



Genetic  
Resources



Federal Ministry  
of Food  
and Agriculture

# International Congress on the Breeding of Sheep and Goats

*Sheep and Goat Breeding and Husbandry:  
Potentials under Socio-Economic Conditions*

*World Conference Center Bonn, Germany 15-16 October 2020*

*Accepted Abstracts*



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## The future of a sustainable sheep and goat breeding

**Dr. Bernhard Polten**

*Federal Ministry for Food and Agriculture (BMEL), Rochusstr. 1, 53123 Bonn, Germany*

Due to their manifold possible uses, sheep and goats are among the oldest domestic animals. There are plenty of good reasons to keep sheep and goats. Approximately one billion sheep and 600 million goats are kept worldwide. They are used for landscape management purposes, e.g.: to keep heathlands open or to maintain the dykes along coasts and rivers. Sheep and goats thus also contribute to the maintenance of biotopes. They promote biodiversity and sustainability.

With the help of sheep and goats, valuable products can be gained from grass and, in the case of goats, also from leaves in grassland areas: milk, meat and wool. They therefore contribute to the income of sheep and goat keepers.

Sheep and goats can adapt to changing environments. Yet, greater adaptive capacity is more important now than ever before. Infectious diseases can spread quickly throughout the world. Environmental changes are often perceived as a result of climate change with different manifestations.

This International Congress on the Breeding of Sheep and Goats intends, for example,

- to give an impression of sheep and goat keeping at global level,
- to translate new research results into practice,
- to identify the real-world need for research, and
- to contribute to networking.

The global COVID-19 pandemic has posed great challenges to all parties involved in the congress. Until only a few months ago, the congress had been planned as a pure face-to-face event. But due to the coronavirus, the congress had to be re-organised as a hybrid event at short notice. This has called for a great amount of extra time and technical efforts from all actors.

But we – and especially the organisation team, the programme group and the scientific programme group, all people involved on and off stage, as well as all participants in this event – hope that all those efforts will be rewarded by an interesting congress and many new contacts and that the new technologies used may be able to outweigh at least some of the disadvantages caused by the coronavirus crisis.

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### Alfons Gimber

*Chairman, Association of German Sheep Breeding Associations*

**Contact:** *Claire-Waldoff-Str. 7, 10117 Berlin, [agimber@web.de](mailto:agimber@web.de)*

As chairman of the Association of German Sheep Breeding Associations, I warmly welcome you in Bonn. We are therefore very grateful that this International Sheep and Goat Congress in Bonn is being organized by the Federal Ministry of Food and Agriculture after the national conference in Berlin in 2019. For me, as chairman of the VDL, it is very important that this international conference here in Germany moves the sheep from the shadows into the limelight. For me, sheep are fantastic animals. That's why I became a shepherd. That is why I was involved in sheep farming at an early age in the association and was elected chairman of the VDL in my home country and last year at federal level. In Germany, we breed about 60 different breeds with about 1.6 million sheep. We keep sheep in full-time sheep farms through to small businesses. Because of the good performance of our sheep breeds, some breeds are also exported. We produce with our sheep excellent foods such as lamb and sheep milk. Unfortunately, because of the competition from the synthetic sector, sheep's wool does not find the desired sales. Sheep are important partners in improving biodiversity. I don't think that in the more than 75-year history of the VDL, such a conference has ever taken place in Germany. A conference at which all important topics related to the sheep and goat sector are dealt with by experts from many countries around the world. I am looking forward to interesting lectures.

### Bernd Merscher

*Chairman, Association of German Goat Breeding Associations*

**Contact:** *Claire-Waldoff-Str. 7, 10117 Berlin, [bernd-merscher@web.de](mailto:bernd-merscher@web.de)*

As chairman of the Federal Association of German Goat Breeders, the umbrella organization for all goat breeders and keepers in Germany, I would like to welcome to you all at this international conference. I come here as the top representative of the goat breeders and keepers and at the same time I am a practitioner and owner, especially of the Boer goat breed. I started to work with goats quite so time ago and now I am a successful goat breeder and make a living of goat husbandry and now live with a lot of friends from and with goat husbandry. Goats inspire me. They are very intelligent and very capable. In relation to body weight, they are more productive than the dairy cow. We take care of the landscape with my goats along the Rhine. I have also done many exports to different countries in the world. With our over 20 goat breeds in Germany, we cover a large variety of breeds. Unfortunately, there is no exact number of goats kept in Germany. The number will be between 120,000 and 200,000 animals. We look after around 12.000 breeding goats through our breeding organizations. Most of the goats kept in Germany are dairy goat breeds. However, meat breeds are also experiencing increasing demand. I would also like to express my thanks to the Federal Ministry of Agriculture. I hope that this conference will create a network so that we will continue to exchange ideas across national borders in the future. The results from this conference certainly also belong in politics.

<b>International Congress on the Breeding of Sheep and Goats</b>			
<b>Opening and Greetings</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 10:00 – 10:10	Moderation	Bernhard Polten	Federal Ministry for Food and Agriculture (BMEL)
Thu. 10:15 – 10:25	Greeting and Opening	Julia Klöckner	Federal Ministry for Food and Agriculture (BMEL)
Thu. 10:25 – 10:35	Greeting from the city of Bonn	Gabriele Klingmüller	Mayor, City of Bonn
Thu. 10:35 – 10:45	Greeting	Alfons Gimber	Association of German Sheep Breeding Associations
Thu. 10:45 – 10:55	Greeting	Bernd Merscher	Association of German Goat Breeding Associations
<b>Plenary Talks</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 10:55 – 11:25	Climate change: Causes and observed trends	Susanne Crewell	University of Cologne Institute for Geophysics and Meteorology
Thu. 11:25 – 11:45	Global climate change: what to expect in the future?	Daniela Jacob	Climate Service Center Germany (GERICS) Helmholtz-Zentrum Geesthacht
Thu. 11:45 – 12:05	The role of small ruminants in poverty reduction and rural development	Mohammed Bengoumi	FAO Subregional Office for North Africa
Thu. 12:05 – 12:35	New opportunities for genomic selection in sheep and goats	Joanne Conington	Scotland 's Rural College, Edinburgh, Scotland

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 1: Animal breeding and genetics: What will sheep and goat breeding look like in the future 1?</b>			
<b>Chair: Prof. Dr. Gesine Lühken, Vice-Chair: Dr. Christian Mendel</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 14:00 – 14:15	Central information processing in German sheep and goat breeding	Jens Wilkens	Vereinigte Informationssysteme Tierhaltung w.V., Verden / Aller, Germany
Thu. 14:15 – 14:30	Genetic evaluation for sheep in Germany	Wolfgang Ruten	IT-Solutions for Animal Production Verden, Germany
Thu. 14:30 – 14:45	MoBPS for sheep and goats – an innovative tool to design and optimize breeding programs	Henner Simianer	Animal Breeding and Genetics Group, Center for Integrated Breeding Research, University of Goettingen, Germany
Thu. 14:45 – 15:00	Early data from a community based breeding program indicates opportunity for genetic gain in Black Bengal goats owned by underprivileged rural women in Bihar State of India	Chanda Nimbkar	Nimbkar Agricultural Research Institute (NARI), Phaltan, India
Thu. 15:00 – 15:15	Development of a sustainable breeding programme in German sheep farming by using multi-live cover (MuNaSch)	Nina Ossowski	Institute of Animal Breeding and Husbandry Christian-Albrechts-University, Kiel
Thu. 15:15 – 15:30	Reproductive traits and dairy use potential of indigenous goats of South Kivu, DRC, can be identified by their tail	Patrick Baenyi	Department of Animal Production Université Evangélique en Afrique Bukavu, DR Congo



<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 2: Animal breeding and genetics: What will sheep and goat breeding look like in the future 2?</b>			
<b>Chair: Prof. Dr. Gesine Lühken, Vice-Chair: Dr. Christian Mendel</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 16:00 – 16:15	Genomics to breed sheep resistant to footrot	Ottmar Distl	University of Veterinary Medicine Hannover Institute for Animal Breeding and Genetics
Thu. 16:15 – 16:30	High-resolution analysis of a QTL influencing sheep resistance to gastrointestinal nematode infection through whole-genome resequencing of a segregating trio	Beatriz Gutierrez-Gil	Animal Production, Faculty of Veterinary Sciences Campus de Vegazana, Universidad de León, Spain
Thu. 16:30 – 16:45	No doubt anymore: A simple genetic test to facilitate breeding for polledness in goats	Rebecca Simon	Institute of Animal Breeding and Genetics, Justus Liebig University, Giessen, Germany
Thu. 16:45 – 17:00	Analysis of Candidate Genes for Growth and Milk Performance Traits in the Egyptian Barki Sheep	Ibrahim Abousoliman	Leibniz Institute for Farm Animal Biology (FBN) , Dummerstorf, Germany
Thu. 17:00 – 17:15	Assisted Reproductive Techniques in Sheep and Goats – Chances and Limits of alternative ways in breeding	Johanna Maria Meilwes	Clinic for Swine, Small Ruminants and Forensic Medicine, University of Veterinary medicine Hannover, Foundation
Thu. 17:15 – 17:30	The use of homologous seminal plasma before and during deep vaginal timed artificial insemination in sheep monitored by thermography and electrical impedance of vaginal mucous	Beste Cil	Department of Animal Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, Ankara University, Turkey

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 3: Economy: How can the profitability of sheep and goat farming be improved?</b>			
Chair: Prof. Dr. Stanislaus von Korn, Vice-Chair: Janine Bruser, Vice-Chair: Fides Marie Lenz			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 9:00 – 9:15	Keynote: Sheep and goats in the world and the importance of economy	Stanislaus v. Korn	Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen Institut für Angewandte Agrarforschung (IAAF)
Fri. 9:15 – 9:30	Assessment of the production of goat milk by means of performance cost accounting in terms of economic efficiency and influence of stock size	Isabel Sand	Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL) Darmstadt, Germany
Fri. 9:30 – 9:30	An assessment of economic efficiency in German sheep farming - a nationwide analysis	Stanislaus v. Korn	Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen Institut für Angewandte Agrarforschung (IAAF)
Fri. 9:45 – 10:00	The Thuringian sheep and goat premium	Adriana Schwarz	Thüringer Ministerium für Umwelt, Energie und Naturschutz
Fri. 10:00 – 10:15	Weidewonne – bringing together lamb marketing and landscape conservation	Stefanie Schröter	Naturstiftung David, Projekt Weidewonne Brau, Germany
Fri. 10:15 – 10:30	Ways to improve the profitability of sheep farming with rare indigenous sheep breeds	Nathalie Ketterle	Kollektion der Vielfalt Zell, Germany

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 4: Environmental performance and climate change: What do sheep and goats contribute to climate change mitigation?</b>			
<b>Chair: Prof. Dr. Thomas Döring Vice-Chair: Klaus Gerdes</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 11:00 – 11:30	Keynote	Elisabeth Jonas	
Fri. 11:30 – 11:45	Adaptation to saline drinking water in goats	Alexander Riek	Institute of Animal Welfare and Animal Husbandry Friedrich-Loeffler-Institute Celle, Germany
Fri. 11:45 – 12:00	Anaplasma phagocytophilum in cattle, sheep and goats in Germany – results of a systematic review of the literature	Matthias Gerhard Wagener	University of Veterinary Medicine Hannover, Foundation Clinic for Swine and Small Ruminants Hannover, Germany
Fri. 12:00 – 12:15	Opportunities to mitigate GHG emissions from sheep and goat farming in Indonesia	Mohammad Ikhsan Shiddieqy	Indonesian Center for Animal Research and Development (ICARD) Bogor, Indonesia
Fri. 12:15 – 12:30	The impact and breeding perspectives of maternal energy metabolism profiles pre- and postpartum on lamb body weight development with special regard to ewe methane emission traits	Jessica Reintke	Institute of Animal Breeding and Genetics University of Giessen Giessen, Germany

Oral presentations: International Congress on the Breeding of Sheep and Goats			
Special			
Time (UTC +2)	Title	Name	Institute
Fri. 8:00 – 8:20	Lämmeraufzucht mit drei verschiedenen Methoden im Vergleich	Christian Mendel	
Fri. 8:20 – 8:40	Intelligente Parasitenbehandlung durch moderne Technik	Kerstin Riek	

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 5: Animal genetic resources: Diversity and characterization</b>			
Chair: Dr. Roswitha Baumung, Vice-Chair: Christian Gerlinger			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 14:00 – 14:30	Keynote: Diversity of sheep in the UK – do we have a problem or an opportunity?	Joanne Conington	Scotland 's Rural College, Edinburgh, Scotland
Thu. 14:30 – 14:42	Genomic Characterization of Selection Signatures: what is the future for sustainable utilization of Ugandan Goat Breeds	Robert Boyle Onzima	Department of Agricultural Sciences, Faculty of Agriculture and Environmental Sciences (FAES), Kabale University, Uganda
Thu. 14:42 – 14:54	Morphological variability and geographical distribution of goat populations from Benin (West Africa)	Habib Whannou	Faculty of Agricultural Sciences, University of Abomey-Galavi
Thu. 14:54 – 15:06	Genetic Diversity and Maternal Origins of Indigenous Sheep Populations in North Ethiopia	Mulata Adhena	Department of Animal Breeding and Genetics Swedish University of agricultural Sciences (SLU) Uppsala, Sweden
Thu. 15:06 – 15:18	Discovery of casein variants in goats using capture sequencing	Siham Rahmatalla	Albrecht Daniel Thaer-Institut für Agrar- und Gartenbauwissenschaften Humboldt-Universität zu Berlin, Germany
Thu. 15:18 – 15:30	The origin and genetic diversity of Bangladeshi indigenous sheep: an updated perspective based on mitochondrial COI Sequences	Md. Abdul Alim	Animal Biotechnology Division, National Institute of Biotechnology Ganakbari, Ashulia, Savar, Dhaka, Bangladesh

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 6: Animal genetic resources: Implementation of policies and support</b>			
<b>Chair: Dr. Roswitha Baumung, Vice-Chair: Christian Gerlinger</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 16:00 – 16:12	Runs of homozygosity islands across 100 sheep and 96 goat populations reveal selection signatures	Wim Gorssen	Research group Livestock Genetics Faculty of Bioscience Engineering KU Leuven, Heverlee, Belgium
Thu. 16:12 – 16:42	Keynote	Fernando Tejerina Ampudia	
Thu. 16:42 – 16:54	The implementation of international commitments for animal genetic resources in Europe and Germany	Holger Göderz	Bundesanstalt für Landwirtschaft und Ernährung (BLE), Informations- und Koordinationszentrum für Biologische Vielfalt, Bonn
Thu. 16:54 – 17:06	The Krainer Steinschaf in Austria – a multilateral approach to in situ conservation of an endangered breed	Beate Berger	AREC Raumberg-Gumpenstein, Institute of Organic Farming and Biodiversity of Farm Animals Thalheim, Austria
Thu. 17:06 – 17:18	Is the German White-Headed Mutton Sheep an endangered breed?	Sowah Addo	Department of Animal Breeding University of Kassel Witzenhausen, Germany
Thu. 17:18 – 17:30	Marketing Situation and Concepts for Products of Endangered local Breeds of Sheep and Goats in Germany	Antje Feldmann	Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen e.V. (GEH) Witzenhausen, Germany

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 7: Management and animal welfare</b>			
Chair: Dr. Heiko Georg, Vice-Chair: Gerhard Schuh, Vice-Chair: Priv.-Doz. Dr. Pera Herold			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 9:00 – 9:15	Keynote: Sheep production in Ireland – key factors influencing profitability	Tim Keady	Teagasc, Athenry, Co Galway, Ireland
Fri. 9:15 – 9:30	Development of an animal-friendly feeding system for horned goats – preliminary results	Bianca Greiner	Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen Nürtingen, Deutschland
Fri. 9:30 – 9:30	Influence of housing and management on claw health of Swiss dairy goats	Lisa-Marie Sailer	Federal Food Safety and Veterinary Office (FSVO) Centre for Proper Housing of Ruminants and Pigs Tänikon, Switzerland
Fri. 9:45 – 10:00	Welfare effects of introducing and separating/reintroducing individual goats	Antonia Patt	Institute of Animal Welfare and Animal Husbandry Friedrich-Loeffler-Institut, Celle, Germany
Fri. 10:00 – 10:15	Goat commercialisation through increasing productivity of homestead herds in South Africa	Marisia Geraci	Goat Agribusiness Project South Africa
Fri. 10:15 – 10:30	A topical anaesthetic wound formulation diminishes pain responses and improves wound healing of lambs at tail-docking	Delia Lacasta	Animal Pathology Department, Instituto Agroalimentario de Aragón Universidad de Zaragoza-CITA Zaragoza, Spain

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 8: Other topics</b>			
Chair: Prof. Dr. Claudia Klein, Vice-Chair: Dr. Bettina Bongartz			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 11:00 – 11:30	Team Sheep vs. Team Corporate - Team building and leadership training as additional income source for shepherds	Hans-Peter Etzold	NatuerlichTeambuilding.de Andernach, Germany
Fri. 11:30 – 11:45	Zoonotic Diseases in Small Ruminants: Risks and Opportunities	Benjamin Bauer	University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants Hannover, Germany
Fri. 11:45 – 12:00	Comparative fattening and slaughter performance of four sheep breeds under practical farming conditions in northern Germany	Dirk Hinrichs	Section Animal Breeding, University of Kassel Witzenhausen, Germany
Fri. 12:00 – 12:15	Expression of genes related with fat metabolism in sheep influenced by use avocado flour in the diet	Pedro de Jesus Deniz Gonzalez	Universidad Autónoma de Nayarit Tepic, Nayarit, México
Fri. 12:15 – 12:30	Udder health in dairy goats and dairy sheep in Hesse	Irene Noll	Regierungspräsidium Gießen Wetzlar, Germany



<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 9: Animal health: Parasitology</b>			
Chair: Prof. Dr. Martin Ganter, Vice-Chair: Dr. med. vet. Karl-Heinz Kaulfuß			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 14:00 – 14:15	Potentials of using milk performance data as indicator for Targeted Selective Treatment in Lacaune dairy sheep in Switzerland	Steffen Werne	Research Institute of Organic Agriculture (FiBL) Frick, Switzerland
Thu. 14:15 – 14:30	Data of “Targeted selective Treatment” based on live weigh gain should be used for breeding for resistance against gastrointestinal nematodes	Martin Ganter	University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Hannover, Germany
Thu. 14:30 – 14:45	Discussion		
Thu. 14:45 – 15:00	Selfmedicative Behavior and Tanniferous Fodder Plants: Alteration in Taste Perception and Feed Preferences of GIN-Infected Boer Goats	Marvin Heuduck	Georg-August-University Department of Animal Sciences Goettingen, Germany
Thu. 15:00 – 15:15	Sainfoin pellets for preventive parasite control and improved protein efficiency in dairy goats	Steffen Werne	Research Institute of Organic Agriculture (FiBL) Frick, Switzerland
Thu. 15:15 – 15:30	Coccidiosis in small ruminants farms - case study in Trás-os-Montes (northeastern Portugal)	Helder Quintas	Centro de Investigação de Montanha (CIMO) Instituto Politécnico de Bragança, Portugal

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 10: Animal health: Locomotive apparatus and monitoring</b>			
Chair: Prof. Dr. Martin Ganter, Vice-Chair: PD Dr. Esther Humann-Ziehank			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Thu. 16:00 – 16:15	Know how: The secret of successful lameness management	Heinz Strobel	Schafpraxis, Stoffenried, Ellzee, Germany
Thu. 16:15 – 16:30	Evaluation of prevalence and risk factors associated with virulent and benign <i>Dichelobacter nodosus</i> in German sheep breeds	Julia Storms	University of Veterinary Medicine Hannover Institute for Animal Breeding and Genetics Hannover, Germany
Thu. 16:30 – 16:45	Discussion		
Thu. 16:45 – 17:00	Study of antibiotic susceptibility against the main pathogens involved in fattening lambs pathology in Spain and Portugal	Jose Maria Bello Dronda	NANTA S.A. University of Zaragoza Small Ruminant ZARA, SPAIN
Thu. 17:00 – 17:15	Relevance of Selenium imbalances in sheep flocks and implications for herd health management consultancy	Esther Humann-Ziehank	LABVETCON – Laboratory Veterinary Consulting, Burgdorf, Germany
Thu. 17:15 – 17:30	Exploiting scanning surveillance data to assess the impact of different initiatives and inform future strategies to control sheep scab	Eilidh Geddes	School of Veterinary Medicine University of Glasgow United Kingdom

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 11: Animal health: Reproduction</b>			
Chair: Prof. Dr. Martin Ganter, Vice-Chair: Dr. Henrik Wagner			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 9:00 – 9:15	The trouble with the reproduction – Chosen problems of the small ruminants	Henrik Wagner	Clinic for Obstetrics, Gynaecology and Andrology for Large and Small Animals with Veterinary Ambulance, Justus-Liebig-University Giessen, Germany
Fri. 9:15 – 9:30	Coxiella burnetii on Dutch dairy sheep farms between 2006 and 2020	René van den Brom	Royal GD, Deventer, Netherlands
Fri. 9:30 – 9:30	Investigation of abortions in small ruminants in Greece due to Chlamydia abortus	Nektarios Giadinis	Clinic of Farm Animals, School of Veterinary Medicine, Thessaloniki, GREECE
Fri. 9:45 – 10:00	Ultrasound findings of common genital pathologies in small ruminants	Mário Balaro	Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Niteroi, RJ, Brazil.
Fri. 10:00 – 10:15	Chronic Mycotoxicosis in a dairy goat farm in Brazil	Mário Balaro	Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Niteroi, RJ, Brazil.

<b>Oral presentations: International Congress on the Breeding of Sheep and Goats</b>			
<b>Block 12: Structures of and prospects for sheep and goat farming, sustainability</b>			
<b>Chair: Dr. Reinhard Reents, Vice-Chair: Dr. Jens Wilkens</b>			
<b>Time (UTC +2)</b>	<b>Title</b>	<b>Name</b>	<b>Institute</b>
Fri. 11:00 – 11:15	Sustainability assessment of Sheep and Goat Production Systems in Peri-urban areas of southern Benin (West Africa)	Bossima Ivan Koura	School of Management and Exploitation of Livestock Systems, National University of Agriculture Ketou, Benin
Fri. 11:15 – 11:30	Characteristics of goat transhumance and its benefits for environmental sustainability	Sezen Ocak Yetisgin	Ondokuz Mayıs University Faculty of Agriculture, Department of Animal Science Samsun, Turkey
Fri. 11:30 – 11:45	Strategies for improving feed management of Batur sheep on smallholder farmers in Batur District	Gresy Eva Tresia	Indonesian Center for Animal Research and Development Indonesia
Fri. 11:45 – 12:00	What policy and future do sheep and goats need in Iran	Farhad Mirzaei	Aryan Rural & Nomads Animal Production Management Association Iran
Fri. 12:00 – 12:15	Evaluation of dried citrus pulp based total mix ration (TMR) for mutton (goat) production	Abdur Rahman	Department of Animal Sciences University of Veterinary and Animal Sciences Jhang Campus, Pakistan
Fri. 12:15 – 12:30	Effects of supplementation with graded levels of pigeon pea foliage on the performance of Arsi-Bale goats fed a basal diet of maize stover treated with effective microorganisms	Eleni Assegid Worku	Department of Animal and Range Science Wolaita Sodo University, Ethiopia

Oral presentations: International Congress on the Breeding of Sheep and Goats		
Summaries		
Chair: Prof. Dr. Bernt Guldbrandtsen		
Time (UTC +2)	Title	Name
Fri. 14:00 – 16:00	Animal breeding and genetics: What will sheep and goat breeding look like in the future?	Christian Mendel
	Economy: How can the profitability of sheep and goat farming be improved?	Janine Bruser
	Environmental performance and climate change	Thomas Döring
	Animal genetic resources	Christian Gerlinger
	Management and animal welfare	Gerhard Schuh
	Other topics	Bettina Bongartz
	Animal health: Parasitology	Karl-Heinz Kaulfuß
	Animal health: Locomotive apparatus and monitoring	Esther Humann-Ziehank
	Animal health: Reproduction	Henrik Wagner
Fri. 16:00	Structures of and prospects for sheep and goat farming, sustainability	Jens Wilkens
	Conclusion and closing remarks	Bernhard Polten

### Climate change: Causes and observed trends

Susanne Crewell

*University of Cologne, Institute for Geophysics and Meteorology*

### Global climate change: what to expect in the future?

Daniela Jacob

*Climate Service Center Germany (GERICS), Helmholtz-Zentrum Geesthacht*

### The role of small ruminants in poverty reduction and rural development

Mohammed Bengoumi

*FAO Subregional Office for North Africa*

### New opportunities for genomic selection in sheep and goats

Joanne Conington

*Scotland's Rural College, Edinburgh, Scotland*



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### Central information processing in German sheep and goat breeding

**Jens Wilkens**

Vereinigte Informationssysteme Tierhaltung w.V., Heinrich-Schröder-Weg 1, 27283 Verden / Aller, Germany

**Contact:** [jens.wilkens@vit.de](mailto:jens.wilkens@vit.de)

**Abstract:**

German sheep and goat breeding has a distinctive federal structure. The breed societies work closely together under the umbrella of VDL/BDZ. Information processing with serv.it OVICAP in the field of herd bookkeeping was established with vit as the VDL service partner. serv.it OVICAP has been an integral part of breeding work in Germany for 10 years now. By working together in a central information system, synergy effects can be used, which contribute to cost reduction and optimization of functionality and data quality.

The breed societies in the association are effectively enabled to functionally administer information on the identification of sheep and goats as well as their pedigrees and breeding relevant characteristics. This consolidated information base (4.884.539 animals in total, 1.104.314 animals registered in herdbook, 61.705 farmer addresses, ) is the basis for nationwide population analyzes and breeding value estimation.

Use by the breeding farms is directly integrated into serv.it OVICAP. 70% of active farms (2.900 breeders) use serv.it OVICAP to retrieve information about animals and make recordings (e.g. lambing – e.g. 64.774 lambings in 2019). A breeding planner can be used by the breeding farmers to estimate inbreeding degrees in mating decisions. The nationwide pedigree is essential for calculating the inbreeding degrees.

For breeders of all sheep and goat breeds, serv.it OVICAP is the information medium for their own breeding work. Working together with and on serv.it OVICAP is an essential contribution to the maintenance and further development of sheep and goat breeding. With regard to future developments a good, expandable basis has been created i.a. in the area of advancing digitalization and implementation of genomic methods of animal breeding.

**Genetic evaluation for sheep in Germany****Dr. Wolfgang Ruten, Dr. Dierck Segelke***IT-Solutions for Animal Production, Verden, Germany***Contact:** *Heinrich-Schröder-Weg 1, 27283 Verden, [Wolfgang.Ruten@vit.de](mailto:Wolfgang.Ruten@vit.de)***Abstract:**

The VDL (Vereinigung Deutscher Landesschafzuchtverbände e. V.), as the umbrella organization of the German State Sheep Breeding Associations, is the client for the sheep breeding value assessment. A consolidation of the pedigree and performance data during the development of the common herd book system at vit (serv.it Ovicap) allowed the establishment and introduction of a nationwide breeding value estimation for sheep. Since 2014 routine evaluation is executed once a year in July for 25 different sheep breeds. All known pedigree and performance data from the field test (fertility, fattening and slaughter performance characteristics, exterior assessment for herd book recording or licensing as well as maternity or mammalian performance) are taken into account for the breeding value estimation.

Table 1 shows the number of animals across all breeds in performance and in pedigree data:

trait block	number of records performance data*	number of animals performance data	number of animals pedigree data
fertility	1.565.899	392.961	490.617
exterior assessment	-	363.236	499.885
fattening and slaughter performance characteristics	-	262.927	426.272
mammalian performance	27.943	7.532	16.538

\* repeated performance

A total of 772.772 sheep received breeding values in the run 2020/07.

Various statistical models are used within the individual trait complexes: A BLUP single-trait repeatability model is used for fertility, and BLUP multi-trait models are used for all other feature complexes. The breeding values are expressed as relative breeding values with an average of 100 points and a genetic standard deviation of 20 points.

With the introduction and establishment of the nationwide breeding value estimation for sheep, breeders and also the regional breeding associations have access to an innovative tool for breeding selection. Furthermore, the objective breeding values are comparable across the regions. By using this source of information consistently, the breeding value estimation can and will contribute to productivity increase in sheep breeding.





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### MoBPS for sheep and goats – an innovative tool to design and optimize breeding programs

**Henner Simianer, Lisa Büttgen and Torsten Pook**

*Animal Breeding and Genetics Group, Center for Integrated Breeding Research, University of Goettingen, Germany*

**Contact:** *Henner Simianer, Animal Breeding and Genetics Group, Center for Integrated Breeding Research, Albrecht-Thaer-Weg 3, 37075 Goettingen, Germany, [hsimian@gwdg.de](mailto:hsimian@gwdg.de)*

**Abstract:**

Designing efficient breeding programs with the objective of generating maximum genetic progress in a cost-efficient way while maintaining genetic diversity, sustainability and animal welfare is a major challenge. We have developed an R-package termed Modular Breeding Program Simulator (MoBPS; Pook et al. 2020) allowing a flexible representation and a powerful simulation of current-time breeding programs. The basic conceptual assumption is that any breeding program can be represented by a network of nodes (typically cohorts of animals) and edges (typically breeding activities like selection or reproduction). A web-based graphical user interface ([www.mobps.de](http://www.mobps.de)) offers an intuitive approach to design breeding programs in a most flexible way. Once such a breeding program is entered, it can be simulated with the R-package, providing predictions for the genetic trend in all traits as well as the development of inbreeding rate. By comparing alternative designs the tool can be used to optimize the breeding program.

We will illustrate the usefulness and the functionality of the MoBPS package with various applications from sheep and goat breeding. It will also be demonstrated to what extent innovative technologies like gene-editing could potentially affect practical breeding in small ruminants. Templates will be provided for major breeding program designs in sheep and goat breeding, including sensible pre-settings of genetic parameters and links to widely-used resources, like the major species-specific SNP genotyping arrays available.

Both the R-package and the web interface are free to use and provide a platform for the improvement of sheep and goat breeding programs worldwide.

