Dairy Policies and Economics
9:15am	Keynote	Socio-economic sustainability, policies, and social aspects of non-cow milk production	Dr Nicoline de Haan	Senior researcher, International Livestock Research Institute, Kenya
9:45am	Invited speaker	Climate change and animal genetic resources for food and agriculture: state of knowledge, risks, and opportunities	Dr Mohammed Bongoumi	Animal Production and Health Officer, Subregional Office of FAO in North Africa, Tunisia
10:15am	Invited speaker	Dairy Markets and Policy for non-bovine milk	Prof Emeritus Andrew M. Novaković	Cornell University, United States
<b>10:45am</b>	<b>Questions and answers</b>			
<b>10:45am</b>	<b>Break</b>			
<b>Sustainable milk production</b>				
	Moderator		Pierre Barrucand	ACTALIA, France. Chair of the IDF SC on Environment
	Moderator		Dr Ying Wang	Dairy Management Inc, United States, IDF SPCC Member on Environment
11:45am	Selected abstract	Small ruminants: assessment of the greenhouse gas methane using the GWP* metrics	Dr Agustín del Prado	BC3-Basque Centre for Climate Change-Klima Aldaketa Ikergai, Spain
12:15pm	Selected abstract	CAP'2ER®: the environmental footprint calculator for French goat systems	Dr Aurore Vigan	Institut de l'Elevage, France
12:35pm	Selected abstract	Managing sheep farm performances at territorial scale to improve productivity and environmental performance	Dr Alberto Stanislao Atzori	Sezione di Scienze Zootecniche, Italy
<b>13:00pm</b>	<b>Questions and answers</b>			

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<b>13:30pm</b>	<b>Break</b>			
<b>Sustainable animal health strategies</b>				
	Moderator		Prof David Kelton	University of Guelph, Canada
	Moderator		Dr Ilka Klaas	Dairy Development Director, DeLaval International
14:30pm	Keynote	Global strategy for the control and eradication of Peste des Petits Ruminants	Anna-Maria Baka	Chargée de mission at Status Department, World Organisation for Animal Health
15:00pm	Invited speaker	Monitoring of goat welfare	Prof Edna Hillmann	Humboldt-Universität zu Berlin, Germany
15:20pm	Selected abstract	Implementation of genomics in French dairy goat selection scheme	Dr Virginie Clément	Institut de l'Elevage, France
	Flash poster	MiRNA profile in milk extracellular vesicles is modulated by caprine alphaS1-casein genotype	Christine Leroux	INRAE, France
	Flash poster	The economic burden of bluetongue disease for the Italian sheep industry and the national herd service	Massimo Canali	Universita di Bologna, Italy
<b>15:30pm</b>	<b>Questions and answers</b>			
	<b>Closing of the day</b>			

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**8TH IDF INTERNATIONAL SYMPOSIUM ON SHEEP, GOAT AND OTHER NON-COW MILK**

**9:00am to 15:30pm. Thursday 5, November 2020**

*Virtual event hosted by the International Dairy Federation Head Office*

**Programme**

Time	Role	Presentation Title	Speakers	Affiliation
<b>Novel milk products &amp; health impact</b>				
9:00am	Welcome and Introductions		Laurence Rycken	Science and Standards Programme Manager, International Dairy Federation
	Moderator		Laurence Rycken	Science and Standards Programme Manager, International Dairy Federation
	Moderator		Erica Hocking	Senior Nutrition Scientist, Deputy Chair of the SC on Nutrition and Health
9:15am	Keynote	The role of goat milk for early life nutrition & other life stages	Dr Sophie Gallier	Clinical Research Manager, Dairy Goat Cooperative, New Zealand
9:45am	Keynote	Improving value and quality of non-bovine milk by lactation physiology	Assist Prof Nurit Argov	Department of Animal Science, Hebrew University of Jerusalem, Israel
10:15am	Selected abstract	Dynamic in vitro gastric digestion of sheep and goat milk: influence of heat treatment and homogenisation	Siqi Li	The Riddet Institute of Massey University, New Zealand
<b>10:30am</b>	<b>Questions and answers</b>			
<b>11:00am</b>	<b>Break</b>			
<b>Processing technologies</b>				
	Moderator		Dr Diarmuid Sheehan	Teagasc, Ireland. Chair of the SC on Dairy Science and Technology
	Moderator		Prof Milena Corredig	Aarhus University, Denmark
11:30am	Keynote	Processing technologies for non-bovine milk: opportunities and challenges	Prof Thom Huppertz	Dairy Science & Technology, Wageningen University & Research, The Netherlands
12:00pm	Keynote	Camel milk and its products, novelties, and challenges	Assoc Prof Mutamed Ayyash	College of Food and Agriculture, UAE University, United Arab Emirate

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	Flash poster	Characterisation of basic composition, physical properties & antimicrobial enzymes of Australian camel milk	Zhengzheng Zou	The University of Queensland, Australia
	Flash poster	Commercial probiotic bacteria selection for the development of a functional fermented beverage based on donkey milk	Panagiotis Mousikos	Cyprus University of Technology, Cyprus
	Flash poster	Testing a commercial $\beta$ -galactosidase to produce lactose-free goat's milk yogurt	Carlo Spanu	University of Sassari, Italy
	Flash poster	Ovine Ice Cream made with addition of Whey Protein Concentrates (Ovine/Caprine)	Ekaterini Moschopoulou	Agricultural University of Athens, Greece
<b>13:00pm</b>	<b>Questions and answers</b>			
<b>13:30pm</b>	<b>Break</b>			
14:00pm	Selected abstract	Technologies to maintain quality of donkey milk powder	Photis Papademas	Cyprus University of Technology, Cyprus
14:30pm	Selected abstract	Technologies to predict the composition of sheep milk	Gilles Lagriffoul	Institut de l'Elevage, France
14:40pm	Selected abstract	Using technology to determine sheep milk quality composition in different organic grazing systems	Pierluigi Caboni	University of Cagliari, Italy
<b>15:00pm</b>	<b>Questions and answers</b>			
<b>15:30pm</b>	<b>Closing of the day</b>			

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**8TH IDF INTERNATIONAL SYMPOSIUM ON SHEEP, GOAT AND OTHER NON-COW MILK**

**9:00am to 15:30pm. Friday 6, November 2020**

*Virtual event hosted by the International Dairy Federation Head Office*

**Programme**

Time	Country	Presentation Title	Speakers	Affiliation
<b>Quality &amp; safety “Farm to Table”</b>				
9:00am		Welcome and Introductions	Aurelie Dubois	Science and Standards Programme Manager, International Dairy Federation
		Moderator	Aurelie Dubois	Science and Standards Programme Manager, International Dairy Federation
		Moderator	Harrie van den Bijgaart	Manager Innovation & Business Development, Quality assurance in dairy, The Netherlands
9:15am	Invited speaker	Why do Somatic Cell Counts in Goat Milk matter?	Olav Østerås	Special Advisor Animal Health and Welfare, TINE Advisory Service, Norway. IDF Chair of the SC on Animal Health and Welfare
10:10am	Selected abstract	Effect of goat milk quality (somatic cell count) on cheese	Ragnhild Aabøe Inglingstad	TINE Advisory Service, Norway
	Flash poster	Management of <i>Listeria monocytogenes</i> risk during cheesemaking and shelf life of Mozzarella di Bufala Campana PDO cheese	Marcello Alinovi	University of Parma, Italy
	Flash poster	Prevalence and characterization of <i>Yersinia enterocolitica</i> detected from sheep and goat raw milk and cheese making plants	Carlo Spanu	University of Sassari, Italy
<b>10:30am</b>	<b>Questions and answers</b>			
<b>11:00am</b>	<b>Break</b>			
<b>Udder health</b>				
		Moderator	Prof Emerita Paula Menzies	University of Guelph, Canada
		Moderator	Dr Gerrit Koop	Universiteit Utrecht, The Netherlands
11:30am	Keynote	Improving animal production	Dr Haim Leibovich	Farm advisor, Sheep and goat dairy systems, Israel

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10:25am	Selected abstract	Making of small ruminants	Dr Jean-Louis Poulet	Institut de l'Elevage, France
	Flash poster	Oxytocin release as good indicator of milking efficiency in camels	Pierre-Guy Marnet	L'institut AGRO, France
<b>12:45pm</b>	<b>Questions and answers</b>			
<b>13:15pm</b>	<b>Break</b>			
14:00am	Selected abstract	Practical Management of Mastitis in small ruminants for vets and farmers	Dr Maria Filippa Addis	University of Milan, Italy
14:20am	Selected abstract	Understanding mastitis in camels to increase productivity	Dinah Seligsohn	Department of Animal Health and Antimicrobial Strategies, Kenya & Sweden
14:50am	Selected abstract	Clinical mastitis in water buffalo: Understanding causes	Shuvo Singha	UNIMI, Italy & SAU, Udder Health Bangladesh, Bangladesh
	Flash poster	Methicillin resistant <i>Staphylococcus aureus</i> in dairy goats in Sweden	Dr Ylva Persson	National Veterinary Institute, Sweden
<b>14:50pm</b>	<b>Questions and answers</b>			
<b>15:20pm</b>	<b>Closing</b>		Dr María Sánchez Mainar	Science and Standards Programme Manager, International Dairy Federation

## Speakers' Bio

### Session 1: SUSTAINABILITY

#### 1. Socio-economic sustainability, policies and social aspects of non-cow milk production

Keynote: Dr Nicoline de Haan, Senior researcher, International Livestock Research Institute, Kenya.

Nicoline de Haan is a rural sociologist by training. She has over 20 years' experience working with livestock small holder systems in Africa and Asia. She has worked for FAO on avian influenza and PPR, and presently at ILRI where she led the work on gender and livestock and now works on the gender research portfolio for 14 agricultural centers (CGIAR).

#### 2. Climate change and animal genetic resources for food and agriculture: state of knowledge, risks and opportunities

Invited speaker: Mohammed Bongoumi, Animal Production and Health Officer, Subregional Office of FAO in North Africa, Tunisia.

Veterinarian, with a postgraduate certificate in Biochemistry and Microbiology, a Master degree in animal production and food quality, and a PhD in Animal Sciences. He worked as professor at the Institute of Agronomy and Veterinary Hassan II until 2008. He joined FAO in 2008 as regional Animal Production and Health officer at FAO's Regional Office for the Near East and North Africa and the FAO Sub Regional Office for North Africa since 2010. He has more than 100 scientific publications and more than 300 communications. He is affiliated with several scientific organizations including the International Society for Research and Development Camels (founding member), the International Society of Animal Clinical Pathology, New York Academy of Science, FAO-CHEAM network, the OIE ad hoc Group on diseases of camelids.

#### 3. Dairy Markets and Policy for non-bovine milk

Invited speaker: Prof Emeritus Andrew M. Novaković, Cornell University, United States.

Andrew Novakovic is the E.V. Baker Professor of Agricultural Economics Emeritus at Cornell University. His primary interest is dairy markets and policy, but he also is broadly interested in agricultural and food policy. He has participated in IDF activities for 25 years and is a member of the Science and Programme Coordination Committee and the Standing Committees on Marketing and Dairy Policy and Economics.

## Session 2: SUSTAINABLE MILK PRODUCTION

### 1. **Small ruminants: assessment of the greenhouse gas methane using the GWP\* metrics**

Selected abstract: Dr Agustín del Prado, BC3-Basque Centre for Climate Change-Klima Aldaketa Ikergai, Spain.

Agustin del Prado is a Research Professor and group leader at the Basque Centre For Climate Change (BC3) (Spain). His main area of expertise is the development and use of mathematical simulations models to assess the effect of ruminants farming systems on climate change and study of potential strategies for climate change mitigation and adaptation. Amongst other duties, he is an IPCC Lead Author for the 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories for the agricultural soil N<sub>2</sub>O and livestock GHG chapters.

### 2. **CAP'2ER®: the environmental footprint calculator for French goat systems**

Selected abstract: Dr Aurore Vigan, Institut de l'Elevage, France.

For about 2 years now Aurore has been working in the French Livestock Institute at the environment service in Brittany. She principally works for the development of a french environmental footprint calculator for ruminant's production systems. And she also works for the deployment of environmental projects for goat sector.

### 3. **Managing sheep farm performances at territorial scale to improve productivity and environmental performance**

Selected abstract: Dr Alberto Stanislao Atzori, Sezione di Scienze Zootecniche, Italy Alberto Stanislao Atzori.

Atzori is senior Researcher at Department of Agricultural Science of the University of Sassari, Sardinia-Italy, he had a PhD in Animal Science at the same University. His background is rooted in animal nutrition and livestock management. He spent part of his Post-doc at Texas A&M University studying System Dynamics modeling and developing new indicators to rank dairy farms for efficiency and profitability. His research currently focusses on the relation among livestock management and environmental impact of both dairy sheep and cattle farms including the participation in demonstrative EU Life+ projects to which this presentation is linked.

## Session 3 - SUSTAINABLE ANIMAL HEALTH STRATEGIES

### 1. Global strategy for the control and eradication of Peste des Petits Ruminants

Keynote: Anna-Maria Baka, Chargée de mission at Status Department, World Organisation for Animal Health.

Anna-Maria Baka is a Veterinary Medicine graduate and holds a master's degree in Food Science and Technology (Aristotle University of Thessaloniki, Greece). She has held several positions in private and public sector in Greece, including in dairy industry, Greek Milk Organisation and Veterinary Services. From 2013 until 2016, she was Greece's national consultant for field work in an EuFMD-led project for early detection of foot and mouth disease as well as other transboundary animal diseases in the Thrace region of Greece, Bulgaria, and Turkey. As of 2016, she has joined the Status Department of the World Organisation for Animal Health (OIE). Her current work relates to the procedures for the recognition of countries' official disease status, in particular with regard to peste des petits ruminants (PPR) and classical swine fever, and to the implementation of the FAO/OIE Global Control and Eradication Strategy for PPR, as the Focal Point liaising between the FAO/OIE Joint PPR Global Secretariat and OIE Headquarters.

### 2. Monitoring of goat welfare

Invited speaker: Prof Edna Hillmann, Humboldt-Universität zu Berlin, Germany.

Edna Hillmann is Professor for Animal Husbandry and Ethology at Humboldt University, Berlin. In her research, she focuses on the effects of housing conditions and management on the welfare of farm animals to provide scientific knowledge for reliable welfare assessment, for policymaking and for meeting societal expectations. Welfare assessment thus is a central aspect of her research. For this aim, her group uses a combination of behavioural observations, and (stress-) physiological, clinical, and cognitive parameters. The use of different sensor systems for measuring behaviour becomes more and more relevant. Edna Hillmann has supervised several studies on goat behaviour and welfare together with her colleagues from Switzerland, where she used to work before moving to Berlin. She has recently established a goat herd for research and teaching purposes in the research facility at her institute.

### 3. Implementation of genomics in French dairy goat selection scheme

Selected abstract: Dr Virginie Clément, Institut de l'Elevage, France.

Virginie Clément is Project manager in « Institut de l'Elevage » (French Livestock Institute with Research and Development activities). After a PhD, she joined the French Livestock Institute. She works on R&D programs with research partners as INRA in the Mixed Technology Unit "Genetic for sustainable livestock farming of small ruminants". Virginie is currently in charge of goat genetic evaluations and the development of programs for new traits under the responsibility of GenEval (the association in charge of ensuring genetic evaluations of ruminants in France) in relation with the breeding society Capgenes.

## Session 4 - NOVEL MILK PRODUCTS AND HEALTH IMPACT

### 1. The role of goat milk for early life nutrition & other life stages

Keynote: Dr Sophie Gallier, Clinical Research Manager, Dairy Goat Cooperative, New Zealand

Dr Sophie Gallier is the Clinical Research Manager at Dairy Goat Co-operative (NZ) Ltd with past research experience in academia and the dairy industry in New Zealand and Europe investigating the composition, structure and nutritional properties of cow's milk, human milk, cow's milk-based formulas and paediatric ingredients. She has managed clinical research in Asia Pacific on the role of the milk fat globule membrane for brain development and cognitive functions during pregnancy and infancy. Her research is now focused on the role of goat milk-based formulas to support healthy growth and development of infants and toddlers, with a focus on digestive functions and allergy development. She is also a current member of the Editorial Board of the International Dairy Journal.

### 2. Improving value and quality of non-bovine milk by lactation physiology

Keynote: Assist Prof Nurit Argov, Department of Animal Science, Hebrew University of Jerusalem, Israel

Nurit Argov-Argaman graduated in Animal Science from the Faculty of Agriculture of the Hebrew University of Jerusalem, Israel. After a postdoc fellowship in the Food Science and Technology department at UC Davis, she joined as a faculty in the Animal Science Department of the Hebrew University of Jerusalem, specializing in lactation physiology and metabolism. Dr. Argov-Argaman is actively engaged and leading research on the metabolic and molecular pathways regulating milk composition, with a special interest in milk lipids, including but not limited to fatty acids, polar lipids, and glycol-conjugates. Her group conducts in vivo studies on various mammalian species, including bovine, caprine, ovine, mice and human to understand how to elevate the content of bioactive molecules in milk. The underlying molecular, biochemical, and metabolic regulation of milk composition is studied in in vitro system of mammary epithelial cells, employing metabolic, biochemical, and biophysical approaches. Her group is also leading the development of a sustainable approach to induce production and improve milk quality by studying the interaction between genetic background and diet of dairy farm animals. Of special focus is the dietary source of plant secondary metabolites which may help to maintain productivity under stressful conditions such as energy balance, heat stress, and water shortage.

### 3. Dynamic in vitro gastric digestion of sheep and goat milk: influence of heat treatment and homogenisation

Selected abstract: Siqi Li, The Riddet Institute of Massey University, New Zealand

Siqi is a Postdoctoral Fellow at the Riddet Institute, Massey University, working in the "New Zealand Milks Mean More" research programme. His role involves investigating the structural assembly and the in vitro gastrointestinal digestion behaviour of milk from different ruminant species in New Zealand. He finished a PhD in 2020 on Food Technology at the Massey University. He holds a MSc on Food Technology from Wageningen University and a bachelor's in food science and Engineering from China Agricultural University.

## Session 5 - PROCESSING TECHNOLOGIES

### 1. Processing technologies for non-bovine milk: opportunities and challenges

Keynote: Prof Thom Huppertz, Dairy Science & Technology, Wageningen University & Research, The Netherlands.