**References:**

Pook, T., M. Schlather, and H. Simianer. 2020. MoBPS - Modular Breeding Program Simulator. *G3; Genes|Genomes|Genetics* 10 (6): 1915–18. <https://doi.org/10.1534/g3.120.401193>



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### Early data from a community-based breeding program indicates opportunity for genetic gain in Black Bengal goats owned by underprivileged rural women in Bihar State of India

**Chanda Nimbkar<sup>1</sup>, Tinni Sawhney<sup>2</sup>, Rubab Azam<sup>2</sup>, Rumani Chakraborty<sup>2</sup> and Peter Amer<sup>3</sup>**

<sup>1</sup>Nimbkar Agricultural Research Institute (NARI), Phaltan, India

<sup>2</sup>Aga Khan Foundation (AKF), New Delhi, India

<sup>3</sup>AbacusBio Ltd., Dunedin, New Zealand

**Contact:** NARI Animal Husbandry Division, Phaltan-Lonand Road, Phaltan 415 523, Dist. Satara, Maharashtra, India. [chanda.nimbkar@gmail.com](mailto:chanda.nimbkar@gmail.com)

#### **Abstract:**

Supported by the Gates Foundation, AKF implemented a programme in Muzaffarpur district of Bihar State, India to transform the lives of rural poor through improving local Black Bengal breed goat production. Project Mesha strives to promote better goat management practices through trained women community workers. With advisory support from NARI and AbacusBio, a pilot breeding programme was established in four villages (~2000 goats) in 2018 for within-breed genetic improvement by selection of male kids for breeding. Based on discussions with rearers, twinning (but not litter sizes larger than twins) and early fast growth (weight at 100 days of age) were decided as selection criteria. Data from October 2018 to March 2020 was analysed using the Echidna Software. The average daily gains (ADG) of kids that were weighed  $\geq$  three times up to the age of 120 days, were estimated with a regression of weight on age for each kid. Fixed models were fitted to analyse kid weights (59, 119 and 38 records for birth, 3 and 6 months' weights respectively) and ADG (199 records). There were 11% singles, 46% twins, 37% triplets and 6% quadruplets. Birth type was significant for birth, 3 month weights and ADG. Sex was significant for birth weight. Village was significant for 3 and 6 months' weights and ADG. The least squares mean (lsm) birth, 3 and 6 months' weights were  $1.7 \pm 0.1$  kg,  $5.9 \pm 0.2$  kg and  $11.0 \pm 0.5$  kg respectively while lsm ADG was  $48.9 \pm 1.9$  g. Substantial variation in analysed traits indicates the opportunity to achieve genetic gain.



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### Development of a sustainable breeding programme in German sheep farming by using multi-live cover (MuNaSch)

**Nina Ossowski<sup>1,2</sup>, Jens Wilkens<sup>3</sup>, Christian Mendel<sup>4</sup>, Ingolf Ruß<sup>5</sup>, Henrik Wagner<sup>2</sup>, Axel Wehrend<sup>2</sup>, Georg Thaller<sup>1</sup>**

<sup>1</sup> Institute of Animal Breeding and Husbandry - Christian-Albrechts-University, Kiel, Germany

<sup>2</sup> Clinic for Obstetrics, Gynaecology and Andrology of Large and Small Animals with Veterinary Ambulance – Justus-Liebig-University, Giessen, Germany

<sup>3</sup> United livestock information systems, Verden/Aller, Germany

<sup>4</sup> Institute of Animal Breeding, Bavarian State Research Center for Agriculture, Poing-Grub,

<sup>5</sup> Tierzuchtforschung e.V., München, Germany

**Contact:** Nina Ossowski, Institute of Animal Breeding and Husbandry, Christian-Albrechts-University Kiel, [nossowski@tierzucht.uni-kiel.de](mailto:nossowski@tierzucht.uni-kiel.de)

#### **Abstract:**

The project MuNaSch (**M**ulti-**N**atursprung **S**chaf) launched to address scientific questions when using more than three rams contemporarily within mating seasons. Eartag-tissue-samples from one complete lambing season were collected from 17 herdbook-breeders located in Bavaria, Baden-Wuerttemberg and Thuringia including the breeds Merinolands-, Merinolangwoll-, Rhoen- and Dorperschaf. The results of paternity testing based on 19 microsatellite-marker were registered in the central data base serv.it OVICAP (German herdbook-system for sheep). According to the mating register and the corresponding lambing list the most likely father among the potential candidates was assigned.

Major aims of this innovative project were: (1) Determining of the preference for particular rams, (2) effects on fertility at herd level, (3) performance of breeding animals and lambs, (4) impact on genetic variability, (5) improvement of breeding value estimation, (6) reduction of birth losses due to shortened lambing seasons.

First analysis of 150 Merinolandschaf ewes bred to three rams mated for four weeks verified the hypothesis of a ram-dominance. Half of the lambs born stemmed from ram A, whereas only 40% descended from ram B and 10% from ram C. Regarding the multiples, by half of the siblings had more than one father within a litter. Currently, the marker-set gets reduced by regarding allele frequency, polymorphic information content, expected and observed heterozygosity to ensure financial efficiency.

The shepherds' feedback was unexceptional positive. With the help of this project the profitability of herdbook-breeders should increase in spite of the tensed situation and help to withstand the current difficulties.



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### Reproductive traits and dairy use potential of indigenous goats of South Kivu, DRC, can be identified by their tail

**Baenyi P.<sup>1,2</sup>, Junga O.J.<sup>2</sup>, Keambou C.<sup>3</sup>, Birindwa A.<sup>1,4</sup>, Wasso S.<sup>1</sup>, Ciza M.<sup>1</sup>, Karume K.<sup>1</sup>; Ochieng J.W.<sup>2</sup>**

<sup>1</sup> Department of Animal Production, Université Evangélique en Afrique, P.O. Box 3323 Bukavu, DR Congo

<sup>2</sup> Department of Animal Production, University of Nairobi, P.O. Box 29053 Nairobi, 00625

<sup>3</sup> Centre for Tropical Livestock Genetics and Health, ILRI Kenya, P.O. Box 30709, Nairobi 00100, Kenya

<sup>4</sup> The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Kampala, Uganda

**Contact:** [baenyipatrick@gmail.com](mailto:baenyipatrick@gmail.com)

#### ***Abstract***

Indigenous goats of South Kivu, Democratic Republic of Congo (DRC), exhibit a wide array of phenotypic variation, but it is unknown whether this variation has any adaptive significance. Quantification of this variation and possible relationship with economically important farm traits could open way for both the conservation of the unique indigenous genetic resource, as well as providing many breeding options for improvement. This study quantified the phenotypic variation and its possible association with questionnaire-based reproductive and milk production traits in 148 oldest female indigenous goats from 148 farms in four territories representing the three agro ecological zones of South Kivu, DRC. A total of five (5) reproductive traits, four (4) milking traits, and 14 morpho biometric traits were analysed. The length and thickness of the tail were significantly correlated ( $p < 0.01$ ) with three reproductive traits (number of kidding per year, age of kid at weaning, and age at first service) and one milking trait (length of lactation). The shape of the horn, body hair coat colour, and the ear orientation were variable but not significantly correlated with reproductive and milking traits. The rest of the traits analysed were either characterized by low variability or were homogeneous. The correlations suggested that these traits can act as phenotypic markers for selection in goat breeding. Correlation between tail morphology and age of kid at weaning (EAKW) suggested that the tail can also act as a marker for longer lactation period, corresponding to longer milking period, a characteristic needed for dairy goats.



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### Genomics to breed sheep resistant to footrot

Monia Lara Budnik, Julia Storms, Anna Wirth and Ottmar Distl

University of Veterinary Medicine Hannover, Institute of Animal Breeding & Genetics, Hannover, Germany

Contact: [monia.budnik@tiho-hannover.de](mailto:monia.budnik@tiho-hannover.de), [ottmar.distl@tiho-hannover.de](mailto:ottmar.distl@tiho-hannover.de)

#### Abstract:

Ovine footrot is a complex disease caused by *Dichelobacter nodosus* and clinically characterized by interdigital dermatitis and under-running footrot. The objectives of our research project are to elucidate genomics of resistance to footrot within and across sheep breeds. In a large number of flocks in Germany, we recorded prevalences of footrot using clinical data and the load of benign and virulent strains of *D. nodosus*. On farm data recording in more than 200 flocks comprising >30,000 sheep was done using a mobile electronic hand-held system for individual animal ear tags and data input. We employed qRT-PCR to differentiate benign and virulent *D. nodosus* strains for classification of the footrot status of flocks. Based on these data, we were able to distinguish resistant, tolerant and susceptible animals. Genotyping was done for approximately 4000 sheep on ovine SNP50 and ovine Infinium HD SNP beadchips in Merinos, Leine, Suffolk and East Friesian for 250-650 animals each and across several breeds for at least 50-100 animals including Bentheim, Dorper, Grey Heath, Forest sheep, Romney Marsh, Texel, White P/H Heath and Pomeranian coarsewool. We found heritabilities for resistance to footrot using mixed models with genomic relationship matrices at  $h^2=0.4-0.7$  for the different breeds. Genome wide association studies with mixed models showed significant associated regions within breeds. Whole genome sequencing data from 120 individuals were employed to filter for highly associated variants. On whole genome sequences imputed genotype data allowed us to validate highly associated regions and variants within and across breeds.



## High-resolution analysis of a QTL influencing sheep resistance to gastrointestinal nematode infection through whole-genome resequencing of a segregating trio

**Beatriz Gutiérrez-Gil<sup>1</sup>, Praveen K. Chitneedi<sup>1,2</sup>, C. Esteban-Blanco<sup>1</sup> & Juan-José Arranz<sup>1</sup>**

<sup>1</sup> Universidad de León, León, Spain

<sup>2</sup> Leibniz Institute for Farm Animal Biology, Dummerstorf, Germany

**Contact:** Dpto. Animal Production, Faculty of Veterinary Sciences, Campus de Vegazana, Universidad de León, 24071, León, Spain. [beatriz.gutierrez@unileon.es](mailto:beatriz.gutierrez@unileon.es)

### **Abstract:**

Gastrointestinal nematode (GIN) infections are one of the major health issues for grazing sheep populations. In the present study, we have used the imputed 50K-chip to high density (HD) chip (600K) genotypes obtained in a commercial population of 532 Churra adult ewes (Chitneedi et al. 2017) to refine QTL previously identified in this population for two indicator traits of GIN resistance (Atlija et al. 2016). For the most promising QTL region previously reported on chromosome 6 (OAR6) for faecal egg count (LFEC), we selected a segregating trio including the Qq sire and two daughters with extremely divergent phenotypes for the FEC trait in concordance with their QTL inferred genotypes, QQ and qq. The trio DNA samples were subjected to Whole Genome Resequencing (WGR) using the paired-end Illumina technology. After applying a variant calling bioinformatic workflow, the variants identified within the refined confidence interval of the LFEC OAR6 QTL were filtered for concordance with the QTL segregation pattern. Based on a variant functional annotation analysis, we identified a list of variants that based on their biological impact and their harboring gene could be considered as potential candidate causal variants of the QTL under study. Future research efforts should confirm the role of the candidate genes and mutations highlighted by this study. This study represents a new forward step towards increasing our knowledge on the genetic basis of genetic resistance to gastrointestinal nematodes in sheep and goat commercial populations.

### **References:**

Atlija, M., Arranz, J.J., Martínez-Valladares, M., Gutiérrez-Gil, B. (2016). Detection and replication of QTL underlying resistance to gastrointestinal nematodes in adult sheep using the ovine 50K SNP array. *Genet Sel Evol.* 48, 4. doi: 10.1186/s12711-016-0182-4



### No doubt anymore: A simple genetic test to facilitate breeding for polledness in goats.

R. Simon<sup>1</sup>, C. Drögemüller<sup>2</sup>, G. Lühken<sup>1</sup>

<sup>1</sup>Institute of Animal Breeding and Genetics, Justus Liebig University, Giessen 35390, Germany

<sup>2</sup>Institute of Genetics, Vetsuisse Faculty, University of Bern, Bern 3012, Switzerland

**Contact:** Rebecca Simon, Institute of Animal Breeding and Genetics, Justus Liebig University Giessen, Giessen 35390, Germany. [Rebecca.Simon@agrar.uni-giessen.de](mailto:Rebecca.Simon@agrar.uni-giessen.de)

#### **Abstract:**

Breeding for polledness in goats is more complicated than in cattle as polledness in goats is associated with disorders in sexual development. The incidence is also known as polled intersex syndrome. It is characterized by homozygous polled and genetically female (XX) individuals being infertile due to phenotypically diverse intersexuality. External genitals in affected intersexual goats range from true female to apparently male and all possible intermediate stages. This makes the identification of such cases in practice difficult and points the breeding on polledness in goats into its limits. Previously, a large deletion was postulated as the causal variant for PIS (Pailhoux et al. 2001). However, so far the development of genetic testing for the polled genotypes was not successful. Resequencing of the whole genomes of two genetically female (XX) goats, one PIS-affected and a horned control revealed an additional complex structural variant, which is combined with the already published variant (Simon et al. 2020).

Our data allowed for the first time the development of a diagnostic PCR to proof both, the individual horn genotype, and the genetic sex of goats simultaneously. The genetic test was validated with more than 1000 goats of different breeds confirming that all analyzed PIS-suspicious goats were homozygous polled and indeed female (XX). Thereby the identification of phenotypically questionable intersexes is possible now. The new genetic testing offers a tool to facilitate breeding for polledness in goats.

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### Analysis of Candidate Genes for Growth and Milk Performance Traits in the Egyptian Barki Sheep

Ibrahim Abousoliman<sup>1,2</sup>, Henry Reyer<sup>1</sup>, Michael Oster<sup>1</sup>, Eduard Muráni<sup>1</sup>, Mosaad Mourad<sup>3</sup>, Mohamed Abdel-Salam Rashed<sup>3</sup>, Ismail Mohamed<sup>2</sup> and Klaus Wimmers<sup>1,4</sup>

<sup>1</sup> Leibniz Institute for Farm Animal Biology, Dummerstorf, Germany

<sup>2</sup> Desert Research Center, Cairo, Egypt

<sup>3</sup> Ain Shams University, Cairo, Egypt

<sup>4</sup> University of Rostock, Rostock, Germany

Contact: [Abou-soliman@fbn-dummerstorf.de](mailto:Abou-soliman@fbn-dummerstorf.de)

#### Abstract:

Indigenous sheep breeds in Egypt, including Ossimi, Rahmani, and Barki, are of great importance for meat production. The Barki sheep is well adapted to desert hard condition like high temperature and shortage of food and water. Animal growth traits like birth weight (BW), weaning weight (WW) and average daily gain (ADG) are important traits due to their impacts on the viability of livestock raised for meat production. Milk production has a very important role in ensuring adequate supplies of new-born lambs and ultimately reducing the mortality rate due to starvation. In this study, data from 251 Barki ewes and lambs were used to investigate the association between genotypes at eight genes (*LEP*, *IGF1*, *DGAT1*, *STAT5A*, *PRL*, *CSN1S2*, *GHR*, and *GHRHR*) and production phenotypes. For each gene, one representative single nucleotide polymorphism (SNP) located in the coding region was selected for genotyping using kompetitive allele specific PCR. *LEP* (rs420693815) was significantly associated with weaning weight and average daily gain ( $p < 0.1$ ). Homozygous carriers of the TT genotype had a lower weaning weight and a lower average daily gain compared to the other genotypes. In ewes, significant effects on milk yield and composition were obtained for *LEP* (rs420693815) (milk yield, fat %), *STAT5A* (rs161082816) (lactose %), *PRL* (rs422713690) (MILK YIELD), and *GHRHR* (rs414991449) (protein%, total solids %), while *IGF1*, *DGAT1*, *CSN1S2*, and *GHR* genes showed no significant associations. The results indicated that *LEP*, *STAT5A*, *PRL*, and *GHRHR* genes might be considered as interesting candidates to improve growth and milk performance in Barki sheep.

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### Assisted Reproductive Techniques in Sheep and Goats – Chances and Limits of alternative ways in breeding

**Johanna Maria Meilwes, Martin Ganter,**

*Clinic for Swine, Small Ruminants and Forensic Medicine and Ambulatory Service, University of Veterinary Medicine Hannover, Foundation; Hannover, Germany*

**Contact:** *Johanna Maria Meilwes, Clinic for Swine, Small Ruminants and Forensic Medicine and Ambulatory Service, University of Veterinary Medicine Hannover, Foundation, Bischofsholer Damm 15, 30173 Hannover*  
[Johanna.Maria.Meilwes@tiho-hannover.de](mailto:Johanna.Maria.Meilwes@tiho-hannover.de)

#### **Abstract:**

Aim of this contribution is to give an overview about the opportunities of assisted reproductive techniques in small ruminants and their use and situation in Germany.

Unlike in other countries artificial reproductive medicine like artificial insemination (AI) and embryo transfer (ET) in sheep and goats is not common in Germany. There are no official data about the use of reproductive techniques in this species.

Compared to cattle, requirements for artificial techniques are much more complex.

In Germany two Breeding Centers for semen collecting in small ruminants are registered.

In addition to research activities, the federal Research Institute for Animal Health, the Friedrich-Löffler-Institute ( FLI ) in Mariensee is keeping as “German gene bank for farm animals” genetic reserves of different sheep and goat breeds.

At the Insemination center of Clinic for Small Ruminants, University of Veterinary Medicine Hannover semen of different sheep breeds is collected, stored and available. AI is performed but due to a low demand by sheep breeders rarely carried out.

To expand and offer opportunities which could improve sheep breeding an national and international exchange of knowledge, experience and not least genetic material is necessary. There is an international request for German sheep genetic for example East Frisian Milk Sheep, which could give the chance to an international exchange.

AI and ET could be a chance to improve the genetic diversity and breeding values. Flock health status could be improved by genetic and health tested animals. Many breeds are defined as rare breeds. Genetic reserves can ensure future preservation.



### The use of homologous seminal plasma before and during deep vaginal timed artificial insemination in sheep monitored by thermography and electrical impedance of vaginal mucous.

**Beste Cil<sup>1</sup>, Koray Tekin<sup>1</sup>, Kumsal Duzgun<sup>1</sup>, Calogero Stelletta<sup>1,2</sup>**

<sup>1</sup> Department of Animal Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, Ankara University, Turkey

<sup>2</sup> Department of Animal Medicine, Production and Health, University of Padova, Italy

**Contact:** Beste Cil, Department of Animal Reproduction and Artificial Insemination, Faculty of Veterinary Medicine, Ankara University, Turkey. +90 555 7318338 email: [cil.beste@gmail.com](mailto:cil.beste@gmail.com)

#### **Abstract:**

Artificial insemination in sheep is an intriguing technique because the species-specific cervix conformation does not allow intrauterine deposit and consequently, the inseminating doses are not yet optimized. The variability of the ovulation time following the estrous synchronization remains the main constraint to increase the accuracy and precision of the technique regarding the success rate. The aim of this work was to apply a timed artificial insemination (TAI) protocol considering a deep vaginal deposition of inseminating doses, testing the effects of homologous seminal plasma (SP) and to simulate the application of “on-field” monitoring system based on thermography (IRT) and vaginal electrical impedance (VEI). A total of 109 young ewes were synchronized with 9-11 days of progestogen releasing device (P) and 300 IU of ECG at P removal in non-breeding season. Ewes were divided into three groups: 1<sup>st</sup> as control (C), deep vaginally inseminated with 3.2 ml of chilled semen dosed as  $100 \times 10^6$  motile sperm/ml, 2<sup>nd</sup> treated with seminal plasma (0.4 ml SP) before TAI (SP24h) and 3<sup>rd</sup> treated with SP at TAI (SPTAI). IRT and VEI were applied at the time of P removal and the TAI. Lamb rates were 33.33% (10/31), 32.36% (16/48) and 36.67% (11/30) for C, SP24h and SPTAI respectively. The monitoring system showed a significant ( $P < 0.05$ ) drop of vulvar temperature and vaginal electrical impedance in pregnant SP24h. IRT and VEI give the possibility to identify the timing of insemination and the animals answering to the hormonal synchronization. SP seems to synchronize the fertilization time and influence vaginal and thermal patterns.

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Poster presentations

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### Assessing morphological diversity of Nigerian and Sudanese goat breeds

**Ogah Danlami Moses<sup>1</sup>, El-Tahir S. Shuiep<sup>2</sup>, Daikwo Sylvester Innocent<sup>3</sup>**

<sup>1</sup>Department of Animal Science, Faculty of Agriculture Nasarawa State University, keffi Shabu-Lafia campus, Nigeria .

<sup>2</sup>Department of Molecular Genetics, Institute of molecular Biology , University of Nyala, Nyala South Darfur State. Sudan.

<sup>3</sup>Department of Animal Production and Health, Faculty of Agriculture, Federal University Wukari, Taraba State.

**Contact:** [mosesdogah@yahoo.com](mailto:mosesdogah@yahoo.com) +2348065303418

#### **Abstract**

A total of 360 goats (both sexes) were sampled for morphological traits assessment to distinguish the populations from Nigeria and Sudan. Three breeds from Nigerian goat populations (West African Dwarf (WAD), Red sokoto and sahelian breeds) and two Sudanese goat populations (Local and Desert breeds) were considered for the study. The WAD goats are traditional breed of goat found along the west African coastal subregion characterized to be short and hardy while the Red sokoto and sahelian goat are mainly found in the savannah and arid zones of Nigeria. The Sudanese breeds are traditional breed found throughout regions of the country especially in the northern arid zone of Sudan. Nine quantitative traits were used, which include, body weight, height at wither, body length, face length, heart girth, neck length, ear length, rump length and tail length. The Sudanese desert goats are heavier  $28.57 \pm 1.38$ , longer body  $58.75 \pm 0.61$ , better heart girth  $69.36 \pm 1.26$ , longer neck, ears, rump and tail  $23.23 \pm 1.26$ ,  $22.65 \pm 0.38$ ,  $14.76 \pm 0.26$ ,  $14.38 \pm 0.20$  respectively while the Nigerian red sokoto goats had longer face  $20.13 \pm 0.39$ . The Mahalanobis distance of the morphological traits between the Sudanese and Nigerian indigenous goats showed that the Sudanese local and the desert breeds are the closest 1.27. While the highest distance was among the Nigerian goat populations red sokoto and the sahelian 68.79. The result of classification into appropriate group clearly show Nigerian goats all classified as 100 percent with the Sudanese breed sharing their classification across breeds. The information generated from this study on the morphology of the goats will provide an insight to the genetic details of the goats populations in the two countries, thus will be a valuable information for the genetic characterization of the goats population from the two countries.



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## **The growth curve pattern of West African Dwarf (WAD) goats breeds in Southern Nigeria**

**U. N. Chikereuba and V. M. O. Okoro**

*Federal University of Technology, Owerri, Nigeria.*

### **Abstract**

The WAD goat breeds are characteristically dwarf, therefore evaluating the pattern of their growth is imperative. Data on bodyweight and morphometric traits from over 700 WAD goats (records from animals aged 1 day – 72 months as well as from different sexes ie males and females were taken) around the Southern parts of Nigeria from households that keep them.

Analysis of variance was applied to estimate the effects of States (location) and sex on the body weight and morphometric traits, as well as fitting of natural and growth curve models (Gompertz, Richards and Logistic) were done to evaluate their growth pattern.

There was a significant ( $P < 0.05$ ) location (States) effects on body weight and some morphometric traits i.e. body length (cm), height at withers (cm), ear length (cm), tail length (cm), chest girth (cm) and chest depth (cm), while sex did not affect the bodyweight and morphometric traits of the goats ( $P > 0.05$ ) in the area of study. The natural growth curve showed a steady increase in growth from day 1 to 48 months before it started to plateau as time increased. However, on fitting growth curve models, Richards model provided the best fit.

The effect of location on body weight and some morphometric traits is of significance to goat farmers as selective breeding could be enhanced by that. The natural growth curve that plateaued at 48 months is also significant, as well as the Richards growth model which could be used in planning the breeding programme of the animals.



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### Blood levels of progesterone and cortisol in Murciano Granadina goats after artificial insemination

**Begoña Peinado, Laura Almela, Ángel Poto, Sonia Galián**

*Murcian Institute for Agricultural and Food Research and Development (IMIDA). La Alberca-Murcia. SPAIN.*

**Contact:** Begoña Peinado. Murcian Institute for Agricultural and Food Research and Development (IMIDA). La Alberca-Murcia. SPAIN. email: [begona.peinado@carm.es](mailto:begona.peinado@carm.es). Telephone: +34 968 366756

#### **Abstract:**

Cortisol is used to assess stress. Early pregnancy detection by blood progesterone determination is important in reproductive programs. In a group of 11 adult Murciano Granadina goats which underwent artificial insemination, a study has been carried out to determine blood levels of progesterone and cortisol as possible biomarkers for early prediction of gestation diagnosis.

Three measurements were taken to determine progesterone levels and two for cortisol. The frequency of sampling was 21 days, with one measurement coinciding with the day of the artificial insemination. An automatic immunofluorescence analyser was used to measure both parameters. Statgraphics Centurion program was used for the statistical analysis.

Among the results obtained we highlight that for pregnant females (n=4) the average progesterone values obtained, on the day of artificial insemination and 21 days later, were always higher compared to females that were not pregnant (n=7):  $12.63 \pm 1.59$  ng / ml and  $15.26 \pm 2.3$  ng /ml respectively, and compared to  $8.63 \pm 1.66$  ng /ml and  $10.74 \pm 2.55$  ng /ml respectively. Similar results were obtained for the average cortisol values, obtaining  $58.74 \pm 31.06$  nmol / L on the day of the artificial insemination in the females that became pregnant, compared to  $90.08 \pm 44.40$  nmol /L in the females that did not become pregnant. These results indicate the usefulness of measuring blood progesterone and cortisol values as an early indicator of expected fertility after artificial insemination.



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### Transcript abundance of candidate genes in different body tissues of Egyptian Barki sheep as an indicator of growth performance

**Nasser Ghanem<sup>1</sup>, Mohamed Zayed<sup>2</sup>, Mohamed Radwan<sup>1</sup>, Mona Mohmady<sup>2</sup>, Mohamed Shehata<sup>2</sup>**

<sup>1</sup> Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt.

<sup>2</sup> Animal and Poultry Division, Desert Research Center, Cairo, Egypt.

**Contact:** Faculty of Agriculture, Cairo University, El-Gamaa Street, 12613 Giza, Egypt. [nassergo@agr.cu.edu.eg](mailto:nassergo@agr.cu.edu.eg)

#### **Abstract:**

Sheep is considered one of the main animal genetic resources in Egypt as contributing in meat production while surviving harsh desert conditions and consuming low quality of forage. The aim of this study was to link the expression profile of selected candidate genes with growth performance of Egyptian Barki sheep. Barki sheep lambs (n=26) were kept and fed individually after weaning. Growth performance traits as well as carcass characteristics were recorded after slaughtering. Samples from different body tissues (muscle, liver, fat) were taken and stored in RNA lysis buffer until RNA isolation. Real-time PCR was used to profile selected candidate genes (RPL7, CTP1, FABP4, ADIPOQ and CAPN3) and GAPDH was used as a housekeeping gene. Our data indicated that, heavier final body weight in the fast growing sheep lambs (52.4 Kg) than both medium (41.4 Kg) and slow growing animals (31.7 Kg) 6 months after weaning. Genes involved in protein biosynthesis (RPL7), fatty acid oxidation (CPT1) and lipolysis (FABP4) were up-regulated in fast and medium growing animals in all studied tissues. While, gene regulating lipogenesis (ADIPOQ) was expressed similarly in fat and liver tissues but increased its expression in muscle of fast and medium growing sheep. Expression of CAPN3 was increased in fast and medium growing compared to slow growing animals. This study clearly indicated the, transcriptional profile of CPT1, FABP4 RPL7 and CAPN3 is linked with growth performance of sheep lambs, providing an evidence for the importance of these genes.



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### Usefulness of the genetic variant TMEM154 E35K for breeding against maedi visna susceptibility in the German sheep population

**Gesine Lühken**

*Institute of Animal Breeding and Genetics, Justus Liebig University, Giessen, Germany*

**Contact:** *Gesine Lühken, Institute of Animal Breeding and Genetics, Justus Liebig University Giessen, Giessen 35390, Germany. [Gesine.Luehken@agrar.uni-giessen.de](mailto:Gesine.Luehken@agrar.uni-giessen.de)*

**Abstract:**

Maedi visna, a disease caused by small ruminant lentiviruses, is present in sheep populations of many countries. The disease ends always fatal and cannot be prevented by vaccination. Developed eradication programs including testing and culling may be helpful but are neither cost-effective nor sustainable. Breeding against maedi visna susceptibility could solve or at least reduce these problems. At first in North American sheep populations, an amino acid substitution (E>K) at position 35 of the transmembrane protein 154 (TMEM154) was observed to be associated with susceptibility to maedi visna.

In our study, we tested this association in 21 maedi visna-affected sheep flocks with different breed background and from different regions in Germany. For this purpose, sheep aged three years or older were tested serologically for maedi visna status by ELISA and genotyped for E35K. Secondly, we determined the E35K allele and genotype frequencies in unrelated sheep of 12 breeds kept in Germany in order to estimate their genetic maedi visna susceptibility status.

In most of the analyzed maedi visna-affected flocks, the 35E allele was significantly associated with seropositivity. However, an association was missing in two Merioland sheep flocks, therefore other, maybe breed-specific factors may additionally influence maedi visna antibody titers. Frequencies of the susceptible 35E allele ranged among the 12 analyzed breeds from 2 % (German Grey Heath) to 93 % (Cameroonian sheep), reflecting their genetic susceptibility status and different starting situations for potential breeding programs.



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### Antibody titer after vaccination as potential phenotype for breeding against footrot in sheep: first results

Annabell Amend, O. O. Adeniyi, Gesine Lühken

*Institute of Animal Breeding and Genetics, Justus Liebig University, Giessen, Germany*

**Contact:** *Gesine Lühken, Institute of Animal Breeding and Genetics, Justus Liebig University Giessen, Giessen 35390, Germany. [Gesine.Luehken@agr.uni-giessen.de](mailto:Gesine.Luehken@agr.uni-giessen.de)*

#### **Abstract:**

Footrot is a highly contagious disease causing lameness and occurs worldwide mainly in sheep and goats. The causal agent is the bacterium *Dichelobacter nodosus*. In some few countries selection against footrot susceptibility based on footrot scores is in progress or already established. However, footrot scores are difficult to collect as well as to interpret, and heavily influenced by weather and ground conditions.

Therefore, the aim of the current project was to establish and validate another method for phenotyping footrot susceptibility, which is the reaction of the animal's immune response after contact with antigens of the pathogen. An enzyme-linked immunosorbent assay (ELISA) including *D. nodosus* antigens extracted from a commercial vaccine was developed. With this ELISA, antibody titers were measured in blood samples collected at several time points after vaccination from female Merinoland and Rhoen sheep. The animals were vaccinated with 5-8 months of age and a second time 4 weeks later. Antibody titer data from 202 Merinoland sheep, belonging to 7 half-sib groups, were included in the presented preliminary analyses.