Professor Thom Huppertz hold an MSc from Wageningen University and a PhD from University College Cork. His research career includes academic and industrial research in the field of dairy science and technology, with dairy chemistry and physics as a central theme. His research topics have ranged from biosynthesis of milk constituents to digestion of dairy products in the human body, with particular emphasis on constituent interactions. He currently combines the roles of Professor of Dairy Science and Technology at Wageningen University, Principal Scientist at FrieslandCampina, Visiting Professor at Victoria University and Editor-in-Chief of International Dairy Journal.

### 2. Camel milk and its products, novelties, and challenges

Keynote: Assoc Prof Mutamed Ayyash, College of Food and Agriculture, UAE University, United Arab Emirate.

After he completed his BSc, Dr. Ayyash worked for two years in the food industry sector which highly encouraged him to pursue his postgraduate studies. Dr. Ayyash joined the master's program of food science at Jordan University of Science and Technology (Jordan) and completed his MSc degree in 2007. At his completion, Dr. Ayyash has been awarded a full scholarship from Victoria University – Australia to pursue his Ph.D. study which is completed in 2013. In 2013, Dr. Ayyash received the Endeavour Postdoctoral Fellowship from the Department of Education – Australia for one year. Dr. Ayyash joined UAEU in 2014 as an Assistant Professor of Food Microbiology and Safety at Department of Food, Nutrition, and Health. Dr. Ayyash leads the research group in the food microbiology area and coordinated the master program of food science. In Sep 2019, Dr. Ayyash has been promoted to Associate Professor and took the role of BSc coordinator of the Food Science program.

### 3. Technologies to maintain quality of donkey milk powder

Selected abstract: Photis Papademas, Cyprus University of Technology, Cyprus.

Photis Papademas is an Assistant Professor of Dairy Science and Technology at the Department of Agricultural Sciences, Biotechnology and Food Science at the Cyprus University of Technology. He has published numerous papers in scientific journals, and he contributed with chapters in scientific books on dairy science and especially on cheese. He has edited the book “Global Cheesemaking Technology: Cheese Quality and Characteristics” published by Wiley. He is also a member of the National (Cyprus) Dairy Committee and an active member of the Standing Committee on Dairy Science Technology of the International Dairy Federation. His research is focused on the study of non-cow milks and more specifically on the characteristics, bioactivity/functionality of donkey milk.

### 4. Technologies to predict the composition of sheep milk

Selected abstract: Gilles Lagriffoul, Institut de l'Elevage, France Gilles Lagriffoul, Department of Genetics and Phenotypes at the Institut de l'Elevage.

Gilles is a 30-year experienced project manager. He is operational manager of the National Dairy Sheep Committee (CNBL), federation of all technical farmer's organizations involved in the French dairy sheep sector. Within CNBL, he oversees the dairy sheep milk quality group. He is also

coordinator of the national “Mixed Unit of Technology – Genetics of small ruminants”, federating INRAE and Institut de l’Elevage R&D programs in small ruminants’ genetic improvement. These responsibilities allow Gilles Lagriffoul to have a strong knowledge in dairy sheep.

#### **5. Using technology to determine sheep milk quality composition in different organic grazing systems**

Selected abstract: Pierluigi Caboni, University of Cagliari, Italy

Professor of food chemistry at the University of Cagliari, Italy, in the High-Resolution Mass Spectrometry Laboratory, Department of Life and Environmental Sciences. The research activity is mainly focused on metabolomics and lipidomics of ovine milk.

## Session 6 - QUALITY AND SAFETY "FARM TO TABLE"

### 1. Why do somatic cell count in goat milk matter?

Invited speaker: Olav Østerås, Special Advisor Animal Health and Welfare, TINE Advisory Service, Norway. IDF Chair of the SC on Animal Health and Welfare.

Olav is a Doctor in Veterinary Medicine (PhD, DVM) with postgraduate education in microbiology, immunology, pathology and statistics by the Norwegian School of Veterinary Science, Oslo, as well as epidemiology and statistics at University of Guelph, Canada. He has an extensive professional veterinary experience on dairy health (1977-present) and has combined his various positions managing animal health and welfare at TINE Norwegian Dairies SA with an academic career at the Department of Production Animal Clinical Sciences, Section for Herd Health and Field Service at the Norwegian School of Veterinary Sciences (1998-2014). He has a thorough research output where he primarily deals with epidemiology, herd health and dairy health data from the Norwegian Animal Recording System. Since 2015, he is special advisor in risk assessment and data-analyses at present at TINE Norwegian Dairies SA. Extra muros, Østerås acts as the Chair of the Standing Committee on Animal Health and Welfare and has been an active member on mastitis and welfare topics. Also, he has been member of the IDF Science and Programmes Coordination Committee on Animal Health and Welfare (2014-2018).

### 2. Effect of goat milk quality (somatic cell count) on cheese

Selected abstract: Ragnhild Aabøe Inglingstad, TINE, Norway.

Ragnhild works as a special advisor for goat milk production in TINE and as researcher at the Norwegian University of Life Sciences. She has MSc in Biotechnology and PhD in Food science and have worked in the field of dairy science since 2008. Her main research interest is how different factors (like species, breed, genotype, feed etc) influences milk quality and composition parameters relevant for product quality.

## Session 7 - UDDER HEALTH

### 1. Improving animal production

Keynote: Dr Haim Leibovich, Farm advisor, Sheep and goat dairy systems, Israel.

Haim Leibovich is a consultant on management and nutrition of Small Ruminants with an experience of more than 30 years in the global sheep and goat industry, working with research institutions, firms, and global aid organizations. His specialist areas include nutrition design, breeding, feasibility studies, and economic analysis. He has a PhD from the Faculty of Agriculture of the Hebrew University in Jerusalem. He has worked as a Senior Extension and Research Officer in the Ministry of Agriculture in Israel and since 2008 he has been working as a private consultant, while continuing research on all aspects of small ruminant husbandry.

### 2. Milking of small ruminants

Selected abstract: Jean-Louis Poulet, Institut de l'Élevage, France.

Jean-Louis is Milking Project Manager at IDELE, the French Livestock Institute, since nowadays more than 8 years now. Before, for 11 years, he was on the field, as a regional milking advisor in Normandy. He works for milking improvement in the 3 species, with the animal-machine-milker interface deep study as a goal. He is also Secretary General of the COFIT, the organisation especially in charge of the French milking machine control system.

### 3. Practical Management of Mastitis in small ruminants for vets and farmers

Selected abstract: Dr Maria Filippa Addis, University of Milan, Italy.

M. Filippa Addis is professor of veterinary microbiology and immunology at the University of Milan, Department of Veterinary Medicine. She graduated in biology and has a specialization and a PhD in microbiology. Dairy ruminant mastitis is one of her main research areas for over 15 years, focusing on microbial pathogens and on the host immune response for understanding disease, finding novel biomarkers, and developing novel diagnosis and prevention tools, especially in small ruminants. She collaborates with a wide Italian and international network, is involved in several projects on dairy ruminant mastitis, and is author of numerous publications on the topic.

### 4. Understanding mastitis in camels to increase productivity

Selected abstract: Dinah Seligsohn, Department of Animal Health and Antimicrobial Strategies, Kenya & Sweden.

Dinah has a MSc's degree in veterinary medicine from the Swedish University of Agricultural Sciences (SLU). She is currently employed at the National Veterinary Institute, Uppsala, Sweden where she works with issues regarding infectious diseases in camelids, climate and sustainability and global development. Her PhD at SLU focuses on subclinical mastitis in pastoralist dairy camels in Kenya with respect to epidemiology, disease transmission and antimicrobial resistance.

### 5. Clinical mastitis in water buffalo: Understanding causes

Selected abstract: Shuvo Singha, UNIMI, Italy & SAU, Udder Health Bangladesh, Bangladesh

Shuvo Singha, is currently engaged as a PhD fellow in University of Milano working on "Buffalo milk chain in Bangladesh" which is being jointly collaborated between Bangladesh, Sweden, and Italy. Previously he has completed his MS in Epidemiology and Doctor of Veterinary Medicine (DVM) from Chattogram Veterinary and Animal Sciences University, Bangladesh.

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Day 1

**4th November 2020**

Sustainability  
Sustainable milk production  
Sustainable animal health strategies

## **Socio-economic sustainability, policies and social aspects of non-cow milk production: Sustainable Development Goals and small ruminants in small holder settings**

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### *Abstract*

Looking at the link between small ruminant production and the Sustainable Development Goals (SDGs) provides us with three clear entry points by which enhancing small ruminant production can help us reach the SDGs. Three SDGs were chosen to illustrate this, SDG 2 on zero hunger, SDG 1 on no poverty and SDG 5 on gender equality. For instance, SDG 2 and small ruminant milk consumption, recent figures ([Pulina et al. 2018](#)) clearly illustrate that there is an increase demand for milk, which will in the future provide a clear push for increased productivity whether for own consumption or for the market. Small ruminants also can support reaching SD 2 on no poverty, as goats and sheep fulfil a multiple of functions in small holder systems. A primary reason is diversification, which allows for income smoothing and insurance in these diverse systems. But understanding the role small ruminants play along the value chain and within national economy is also important to understand how to improve the system. More and more research is also highlighting how small ruminants are important for women and a venue for empowerment as is the important role they play in small ruminant production systems. As we move forward and increase production to reach the SDGs, we need to get a more nuanced typology to target interventions better, we need to include women in our interventions, and to understand the trade-offs between different outcomes and production if we want to increase productivity.

## Climate change and animal genetic resources for food and agriculture: state of knowledge, risks and opportunities

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### *Abstract*

Livestock and their production provide many benefits to humankind by contributing to food security (providing 13% of energy and 28% of proteins), wealth generation and maintenance and rural development. Livestock plays also important social, cultural and ecologic roles. One-third of arable land is used for the production of livestock feed and more than one-quarter of the ice-free terrestrial surface is used for grazing. Due to world's population increase, this importance is expected to increase by 2050, with an increase of milk and meat demand by 58% and 73% respectively. According to the fifth ICCP report, the average ambient temperature has increased by about 1°C during the period 1901–2012. Average temperatures for the five-year (2015-2019) and ten-year (2010-2019) periods were the highest on record. Livestock can have negative impacts on the environment, among top 2 to 3 sources of environmental degradation. The main impacts of climate change on livestock include landscapes and soil, water availability and quality, biodiversity, non-renewable resources, emergence and spread of animal diseases, etc. Type and scale of impacts depend on production system with severe shocks for livestock small holders. In addition to the decrease of water and rangelands resources, climate change induces disorganization of production systems and mobility and social connections. Diversity of animal genetic resources is decreasing, about 10% of known breeds are extinct, 20% of breeds are at risk and 30% of breeds is unknown. Most developing countries lack capacity for optimal animal genetic resources management (characterization, inventory & monitoring, breeding and conservation, development of policies and legal structures, etc.). FAO programme in support to sustainable livestock development includes: development of tools for modeling of GHG and other factors contributing to environmental impact, promotion of Tool box of practices that increase efficiency of livestock production, capacity building on breeding programmes to increase production efficiency and maintain biodiversity, raise awareness of contributions of breeds to a wide variety of ecosystem services and control of the main animal diseases. It is also recommended to enhance applied research, support countries for developing strategies for sustainable livestock production and promoting “One health” Approach for addressing emergent diseases.

## Markets and Policy for Non-Bovine Milk

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### *Abstract*

Although cows (various bovine species) account for 80% of the world's production and human consumption of milk, numerous other species are used in agricultural systems to which they are especially well adapted. Largely due to their prevalence in the huge milk producing area of South Asia, water buffalo are the dominant non-bovine species for dairy purposes, representing about 15% of the world's milk supply. Goats and sheep are commonly used from central Asia to southern Europe. Camels, horses, donkey, yak and numerous other species are also used in areas where those species thrive and have cultural roots. Non-bovine species milk is especially important in Asia and Africa, but they are of growing interest in the Americas and Europe resulting from consumer interest in their products. In areas where non-bovine milk is of newer interest, consumer demand is driven by several factors. For some, cheese and other dairy foods made from sheep or goat milk offers a new taste experience. Some consumers are attracted to the nutrient profile of non-bovine milks or believe they offer health benefits or find them to be more palatable. From a producer perspective, dairy sector development is identified as a rural development opportunity both in developing countries characterized by small holders and in developed countries where farmers are looking to diversify. Although government policies in developed countries tend to focus on income supports for producers of cow milk, increasingly attention is paid to non-bovine species as a vector for rural development.

## Global Strategy for the Control and Eradication of Peste des Petits Ruminants

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### *Abstract*

Peste des petits ruminants (PPR) is a viral fast-spreading disease, caused by a morbillivirus, which mainly affects sheep and goats and some wild small ruminant species. The disease was first reported in Ivory Coast in 1942, but since then, it has steadily expanded its geographical distribution beyond its original endemic region in Western Africa. Currently, almost 70 countries across Asia, Africa, Middle East and Eastern Europe have reported the infection to the World Organisation for Animal Health (OIE) and another 50 countries are considered at risk for PPR.

PPR is characterised by severe morbidity and mortality rates and has a high economic impact in areas affected by the disease. 80% of the world's sheep and goat population (2.4 billion head) is at risk of becoming infected by PPR, which can kill over 90% of the animals exposed and causes annual global losses estimated to be between USD 1.4 and 2.1 billion. Some 5.4 billion people live in the areas affected by PPR and, of which, the majority are the world's poor livestock keepers. PPR has a direct effect on over 300 million families which rely on small ruminants for their livelihoods in particular, on women who are often small ruminant owners, processors and users of livestock products.

Eradication of PPR is within reach: the disease is readily diagnosed, and an effective single-injection vaccine confers immunity to the animal throughout its life. The control and eventual eradication of the disease will contribute significantly to achieving the United Nations Sustainable Development Goals (SDG) by 2030, in particular the elimination of poverty (SDG1), the end of hunger and malnutrition (SDG2) and the promotion of gender equality (SDG5).

A globally concerted effort to support both national and regional actions is required to control and subsequently eradicate PPR and the Animal Health Services entrusted with this task require support and strengthening. In view of this, the Food and Agriculture Organization of the United Nations (FAO) and the OIE launched the PPR Global Control and Eradication Strategy with the aim of global freedom from PPR by 2030. The Strategy was endorsed at Ministerial level by over 70 countries at the FAO/OIE International Conference on PPR held in Abidjan, Côte d'Ivoire, in April 2015 and a PPR Global Eradication Programme for 2017-2021 was developed to operationalise the first phase of the Strategy.

Since the launch of the Strategy in 2015, significant progress has been achieved towards the goal of PPR global eradication. 59 countries have been officially recognised by the OIE as having a PPR free status according to the OIE Standards. 68 infected and at risk countries have been assisted to develop their national strategic plans and two rounds of biannual regional consultations meetings have been organised to facilitate exchange of information among stakeholders of different countries and promote harmonisation of national strategies. OIE Performance of Veterinary Services (PVS) field missions with a specific focus on PPR have been contacted in eight PPR infected countries. An OIE vaccine bank has been established to ensure the procurement of high-quality vaccines manufactured in line with OIE standards and delivered in a timely manner for the benefit and use of OIE Members. The OIE and FAO have developed a joint resource mobilisation plan and continue to work closely with resource partners who have committed to provide support to national, regional and global PPR eradication efforts.

## On-farm Monitoring of Goat Welfare

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### *Abstract*

There are several indicators used to assess animal welfare on-farm, which are categorised as being “animal based”, e.g. skin lesions/lameness score, “resource based”, e.g. lying space/number of feeding places/pasture size, or “management based”, e.g. feeding intervals/frequency of claw trimming/duration of pasture access. Here, I will focus on animal-based welfare indicators only. For on-farm welfare assessment, an indicator has to be (a) valid, i.e. must reflect what it is supposed to predict; (b) reliable, i.e. the measurement of the indicator must be repeatable; and (c) feasible during on-farm inspections. Thus, indicators that require laboratory analysis, are time consuming, or require the use of specific devices are not (yet) feasible for an on-farm welfare monitoring. Indicators that can be measured at the slaughterhouse are promising, but not part of an “on-farm monitoring”. The Welfare Quality® Project has defined four welfare principles that cover health, feeding, housing, and behaviour. Showing different experiments assessing the effects of housing/management on goat welfare, it is concluded that the welfare of goats that are individually introduced into established groups is strongly impaired. Further, restraint in a feed barrier enabled all individuals of a group to feed after feed delivery, but if goats are restrained, blinds between adjacent feeding places are necessary to prevent agonistic interactions. Also, equipping loose-housing pens with partitions, elevated levels and lying niches positively affects feeding, resting and social behaviour. For assessing the „Good Feeding“ and „Good housing“ principles, animal based monitoring is possible but time-consuming, and can be supported by resource/management based indicators. If the animal is healthy, resources are adequately available and management meets the animals’ needs, the animal has the opportunity to exhibit all behaviours it is motivated to, and, ideally, laborious assessment of „Appropriate Behaviour“ would become redundant.

## **CAP'2ER® : the environmental footprint calculator for French goat systems**

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### *Abstract*

CAP'2ER® is an environmental assessment tool developed in France for dairy, beef and sheep farms, and recently for goat systems. Answering to Life Cycle Assessment standards, the system boundaries covered by CAP'2ER® represents "cradle-to-farm-gate" (on-farm impacts plus embodied impacts from inputs used on the farm). The methodology is a multicriteria assessment (GHG emissions, eutrophication, acidification, and energy use) based on international methodologies. The tool also evaluates positive contributions like carbon sequestration, biodiversity and food performances. The functional unit is the quantity of product in liter of fat and protein corrected milk leaving the farms. By this way, items allow to explain farmers the link between practices and environmental impacts. At each step, farm results are compared to a reference according to the production system.

The first objective of the tool is to sensitive stakeholders on the link between environmental impacts and breeding, and the second one is to allow the development of mitigation action plans on farms. By this way, the CAP'2ER® level 1 is a simplified tool which requires 30 technical data. It aims at educating farmers and livestock advisers to consider environmental issues in order to do a quick evaluation of the environmental footprint, to get farmers into position compared to references and to create a national observatory. The CAP'2ER® level 2 aims at including environmental assessment in the advising approach and creating the link with technical aspects. Reserved to specialists in breeding production systems, the level 2 allows to set up mitigation action plans in order to reduce impacts and to increase positive contributions.

Thanks to CAP'2ER® which will be used by advice companies, producer associations, milk suppliers..., the goat sector will be able to measure its contribution to environmental issues, to apply mitigation practices in order to develop a sustainable goat strategy at a national scale.

## **Establishment of a goat sector in Algeria as a lever for rural development: Case of the Amizour region of Bejaia**

Bellil Kousseila<sup>1</sup>, Lazereg Messaoud<sup>1</sup>, Salhi Salima<sup>1</sup>, Boukrif Moussa<sup>2</sup>, Iguerouada Mokrane<sup>3</sup>, Zaidi Zakia<sup>3</sup>, Belkheir Boussad<sup>4</sup>

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### *Abstract*

Aware of the economic and social stakes involved in the development of the goat sector, the project is part of a logic of development from the bottom of rural areas through the identification of mechanisms and favourable factors for the establishment of a structured goat sector in the wilaya of Bejaia and to support the financing and launch of human-scale livestock projects integrated into an approach to enhance the potential of mountain areas. Our bottom-up and participatory approach requires the identification of the region's potential in goat breeding and the most appropriate organisational methods for its development and the local actors to be involved in this project. Secondly, our research consists in supporting the development of small structures for the valuation and marketing of milk and milk products. This support will be provided by teachers and researchers as well as experts in the field in order to strengthen the capacities of stakeholders in managerial, technical and regulatory aspects.

The major impact of the project will be the implementation of a structured goat sector through the improvement of milk production and productivity, the main problem of valorisation of production, especially industrial. The project also aims to organise the players horizontally in the form of cooperatives or permanent professional associations, and vertically (farmers-collectors-valuers) to make the most of goat products and have more income for small farmers and enable them to access new markets at regional or national level. The project's objective is the development from below of a local economy that is economically, socially and environmentally sustainable in mountain areas, which will ultimately enable these so-called disadvantaged areas to become financially self-sufficient. In the long term, this development process will enable local actors to have a brand image or even a label of artisanal products linked to the mountainous terroir.

## The role of small dairy farming in local development

Messaoud Lazereg, Manel Djediane

Centre de Recherche en Economie Appliquée pour le Développement, Algiers, Algeria

### *Abstract*

In Algeria, agriculture and livestock are the main source of income for rural people. This population, being far from its potential market, suffers from several constraints which limit its capacity to improve its socio-economic situation. To remedy this situation, local actors are developing subsistence strategies based on subsistence farming and the transformation of surplus production in an artisanal way. This way of processing extends the life expectancy of agricultural products and makes it possible to have a future market for agricultural products.

Establishing a new value chain or entering an existing value chain are two difficult tasks for smallholder farmers in developing countries. If a market opportunity is recognized, smallholders still need entrepreneurship, business skills, education and a range of other assets to start a business. Business and entrepreneurship skills are generally not provided by schools. The lack of managerial skills increases the difficulties encountered by smallholders in creating a value-added business.

The Algeria market is supplied by four sources of milk: cow, sheep, goat, and camel. Almost public polices and academic studies are interested by the cow's milk. In this study, we try to show the role the other milks in the supply of the Algerian dairy market. The aim of the study is to show the geographical distribution of the farms, the global supply of the market, and the sub-product of these milks. The second part, this study will analyse the role of the small farming of goat, sheep, and camel in the creation of a dynamic of local development. These small farms are the product of family farming, which is often defined in opposition to other forms, notably entrepreneurial.

## World Goat Day 2017 (Symposium, Commemoration, Exhibition) at a glance

Farhad Mirzaei

ASRI, KARAJ, Islamic Republic of Iran

### *Abstract*

The history of WGD goes back to my PhD thesis in 2010 when I was studying at NDRI, Karnal, India. National Goat Day took place in Karaj, Iran on 27 January 2016. Around 400 people including of farmers, scientists, experts and policy maker participated and emphasized their support to have WGD in 2017. The representative of FAO to Iran and ECO had statement in NGD2016 which helped too much our main goal in 2017. After that successful NGD in 2016, we started to build a huge capacity from all parts of policy making, academies, research, extension and farming to bring them to this point of view. After communication with DAO, OIE, IFAD and ILRI, World Goat Day took place in Karaj, Iran on September 18-19, 2017. Iran is the site where domestication of goat started around 10,000 years ago. More than 1000 producers, villagers, goat keepers, members of tribal communities, agriculture related industries, students, extension agents, scientists, researchers, national and international dignitaries, as well as governmental agencies participated to show their support. Almost all the major indigenous goat breeds were represented and they were housed separately for biosecurity purposes. Proud selected goat farmers and villagers brought their show goats and shared their beautiful goats with the participants. They were awarded for producing prize-winning goats. Dignitaries from different countries including Armenia, Argentina, Australia, France, India, Kenya, Turkey and the U.S. were present and shared their experiences with the audience. Numerous seminars, and workshop topics dealing with Iranian indigenous goat breeds, breeding and selection, reproductive management, feeding managements, sustainable agriculture, low input agriculture, etc. were conducted and well attended by producers, goat keepers, tribal and pastoral producers as well as scientists and researchers, and most importantly outreach personnel and students. At the final session of event, we had World Goat Day statement.

## Carbon footprint of dairy sheep and goat farms

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### *Abstract*

The aim of this work was to estimate the carbon footprint (CF) of 15 dairy sheep and 6 goats farms having different flock size and located at different altitudes and using different forage systems (sheep: lowland, hill and mountain areas for <200, 200-500, >500 meters a.s.l., respectively; goats: housed and mixed systems). The farmers were surveyed for a complete life cycle inventory of cradle-to-gate farm production processes. A modified Tier2 of IPCC (2006) approach was used to estimate the CF. Specific dairy sheep equations were used to estimate feed intake, nutritional requirements and nitrogen excretion. Hotspots included primary and secondary emissions from enteric and manure, feed production, feed purchased and energy. Functional unit was fat and protein corrected milk (FPCM; 1.047 Mcal/kg for sheep; 0.737 Mcal/kg for goats). CF was allocated 100% to milk. Average milk production level was equal to 646 (range 132 to 847) and 196 (range 112 to 320) kg/yr FPCM head<sup>-1</sup> for goats and sheep farms, respectively. On average, CF was lowest in goat forage systems than in sheep forage systems ( $2.49 \pm 0.77$ , ranging from 1.69 to 5.24 kg CO<sub>2</sub>eq kg FPCM<sup>-1</sup>;  $3.39 \pm 0.29$  ranging from 1.94 to 5.54 kg CO<sub>2</sub>eq kg FPCM<sup>-1</sup>, respectively). The contribution to the total emission was about 50% and 40% from enteric methane in sheep and goat forage systems, respectively. Variability of farm CF was mainly attributable to milk production level than to forage systems. Pooled sheep and goats data of production, expressed in terms of annual milk energy output (PL; Mcal of milk energy head<sup>-1</sup> year<sup>-1</sup>), explained most CF variability ( $CF = 84.4 \times PL - 0.614$ ;  $R^2 = 0.87$ ). It indicated that mitigation policies for reduction of emission intensities for the whole small ruminant dairy sector can primarily target sustainable intensification of animal energy output. Funded by Forage4Climate EU LIFE project.

## Assessing the contribution of European small ruminants to warming using the GWP\* metrics

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### *Abstract*

To meet the 2 °C climate target, deep cuts in greenhouse gas (GHG) emissions will be required for CO<sub>2</sub> from fossil fuels and, most likely, for methane and nitrous oxide from agriculture and other sources. Recent calls based on conventional metrics advocate that a huge reduction in meat and dairy products consumption is essential to avoid climate warming. However, conventional metrics do not consider well the effect of changing short-lived GHG (e.g. CH<sub>4</sub>) emission rates on atmospheric warming. Using a new metric by Oxford University (GWP\*) we can link annual GHG emission rates with warming effect. In this study as part of the EU-funded iSAGE H2020 project <https://www.isage.eu/>, first we quantified GHG emissions from small ruminant production systems in Europe from the 1961-2017 period and associated these emissions, using GWP\*, with its respective contribution to additional warming during the 1990-2017 period. Subsequently, We tested the effect in the future of introducing 8 different emission target scenarios for 2050 from small ruminant production systems in Europe as a way to analyse by how much small ruminant production in Europe would need to reduce GHG emissions to contribute to stabilize temperature. This exercise showed that for the period 1990-2017 the European sheep and goat production system has contributed to no additional temperature increase. For the future, keeping constant emissions will result in a non-warming effect. A faster cooling effect will be found if we decreased annual emissions. For comparative reasons, reduction of emissions rates at the same rate from fossil fuels would still lead to warming due to the long life of CO<sub>2</sub> as any time we add fossil fuel CO<sub>2</sub> to the atmosphere, as this CO<sub>2</sub> lasts for hundreds of years, we are adding CO<sub>2</sub> to the stock of CO<sub>2</sub> already present in the atmosphere.

## Mastitis in small ruminants – A practical handbook for vets and farmers

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<sup>1</sup>National Reference Centre for Sheep and Goat Mastitis - Experimental Zooprophyllactic Institute of Sardinia, Sassari, Italy. <sup>2</sup>Department of Veterinary Medicine – University of Milan, Milan, Italy

### *Abstract*

Mastitis is the most common disease in small ruminant dairy farming, and it is the leading cause of economic losses owing to the reduced quality of milk productions, increased animal culling, and the associated health-care costs. Bacteria are the main causative agents of the disease and represent the primary cause of antibiotic use, increasing the risk for selection and spread of antimicrobial resistance. Mastitis can be considered a “management disease”, as the level of knowledge and awareness of the breeder is the most effective tool for its control. Aim of this work is to collate and review the available literature on bacterial mastitis (excluding mycoplasmas) combining it with the professional experience of the National Reference Centre for Sheep and Goat Mastitis (CRENMOC). CRENMOC was established at the Experimental Zooprophyllactic Institute of Sardinia (Italy), a public veterinary institute responsible for prevention, control and research activities in animal health and welfare, food safety, and environmental protection. The book is divided into 16 main chapters: what is mastitis, udder immunity, epidemiology, aetiology, risk factors, clinical, microbiological and biomolecular diagnosis, antibiotic susceptibility testing, indirect diagnosis, prevention and control, vaccines, therapy, milk quality, costs, and zoonoses. Moreover, two easy-to-use algorithms on the cultural isolation and identification of the mastitis-causing bacteria and on the diagnosis of mastitis in small ruminant dairy farming are annexed. This handbook (freely available online at <https://www.izs-sardegna.it/quaderni/Mastitis%20in%20small%20ruminant.pdf>) is intended to provide technical and scientific background to veterinary practitioners and farmers; in particular, to support them in improving their knowledge on sheep and goat mastitis and its negative impact on milk quality with effective tools for its management.

## The economic burden of the bluetongue disease for the Italian sheep industry and the national health service

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### *Abstract*

Bluetongue (BT) is a virosis transmitted by *Culicoides* and affecting wild and domestic ruminants. Severe disease is mostly limited to some sheep breeds and deer species. In Italy, BT was firstly detected in summer 2000. Since then, there have been 12 incursions and more than 50,000 outbreaks involving different BTV strains and serotypes. BT is qualified as “notifiable disease” by OIE and listed in categories C+D+D of the European Animal Health Law. BTV infection may cause deaths, weight losses, reduced milk yields, infertility, and abortions in livestock, increased expenditures by farmers and health authorities (cost of treatments, vaccines, surveillance and control plans), and lost revenues for restrictions to animal movement (involving also cattle). This study quantifies the BT impact on the Italian sheep industry and the national health service by focusing on the outbreaks caused by BTV-4 in Tuscany and Lazio (years 2016-2017), and Sardinia (2017-2018). The project develops a deterministic model incorporating epidemiological, zootechnical and economic variables based on data from the national veterinary database, questionnaire surveys, and expert interviews. A sequence of equations describes the costs in the different livestock categories according to the clinical courses of the disease, by allowing a comprehensive assessment at the farm level. Public costs are evaluated by analysing the activities needed to implement BT surveillance and intervention programmes. Regional and local health authorities, and Istituti Zooprofilattici Sperimentali are involved in data collection. Expenditures are calculated through the attribution of standard costs to the operational protocols. The study proposes a wide analysis of losses and resource consumption caused by BT at different levels (private and public sectors) for a comprehensive assessment of the economic outcomes in the Italian situation. The epidemiological-economic model provide information to evaluate cost-effectiveness of intervention strategies, also in the context of other countries affected.

## Implementation of genomics in French dairy goat selection scheme

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### *Abstract*

The main French dairy goat breeds Alpine and Saanen, are selected using a total merit index that combines production traits (protein and fat yield, protein and fat content), udder morphology and udder health (somatic cell counts). Several changes in the last few years have provided tools that may be used to improve selection for dairy goats in using genomic information, specifically the availability of a high-density SNP chip (Illumina 50K SNP) in 2011 and the implementation of a reference male population. These tools, allowing for connection of phenotypes and genomic information, and INRA's studies to develop model adapted to dairy goats data enabled to consider the implementation of genomic selection.

To adapt the selection scheme to this new challenge, significant changes have been implemented by the breeding organization Capgenes. As before, the elite AI males are mated with the elite females selected from connected flocks. Young bucks born from these planned matings are now genotyped at one month of age and information provided by DNA is used to compute GEBVs (Genomic Estimated Breeding Values). Genetic evaluation programs have been adapted to produce an early GEBV as soon as genotyping is available. Thus, the use of this information to choose elite bucks among candidates from the very first year, leads to a reduction of the generation interval. Furthermore, the higher accuracy of these GEBVs, compared to EBVs with only pedigree information, and a larger number of planned matings (+20% in two years) has resulted in an increased intensity of male selection.

Thanks to these changes, an increase of genetic progress is expected in the coming years, which should result in a rise on the net margin of the breeders. Moreover, new traits can be introduced into the breeding goals while maintaining the same efficiency on historical traits. Studies are ongoing on developing GEBVs on longevity as well as feed efficiency. GEBVs for female AI fertility and for semen production are expected for 2020.

## Growth of Dutch dairy goat kids in relation to their drinking behaviour

Wouter Oltheten, Rik van der Tol

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### *Abstract*

Optimization of the rearing strategy of intensively farmed Dutch female dairy goat kids is desired to improve health indicators, reduce labour demand and increase milk production at later age. The objective of this research is to get more insight in the growth of female dairy goat kids during preweaning and their response to weaning in relation to their drinking behaviour. On two commercial farms the body weight, body condition, height at withers, height at hip and back length of 184 female goat kids were measured once every two days from birth until 15 days after weaning. A novel measurement system registered the consumed amount of milk replacer and duration of drinking on one farm. All kids were fed ad libitum milk replacer and were housed groupwise. During the second week of their lives, 50% of the kids following the ad libitum diet, consumed more than twice the amount advised by literature. Significant differences between the farms were found for body weight, back length, weight corrected back length and body condition. Higher body weight growth after weaning can be obtained by weaning at a higher age, while maintaining body weight at weaning low. Lean kids are less affected by weaning than kids with a high body condition score. Genetic profile of the kid plays a significant role in its development, both during pre- and postweaning. The preliminary results of this research provide an important reference point for the realization of an individual automated milk feeding system for goat kids.

## Managing sheep farm performances at territorial scale to improve productivity and environmental performance

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### *Abstract*

The Sardinian sheep sector includes about 10.000 professional dairy farms and 2.7 million ewes, producing about 330 millions liter of sheep milk, mostly from December to July (about 130 L/yr. of milk per present ewe). This work proposes a method to be applied at territorial level to improve technical and environmental efficiency of the dairy sheep sector in Sardinia and to quantify economic and environmental benefits. Partial correlations and distributions of 58 variables from 490 real sheep farms were calculated, to describe the technical profile of small farms (<300 heads) and medium-large farms (>300 heads). A MonteCarlo simulation (@RiskSoftware-Palisade.com) was run to develop a synthetic database of the Sardinian sheep sector (6261 farms <300 heads, 41% of heads; 3744 farms >300 heads, 59% of heads). Several scenarios were tested in a 10 year horizon, assuming stable total Sardinian milk. Results showed that an improvement of 20 L/yr. per ewe of the 3744 medium-large farms would reduce the regional flock of 8.5%, saving 15,000 ha of pastureland. Similar improvements would be obtainable increasing by 30 L/yr. the production of the 6261 small farms. The increase of annual fertility would induce limited advantages, while reduction of delayed lambings (enough to pass from 20 to 60 milking days in november-dicember) in the 3744 medium-large farms would increase the regional milk production level of 17 L/yr. per present ewe, to reduce the regional flock of 12%, save resources for ewe maintenance costs equal to 22,000 ha of pasture land (or stored forages for 19 Million of €) and to reduce sheep methane emissions of 11%. The same strategy applied to all flocks would reduce of 21% the ewes, reducing pastureland by 40.000 ha and methane emissions by 15%. The method might be used for the development of territorial policies.

## Producing pasture-like milk from goats in confinement

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### *Abstract*

Grazing *Pistacia lentiscus* (lentisk) – dominated pasture improves milk quality. We aimed at mimicking the effect of such pasture on milk production produced indoors, by partly replacing the hay in goats ration with lentisk or providing a lentisk infusion as drink.

Experiment 1: Thirty Damascus goats were randomly assigned to three treatment groups (n=10): 4 h grazing a lentisk-rich pasture (P), confinement with vetch hay without (H) or with clipped P. *lentiscus* (HPIS) given ad-libitum for three weeks. Dietary attributes and intake were assessed by fecal NIRS. Tannin intake was 141 and 109 g/d in HPIS and P goats, respectively. Milk yield (1.5 l/d) and dietary DM intake (DMI, 2.23 kg) did not differ between groups. HPIS goats yielded milk richer in milk protein (3.77 vs 3.29%;  $P < 0.001$ ) and had 49% higher curd strength, compared with the H-group ( $P > 0.01$ ) and produced milk richer in fat (5.89 vs. 4.36%;  $P < 0.05$ ) and 48% richer in omega 3 ( $P < 0.0001$ ) than H-group, resulting in lower ratio of omega 6 to omega 3 (5.0 vs 8.2, respectively;  $P < 0.0001$ ).

Experiment 2: Twenty-four Damascus goats were fed hay and concentrate. They drank lentisk infusion (LI, n=12) or fresh water (FW, n=12), in crossover design, in two periods of three weeks. Groups did not differ in their DMI and milk yield. Goats in the LI-group, which consumed approximately 12 g/day of tannins, produced milk richer in fat (5.62 vs. 4.19%;  $P < 0.05$ ) and 21% richer in C18:3n3 ( $P < 0.05$ ), resulting in lower ratio of omega 6/3 (5.89 vs 6.74, respectively;  $P < 0.05$ ). P. *lentiscus* given as fodder enhances milk protein and fat production and quality, while infusion of P. *lentiscus*, increase fat content and quality.