In all sheep, antibody titers increased after vaccination to a peak at week 6, followed by a slower decrease. Between some half-sib groups, antibody titers were significantly different for several time points after vaccination. Estimated heritabilities for antibody titers, e.g. at 4 months after vaccination (animal model: 0.22; sire model: 0.42) are promising for a potential use of this phenotype for breeding towards lower footrot susceptibility and/or better effect of vaccination.





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### Efficiency of Estrus Synchronization Protocols and Artificial Insemination technologies in Abergelle Goat at Station and on farm conditions of Wagemira zone, Ethiopia

**Bekahegn Wondim<sup>1,2</sup>, Mengistie Taye<sup>1,3</sup>, Kefyalew Alemayehu<sup>1</sup>, Aynalem Haile<sup>4</sup>, Mourad Rekik<sup>5</sup>**

<sup>1</sup>Animal Production and Technology department, Collage of Agriculture and Environmental Science, Bahir Dar University: PO. Box 5501, Bahir Dar, Ethiopia

<sup>2</sup>Sekota Dry land Agriculture Research Center (SDARC), PO. Box 62, Sekota, Ethiopia

<sup>3</sup>Biotechnology Research Institute, Bahir Dar University, POBox 79, Bahir Dar, Ethiopia

<sup>4</sup>International Center for Agricultural Research in Dry Areas (ICARDA), PO.Box 5689, Addis Ababa, Ethiopia

<sup>5</sup>International Center for Agricultural Research in Dry Areas (ICARDA), PO.Box 950764, Aman, Jordan

**Contact:** [bewondim23@gmail.com](mailto:bewondim23@gmail.com)

#### **Abstract**

Reproductive bio-technological tools are important to suit kidding time with better forage availability and accelerate improved genetics in the goat breeding programs. The study was conducted during 2019/2020 to investigate the effect of different estrus synchronization protocols on estrus response and conception rate of Abergelle goats following fixed time artificial insemination. Three estrus synchronization protocols: 1) Pregnant mare serum gonadatropins with Enzaprost<sup>®</sup> as separate injection, 2) single injection of prostaglandin, and 3) double injection of prostaglandin were evaluated during the experiment. A total of 278 does for the treatment group and 57 does were used as control group. For semen collection, 23 bucks were used. For the first treatment groups, progesterone impregnated vaginal sponge was inserted at day1 and stayed for 11 days inside, 48 hour before sponge removal, 1ml (600IU) gonadatropins followed by 1ml Enzaprost<sup>®</sup> were administered. For the second treatment groups, 1ml of Enzaprost<sup>®</sup> was administered at day 1. For the third treatment groups, 1ml of Enzaprost<sup>®</sup> were administered at day 1 followed by the second 1ml injection of Enzaprost<sup>®</sup> at day 11. Insemination was performed after 48 hour of estrus follow up. The control groups were allowed to mate as usual. The study revealed that overall estrus response of 87.6%, 61.4% and 53% were investigated from first, second and last treatments, respectively. Relatively higher proportion of the conception rate ( $p < 0.05$ ) was resulted from double injection of prostaglandinF2 $\alpha$  (78.8%). It was concluded that double injection of prostaglandinF2 $\alpha$  was selected as best protocol for its efficiency.



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### Physiological Condition of North Sumatera Local Sheep in Several Districts

**Alfian Destomo<sup>1</sup>, Arie Febretrisiana<sup>1</sup>, Anwar Anwar<sup>1</sup>, Bess Tiesnamurti<sup>2</sup>**

<sup>1</sup> Indonesian Goat Research Institute, North Sumatera, Indonesia

<sup>2</sup> Indonesian Center of Animal Research and Development, West Java, Indonesia

**Contact:** Loka Penelitian Kambing Potong, PO Box 1 Galang, 20585, [alfiandestomo@gmail.com](mailto:alfiandestomo@gmail.com)

#### **Abstract:**

North Sumatra, has great potential to support livestock production in Indonesia, especially sheep, because there is a fairly large plantation area to provide feeds. North Sumatra has an area of 72,981 km<sup>2</sup> and almost throughout its territory people are raising sheep. Farmers keep local Sumatran sheep and crossbred sheep with a different production system. The aim of this study was to determine the effect of location, production system, age of animal, sex and body weight on the physiology condition of sheep (heart rate, respiratory rate and rectal temperature). The study was conducted in December 2019 in several groups of farmers at five Districts, with a total of 192 animals. The data were analyzed using General Linear Model (SAS, 10). The results showed that the location of study, production system and age of sheep had significant effect ( $P < 0.05$ ) on heart rate, respiratory rate and on rectal temperature. However, the breed of sheep has no effect on heart rate (average 49.2 time per minute) and respiratory rate (average 49.2 time per minute). Not only that, it is also showed, that the rectal temperature of local breed was significantly higher ( $P < 0.05$ ) compared to St. Croix crossbreed sheep (39.5 °C and 39.1 °C, respectively). The body weight also appeared to have significant effect ( $P < 0.05$ ) on heart rate, respiratory rate and rectal temperature. This study shows that the physiological condition of the sheep influenced by various factors, including the location of the study, production system, sex, age of sheep and body weight.

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### Immune Adaptive Genetic Positive Selection of IL-4 Domestic Chinese Goats

**Akhtar Rasool Asif<sup>1,2</sup>, Aun Muhammad<sup>2</sup>, Sumayyah Qadri<sup>3</sup>, Ali Haider Saleem<sup>2</sup> and Xiaoyong Du<sup>1</sup>**

<sup>1</sup>. Key Lab of Animal Genetics, Breeding and Reproduction of Ministry Education, College of Animal Science and Technology, Huazhong Agricultural University, Wuhan 430070, PR China

<sup>2</sup>. University of veterinary and Animal Sciences Lahore Pakistan.

<sup>3</sup>. Livestock dairy Development Lahore, Punjab, Pakistan

**Contact:** Akhtar Rasool Asif: [akhtar.rasool@uvas.edu.pk](mailto:akhtar.rasool@uvas.edu.pk)

#### **Abstract**

The identification of the candidate genes that play key role in phenotypic variation in livestock populations can provide new information about evolution and positive selection. IL-4 (Interleukin) gene is associated with the increased nematode resistance in small ruminants; however, the role of IL-4 for the genetic control of different diseases in Chinese goat breeds is poorly described in scientific literature. Therefore, the current investigation was performed for the better understanding of the molecular evolution and the positive selection of single nucleotide polymorphism in IL-4 gene. We used Fixation Index (F<sub>ST</sub>) based method for the outlier loci determination and found that IL-4 gene was present in outlier area with the provisional combined allocation of mean heterozygosity and F<sub>st</sub>. Positively selected IL-4 gene was significantly ( $p < 0.05$ ) present in corresponding positive selection area. Hence, our study provided novel information about the nucleotide variations in IL-4 gene and found to be non-synonymous which may helpful for the genetic control of diseases by enhancing the immune system in local Chinese goat breeds as well as in other analyzed vertebrate species.



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### Educating children in breed improvement of Black Bengal goats in West Chamaran

**Rajeshwaran Selvarajan and ThakurAditi**

*Development Management Institute, Patna, India*

**Contact:** [Development Management Institute, 2<sup>nd</sup> Floor, Udyog Bhavan, Gandhi Maidan, PATNA – 800004, India, [sraj@dmi.ac.in](mailto:sraj@dmi.ac.in)]

**Abstract:**

Action research work is being carried out by the Development Management Institute Patna India in West Champaran area of Bihar state in education. To support their learning at school, the children were involved in breed improvement of the Black Bengal goats reared in their homes. This was done by involving them first in weighing of bucklings (n=118) and doelings (117) of age of 1st to 12th month. Chevon from these goats called Champaran meat is a delicacy in this region. Purpose was to establish the standard growth chart of goats in that area as reference point. The next step was to sensitize the children to observe the difference in growth rate of their animals individually over their first twelve months of growth and compare it with the standard and finally assist them and their families to select the male kids born to top 10% and female kids born to above average mothers based on their growth rate, age at first kidding and twinning probability and no. of kids born in life-time and use them as next generation. The larger objective is to locally develop breeding stock of Black Bengal goats for the region and fetch a higher market price than if sold for meat purpose. The average weight of male and female kids of Black Bengal goats at 12 months of age was 16.8 Kilo and 16 kilo, respectively.



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### Wool fiber density and other characteristics from birth to weaning in Junin lambs

E.C. Quispe<sup>1,2</sup>, W.H. Grabiél<sup>3</sup>, J. Aliaga<sup>1</sup>, M.D. Quispe<sup>4</sup> and R. Quispe<sup>3</sup>

<sup>1</sup> Animal Production Department, Universidad Nacional Agraria La Molina, Lima, Perú.

[jaliaga@lamolina.edu.pe](mailto:jaliaga@lamolina.edu.pe)

<sup>2</sup> Laboratory of Animal Fibers, Natural Fiber's Tech SAC. Lima, Perú. [edgarquispe62@gmail.com](mailto:edgarquispe62@gmail.com)

<sup>3</sup> Animal Production Department, Universidad Nacional del Centro del Perú, Huancayo, Perú. [rolando-quispe@outlook.com](mailto:rolando-quispe@outlook.com)

<sup>4</sup> Engineering Department, Maxcorp Technologies SAC. Lima, Perú. [maxdavid22@gmail.com](mailto:maxdavid22@gmail.com)

**Contact:** [edgarquispe62@gmail.com](mailto:edgarquispe62@gmail.com)

#### **Abstract:**

This research had to objectives to evaluate monthly the body weight and some characteristics of the skin and wool fibers from birth to weaning (120 days) and to analyze relationships between them to order assessing the potential of fiber and duct density as a news selection criterion for improving wool quality, of Junín lambs. Data on live weight, skin surface, monthly fiber growth (MFG), fiber density (FibDen), ducts density (DuctDen), FibDen/initially tattooed area (ITA), DuctDen/ITA, belonging to 24 Junin lambs, were considered. Additionally, the percentage of ducts with one, two, three, or four fibers (PD1F, PD2F, PD3F or PD4F, respectively), and average fiber diameter, were considered also. Live weight and surface skin were recorded with weight scale and graduated ruler, respectively. DenFib and DuctDen were objectively determined using the device and methodology called FIBER DEN. AFD was measured with FIBER EC instrument. It was found that the FibDen and DuctDen increase monthly almost in proportion to the increase of the skin surface from birth to 120 days, with averages of 34.5 and 31.01 fibers and ducts per mm<sup>2</sup>. The direct relationship between AFD and the number of cuts (shearing) of the fiber, and FibDen with MFG into the period of study were found. Besides, the indirect relationship between AFD and FibDen and DuctDen was also found, with sufficient statistical evidence. It is concluded that FibDen and DuctDen could be considered as novel selection criteria for simultaneous improvement of wool quality and quantity because FibDen and DuctDen have a relation with quality and quantity characteristics.



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### Relationship between seminal vesicles echogenicity and semen quality in rams of endangered Venetian sheep breeds

**Calogero Stelletta**

*Department of animal medicine, production and health, University of Padova,*

**Contact:** Prof. Calogero Stelletta, Department of animal medicine, production and health, University of Padova, Viale dell'Università 16, 35020, Legnaro (PD), Italy. Email: [calogero.stelletta@unipd.it](mailto:calogero.stelletta@unipd.it)

#### **Abstract:**

Seminal vesicles are the main producers of seminal plasma (SP) in rams. Their secretions can greatly influence the quality of sperm suspended on them. Sheep endangered breeds (SEB) need more attention on semen treatment after collection because the genetic materials should be maintained efficiently to enhance the biodiversity sustainability. Aim of this work was to investigate the relationship among testosterone under GnRH challenge test (T), echogenicity of seminal vesicles (low, medium, high) and testicles (Vencato et al., 2014), SP composition (P, Ca, Mg, PT, ALP, LDH, cholesterol, triglycerides) and spermatid post-thawed kinetic parameters (total motility, progressive motility, VAP, VSL, VCL, ALH, BCF, STR, LIN) in 4 Venetian SEB (Alpagota, Brogna, Foza, Lamon). A total of 22 rams (N=5, Brogna, N=7 Lamon, N=5 Foza e N=5 Alpagota), 1-5 years old, were used as breeders submitted to a preservation program for extinction threatened breeds and collected two times with electro-ejaculator. Data analysis showed significant relationships among scrotal circumference, T and semen kinetic parameters. Negative correlations indices ( $P < 0.05$ ) resulted between testicular parenchymal echogenicity and semen volume as well as among seminal vesicles echogenicity, semen volume (-0.76) and seminal plasma total proteins (-0.82). Moreover, lower levels of calcium ( $2.15 \pm 0.3$  mg/dl) and cholesterol ( $28.83 \pm 3.37$  mg/dl) concentrations than reference levels (Juyena and Stelletta, 2012) were revealed in all breeds. Clinical biochemistry can be considered routinely to check the quality of the SP helping the eventual make-up of the extenders for chilled or frozen inseminating doses.

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### Echotexture characterization of accessory glands in buck

#### Calagero Stelletta

*Department of animal medicine, production and health, University of Padova,*

**Contact:** Prof. Calagero Stelletta, Department of animal medicine, production and health, University of Padova, Viale dell'Università 16, 35020, Legnaro (PD), Italy. Email: [calagero.stelletta@unipd.it](mailto:calagero.stelletta@unipd.it)



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### Genetic polymorphism in the TLR4 gene and its association with milk traits in Egyptian sheep

**Ahmed M. Sallam**

*Animal and Poultry Production Division, Desert Research Center*

**Contact:** 1<sup>st</sup> Mathaf El-Mataryia, 11735, Cairo, Egypt. [ahmedsallam2@gmail.com](mailto:ahmedsallam2@gmail.com)

#### **Abstract:**

The Egyptian dairy production industry is predominantly based on cows and buffaloes, with little care for sheep and goats. However, sheep contributes about 5% of the total whole milk produced annually in Egypt and contributes a substantial part of their livelihood of a large proportion of the Egyptians. Information available regarding the genetics of sheep milk is scarce in the Egyptian breeds. The objective of this study was to identify genetic variants in the TLR4 gene for milk traits in Barki sheep as one of the three major sheep breeds in Egypt. Records were available for about 300 ewes and were genotyped using polymerase chain reaction (PCR)-single strand conformation polymorphism (SSCP) protocol. Two distinctive conformation patterns (named G and T) were observed in the investigated region. The genotypic frequencies were 44.6%, 35.7% and 19.7% for GG, GT and TT genotypes, respectively. The direct sequencing identified a missense mutation located in the coding sequence of exon3 of the gene (c.1710C>A), which changes the amino acid sequence of the resulted protein (p.Asn570Lys). The association analyses suggested that the identified polymorphism had a significant effect (p-value<0.05) on the daily milk yield, fat percentage and protein percentage. Summarizing, the TLR4 is suggested as candidate gene to improve milk traits in the Egyptian sheep.





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### Influence of Lipoprotein lipase (LPL) gene polymorphism on production traits in dairy goats

**Evaldas Šlyžius<sup>1</sup>, Birutė Šlyžienė<sup>1</sup> and Renata Bižienė<sup>2</sup>**

<sup>1</sup>Lithuanian University of Health Sciences, Department of Animal Breeding, Kaunas, Lithuania

<sup>2</sup>Lithuanian University of Health Sciences, Institute of Biology Systems and Genetics, Kaunas, Lithuania

**Contact:** Evaldas Šlyžius, Lithuanian University of Health Sciences, Department of Animal Breeding, Kaunas, Lithuania, email: [Evaldas.slyzius@ismuni.lt](mailto:Evaldas.slyzius@ismuni.lt)

#### **Abstract:**

The objective of this study was to investigate the influence of LPL gene polymorphism on production traits in dairy goats.

The polymorphism of the goat was analysed in 272 unrelated individuals belonging to three pure goat breeds (Saanen, n=104; Anglo Nubian, n=88 and Alpine, n=80) in Lithuania. The statistical characteristics were calculated using IBM SPSS Statistics, version 20.

In the examined herd, the genotype CC of LPL gene was present in 24.3% of goats, 19.9% of goats had heterozygotic CG genotype and 55.8% of goats had GG genotype. The results showed that goat LPL gene with CC genotype has a higher milk yield (0.14 kg higher compared to GG and 0.72 kg higher compared to CG genotype,  $P < 0.01$ ). The goats with GG genotype have a higher fat content (0.09% higher compared to CC, 0.23% higher compared to CG genotype,  $P < 0.05$ ), while the protein content was higher in goats with CG genotype (0.06% higher compared to CC, 0.03% higher compared to GG genotype,  $P < 0.05$ ). We also estimated, that goats with CC genotype had higher lactose (4.29 %) and lower SCC log<sub>10</sub> (4.506) value ( $P < 0.01$ ). The analysis of the goat milk production parameters showed the significant mean differences between the breeds ( $P < 0.01$ ). The highest milk yield was estimated in Alpine goats, while the lowest SCC and the highest milk fat and protein content in Anglo Nubian goats ( $P < 0.01$ ).

The results of our research show that examined LPL gene polymorphisms seem to be the valuable biomarkers of the goat selection process.



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### The Nolana project - breeding high-performance hair sheep for Germany

#### Rolf Minhorst

Nolana-Netzwerk Deutschland e.V., registered association, 56745 Weibern, Germany, <https://www.nolana-schafe.de>

**Contact:** Dr. Rolf Minhorst, Eichertstr. 48, 56745 Weibern, Germany. Tel: ++48-(0)2655-962912  
[rolf.minhorst@t-online.de](mailto:rolf.minhorst@t-online.de)

#### **Abstract:**

The price of raw wool in Germany has been falling since the end of World War II. Today, the production costs of wool far exceed the gross income from the sale of wool. In view of this precarious situation, the author proposed in 1997 to breed a new synthetic hair breed called Nolana. The project immediately enjoyed broad approval from many sheep breeders, some research institutions and animal husbandry administration.

Due to the EU import restrictions, no genetic material could be imported from overseas. So it was decided to follow the example of the synthetic or composite breeds that are widespread in the United States, relying only on the rules of quantitative genetics. It was supposed to be an open breeding program in which new breeds could be included at any time without a predetermined percentage of genes. The flocks present in the participating farms, primarily the Merino landrace, Suffolk or German Blackhead, served as mother base.

The Wiltshire Horn breed was used as the sire line. In later years, Dorper and Barbados rams were added. It was worked through simple back-crossing up to R<sub>2</sub> and subsequent genetic consolidation. The 15th fattening and slaughter performance test for sheep in the Köllitsch testing station in 2010, demonstrated that the performance parameters of the new Nolana breed are in the good average of the existing dual-purpose breeds.

The project was taken up by many breeders and supported by the sheep breeding associations of the federal states by setting up herd books. Two new synthetic hair breeds have emerged from the Nolana project: The white Nolana meat sheep (NOL) and the brown hair sheep (BHS), both of which were officially recognized by the VDL on November 01, 2018. Actually, the Nolana-Network has 86 Members. The Nolana herdbook-stock includes 52 rams and 745 ewes, The Brown Hairsheep herdbook-stock includes 41 rams and 401 ewes. Besides that, there is also an unknown number of breeders and animals that are not listed in the herdbook. A conservative estimate, for example on the basis of Facebook ads, would result in at least five times the number of Nolana and Brown Hairsheep existing at present in Germany.



Genetic Resources

## Animal breeding and genetics

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### New genomic tools for sheep breeding in Germany

**Monia Budnik, Julia Storms, Anna Wirth, Ann-Kathrin Struck and Ottmar Distl**

*University of Veterinary Medicine Hannover, Institute of Animal Breeding & Genetics, Hannover, Germany*

**Contact:** [monia.budnik@tiho-hannover.de](mailto:monia.budnik@tiho-hannover.de), [ottmar.distl@tiho-hannover.de](mailto:ottmar.distl@tiho-hannover.de)

#### **Abstract:**

New genomic tools became available through ovine genome projects and the development of genome-wide single nucleotide polymorphisms (SNP) arrays. We employed the newly developed ovine GGP 50 K beadchip for >3000 sheep in a wide spectrum of sheep breeds in Germany. The objectives were to test the suitability of this new tool for genotyping Mendelian traits including haplotypes for scrapie resistance, genetic variants for muscularity, fecundity, microphthalmia, entropion, susceptibility for maedi-visna, parentage testing, determination of sex and genomic evaluations for quantitative traits. For genotyping, we used EDTA-blood samples on FTA cards. All samples passed quality checks with a genotyping rate of 98%. Most Mendelian genotypes were accurately genotyped. We found alleles associated with spider lamb, microphthalmia and yellow fat phenotype in very few cases. The TMEM154 K/K genotype associated with lower risk to maedi-visna showed a frequency of 46%. The myostatin allele causing muscular hypertrophy (MSTN:g.6223G>A) was at a frequency of 0.16. More than 60% of the sheep were homozygous for the ARR haplotype. We employed genome-wide SNP genotypes to estimate heritabilities for growth traits recorded in field and stationary tests. In addition, we estimated genomic diversity measures for management the endangerment of particular breeds. Size of training sets and blending of breeds were tested to determine increase in prediction accuracies under different scenarios for German sheep breeds. Imputation of genotyping data on whole genome sequencing data seems to be advantageous for QTL detection. Single-step methods should improve accuracy of prediction by 15-35% compared with other methods.



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### Breeding work towards increasing genetic resistance of scrapie in selected flocks in Poland

**Marcin Świątek, Żaneta Szymańska, Roman Niżnikowski**

*Warsaw University of Life Sciences, Warsaw, Poland*

**Contact:** [marcin.swiatek@sggw.edu.pl](mailto:marcin.swiatek@sggw.edu.pl)

#### **Abstract:**

PrP prion protein gene was recognized as responsible for the appearance of scrapie in sheep. In this gene, series of polymorphisms at codons 136, 141, 154, and 171 were identified. Two forms of transmissible spongiform encephalopathy had been determined in sheep: classical scrapie and atypical (Benestad et al., 2003; Lühken et al., 2004). The study was conducted in 2014-2019 on four flocks belonging to Agricultural Property Agency and one belonging to Warsaw University of Life Sciences on following breeds: Polish Merino (n=644), old-type Polish Merino(n=526), Suffolk(n=127) and Berrichone du cher(n=99), Wrzosówka sheep (n=305) and Żelazna sheep (n=377). At the beginning all animals were genotyped. Sample genotyping was performed with KASPar® system([www.kbioscience.co.uk](http://www.kbioscience.co.uk)), which uses a single nucleotide polymorphism (SNP). Frequency of alleles and genotypes of scrapie was determined. Every year, after determination of scrapie genotypes, each sheep with alleles containing valine in codon 136 was removed from the flock and only ARR allele carriers were left in the herd for further breeding. That measures led to increase the frequency of the ARR/ARR genotype and the genotypes with ARR allele and total elimination of alleles containing valine. Moreover, both forms of this disease could coexist in the same flock (Mazza et al., 2010). In that case, genotyping for alleles containing phenylalanine at codon 141 in abovementioned flocks was done. Breeding work assumption in studied sheep flocks which required elimination sheep with valine at codon 136 and phenylalanine at codon 141 allele has resulted in its decreasing or complete elimination. The applied breeding program has been fully confirmed and should be applied to practice in order to eliminate genetic conditions from sheep populations susceptible to scrapie.

#### **References:**

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- Mazza, M., Iulini, B., Vaccari, G., Acutis, P.L., Martucci, F., Esposito, E., Peletto, S., Barocci, S., Chiappini, B., Corona, C., Barbieri, I., Caramelli, M., Agrimi, U., Casalone, C., Nunno, R. (2010). Co-existence of classical and Nor98 in a sheep from Italian outbreak. *Research in Veterinary Science*, 88(3):478-485. <https://doi.org/10.1016/j.rvsc.2009.11.015>
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### New aseasonal sheep lines for the production of slaughter lambs in Poland

**Roman Niżnikowski, Marcin Świątek, Żaneta Szymańska**

*Warsaw University of Life Sciences, Warsaw, Poland*

**Contact:** [roman\\_niznikowski@sggw.edu.pl](mailto:roman_niznikowski@sggw.edu.pl)

**Abstract:**

Now in Poland synthetic lines of sheep are gaining importance due to their asesonality, thanks to which the supply of lamb meat is possible all year round. Among the Polish aseasonal pure breeds are Polish Merino and Polish Wrzosówka sheep but both breeds (which represent about 25% total sheep population) are in programme for Research on Genetic Resources which made them difficult from being used in production. In 2010 first step to obtain a synthetic lines of sheep was undertaken as part of the work carried out at the Warsaw University of Life Sciences. Polish Wrzosówka ewes were used as the starting material, which were crossed with Berrichone du Cher rams, obtaining the F<sub>1</sub> generation, followed by subsequent generations: F<sub>2</sub>, F<sub>3</sub>, etc. In F<sub>2</sub> generation, two types of coat were obtained - white and uniformly colored (brown to black). Due to the fact that the white coat sheep were obtained in several places in the country, and the colored only in Roztocze (Central-Eastern Poland), they were given the names: WROBER and Roztoczańska sheep respectively. Both sheep lines are characterized by asesonality in reproductive, good growth rate and muscularity as well as resistance to worse environmental conditions. Due to significant amounts of land excluded from agricultural production, the number areas that require protection be grazing is increasing. However, thanks to the registration of both sheep lines (in 2020) by the Ministry of Agriculture and Rural Development and their inclusion in the sheep breed structure in Poland it is possible to supply fresh lamb meat throughout the year. Actual population of WROBER sheep is 130 ewes and 6 rams kept in 6 flocks and roztaczańska sheep is 40 ewes and 4 rams kept in 2 flocks



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### Aortic connective tissue abnormalities resembling Marfan syndrome in goats

**Karianne Lievaart-Peterson<sup>1</sup>, Liesbeth Harkema<sup>1</sup>, Rene van den Brom<sup>1</sup>, Reinie Dijkman<sup>1</sup>, Eveline Dijkstra<sup>1</sup>, Mark van der Heijden<sup>2</sup>, and Piet Vellema<sup>1</sup>**

<sup>1</sup> Royal GD, Deventer, the Netherlands

<sup>2</sup> Universitaire Landbouwhuisdierenpraktijk, Harmelen, the Netherlands

**Contact:** Karianne Lievaart-Peterson, Royal GD, Po BOX 9, 7400 AA Deventer, The Netherlands

Telephone +31 (0)570-660478, [k.lievaart-peterson@gdanimalhealth.com](mailto:k.lievaart-peterson@gdanimalhealth.com)

#### **Abstract:**

Three cases of sudden death in adult dairy goats revealed a hemoabdomen due to rupture of the cranial abdominal aorta or cranial mesenteric artery at post mortem examination. Histologically, there was evidence of impaired vessel wall architecture with loss and fragmentation of elastin fibres, proliferation of the lamina intima and fibrosis. Similar microscopic lesions have been described in Marfan syndrome. Marfan syndrome is a genetic (autosomal dominant) disorder that affects the connective tissue, named after French paediatrician Antoine Marfan, who first described it in 1896 in children. Clinical manifestations involve the cardiovascular, ocular and skeletal system. It is caused by mutations in the gene encoding fibrillin-1, the major component of extracellular microfibrils that support elastin fibre deposition (Coelho and Almeida, 2020). Marfan-like syndrome has since been suggested or described in dogs, cattle (Hirano *et al.* 2012), sheep, and horses. Multiple connective tissue disorders in man and animals are caused by heritable genetic defects and may share similar features.

A genetic defect cannot be ruled out since the Dutch dairy goat population share a small genetic background. Occasionally rupture of the uterine artery is observed, but without similar vessel wall lesions. There is a need for further research including larger numbers of cases, further typing of vessel wall lesions as well as genetic typing.

To the best of our knowledge, this is the first description of morphologic connective tissue abnormalities resembling features of Marfan syndrome in goats.

#### **References:**

Coelho, S. G., Almeida, A. G. (2020). Marfan syndrome revisited: From genetics to the clinic. *Rev Port Cardiol*, 39(4), 215-226. doi:10.1016/j.repc.2019.09.008

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Genetic Resources

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### Prion Protein gene (*PRNP*) Polymorphism in Latvian native breed Goats

**Kristine Piliena<sup>1</sup>, Lasma Zelca<sup>2</sup>, Daina Jonkus<sup>2</sup>**

<sup>1</sup> Latvian Goat Breeding Association, Talsi region, Latvia

<sup>2</sup> Latvia University of Life Sciences and Technologies, Jelgava, Latvia

**Contact:** Berzi, Vandzene, Vandzenes municipal, Talsi region, Latvia, [piliena@inbox.lv](mailto:piliena@inbox.lv)

#### **Abstract:**

Scrapie is a lethal, neurodegenerative disease that is affecting sheep and goats. It is a disease that belongs to the group of transmissible spongiform encephalopathies (TSEs). This disease cause economic loss to herds, where animals are affected by it. The classical scrapie in sheep and goats has been affected by prion protein (*PRNP*) gene polymorphisms (Goldmann et al., 2011). The disease is hereditary and can be limited or eliminated by a thoughtful animal breeding by the selection of scrapie-resistant animals. Latvian native breed goats are dairy goats and their population is small. The aim of the study was to explain the polymorphism of the Latvian native goat breed population according to codons 146 and 222 of the *PRNP* gene. Genetic analyzes were performed in a laboratory by Eurofins Medigenomix GmbH. In total 397 samples were analyzed. It has been found, that in Latvia bred goats, the NN146 genotype is dominated after the codon 146. The frequency of NN146 genotype was 97.7%. The genotype NS146 of heterozygous animals was only 2.3%. Only 9 animals or 1.1% are found with the resistant S146 allele. A larger polymorphism was observed at codon 222, where the frequency of the resistant K222 allele was 11.5%. The homozygotes KK222 genotype was in 3 animals or 1.0%, the heterozygotes QK222 genotype was in 21.2% and the QQ222 genotype was in 77.8%. Although the number of animals with resistant alleles is small, in further breeding process it is crucial to increase the number of animals with necessary genotypes.

#### **Acknowledgements:**

Research was conducted with support from LR Ministry of Agriculture. Contract number 20-100-20-1.8-000011.