## Latvian dairy goat breeds as Saanen, Latvian Native and crossed breed suitability for cheese production

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### *Abstract*

Dairy goat sector is becoming more extensive in Latvia. Therefore there is need of detailed knowledge about goat milk chemical composition and breed impact on it. Also renneting properties were analysed. Casein is main milk protein composition and got important meaning in cheese production. The aim of this study was to analyse influence of breed on goat milk chemical composition and protein fraction. This study was done in summer 2020. Texture Analyser TA.HD.plus (Stable Micro Systems, UK) was used to analyse curd firmness. Protein, casein, fat, lactose, urea content and freezing point were measured by infrared spectroscopy. In total 30 individual samples were analysed. Animal group were second (n=7), third (n=15) and fourth (n=8) lactation. Studied breeds were Saanen, Latvian Native and milking crosses (closer to Anglo Nubian). For understanding average results bulk milk samples were analysed (n=5). Fat and protein ratio were calculated and highest were established 1.31 in fourth lactation. The fat content was from 2.08% to 4.47%. The protein content varied from 2.52% to 3.65%. Highest casein content were 2.8% in second lactation and lowest 1.94 for Latvian Native goat. Freezing point from -0.397 °C to -0.539 °C. Higher curd firmness were measured 2.829 N.

Further analysis requires for understanding the effect of the breed and genetics on goat milk quality and cheese outcomes.

Day 2

**5th November 2020**

Novel milk products & health impact  
Processing technologies

## The role of goat milk for early life nutrition & other life stages

Sophie Gallier

Dairy Goat Cooperative, Hamilton, New Zealand

### *Abstract*

Bovine milk is the most common dairy milk consumed worldwide and has been extensively researched for its functional, technological, and nutritional properties for a wide range of products. One such product is infant formula, which is the most suitable alternative to feed infants, when feeding breast milk is not possible. Several bioactive components naturally present in bovine milk, including the milk fat globule membrane, milk fat, oligosaccharides, sialic acid and other minor bioactives, have been isolated in selected dairy streams and studied for their role in infant growth and overall development. For several reasons, including perceived better gastrointestinal tolerance, nutritional value and farming systems, consumers now seek alternatives, such as goat and sheep milk. Both types of milk are increasingly used to manufacture infant and young child formulas. Sheep milk is still new in the infant formula category, while goat milk has been used for more than 30 years. As more research on the role of goat milk in infant nutrition and in later life has been done, the presentation will focus on goat milk. While similar in many aspects, compositional and functional differences exist between bovine milk and caprine milk. This offers the opportunity to explore different formulations or manufacturing options for formulas based on goat milk. The use of whole milk as the only source of proteins in infant formula allows levels of several naturally-occurring bioactives to be maximised. Preclinical research demonstrates that caprine milk proteins form a softer curd under gastric conditions and are less allergenic. Caprine milk has been shown to modulate the gut microbiota, immune response and neuro-behavioural response during feeding. Some recent research indicates a role for caprine milk on digestive health and the gut-brain axis and further work is warranted on its role in allergy development.

## Processing of non-bovine milk: opportunities and challenges

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### *Abstract*

Due to the fact that raw milk is a perishable product that can contain pathogenic micro-organisms, processing is required to ensure the safety and extend the shelf-life of milk and dairy products. In addition to inactivation of pathogenic and spoilage micro-organisms, processing can also incur other changes, e.g., in nutritional value, sensory properties and the product matrix. Choice of processing technology and processing intensity is therefore often a trade-off between maximizing desired and minimizing undesired effects, while also considering cost and scale of operation. When considering the processing of non-bovine milk compared to bovine milk, general effects on constituents will be comparable, but the magnitude may differ. Furthermore, the generally higher margins on non-bovine milk can make novel processes, which may be economically unfeasible for the bovine milk processing, more feasible; e.g., the use of high pressure processing to retain biologically active proteins. Combination of unique properties of non-bovine milks with unique benefits of processing technologies can thus lead to marketable benefits.

## Camel milk and its products, novelties, and challenges

Mutamed Ayyash

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### *Abstract*

Camels are found in Asia and Africa and are kept mostly by nomads and tribes living in desert regions. Australia has half a million of wild camels, especially in Northern Territory. Globally, there are two widespread species of camels: one-humped Arabian camels or dromedaries (*Camelus dromedarius*) – the camels of the plains; and two-humped Bactrian camels (*Camelus bactrianus*) – the camels of the mountains. Camels are raised for milk, meat, fiber (wool and hair), transport, and other work; their dung is used as fuel. An FAO estimated that global camel milk production is approximately more than 3+ million tons. Camel milk is a crucial product to vast nations in Africa and Asia due to its nutritious, healthy, and therapeutic properties. Camel milk products (e.g., yogurt and cheese) are the main source of dietary elements in some countries. Food manufacturers have become more interested in camel milk properties. For instance, whey proteins in camel milk have remarkable functional properties (e.g., foaming) compared with bovine milk. The thermal resistance of camel milk proteins is low during drying. Camel milk powder has poor stability at UHT treatment (120 - 140°C). The rennetability time is longer than bovine milk. A fragile rennet-induced and acid-induced coagulum are formed. The solubility of camel whey proteins is very sensitive to pH changes. The fermentation of camel milk by lactic acid bacteria requires more time compared with bovine milk till pH reaches 4.6. The sensory properties of camel milk and its products need further investigations. It is recommended to have deep investigations to correlate between the sensory properties and chemical compounds in CM using instrumental analysis GC/MS and LC/MS. International collaboration is required to provide accurate and valid information about camel milk composition over a long period from different regions/countries.

## Milk protein mining in Indian goat breeds

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### *Abstract*

Goat's milk attracts massive attention as it can be a reliable alternative if not a replacement to cow's or mother's milk. It fulfills nutritional requirement of pregnant mothers, infants and older people in difficult conditions. The present study was carried out in 1362 milk samples of 15 Indian goat breeds/genotypes belonging to different agro-climatic zones. The milk composition analysis was carried out by infrared spectroscopy and milk protein polymorphism was studied by 14% SDS PAGE. Further analysis of protein variants by 2DE and nLC-MS/MS was carried out. Protein% was significantly higher ( $P < 0.05$ ) in Himalayan local goat (4.31%), Ganjam (4.01%) and Gaddi (3.91%) as compared to other breeds. *CSN1S1<sup>A</sup>* and *CSN1S1<sup>B</sup>* alleles were associated with higher protein content. Proteins corresponding to 1308 genes including casein and other low abundance proteins were identified. Proteins involved in immune-regulation and mineral absorption like Antileukoproteinase, Neutrophil defensin, Thioredoxin, Clusterin, complement C3, Calcium-binding protein, Osteopontin and FABP were found to be present in goat milk. The identified proteins are associated in **156** KEGG pathways including information processing, metabolism and disease pathways such as Tuberculosis, Malaria, and Measles. GO annotation analysis showed that the proteins were distributed mainly in nucleus, membrane, cytosol and cytoplasm and also ribosome, spliceosome complex, proteasome, mitochondria, endosome, golgi, vacuole, organelle lumen. Function of protein binding was associated with 25.9%, catabolic activity with 15.9%, structural molecule with 14.9% of annotated proteins; some proteins were involved with process like cell proliferation, division, development and cell communication. Post translational modification showed the phospho-peptides had ACE inhibitory, anti-inflammatory, antimicrobial and other known bioactive properties. Biogrid and STRING analysis were performed to study interactions of casein with other proteins. Goat milk proteome is suitable for drug discovery, nutraceuticals and functional foods for human health applications.

## Commercial probiotic bacteria selection for the development of a functional fermented beverage based on donkey milk

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### Abstract

The fermentation of donkey milk by probiotic bacteria could enhance the milk's nutritional value and prolong its shelf life. *Bifidobacterium animalis* subsp. *lactis* BB-12, *Lactobacillus acidophilus* LA-5, *Lactobacillus rhamnosus* LGG, *Lactobacillus paracasei* subsp. *paracasei* L. CASEI 431 and *Lactobacillus helveticus* R0052 were examined for their ability to grow in donkey milk. Probiotics were used in pure cultures and in co-cultures with *Streptococcus thermophilus*; with and without prebiotic (inulin) addition. Fermentation was carried out at 37°C and the process was subsequently stopped by cooling milk at 4°C; i.e. when milk had reached pH <5. Acidification and viable cell population were followed during fermentation, while microbial survival and milk's pH were monitored over 21-days storage at 4°C. Antimicrobial activity and organic acid production of produced beverages were also determined. All probiotic strains were grown in sufficient populations (i.e. >6 log cfu/ml), during 24-30 hrs. In general, the fermentation time was reduced when the probiotic strains were co-grown with *Streptococcus thermophilus* and the addition of inulin. The addition of inulin did not influence probiotics' growth but enhanced their survival during refrigerated storage. Lactic acid and butyric acid were the most abundant organic acids produced. The beverage produced by *Lactobacillus helveticus* R0052 showed significant antimicrobial effect against *Listeria monocytogenes*, *Staphylococcus aureus* and *Bacillus cereus*. Future work includes the study of other bioactivities i.e. antioxidant activity, immunomodulation as expressed by the stimulation of specific cytokines in PBMC cell lines after in-vitro digestion and sensory characterization.

## Influence of indigenous microbial culture addition on physicochemical and sensory properties of white-brined ewe's milk cheese

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### Abstract

Three bacteria (*Lactobacillus brevis*, *Lactobacillus plantarum*, *Enterococcus faecium*) and two yeast (*Kluyveromyces lactis*, *Yarrowia lipolytica*) strains which were previously isolated from a raw ewe's milk cheese, were used as adjunct culture in white-brined cheese made from ewe's milk to promote the textural and sensory properties at the end of 120 days of ripening.

Three batches of brined cheeses were produced from pasteurised milk (72°C for 15s) by the addition of different microbial cultures. A control batch (C) was manufactured without the addition of any culture. The second batch was inoculated with bacteria mix culture only (B) and the third batch was produced with the combination of bacteria and yeast mix culture (B+Y).

The influence of the inoculation of different culture combinations on the chemical, textural and sensory properties of cheeses were evaluated. With this aim, compositional analysis (pH, acidity, fat, protein, total solid contents), instrumental texture-profile-analysis and sensory evaluation depending on the hedonic scale were carried out.

According to the results the lowest pH values, associated with softer textures were determined in the cheeses produced with yeast addition (B+Y) after the ripening period. The fat contents of C and B were determined almost the same (24.75-25.0%). However, in B+Y, the fat content of cheeses was detected as 28.50%, most probably because of the lipid production capacity of *Y.lipolytica*. Protein and total solid contents (%) of all cheeses were determined closely, yet the ripening index of B+Y was detected as the highest with the value of 20.66, which was followed with B and C, with the values of 20.02 and 16.96, respectively. B+Y was selected as the best perceived product with respect to taste, odor and flavor, most likely due to its mild acidity, soft texture and desirable aroma comprised because of the enzymatic activities of adjunct microorganisms.

## Dynamic *in vitro* gastric digestion of sheep milk: influence of heat treatment and homogenisation

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### *Abstract*

Milks from different species are known to vary in composition, physicochemical properties, and structure and hence are likely to behave differently in the gastrointestinal tract (GIT), possibly affecting the kinetics of digestion and the bioavailability of nutrients. In the present study, we investigated *in vitro* gastric digestion behaviour of differently processed sheep and goat milk. The samples included raw milk, pasteurized milk (75°C for 15 s), homogenized-pasteurized milk, and homogenized-heated milk (95°C for 5 min). The digestion was performed using a dynamic *in vitro* gastric model, the human gastric simulator (HGS). Sheep and goat milk formed curds during gastric digestion. The pH profiles, the structure, the composition, and the rheological properties of the curds, and the rates of protein hydrolysis were examined. The properties and structure of curd were influenced by both processing treatments and different species. For example, homogenisation resulted in loosened curd structure in milk from all species, while homogenised sheep and goat milk curds were more crumbly than those formed in homogenised cow milk. The moisture content of the curd increased with more intense processing conditions, and was higher for goat milk curd than sheep milk curd. The complex modulus  $G^*$  of the curd formed from homogenized and heated (95°C for 5 min) milk was significantly lower than that from raw milk after 120 min of digestion. The difference in clot structure induced by processing treatments affected the rate of hydrolysis of casein and whey proteins by pepsin during gastric digestion. This study demonstrated the effects of processing on the gastric digestion behaviour of sheep and goat milk, which was different from that of cow milk in certain aspects.

## Use of lysozyme extracted from donkey milk as antimicrobial agent in the production of dairy products

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### *Abstract*

Antimicrobial preservation techniques can be applied in order to increase the shelf life, and retard the development of harmful microorganisms and food spoilage, while preserving the structure, nutritional value, taste and flavor of the food. Nowadays, the use of natural ingredients as alternative to chemical additives in food industry is rapidly becoming widespread due to the increasing concern of consumers about the usage of chemical ingredients.

Lysozyme, a natural enzyme, is known to have antimicrobial effects on many microorganisms. The studies we carried out previously showed that lysozyme was found in high amounts (approx. 1 g/L) in donkey milk. In this study, lysozyme was extracted from donkey milk and purified with lysozyme suppressed PHEMA based composite cryogel columns in Fast Pressure Liquid Chromatography (FPLC). Purification degree of extracted components were checked by SDS-PAGE according to their molecular weights. The SDS-PAGE pattern showed that the molecular weight of extracted lysozyme from donkey milk was nearly 12-13 kDa. Lysozyme activity was assayed by turbidimetric and fluorescence-based methods at 450 nm with hen egg white lysozyme as standard and determined in the range of 163.7-180.30 U/ml. The extracted lysozyme also showed very good performances within wide pH and temperature. Extracted and purified enzyme subsequently applied to Kashar cheese as coating material and used in spray form in yoghurt as antimicrobial material. The obtained products were compared with the control products with respect to their physicochemical, textural, sensory and microbiological properties. The obtained results demonstrated that both products exhibited lower microbial counts and better physicochemical and sensorial properties throughout the production and ripening periods. The results of this study highlight lysozyme extracted from donkey milk has a potential usage as antimicrobial agent for extending the shelf-life of products.

## The Medicinal Value of Camel Milk and its Significance in Food Security in the Northern Kenya Region

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### *Abstract*

Camels herded in the Northern Kenya produces well below their potential average and the pastoralist have suffered continuous food insecurity over years. This is attributed to myriad of constrains including inadequate expertise on camel production, poor access to camel veterinary drugs and poor market access for male animals. However, there is a rising concern among scientists in different organizations to improve milk, meat and hide production from camels by disseminating appropriate information and demonstrating improved techniques through outreach program.

Also called the white gold of the desert, Camel milk is more like human milk. It differs from other mammals' milk as its chemical composition is low in cholesterol and sugar and high in minerals, vitamin C and protective proteins like lactoferrin, lactoperoxidase, immunoglobulins and lysozyme, lacks B-lactoglobulin.  $\beta$ -lactoglobulin camel milk is unique in terms of antioxidative factors, antibacterial, antiviral, antifungal, anti-hepatitis, anti-arthritis, treatment for paratuberculosis, prevents aging, remedy for autoimmune diseases and it has cosmetic values. Insulin in camel milk is safe and efficacious in improving long term glycemic control in diabetic patient. Camel milk reduces autism symptoms in children. Lactoferrin has ability to inhibit the proliferation of cancer cell. Camel milk is rich in magnesium and zinc thus endowed antiulcer properties. Camel milk has high  $\alpha$ -hydroxyl acids which are known to plump and smoothies the skin and used to treat skin disorders such as dermatitis, Acne, Psoriasis and Eczema. This paper calls for further research on ways to improve camel productivity for less resilience on food relief and the medicinal value of camel milk

## Characterisation of basic composition, physical properties and antimicrobial enzymes of Australian camel milk

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### *Abstract*

Although camel milk is an increasingly popular non-bovine milk alternative around the world including Australia, study of Australian camel milk is lacking despite a population of over one million of the animals. We present the first comprehensive and systematic analysis of major nutritional components, physical properties, and antimicrobial enzymes including xanthine oxidase (XO), lactoperoxidase (LPO) and polyamine oxidase (PAO), of Australian camel milk, over four seasons. The composition and physical properties of Australian camel milk varied with season, milking frequency and yield. Higher content of fat, total solids and lactose was observed in spring samples compared to other seasons, while no significant ( $P < 0.05$ ) difference was found for protein and ash content among the four seasons. Milk viscosity was found to be stable with the seasonal changes. Smaller average particle size was observed in summer and autumn samples. Lactose content was always positively correlated to milk yield for the four seasons, while fat, protein, total solids and ash content as well as particle size and viscosity were generally inversely correlated to milk yield. The activity of XO was nearly undetectable in camel milk, while the highest LPO and PAO activities were observed in summer and winter samples, respectively, over the year. LPO and PAO activities were usually correlated positively with milk protein content. The secretion of LPO into milk seemed to be at least partially dominated by genetic variations among individual camels, while the PAO activity was inversely correlated to milk yield. A synergistic action of the antimicrobial enzymes PAO and LPO in generating the potent antibacterial hypothiocyanite may exist in the camel milk. The results provided a better understanding of the Australian camel milk and gave insights into processing of milk products from this animal.

## MiRNA profile in milk extracellular vesicles is modulated by caprine alphaS1-casein genotype

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### Abstract

In addition to the major and well-known milk components, nutritional quality of milk is also influenced by recently detected components, such as miRNAs that regulate many biological processes. They were found in different fractions of milk including extracellular vesicles (EVs). Evidence of the presence of food-sourced miRNAs in human plasma suggests that they could influence human health.

In goats, the polymorphisms occurring at the *CSN1S1* locus deeply impact mammary epithelial cell (MEC) function and milk composition. We hypothesized that this polymorphism may influence cargo miRNA in milk-derived EVs. Our objectives were to: i) characterize the miRNome from milk-derived EVs; ii) compare the miRNomes of strong (*AA*) vs natural-KO (*OO*) genotypes and hypothesize on the putative effects on milk consumers.

Total RNA isolated from EVs was subjected to RNAseq using Illumina NextSeq500. Sequences were mapped on *Bos taurus* genome (UMD3.1) and miRBase. Differential analyses, multiple testing correction and bioinformatics analyses were performed.

We identified 247 miRNAs with  $\geq 1$  count. A comparison of the most abundant 20 miRNAs between human and caprine milk-derived EVs revealed 10 miRNAs in common. The comparison of EVs miRNomes of goat *CSN1S1AA* vs *OO* revealed 15 differentially abundant miRNAs (DAM;  $P_{adj} \leq 0.05$ ). The integration analyses between potential mRNAs targeted by these DAMs and the differentially expressed genes at mRNA level identified cytoskeleton remodeling as the first pathway modified. Others common pathways are apoptosis and endoplasmic reticulum (ER) stress response that are linked to the ER dilatation observed in MEC of *CSN1S1OO* goats. To evaluate a potential effect of the DAMs, on goat milk consumers, we considered miRNAs exhibiting a fold change  $> 1.5$  and with over 50 counts. Among the most abundant 20 process networks potentially altered, 5 are involved in development. The effects of miRNAs on infants and adults consuming goat milk have to be considered.

## Effect of heat treatment of goat milk on whey proteins, endogenous enzymes, rennet clotting behavior and yoghurt-type gel

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### *Abstract*

Raw goat milk (G0) was heat treated by means of a laboratory HTST/UHT system combining a tubular heat exchanger with upstream homogenization for 16 s at the following temperatures: 68 (G1), 73 (G2), 78 (G3), 85 (G4) and 100 °C (G5). In addition, homogenized goat milk was heated under batch conditions at 90°C for 5 min (S6). Experiments were performed in triplicate. Denaturation of whey proteins was determined by the Kjeldahl and RP-HPLC methods, ALP and LPO activities according to ISO 3356/IDF 63 and ISO/TS 17193 /IDF/RM 208, respectively, rennet clotting behavior by Formagraph procedure and yoghurt-type gels were prepared with yoghurt starters and incubation at 43 °C. At 85 °C and at 100 °C for 16s, >50% and >90% average loss of native  $\beta$ -lg was observed, whereas the reduction of soluble nitrogen was approx. 35% and 45%, respectively. Under these conditions, the average rennet clotting time increased from 12.30 min in raw milk to 15.5 and 17.4 min, whereas curd consistency decreased from 34.20 to 22.5 and 17.3 min, respectively. ALP in raw goat milk (G0) was  $324.52 \pm 47.28$   $\mu$ g phenol/ml and its residual activity after pasteurization (G2) was 0.07% of the initial. LPO of G0 milk was  $199.31 \pm 6.71$  U/L, which was completely inactivated at 85°C for 16s. The development of acidity was significantly retarded during the incubation of G2 and G3 milks and the same was true for the water holding capacity of the gels compared to batch-heated G6 goat milk (G6).

## Alternative splicing events expand molecular diversity of camel $\alpha$ 2-casein, increasing its ability to generate potentially bioactive peptides

Alma Ryskaliyeva, Celine Henry, Guy Miranda, Bernard Faye, Gaukhar Konuspayeva, Patrice Martin

### *Abstract*

Milk contains bioactive and health-promoting compounds affecting physiological functions or reducing disease risk. Several properties assigned to camel milk, which is traditionally used as therapeutic adjuvant in some infectious or metabolic diseases, seem to be related to the protein fraction. Indeed, substantiated or potential bioactive protein components have been found, encrypted in milk protein sequences. In a previous study on camel milk from Kazakhstan, we reported the occurrence of two unknown proteins (UP1 and UP2) with different levels of phosphorylation. We showed that these proteins are isoforms of  $\alpha$ 2-casein (called here  $\alpha$ 2-CNsv1 and  $\alpha$ 2-CNsv2, respectively) arising from alternative splicing events. First described as a 178 amino-acid long protein carrying 8P groups (Kappeler et al., 1998), the major camel  $\alpha$ 2-CN isoform has a molecular mass of 21,906 Da.  $\alpha$ 2-CNsv1 appeared as a rather frequent (35%) isoform displaying a higher molecular mass (+1,033 Da) with four phosphorylation levels (8P to 11P). Using cDNA-sequencing,  $\alpha$ 2-CNsv1 was shown to be a protein variant arising from the splicing-in of an in-frame 27-nucleotide sequence, flanked by canonical motifs defining an additional exon, encoding the nonapeptide ENSKKTVDM, which corresponds to the bovine exon 13. Its presence was confirmed at the genome level.  $\alpha$ 2-CNsv2, which was present with 8P to 12P, was identified by LC-MS/MS as an isoform including an additional decapeptide (VKAYQIIPNL), encoded by a 3'-extension of exon 16. Since milk proteins represent a reservoir of biologically active peptides, capable of modulating different functions, the molecular diversity generated by differential splicing mechanisms might increase its content. To evaluate this possibility, we searched for bioactive peptides encrypted in the different camel  $\alpha$ 2-CN isoforms, using an in-silico approach. Several peptides, putatively released from the C-terminal part of camel  $\alpha$ 2-CN isoforms after in silico digestion by proteases from the digestive tract, were predicted to display anti-bacterial and antihypertensive activities and might be involved in some of the healthy properties of camel milk.

## Comprehensive Proteomic Analysis of Camel Milk-derived Extracellular Vesicles

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### Abstract

Milk is a complex biological fluid in which supramolecular structures (casein micelles and milk fat globules) are present beside lactose, minerals, vitamins and soluble whey proteins, as well as somatic cells. It was recently shown that milk also contains extracellular vesicles (EVs) that are released by mammary cells and recognized as a novel mechanism of mother-to-neonate transmission of information and regulatory molecules. EVs were recovered from the milk of *C. dromedarius*, *C. bactrianus*, and hybrids from Kazakhstan, by optimized density gradient ultracentrifugation. They were visualized by transmission electron microscopy and characterized using nanoparticle tracking analysis. Purified EVs had a heterogeneous size distribution with diameters ranging between 25 and 170 nm, with average yield of  $9.5 \times 10^8$  -  $4.2 \times 10^{10}$  particles per milliliter of milk. Combining classical and advanced proteomic approaches (LC-MS/MS), a comprehensive proteomic analysis of camel milk-derived EVs was performed from the milk of 24 camels (*C. bactrianus*, n=8, *C. dromedarius*, n=10 and hybrids, n=6). A total of 1,015 unique proteins involved in different biological processes were thus identified, including most of the markers associated with small EVs, such as CD9, CD63, CD81, HSP70, HSP90, TSG101 and ADAM10. Camel milk-derived EV proteins were classified according to biological processes, cellular components and molecular functions using gene-GO term enrichment analysis of DAVID 6.8 bioinformatics resource. Camel milk-derived EVs were mostly enriched with exosomal proteins. The most prevalent biological processes were associated with exosome synthesis and secretion processes (such as intracellular protein transport, translation, cell-cell adhesion and protein transport, as well as translational initiation) and were mostly engaged in molecular functions such as Poly(A) RNA and ATP binding, protein binding and structural constituent of ribosome. These results provide information on milk-derived EVs proteome paving the way for new avenues of investigation into the function of these vesicles concerning the mammary gland physiology and the health-benefit value of camel milk.

## New Processing Technologies from the Buffalo Milk

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### *Abstract*

Buffaloes are the second largest source of milk supply in the world. In India nearly half of the milk processed by the organised dairies comes from buffaloes. Buffalo milk has several technological advantages over cow milk, owing to better physiochemical constituent as compared to cow milk. Recently new processing technologies and products has been successfully developed from the buffalo milk for manufacture of variety of condensed and dried milk products using buffalo milk. In addition to regular products, processed have been developed for making infant milk foods, other dehydrated and formulated products like dried ice-cream mix, dried cream, butter powder, dahi powder, Shrikhand powder, khoa powder, tea and coffee complete, mango milk powder and chocolate milk powder, etc. Buffalo milk has been used for the production of a wide range of fermented milk products such as dahi, lassi, chhach, mishit doi, Shrikhand in India. Yoghurts made from buffalo milk are naturally thick set without having to add milk proteins or gelling agents. UHT processed buffalo milk and cream are whitener and more viscous than their cow milk counterparts, because of conversion of greater levels of calcium and phosphorus into the colloidal form, buffalo milk is, therefore more suitable for the production of tea and coffee whiteners than cow milk. Higher innate levels of proteins and fat render buffalo milk more economical alternative to cow milk for production of casein, caseinates, whey protein concentrates, a wide range of fat-rich dairy products. Cheese made from buffalo milk displays typical body and textural characteristics. More specially, where chewing and stringing properties are specially desired as in case of mozzarella cheese.

## A continuous UV-C light technology as a promising novel non-thermal processes to maintain a safe and superior quality donkey milk freeze-dried powder

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### Abstract

Donkey's milk is considered to be the best alternative to human milk especially for cow's milk protein allergy infants due to its chemical composition (nutrients and bioactive compounds), good palatability and clinical tolerability. These milk components include constituents with antimicrobial, anti-inflammatory, antioxidant and immunomodulatory activities that could be adversely affected by thermal treatments such as pasteurization. As a result of the growing interest for minimal processing of foods in recent years, the primary aim of the study was to produce a minimally processed freeze-dried donkey milk powder. The inactivation of milk-borne pathogens and spoilage bacteria by a non-thermal turbulent flow UV process was compared to the conventional thermal pasteurization process. Raw donkey milk was inoculated with the following bacteria at an initial concentration of  $10^5$  cfu/ml for *L. innocua* (NCTC 11288), *S. aureus* (NCTC 6571), *B. cereus* (NCTC 7464), *Cr. sakazakii* (NCTC 11467), *E. coli* (NCTC 9001) and *Salmonella enteritidis* (NCTC 6676) and exposed to UV radiation using a research-scale, low-power UV unit SP-1 (SurePure Inc). The unit contains a UV bulb and an optically pure quartz sleeve separating milk from the UV bulb. Inoculated milk was exposed to a UV dose range between 0 to  $4000\text{J L}^{-1}$  at a flow rate  $4000\text{L h}^{-1}$  in order to determine the minimum UV dosage. Samples were collected after each UV dosage and microbiologically tested using selective media. Results showed that a UV dose of  $1000\text{J L}^{-1}$  was able to reach a 5-log reduction of all bacteria tested. The second objective is to evaluate any effect on composition (Vitamin D3, lysozyme, immunoglobulins) and on biological activity (antioxidant, antimicrobial and ACE-inhibitory activity, cytokine production) upon application of an enzymatic *in-vitro* digestion model (INFOGEST 2.0) mimicking the human gastrointestinal system of freeze-dried donkey milk powder produced from raw, pasteurized and UV-C treated donkey milk.

## Testing a commercial $\beta$ -galactosidase for the production of lactose-free goat's milk yogurt

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### Abstract

Worldwide demand of goat's milk yogurt has increased because of its benefits to health. About 70% of world population presents  $\beta$ -galactosidase deficiency, predisposing to lactose intolerance. Milk fermentation reduces lactose content, but significant amounts still persist in yogurt. Lactose-free dairy products are available to lactose intolerant individuals. Production of lactose-free yogurt relies on  $\beta$ -galactosidase (lactase) enzyme addition which hydrolases lactose into glucose and galactose. The present is a preliminary laboratory study aimed to assess the dose of a commercial lactase necessary to produce lactose-free goat's milk yogurt (lactose <0.1 g/100 g). Raw goat milk was heated at 85°C for 20 min. After heat treatment, milk was cooled to 41±1 °C and added with freeze-dried starter culture consisting of *Streptococcus salivarius subsp. thermophilus* and *Lactobacillus delbrueckii subsp. bulgaricus*. Milk was aliquoted into 100 mL flasks and submitted to either of 5 treatments: addition of lactase in concentration of 0.3 g/L, 0.6 g/L, 1.0 g/L, 1.4 g/L, respectively and no lactase (negative control). Flasks were incubated at 41±1 °C for 4 hours. After incubation, fermented milk was transferred into vials and cooled to stop lactase activity. Determination of residual lactose content was performed by enzymatic method using differential pH measurement according to ISO 26462:2010/IDF 214:2010. The experiment was conducted in three independent trials using triplicate samples for each treatment. Lactose content after 4 h incubation was 4.69±0.0 g/100 mL in negative controls, below the limit of detection (0.06 g/100 mL) in samples added with 0.6, 1.0 and 1.4 g/L of lactase while ranged between <0.06 and <0.1 g/100 mL in samples added with 0.3 g/L. Our results support the conduction of specific trials at the plant aimed to validate the efficacy of lactase at 0.3 g/L during industrial yogurt production

## Fermentation products of bacteria isolated from koumiss

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### Abstract

Koumiss is a traditional drink made from fermented mare milk consumed in many Central Asian countries, especially Kazakhstan. Currently, the number of farmers producing koumiss by modern dairy technological way is growing in Kazakhstan. Therefore, research on koumiss starter cultures has become of great applied interest. Koumiss fermentation occurs spontaneously and involves strains of lactic bacteria and yeast which give it its characteristic taste appreciated by consumers, namely slightly acid, gaseous, and low alcohol content (below 3% ethanol). The physiological and biochemical properties of strains isolated from koumiss are rarely described in literature. In this study, two lactic acid bacteria strains isolated from Kazakhstani koumiss (Almaty region farms) *Lactobacillus kefir* and *L. casei* were characterized for their fermenting characteristics: growth kinetics, volatile (VOC) and non-volatile compounds produced. Bacteria were grown on MRS medium with addition of different sources of carbon (glucose, galactose, and lactose at 30 g·L<sup>-1</sup>) and on mare milk. Final products (ethanol, lactic acid, and residual carbohydrates) were analyzed using HPLC with Refractive Index Detector. The VOC analysis was performed using Gas Chromatography coupled with Solid-Phase Micro-Extraction. Growth rates reached 0,25 ± 0,006 h<sup>-1</sup> for *L. kefir* and 0,99 ± 0,001 h<sup>-1</sup> for *L. casei* at 30 °C and 37 °C respectively. The main difference in their metabolism was that *L. kefir* produced a maximal ethanol content of 10,8 g·L<sup>-1</sup> in MRS broth containing glucose, while *L. casei*, produced 12,6 g·L<sup>-1</sup> and 26,5 g·L<sup>-1</sup> of ethanol in MRS broth containing galactose and lactose respectively. The main VOCs from mare milk fermentation with *L. kefir* were Pentanoic acid (27%) and Isoamylalcohol (20%), while *L. casei* produced high amounts of Acetaldehyde (26%) and Acetic acid ethyl ester (24%). These findings will be used to characterize more precisely the growth kinetics of both bacteria and their metabolite production kinetics and to build a mathematical model of koumiss fermentation.

## Can MIR spectra be used to predict the fine composition of dairy sheep milk?

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### *Abstract*

Mid-infrared (MIR) spectra technology offers more and more possibilities for milk characterization beyond routine measurements such as fat or protein contents. However, it is still little used in France to predict the fine composition of dairy sheep milk. Thus, from 2017 to 2019, the French National Committee for Dairy Sheep (CNBL) has carried a research & innovation program (MIROL) whose ultimate goal is to build the basis for large-scale use of MIR spectra. One of the key point of MIROL was to check whether the existing equations were usable. 474 flock's milk samples were collected every 15 days from 38 farms representing the diversity of French dairy sheep systems. Reference analyses were carried out on some of these milks to measure the accuracy of the available equations and possibly to propose new ones. Concerning the fatty acid profiles, the correlations between the reference and the predicted value were between 0.8 to 0.9 with an error of a few percent for the most represented families of fatty acids. It seems necessary to improve the existing equations for their use in dairy ewes. Concerning milk caseins, we were able to propose a new equation based on MIR spectra with an interesting degree of precision ( $R^2 = 0.94$ ). Moreover, the analyses performed allowed us to explore the variability of the fine milk composition of dairy sheep milk during the year and according to the farming systems.

## Effect of salting and ripening conditions on the characteristics of a reduced-fat semi-hard cheese manufactured from a mixture of goat milk with skimmed cow milk

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Laboratory of Dairy Research, Department of Food Science and Human Nutrition, Agricultural University of Athens and DELTA Dairy Industry SA

### *Abstract*

The objective of the present study was the manufacture of semi-hard reduced-fat cheese from a mixture of goat and skim cow milk heat-treated at 72°C for 10 min. The salting in brine resulted in two groups of cheeses symbolized as A and B with reduced and normal salt content respectively. After stay at 15°C for 9 days and vacuum packaging cheeses of both groups were differentiated according to further ripening treatments. Cheeses Aa and Ba were ripened at 15°C up to 28 d and then at 10°C up to 54 d, while counterparts Ab and Bb were ripened at 10°C up to 54 d, before transfer at 4°C. The experiments were carried out in triplicate. Cheese samples were analyzed in respect to physicochemical composition, quantitative and qualitative features of proteolysis and textural profile, mineral fraction and organoleptic properties. Cheese milk mixture and treatment combined with the applied cheese making conditions resulted in stable cheese curd. Statistically significant effects of ripening conditions on the studied parameters were scarce, whereas salting affected some of them. In fact, the factor, which affected significantly ( $P < 0.05$ ) the most part of cheese features was the stage of ripening. Reduced-salt cheeses A had significantly higher ( $P < 0.05$ ) moisture,  $\alpha_w$  and MNFS, similar concentration of free amino groups and less hardness than the respective B cheeses. The ripening temperature affected significantly ( $P < 0.05$ ) the proteolysis rate expressed as accumulation of hydrophilic and decrease of hydrophobic peptides in cheese water-extract. The organoleptic scores of all cheeses were high and did not differ significantly; however, both cheeses Ab and Bb ripened at 10°C were the most accepted. Textural defects and bitterness were not detected in any cheese. Finally, PCA analysis showed that gross composition and quantitative assessment of RP-HPLC profiles were adequate for the thorough study of the effect of various factors.

## **Cross flow microfiltration of ovine whey derived from the manufacture of Feta and Gruyere-type cheese: Effect on chemical composition and microflora**

Ekaterini Moschopoulou, Kyriaki-Eirini Moschou, Golfo Moatsou, Evaggelia Zoidou

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### *Abstract*

Membrane technology has been applied to the food industry over the last 30 years and is a cost-effective solution to separate components.

The aim of this research work was to study the effect of cross-flow microfiltration through ceramic membranes with pore size 1.4  $\mu\text{m}$  on components of ovine whey derived from soft and hard cheese. More specifically, the effect on chemical composition, minerals, whey proteins, pH and acidity, microbiological composition and carbohydrates was examined. The samples analyzed were whey derived from Feta cheesemaking (sample FW) and Gruyere-type cheesemaking (sample GW) as well as the corresponding permeates and retentates.

The whey obtained from the hard cheese manufacture was significantly ( $P < 0.05$ ) richer in fat, protein, calcium, and total solids content than whey obtained from the soft cheese. Cross-microfiltration through the 1.4  $\mu\text{m}$  membrane pores decreased significantly the fat and total solids contents of both permeates that of FW and GW. As for fat, a reduction of 1.65% to 0.14% was achieved for GW and from 0.45% to 0.06% for FW. No effect on minerals and whey proteins was observed. Furthermore, microfiltration did not affect neither the pH and the lactic acid contents nor the main carbohydrates, such as lactose, glucose, and galactose. Finally, it reduced the population of total mesophilic flora, thermophilic lactococci and lactobacilli by 3-5 log cycles, while it eliminated the populations of yeasts, fungi, and coliforms.