#### **References:**

Goldmann W, Ryan K, Stewart P, Parnham D, Xicohtencatl R, Fernandez N, Foster J. (2011). Caprine prion gene polymorphisms are associated with decreased incidence of classical scrapie in goat herds in the United Kingdom. *Veterinary Research* 42(1):110. [Doi.org/10.1186/1297-9716-42-110](https://doi.org/10.1186/1297-9716-42-110)



Genetic Resources

## Economics:

*How can the profitability of sheep and goat farming be improved?*

Keynote presentation



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### Keynote - Sheep and goats in the world and the importance of economy

#### Stanislaus v. Korn

Hochschule für Wirtschaft und Umwelt Nürtingen-geislingen (HfWU), Germany

**Contact:** Prof. Dr. Stanislaus v. Korn, Institut für Angewandte Agrarforschung (IAAF), Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen, 72622 Nürtingen, [stanislaus.korn@hfwu.de](mailto:stanislaus.korn@hfwu.de)

#### Abstract:

With the increasing number of sheep and goats in the world, the importance of small ruminants grew over the past 18 years. Such increases can be observed especially in Africa and Asia, while sheep stocks in Americas, Europe and Oceania had declined.

Sheep and goats mainly contribute to food and income security by producing of food goods. The small ruminants fulfill these functions in different systems in accordance with the respective site conditions: in subsistence farming, e.g. in Africa and Asia, as well as in profit-oriented farms, e.g. in Europe. Favoured und less favoured areas are used, which often have no alternative use.

However, prerequisites for sensible sheep and goat husbandry are adequate biological performance (good productivity in subsistence farming) or adequate profitability through the production of marketable products.

Both parameters (productivity and profitability) always determine the importance of small ruminants. In this context, it is the goal of the Session Economy to analyze positive as well as negative influencing factors.





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## Economics:

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Oral presentations



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### Assessment of the production of goat milk by means of performance cost accounting in terms of economic efficiency and influence of stock size

**Isabel Sand<sup>1</sup>, Christina Gao<sup>1</sup>, Wilfried Hartmann<sup>1</sup>, Fides Marie Lenz<sup>2</sup>, Yvonne Kranch<sup>3</sup>**

<sup>1</sup> Kuratorium für Technik und Bauwesen in der Landwirtschaft (KTBL), Darmstadt, Germany

<sup>2</sup> Landwirtschaftskammer Nordrhein-Westfalen, Lippstadt, Germany

<sup>3</sup> PROFUMA Spezialfutterwerke GmbH & CO KG, Dormagen, Germany

**Contact:** Isabel Sand, [i.sand@ktbl.de](mailto:i.sand@ktbl.de)

#### **Abstract:**

**Purpose:** To evaluate the performance and costs of goat milk production, if it is economical, and whether animal places has an influence on performance cost accounting.

**Methods:** We modelled three production processes of dairy goat farming. These only differed in stock size with the area per animal of 1.86 square metres kept constant. This resulted in 125, 245, and 490 animal place. We also kept the production characteristics constant. With these assumptions, a performance-cost calculation was carried out. It included a list of performance and direct costs, investment requirements and annual building costs, operating costs and performances, costs and success factors.

**Results:** Animal places had no influence on the direct costs and direct cost free performance. However, animal places had an impact on variable costs. These increase with a decrease in animal places and thus decrease the profit margin. Direct and operating free and single-free performance increase with increasing animal places. In the same way, the operating productivity increases and the unit costs are positively affected while the price per litre goat milk decreases. For all three scenarios, the gross margin was still positive, but the direct and operating cost free and individual cost free performance was negative.

**Conclusion:** All three models of production processes turned out as non-economical. To increase profitability, production costs must be lowered, or the benefits improved. In the largest barn for example, the assumed sales milk price of € 0.79 per litre would have to increase by around 35 % in order to cover cost.

**Relevance:** We were able to show which economic variables in the performance and cost calculation arise for the farmer in goat milk production, whether it is economical in the planning examples and where there is room for improvement.



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### An assessment of economic efficiency in German sheep farming - a nationwide analysis

**Stanislaus v. Korn<sup>1</sup>, Stefan Völl<sup>2</sup>, Arbeitskreis Wirtschaftlichkeit<sup>2</sup>**

<sup>1</sup> Hochschule für Wirtschaft und Umwelt (HfWU), Nürtingen-Geislingen, Germany

<sup>2</sup> Vereinigung Deutscher Landesschafzuchtverbände (VDL), Berlin, Germany

**Contact:** Prof. Dr. Stanislaus v. Korn, Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen Institut für Angewandte Agrarforschung (IAAF), 72622 Nürtingen, [Stanislaus.korn@hfwu.de](mailto:Stanislaus.korn@hfwu.de)

#### **Abstract:**

In view of the declining herd population (v. Korn 2019), the analysis of the economic situation in sheep farming is of central importance for the establishment of suitable control measures in order to be able to maintain sheep farming. Against this background, the aim of the project funded by the Landwirtschaftliche Rentenbank was to carry out a nationwide representative analysis of the current assessment of profitability in sheep farming.

For this purpose, all available data from consulting initiatives as well as from accounting and testfarm results have been researched, merged and adjusted. Thus, the most extensive data basis on sheep profitability was created with approximately 700 farm surveys from recent years.

The results show large variations between regions, based mainly on different herd structures and location conditions. The deviations between the years are primarily determined by the fluctuating lamb prices. Overall, it was found that approximately 60% of total income from sheep farming (290 €/Ewe+Year) comes from public donations.

However, under the current price and cost relationships, full costs cannot be covered despite the comparatively high proportion of public funds. This means that if sheep farming is to be preserved in its multifunctionality for landscape, nature conservation, society and rural structures, suitable support instruments must also be installed in the future (EU 2018), but also consulting, training and commitment in sheep farms will be required.

#### **References:**

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v. Korn, St. (2019). Strukturen und Perspektiven der Schafhaltung, Workshop „Zucht und Haltung von Schaf und Ziege in Deutschland“, Okt. 2019 Berlin



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## Economics:

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Oral presentations

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### The Thuringian sheep and goat premium

**Adriana Schwarz<sup>1</sup>, Henryk Baumbach<sup>2</sup>**

<sup>1</sup> Thuringian State Office for Environment, Mining and Nature Conservation, Weimar, Germany

<sup>2</sup> Thuringian Ministry for Environment, Energy and Nature Conservation, Erfurt, Germany

**Contact:** Adriana Schwarz, Thuringian State Office for Environment, Mining and Nature Conservation, Harry-Graf-Kessler-Straße 1, 99423 Weimar, Tel: +49 361 57 3943 595, [adriana.schwarz@tlubn.thueringen.de](mailto:adriana.schwarz@tlubn.thueringen.de)

#### **Abstract:**

Since 1990 the sheep population in Thuringia has decreased significantly. The total number of sheep has shrunk to less than 1/4, compared to 1989 (542,253). The fundamental change of agricultural structures after the unification and the abolition of coupled payments for sheep and goats at federal level in 2005 led to this dramatic decline.

Therefore, Thuringia has supported and initiated some initiatives to reintroduce a premium for grazing animals. Thuringia introduced its own premium for sheep and goats in 2019 (limited until 2021), which is fully financed from state resources and granted as de-minimis aid. The premium is supposed to counter the decrease of animal population, which is essential to conserve high nature value grassland in the medium term. Furthermore, the initiative aims to reintroduce coupled payments as appropriate instrument at federal level with the new CAP period.

Thuringia supports farmers with 25 € per animal and year. Due to the de-minimis rules, the total annual amount is limited to 6,666 € per agricultural holding. In 2019, the premium was paid to 321 farms for 47,000 animals. The total number of dams kept by these farms was about twice this number. However, due to the aid ceiling the premium was capped.

In 2019 the sheep population in Thuringia started to rise again slightly by 2 % (121,900 vs. 119,500 in 2018). With this concept, Thuringia has a pioneering role in Germany, which other federal states have picked up. However, a fundamental solution has to be found at the federal level.



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### Weidewonne – bringing together lamb marketing and landscape conservation

**Stefanie Schröter**

*Naturstiftung David, Projekt Weidewonne, Brau, Deutschland*

**Contact:** Heidelbergstr. 1, 06577 Braunsroda, Germany, [stefanie.schroeter@naturstiftung-david.de](mailto:stefanie.schroeter@naturstiftung-david.de)

#### **Abstract**

Today, the main threat for the valuable dry grasslands is under-grazing, which results in matting and shrub encroachment. After German reunification, the sheep stock decreased especially in Eastern Germany. On average, 58 % of the shepherd's income in Thuringia results from subsidies. However, the German lamb market is challenged by the cost-effective imports from New Zealand. The applying project Weidewonne aims at supporting shepherds, who are also engaged in landscape conservation, by an increase of the value lamb caused by implementing direct marketing.

The brand "Weidewonne" was created for the marketing of landscape conservation lamb in the Thuringian Basin. Since 2011, quality criteria and marketing channels were developed within an EU LIFE project. Since 2017, the project is managed on behalf of the Thuringian Ministry for Environment, Energy and Nature Conservation by the foundation "Naturstiftung David" and funded by ELER.

Currently, 16 shepherds participating in the project, along with butchers, who stock "Weidewonne lamb". Regular marketing campaigns involves partners from slaughter and distribution. In March 2020, an online shop was launched. Now, customers, who have no access to "Weidewonne butchers", are able to order online fresh lamb.

The project shows that nowadays shepherds not only have issues of economical nature but also of social acceptance, bureaucracy and farm succession. In future, the Weidewonne project gains to increase its activities by fully supporting shepherds throughout Thuringia. Then it will be possible to evaluate the improve on a statistical basis.



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### Ways to improve the profitability of sheep farming with rare indigenous sheep breeds

**Nathalie Ketterle<sup>1</sup>, Caroline Ketterle<sup>2</sup>**

<sup>1</sup> Kollektion der Vielfalt, Zell, Germany

<sup>2</sup> University of Applied Science Nürtingen-Geislingen (HfWU), Nürtingen, Germany

**Contact:** Nathalie Ketterle, Boßlerstr. 1, D-73119 Zell u.A., [nathalie.ketterle@kollektion-der-vielfalt.de](mailto:nathalie.ketterle@kollektion-der-vielfalt.de)

#### **Abstract:**

The main goal is the preservation of rare indigenous sheep breeds by using their typical and natural coloured wool in traditional and modern ways, creating sustainable woollen products and selling them directly from farmgate to the consumers and therefore increase the profitability of sheep farming and preserve biodiversity.

When we started 2004, the renewable research wool was regarded as waste and it had no use at all. Instead of increasing the income of farmers, wool costs them and shearing their sheep is only done for animal welfare reasons.

Instead of throwing away an eco-friendly and sustainable fibre, we found use for the wool of our indigenous sheep breeds thereby avoiding microplastic pollution since wool is compared to synthetical fibre reusable and 100% biodegradable.

Since 2009, we consult and support projects all over Europe to develop a whole value chain for wool and collaboratively create a local brand for woollen products from rare indigenous sheep breeds.

By selling high quality woollen products directly from "sheep to shop", the whole value chain is maxed out, increase the income of the breeders, supporting preservation of rare indigenous sheep breeds and maintaining and sustaining biodiversity and cultural heritage.

Another benefit, 5 % of the weight of wool is pure organic carbon. When stored in wool, there is less carbon in the atmosphere and this mitigates climate change.

Our work contributed to agriculture and landscape conservation as well as to the promotion of old and endangered sheep breeds and the preservation of their genetic diversity.



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## Economics:

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### From an idea to optimize the regional lamb marketing for small farms with an official Slaughterhouse for small ruminants – a good idea?

**Henrik Wagner**

*Clinic for Obstetrics, Gynaecology and Andrology for Large and Small Animals with Veterinary Ambulance, Justus-Liebig-University Giessen*

**Contact:** Dr. Henrik Wagner, Frankfurter Straße 106, 35392 Gießen, [Henrik.W.Wagner@vetmed.uni-giessen.de](mailto:Henrik.W.Wagner@vetmed.uni-giessen.de)

**Abstract:**

The production of lamb is the provision of high quality food, which should also be evaluated ethically and economically. My sheep should not be transported for long. The author always had the problem of only being able to deliver lambs seasonally. Old animals can only be sold very badly via this. So my goal is to be able to deliver lamb on demand and thus to react flexibly to the market. As a veterinarian, safe and stress-free slaughtering is my top priority. So a slaughterhouse had to be built.

The lecture explains the route from planning to the implementation of an EU-approved slaughterhouse for small ruminants with all the pros and cons for small farms. Unconventional solutions are also discussed, as the cost structure of wage slaughter and the problem of disposal of slaughter by-products. The lecture should also show how important and meaningful the cooperation with the approval authority is and that this should not always be seen as negative on the part of the farmers.

The aim of the lecture is to present the critical checkpoints of the small farmers for the marketing of their lambs and to present the economic and sociological problem areas in the routine process of slaughtering and marketing honestly and openly. It should make you think in order to improve regional marketing and to get solution approaches rolling at the political level. The small slaughterhouses take animal welfare enormously into account and thus make an active contribution to the production of healthy and safe food.



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Poster presentations

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### Factors Influencing Household Preference for Goat Meat in Nigeria

**Olaniran Anthony Thompson**

*Department of Agricultural and Resource Economics,  
Federal University of Technology, P. M. B. 704, Akure, Ondo State, Nigeria*

**Contact:** [oathompson@futa.edu.ng](mailto:oathompson@futa.edu.ng); +2348036288434

#### **Abstract**

Goat meat is known worldwide as a very important component of human diet because of its high nutritive value and significance in improving human health. The study therefore examined the households' preference level for goat meat in Nigeria; examine factors affecting the households' preference level for goat meat in the Country and determine factors influencing the choice of goat meat consumption by the households in Nigeria. Multi-stage sampling technique was used to select 360 households in Oyo and Lagos State, Nigeria. Ordered probit regression model was used to examine the factors affecting household preference level for goat meat in Nigeria and multinomial logistic model was used to determine the factors influencing the choice of goat meat consumed by the households in Nigeria. The study revealed that fillet was the most preferred goat meat because of its easy accessibility with preference index 0.91 in Nigeria. The ordered probit model estimation results revealed that positive relationship existed between level of education and preference level for sea food in Nigeria. Result of marginal effect revealed that increase in income of the household will increase the likelihood of having high preference for seafood by 1.81e-06%, increase the likelihood of having moderate preference by 2.84e-06% and increase the likelihood of having low preference by 3.52e-06%. Multinomial logistic model results revealed that income significantly increases the probability of choice of fillet, calamari, crabs and lobster in Nigeria. Most of the respondents rarely have access to seafood. Therefore, the study recommends that seafood marketers should ensure good distribution network of their products within the Country.



Genetic Resources

## Economics:

*How can the profitability of sheep and goat farming be improved?*



Poster presentations

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### Place of goat meat in human consumption in the Chlef region in Algeria

**Mohamed Sadoud, Yassine Sadoud.**

*H. Benbouali Chlef University, BP 151, Chlef, Algeria*

**Contact:** [m\\_sadoud@yahoo.fr](mailto:m_sadoud@yahoo.fr)

#### **Abstract:**

According to FAO statistics; in 2017, Algeria had around 5 million goat heads and produced 7500 tonnes of goat meat. According to Madani (2000), the goat breeds existing in Algeria are of the traditional type, the majority of which are subject only to natural selection. They are composed by animals of the local population with generally Nubian blood. In addition to local populations, there are also introduced populations, and crossed populations. The survey took place during 2019. The questionnaire was sent to 200 heads of households. The surveys comprising 24 questions targeted the usual consumers of goat meat, who were previously selected according to the difficult piedmonts and mountain areas of the Chlef region. Consumer preferences are very complex and heterogeneous and depend not only on the sensory properties of the meat, but also on psychological and socio-demographic factors. Thus, they look for freshness considered as a factor in the appreciation of the quality of a meat and for this they pay great attention to the color of the meat, which is used as an indicator of the age of the animal (Oury et al., 2009). They consider juiciness and taste as very important criteria in the choice of meat.

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## Environmental performance and climate change:

*What do sheep and goats contribute to climate change mitigation?*



Oral presentations

### Adaptation to saline drinking water in goats

Rukhsana Amin Runa<sup>1</sup>, Alexander Riek<sup>2</sup>, Lea Brinkmann<sup>3</sup> and Martina Gerken<sup>3</sup>

<sup>1</sup> Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh, Bangladesh

<sup>2</sup> Institute of Animal Welfare and Animal Husbandry, Friedrich-Loeffler-Institute, Celle, Germany

<sup>3</sup> Department of Animal Sciences, University of Göttingen, Göttingen, Germany

**Contact:** Dr. Alexander Riek, Institute of Animal Welfare and Animal Husbandry, Friedrich-Loeffler-Institut, Dörnbergstr. 25/27, 29223 Celle, Tel: +49 5141 3846 160, Email: [alexander.riek@fli.de](mailto:alexander.riek@fli.de)

#### **Abstract:**

In the context of global warming, salinization of groundwater and soil is a prevalent global issue with serious consequences on animal health and production. Therefore, we investigated the capacity of goats to adjust their salt intake from saline drinking water in a free choice system. Twelve non-pregnant Boer goats were kept in individual pens for 4 weeks. In the control phase (1 week), only fresh water was supplied in five identical buckets for each pen. During the subsequent treatment phase (3 weeks), fresh tap water and four different concentrations (0.75, 1.0, 1.25, and 1.5% NaCl) of saline water were offered simultaneously in a free choice system. Hay, water and a mineral lick were provided ad libitum. Dry matter intake, total water intake and total sodium intake were significantly ( $P < 0.001$ ) higher during the treatment phase. All goats had a significant preference for fresh (0% NaCl) over saline water. At the beginning of the simultaneous choice situation, animals did not differentiate between salt concentration of 0.75% and 1.0%. However, with successive treatment, animals distinguished more sensitively between saline water concentrations and preferred the 0.75% salt concentration. The total sodium intake of goats ranged between 0.37-0.55 g/kg BM<sup>0.75</sup> per day during the treatment phase, being 8 to 11 fold higher than the daily requirements of sodium for body maintenance. The results suggest that goats are able to differentiate between saline water concentrations and adjust their sodium intake by quick adjustments in self-selection in a free choice system.



## Environmental performance and climate change:

What do sheep and goats contribute to climate change mitigation?



Oral presentations

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### ***Anaplasma phagocytophilum* in cattle, sheep and goats in Germany – results of a systematic review of the literature**

**Matthias G. Wagener, Martin Ganter**

University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Hannover, Germany

**Contact:** University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Bischofsholer Damm 15, 30173 Hannover, Germany; [matthias.gerhard.wagener@tiho-hannover.de](mailto:matthias.gerhard.wagener@tiho-hannover.de)

#### **Abstract:**

*Anaplasma phagocytophilum*, formerly called *Ehrlichia phagocytophila*, is a Gram-negative, obligate intracellular bacterium that has a broad host range. Because it is transmitted by ticks and enters the neutrophil granulocytes, clinical pictures are called granulocytic anaplasmosis in dogs or humans, or tick-borne fever in ruminants. Clinical signs in small ruminants include an acute febrile reaction, abortion, depressed appetite and respiratory symptoms. Due to secondary infections a broad range of other clinical signs is also observed. Tick-borne fever in small ruminants typically played a role in northern Europe, and higher-altitude regions in southern Europe. But there are also high seroprevalences in dogs or wild ruminants in Germany. Positive samples of patients show that there is also a clinical impact of the infection in German small ruminants. A systematic literature search in three scientific databases was performed. Search terms were “*Anaplasma phagocytophilum*” AND “Germany” AND (“sheep” OR “goat” OR “cattle”) as well as synonyms or German translations of the terms. 161 sources (without replicates) from 1920 to 2020 were found. 13 sources were identified as suitable in providing information about the status of *A. phagocytophilum* in cattle or small ruminants in Germany. Except one source all were from the last decade, 9 of them dealt with cattle, 2 with sheep, 2 with goats, 2 with mouflons. All sources containing small ruminants included more than one host species. These data show a lack of knowledge concerning this pathogen in small ruminants in Germany. Tick-borne fever in ruminants might be currently underdiagnosed and even might get a higher impact on flocks in Germany due to the climate change and the accompanying better conditions for ticks as a vector of *A. phagocytophilum*.

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## Environmental performance and climate change:

*What do sheep and goats contribute to climate change mitigation?*



Oral presentations

### Opportunities to mitigate GHG emissions from sheep and goat farming in Indonesia

**Mohammad Ikhsan Shiddieqy<sup>1</sup>, Bess Tiesnamurti<sup>1</sup> and Yeni Widiawati<sup>2</sup>**

<sup>1</sup> Indonesian Center for Animal Research and Development (ICARD), Bogor, Indonesia

<sup>2</sup> Indonesian Research Institute for Animal Production, (IRIAP), Ciawi, Indonesia

**Contact:** Jalan Raya Pajajaran Kav. E-59, Bogor 16151, Indonesia, (+62) 251 8322185, [m.ikhsan.shiddieqy@litbang.pertanian.go.id](mailto:m.ikhsan.shiddieqy@litbang.pertanian.go.id)

#### **Abstract:**

Sheep and goat farming play an important role in the livelihoods of the farmers in Indonesia. Small ruminants farming in Indonesia is identified with limited ownership by farmers (2-7 heads/household). Farming management systems are dynamic in response to the availability of resources. Indonesia's Ministry of Agriculture is trying to boost the small ruminants population. However, an increase in small ruminants population is related to the contribution of sheep and goat to greenhouse gas (GHG) emission. The small ruminant production system is affected by climate change and contributes to global warming with GHG emissions (Marino et al., 2015). Since goats are considered more climate resilient than other ruminant species (Pragna et al., 2018), their contribution to GHG emissions is more important to highlight. This paper aims to provide an integrated overview on the opportunities to mitigate GHG emissions from sheep and goat farming in Indonesia. Beef cattle are the highest contributor of enteric CH<sub>4</sub> (18.04 Gg CO<sub>2</sub>-e or 65,12%) among livestock's GHG (Tier 1) in the country, while goat and sheep are 2.043 Gg CO<sub>2</sub>-e (8.47%) and 1.509 Gg CO<sub>2</sub>-e (6,26%) in 2014, respectively. However, GHG emissions from small ruminants are significant since the population are growing 10.1% per year. GHG emissions (enteric CH<sub>4</sub>, feces CH<sub>4</sub> and feces N<sub>2</sub>O) from sheep using Tier 2 method are 1.693 Gg CO<sub>2</sub>-e in 2014 (Widiawati and Tiesnamurti, 2019). Among the various GHG mitigating strategies, our review suggests that the most effective mitigation strategies in Indonesia is through nutritional intervention, such as utilization of tropical legumes and palm kernel cake as small ruminants feed which reduce enteric CH<sub>4</sub> production.

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## Environmental performance and climate change:

*What do sheep and goats contribute to climate change mitigation?*



Oral presentations

### The impact and breeding perspectives of maternal energy metabolism profiles pre- and postpartum on lamb body weight development with special regard to ewe methane emission traits

Jessica Reintke<sup>1</sup>, Kerstin Brügemann<sup>1</sup>, Tong Yin<sup>1</sup>, Petra Engel<sup>1</sup>, Henrik Wagner<sup>2</sup>, Axel Wehrend<sup>2</sup>, Anja Müller<sup>3</sup>, and Sven König<sup>1</sup>

<sup>1</sup> Institute of Animal Breeding and Genetics, University of Giessen, Ludwig St. 21B, 35390 Giessen, Germany

<sup>2</sup> Clinic for Obstetrics, Gynaecology and Andrology of Large and Small Animals with Veterinary Ambulance, University of Giessen, Frankfurter St. 106, 35392 Giessen, Germany

<sup>3</sup> IDEXX Laboratories, Vet Med Labor GmbH, Im Moltengraben 65, 70806 Kornwestheim, Germany

**Contact:** Jessica Reintke, Institute of Animal Breeding and Genetics, University of Giessen, Ludwig St. 21B, 35390 Giessen, Germany, [Jessica.Reintke@agrar.uni-giessen.de](mailto:Jessica.Reintke@agrar.uni-giessen.de)

#### **Abstract:**

The profitability of sheep production strongly depends on the maternal health and feed efficiency status, and on lamb weaning performance. This study focused on intergenerational aspects and associations between maternal energy metabolism profiles with lamb body weight development. Data included repeated observations for body condition and methane (recorded via laser methane detector) traits from 330 ewes (253 Merinolandsheep, 77 Rhönsheep) postpartum, and macro-, microelement and metabolic status (blood samples) from 46 ewes pre- and postpartum. Additionally, the body weight of 629 lambs was recorded. In Merino ewes, a maternal serum magnesium level > 1.0 mmol/L at weaning was associated with an increase of 13 % in lamb body weight, compared to offspring from ewes with lower serum magnesium concentration. Furthermore, copper positively affected ewe body condition at weaning in both breeds. In Rhönsheep, a sufficient selenium supply was important to optimize body condition. Moreover, high zinc level during lactation was associated with reduced methane emissions in Merino ewes and a low  $\beta$ -hydroxybutyrate level contributed to decreased methane emissions in both breeds. Large methane levels of an ewe were associated with reduced lamb body weight and reduced ewe body condition. Heritabilities for methane traits were small ( $h^2 \leq 0.03$ ) and genetic correlations between methane emissions, ewe body condition traits and lamb body weight were mostly negative. Results indicate that the maternal mineral and metabolic status affects ewe body condition, methane emissions and lamb body weight. Furthermore, breeding on reduced methane emissions also contributes to genetic improvements of lamb weaning performance.



## Environmental performance and climate change:

*What do sheep and goats contribute to climate change mitigation?*



Poster presentations

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### Sheep and goat, climate change and environmental performance: a perspective from Nigeria

**Lizzy Igbine**

Nigerian Women Agro Allied Farmers Association'

**Contact:** Tel: +2348034106448 [lizzy\\_igbine@ymail.com](mailto:lizzy_igbine@ymail.com)

**Abstract:**

Global climate changes have great impact on livestock, and vice-versa. In particular, achieving a sustainable livestock production, intensification and diversification are all determined and affected by climate change. Higher temperatures are much more hazardous for growing, finishing and breeding animals than a cold environment. Further, temperature affects the multiplication and breeding of sheep and goat as high temperatures may cause lower breeding success. Animals reared in tropical environments are generally subjected to more than one stressor at a time. Multiple stressors greatly affect animal production. There is a need to meet environmental objectives without jeopardising food security, while rearing animals in humane farming systems. Five years ago, our researchers were hopeless about climate change and the future of animal breeding example is sheep and goat. The curve goes up and down according to the impact of climate change. Animals also give organic fertilizers to the crop as sheep and goat wastes are used. In breeding quality organic foods have high premiums and class. To support the achievement of food security, the need to increase the stock of goat and sheep is inevitable. Sheep and goat production will help us to achieve SDG1.



## Environmental performance and climate change:

*What do sheep and goats contribute to climate change mitigation?*



Poster presentations

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### Land use conflict between farmers and herdsmen – implication for agricultural and rural development in Nigeria

**Michael Adedotun Oke**

*Foundation Plot 232, Kaida Along Old Kuntunku Gwagwalada, P.O. Box 11611, Garki, Federal Capital Territory, Abuja, Nigeria.*

**Contact:** Tel +2348027142077, +2348188554446 E-mail: [maof2020@gmail.com](mailto:maof2020@gmail.com)

**Abstract:**

Farmers and herdsmen are having a lot of conflict in areas of land matter. This is due to the inadequacy of grazing resources and the effect of this is noted on the household welfare, due to loss of material resources and agricultural produce as well as reduced income. This presentation studies the different conflicts, suggesting ways of ending such, as creating awareness of land use regulations among farmers and herdsmen, provision of grazing land, extension services to teach farmers and herdsmen on conflict coping mechanisms, and educating the farmers and herdsmen for peaceful co-existence for mutual benefit. This also includes the need to have viable and active NGOs acting on farmers-herdsmen conflict management, especially in areas of awareness, education prevention, support of livestock-centered livelihoods including cattle herding, and conflict mitigation. Finally, a conflict management framework is required to curb the danger posed by farmer – herdsmen conflicts and traditional and local leaders should be well involved in finding solutions.



Genetic Resources

## Animal genetic resources: *Diversity and characterization?*



Keynote presentation

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### Keynote: Diversity of sheep in the UK – do we have a problem or an opportunity

Joanne Conington

*Scotland's Rural College, Edinburgh, Scotland*



## Genomic Characterization of Selection Signatures: what is the future for sustainable utilization of Ugandan Goat Breeds

**Robert B. Onzima<sup>1,2,4,5</sup>, Maulik R. Upadhyay<sup>1,3</sup>, Harmen P. Doekes<sup>1</sup>, Mirte Bosse<sup>1</sup>, Martien A. M. Groenen<sup>1</sup> and Richard P. M. A. Crooijmans<sup>1</sup>**

<sup>1</sup> Animal Breeding and Genomics, Wageningen University and Research, Wageningen, Netherlands

<sup>2</sup> Department of Agricultural Sciences, Faculty of Agriculture and Environmental Sciences (FAES), Muni University, Arua, Uganda

<sup>3</sup> Department of Veterinary Sciences Agricultural Population Genomics, Ludwig-Maximilians-University Munich, Germany

<sup>4</sup> Department of Agricultural Sciences, Faculty of Agriculture and Environmental Sciences (FAES), Kabale University, Kabale, Uganda

<sup>5</sup> National Agricultural Research Organization (NARO) P O Box 295, Entebbe, Uganda

**Contact:** Department of Agricultural Sciences, Faculty of Agriculture and Environmental Sciences (FAES), Muni University, P.O. Box 725, Arua, Uganda [robertonzima@gmail.com](mailto:robertonzima@gmail.com) [r.onzima@muni.ac.ug](mailto:r.onzima@muni.ac.ug)

### **Abstract:**

Both natural and artificial selection are among the main drivers shaping genetic variation across the genome of livestock species. Selection typically leaves signatures in the genome, which are often characterized by high genetic differentiation across breeds and/or a strong reduction in genetic diversity in regions associated with traits under intense selection pressure. We evaluated selection signatures in six Ugandan goat breeds: Boer (n=13), and the indigenous breeds Karamojong (n=15), Kigezi (n=29), Mubende (n=29), Small East African (n=29) and Sebei (n=29). After genotyping quality control, 45,294 autosomal single nucleotide polymorphisms (SNPs) remained for further analyses. A total of 394 and 6 breed-specific putative selection signatures were identified across all breeds, based on marker-specific fixation index ( $F_{ST}$ -values) and haplotype differentiation (hapFLK), respectively. These regions were enriched with genes involved in signalling pathways associated directly or indirectly with environmental adaptation, such as immune response (e.g. *IL10RB* and *IL23A*), growth and fatty acid composition (e.g. *FGF9* and *IGF1*), and thermo-tolerance (e.g. *MTOR* and *MAPK3*). The study revealed little overlap between breeds in genomic regions under selection and generally did not display the typical classic selection signatures as expected due to the complex nature of the traits. In the Boer, candidate genes associated with production traits, such as body size and growth (e.g. *GJB2* and *GJA3*) were identified. This study provides insights into the effects of long-term selection in Boer and indigenous Ugandan goat breeds, which are relevant for implementation of breeding programs and conservation of genetic resources, and their sustainable use and management.





## **Morphological variability and geographical distribution of goat populations from Benin (West Africa)**

**Habib R. V. Whannou<sup>1</sup>, Ulriche C. Afatondji<sup>1</sup>, Dominique Demblon<sup>2</sup>, Marcel R. B. Houinato<sup>1</sup>, Luc H. Dossa<sup>1</sup>**

*1 Faculty of Agricultural Sciences, University of Abomey-Calavi, Benin*

*2 Higher Education Institute Condorcet Province of Hainaut, Belgium*

**Contact:** Faculty of Agricultural Sciences, University of Abomey-Calavi, email: [raidvich27@gmail.com](mailto:raidvich27@gmail.com)

### **Abstract:**

Worldwide, insufficient knowledge of the genetic and phenotypic variabilities within and between local goat populations and of their suitability to diversified production environments hampers the development of programs for their rationale selection, use and management. This study explored the current geographical distribution of goat populations in Benin based on their morphology, as a first step in their genetic molecular and phenotypic characterizations. From November 2019 to February 2020, ten qualitative and twenty-six linear body measurements were taken on 2114 adult female goats in the ten phytogeographic zones that compose the three vegetation areas of Benin. Fifteen ratios were generated from the quantitative variables. The data were analyzed using generalized linear model procedures followed by multiple comparison of least square means and multivariate analytical methods, including canonical discrimination analysis and hierarchical ascendant classification. All linear body measurements significantly varied ( $P < 0.05$ ) among zones. The highest mean values of height traits were recorded in the drier zones of the Sudanian area and the lowest in humid Guineo-congolaise area. In the discriminant function analysis, only 61.80% of the measured individuals were correctly classified in their district of origin by 26 measured variables and 8 ratios. The cluster procedure analysis revealed four sub-populations within the three large known goat populations. These results confirm the spatial variation of goat populations according to production areas in Benin, but also suggest that interbreeding may have taken place among animals from the different phytogeographic zones.



## Genetic Diversity and Maternal Origins of Indigenous Sheep Populations in North Ethiopia

**Mulata Hayelom Adhena<sup>1,2,3</sup>, Getinet Mekuriaw Tarekegn<sup>1,4</sup>, Anna M Johansson<sup>1</sup>**

<sup>1</sup>Department of Animal Breeding and Genetics, Swedish University of agricultural Sciences, Uppsala, Sweden

<sup>2</sup>Department of Animal Production and Technology, Adigrat University, Ethiopia

<sup>3</sup>Ethiopian Biodiversity Institute, Mekelle Biodiversity Centre, Ethiopia

<sup>4</sup>Department Animal Production and Technology, School of Animal Sciences and Veterinary Medicine, Bahir Dar University, Ethiopia

**Contact:** Mulata Hayelom Adhena, Ethiopian Biodiversity Institute Mekelle Biodiversity centre, E-mail:

[Mulata.ha@gmail.com](mailto:Mulata.ha@gmail.com), Cell phone: +251 0912419735

### **Abstract**

This study was aimed to investigate the haplotype variations and maternal origin of four sheep populations (Tigray highland, Abergelle, Begait and Elle) of North Ethiopia. A total of 24, 10, 9 and 5 animals were sampled from the above-mentioned sheep populations, respectively. A 1088 bp of the mtDNA control region was amplified using specific primers and the polymerase chain reaction was performed. The control region of the mtDNA was sequenced in 48 samples. For the haplotype diversity, 1088 bp of the d-loop region of the indigenous sheep populations was analysed. Whereas, to define the maternal origins, 729 pb of mtDNA D-loop region aligned to sequences of globally defined reference sequences was used. A total of 137 segregating sites and 45 haplotypes (h) were investigated from all 48 sequences of the four sheep populations: 74, 32, 42 and 23 for Tigray highland, Abergelle, Begait and Elle sheep populations, respectively. Tigray highland sheep has higher haplotypes (22) than Abergelle (9), Begait (9) and Elle (5). Elle, Begait and Tigray highland sheep populations have higher haplotype diversity ( $1 \pm 0.126$ ,  $1 \pm 0.052$  and  $0.99 \pm 0.014$ ) than Abergelle sheep ( $0.978 \pm 0.054$ ) in respective order. The AMOVA analysis indicates 29.78% variation explained among the 4 populations. The phylogenetic network analysis clustered the haplotypes into two haplogroups, haplogroup A and B. The mismatch analysis showed presence of a one-time demographic expansion. The study revealed that the four indigenous sheep populations of Northern Ethiopia have rich materilines which is very essential for future conservation and breeding programmes.



## Discovery of casein variants in goats using capture sequencing

**Siham A. Rahmatalla<sup>1,2</sup>, Danny Arends<sup>1</sup>, Ammar Said Ahmed<sup>1</sup>, Lubna M. A. Hassan<sup>3</sup>, Stefan Krebs<sup>4</sup>, Monika Resissmann<sup>1</sup>, Gudrun A. Brockmann<sup>1</sup>**

<sup>1</sup>Albrecht Daniel Thaer-Institut für Agrar- und Gartenbauwissenschaften, Humboldt-Universität zu Berlin, Invalidenstraße 42, D-10115 Berlin, Germany

<sup>2</sup>Department of Dairy Production, Faculty of Animal Production, University of Khartoum, Shambat P.O. Box 32, 13314 Khartoum North, Sudan

<sup>3</sup>Laboratory of Functional Genome Analysis, Gene Center, University of Munich (LMU), Feodor-Lynen-Strasse 25, 81377 Muenchen, Germany

**Contact:** Siham A. Rahmatalla, Albrecht Daniel Thaer-Institut für Agrar- und Gartenbauwissenschaften Humboldt-Universität zu Berlin, Invalidenstraße 42. [rahmatas@hu-berlin.de](mailto:rahmatas@hu-berlin.de)

### **Abstract:**

Genetic polymorphisms in casein genes (*CSN1S1*, *CSN2*, *CSN1S2*, and *CSN3*) are known to affect milk protein, milk composition, cheese processing properties and human digestibility (Martin et al. 2002; Selvaggi & Tufarelli 2012; Lad et al. 2017). In this study, we investigated sequence variants in coding regions of casein genes in four Sudanese goat breeds (Nubian, Desert, Nilotic, and Taggar) and compared them with Saanen goats, Bezoar ibex, as well as Alpine and Nubian ibex. Using high-density capture sequencing 22 non-synonymous and 13 synonymous SNPs were identified, among them 11 and 7 novel SNPs, respectively. In the *CSN1S1* gene, six non-synonymous (two novel) and seven synonymous SNPs (five novel), in the *CSN2* gene five non-synonymous (three novel) and one synonymous SNP, in the *CSN1S2* gene, six non-synonymous (four novel), and in the *CSN3* gene five non-synonymous (two novel) and five synonymous (one novel) SNPs were detected. Most novel SNPs in coding regions of the casein genes were detected only in the critically endangered Nubian ibex. The identified markers for milk protein variants are additional useful tools for breed characterization, investigating biodiversity and phylogeny, and for the preservation of endangered breeds. Further research is needed to characterize these new sequence variants with respect to allele frequencies in different breeds and consequences on milk properties for human nutrition.

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## The origin and genetic diversity of Bangladeshi indigenous sheep: an updated perspective based on mitochondrial COI Sequences

Md. Abdul Alim<sup>1</sup>, M. M. Kamal Hossain<sup>1</sup>, Nusrat Jahan<sup>1</sup>, Rubaya<sup>1</sup>, Anjuman Ara Bhuyan<sup>1</sup>, Rafsan Radeen<sup>1</sup>, Jahangir Alam<sup>1</sup> and Md. Salimullah<sup>2</sup>

<sup>1</sup> Animal Biotechnology Division, National Institute of Biotechnology, Ganakbari, Ashulia, Savar, Dhaka-1349, Bangladesh

<sup>2</sup> Molecular Biotechnology Division, National Institute of Biotechnology, Ganakbari, Ashulia, Savar, Dhaka-1349, Bangladesh

**Contact:** Dr. Md. Abdul Alim, Animal Biotechnology Division, National Institute of Biotechnology, Ganakbari, Ashulia, Savar, Dhaka-1349, Bangladesh, Phone: +8801718110582, Email: [alimmdcau@gmail.com](mailto:alimmdcau@gmail.com)

### **Abstract:**

Sheep is an important indigenous genetic resource in Bangladesh that have higher adaptability to fluctuating climate, poor nutrition and management system, resistance to local diseases and parasites and suitable for subsistence farming. The country possesses two types of sheep breed known as Native sheep and Garole. The history of domestication, genetic background and variability of the local sheep (*Ovis aries*) populations in Bangladesh remains largely unknown. Therefore, the aim of this study was to provide a characterization, possible origin and genetic relations within the Bangladeshi sheep breeds and to study their genetic connections with the global sheep breeds. A 632-bp fragment of mitochondrial COI region was sequenced in 54 sheep representing two populations; native sheep and garole. The 51 reference sequences representing different domestic sheep clades in Asia, Africa, America, Australia, Europe and Eurasian regions were included. Sequence polymorphism and maternal origin of two Bangladeshi populations were analyzed. Sequence analysis revealed 72 variable sites that defined 20 haplotypes. The haplotype and nucleotide diversity were  $0.766 \pm 0.040$  and  $0.013 \pm 0.0025$ , respectively. Furthermore, AMOVA analysis revealed 94.12 % of the total genetic diversity was accounted for within population variation. The median network and phylogenetic analysis indicated that individuals from all Bangladeshi sheep populations were represented in the clade A, those maternal origins are presumed to be from Asian, more particularly India and China, European and Australian countries. These results inferred that Bangladeshi indigenous sheep still have abundant genetic diversity and have originated from multiple maternal lineages, and further conservation efforts are warranted to maintain the diversity.



## **Runs of homozygosity islands across 100 sheep and 96 goat populations reveal selection signatures**

**Wim Gorssen, Roel Meyermans, Steven Janssens and Nadine Buys**

*Department of Biosystems - Livestock Genetics - KU Leuven, Leuven, Belgium*

**Contact:** +32 16 37 78 24; [wim.gorssen@kuleuven.be](mailto:wim.gorssen@kuleuven.be)

### **Abstract:**

Runs of homozygosity (ROH) are long stretches of homozygosity which are mainly caused by inbreeding. These ROH can be used for the detection of selection signatures by computing/defining ROH islands. Although there are numerous goat and sheep SNP datasets available online, many of these data were never investigated for ROH (islands) and an overview of known ROH islands in sheep and goats is currently missing. In this study, we analysed ROH inferred from medium density SNP datasets in goats (96 populations; 4327 animals; Colli et al., 2018) and sheep (100 populations, 3490 animals; Sempéré et al., 2015). ROH analyses were performed using PLINK and graphically presented per population. Next, results on ROH islands per population were summarised per species. We defined ROH islands as SNPs with a P-value for ROH incidence larger than 0.999 (using standard normal z-scores), and an incidence of minimum 30%.

A number of known ROH islands was confirmed, for example selection signatures for the myostatin gene in Texel sheep on OAR2. However, we also identified several ROH islands which were common in many populations, but with yet unknown, underlying biological mechanism. For example, fifteen sheep populations showed an ROH island on OAR6 at 37-38 Mb and six goat populations showed an ROH island on ARS12 at 35Mb. These findings may direct future studies or can serve as a reference for results in other populations or other investigations. Therefore, these results can be a valuable tool in future genetic research in sheep and goats.

### **References:**

Colli L, Milanese M, Talenti A, Bertolini F, Chen M, Crisà A, et al. (2018). Genome-wide SNP profiling of worldwide goat populations reveals strong partitioning of diversity and highlights



## Genetic diversity of Algerian and Turkish native sheep breeds

**Abdelkader Ameer Ameer<sup>1</sup>, Onur Yilmaz<sup>2</sup>, Nezhir Ata<sup>2</sup>, Ibrahim Cemal<sup>2</sup>, Semir Bechir Suheil Gaouar<sup>3</sup>**

<sup>1</sup> Agronomic sciences department, University of Tlemcen, Tlemcen, Algeria

<sup>2</sup> Department of Animal Science, Adnan Menderes University, Aydın, Turkey

<sup>3</sup> Department of Biology, University of Tlemcen, Tlemcen, Algeria

**Contact:** Ameer Ameer A. University Of Tlemcen, Department of Agronomic sciences, and Faculty life and nature sciences, Email [ameurabdelkader@gmail.com](mailto:ameurabdelkader@gmail.com) ; Tel: +213 657 052 803

ORCID: <https://orcid.org/0000-0002-7450-4311>

### **Abstract:**

The present study was conducted to investigate the genetic diversity and relationship of some native sheep breeds reared in Turkey and Algeria. A set of fourteen microsatellite markers was used for genotyping 240 animals from four Algerian (Hamra, Ouled Djellal, Sidaou and Tazegzawt) and four Turkish (White Karaman, South Karaman, Karacabey Merino and Kivircik) sheep breeds. A total of 340 alleles were observed. The mean number of alleles ( $N_a$ ) and the effective alleles ( $N_e$ ) were, respectively, 24.29 and 10.99 with an average polymorphic information content (PIC) of 0.90. High genetic diversity level was inferred by observed (0.90) and expected heterozygosity (0.76). All FIS (inbreeding coefficient) values were obtained as positive and significant in all sheep breeds studied except White Karaman and Sidaou breeds. Mean value of DST, GST and HT values were found as 0.054, 0.060 and 0.91, respectively. The mean global coefficient of gene differentiation (GST) showed that approximately 94.0% of the genetic variation was within-population. The highest number of private alleles with frequency above 5% was observed in Ouled Djellal sheep. As a result, the eight sheep breeds studied show a distinction between them. Nevertheless, only the Algerian breed Ouled Djellal which is located near the Turkish ovine breeds in the dendrogram, this breed which introduced by the Tribes of Arabia "Benou HILAL" coming from the Middle East. However, the other breeds (Hamra, Tazagzawet and Sidaou) are native breeds of North Africa. In addition, such information provides an overview of the effect of conservation activities on breeding farms, suggesting that we should take some measures to avoid further losses of genetic diversity and minimize inbreeding represented by these breeds as soon as possible.

**Keywords:** Polymorphism, native sheep breeds, Turkey, Algeria, Microsatellite.



## Estimating Population Structure and Relationship of Dairy Goat Genotypes in Kenya

**Ruth Waineina<sup>1,2</sup>, Kiplangat Ngeno<sup>2</sup>, Tobias Okeno<sup>2</sup> and Evans Ilatsia<sup>1</sup>**

<sup>1</sup> Kenya Agricultural and Livestock Research Organization, Naivasha, Kenya

<sup>2</sup> Egerton University, Njoro, Kenya

**Contact:** P.O. Box 25 -2007 Naivasha, Kenya. Telephone: +254 721 430 07 [waineinaruth@gmail.com](mailto:waineinaruth@gmail.com)

### **Abstract:**

Population structure and relationship information among dairy goat is critical for genetic improvement, utilization and conservation. In Kenya, crossbreeding between exotic and local goats has been the breeding strategy of choice to improve productivity of dairy goats. This study explored population structure and level of gene introgression among four goat genotypes in Kenya. Alpine (n = 31), Toggenburg (n = 29), Saanen (n = 24) and Galla (n = 12). Genomic DNA was extracted from whole blood using DNeasyBlood and tissue kit and genotyped using GoatSNPBead Chip developed by International Goat Genome Consortium. Principal components analysis utilizing allele frequencies of the SNP markers estimated population structuring and relatedness. Genotype relationships were evaluated based on the calculated Reynolds genetic distances. A phylogenetic tree was constructed to represent genotype clustering using iTOL software. Model-based clustering (ADMIXTURE) investigated population structure. Genotypes relationships revealed four distinctive cluster: Alpine, Galla, Saanen and Toggenburg. The ADMIXTURE results revealed some level of gene intermixing among the four genotypes. Saanen goats were the most admixed genotype in this study with 84%, seven percent and four percent of its genome derived from Galla, Alpine and Toggenburg respectively. Alpine and Toggenburg goats shared some relationships with the Galla goat; 10% and one percent respectively. The association of Galla with other genotypes was anticipated since Galla goat was used as the founder population for crossbreeding with Saanen, Alpine and Toggenburg breeds. The results revealed there is gene-flow from exotic goats to the Galla populations due to upgrading program. The levels between genetic variations will provides good opportunity for sustainable utilization, conservation and future genetic resource improvement programs in goat genotypes in Kenya.



## Kazimierzowska Goat- native breed of Polish goats

**Żaneta Szymańska<sup>1</sup>, Marcin Świątek<sup>1</sup>, Roman Niżnikowki<sup>1</sup>**

<sup>1</sup> Warsaw University of Life Sciences, Warsaw, Poland

**Contact:** e-mail: [zaneta\\_szymanska@sggw.edu.pl](mailto:zaneta_szymanska@sggw.edu.pl)

### **Abstract:**

Kazimierzowska Goat is a native breed of Polish goats, regenerated in last few years. Kazimierzowska goat was a historic breed, whose appeared in farm until the 60' XX century. It was polish local race, occurred in lubeskie province, near Kazimierz Dolny city. The intensive progress of agriculture and political changes meant that local breeds were forgotten, and finally acknowledge as extint, historical

That were until 2005 when PIB started work to recreate the Karpacka breed, another local breed. In 2014 the Warsaw Univacity of Life Scientes, started work at recreate the Kazimierzowksa breed. Goat with captivating type of appearance, yellowish-gold colour of eyes contrasting with intensely dark (uniformly black) fur. Both males and females have horns bend towards the outside (Kopański, 1985; Ocetkiewicz, 1963). Hight in withers reaches 60 cm and weight fluctuates between 40 and 50kg. Male goats were slightly higher and heavier. Goats give about 300 kg of milk in lactation period with on average 4-5% amount of fat, theirs prolificacy is on about 160% level.

The selection was based on the goat phenotype, elaborated on the basis of available literature data. The starting material were domestic non-racial goats, but with the right exterior. The first flock consisted of 8 goats and 2 bucks. Currently, there are 4 flocks of 35 mothers and 6 adult bucks under the care of Warsaw University of Life Sciences. A relatively small number of animals forced the use of inbreeding (mating daughters with fathers). It allowed to consolidate the desired features. Work has now begun to find the genetic differences of this breed.

Towards the end of 2019 the breed was officially legitimatised, flock-book was made for it and it was encompass with production recording.

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Trybulski M., 1923, *Kozy (rasy i hodowla)*, Księgarnia Rolnicza, Warszawa, s. 6 – 7, 14 – 15





## **Restitution forgotten goat breeds as an example of enriching farm animal biodiversity**

**Jacek Sikora, Aldona Kawęcka, Michał Puchała**

*Department of Sheep and Goat Breeding, National Research Institute of Animal Production, 32-083 Balice Poland*

**Contact:** email: [jacek.sikora@izoo.krakow.pl](mailto:jacek.sikora@izoo.krakow.pl)

### **Abstract:**

At the beginning of the 20th century, the population of goats in Poland was about 300,000. There were the following breeds: Pokucka goat, Carpathian goat, Sandomierz goat, Kazimierz goat and Silesian goat. In the post-war period, the emerging population was based on imported breeds. Native goat breeds previously found in Poland have been successively displaced. In the first decade of the 21st century, attempts were made to reconstruct old, forgotten goat breeds. The first of the reproduced breeds of goats was the Carpathian goat, found in large numbers in the mountainous areas of south Poland. It was a white goat, medium-sized, horned. These goats had good breeding characteristics and the average milk yield was about 350 kg per year.

A Sandomierz goat comes from the area of the Vistula Lowland near Sandomierz (eastern Poland). These goats were relatively large, covered with long hair with dense undercoat, horned; white coat with patches in three colors: gray, black or yellow-brown. The milk yield of goats was around 400 kg.

The Kazimierz goat occurred in the central part of the country. It was characterized by black color, without varieties. She had a long and thick coat with noticeable undercoat. The eyes were distinctly golden-yellow colored iris, which contrasted strongly with the black color. Both sexes have bow-like, slightly twisting corners at the outside. The level of milk production is about 300 kg for 250 days of lactation. Currently, there are 250 Carpathian goats in 20 herds, 40 Sandomierska goats in 3 herds and 20 Kazimierzowska goats in 2 herds. Actions taken to restore old and forgotten breeds of goats contribute to increasing biodiversity



## **The implementation of international commitments for animal genetic resources in Europe and Germany**

**Holger Göderz**<sup>1</sup>

<sup>1</sup> Federal Office for Agriculture and Food, Bonn, Germany

**Contact:** Holger Göderz, Federal Office for Agriculture and Food, Deichmanns Aue 29, DE-53179 Bonn, Germany, [holger.goederz@ble.de](mailto:holger.goederz@ble.de)

### **Abstract:**

Countries have agreed international and national commitments and strategies for the conservation and use of animal genetic resources (AnGR). Information is provided on the most relevant international commitments: the Global Plan of Action for AnGR (GPA), the Convention on Biological Diversity and the Sustainable Development Goals with a focus on the situation in Germany. In Germany, a programme for AnGR has been adopted in the year 2003. After the adoption of the GPA in the year 2007, this programme has been revised. Important actions are a continuous monitoring of all livestock breeds in Germany, the establishment of a national gene bank, the providing of public payments for the breeding of endangered breeds and project funding. In the year 2013, the national risk classification system in Germany has been revised. Since then, the number of breeds that are strongly endangered could be reduced. The stocks of the 19 endangered native sheep breeds increased. One of the success stories is the Alpines Steinschaf, which has been also facilitated by a wool marketing initiative. Its stock of breeding animals increased from 465 (2011) to 1,265 (2019). The stocks of the three native goat breeds have increased by approximately ten percent in this period. The National Programme for the Conservation and Sustainable Use of Animal Genetic Resources in Germany has proven to be suitable to increase or at least to maintain breeding stocks of endangered breeds and thus to maintain AnGR as a basis for the adaptability of livestock production.



## **The Krainer Steinschaf in Austria – *in situ* conservation of an endangered breed**

**Beate Berger<sup>1</sup>, Barbara Soritz<sup>2</sup>**

<sup>1</sup> AREC Raumberg-Gumpenstein, Thalheim, Austria

<sup>2</sup> Arche Austria, Austria

**Contact:** Beate Berger, AREC Raumberg-Gumpenstein, Institute of Organic Farming and Biodiversity of Farm Animals, Austrasse 10, 4601 Thalheim, Austria. +43(0)72424701122 [beate.berger@raumberg-gumpenstein.at](mailto:beate.berger@raumberg-gumpenstein.at)

### **Abstract:**

The Austrian Conservation Breeding Program supports 29 breeds of Farm Animals. The example of the Krainer Steinschaf shows the network and different approaches necessary to analyze, rebuild and use a highly endangered breed. The Krainer Steinschaf is a small framed, non-seasonally fertile dairy sheep. The breed belongs to the cluster of rough wool breeds stemming from the Medieval Zaupelschaf and is well separated from the other endangered Austrian sheep breeds. The flock book population increased from 160 animals (1997) to 4071 animals (2020). Due to a strictly controlled mating plan based on pedigree analysis, the inbreeding rate in the active breeding population was 0,45% for 2007 and 0,4% for 2020. The breeding organization is responsible for the breeding goals and registration of breeding animals on a genetic basis as broad as possible. A farmer driven marketing organization production systems and quality marketing schemes. Pasturing without concentrates is the main production system. On pasture milk yield drops about two months after lambing with the onset of estrus. Twinning rate is not an issue as the ewes can lamb twice a year. For eight years, a quality program of a big food retailer brought up to 1000 lambs per year to market. Unfortunately, the program ceased because of reasons beyond control of the breeders. Now on farm marketing is the main distribution channel. Breeding goals and marketing issues to improve conservation of the breed are discussed.



## Is the German White-headed Mutton Sheep an endangered breed?

**Sowah Addo<sup>1</sup>, Stefanie Klingel<sup>2</sup>, Georg Thaller<sup>3</sup>, and Dirk Hinrichs<sup>1</sup>**

<sup>1</sup> University of Kassel, Witzenhausen, Germany

<sup>2</sup> Arche Warder Zentrum für alte Haus- und Nutztierassen e.V., Warder, Germany

<sup>3</sup> Christian-Albrecht University, Kiel, Germany

**Contact:** Animal Breeding Department, University of Kassel, Nordbahnhofstr. 1a, 37213 Witzenhausen, Germany; [uk069108@uni-kassel.de](mailto:uk069108@uni-kassel.de)

### **Abstract:**

German White-headed Mutton is a meat type sheep classified as a monitoring population, meaning that the effective population size is between 200 and 1000, and a semen cryoconservation programme should be initiated as soon as the number of adult male animals falls below 100. Effective population size estimation for this classification is based on the number of flock book animals, being 1,912 ewes and 102 rams in 2019. In light of the availability of pedigree and marker information, the present study aimed at elucidating the diversity status of German White-headed Mutton from pedigree and genome perspectives. Our data consisted of pedigree information on 19,000 animals, and on 46 individuals genotyped at 40,753 single nucleotide polymorphism markers.

Pedigree-based inbreeding coefficient and effective population size estimates were 1.02% and 132 for the whole population, and 3.50% and 99 for a reference subpopulation of animals born between 2012 and 2015, respectively. Estimate of average generation interval was 3.24 years. Runs of homozygosity-based inbreeding coefficient estimates varied with approximate number of ancestral generations (G) i.e., 1.36% (G = 2), 4.47% (G = 8) and 11.30% (G = 64). A linkage disequilibrium-based effective population size estimate was 53 at 5 generations ago.

Our estimates of effective population size are above the commonly accepted minimum value of 50 (FAO, 1998). However, values below 200, imply that the German risk classification system could be revised considering both, the method/data to estimate effective population size and the thresholds for assigning breeds to certain risk classes.

### **Reference:**

FAO (1998). Secondary guidelines for development of national farm animal genetic resources management plans: Management of small populations at risk. url: <http://www.fao.org/3/a-w9361e.pdf>



## Marketing Situation and Concepts for Products of Endangered local Breeds of Sheep and Goats in Germany

**Antje Feldmann, Katrin Dorkewitz**

*Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen e.V. (GEH), Witzenhausen, Deutschland*

**Contact:** *Antje Feldmann, Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen e.V. (GEH); Walburger Str. 2, 37213 Witzenhausen, E-Mail: [feldmann@g-e-h.de](mailto:feldmann@g-e-h.de), Tel.: +49 (0)5542-1864*

### **Abstract:**

Many local breeds of sheep and goats are on the Red List of Endangered Livestock Breeds in Germany (BLE, 2019). The project "Marketing concepts for products of endangered breeds of farm animals" (Menger et al., 2020) analyzed the current marketing situation of endangered breeds with the focus on food retailing. On the basis of questionnaires from 182 farms and an online research it became clear that the majority of the farmers sell their products via direct marketing (81 %). Wild fluctuations were found, especially in pricing. The marketing situation was mostly balanced (51.5 %) or demand exceeded supply (33.8 %).

Sales tests in food retailing showed that consumers are willing to pay premium prices. Sales promotion measures are able to stimulate business. Products from endangered breeds can be sold very well, especially in urban areas. Markups of 65 % on goat's cheese from the Thuringian Forest Goat did not show negative effects on sales. After a period of communication methods the sales figures almost doubled, even without negative effects on the sale of other goat cheese products. There was neither a substitution nor a cannibalization effect.

The establishment of products from endangered breeds of farm animals in the food retail trade supports sustainable conservation in agricultural use. The project results enable sheep- and goat-breeders and retailers to gain an overview of the communication with the customer, the requirements of the trade and the needs of the farmer and helps them to transfer this knowledge to their own work.

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Bundesanstalt für Landwirtschaft und Ernährung (BLE) (2019): Einheimische Nutztierassen in Deutschland und Rote Liste gefährdeter Nutztierassen 2019. Online verfügbar unter <https://www.ble.de/SharedDocs/Downloads/DE/Landwirtschaft/Biologische-Vielfalt/RoteListe.html>, zuletzt geprüft am 30.04.2020

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### Keynote: Sheep production in Ireland – key factors influencing profitability

**T.W.J Keady**

Teagasc, Athenry, Co Galway, Ireland.

Contact: [Tim.Keady@teagasc.ie](mailto:Tim.Keady@teagasc.ie)

**Abstract:**

Ireland has a population of 4.7 million people and produces enough food to feed 40 million; consequently 85% of its agricultural production is exported. Sheep production in Ireland is grass-based and lambing generally coincides with the initiation of grass growth in early March. Ireland is the fourth largest exporter, worldwide, of sheep meat and the largest net exporter in the EU. The EU is the second largest importer of sheep meat in the world, is only 85% self-sufficient in sheep meat production, and accounts for 88% of Irish sheep meat exports. The following are some key factors impacting sheep farm productivity and profitability:

1. Use of prolific ewe genotypes (e.g., Belclare X) increases annual ewe productivity by up to 0.35 lambs reared per ewe joined.
2. Mating flock replacements to lamb at 1 year of age has no negative effect on ewe productivity at 2 years of age and significantly increases ewe lifetime performance.
3. Each 0.5 kg increase in lamb body weight (BW) at birth increases weaning weight (100 days) by 1.5 kg and thus reduces age at slaughter by approximately 10 days. Optimum birth BW is the highest weight that is compatible with a live, unassisted birth that survives. The optimum birth BW for lambs born as twins and triplets is 0.93 and 0.78 that of singles.
4. Each 5-percentage-point increase in the digestibility of the grass silage offered during mid and late pregnancy increases lamb BW at birth by 0.25 kg and ewe BW at lambing by 6.5 kg. Soybean meal as the dominant protein source in concentrate offered during late gestation increases lamb BW at birth by 0.3 kg.
5. Shearing ewes at housing (mid-December) rather than early summer (May/June) increases lamb BW at birth by 0.7 kg.
6. Leaving male lambs entire increases BW at weaning by 1.8 kg and reduces age at slaughter by 16 days without any negative impact on meat eating quality characteristics.
7. Lambs managed on a grazed-grass only diet can be consistently finished prior to the end of the grazing season. In a 12-year study (in which concentrate, maximum of 300 g/day, was only offered to lambs being reared as triplets) the mean BW gain pre weaning was 330, 271 and 279 g/day for lambs born and reared as singles, twins and triplets, respectively; corresponding BW weight gains from weaning to drafting for slaughter were 183, 178 and 163 g/day.
8. Increasing the feed value of the silage offered to lambs being finished on ensiled forage diets increases BW gain or reduces the level of concentrate supplementation required to achieve a give level performance.
9. Many swards are marginal or deficient in minerals (e.g., cobalt). Need to identify deficiency based on laboratory analyses and/or veterinary guidance



10. There are a number of EU-funded thematic networks (e.g., SheepNet, EuroSheep) that use a multi-actor approach to engage farmers, scientists, advisors/consultants, veterinarians etc. These networks demonstrate that solutions to many producer needs are available, either locally or worldwide, and compile reservoirs of solutions (e.g., [www.sheepnet.network](http://www.sheepnet.network), [www.eurosheep.network](http://www.eurosheep.network)).