In conclusion, cross microfiltration of whey through ceramic membranes with pore size 1.4  $\mu\text{m}$  affected its biochemical properties in the same way no matter its source.

## Use of buttermilk in the manufacture of reduced-fat sheep milk cheese

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### *Abstract*

The objective of the present work was to study the effect of the enrichment of reduced-fat sheep cheese milk with sheep sweet buttermilk on semi-hard cheese manufactured from them. For this purpose, butter was produced from non-acidified sheep milk cream and the resultant sweet buttermilk was lyophilized (SSB). Cheeses made from i. full-fat, ii. reduced-fat and iii. reduced-fat with SSB sheep milk were manufactured in triplicate experiments. The main elements of the applied technology were: moderate temperatures during cheesemaking, curd-washing, packaging at 6 days and ripening at two different temperatures. Cheeses were analysed in regard to gross physicochemical composition, textural profile, RP-HPLC of the water-soluble fraction, mineral profile, colour, meltability and organoleptic evaluation. Compared to control full-fat cheese, the duplication of protein to fat ratio in the reduced fat cheeses did not affect their stability and organoleptic scores. The enrichment with SSB increased significantly ( $P<0.05$ ) cheese moisture and MNFS, without affecting pH and salt-in-moisture. Textural analysis parameters of SSB reduced-fat cheese were significantly different ( $P<0.05$ ) compared to reduced-fat counterpart. Moreover, SSB addition affected positively the cheese colour parameters and organoleptic scores. Finally, the use of SSB combined with ripening under packaging and decrease of ripening temperature affected positively the characteristics of sheep milk reduced-fat cheese.

## Use of antimicrobial proteins of donkey milk as preservative additives in production of dairy products

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### *Abstract*

Antimicrobial preservation techniques can be applied in order to increase the shelf life, and retard the development of harmful microorganisms and food spoilage, while preserving the structure, nutritional value, taste and flavor of the food. Nowadays, the use of natural ingredients as alternative to chemical additives in food industry is rapidly becoming widespread due to the increasing concern of consumers about the usage of chemical ingredients.

Lysozyme, a natural enzyme, is known to have antimicrobial effects on many microorganisms. The studies we carried out previously showed that lysozyme was found in high amounts (approx. 1 g/L) in donkey milk. In this study, lysozyme was extracted from donkey milk and purified with lysozyme suppressed PHEMA based composite cryogel columns in Fast Pressure Liquid Chromatography (FPLC). Purification degree of extracted components were checked by SDS-PAGE according to their molecular weights. The SDS-PAGE pattern showed that the molecular weight of extracted lysozyme from donkey milk was nearly 12-13 kDa. Lysozyme activity was assayed by turbidimetric and fluorescence-based methods at 450 nm with hen egg white lysozyme as standard and determined in the range of 163.7-180.30 U/ml. The extracted lysozyme also showed very good performances within wide pH and temperature. Extracted and purified enzyme subsequently applied to Kashar cheese as coating material and used in spray form in yoghurt as antimicrobial material. The obtained products were compared with the control products with respect to their physicochemical, textural, sensory and microbiological properties. The obtained results demonstrated that both products exhibited lower microbial counts and better physicochemical and sensorial properties throughout the production and ripening periods. The results of this study highlight lysozyme extracted from donkey milk has a potential usage as antimicrobial agent for extending the shelf-life of products.

## Semihard goat milk cheese: composition, sensory and rheological properties during ripening and storage

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### *Abstract*

Semihard goat milk cheese was produced using the following cheesemaking technology: goat milk was pasteurized and starter culture was added and incubated for 30 min. Milk clotted by liquid rennet and 45 min. later, the curd was cut into cubes of 3-4 cm<sup>3</sup> size. The curd and whey were stirred for 10 min followed by an increase of temperature from 35 to 40° C, under stirring, until the desired firmness of curd particles was obtained. The curd was left to rest for 5 min., transferred into moulds and pressed for 90 min. with inversion every 30 min. After overnight hold at 16 ° C, the cheese was immersed into 18% w/w NaCl brine for 24 hours. Then it was transferred to the ripening room for 30 days maturation at 15-16° C and stored at 3-4° C for 180 days. The cheese was packaged in polyethylene bags under vacuum at 20 days of ripening to avoid yeast-moulds spoilage. The starter culture used was a mixture of mesophilic and thermophilic LAB. The composition, sensory and rheological properties of cheese were investigated during ripening and storage. At 60 days cheese had pH 5.02, moisture 43.61%, fat 28.27%, protein content 22.40% and yield 14.93%. pH increased slightly while protein decreased slightly during storage probably due to proteolysis. The salt and total free fatty acids content were 1.5% and 1.28% respectively at 180 days. The sensory scores for appearance, body and texture and flavor of cheese at 60 days were 9.17 (max. 10), 36.27 (max. 40) and 43.97 (max.50) respectively. The panelists commented a light yellow color, a soft elastic texture and a pleasant taste of cheese with a slight bitterness that is balanced by creamy buttery notes. The rheological properties i.e. hardness, force to fracture, cohesiveness, springiness, gumminess and chewiness were decreased during storage.

## Physical-chemical and microbiological characterization of donkey milk and its application in the processing of yogurt

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### *Abstract*

Interest in evaluating the characteristics of donkey's milk is growing. Previous studies show a composition similar to that of breast milk, good tolerability and palatability, and the absence of allergens. Despite these benefits, donkey milk has not yet been industrialized, which may be due to the little information available to consumers. This is the case of Peru, so to encourage its industrialization, it is necessary to characterize it and then adapt it to the processes that are carried out in the production of dairy products. The objectives of this study were to evaluate the changes in the physical-chemical and microbiological characteristics of donkey milk during the lactation period (180 days). The treatments were divided into six periods (30 days), counted from day 30 after delivery. Likewise, in the processing of yogurt, six treatments were carried out in which the percentage of milk solids was varied from 9.0 to 11.5. In the milk pH, density, acidity, total solids, fat, and cryoscopic point were evaluated. The determination of the content of lactose, total protein, calcium, and magnesium was also carried out. In the microbiological analysis, viable mesophilic aerobes and total coliforms were counted, both in CFU / ml. The results indicated that the values of pH, density, acidity, and lactose content remain constant during the lactation cycle, with averages of 7.00, 1.034 (g / ml), 0.049 percent (lactic acid), and 5.92 percent, respectively. The total solids were decreasing as the lactation days increased, presenting values of 10.79 and 8.96 percent, in the first and sixth period, respectively; the same behavior was shown by proteins, calcium, and magnesium, with initial values of 2.50 percent, 864.5 ppm, and 146.9 ppm, and final values of 1.27 percent, 690.1 ppm, and 82.3 ppm, respectively. The fat content showed a variable behavior, increasing at the beginning and then decreasing, presenting an average value of 0.24 percent. In the case of the cryoscopic point, the values increased, presenting an initial value of -0.674 °C and -0853 °C, in the last period. The values obtained were very close to those indicated by previous studies carried out, except for the magnesium content, which could be attributed to the breed and / or feeding of the animal. In the microbiological results, a count <10 CFU / ml was obtained for total coliforms, and between 10 and 20505 CFU / ml, in the case of viable mesophilic aerobes. Total solids, cryoscopic point, total protein, calcium, and magnesium concentrations showed variations during the evaluation period. In the treatments for the processing of yogurt, it was concluded that it is possible to make this product as long as the amount of milk solids is increased.

## Physicochemical and sensory properties of yogurt types made from ahabadi goat's milk (probiotic, pineapple nectar, cow's and goat's milk mixture)

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<sup>1</sup> Agricultural and Natural Resources Research Center, Urmia, Iran, <sup>2</sup> Animal Science Research Institute of Iran, Karaj, Iran,

### Abstract

The objective of the present study was to improve the sensory characteristics of goat's milk yogurt. A total of 4 treatments were performed: control, probiotic (0.02% *Lactobacillus acidophilus* LA-5 and *Bifidobacterium lactis* BB12), pineapple nectar (20%), and a mixture of 50% goat's milk and 50% cow's milk, were used to prepare yogurt by Mahabadi goat's milk. Physicochemical and sensory properties, as well as the viability of probiotic were evaluated during 28 days of storage at 4°C.

Total solids in the yogurt samples containing pineapple nectar decreased and, in 3 others increased. Fat and protein in yogurt samples did not change during storage. The pH of samples had a decreasing trend for 21 days and increased significantly on the 28<sup>th</sup> day ( $p < 0.05$ ). The acidity of samples increased significantly and insignificantly by 21 days. Syneresis in pineapple nectar yogurt increased until the 7<sup>th</sup> day and then decreased. In 3 other yogurt samples, syneresis increased until the 2<sup>nd</sup> week and then decreased significantly ( $p < 0.05$ ). The water holding capacity of all yogurt samples decreased initially and then increased. Viscosity increased in all samples until day 7<sup>th</sup> and then decreased significantly ( $p < 0.05$ ). The number of probiotic bacteria in probiotic yogurt increased significantly until the 14<sup>th</sup> day and then dropped significantly ( $p < 0.05$ ). The highest overall acceptability score belonged to the yogurt samples made of a mixture of cow's and goat's milk. The results of the current study indicated that the addition of probiotic bacteria, pineapple nectar, and cow's milk to Mahabadi goat's milk significantly improved the sensory characteristics and covered the goaty taste of goat's milk yogurt while maintaining its quality characteristics.

## Characterization of traditional Kefalotyri cheese

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### *Abstract*

A very popular, artisanal Kefalotyri hard cheese is still manufactured traditionally in the mountains of Pindos without starter cultures, using an artisanal cheese-making procedure. The objective of the present study was to characterize this traditional Kefalotyri cheese. Sheep raw milk was used without starter culture addition for Kefalotyri cheese manufacture. At 90 days of ripening and storage (date that a hard cheese can be sold in the market), Kefalotyri cheese had moisture 40.46%, fat 28.83%, fat-in-dry matter 47.89%, salt 4.12%, proteins 23.33% and ash content 6.39%; pH 5.23, water activity 0.913, proteolysis index (100 x Water Soluble Nitrogen /Total Nitrogen) was 18.76%; while butyric acid and 3methyl butanoic acid were the most abundant volatile compounds. The results indicate that the manufacturing method should be standardized in order to fulfill the requirements of the Greek legislation for a hard cheese and could establish a scientific basis for improvements in the quality of this variety with the aim of producing a consistent, safe Kefalotyri cheese with a traditional aspect.

The authors thank the Region of Epirus, Greece for the financial support of this study.

## Ovine Ice Cream made with addition of Whey Protein Concentrates of Ovine - Caprine origin

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### *Abstract*

A common practice in ice cream making is the use of milk powders to increase the non-fat milk solids. In this study, the substitution of bovine skimmed milk powder (SMP) with whey protein concentrates (WPC) of ovine/caprine origin in the manufacture of ovine ice cream with 5% fat was investigated. Three ice cream mixes were prepared using ovine skimmed milk, ovine cream, stabilizers/emulsifiers, sucrose : fructose at a ratio 50:50 and bovine SMP (ice cream A; control product) or WPC containing 65% protein (ice cream B) or WPC containing 80% protein (ice cream C). All ice cream mix or products were analyzed for their composition,  $\alpha_w$ , freezing point, color, overrun, hardness and melting rate. In addition, they were organoleptically evaluated.

Results showed that the protein content of ice cream C was significantly ( $P<0.05$ ) higher than ice cream A, while lactose content of both, ice cream B and C were significantly ( $P<0.05$ ) lower.  $\alpha_w$  value of both B and C ice cream mix was lower than of ice cream A whereas the latter presented significantly ( $P<0.05$ ) lower freezing point. Regarding the melting rate, it was lower in the case of ice creams B and C than in ice cream A. On the other hand, the WPC addition decreased significantly ( $P<0.05$ ) the overrun from 76% (ice cream A) to 46% (ice cream B) and 36% (ice cream C) and increased significantly ( $P<0.05$ ) the hardness of ice cream C. Color was also affected since ice cream A was significantly brighter, while ice creams B and C were more yellowish. Finally, regarding the flavor, ice cream A obtained higher scores.

In conclusion, totally substitution of bovine SMP with ovine/caprine WPC in ovine ice cream manufacture seems to be feasible although further study is needed to optimize the overrun.

## **The study the antimicrobial activity of peptides delivered from mare whey proteins**

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### *Abstract*

The goal of the given article is to study the antimicrobial properties of whey protein hydrolyzates on *E. coli* culture. The results presented that the synergistic antimicrobial activity of the enzymatic hydrolysates of whey proteins on pathogen cultures is concentration dependable. Fractionation of 120 min hydrolysate by pepsin showed significant antibacterial activity. Based on the results of the present study, it can be concluded that the enzymatic hydrolysates of the native proteins derived from mare whey have antibacterial ability. This study suggested that the Kazakhstan mare's milk has antibacterial activity and may be candidate for pharmaceutical studies as a purpose of producing antibacterial agents based on biologically active peptides.

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## Why do Somatic Cell Counts (SCC) in Goat Milk matter?

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### *Abstract*

Some particles in goat milk will have cell membrane without DNA due to apocrine secretion. These cytoplasmatic particles will be counted in particle count equipment, but not in DNA staining techniques. SCC in goat milk is usually higher than in cow milk. The median SCC in Norwegian Goat Control is 390,000 while SCC in cows are 60,000 per ml. BMSCC in goat have a median on 820,000 while cow have 120,000 per ml in Norway. Both udder infection, parity, lactation stage, seasonality and breeding period are associated with variation in SCC in goat milk. SCC in *Staphylococcus aureus* infected goats are from 1.5 to 3 millions or more, while SCC in NAS infected goats are from 1.5 to 1.9 million in mean. Uninfected goats have a mean around 600,000 cells per ml. The variation is huge. The increase in SCC with increasing parity is: 234,000 in 1<sup>st</sup>, 316,000 in 2<sup>nd</sup>, and 800,000 to 1,2 million in higher parities. There is a higher level of SCC in the first 14 days, lowest around 30 days in milk and then increasing onward. Several countries report higher SCC during pasture in the summer, and during breeding time. The association of late lactation, summer and breeding is more pronounced in infected animals. Yield decreases 8 to 10 % with increasing SCC depending on lactation stage and parity. Protein content in milk is decreasing at an increasing level of SCC until 200-300,000, however, at higher SCC protein content increases. This increase is probably due to increased immunoglobulin and a decrease in casein. The lactose content is also decreased with increasing SCC. It is a big unsolved question, how does this influence cheese quality, taste, self-life of products, and where should the limits be set for quality payment systems in the dairy industry?

## Improving small ruminants' production

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### *Abstract*

Increased world population, urbanization, and a higher standard of living, combined with shortage of land and water and high cost of labor, necessitate the improvement of food production efficiency. Small ruminants are ubiquitous all over the world as a source for animal protein and have traditionally been raised on marginal resources with low productivity. Sheep and goats produce meat and milk, and by changing the emphasis to either of these purposes according to market conditions it is possible to improve economic outcomes. In order to achieve optimal production precise management is essential. This kind of management requires precise scheduling of diverse activities in the herd and data-based adjustments. We present new useful management tools for dairy sheep and goats. "Sheeping" is a cloud-based management software which enables farm managers to analyze herd performances (like daily milk production, conception rate, litter size etc.) according to different interventions and helps take appropriate actions. It is also possible to compare herd performances to other farms with an overview for professional consultants in order to suggest needed improvements. "Farmdesk" is a software that automatically processes levels of milk production and constituents and enables immediate interpretation and adjustment of ration accuracy. We show examples of improved results achieved by these means.

## Management of *Listeria monocytogenes* risk during cheese-making and shelf life of Mozzarella di Bufala Campana PDO cheese

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### *Abstract*

The presence of *Listeria monocytogenes* in Mozzarella di Bufala Campana (MBC) PDO cheese, recently notified at retail, suggested to reevaluate the steps of cheese-making able to control the associated risk. While milk pasteurization is the usual CCP, the lethal effect of cheese curd stretching with boiling water should be better understood, as its management is aimed to obtain the typical fibrous cheese structure but microbial count reduction is only an expected and variable secondary effect. So, to predict the lethal effect of curd stretching according to the applied conditions by each dairy, the knowledge of the kinetic parameters of *L. monocytogenes* heat inactivation ( $D_t$  and  $z$ ) in cheese curd becomes crucial. Similarly, knowledge of  $D$  and  $z$  of *L. monocytogenes* in tap water, brine and covering liquid will help to more efficiently manage the heat treatment of these fluids potentially contaminating MBC cheese surface after molding during the steps of cheese hardening, brining and packaging. Results obtained in the range from 60 to 70°C for times up to 30 min showed the relevance of the medium in determining a significant different heat resistance of *L. monocytogenes*.

To increase the knowledge about mechanisms of post-contamination, the potential pathways of contamination among cheese and the fluids occurring after molding were studied, simulating different conditions. The ability of *L. monocytogenes* to be transferred from a contaminated fluid to the cheese surface, its adhesion and viceversa were demonstrated. Challenge tests performed at refrigerated temperature confirmed the inability of *L. monocytogenes* to grow within 30 d, but also its ability to survive. A possible competitive role of microflora transferred from MBC surface to covering liquid in controlling *L. monocytogenes* growth was evidenced.

Heat treatment of all the fluids involved in MBC processing may be an important contribute to risk reduction

## Prevalence and characterization of *Yersinia enterocolitica* detected from sheep and goat raw milk and cheese making plants

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### Abstract

*Yersinia enterocolitica* is a food-borne pathogen, with the ability to contaminate raw milk, milk products and production plants environments. Aim of the present study was to evaluate the prevalence of *Y. enterocolitica* in sheep and goat raw milk and industrial cheese-making production plants in Sardinia (Italy). During two years, 738 samples were collected from bulk milk tanks: 507 raw sheep milk samples (from 341 farms) and 231 raw goat milk samples (from 120 farms). Moreover, 175 samples were collected from two industrial cheese making plants (A and B), including raw milk filters and along different production lines (from food contact and non-food contact surfaces). All samples were tested for *Y. enterocolitica* presence by cold enrichment (14 days). Species identification and determination of virulence profile were carried out by two different PCR (16S rRNA, *ail*, *inv*, *ystA*, *ystB* genes). A subset of isolates was further submitted to bio and serotyping. *Y. enterocolitica* was identified from 24/231 (10.4%) goat milk samples and 21/507 (4%) sheep milk samples. *Y. enterocolitica* was detected from both cheese-making plants with a prevalence of 2/62 (3.2%) in plant A and 13/113 (11.5%) in plant B. particularly, the pathogen was detected from floors and floor drains of different areas and from one raw milk filter. Bio-serotyping of *Y. enterocolitica* isolates identified only biotype 1A. All the strains showed the presence of at least one virulence gene: 14/58 (24.1%) harboured *ystB* gene, 43/58 (74.1%) *ystB* and *inv*, and 1/58 (1.7%) *ail*, *ystA* and *inv*. Few data are available for *Y. enterocolitica* prevalence in milk, particularly sheep and goat milk. Our study showed a high prevalence of potential pathogenic *Y. enterocolitica*, especially in raw goat milk. The presence of this pathogen in raw milk and cheese-making plants can represent a zoonotic risk.