Sheep productivity and performance can be improved dramatically by using existing technologies and information resources, thus potentially increasing farm profitability.



## Development of an animal-friendly feeding system for horned goats – preliminary results

**Bianca Greiner<sup>1</sup>, Stanislaus von Korn<sup>1</sup>, Katrin Sporkmann<sup>2</sup>, Heiko Georg<sup>2</sup>, Andreas Kern<sup>3</sup>, Charlotte Lutz<sup>1</sup>, Maren Bernau<sup>1</sup>**

<sup>1</sup> Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen, Nürtingen, Deutschland

<sup>2</sup> Thünen-Institut für Ökologischen Landbau, Westerau, Deutschland

<sup>3</sup> Bioland Erzeugerring Bayern e.V., Augsburg, Deutschland

**Contact:** Bianca Greiner, Hochschule für Wirtschaft und Umwelt Nürtingen-Geislingen, Institut für Angewandte Agrarforschung, Hechingerstraße 12, 72622 Nürtingen, Phone: 07022 201-271, [bianca.greiner@hfwu.de](mailto:bianca.greiner@hfwu.de)

### **Abstract:**

In Germany, particularly in federal state Baden-Württemberg, dairy goat farming is becoming increasingly important as an alternative source of income (Statistisches Bundesamt, 2017). In feeding dairy goats there is a need for developing concentrate feeding systems adapted for horned goats, since dehorning is forbidden in Germany (Animal welfare act, 2019). Due to their species-specific behavior, agonistic interactions and horn-induced injuries are often found, especially while competition during feed intake. Injuries affect animal well-being, animal health, and result in economic losses (Leitner *et al.*, 2007). The project aimed to develop a functional and safe feeding system for horned goats. For further development of concentrated feeding systems, two different systems that are available for hornless goats were selected: A) the Lamking Double Box (LB) (Wasserbauer GmbH) and B) the Capra Box (CB) (Dedden/Hanskamp). One of each system was installed on two different farms in Germany (together 320 goats). Both systems differ fundamentally in the way they work. LB works with a sideways swinging door, whereas CB works as a walk through. To evaluate the feeding system, body condition scoring as well as incidence and type of udder and body injuries were evaluated before and after installation.

A first result is the functionality of the optimized feeding system in each farm, which will be presented during the talk. Data evaluation is still ongoing to be able to give sufficient information about both feeding systems in terms of animal well-being, animal health and economics.

**Funding:** The project is funded within the framework of the European Innovation Partnership "Landwirtschaftliche Produktivität und Nachhaltigkeit" (EIP-AGRI). The funding measure is a measure of the "Maßnahmen- und Entwicklungsplan Ländlicher Raum Baden-Württemberg 2014-2020" (MEPL III). The project is funded by the state of Baden-Württemberg and the "Europäischer Landwirtschaftsfond für die Entwicklung des Ländlichen Raums (ELER)".

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## Influence of housing and management on claw health of Swiss dairy goats

**Lisa-Marie Sailer**<sup>1</sup>, Joan-Bryce Burla<sup>1</sup>, Beat Wechsler<sup>1</sup>, Mirjam Holinger<sup>2</sup>, Patrik Zanolari<sup>3</sup>, Katharina Friedli<sup>1</sup>

<sup>1</sup> Federal Food Safety and Veterinary Office (FSVO), Centre for Proper Housing of Ruminants and Pigs, Tänikon, Switzerland

<sup>2</sup> Department of Livestock Sciences FiBL, Frick, Switzerland

<sup>3</sup> University of Bern, Vetsuisse Faculty, Clinic for Ruminants, Bern, Switzerland

**Contact:** Lisa-Marie Sailer, Tänikon 1, 8356 Tänikon, Schweiz, +49 151 59216779, [lisa-marie.sailer@agroscope.admin.ch](mailto:lisa-marie.sailer@agroscope.admin.ch)

### **Abstract:**

Dairy goats are commonly housed on deep bedding, at least during winter periods. Due to the lack of claw horn wear on abrasive surfaces, goats have a high prevalence of overgrown wall horn. As a result, claw health and locomotion behaviour could be impaired. To evaluate claw conditions and claw lesions, data was collected on 28 dairy goat farms all over Switzerland in autumn 2018 and spring 2019. Locomotion activity and lying behaviour were recorded by means of MSR-loggers. Furthermore, management data concerning housing and claw trimming was gathered on all farms. Linear and generalized linear mixed-effects models were designed to analyze data. Almost all claws showed at least moderate or even severe wall horn overgrowth. Horn separation and sole hemorrhages turned out to be the most frequent lesions. Severe pathologies and infectious claw diseases did not occur. With severely overgrown claws the risk of developing sole hemorrhages was nearly twice as high as with moderate overgrowth. For horn separation, we could show a positive effect of education of the trimmer and of pasture at the time of data collection. Furthermore, season had a significant effect on locomotion activity and on the number of lying bouts per 24 hours. In conclusion, the goats did not seem to be impaired in their locomotion by wall horn overgrowth. However, severe wall horn overgrowth was associated with an increase in the proportion of claws with sole hemorrhages. Therefore, regular, frequent and skilled claw trimming should be propagated.

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## Welfare effects of introducing and separating/reintroducing individual goats

**Antonia Patt<sup>1</sup>, Lorenz Gygax<sup>2</sup>, Beat Wechsler<sup>3</sup>, Edna Hillmann<sup>2</sup>, Nina M. Keil<sup>3</sup>**

<sup>1</sup> Institute of Animal Welfare and Animal Husbandry, Friedrich-Loeffler-Institut, Celle, Germany

<sup>2</sup> Animal Husbandry and Ethology, Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences, Humboldt-Universität zu Berlin, Berlin, Germany

<sup>3</sup> Centre for Proper Housing of Ruminants and Pigs, Federal Food Safety and Veterinary Office, Agroscope, Ettenhausen, Switzerland

**Contact:** Antonia Patt, Dörnbergstr. 25/27, 29223 Celle, +49 5141 3846 150, [antonia.patt@fli.de](mailto:antonia.patt@fli.de)

### **Abstract:**

In goat husbandry, several management procedures are associated with regrouping of animals, e.g. introduction of unfamiliar goats or temporary separation and subsequent reintegration. In two experiments, we thus aimed to quantify the effects of a) introducing (for five days) an unfamiliar goat into an established herd using both horned and hornless groups, and of b) separating (two days) and reintegrating (three days) individual goats. In both experiments, we collected data on social interactions, lying and feeding behavior, and concentrations of fecal cortisol metabolites. Data were analyzed using linear mixed-effects models. In the first experiment, introduced goats showed substantially longer lying times, shorter feeding times and elevated concentrations of fecal cortisol metabolites. Further, introduced goats received most agonistic interactions on the first day. These changes were found in all groups, but were more pronounced in horned goats. During the second experiment, we investigated whether an increased level of contact (visual and tactile) with the original group during separation could reduce the negative effects of separation and reintegration compared to only allowing for acoustic contact with the group. Separated goats showed shorter feeding times during separation and higher fecal cortisol metabolites concentrations during both periods. Increased contact during separation mitigated these effects. Both the introduction of an unfamiliar individual into established groups and the temporary separation of individuals from the rest of the groups led to clear stress responses and should thus be avoided whenever possible. If separation is unavoidable, visual and tactile contact should be permitted to mitigate adverse effects.



## Goat commercialization through increasing productivity of homestead herds in South Africa

Rauri Alcock<sup>1</sup>, Marisia Geraci<sup>2</sup>

<sup>1</sup> Mdukatshani Rural Development Project, Hilton, South Africa

<sup>2</sup> Heifer Project South Africa, Hillcrest, South Africa

**Contact:** [khonya@yebo.co.za](mailto:khonya@yebo.co.za)

### **Abstract:**

The South Africa Goat Agribusiness Project (GAP) is a project aimed at commercialising goats owned by African communal farmers in rural areas in South Africa. GAP has been working for 5 years to pilot interventions to support smallholder farmers focusing on goats as this sector of the economy has never been considered commercial. It is estimated that South Africa imports a million goats from its neighbours worth 67 million euro annually. The entire market for goats in South Africa is for live sacrifice rather than for meat. Even with an urbanising and growing middle class, the demand for these animals and related cultural practices is increasing. Through a process of innovation support and learning, GAP has facilitated and captured in field work through farmer exchanges and distributed these successes to scale up the productivity across the country. Bush encroachment is destroying many grazing areas in the country and linked to successive droughts, making goat farming a successful alternative to livestock farmers in an environment where cattle are on the decline. The GAP innovations and interventions focused on low productivity experienced by smallholder women goat farmers left in charge of homes through a legacy of migrant labour system. Research in field showed that kid mortality was the biggest production loss, with losses ranging from 60-80% of kids. A pilot involving building enclosures and creep feeding kids from 2 weeks to 3 months reduced mortality to 5%. Locally harvested plant materials were processed to feed the kids 100 grams a day. GAP also developed an energy block, with 15% protein, that farmers mix and process themselves. A health management and disease control program carried out by 260 Community Animal Health Workers who were locally recruited, unemployed youth. They were extensively trained and equipped as an independent business to support communities and their livestock.



## A topical anaesthetic wound formulation diminishes pain responses and improves wound healing of lambs at tail-docking

Ferrer, L.M.<sup>1</sup>; Lacasta, D.<sup>1</sup>; Ramos, J.J.<sup>1</sup>; Ortín, A.<sup>1</sup>; Tejedor, M.T.<sup>2</sup>; Castells, E.<sup>3</sup>; Ruiz de Arcaute, M.<sup>1</sup>; Pérez, M.<sup>1</sup>; Rubira, I.<sup>4</sup>; Windsor, P.A.<sup>5</sup>

<sup>1</sup> Animal Pathology Department. Instituto Agroalimentario de Aragón-IA2 (Universidad de Zaragoza-CITA). Veterinary Faculty of Zaragoza. C/Miguel Servet 177. 50013 Zaragoza. Spain.

<sup>2</sup> Anatomy, Embryology and Animal Genetics Department. CIBER CV (Universidad de Zaragoza-IIS). Veterinary Faculty of Zaragoza. C/Miguel Servet 177. 50013 Zaragoza. Spain.

<sup>3</sup> Centro Clínico Veterinario. C/ Madre Genoveva Torres Morales, 8, 50006 Zaragoza. Spain.

<sup>4</sup> Gabinete técnico Veterinario S.L. C/ Isla conejera s/n. 50013 Zaragoza. Spain.

<sup>5</sup> Sydney School of Veterinary Science, The University of Sydney. Camden, NSW | 2570 Australia.

**Contact:** [dlacasta@unizar.es](mailto:dlacasta@unizar.es)

### **Abstract:**

Tail docking is a painful husbandry practice performed routinely in sheep production worldwide. We examined two different procedures for surgical tail docking; with and without general anaesthesia (GA), including the use of a topical wound gel formulation to alleviate pain and improve healing after surgery, containing local anaesthetics lignocaine and bupivacaine, with cetrimide and adrenalin (Tri-Solfen®; TS).

Forty-four female lambs with similar weights were recruited into four equal cohorts: Groups A and C, the tail was excised with a scalpel without anaesthesia and Groups B and D, the tail was surgically excised and stitched under GA. C and D groups were immediately treated with TS. Pain-related behaviour was assessed using a numerical rating scale (NRS) developed previously. A trained scientist blinded to treatment observed the lambs immediately (T0), 2.5h (T1) and 5h (T2) after tail docking. Following the procedure, the animals were examined daily for 15 days, with lesions photographed. This enabled analysis of wound healing after tail-docking and the detection of secondary infections.

Behavioural observations identified that groups without GA (A & C) displayed significantly less pain-related behaviours immediately after the procedure, especially if treated with TS (C). Similarly, the mean of days when animals showed no signs of wound infection was longer in the groups not undergoing GA, especially in those treated with TS.

Surgical tail-docking without GA but where wounds are immediately sprayed with TS is an affordable and welfare appropriate method of conducting tail docking in lambs, avoiding the unnecessary use of antibiotics.



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## Evaluation of behavior during grazing for crossbred hair sheep in the dry Caribbean

**Clara Rúa-Bustamante<sup>1</sup>, Sandra C Perdomo Ayola<sup>1</sup>, Juan Zambrano-Ortiz<sup>1</sup>, Lorena Aguayo<sup>2</sup>**

<sup>1</sup>*Corporación Colombiana de Investigación Agropecuaria – AGROSAVIA, CI. Motilonia, Codazzi-Cesar, Colombia*

<sup>2</sup>*Corporación Colombiana de Investigación Agropecuaria – AGROSAVIA, CI Turipaná. Cereté –Córdoba,, Colombia.*

**Contact:** Clara Viviana Rúa-Bustamante. CI Motilonia, Agrosavia. Email: [crua@agrosavia.co](mailto:crua@agrosavia.co)

### **Abstract:**

The aim was to evaluate the behavior of crossbred hair sheep, grazing under dry Caribbean agro-ecological conditions from North of Colombia. The behavior of nine males (300d) in a pasture composed of native trees, shrubs, weeds and different tropical grasses, was recorded. During four consecutive days, an instantaneous sampling was performed between 8:00 and 15:30, every 15 min. The behavioural events recorded were grazing, eat fruit (mango), browse, resting, walking, ruminating, drinking, others. The temperature (T) and relative humidity (H) were stored in dataloggers. The ITH index was calculated. For the statistical analysis, three blocks were formed: morning, noon and afternoon, using SAS 9.4 statistical software. The general behavioural budget was 56.4% grazing, 12.4% eating fruit, 9.8% browsing, 7.6% rest, 6.4% walking, 5% ruminating, 0.1% drinking, 0.1% others. Most grazing was during afternoon (44.9%) , then morning (39.8%) and noon (15%), where the ITH index was respectively 74.8 (T=23.7 ± 0.31°C, RH= 100%), 74.1 (T= 23.3 ± 0.1°C, RH 100%) and 73,7 (T= 23.1 ± 0.17°C, RH 100%). This could suggest that grazing frequency does not depend on this indicator. The consumption of mango (49.2%) and browsing (49%), was mainly in the morning. The frequency of behaviours appears to not be limited by the ITH-related variables rated within normal values. More studies are necessary to determine if the intensity of ultraviolet radiation is a factor that may be influencing the behaviour of sheep in general, and consumption specifically.



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Poster presentations

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### Sheep farming in marginal lands of Central Italy: recognition of common errors as a path to responsible shearing

Sebastian Alessandro Mignacca

*Istituto Zooprofilattico Sperimentale della Sicilia, Barcellona Pozzo di Gotto, Italy*



### Handling Sheep without docking of the tail - Demonstration Project Animal Welfare

**Martin Steffens**

*Hesse Department of Agriculture Affairs (Landesbetrieb Landwirtschaft Hessen), Wetzlar, Germany*

**Contact:** Schanzenfeldstr. 8, 35578 Wetzlar, +49 64419289-372, [martin.steffens@llh.hessen.de](mailto:martin.steffens@llh.hessen.de)

**Abstract:**

The German Federal Ministry of Food and Agriculture support the “Demonstration Project Animal Welfare” through the Federal Office of Agriculture and Food to give famers the opportunity to change husbandry conditions in order to improve welfare to the Sheep. In total 6 farmers were chosen to keep Sheep with long tails. The participants started in 2017. The docking is done in particular for hygienic reasons. Most of the breeds of sheep bred in Germany have long, woolly tails that can be very dirty. The contaminated areas can be used by various types of flies to lay their eggs or larvae and lead to so called myiasis (fly maggot infestation) in affected sheep. By shortening the tail, the above-mentioned fecal contamination can be reduced. Although scientific studies have not unanimously linked tail length and the likelihood of myiasis, blowfly infestation is one of the main reasons for tail cropping in sheep.

The keeping of uncrossed long-tailed breeds is hardly practiced in Germany. Throughout Germany, up to six companies were sought for the thematic network “No tail docking in sheep lambs” who would like to participate in this pilot project as demonstration companies over a period of two and a half years.

To handle this challenge the improvement of all areas in the environment of the sheep e.g. food, stable management, genetics, parasite management, and much more is necessary. The Hesse Department of Agriculture Affairs, represented by Martin Steffens, was instructed by the Federal Office of Agriculture and Food to perform the advising part for these farmers and can show the results and options to handle Sheep with long tails.





## Comparison of concentrate and flour mixture digestibility results in purebred Latvian Dark-Head lambs

**Liga Senfelde<sup>1</sup>, Daina Kairisa<sup>1</sup> and Dace Barzdina<sup>1</sup>**

<sup>1</sup> Latvia University of Life Sciences and Technologies, Faculty of Agriculture, Institute of Animal Science, Street Liela 2, LV-3001 Jelgava, Latvia

**Contact:** Latvia University of Life Sciences and Technologies, Faculty of Agriculture, Institute of Animal Science, Street Liela 2, LV-3001 Jelgava, Latvia, [shenfeldel@gmail.com](mailto:shenfeldel@gmail.com)

### **Abstract:**

Research has been conducted to compare the efficiency of concentrate and flour mixture digestibility in lambs during fattening. Purebred Latvian Dark-Head ram lambs were used in the research. Feed were provided ad libitum for two groups: CON (concentrate and hay) and BNF (hay and flour mixture consisting of 50% beans, 25% barley and 25% oats). The mean live weight of the lambs at the start of research was 24.6 kg (CON) and 25.6 kg (BNF), with a mean age of  $83 \pm 1.4$  days (CON;  $p < 0.05$ ) and  $75 \pm 1.6$  days (BNF). Feed digestibility data were recorded in three periods each for five days in week 3 (F), 6 (S) and 9 (T) of the fattening when the lambs were placed in cages with a slatted wooden floor and a container with a grate under it for faecal and urine production. The average daily consumption of concentrate for CON were higher and ranged from  $1.25 \pm 0.11$  kg (F) to  $1.75 \pm 0.09$  kg (T). The average daily hay consumption were higher for BNF and ranged from  $0.23 \pm 0.03$  kg (F) to  $0.18 \pm 0.03$  kg (T). Higher faecal production per lamb were collected in BNF ( $0.85 \pm 0.05$  kg (F) to  $0.96 \pm 0.07$  kg (T)). The proportion of digested dry matter during the research ranged from 76.3% to 80.2% (CON) and from 63.1% to 77.9% (BNF). A faecal fraction was soft (CON) and solid (BNF).



## Assessment of management practices among indigenous goat breeders in the humid tropical forest zone of Nigeria

**Oluwatosin Jesuyon, Modupe Orunmuyi, Oluwapelumi Boluwaji, Adeolu Aganga, and Sunday Ogunjimi**

*Federal University Oye-Ekiti, Nigeria*

**Contact:** Animal Production and Health Department, Federal University Oye-Ekiti, Nigeria. GSM: +234-806-431-0337. E-mail: [dr.oluwatosinjesyuyon14@gmail.com](mailto:dr.oluwatosinjesyuyon14@gmail.com)

### **Abstract:**

The study was undertaken to assess indigenous breeding practices and structure among back-yard goat farmers in the livestock-production system of a humid tropical forest zone. Pretested questionnaires and interview schedules were used to collect information from farmers, for two consecutive years, in six selected communities namely; Omuo, Isan, Emure, Oke-Imesi, Ikole and Ayede in South-west Nigeria. Profile assessed were management practices, breeding practices, reproductive performance, disease prevalence, healthcare and challenging problems. Data were analyzed by descriptive statistics using Statistical Package for Social Science (SPSS) Version 20. Bucks run with does all-year round on free-scavenging system, mature sexually at 7-10 months (52%), breeding goal was flock multiplication (24%) and body weight (15%). Prolificacy ranged from 1-4 kids, natural kid nursing took 7-12 weeks, while selection was based on colour, fecundity and health status (20, 13 and 9, %). Breeding was by random mating. Artificial Insemination was not routinely practiced. Bucks were used for 1-2 years while does reproduced till old-age. Diseases were most prevalent in the wet season (10.2%). Mortalities were rarely investigated. Vaccination was common practice among farmers (59%). Resistance to tropical diseases was estimated to be about 30%. Castration was performed (24, %) by farmers themselves. Dehorning was not practiced. Official government intervention and strategic improvement is almost nil. Challenges include absence of an organized sector, the scavenging system and lack of accessibility to veterinary care; although many farmers engage indigenous treatment methods. Organized goat sector for targeted improvement is essential. Intensification of ethnoveterinary practices would improve goat production because it is cheap and materials are accessible to farmers. Improvement of traditional goat breeding would bring more animal protein to rural people and higher income to farmers.

**Keywords:** Breeding system, backyard farmers, West African dwarf goats, management structure.

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## Influence of processed neem fruit and yeast mixtures on performance and digestibility of West African dwarf sheep

Ososanya, T. O.

*Department of Animal Science, University of Ibadan, Ibadan, NIGERIA*

**Contact:** [tososanya85@gmail.com](mailto:tososanya85@gmail.com)

### **Abstract:**

Sixteen (16) male West African Dwarf (WAD) sheep weighing  $14.41 \pm 2.54$  kg were fed processed neem fruit and yeast supplementation to determine performance characteristics and nutrient digestibility. The rams were assigned to four dietary treatments of four rams per treatment comprising control (T1), yeast alone at 5 g/d (T2), neem fruit alone at 5 g/d (T3) and yeast plus neem fruit at 5 g/d (T4). The DM (%) contents were: 93.03, 93.04, 93.71 and 93.71 while the CP (%) were: 8.75, 8.75, 10.29 and 10.29 for diets 1, 2, 3 and 4, respectively. Weekly feed intake and body weight changes were determined and feed efficiency calculated. On 56th day, three rams per treatment were selected for metabolic study. Nutrients digestibility were calculated while nitrogen retention study was determined. Results indicated yeast and neem fruit supplementation improved intake and average daily weight gain. Also, DM (56.71%, 57.19% and 69.16%) and ME (7.63, 7.47 and 8.05 MJ/kgDM) digestibility for diets 2, 3 and 4 differed significantly ( $P < 0.05$ ) from diet 1 (DM 49.74 and M.E 5.55). Also, CP digestibility (%) for diet 4 (82.73) differed significantly ( $P < 0.05$ ) from diets 1, 2 and 3 (72.79, 76.79 and 76.33), respectively. The DM intake (g/day) across the treatments differed significantly ( $P < 0.05$ ) from diet 4 (898.32g/d) and diet 1 (636.06g/d), respectively. Nitrogen retention was best in diet 4 and least in diet 1. Addition of yeast and processed neem fruit (T4) promoted average daily weight gain and performance was better than other diets.

**Key words:** Processed neem fruit, Yeast, Digestibility, Nitrogen Retention and West African Dwarf sheep



## Problems with the back teeth! A relevance for breeding sheep and goats in Germany?

**Philip Christian Tegtmeyer**

*Tierarztpraxis Tegtmeyer - Sheep and goat health consultancy – Langenhagen, Germany*

**Contact:** Dr. med. vet. Philip C. Tegtmeyer, Resser Str. 1a, 30855 Langenhagen, Germany,  
[mail@tierarztpraxis-tegtmeyer.de](mailto:mail@tierarztpraxis-tegtmeyer.de)

### **Abstract:**

Teeth problems, particularly the defective position of molar teeth might have a considerable importance for malnutrition of sheep and goats in Germany. It is recognised in elder animals mainly.

It is generally known that the set of teeth of small ruminants wears down over the years. This might be influenced by the type of feed. Because of a following defective position of back teeth and loss of teeth sheep and goats often cannot eat adequately and fast enough. Loss of incisor teeth is a common finding in German sheep flocks. In most cases the animals do not suffer from the loss of incisors but they are often culled. In the author's experience we have to look closer at the back teeth instead of the common practise of controlling incisors.

What kind of teeth problems can be detected? Comparable with horses, small ruminants develop sharp edges on the molar teeth caused by the chewing process. These edges often overtop the other teeth and cause mechanical irritations when animals are chewing. Often, the corresponding teeth of the other side are damaged by these edges.

The prevalence of back teeth disorders is not known. In order to get some numbers 18 skulls of preselected old ewes were examined for teeth disorders after slaughter. Eight ewes had back teeth problems which caused functional damage. In postmortem examinations and inspections of the oral cavity often massive failures of the denture can be detected. Back teeth disorders can also be detected in younger sheep. Problems can become present for example under second dentition of gimmers. The defective positions of molar teeth may advance the hypothesis that these problems are heritable. First of all a prevalence study is needed for a real confirmation of the hypothesis. Furthermore, research on the aspect of the heritability has to be conducted.

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## Effect of a topical anaesthetic formulation on viral load in lambs naturally infected with orf virus

Lacasta, D.<sup>1</sup>; Reina, R.<sup>2</sup>; Ramos, J.J.<sup>1</sup>; Ferrer, L.M.<sup>1</sup>; Benito, A.A.<sup>3</sup>; Tejedor, M.T.<sup>4</sup>; Martínez, S.<sup>1</sup>; Ruiz, H.<sup>1</sup>; Echeverría, I.<sup>2</sup>; Windsor, P.<sup>5</sup>

<sup>1</sup> Animal Pathology Department. Instituto Agroalimentario de Aragón-IA2 (Universidad de Zaragoza-CITA). Veterinary Faculty of Zaragoza. C/Miguel Servet 177. 50013 Zaragoza. Spain.

<sup>2</sup> Instituto de Agrobiotecnología (CSIC-Gobierno de Navarra). Av. Pamplona, 123, 31192 Mutilva Baja, Navarra. Spain.

<sup>3</sup> Laboratorios Exopol Diagnóstico y Autovacunas. Polígono San Mateo de Gállego. Spain.

<sup>4</sup> Anatomy, Embryology and Animal Genetics Department. CIBER CV (Universidad de Zaragoza-IIS). Veterinary Faculty of Zaragoza. C/Miguel Servet 177. 50013 Zaragoza. Spain.

<sup>5</sup> Sydney School of Veterinary Science, The University of Sydney. Camden, NSW | 2570 Australia.

**Contact:** [dlacasta@unizar.es](mailto:dlacasta@unizar.es)

### **Abstract:**

Orf is a highly contagious eruptive skin condition of sheep and goats. Vaccination with live orf virus is the preferred option for disease control, despite this vaccine is unavailable in many countries. Treatment of orf lesions involves standard hygiene and management of presumptive secondary infections with antibiotics. The wound dressing formulation, Tri-Solfen® (Animal Ethics Pty Ltd, Australia) offers advantages over current therapies, providing pain relief and potentially, more rapid healing of lesions. The formulation contains two local anaesthetics (lignocaine and bupivacaine), adrenalin and an antiseptic (cetramide) in a gel formulation, and has creates a pH of ~2.7 that is potentially viricidal.

Fourteen one-month-old lambs, naturally infected with orf, were recruited from a farm during an outbreak of orf disease. The animals were selected at the early stages of the infection and divided into two cohorts: Group A (n=11) treated with Tri-Solfen® and Group B (n=3), a control group without treatment.

Swabs were obtained before treatment (T0) and days 1 (T1), 3 (T2) and 5 (T3) post-treatment, then submitted to direct DNA extraction and real-time PCR quantification (Exopol) or to incubation with primary tissue cultures from ovine skin fibroblasts (OSF) and T-immortalized goat embryonic fibroblasts (TIGEF). In the study conducted using quantitative PCR, no significant differences were found (p=0.722). However, when the viral load was assessed in OSF cell cultures, there was a significant difference (p<0.05) in reduction between both groups between T0 and T3.

These findings suggest that treatment of orf lesions with Tri-Solfen® reduces the viral load present in lesions.



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### Poster presentations

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## Effect of a topical wound anaesthesia formulation on the cortisol and the acute phase responses of lambs undergoing tail docking.

**Ortín, A.<sup>1</sup>; Borobia, M.<sup>1</sup> Ramos, J.J.<sup>1</sup>; Lacasta, D.<sup>1</sup>; Ferrer, L.M.<sup>1</sup>; Tejedor, M.T.<sup>2</sup>; Ruiz, H.<sup>1</sup>; Jimenez, C.<sup>3,4</sup>Windsor, P.A.<sup>1</sup>;**

*1 Animal Pathology Department. Instituto Agroalimentario de Aragón-IA2 (Universidad de Zaragoza-CITA). Veterinary Faculty of Zaragoza. Zaragoza. Spain*

*2 Anatomy, Embryology and Animal Genetics Department. CIBER CV (Universidad de Zaragoza-IIS). (Universidad de Zaragoza-CITA). Veterinary Faculty of Zaragoza. Zaragoza. Spain.*

*3 Gabinete Técnico Veterinario S.L. C/ Isla conejera s/n. 50013 Zaragoza, Spain.*

*4 Sydney School of Veterinary Science, The University of Sydney. Sydney. Australia.*

**Contact:** Aurora Ortín. [aortin@unizar.es](mailto:aortin@unizar.es)

### **Abstract:**

In this study we evaluated the effect of a topical wound gel formulation containing local anaesthetics lignocaine and bupivacaine, with cetrimide and adrenalin (Tri-Solfen®; TS) on the concentrations of serum cortisol (SC) and the acute phase protein serum amyloid A (SAA) in tail-docked lambs.

Forty-four female lambs with similar weights were recruited into four equal cohorts: Groups A and C, the tail was excised with a scalpel without anaesthesia and Groups B and D, the tail was surgically excised and stitched under general anaesthesia (GA). C and D groups were immediately sprayed with TS. Blood samples were collected before tail docking and at different time intervals post-tail excision. Concentrations of SC and SAA were determined using ELISA assays (Salivary Cortisol ELISA SLV-2930, DRG Diagnostics, Marburg, Germany; PHASE TM Serum Amyloid A Assay, Tridelta Development Ltd., Maynooth, Ireland). Statistical analysis were performed using IBM SPSS statistics version 26 (2019) software (IBM, Armonk, NY, USA).

SC concentration did not change significantly over time in cohorts tail-docked under GA (B & D), but peaked at 30 min post tail removing without anaesthesia (A & C), and treatment with TS (C) appeared to reduce this cortisol response.

In cohorts B & D, SAA concentrations increased significantly 48 hours after tail docking, as it is expected after a noxious stimulus, but treatment with TS avoided the elevation of SAA at this time point in lambs where the tail was excised without anaesthesia.

These results appear to indicate that treatment with TS reduces cortisol and SAA responses in lambs tail docked without anaesthesia, although further research is needed to corroborate these findings.



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## Keynote: Team Sheep vs. Team Corporate - Team building and leadership training as additional income source for shepherds

**Hans-Peter Etzold**

<sup>1</sup> *NatuerlichTeambuilding.de, Andernach, Germany*

**Contact:** *Im Rosental 23, D-56626 Andernach, [peter@leadalpha.eu](mailto:peter@leadalpha.eu), [spitzenplatz@gmail.com](mailto:spitzenplatz@gmail.com) - <https://www.natuerlichteambuilding.de/>*

### **Abstract:**

Team building activities and leadership training are additional income sources for professional shepherds. The innovative activity combines the experience of nature with immediate feedback regarding leadership and teamwork styles. With the help of a management coach and under supervision of the shepherd corporate teams lead and drive a herd of sheep and goats from A to B in a touristically attractive area. While the sheep and goats are grazing during breaks, the teams reflect upon their performance and discuss the lessons learnt related to the herding of the sheep, but also their leadership styles and teamwork. The author is the pioneer of sheep herding as a team building and leadership training activity and offers this kind of activity in cooperation with local shepherds to SME and global corporations. Since 2015 he has served approx. 350 clients. Shepherds are required to have at least 500 sheep and goats in an attractive landscape preferably within one hour's drive of a major city. The shepherds are also required to consider themselves as service providers to professionals from outside the primary sector.

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<https://www.natuerlichteambuilding.de/>

<https://programm.ard.de/TV/Programm/Sender/?sendung=28106372186471>

[Kevin Leman, William Pentak: Das Hirtenprinzip, Sieben Erfolgsrezepte guter Menschenführung, 2010.](#)



## Zoonotic Diseases in Small Ruminants: Risks and Opportunities

**Benjamin Bauer<sup>1</sup>, Martin Runge<sup>2</sup>, Annika Wolf<sup>1</sup>, Louise Prüfer<sup>2</sup>, Laura Wiesner<sup>3</sup>, Imke Steffen<sup>3</sup>, Cornelia Silaghi<sup>4</sup>, Matthias Wagener<sup>1</sup>, Wibke Rubel<sup>1</sup>, Martin Ganter<sup>1</sup>**

<sup>1</sup>University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Hannover, Germany

<sup>2</sup>Lower Saxony State Office for Consumer Protection and Food Safety (LAVES), Food and Veterinary Institute Braunschweig/Hannover, Hannover, Germany

<sup>3</sup>University of Veterinary Medicine Hannover, Foundation, Institute for Biochemistry and Research Center for Emerging Infections and Zoonoses, Hannover, Germany

<sup>4</sup>Friedrich-Loeffler-Institut, Institute of Infectiology, Greifswald – Isle of Riems, Germany

**Contact:** University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Bischofsholer Damm 15, 30173 Hannover, Germany; [Benjamin.Bauer@tiho-hannover.de](mailto:Benjamin.Bauer@tiho-hannover.de)

### **Abstract:**

The awareness of zoonotic diseases in small ruminants has increased within the last two decades. Most of the zoonotic pathogens cause abortion in sheep and goats (Ganter 2015). For instance, the intracellular bacteria *Coxiella burnetii* affected more than 4,000 people in The Netherlands from 2007 until 2011. Large dairy goat farms were responsible for this Q fever epidemic. In contrast, lambing sheep are responsible for small-scale Q fever epidemics across Germany. A recent study revealed a prevalence between 31.3% and 33.8% in German sheep flocks (Wolf *et al.* 2020). Main risk factors are purchases of sheep and goats and year-round lambing. An active monitoring and surveillance system followed by strategic vaccination programs in small ruminant flocks are suitable to prevent Q fever in humans.

Furthermore, there are several zoonotic vector-borne diseases harming small ruminants and humans alike. These are mainly transmitted either by ticks or by insects. Sheep and goats have a limited home range, are available in large numbers, are well dispersed in the environment and show a long-lasting antibody response after natural infections (Gerth *et al.* 1995). In consequence, small ruminants seem to be ideal sentinels for surveillance of zoonotic vector-borne pathogens like Tick-borne Encephalitis Virus (TBEV), West Nile Virus, Crimean-Congo Hemorrhagic Fever Virus and *Anaplasma phagocytophilum*. For instance, recent examinations of small ruminant sera determined a TBEV intra-herd prevalence of 12.5% in a goat flock. This flock is located in a non-TBEV risk area in Northern Germany and a potential new endemic area of TBEV was identified. According to the One-Health approach, it is necessary to implement efficient measures to control zoonotic livestock diseases. However, it is also essential to increase the awareness and preparedness of the public health sector for zoonotic vector-borne diseases using small ruminants as sentinel animals.

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Genetic Resources

## Other topics



## Oral presentations

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Wolf, A., Prüfer, T. L., Schoneberg, C., Campe, A., Runge, M., Ganter, M., Bauer B. U. (2020). Prevalence of *Coxiella burnetii* in German sheep flocks and evaluation of a novel approach to detect an infection via preputial swabs at herd-level. *Epidemiol Infect* 148, e75. doi: 10.1017/S0950268820000679



## Comparative fattening and slaughter performance of four sheep breeds under practical farming conditions in northern Germany

Regina Roessler<sup>1</sup>, Stefanie Klingel<sup>2</sup>, Nina Ossowski<sup>3</sup>, Georg Thaller<sup>3</sup>, Dirk Hinrichs<sup>1</sup>

<sup>1</sup> University of Kassel, Section Animal Breeding, Nordbahnhofstr. 1a, 37213 Witzenhausen, Germany

<sup>2</sup> Arche Warder Zentrum für alte Haus- und Nutztierassen e.V., Langwedeler Weg 11, 24646 Warder, Germany

<sup>3</sup> Christian-Albrechts-Universität zu Kiel, Section Animal Breeding and Genetics, Hermann-Rodewald-Straße 6, 24118 Kiel, Germany

**Contact:** Head of Section Animal Breeding, University of Kassel, Nordbahnhofstr. 1a, 37213 Witzenhausen, [dhinrichs@agrar.uni-kassel.de](mailto:dhinrichs@agrar.uni-kassel.de)

### **Abstract:**

The production of lamb meat has become more important than wool production in the past decades due to changing market conditions. Therefore, the influence of breed on fattening and slaughter performance was studied in 20 Charollais, 40 German White-headed Mutton, 17 Suffolk and 13 Texel male lambs in a pasture feeding trial in Eiderstedt over a 2-month period. The aim was to identify animals that perform well under the practical farming conditions in northern Germany. Analysis of variance or Kruskal-Wallis tests were performed in R 3.6.1. Tukey-HSD test was used for pairwise comparisons of the corrected mean values. Corrections were made for the age, the liveweight or the cold carcass weight. A significant effect of breed on the fattening and slaughter performance was observed. Initial liveweight was highest in Suffolk (46.7 kg) and lowest in German White-headed Mutton (40.4 kg). The highest final liveweight (61.3 kg), carcass weight (28.1 kg warm, 26.7 kg cold) and daily weight gain (271 g) were observed for Charollais. Suffolk had the lowest daily weight gain (161 g/d), and their carcass weight was nearly 2 kg lighter than for Charollais. However, no breed differences were observed for net daily gain. The German White-headed Mutton were genetically inferior with regard the subcutaneous fat (0.57 cm) and ultrasonic muscle thickness (26.3 mm), while Texel had similar slaughter performance than Charollais. The carcass examination showed no breed differences in the incidence of pulmonary pneumonia. In conclusion, no sheep breed was clearly superior in all the studied performance traits.



## Expression of genes related with fat metabolism in sheep influenced by use avocado flour in the diet

Pedro de Jesus Deniz-Gonzalez<sup>1</sup>, Javier German Rodriguez-Carpena<sup>1</sup>, Job Oswaldo Bugarín-Prado<sup>1</sup>, Clemente Lemus-Flores<sup>1</sup>, Miguel Ángel Ayala-Valdovinos<sup>2</sup>, Theodor Duifhuis-Rivera<sup>2</sup>.

<sup>1</sup> Universidad Autónoma de Nayarit, Tepic, Nayarit, México

<sup>2</sup> Universidad de Guadalajara, Guadalajara, Jalisco, México

**Contact:** Deniz-Gonzalez, P.J., Doctorado en Ciencias Biológico Agropecuarias, U.E. en I+D+i en Calidad de Alimentos y Productos Naturales, Centro Nayarita de Innovación y Transferencia de Tecnología (CENITT-Universidad Autónoma de Nayarit). Av. Emilio M. González s/n. Ciudad del Conocimiento, Col. Cd. Industrial. C.P. 63173. Tepic, Nayarit; México. phone +52 (322) 192 86 87. e-mail: [pedro\\_deniz@hotmail.com](mailto:pedro_deniz@hotmail.com)

### **Abstract:**

The avocado (*Persea americana* Mill) is a tropical fruit originating in Mexico. The massive production of this fruit in Mexico allows to satisfy the internal demand, to export to other countries and an excess of this crop is still reported. Avocados can be used for animal feed and this is particularly applicable for fruits discarded for human consumption due to non-compliance with commercial standards (Hernandez-Lopez *et al.* 2016). Regarding its nutritional value, avocado is a source of unsaturated fatty acids that could modify the lipid metabolism of sheep. In the present study, using the methodology of Livak and Schmittgen (2001), was evaluated the effect on the expression of the messenger ribonucleic acid of the ACACA, FAS, PPARG, SREBF1, SCD genes in the *Longissimus dorsi* muscle, caused by the inclusion of 5% avocado flour in the diet for 84 days before slaughter (n = 6) compared to a control treatment (n = 6). An increase in the expression (p < 0.05) of the ACACA (3.015), PPARG (2.252) and SCD (7.723) genes of the treated animals was found, compared to the control treatment (1.0). The results confirm the hypothesis of Dervishi *et al.* (2011) that the feeding system generates changes in the level of expression of messenger ribonucleic acid in genes related to fat metabolism. The use of avocado in sheep feeding could be a tool that allows manipulating the intramuscular profile of fatty acids in meat by altering the genetic expression of enzymes related to different routes of lipid metabolism.

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## Udder health in dairy goats and dairy sheep in Hesse

**Irene Noll**

Regional Council of Gießen, Wetzlar, Germany

**Contact:** Irene Noll, Schanzenfeldstr. 8, Dezernat 51.2, 35578 Wetzlar, [Irene.Noll@rpgi.hessen.de](mailto:Irene.Noll@rpgi.hessen.de)

### **Abstract:**

Since milk of small ruminants, unlike dairy cows, is largely processed on the farm itself, often as raw milk, the increased microbiological risk requires special care.

The occurrence of individual, mostly serious clinical udder diseases contrasts with a multiple of subclinical udder diseases.

In order to detect subclinical diseases, the content of somatic cells in milk can be estimated using the California Mastitis Test (CMT).

In case of a cumulative or increasing number of half-differences, half-milk samples are taken. These milk samples are sent to a recognized laboratory for cytobacteriological analysis.

In subclinical mastitis in small ruminants, coagulase-negative staphylococci are mostly found. In contrast, *Staphylococcus aureus* (*S. aureus*) is usually the triggering agent in clinical mastitis, occasionally *Pasteurella multocida*, *Mannheimia haemolytica*, *Escherichia coli* and pseudomonads can be found.

Since *S. aureus* can also often be detected in wounds, greater attention should also be paid to teat and udder wounds as part of a rehabilitation, as these can represent a constant reservoir of pathogens. This mainly happens when the lambs/ fawns have not yet been weaned and the dams are already being milked.

As part of the official milk hygiene monitoring, cytobacteriological total stock examinations are regularly carried out on dairy goat and dairy sheep farms in Hesse.

The results are presented.



## Goat production systems characteristics and management practices in Zambia

**Kolawole Odubote**

*University of Zambia, Lusaka, Zambia*

**Contact:** *Department of Biomedical Sciences, School of Veterinary Sciences, University of Zambia, Email: [kola.odubote@gmail.com](mailto:kola.odubote@gmail.com)*

**Abstract:**

This study was undertaken to describe goat production system characteristics and management practices in Zambia. The data collected during the Zambia 2017/2018 livestock and aquaculture census were analyzed using both qualitative and quantitative methods. The main production system was essentially traditional and extensive with free range being the dominant feeding practices. The management practices were minimal although main purpose of keeping goats were for sale and income. The constraints to goat production were mostly on the inadequacies of the production systems and limited management practices such as disease control, management of grazing lands, feeds and feeding, theft, livestock extension services, access to water, distance to dipping facilities, access to quality breeding stock, record keeping, access to credit and market development amongst others. The study also revealed a wide array of genetic resources of local breeds, exotic breeds and crosses between and among them. However, the local-exotic crosses represented the largest single genetic group which was a reflection of government and development organizations programmes and the farmers' desire to improve productivity through crossbreeding although indiscriminately carried out. It is therefore imperative that a holistic system approach is required to develop the goat sector in Zambia. A community based goat breeding programme to optimally utilize available genetic resources and livestock extension services to reach farmers with husbandry skills that include crop livestock integration, promotion of pasture production with high yielding fodders, management of communal grazing lands, hygienic practices, disease control and market development would be key steps to improve production and productivity.



## Range Plants characteristics in Butana Plain, Gezira State, Sudan

Mohamed Elimam

*Affiliation*

*Contact*

**Abstract:**

Small ruminants are very important in the in Butana plain, Gezira State, Sudan and mainly depend on rangeland which deteriorated for many factors affecting animals health and performance, especially in the dry season. Information on rangeland is scare in the area and a study was conducted for rangeland characteristics including inventory, frequency distribution, biomass and proximate analysis in Umelqura (UMGL) and East of the Gezira (EGL) localities from May to June in the following year. A 1x1m quadrat was used to determine plants inventory, distribution and biomass. Plants were identified, counted, weighed, dried and used for proximate analysis. Data was analyzed according to the completely randomized design. There were 35 herbs (22 forbs and 13 grasses) in 17 families (2 for grasses and 15 for forbs) and plants types and numbers varied in sites and were higher in UMGL (28) than EGL (21). Main plants were Tabar in UMGL and Turba, Um genegra, Sharaya and khudra in EGL. There were monthly and seasonal variations in plants numbers and types among sites in the two localities. There were variations among sites, month and seasons in plants frequency distribution and biomass. There were variations among areas, month and seasons in plants proximate analysis and CP was generally high. It is recommended to monitor rangelands plants regularly for optimum exploitation.





## Gender roles in goats production in Ogbomoso region, southwestern Nigeria

**David Aderemi Ajayi, Saheed Adeyemi Busari, Comfort Oluwabori Durosinmi, Sunday Olufemi Osewa, Olusola Jolaiya and Oluwasogo Dammy Abegunrin**

*National Centre for Genetic Resources and Biotechnology, Moor Plantation, Ibadan, Nigeria.*

**Contact:** *Animal Genetic Resources Department, National Centre for Genetic Resources and Biotechnology, PMB 5382 Moor Plantation, Ibadan, Nigeria. [rhemiajayi@gmail.com](mailto:rhemiajayi@gmail.com) Tel: +2348034073868*

### **Abstract:**

Women play important roles in livestock production in developing countries. Information on their roles in goat production activities is however not sufficiently documented in literature and hence a study was conducted to document gender roles in goats production in Ogbomoso region of southwestern Nigeria.

Data was collected by using questionnaire administered to 142 purposively selected farmers who kept goats on personal information and goat production related activities.

About 51.10 % of the farmers interviewed were aged 41 years and above. The breed reared by 90 % of the respondents was West African Dwarf goats. Furthermore, 60 % of the farmers reared the animals for meat purpose while 36% kept goats to serve as a source of income. The major constraints in goat production enterprises included lack of capital, diseases and thefts of the animals.

Majority of the farmers agreed that the roles of selection of foundation stock, pen construction, caring for sick animals, slaughtering and processing of slaughtered animals are played by men while women played leading roles in feeding, caring for young animals, cleaning of the pens and marketing of goats.

In conclusion, men play more roles than women especially in those activities requiring more energy in goat production in Ogbomoso region of southwestern Nigeria.



## Comparative study of some physicochemical properties in milk from Murciano Granadina goats which had, or not, been treated with antibiotics

**Laura Almela<sup>1</sup>, Begoña Peinado<sup>1</sup>, Sonia Galián<sup>1</sup>, Ángel Poto<sup>1</sup>, Elisa Escudero<sup>2</sup> and Pedro Marín<sup>2</sup>**

<sup>1</sup> Murcian Institute for Agricultural and Food Research and Development (IMIDA). La Alberca-Murcia. Spain.

<sup>2</sup> Department of Pharmacology. Murcia Region. Spain.

**Contact:** Laura Almela. Murcian Institute for Agricultural and Food Research and Development (IMIDA). La Alberca-Murcia. SPAIN. Email: [laura.almela@carm.es](mailto:laura.almela@carm.es). Telephone: +34 968 366756

### **Abstract:**

Some physicochemical properties have been compared in the milk from Murciano-Granadina (M-G) goats which had been given antibiotics (A) and milk from untreated goats (NA), to find out if the addition of antibiotics makes any difference in the processing of the milk.

Of the total goats in the study, 20 goats were not treated at all and 6 goats were given antibiotics. The milk collection was daily, separating milk A from milk NA. Thirty-six samples (18 A and 18 NA), from different days over 2 months, were analysed. Milk A and milk NA were subjected to a pasteurization process, and once cooled to 40°C commercial rennet was added (enzymatic coagulation). The coagulation point was timed and measured using the “buttonhole technique”, checking the coagulation status every 5 seconds. The rennet and whey were separated and the following parameters were measured: whey amount, rennet weight, whey and rennet pH, and rennet colour.

The results showed a milk A curdling time of three minutes and fourteen seconds, compared to a milk NA curdling time of three minutes and four seconds. According to the statistical comparison study, there are no significant differences between them for this variable, nor for the other variables studied. The results indicate that after the pasteurisation process there are no significant differences between the milk from those goats treated with antibiotics and those which weren't. Neither are there any observable alterations in the milk processing process.



## **SIRA SMART SCALE, a milk lamb weight scale that helps to introduce maternal index in extensive meat breed breeding productivity.**

**Marta Gómez Segura<sup>1</sup>, Jesús Ochoa<sup>2</sup>, Manuel Quinteiro<sup>3</sup>, Juan Altarriba<sup>4</sup>,**

<sup>1</sup> ARANA, Navarra, Spain

<sup>2</sup> INTIA, Navarra, Spain

<sup>3</sup> Compañía de Instrumentación y Control, Alcobendas, Spain;

<sup>4</sup> Zaragoza Veterinary University, Zaragoza, Spain

**Contact:** Marta Gomez Segura, ARANA, Ainziburu S/N, 31170 Iza, Navarra (Spain),

[mgomez@arana.centroiza.com](mailto:mgomez@arana.centroiza.com)

### **Abstract**

Raza Navarra is a North Spain extensive meat breed. After 30 years breeding to select the most prolificably maternal lines we are trying to introduce maternal index in order to improve productivity and profit.

Handling to weight milk lambs in an extensive breed means lots of problems farmers are not willing to assume. Nowadays sheep sector lacks of financial return, it is aged and farmers are discouraged, but even then it needs imaginative technical improvements to try to increase its profits.

Selecting ewes by their maternal index could reduce the time lambs need to reach their optimal weight to go to the market, which means costs are likely to be lower.

SIRA SMART SCALE is a milk lamb weight scale which registers individual lamb weight without farmer interaction.

It includes a camera that discriminates between one or more lambs on the scale and if they have fully stepped on it. Lambs are identified by means of an electronic ear tag so the scale registers their individual number and the date they have been weighed.

With this poster we would like to show the material, method and results obtained with SIRA SMART SCALE during 2019-2020 in several Raza Navarra herds.

### **Results:**

During 2019 12,642 lambs have been weighed.

Data shown below are from a single herd, where 1762 lambs where weighed (they mean 90% of lambs born during 2019)

- On average the lambs had 37 days of life the day of weighing.
- Results shown the average daily weight gain is 0.211 grams per day.
- The ewe age does not seem to interfere on lamb weight.
- Female lambs weight nearly a kilo less than males at day 37 of birth.
- On average, at day 37 of birth, single born lambs weight 1.257 kg more than doubles and 1.730 kg more than triples,



## Strategies for improving feed management of Batur sheep on smallholder farmers in Batur Subdistrict

**Gresy Eva Tresia, Zuratih, Bess Tiesnamurti**

*Indonesian Center for Animal Research and Development*

**Contact:** Jalan Raya Pajajaran Kav. E-59, Bogor 16151, Indonesia, (+62) 251 8322185

[gresy@pertanian.go.id](mailto:gresy@pertanian.go.id)

### **Abstract:**

Batur Sheep is one of the superior animal genetic resources, which have important contribution to development of livestock in Banjarnegara District of Central Java. However, its genetic potential has not yet been managed optimally by smallholder lead to small business of Batur sheep, which become less economical and not competitive. Provide feed management should be streamlined to increase economic efficiency livestock. This research was aimed to study feed management at smallholder farmers and the level of feed accessibility in Batur Subdistrict. This research was conducted using purposive sampling method involving three farmers groups of Batur sheep, where the primary data were collected through interviews and field observations. The secondary data were obtained from existing records in the Statistics Indonesia and Livestock Service of Banjarnegara. Data were analyzed using analysis of variance. The result showed that feeding management in Batur smallholder was classified good criteria and feed accessibility was considered to be pretty accesible. The body condition score and body weight of Batur sheep in three farmer group are not significantly different ( $P>0.05$ ). The average body weight of Batur sheep at the ages of I0, I1, I2, I3, and I4 were  $35,16\pm 8,47$  kg,  $51,67\pm 7,54$  kg,  $55,68\pm 15,32$  kg,  $54,82\pm 8,08$  kg, and  $52,54\pm 12,13$  kg, respectively. Feed formulation was based on crops by product, however the feed technology to provide quality feed throughout the year has not been implemented. Feed based crops in Batur subdistrict estimated has capacity of 724, 16 livestock units. The result of proximate analysis and in vitro digestibility of long beans, carrots, and cabbage was indicated better than grass, where they can be used as rations for Batur sheep up to 40-100%.

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## Zootechnical management of small ruminants at wayuu indigenous communities in La Guajira, Colombia

**Clara Rúa-Bustamante<sup>1</sup>, Juan Zambrano-Ortiz<sup>1</sup> and Venus V Epieyu<sup>2</sup>**

<sup>1</sup> Corporación Colombiana de Investigación Agropecuaria – AGROSAVIA, CI. Motilonia, Codazzi-Cesar, Colombia

<sup>2</sup> Universidad de la Guajira – Colombia.

**Contact:** Clara Viviana Rúa-Bustamante. CI Motilonia, Agrosavia. Email: [crua@agrosavia.co](mailto:crua@agrosavia.co)

### **Abstract:**

Background: Wayuu indigenous people inhabit the desert and arid areas of La Guajira departament developing sheep and goat pastoralism traditionally. Objective: To study and document the zootechnical management practices performed by the Wayuu indigenous communities to raise sheep and goats. Methodology: An ethnography was performed. Nine communities located in the middle and upper La Guajira were visited. The collected qualitative information was analyzed using Atlas.ti 6.2. Weighing was performed in pens. Samples of forage consumed by the animals were taken, dried and sent to the laboratory for analysis by NIRS (near infrared). The quantitative information was analyzed in SAS 9.4 software. Results: Records of 832 observations were grouped into 48 categories and associates into 10 families. It was confirmed that the rearing of small ruminants is of utmost importance in the wayuu culture. Traditional knowledge of some variables of zootechnical management was evidenced, mainly in breeding, feeding habits, traditional medicine and pen construction. Less knowledge was observed in animal health and welfare, directed grazing, manure management and use, reproduction and genetic improvement. Sheep had an average live weight of  $35.4 \pm 6.6$  kg and rams  $43.1 \pm 10.7$  kg. (n = 177). The goats presented an average of  $36 \pm 8.8$  kg of live weight and the male goats  $45.2 \pm 16.1$  kg (n = 184). Between the 27 forages samples were collected, mostly were legumes (14), of which *Caesalpinia coriaria* and *Prosopis juliflora*. Conclusions: The wayuu possess wide traditional knowledge and other knowledge related to some aspects of zootechnical management, transmitted from generation to generation.



## Survey of small ruminant farmers in Oluyalo local government area of Oyo State, Nigeria

Okunlola, O. O.

*Department of Agricultural Education, School of Vocational and Technical Education, The College of Education, Lanlate*

**Contact:** [greenfields2012@gmail.com](mailto:greenfields2012@gmail.com)

### **ABSTRACT**

Small ruminant farmers in Nigeria have not received much attention and intervention, like their cattle and poultry counterparts, from relevant government agencies partly due to lack of database to work with by the concerned authorities. This study was therefore conducted to profile the small ruminant farmers in Oluyole Local Government Area (LGA) of Oyo state, Nigeria. A multi-stage sampling method was adopted in the administration of structured questionnaires in the study area. A total of 100 questionnaires were administered and all were recovered, processed and subjected to descriptive statistics using frequency counts and percentages. The results obtained revealed that majority of the respondents had secondary education (49%) but no formal training in livestock management (86%). It was also observed that majority of the farmers raised goat (58%) and their farms were located in residential areas (65%). From the results, majority of the respondents practiced intensive farming system (55%) and 84% had access to veterinary services among which 80.95% of them engaged the services of veterinary technicians. Also, the study revealed that majority of the respondents (80%) financed their livestock enterprises with personal savings. The study also showed that 63% of the respondents had ready market for their products, 65% engaged in retail sales and 84% sold live animals.



## Feeding dairy sheep and goats

**George Christodouloupoulos**

*Clinical Veterinary Medicine Dept, Faculty of Veterinary Science, University of Thessaly, Karditsa, Greece*

**Contact:** P.O. Box 199, Karditsa, GR-43131, Greece; Tel: 00306942061708; Email: [gc@vet.uth.gr](mailto:gc@vet.uth.gr)

### **Abstract:**

On the farm, dairy sheep and goats are usually fed a mixture of concentrates as well as a kind of roughage. Often, the advice given by the practitioners on what quantities they should be fed is empirical. Here are our calculations which determined what quantities they should be fed.

Our calculations are intended for mixtures of concentrates containing 15-17% crude proteins and 20-25% digestive fibers; therefore the mixtures are “total mixed rations”, as they are meant to feed each head over 0.5 kg per day (Thonney and Hogue, 2013; AHDB, 2018).

In a dairy ewe farm, the quantities of roughages (x) and concentrate mixture (y) that should be fed can be calculated using the formulas:

$$x = \frac{7.1L + 0.085W - 1.2 \frac{bW}{k} + 2.85}{a - \frac{bq}{k}} \text{ and } y = 1.2 \frac{W}{k} - \frac{q}{k} x, \text{ where } x \text{ and } y \text{ are given in kg of dry matter; } L \text{ is the}$$

daily milk yield (kg), W the live weight of ewe (kg), k and q the percentage of neutral detergent fibers and a and b the amount of metabolisable energy (ME) in the concentrates and roughage correspondently.

Since the ME of the concentrates is greater than that of the roughage, if the animals consume more roughage than the quantity calculated their ME needs will not be met. However, if the required quantities of roughage are not available, any available amount may be fed and the missing quantity may be replaced by a quantity of concentrates equivalent in ME so as to meet the livestock's needs.

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## Potentials of using milk performance data as indicator for Targeted Selective Treatment in Lacaune dairy sheep in Switzerland

Katharina Schwarz<sup>1,2</sup>, Beat Bapst<sup>3</sup>, Mirjam Holinger<sup>1</sup>, Inga Schleip<sup>2</sup>, Steffen Werne<sup>1</sup>

<sup>1</sup> Research Institute of Organic Agriculture (FiBL), PO Box, 5070 Frick, Switzerland

<sup>2</sup> Eberswalde University for Sustainable Development, Schicklerstrasse 5, 16225 Eberswalde, Germany

<sup>3</sup> Qualitas AG, Chamerstrasse 56, 6300 Zug, Switzerland

**Contact:** Steffen Werne, Ackerstrasse 113, 5070 Frick, Switzerland, email: [steffen.werne@fibl.org](mailto:steffen.werne@fibl.org)

### **Abstract:**

Anthelmintic resistance is a major threat in small ruminant farming worldwide. One approach to slow down the development of anthelmintic resistance is Targeted Selective Treatment (TST), where a part of animals is left unexposed to anthelmintic treatment and thus providing refugia for susceptible parasites. Closely linked to the successful implementation of TST is the identification of animals in need of treatment. The aim of this study was therefore to investigate the general relation between milk yield and gastrointestinal nematode infections in a Swiss Lacaune dairy sheep subpopulation and, based on this, to evaluate milk yield data as a potential TST indicator in dairy sheep. On 15 Swiss farms nematode egg excretion per gram faeces (EPG) and individual milk performance of 1159 Lacaune ewes were obtained between August and December 2019. Faeces collection and individual milk performance data were closely time-related. Coprocultures of pooled samples were conducted to determine the proportion of *H. contortus* on farm level. A linear mixed model was fitted, using log-transformed EPG as dependent variable and milk yield, milk protein content, days in milk, lactation number and the proportion of *H. contortus* as fixed effects. The farm was included as random effect. The results revealed a significant relation between milk yield and EPG ( $P < 0,01$ ), which was most pronounced in the earlier stage of lactation, indicating high yielding ewes to be less resistant to GIN infections than low yielding ewes. The results suggest therefore the possibility of using milk yield data as TST indicator in dairy sheep.





## Data of “Targeted selective Treatment” based on live weigh gain should be used for breeding for resistance against gastrointestinal nematodes

**Martin Ganter<sup>1</sup>, Bernd Möller<sup>2</sup>, and Inga Nolte<sup>1</sup>**

<sup>1</sup> University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Hannover, Germany

<sup>2</sup> Institute of Farm Animal Genetics. Friedrich-Loeffler-Institute. Neustadt-Mariensee, Germany.