## CapriMam3D - 3D technologies to improve goat milking

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### Abstract

A significant rise in herd-level somatic cell counts in recent decades in French dairy goat herds has led to a great deal for research. The main etiology of mastitis has been identified as *Staphylococcus spp*, which suggests an important role of all aspects of milking management (hygiene, passive or active contamination, cluster and liner fit to udder and teat morphology, aggression associated with machine setting, over-milking and rough-handling of the udder).

The CapriMam3D project, starting in January 2020, investigates different ways to improve milking conditions in order to minimize the risk of developing intramammary infections. It deals with the animal-machine diptych as a central element of milking and it is based on three-dimensional technologies (3D imaging and printing).

This 36-months project has two operational objectives. Firstly, the project will develop a mobile device for three-dimensional goat udder phenotyping. The objective is to replace visual scoring (measurement and observation by an approved technician) and, consequently, to obtain objective automated phenotypes of udder and teat conformations. This will also give the opportunity to include new measurements of dimensions and volumes. This device will also be used to assess the udder and teat shape changes, particularly during milking, suspected of causing incidents (especially air intakes) that contribute to the transmission of infections.

The second objective of the project is to develop, in our "Milking and Milketers" ICAR laboratory, a model to study interactions between teats and teatcups, as a first step to compare and, in the future, to adapt milking equipment to animal characteristics. Using 3D technology, this model will occur in 2 steps 1) develop flexible artificial teats representative of goat mammary conformations, 2) adapt the methods currently applied for cow teatcup characterization to the specific characteristics of goats (shape, milk emission characteristics).

The tools and methods developed are intended to be deployed for a large-scale implementation at the end of the project. They should also benefit other dairy ruminant sectors.

## Oxytocin release as good indicator of milking efficiency in camels

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### Abstract

Camels are now managed more intensively to answer increased market demand, and recently manual milking is giving way to mechanical milking. At this stage, milking parlors, equipment and machine settings are mainly derived from those used for dairy cows with more or less empirical adaptation.

We developed the first oxytocin (OT) enzyme immunoassay to camels to objectively determine the efficiency of physiological stimulation induced by mechanical milking in camels (Marnet et al, 2018). This experiment aimed to compare machine milking and suckling efficiency in camels.

Six dromedary camels were acclimated to frequent handling in order to reduce stress related to manipulation during blood sampling episodes. OT concentrations were determined before, during and after two different natural calf suckling episodes by jugular blood venipuncture at -2; -1; -0,5, 0; 0.5; 1; 2; 5; 10; 15 and 30 min (OT release patterns) . Three weeks later, after training of camels to human manipulation, parlor entry, milking by hand then by machine in a mixed management of suckling and milking, blood sampling were done again during two episodes of machine milking in parlor, without young aside mothers, using the same sampling frame. Milking machine settings were 60 pulsation/min and 60% ratio using a vacuum of 48 Kpa.

Our results showed various patterns of OT release with significantly higher concentrations of OT at the peak ( $265.41^a \pm 41.26$  pg/ml), total OT quantity released ( $29935.00^a \pm 4306.68$  pg/ml/30min), number of pre-stimulation releases (11/12 suckling) during suckling episodes than during machine milking ones ( $79.05^b \pm 45.18$  pg/ml and  $7895.42^b \pm 4717.73$  pg/ml/30min and 3/12 milking respectively).

Our experiment confirmed OT release pattern as a good tool to evaluate the quality of stimulation during milking. Here, it appears a reduced stimulation during mechanical milking probably due to the new environment and equipment for our camels or to physiological inhibition due to maintained maternal behaviour in this mixed management. This work confirms the possibility to milk mechanically camels without young aside mothers but show the sensitivity of the camels and the need to better adapt machine settings to animals but also to material and parlor conception.

1. **MARNET P.G.**, PORTANGUEN J., ATIGUI M., HAMMADI M., 2018. First evidence of oxytocin discharge during machine milking in dromedary camels. In proceeding of the 5<sup>th</sup> conference of ISOCARD, 12-15 Nov. Layoune, Maroc.

## Milking impacts on rubber liners for goats

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### *Abstract*

Liners are the only part of the milking device in direct contact with teats. The condition of the liners, particularly the state of wear, affects the quality of the milking process.

Our study was carried out in 5 French commercial goat farms, all equipped with the same clusters, to investigate the effect of ageing of rubber liners on their milking characteristics (according to ISO 3918-2007 and 6690-2007). Milking machine cleaning procedures were systemically controlled. Measurements were done partially in on-farm but mainly in our “Milking and Milkometers” ICAR laboratory. The deformation of the barrel, Touch Point Pressure Difference (TPPD), mouthpiece depth, pulsation transition, and porosity of the liners were evaluated. Measurements were taken in the following manner, respectively: a caliper measurement at 7.5 cm from the mouthpiece lip; an INRA tool which measures vacuum level when the liner closes; a specific strip for mouthpiece depth measurement, the MilkoTest MT52 that measures pulsation characteristics (Bilgery, CH) and a 35x magnifying glass. Evaluation was done at 500, 1,250, 2,500 (NLT: Normal Life Time for the brand), 3,750 and 6,000 (ELT: Extreme Life Time) milkings on randomly selected liners.

Measurements indicated that the liners progressively flattened with use; exceeding 6% after NLT and up to 9% at ELT. TPPD decreased by 12.8% at the NLT measurement, and up to 19.7% at the ELT. Mouthpiece depth was found to have slightly increased. For 2 farms, the transition phases of the pulsation cycle were found to have decreased. Visible evidence of wear, nicks in the mouthpiece chambers and cracks on the two collapsing lines, were globally seen after 3,750 milkings, but on one farm, were already present at NLT.

The result of these changes occurs over time, liners tend to not open fully, open more rapidly, and collapse more during the closed phase. Additionally, the rubber becomes more flexible and its surface is degraded. These changes could lead to an increased duration of milking, increased number of liner slips' more aggressive pulsation and increased bacteriological risks. These results are in line with the firm recommendations.

## Conventional and omics approaches shed light on Halitzia cheese, along-forgotten white-brined cheese from Cyprus

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### *Abstract*

Production and ripening of Halitzia cheese was examined by conventional physicochemical and microbiological analyses along with state-of-the art metagenomics. Cheese was made from (A) raw goat milk without the addition of starters; (B) pasteurized goat milk without the addition of starters; (C) pasteurised milk with the addition of starters. The type and counts of microorganisms were mainly influenced by ripening time; microbial counts for lactic acid bacteria were predominant and remained stable with little or no variation throughout ripening. Coliforms and coagulase positive staphylococci declined during ripening and at the end of ripening the staphylococci were not detected. Yeasts were detected at low counts but in great diversity throughout ripening. Metagenomics analysis confirmed the results obtained by the classical microbiological analysis. The physicochemical parameters during ripening were also determined; at 60 days the pH value and moisture, fat, protein, ash, and salt contents did not significantly differ among cheese types.

## Impact of udder and teat conformation on the risk of increased milk somatic cell counts in dairy goats

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### *Abstract*

The relationship between udder and teat conformation and the risk of increased milk somatic cell counts was studied in 15 french goat farms.

The udders of 5,820 goats were each assigned to one of six reference conformation profiles defined on the basis of the scores obtained during type appraisal. For each goat, the udder was palpated and teat sphincters inspected one or twice during lactation by a single team of three vets. For part of the population (n=265), milking incidents (air intakes, cluster kick-offs...) were also recorded twice. Somatic cell counts were determined as part of regular milk recording. A crossing data between conformations and teat lesions or milking incidents was carried out for 1,938 and 139 goats respectively.

The study confirmed the relationship between udder floor position and level of SCC with a difference of 300,000 cells/ml between extreme udder profiles on this trait. This was supported by differences seen in the frequency of chronic infection using presence or absence of significant mammary imbalance, marked induration and highly reactive lymph nodes: 10.8%, 28.5%, 31.8% vs 4.6%, 19.8 %, 15.7% between classes with lower and higher scores of floor position, respectively.

The shape of the udder and teats influenced the risk of teat sphincter lesions. Two groups of udders were identified as being at higher risk of teat injuries: group 1 with increased frequencies of compression rings and flat teat-ends, characterized by larger teats and poor fore udder attachment and group 2 with higher frequencies of congestion, characterized by thinner and more divergent teats. These elements showed the importance of 1) teat-milking unit adequacy, 2) massage area and 3) positioning of the liner.

Finally, udders shape seemed to influence milking incidents. Some udders were associated with more frequent air intakes, phenomenon probably related to their greater compliance. Pocketed udders were more likely to be handled and massaged by milkers.

Thus, conformation of udders and teats is a major element to improve milking conditions. Coupled with milk ejection analysis, it has to be considered for management and selection of goats in relation to infectious risk.

## ***Streptococcus agalactiae* in lactating camels (*Camelus dromedarius*) and their calves – is there an extramammary reservoir?**

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### *Abstract*

*Streptococcus agalactiae* (*Str. agalactiae*) is a common cause of mastitis in dairy camels in the Horn of Africa, with implications for public health and household economy. The existence of a potential extramammary reservoir of this pathogen in camel herds has not been systematically explored. The aim of this study was to investigate the presence of *Str. agalactiae* in milk and in other body sites in apparently healthy dairy camels and their calves.

The study was conducted in Laikipia county, Kenya. A total of six herds were included in a convenience sample. In these herds, swabs were taken from the nasal and vaginal mucosa of all lactating camels and from the nasal, oral and rectal mucosa of their suckling calves. In addition, milk samples were collected at udder lever from camels with a California Mastitis Test (CMT) score  $\geq 2$  (scale 1-5) in at least one quarter. A total of 88 dams and 87 calves were sampled.

Samples were enriched in Todd Hewitt broth and cultured on Edwards media. Any CAMP (Christie-Atkinson-Munch-Peterson)-test positive colonies were subjected to latex agglutination test and their identity was confirmed using Matrix Assisted Laser-Desorption Ionisation Time of Flight Mass Spectrometry (MALDI ToF MS).

More than half of the camels (50/87) had a positive CMT-reaction. *Str. agalactiae* was isolated from milk in 4 out of 6 herds and from 20% of the milk samples (10/50). Furthermore, *Str. agalactiae* was found in 34% (38/113) of nasal swabs, in 4% (3/87) of rectal swabs and in 7% (6/87) of the oral swabs but not in any of the vaginal swabs. There was a positive association between the isolation of *Str. agalactiae* from the lactating dam and its suckling calf ( $p=0.011$ , OR=4.7). In conclusion, these findings indicate that camels can be asymptomatic carriers of *Str. agalactiae* in the nasal cavity and in the gastrointestinal tract.

## Methicillin resistant *Staphylococcus aureus* in dairy goats in Sweden.

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### Abstract

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a widespread zoonotic bacterium of increasing clinical importance. In humans, it may cause infections that are difficult to treat due to multiresistance. Although several animal species may also develop MRSA infections, they are most often healthy carriers. MRSA has previously been detected in goat herds in Sweden, and with a high occurrence of *mecC*-MRSA in the goats, but only few herds were investigated and most of these herds were not producing milk for human consumption. Goats have elsewhere been identified as infected with *mecC*-MRSA. The prevalence of MRSA among dairy goat herds in Sweden is not known. The present cross-sectional study was therefore conducted on 22 dairy goat herds, to study the prevalence of MRSA.

A total of 22 bulk milk samples and pooled swabs from nose, mouth and perineum using E-Swabs™ (Copan Diagnostics) from 115 goats, were collected during August to September 2019 for bacteriological investigation. From the milk samples 5 mL was added to 45 mL Mueller-Hinton broth with 6.5% NaCl and incubated at 36±1°C overnight. From swabs 0.5 mL suspension fluid was added to 4.5 mL MHB with 6.5% NaCl and incubated as above. From each enrichment 50 µl was evenly spread on two plates in parallel, Brilliance MRSA2 (Oxoid) and Brilliance Staphylococcus (Oxoid) agar and incubated for 18-24 h at 36±1°C. Suspected isolates was confirmed as *S. aureus* using MALDI-TOF and subjected to PCR targeting the *mecA* and *mecC* genes to confirm MRSA status.

No samples were found positive for MRSA.

To conclude, there are no indications of an emerging spread of MRSA in Swedish dairy goat herds.

## Proteomic changes specifically related to intramammary infection in late lactation goat milk

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### *Abstract*

The milk somatic cell count (SCC) is a standard parameter for monitoring intramammary infection (IMI) in dairy ruminants. In goats, however, physiological variables including the stage of lactation can heavily compromise SCC specificity, by causing increases independent from infection. The availability of more specific, alternative markers would improve the reliability of IMI detection and enable more meaningful management decisions, especially at the dry-off. However, also protein markers with very good diagnostic performance in other species, including cathelicidins, do not seem promising for mastitis monitoring in goats at this lactation stage. With the aim of identifying and understanding protein changes specifically related to bacterial infection, we carried out a shotgun proteomic study on late lactation, high SCC half-udder milk from healthy goats and from goats with a subclinical *Staphylococcus aureus* IMI. Mid lactation, low SCC milk from healthy goats was used as a reference. As a result, we observed 52 differential proteins (DPs) in *S. aureus*-infected late lactation milk and only 19 DPs in uninfected late lactation milk. The relative abundance of common DPs was typically higher in *S. aureus*-infected milk, with only 3 DPs being more abundant in uninfected milk. Unexpectedly, the latter included also serum amyloid A. Of all DPs, 38 were specific of *S. aureus*-infected milk and included haptoglobin and numerous cytoskeletal proteins. Based on STRING analysis, the 38 DPs were involved in defense response processes and cytoskeleton organization and were related to the cellular and extracellular matrix rearrangements involved in the blood-milk barrier permeability increase occurring during inflammation. Being strictly related to infectious/inflammatory processes, these proteins may hold promise as more reliable markers of IMI than SCC in late lactation dairy goats, especially haptoglobin which has already demonstrated potential in the dairy cow and is directly related to inflammatory changes in the blood-milk barrier.

## Proteomic changes occurring in the milk of water buffalo with subclinical staphylococcal mastitis

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### Abstract

*Staphylococcus aureus* (SAU) and non-aureus staphylococci (NAS) are the primary intramammary pathogens affecting water buffalo, and the main cause of subclinical mastitis. We analyzed the milk of subclinically infected and of clinically healthy quarters by shotgun proteomics and label-free quantitation to gain a better understanding of the changes induced by infection and to identify novel, sensitive and specific mastitis markers. The study included 6 quarter milk samples with a somatic cell count (SCC) > 3,000,000 cells/mL (3 SAU-positive and 3 NAS-positive) and 6 uninfected quarter milk samples with SCC < 50,000 cells/mL. Out of 1530 unique proteins identified, 162 were changed by SAU while only 127 were changed by NAS. The changes induced by SAU were also significantly more intense than those induced by NAS ( $P < 0.0005$ ). The proteins increased in staphylococcus-infected milk were 119 and had mostly structural ( $n=43$ , 28.29%) or innate immune defense functions ( $n=39$ , 25.66%). These included vimentin, cathelicidins, histones, S100 proteins, neutrophil granule proteins, haptoglobin, and lysozyme. Western immunoblotting validation confirmed that cathelicidins were the most increased protein family in staphylococcal mastitis, with a stronger reactivity in SAU mastitis. The increase in S100A8 and haptoglobin was also confirmed by western immunoblotting. On the other hand, the proteins decreased in staphylococcus-infected milk were 33 and were mainly involved in lipid metabolism ( $n=13$ , 59.10%). These included butyrophilin, xanthine dehydrogenase/oxidase, and lipid biosynthetic enzymes. This study highlighted that subclinical SAU mastitis, but also subclinical NAS mastitis, affects water buffalo milk quality by modifying its protein and lipid composition, with possible repercussions on the textural and sensorial quality of dairy products. In addition, we identified several proteins specifically increased by infection with potential as sensitive and specific mastitis markers.

## Diagnostic performance of milk somatic cell counts and cathelicidin ELISA for detecting infectious mastitis in late lactation sheep and goats

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### *Abstract*

In small ruminants the reliability of the most widespread mastitis monitoring test, the somatic cell count (SCC), is typically reduced in late lactation. Nevertheless, this is one of the most critical moments for making management decisions. Based on previous studies, cathelicidins (CATH) are among the most promising protein mastitis markers sheep, goat, and cow milk when detected with an in-house developed ELISA test in full lactation. To assess its performance in late lactation, we compared SCC and CATH levels in the milk of ewes and does with subclinical intramammary infections (IMI) as diagnosed by bacteriological culture (BC). The study included 315 sheep and 223 goat half-udder milk samples collected in the last month of lactation. The diagnostic performance of SCC and CATH was quite different in the two species. In sheep, the area under the curve (AUC) value of the Receiver Operating Characteristic (ROC) curve was higher for CATH (0.9041) than SCC (0.8829). Accordingly, CATH was more specific (82.92%) than SCC (73.67%) at a sensitivity of 91.18%. That is, CATH showed a markedly superior diagnostic performance than SCC in late lactation sheep milk. In goats, the AUC was lower than 0.67 for both CATH and SCC. CATH was even less specific (61.90%) than SCC (65.08%) at a sensitivity of 64.71%. Therefore, CATH does not seem to be a valid alternative to SCC in late lactation goats, which should preferably be tested at peak lactation as also suggested by others. On the other hand, sheep can be screened for mastitis at the end of lactation, and CATH should be preferred over SCC for its higher specificity. Nevertheless, careful cost/benefit evaluations will be needed to assess its real advantages over the California Mastitis Test (CMT) in the farm setting.

## Assessment of RP-HPLC milk analysis to quantify casein variants in sheep milk

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### *Abstract*

This study was carried out to assess and identify a suitable method for quantifying specific proteins in Sarda sheep milk with the aim of obtaining more accurate information on their correlations with cheese yield and addressing genomic association studies to specific protein variants rather than the total protein content. Isoelectric focusing (IEF), two-dimensional difference gel electrophoresis (2D DIGE), and reverse phase-high pressure liquid chromatography (RP-HPLC) were assessed for cost, ease of execution, throughput, accuracy, and ability to provide quantitative results. Milk fractions obtained with the different methods were characterized by liquid chromatography-tandem mass spectrometry (LC-MS/MS) for protein identification. As a result, we selected and optimized a RP-HPLC method presenting relevant advantages over the other analytical approaches. A total of 673 milk samples from a genotyped sheep herd were tested by somatic cell count (SCC) and cathelicidin ELISA to exclude milk protein alterations related to mammary gland inflammation. All ELISA-negative samples with < 500.000 cells/mL (n=49) were then subjected to RP-HPLC analysis. Adding to the easy quantitation of the different caseins, the method quickly and easily identified casein variants, including alpha-S1 casein which is known to be related with micelle size and curdling time. Moreover, the method detected a beta-lactoglobulin polymorphism significantly associated to the total milk protein content that may represent a misleading factor when using total N content for assessing milk quality, since it leads to an increase in total N but is not advantageous in terms of cheese yield. In conclusion, when compared to total N or total casein determination, the described RP-HPLC method provides valuable additional information on the true correlation of cheese yield with genetic polymorphisms significantly associated with the total protein content. The study was funded by the Autonomous Regional Government of Sardinia (Italy) with the project MIGLIOVIGENSAR.

## Subclinical mastitis in water buffalo (*Bubalus bubalis*) in Bangladesh

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### Abstract

Globally, subclinical mastitis is an important production disease in the dairy industry and has a great economic impact due to reduced milk yield, milk quality deterioration, treatment costs, culling and risk for antimicrobial resistance. A cross sectional study was conducted on 17 randomly selected buffalo farms in Bangladesh during Sep and Oct 2019 to (1) estimate the prevalence of subclinical mastitis (SCM), (2) isolate causative pathogens and (3) investigate the presence of antimicrobial resistance. A total of 132 lactating buffaloes were included. The number of lactating buffaloes at each farm varied between 1 and 66. Quarter milk samples were collected before the morning milking procedure from each lactating buffalo and tested with California mastitis test (CMT). Bacterial culturing was performed from all milk samples with CMT  $\geq 2$ , which was the definition for SCM in this study. The milk samples were cultured on bovine blood agar, MSA-agar and MAC-agar and identified using visual inspection of the colonies as well as by Gram-staining, biochemical testing and matrix-assisted laser desorption/ionization (MALDI-TOF). All *Staphylococcus* spp. were tested for production of penicillinase using the clover leaf method.

An average of 51% of the buffaloes had SCM, but the prevalence varied substantially between farms (0 - 100%). The most common pathogen was non aureus staphylococci (35%), followed by non-specified Gram-positive bacteria (23%), *Micrococcus* spp. (17%), *Streptococcus* spp. (9.0%), *Corynebacterium* spp. (3.4%), *Arcanobacterium pluranimalium* (3.4%) and other specified bacteria (10%), where only one was *Staphylococcus (S.) aureus*. The level of *Staphylococcus* spp. that were producing penicillinase was 39%.

The prevalence of SCM was around the same level compared to results from other recent studies in the region. The causing pathogens were surprising, mainly since *S. aureus* was more common in other recent similar studies.

## Somatic Cell Counts in Norwegian Goat Milk

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### *Abstract*

Norwegian goat dairy industry consists of 267 dairy herds during 2019. The total delivery of goat milk was 19,802,000 liters. The goat industry is placed in the mountainous and fjord area. Both feeding, breeding and health has been improved the last years. The three diseases CAE, paratuberculosis and pseudotuberculosis was eradicated during the Healthy Goat project around 2010. The main health issue at present is subclinical mastitis and parasites. The bulk milk somatic cell count (BMSCC) was in 2019: 945,000 in arithmetic mean, 882,000 in weighted arithmetic means and 773,000 in geometric mean. This is much higher than the cow milk BMSCC at the same time which was 136,000 in arithmetic mean and 117,000 in geometric mean. There is a large variation in Goat BMSCC over years and during year. From 2010 to 2019 the lowest arithmetic BMSCC in March has decreased from 734,000 to 459,000 and the highest BMSCC in August has decreased from 1700,000 to 1400,000. The rolling 12 months average has decreased from 1210,000 to 929,000. It is big question what causes this seasonal variation and what does it mean for cheese quality? It is a challenge making a good quality payment system. Looking at the distribution 10 % of the samples in 2019 was below 320,000 and above 1730,000. If we look at individual goat SCC (IGSCC) we see the same seasonal fluctuation. In the same period the geometric mean IGSCC from 2010 to 2019 decreased from 370,000 to 225,000 (arithmetic from 785,000 to 600,000) at the lowest level in March and from 950,000 to 725,000 (arithmetic from 1600,000 to 14000,000) in August. There is a significant association between IGSCC and protein, fat and lactose percentage, all decreased with increasing SCC, but protein and fat increased passing SCC 300,000.

## Shiga-toxin producing *Escherichia coli* (STEC) in French dairy goat herds

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### Abstract

Case studies were conducted in 12 dairy goat farms whose milk was contaminated several times by potentially highly pathogenic shiga-toxin producing *E. coli* (STEC). Repeated environment and milk samples were performed for one year.

Isolates belonging to 4 out of the 5 potentially highly pathogenic strains groups (according to the French Food Safety Agency (Anses) definition) were obtained. Isolation rates were higher for samples of fecal origin, including overshoes on the bedding. Strains originated from 10 goat farms were characterized and compared through Pulse-Field Gel Electrophoresis analyses: data obtained confirmed the faecal origin of the strains and their circulation through bedding and udder skin. Diversity of strains was high on and between farms and both milk and fecal contamination were intermittent.

Feeding a complex of yeast, yeast fractions and clay during six weeks allows in some of these goat farms a limitation of milk contamination, but it remains to be tested on a larger scale.

## **Ion mobility mass spectrometry approach to explore the lipidome of sheep's milk from diverse organic grazing systems**

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### *Abstract*

Few studies have been reported on the effect of feeding different fresh forages and pasture grazing on complex lipid and in particular on glycerides, glycerophospholipids and sphingomyelins of ovine milk.

The aim of this study was to explore, by the means of a new lipidomic approach based on ion-mobility mass spectrometry and fatty acids analysis, the effects on the lipid profile of ewe's raw milk of 1) different forages (*Trifolium resupinatum*, Tr; *Sulla coronaria*, Su; *Medicago polymorpha*, Me) grazed in association with *Lolium multiflorum* and 2) the percentage of pasture grazing in the diet (40 vs 60%).

For this purpose, a supervised chemometric model was developed and the results showed that the forage species (Tr, Su, Me) and the different percentages of pasture in animal diet (40 vs 60%) produced distinctive changes in the milk levels of lysophosphatidylethanolamines, phosphatidylethanolamines, phosphatidylcholines, diglycerides, sphingomyelins, triglycerides and ceramides.

The analysis of milk fatty acid profile showed that polyunsaturated fatty acids, namely conjugated linoleic acid, trans fatty acids, eicosapentaenoic acid and, docosapentaenoic acid were higher in Tr than Me and Su milks and their contents increase along with the percentage of herbage in the diet (60 > 40%).

Overall, these methods can be successfully applied for evaluating the nutritional characteristics of sheep milk, sheep dairy products and for the authentication of sheep organic value chain based on grazing diverse forages. Moreover, these supervised chemometric models lays the foundation to develop a decision support system software able to estimate milk quality based on the farm management.

## Effect of somatic cell count on rennet coagulation properties in goat milk

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### *Abstract*

The somatic cell count (SCC) is often higher in goat milk compared to milk of sheep or cows, and sometimes increase with advancing lactation stage, parity, at oestrus etc., in addition to intramammary infections (IMI). While SCC is a useful indicator of mastitis in cows, increased levels of SCC can be observed in goats without any clinical signs of infections. Effects of somatic cells in cow milk have been extensively studied, however, the knowledge of somatic cells in goat milk is scarce in comparison, and no limit for maximum counts has yet been established in Europe. Knowledge regarding SCC and its effect on goat milk composition and technological parameters, is important for establishing maximum counts, quality payment etc. Therefore, the aim of this study was to investigate possible effects of SCC on rennet coagulation properties in goat milk. Milk samples from thirty-one goats were sampled six times during one lactation for analysis of rennet coagulation parameters and SCC, measured by Formagraph and Milkoscan, respectively. Higher SCC prolonged the rennet clotting time (RCT) ( $r=0.64$ ,  $p<0.0001$ ), and the effect was especially prominent in late lactation. Also, a decrease in curd firmness (A30) was observed at elevated levels of SCC ( $r=-0.23$ ,  $p=0.0016$ ), however the effect was not as strong as for RCT and not related to a specific lactation stage. SCC below 400 000 did not affect the coagulation parameters, however, between 400 000 and 6 400 000 RCT increased and A30 decreased with 12%. The most considerable effect was observed when SCC levels exceeded 6 400 000, where RCT increased by 250% and A30 decreased by 36%, which strongly indicates that SCC above this level is unsuitable for cheesemaking.

## Dissemination in France of the European guide for good hygiene practices intended for farmhouse cheese and dairy producers

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### *Abstract*

Guides for Good Hygiene Practices and for the application of HACCP principles are highlighted in European health regulations (Hygiene Package). These guides should help food business operators to implement permanent procedures based on the principles of HACCP. They should be drafted by producers in the relevant sector and assessed and endorsed by the public authorities.

In accordance with this requirement, a Guide has been written at European level by the Farmhouse and Artisan Cheese and dairy producers' European network (FACEnetwork) in particular for farmhouse cheese and dairy producers. It is a voluntary tool intended for application to the specific practices of this food sector. In France, the livestock Institute (Institut de l'Elevage-Idele) was involved as expert and FNEC (National Organization of goat breeders and farmhouse cheesemakers) as the organisation representative for farmhouse cheese producers.

As this Guide does not deal with dairy technology or microbiology, the producers using it must have had adequate prior training on these technical subjects. In France, a network of advisors who are dealing with farmhouse cheese and dairy producers is managed by Institut de l'Elevage. Professional organizations (FNEC/FNPL) have decided to disseminate this tool by trainings with implication of this network in order to ensure a better understanding of the Guide and a better dissemination of good practices for farmhouse cheese and dairy sector. Thus, training materials have been developed at national level to train advisors who will also be accredited to train producers. More than sixty advisors are accredited today. Results of a survey allows us to improve our tools and to better answer to the technician's issues.

## The importance of the teat-liner interface

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### *Abstract*

Milking is an essential part of dairy farming. It has to allow the collection, in majority mechanically nowadays, of a maximum of milk, quickly but without damaging the teats. For this, it is important to master the animal - machine - milker relationships.

Milking clusters for small ruminants are complex and diverse assemblies of elements, each with their own interests and limits. The "mechanical" quality of the milking is largely due to the teat - liner interface. Those lasts are normally the only components of the milking installation in contact with the udder. They are composed of 3 complementary parts - a mouth-piece chamber, a body and a short milk tube - of particular measurements and geometries, generating particular inside vacuum fluctuations and translations of pulsation signal, varying with the configuration and the flow of circulating milk.

The standards (ISO 5707: 2007 §8.7) encourage stable vacuum under the teat (28 to 38 kPa in small ruminants) and regular pulsation, guarantees of a non-aggressive milking. These parameters will be impacted among other things by the forms in confrontation, outside of the teats and inside of the liner mainly, but also by the "plastic" characteristics of these same elements coexisting during milking, flexibility and compliance of the teats and reactivity of the material constituting the liner.

This communication is a review of what is of importance when choosing, implementing and renewing a liner for small ruminants.

## Control activities carried out in the MIPAAFT ICQRF department for ascertaining milk and dairy products quality

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### *Abstract*

The Department of the Italian Ministry of Agriculture, ICQRF is the main enforcement worldwide authority fighting agri-food products frauds. The last year confirmed the strategic role of the agri-food sector for the Italian economy, with more than 44.6 billion euro of export. The ICQRF with its daily protection action of “Made in Italy” products gives a significant contribution to consolidate the reputation of Italian products quality.

The aim of the present study was to show the ICQRF impact and the results on the frauds control activities on milk and dairy products in the last three years. ICQRF carried out No. 13,885 anti-fraud controls, with 8,727 inspections, and 5,158 analyzed controlled products. The non-compliances detected regarded 24.6% of the operators inspected, 10.6% of the products checked, and 5.2% of the samples analyzed. ICQRF activities against fraud for milk and dairy products are: inspections (e.g. control of labeling, traceability, tracing back, web investigation etc.), ex officio for PDO/PGI products and laboratory analysis.

Main violations regard buffalo, sheep and goat cheeses produced with the illicit addition of cow milk not allowed (e.g. Buffalo mozzarella and Pecorino cheese), presence of not declared preservatives in label or prohibited preservatives, fresh and UHT milk with fat content lower than declared. Infringements of the labelling provisions by the omission of mandatory indications, including indication of the milk geographical origin, irregular use of voluntary indications, misleading use of designation of origin, irregular use of voluntary indications, misleading use of designation of origin. Failure to adopt suitable traceability system, PDO cheeses non-compliant to the product specifications.

We can conclude that ICQRF Department acts as National control against fraud, usurpations, and guarantee the products quality for consumers. Moreover International and Web activities are crucial in order to protect the Italian sounding phenomena and counterfeits the detriment of Made in Italy.

## Benefits of fodder feed practices on the quality of sheep's milk : a useful topic for communication from organic producers to consumers

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### *Abstract*

In organic farming, grass is the staple feed for ruminants. Self-producing fodder is of considerable importance because it allows to move towards more feed autonomy and positively influences the quality of the milk (including its "health value").

A follow-up was carried out at a dairy sheep breeder wishing to know the impact of his feeding practices on milk quality in order to communicate transparently to his customers. This was done over a year and a half to relate milk production data and milk quality to the succession of feeding practices dictated by the seasons (grazed grass, preserved fodder). Sampling days were adjusted to correspond to changes in feeding practices conventionally encountered over a production year (grazing, change of meadow or type of fodder).

A characterization of the total diet was carried out throughout the monitoring by keeping a register providing information on the nature of the concentrates and fodder used, their intake and their feeding values (by NIR spectroscopy analyses). Product characterization concerned both milk and cheese. The quality of the milk was assessed by analyzing the fatty acid (FA) profile and the dosage of vitamins E and B12. In addition, cheese resulting from a "lactic curd" type production (fresh cheese), was sampled to ensure that the transformation process does not alter the FA profile of the milk. Finally, data on milk production, milk protein and fat content and cheese yield were also collected.

The dairy sheep farm followed was in total feed autonomy with fodder as the main ingredient (from 58% up to 94% of the diet). The FA profile of the milk is overall better on grazed grass (+ 180% of CLA c9t11), except for linoleic and  $\alpha$ linolenic acids which have higher levels with hay (+25% and +46% respectively). There was also a trend towards vitamin E fortification in milk with grazing grass (Pearson correlation coefficient = 0,75). Finally, cheese processing does not modify the fatty acid profile of the milk.

This information can help the organic producer to objectively communicate the benefits of his feeding practices on milk quality.

### *Acknowledgements*

This study was carried out thanks to the financial funding of the Walloon Public Services (SPW) - DGO3 - and the Walloon Agricultural Research Centre. A very special thanks to Julien and Pierre Artoisenet (Bergerie des Fauves Laineux) and to Yvan Larondelle (BNTE Laboratory of UCLouvain).

## 2D-Cross Correlation Spectroscopy Coupled with Molecular Fluorescence Spectroscopy for Analysis of Molecular Structure Modification of Camel Milk and Cow Milk Mixtures during Coagulation

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### *Abstract*

Synchronous fluorescence spectroscopy (SFS) coupled with two-dimensional correlation spectroscopy (2DCOS) was employed to monitor, at the molecular level, the coagulation of five mixture ratios of camel's milk (CaM) and cow's milk (CM) (100% CaM, 75% CaM:25% CM, 50% CaM:50% CM, 25% CaM:75%CM and 100% CM). The dissimilarities among the different formulations are highlighted on the synchronous 2DCOS-SFS. In addition, according to the cross-peak symbols in synchronous and asynchronous spectra, the rate of response modification in riboflavin, protein and vitamin A matched with common coagulation phenomena usually reported during chymosin coagulation (hydrolysis of  $\kappa$ -casein, destabilization of casein micelles and aggregation). This study demonstrated that 2DCOS-SFS is a successful strategy to discriminate milk mixtures and to monitor molecular structure modifications during coagulation process.

## Food safety analysis of Moroccan camel milk samples

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### *Abstract*

Camel milk is considered the staple food in most of the Saharan pastoral areas. It possesses all the advantages of milk but also several therapeutic virtues are attributed to it. However, camel breeding still plays a marginal role at the global level. Food safety concerns remain one of the major constraints limiting the widespread consumption of this milk. In addition to the danger associated with the potential presence of human pathogenic bacteria in camel milk, mycotoxins, in particular aflatoxin M1, must be the subject of special monitoring. The main objective of the EU ARIMNet 2 CA.RA.VA.N project "Toward a CAMEL tRANSnational VALue chaiN" is to set up a set of interdisciplinary measures capable of generating knowledge and practices contributing to the socio-economic development of the camel sector in North Africa (Algeria, Morocco and Tunisia) and in particular to promote the safety of foods from camel origin. The aim of this study was to evaluate the safety of Moroccan camel milk samples by aflatoxin M1 and bacterial communities analysis.

Sixty-five samples of camel milk originated from different regions of Morocco, in particular from the region of Laâyoune were collected during milking but also at different points of sale. Aflatoxin M1 was determined using Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometric (LC/ESI-MS/MS). Furthermore, bacterial DNA was extracted and a 16S metabarcoding analysis was performed. The results showed that aflatoxin M1 was not detected in any of the samples analyzed. An analysis of multi-mycotoxins (aflatoxins B1, B2, G2, G1, ochratoxins, etc.) was also carried out on all the samples by the same analytical method and the concentrations of the multi-mycotoxins analyzed are below their detection threshold. The metabarcoding approach showed complex bacterial communities. Bacterial diversity seems more linked to geographic origin than to sampling methods. Additional sampling from different north-african countries should be performed in order to confirm these preliminary results.



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