**Contact:** University of Veterinary Medicine Hannover, Foundation, Clinic for Swine and Small Ruminants, Bischofsholer Damm 15, 30173 Hannover, Germany; [Martin.Ganter@tiho-hannover.de](mailto:Martin.Ganter@tiho-hannover.de)

### **Abstract:**

The development of the FAMACHA© system (VAN WYK u. BATH, 2002) was a milestone in the use of Targeted Selective Treatment (TST). The transfer for non-hematophagic endoparasite populations remains a challenge (KENYON U. JACKSON, 2012). In a study on adapting Targeted Selective Treatment (TST) to a farm with non-hematophagic endoparasite populations daily weight gain was used as parameter for treatment of individual lambs within a group of 76 bleackheaded mouton lambs. Lambs who did not achieve the target weight were treated with ivermectine (2 mg/kg body weigh). Target weights were evaluated in the grazing season before in the same flock on the same pastures. Individual samples for faecal egg count were taken every four weeks. By reaching 45 kg b. wt. ram lambs were slaughtered and the gut examined for gastrointestinal nematodes (GIN). Compared to a regular deworming every four weeks the number of deworming was reduced by 66.9% in male lambs and 76.6% in female lambs respectively. High rates of not treated lambs turned out. In total 36 lambs (18 = 41.9% female + 18=47.4% male) remained untreated over the whole grazing season and achieved the target weights. Clinical endoparasitosis was not present. Positive effects of some lamb’s treatment on gastrointestinal nematodes (GIN) on FEC in the feces of untreated lambs were observed (NOLTE, 2019). The comparison with the two previous years (TRAPP, 2013, SCHÖWERLING, 2016) showed a high variability in GIN populations in the gut of the slaughter lambs. Lambs who need no anthelmintic treatment over the entire grazing season, but meet the target weight gain, should be selected as replacements. By using this as a selection criterion for breeding, an indirect selection for resistance against GIN could be achieved.

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## Selfmedicative Behavior and Tanniferous Fodder Plants: Alteration in Taste Perception and Feed Preferences of GIN-Infected Boer Goats

Marvin Heuduck<sup>1</sup>, Christina Strube<sup>2</sup>, Katharina Raue<sup>2</sup>, Eva Schlecht<sup>1</sup>, Martina Gerken<sup>1</sup>

<sup>1</sup> Georg-August-University, Goettingen, Germany

<sup>2</sup> University of Veterinary Medicine, Hanover, Germany

**Contact:** Marvin Heuduck, Department of Animal Sciences, Albrecht-Thaer-Weg 3, 37075 Goettingen, Tel.: +49-(0)551-3925779 [marvin.heuduck@uni-goettingen.de](mailto:marvin.heuduck@uni-goettingen.de)

### **Abstract:**

Nematode infections are a common thread in ruminant livestock and excessive usage of conventional anthelmintics led to emergence of resistant nematode populations. This underlines the relevance of paradigm shift towards a sustainable control approach of nematode infections. In this study, possible changes in taste perception and in feed preferences of goats were scrutinized to prove ascertained higher feed intake of tanniferous plants by goats in case of nematode-infection.

Feed preferences of 18 Boer goats were analyzed via cafeteria-trial (12 weeks) regarding influence of changes in health status from non-infected to infected. Goats were divided in different groups: I) Non-infected + feeding-trial II) Infected + feeding-trial III) Infected without feeding-trial. The cafeteria-trial was conceptualized with pellets of tanniferous plants (leaves of sainfoin, willow, walnut, blackberry) of various tannin-contents and tannin-free hay pellets. After four weeks a mixed nematode-infection was administered to group II) and III).

Besides feed intake and selection procedure, blood parameters, saliva composition and feces were analyzed on weekly basis in order to make assessments of the course of infection and potential shifts in feed preferences due to changes of taste perception.

Analysis of trial data revealed an alteration from tannin-free (hay) and low tannin-containing feed (sainfoin) to higher tannin-contents (walnut, blackberry) in the course of infection. Results of blood, saliva and feces parameters have not yet been completely evaluated to give a more detailed overview about the effects on parasite burden and a potential altered taste perception.



## **Sainfoin pellets for preventive parasite control and improved protein efficiency in dairy goats**

**Steffen Werne<sup>1</sup>, Nadine Arnold<sup>2</sup>, Erika Perler<sup>1</sup> and Florian Leiber<sup>1</sup>**

<sup>1</sup> *Research Institute of Organic Agriculture FiBL, 5070 Frick, Switzerland*

<sup>2</sup> *ZHAW Life Sciences und Facility Management, 8820 Wädenswil, Switzerland*

**Contact:** *Steffen Werne, Ackerstrasse 113, 5070 Frick, Switzerland, email: [steffen.werne@fibl.org](mailto:steffen.werne@fibl.org)*

### **Abstract:**

Condensed tannins of the legume sainfoin (*Onobrychis viciifolia*) are frequently associated with beneficial effects when offered as feed to ruminants. We hypothesised that offering sainfoin to dairy goats may improve the ruminal protein-efficiency indicated by lower urea and higher protein yields in goat milk and as well may lower nematode egg excretion (EPG). Over a period of 7 weeks, in total 20 alpine goats were fed with 700g sainfoin (n=10) or 700g (n=10) alfalfa pellets daily. Milk protein and urea yield as well as EPG were measured regularly on individual basis. All animals were kept in one group, except for milking and pellet feeding and had access to pasture for approx. 5 hours daily. Intake from pasture or ad libitum offered hay was not determined. The concentration of condensed tannins in sainfoin and alfalfa was 4% and 0.3%, respectively. Crude protein content was 18.2% for sainfoin and 20.1% for alfalfa (corrected for 100% dry matter). Repeated measurement analysis could not reveal significant differences (p=0.148) of the EPG between groups, even though arithmetic mean of EPG in the sainfoin group was 18% lower compared to the control group. Also the total daily milk protein (p=0.700) and total daily urea milk content (p=0.410) per animal did not differ between treatments. Other studies often report a reduced nematode egg excretion if sainfoin was administered ad libitum. As a dose dependent effect for condensed tannins is assumed, the total amount of condensed tannins in our trial might have been too low to provoke any effect.



## **Coccidiosis in small ruminant's farms - case study in Trás-os-Montes (northeastern Portugal)**

**Hélder Quintas<sup>1</sup>, Margarida Afonso<sup>2</sup>, Daniela Silva<sup>3</sup>, Luís Cardoso<sup>2,5</sup>, Delia Lacasta<sup>4</sup>, Luis Miguel Ferrer<sup>4</sup> and Ana Patrícia Lopes<sup>2,5</sup>**

<sup>1</sup> Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

<sup>2</sup> Departamento de Ciências Veterinárias, Escola de Ciências Agrárias e Veterinárias, Universidade de Trás-os-Montes e Alto Douro (UTAD), Vila Real, Portugal

<sup>3</sup> Segalab, Póvoa de Varzim, Portugal

<sup>4</sup> Departamento de Patología Animal. Facultad de Veterinaria C/ Miguel Servet 177, 50013 Zaragoza, Spain.

<sup>5</sup> Centro de Ciência Animal e Veterinária (CECAV), UTAD, Vila Real, Portugal

**Contact:** [helder5tas@ipb.pt](mailto:helder5tas@ipb.pt)

### **Abstract:**

Coccidiosis is one of the most important intestinal diseases in small ruminants and it has a significant economic impact in farms over the world. The manifestations of the disease occurs mostly among young animals when submitted to stressful conditions. Thus, in improving prophylactic plans, it is necessary to understand the risk factors associated with each production system in particular. This study was carried out in the region of Trás-os-Montes (Portugal) in animals between 4 and 6 weeks of age from 46 different farms in two different years. Several factors related to the management of farms were associated with the presence of strong infections (OPG > 5 000) and isolation of pathogenic species. It is concluded that the *Eimeria* species with the highest prevalence in sheep was *E. ovinoidalis* (68.70%) and the less prevalent *E. intricata* (13.30%). In the case of goats, *E. ninakohlyakimovae* was the species with the highest prevalence (100%) and *E. alijevi* (25.00%) with the lowest. In farms where it was possible to verify a high concentration of animals near drinking spots, there were significantly ( $p < 0.001$ ) more strong infections. The likelihood of developing strong infections was almost 8 times higher (OR = 7.677; IC 95%: 2.729 – 21.589) than the other farms. Moreover, in farms where antiparasitic treatments were used, the likelihood of isolating oocysts from pathogenic species of *Eimeria* ( $p = 0.0065$ ) was 12,17 times lower (OR = 12.167, IC 95%: 1.786 - 82.864) than in the other farms.



## Know how: The secret of successful lameness management

### Heinz Strobel

Schafpraxis, Stoffenried, Germany, [www.schafpraxis.de](http://www.schafpraxis.de)

**Contact:** Dr.Heinz Strobel, Am Hopfenberg 8, D-89352 Ellzee, [drheinzstrobel@t-online.de](mailto:drheinzstrobel@t-online.de)

### Abstract:

Lameness still is major problem with ecological, economical and ethical relevance on many farms (keywords: antibiotica, welfare, residues, manpower, productivity). During the last decade frustrating cycles of footrot could be broken on a fair number of farms by applying sustainable strategies. The goal were either *Dichelobacter nodosus* PCR neg. flocks or or permanent footrot control on acceptable levels (< 3%).

The evaluation of difficulties along the elimination process on farm and the results of the following monitoring clearly shows, that relapses and failures were mainly due to carelessness or wrong decisions by stocksmen in critical situations e.g. when joining rams to the flock without quarantine or prophylactical treatment.

As a consequence the transfer of knowledge should be intensified and optimized along with the design of protocols tailor suited for individual farms and maintained during the following observation period. It is not sufficient to replace traditional and counterproductive opinions of owners by evidence based informations. It is essential to provide a common basic knowledge to all people involved. All staff in charge of handling sheep must be able to identify risks and take appropriate measures irrespective of language barriers or hierarchies. As a result of many presentations, consultancies and stable schools a set of didactical components were created. So knowledge on lameness can be transferred by webinars, FAQ lists, interactive courses and posters (demonstrated in this presentation). Antibiotic stewardship, animal welfare und environmental aspects make sustainable strategies indispensable on the way to effective lameness management.

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## **Evaluation of prevalence and risk factors associated with virulent and benign *Dichelobacter nodosus* in German sheep breeds**

**Julia Storms<sup>1</sup>, Anna Wirth<sup>1</sup>, Monia Lara Budnik<sup>1</sup>, Peter Kuhnert<sup>2</sup>, Jörg Jores<sup>2</sup> and Ottmar Distl<sup>1</sup>**

<sup>1</sup> University of Veterinary Medicine Hannover, Institute of Animal Breeding & Genetics, Hannover, Germany

<sup>2</sup> University of Berne, Institute of Veterinary Bacteriology, Bern, Switzerland

**Contact:** [julia.storms@tiho-hannover.de](mailto:julia.storms@tiho-hannover.de)

### **Abstract:**

Footrot is a contagious disease of major welfare and economic concerns in sheep worldwide. The etiological agent of ovine footrot, *Dichelobacter nodosus*, differs in virulence due to the subtilisin-like proteases. Two proteases, AprV2 and AprB2, determine virulent and benign strains. The thermostable AprV2 protease is required for virulence. The objectives of our study were to screen a large number of sheep breeds for *D. nodosus* strains, their clinical status and associated risk factors. Data and samples were collected from > 9000 sheep in 200 flocks with >20 different breeds from all over in Germany. In addition, herd footrot history and potential risk factors for footrot were recorded. We used a competitive qRT-PCR method to detect the allelic differences TA/CG at nucleotide 661/662 in the aprV2 and aprB2 gene sequences. All sheep were examined and scored for foot and claw lesions and recorded along with breed, sex, age and previous footrot treatments. Specificity of the qRT-PCR was >99%. Sheep with underrunning footrot showed a detection rate of 96.3% for virulent strains and sheep with mild and moderate to severe interdigital dermatitis of 41.4% and 86.6%. Low prevalences (< 20%) were seen in Forest sheep, East Friesian, and Skudde and moderate to high prevalences in Merinos, Leine, Bentheimer, Texel, Suffolk, Grey and White Heath (>40%). Risk factors by breed, season, region, flock and footrot history were analysed and will be shown. Breed and flock had the highest impact on *D. nodosus* prevalence.



## Study of antibiotic susceptibility against the main pathogens involved in fattening lambs pathology in Spain and Portugal.

José María Bello Dronda<sup>1</sup>, Lorenzo Fraile Sauce<sup>2</sup>

<sup>1</sup> NANTA S.A. Ronda de Poniente,9. 28760 Tres Cantos (Madrid). Spain

<sup>2</sup> Departament de Ciència Animal, ETSEA, Universitat de Lleida, Lleida, Spain

Contact: [jm.bello@nutreco.com](mailto:jm.bello@nutreco.com)

### **Abstract:**

The increase of the antimicrobials resistance has become a global public health problem. In the EU, reduction policies have been implemented under the “One Health” concept that implies human and animal health. The monitoring of resistance in different animal species has become a priority within the strategies of fighting against resistance.

Four hundred and twelve cases were analyzed from 2015 to 2019, coming from 121 lamb feedlot farms in Spain and Portugal. Several studies were carried out to obtain practical knowledge in order to reduce the use of antimicrobials as much as possible. Firstly, several comparative studies were carried out between samples from nasotracheal lavages and those obtained from lung tissue (“in farm examination necropsy”) in order to check the suitability of this type of samples in monitoring the susceptibilities of the pathogens (*Pasteurella multocida*, *Mannheimia haemolytica* and *Biberstenia threalosi*) involved in respiratory problems. Secondly, another study was carried out in order to know the evolution along the years of the susceptibilities to some antibiotics of the most important pathogens (*P. multocida*, *M. haemolytica*, *B. threalosi* and *Escherichia coli*) involved both in respiratory and digestive diseases. Finally, a “map” of the susceptibilities of pathogens to a significant number of antibiotics available in the market were obtained.

Similar results in susceptibility were found in most of the pathogens studied comparing lavages and tissue samples. Besides, similar evolution in susceptibility of pathogens to most antibiotics checked was observed, with an increment during 2018 and 2019. In general, tetracycline (very used by oral supply) gave less susceptibility than others did. On the opposite way, amoxicillin could be an antibiotic available for further oral use.

In conclusion, the nasotracheal lavages are an efficient and valid method of taking suitable respiratory samples in practical conditions of monitoring. Besides, there is a tendency to the increment of the susceptibility of pathogens to a large part of antibiotics, in parallel to the reduction of the actual use of antimicrobials. Finally, the maps of susceptibilities provide very useful epidemiological information to be used in the strategies of antibiotic pressure reduction.

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Genetic Resources

**Animal health:**  
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## Relevance of Selenium imbalances in sheep flocks and implications for herd health management consultancy

**Esther Humann-Ziehank**

*LABVETCON – Laboratory Veterinary Consulting, Burgdorf, Germany*

**Contact:** LABVETCON, Foehrenkamp 20, D-31303 Burgdorf. [mail@labvetcon.de](mailto:mail@labvetcon.de)

### **Abstract:**

Adequate nutritional supplementation of selenium is indispensable for adequate selenoprotein expression and function in animals. Germany was considered to provide low selenium in regional grown fodder causing selenium deficiency in sheep flocks as well as in wild ruminants as shown in roe deer (Humann-Ziehank et al., 2008). Marginally selenium supplemented sheep underwent ongoing selenium deprivation. Vital organs are affected by selenium deficiency attenuating functional parts of the antioxidative system. Improvement of selenium supplementation to an adequate level strongly alters serum and liver selenium concentration within 10 and 20 days, respectively, followed by a plateau (Humann-Ziehank et al., 2013a). The occurrence of selenium deficiency was demonstrated in an epidemiological study including 150 German sheep flocks. Selenium deficiency was found to be widespread in German sheep flocks. More than one third of the flocks showed relevant selenium deficiency in serum indicating the strong need to optimise the nutritional management. As it is impossible to estimate the final forage Se concentration by environmental factors only, there is a need for validation at animal level (Humann-Ziehank et al., 2013b). The best metabolic biomarker of selenium deprivation and nutritional selenium upgrade, respectively, was selenium in serum. Moreover, hepatic selenium concentrations reliably reflected the upgrade of selenium supply within days (Humann-Ziehank et al., 2013a). Factors raising suspicion of selenium imbalances are large flocks and transhumance. Stationary flocks had constantly higher mean serum selenium concentrations during the breeding, lambing and grazing period, whereas flocks practising transhumance had significant lower selenium status except during lambing (Humann-Ziehank et al., 2013b).



## Exploiting scanning surveillance data to assess the impact of different initiatives and inform future strategies to control sheep scab.

**Eilidh Geddes<sup>1</sup>, Sibylle Mohr<sup>2</sup>, Sian Mitchell<sup>3</sup>, Sara Robertson<sup>4</sup>, Anna Brzozowska<sup>4</sup>, Stewart Burgess<sup>5</sup>, Valentina Busin<sup>1</sup>**

*1 School of Veterinary Medicine, University of Glasgow, 464 Bearsden Road  
Glasgow, United Kingdom*

*2 Boyd Orr Centre for Population and Ecosystem Health, College of Medical, Veterinary and Life Sciences,  
University of Glasgow, Glasgow, United Kingdom*

*3 Carmarthen Veterinary Investigation Centre, Animal and Plant Health Agency, Carmarthen, United Kingdom*

*4 Surveillance Intelligence Unit, Animal and Plant Health Agency, Weybridge, Surrey, United Kingdom*

*5 Moredun Research Institute, Pentlands Science Park, Bush Loan, Edinburgh, United Kingdom*

**Contact:** Valentina Busin, School of Veterinary Medicine, University of Glasgow, 464 Bearsden Road  
Glasgow, United Kingdom, [valentina.busin@glasgow.ac.uk](mailto:valentina.busin@glasgow.ac.uk)

### **Abstract:**

Veterinary surveillance is an essential tool designed to aid decision making and a fundamental concept in food security, public health and international trade (Hoinville et al., 2013). This study aimed to investigate the use of existing scanning surveillance data for sheep scab to assess the impact of different initiatives and inform future control strategies.

The data analysed were submissions with a positive sheep scab diagnosis confirmed through identification of *Psoroptes ovis* mites in skin scraping in Great Britain for 2003-2018. Information were also collected on all known knowledge transfer, skills training, free testing and legislative actions (initiatives) designed to improve surveillance or decrease disease within the study period for sheep scab. First, a spatial analysis to highlight areas of concern was carried out, followed by an analysis of the effect of past initiatives on temporal patterns (Tongue et al., 2019). A total of 2,401 positive skin scrapes were recorded within the study period. The yearly distribution showed a significant downward trend in positive cases, from a peak of 277 in 2004, to 55 cases in 2015. In the study period nine initiatives occurred. Three of these initiatives had a significant effect on the number of positive cases diagnosed and this type of scheme did evoke the intended response. In conclusion, the analysis of an existing scanning surveillance source enhanced our knowledge of sheep scab by identification of areas for targeted control and offered a framework to measure the impact of future initiatives.

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## **The trouble with the reproduction – Chosen problems of the small ruminants**

**Henrik Wagner, Axel Wehrend**

*Clinic for Obstetrics, Gynaecology and Andrology for Large and Small Animals with Veterinary Ambulance, Justus-Liebig-University Giessen*

**Contact:** Dr. Henrik Wagner, Frankfurter Straße 106, 35392 Giessen, Phone: +49 641 9938703

Mail: [Henrik.W.Wagner@vetmed.uni-giessen.de](mailto:Henrik.W.Wagner@vetmed.uni-giessen.de)

### **Abstract:**

In breeding and keeping small ruminants, successful and safe reproduction is the basis for the financial security of the farm. In the course of the lecture, four problem areas of reproduction are to be worked out and case studies are given, which are very common in animal husbandry.

1. Low lambing rate
2. Extended lamb time
3. Weakness lambs
4. Abortions

The ram are of great importance to the clinical examination, which is unfortunately too often forgotten. As a further investigation, the ultrasonographic display of the testicles is a simple and quick diagnostic tool to better classify the breeding ability of the bucks. This technique is used too rarely at the licensing events and performance tests to assess the quality of the bucks in relation to their reproductive ability. Quarantine measures for new purchases and correct operational management (vaccination, deworming, serological examinations) are explained and their necessity discussed. Abortions continue to play a major role in small ruminants. Due to the mostly seasonal lambing, high losses occur quickly. What exactly has to be done with an abortion is with regard to securing and curtailing a possible transmission, especially in the case of zoonoses, and the possible future avoidance should be discussed.

The neonatal loss rate is always used as an index for animal welfare-related violations. This aspect is discussed in the lecture and the importance of minimizing such losses is emphasized. The veterinary care of the herds must also be critically evaluated. The density of specialist veterinarians for small ruminants can still be optimized.



## *Coxiella burnetii* on Dutch dairy sheep farms between 2006 and 2020

**René van den Brom, Carlijn ter Bogt-Kappert, Erik van Engelen, Marian Aalberts, and Piet Vellema**

Royal GD, Deventer, Netherlands

Contact: [r.vd.brom@gdanimalhealth.com](mailto:r.vd.brom@gdanimalhealth.com)

### **Abstract:**

Q fever is a zoonotic disease caused by the intracellular bacterium *Coxiella burnetii*, which is able to infect several animal species, as well as humans. Domestic ruminants are the main animal reservoir. In small ruminants, infections mostly don't give clinical symptoms. However, abortions and stillbirths can occur, mainly during late pregnancy. Shedding of *C. burnetii* occurs in faeces, milk and mostly in placental membranes and birth fluids. During parturition of infected small ruminants, bacteria from birth products become aerosolized. Transmission to humans mainly happens through inhalation of contaminated aerosols (Maurin and Raoult, 1999).

In 2005, *C. burnetii* was diagnosed for the first time as cause of abortion on a dairy goat farm in the Netherlands, and between 2005 and 2010, this diagnosis was confirmed on in total 28 dairy goat and two dairy sheep farms (Van den Brom and Vellema, 2009). During this period, more than 4000 people became infected. A large package of preventive measures was implemented, mainly for dairy goat and dairy sheep farms, with the aim to reduce shedding, subsequent environmental contamination and thus human exposure to *C. burnetii* (Van den Brom et al., 2015), and compulsory vaccination was the most important one. Monthly bulk tank milk (BTM) surveillance, using a *C. burnetii* PCR, is functioning since October 2009, and has been an effective and useful tool to distinguish between *C. burnetii* excreting and non-excreting small ruminant farms.

Vaccination of dairy sheep with phase 1 vaccine Coxevac®, at a dose of 1 mL as prescribed for sheep since the start of compulsory vaccination, seems very effective in preventing abortion and reduction of shedding of *C. burnetii*, since no cases of abortion caused by *C. burnetii* have been confirmed after vaccination, and no *C. burnetii* shedding has been detected on dairy sheep farms after 2013 in the BTM surveillance. Antibody levels against *C. burnetii* have been high to very high since vaccination started.

We briefly present the history of Dutch dairy sheep farming, and will discuss results of implemented measures as notification, vaccination, hygiene, and surveillance, on Dutch dairy sheep farms between 2006 and 2020.

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## Investigation of abortions in small ruminants in Greece due to *Chlamydia abortus*

Giadinis N.D.<sup>1</sup>, Kiossis E.<sup>1</sup>, Chochlakis D.<sup>2</sup>, Lafi S.Q.<sup>3</sup>, Psaroulaki A.<sup>2</sup>, Petridou E.J.<sup>4</sup>, Filippopoulos L.K.<sup>5</sup>, T. Calvo Gonzalez-Valerio<sup>5</sup>, Massimiliano Baratelli<sup>5</sup>

<sup>1</sup> Faculty of Veterinary Medicine, Thessaloniki, GREECE

<sup>2</sup> Medical School, Heraklion, GREECE

<sup>3</sup> Faculty of Veterinary Medicine, Irbid, JORDAN

<sup>4</sup> Faculty of Veterinary Medicine, Thessaloniki, GREECE

<sup>5</sup> Laboratorios Hipra S.A., Girona, SPAIN

**Contact:** Nektarios Giadinis, Clinic of Farm Animals, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, St. Voutyra 11, 54627, Thessaloniki, GREECE. E-mail : [ngiadini@vet.auth.gr](mailto:ngiadini@vet.auth.gr)

### **Abstract:**

Chlamydiosis due to *Chlamydia abortus* is one of the most common causes of abortion in small ruminant flocks worldwide. Although the causative agent is zoonotic, chlamydiosis is not a reportable disease.

Sixty abortion cases originating from different sheep flocks in Greece were investigated for *Chlamydia abortus*. Fetal stomach content, fetal liver, placenta or vaginal swabs were used for examinations. PCR for *Chlamydia abortus* gene 16S was positive in 25 out of 60 cases, while examination for gene 23S was positive for 12 of them. Three samples were found doubtful.

Moreover, serological investigation for *Chlamydia abortus* was conducted. Blood samples from 26 randomly selected sheep flocks not vaccinated against chlamydiosis were collected. From each flock, 15 to 20 blood samples were taken from adult female sheep. In total 464 blood samples were examined. One hundred and six samples were found positive (22.8%), while 24 samples (5.24%) were found doubtful. Also, at farm level, from the total number of 26 farms, 18 of them had positive animals (69.2%).

In conclusion, chlamydiosis is considered a highly likely cause of sheep abortion in Greece. Therefore, vaccinations of the sheep flocks should be recommended for the prevention and control of the disease.

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## Ultrasound findings of common genital pathologies in small ruminants

**Mário Balaro, Isabel Cosentino, Felipe Leal, Lucas Barbosa, Fernanda Gonçalves, Ana Beatriz Carvalho, Bruno Vieira, Mirella Dias, Paula Cortat de Souza, Felipe Brandão**

Fluminense Federal University, Niteroi, RJ, Brazil.

**Contact:** Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Rua Vital Brasil Filho, 64, zip code: 24320-340, Niteroi, RJ, Brazil. E-mail address: [mariobalardo@id.uff.br](mailto:mariobalardo@id.uff.br) (MFA Balaro).

### **Abstract:**

This study reports the prevalence of some reproductive tract pathologies of small ruminants from September 2012 to February 2020 at Rio de Janeiro State, Brazil (16 extensive sheep and 10 intensive dairy goat flocks). An ultrasound device (Sonoscape S6®, Sonoscape, Yizhe Building, Yuquan Road, Shenzhen, China) coupled to a linear transducer of 7.5 MHz (transrectal) or 5 MHz convex (transabdominal) were used; B-mode and Color Doppler-mode ultrasound tapes were recorded and evaluated by the same operator (MB). The chi-square test was adopted for frequency comparison ( $P < 0.05$ ). Reproductive disorders were detected in 6.5% (216/3331) female's and 47.0% (32/68) male's examinations. In females: hydrometra (2.5%; 83/3331), aseptic resorption of the embryo/fetus (0.9%; 29/3331), recent embryonal/fetal death detected by the lack of heartbeat (0.7%; 23/3331), cystic endometrial hyperplasia (0.6%; 19/3331), follicular cyst (0.5%; 16/3331), hydrosalpinx (0.3%; 9/3331), luteal cyst (0.2%; 7/3331), pyometra (0.1%; 4/3331), retained placenta (0.1%; 4/3331), septic resorption (0.09%; 3/3331), endometritis (0.06%; 2/3331), macerated fetus (0.06%; 2/3331), visceral cisticercosis (0.06%; 2/3331) and single cases of ovarian tumor, mummified fetus, cervicitis and upper or infra-cervical abscess (0.03%; 1/3331). Ewes had significantly fewer reproductive disorders than does (3.9%; 65/1647 vs. 8.9%; 151/1684  $P < 0.05$ ). In males: testicular microlithiasis (33.8%; 23/68), testicular degeneration (4.4%; 3/68), varicocele (2.9%; 2/68) and single cases of testicular tumor, hydrocele, cryptorchidism and inguinal hernia (1.5%; 1/68). No differences between rams (43.4%; 23/53) and bucks (60.0%; 9/15) were found. In conclusion, does have significantly more reproductive tract disorders than ewes. Ultrasonography provides clinically useful information relating to diagnosis, prognosis, and therapeutics.

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## Chronic Mycotoxicosis in a dairy goat farm in Brazil

Paula Renata Cortat<sup>1</sup>, Felipe Seabra Cardoso Leal<sup>1</sup>, Helena Gomes Ferreira Pinto<sup>1</sup>, Caroline Brito Dos Santos<sup>2</sup>, Mirela Balistrieri Dias<sup>1</sup>, Bruno Ribeiro Vieira<sup>1</sup>, Felipe Zandonadi Brandão<sup>1</sup>, Claudia Del Fava<sup>2</sup>, Luiz Antonio Moura Keller<sup>1</sup>, Mário Felipe Alvarez Balaro<sup>1</sup>

<sup>1</sup> Fluminense Federal University, Niteroi, RJ, Brazil.

<sup>2</sup> Pathological Anatomy Laboratory, Biological Institute, São Paulo, SP, Brazil.

**Contact:** Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Rua Vital Brasil Filho, 64, zip code: 24320-340, Niteroi, RJ, Brazil. E-mail address: [mariobalaro@id.uff.br](mailto:mariobalaro@id.uff.br) (MFA Balaro).

### **Abstract:**

Mycotoxicosis is a disease caused by distinct mycotoxins. This study aimed to describe a case of chronic mycotoxicosis in a dairy goat flock kept under an intensive system in Minas Gerais, Brazil. Lactating goats presented history of drop in milk production and weight loss in the past six months with abortion and premature births. Twelve goats showed thinness (BCS = 2), pale mucous membranes and mild dehydration at clinical examination. Blood samples and feces were collected for the whole blood count, biochemistry and coproparasitological exam. Due to the poor quality of cornmeal, samples were collected for mycotoxicological analysis. Goats showed mild anemia (Hb ~ 22 %), platelet aggregate, thrombocytosis (~1.2x10<sup>5</sup>/μL), reversal of the neutrophil/lymphocyte ratio (~1.2), hyperproteinemia (~7.5 g/dL) with hypoalbuminemia (~2.7 g/dL) and hyperglobulinemia (~4.8 g/dL). The average egg per gram of feces count was low (~625 e.p.g.). Hemoparasites were not detected. In cornmeal samples were detected average of 354.5 μg/Kg Aflatoxins (AFs), 2300 μg/Kg Fumonisin (FUMO), 2165 μg/Kg zearalenone (ZEA) and 3325 μg/Kg Deoxynivalenol (DON). From an euthanized goat, it was found anemia, generalized anasarca, severe ascites, and decreased liver size in the necropsy exam. Histopathological report revealed lobular center degeneration and liver necrosis with nephrosis and cerebral cortical spongiosis discreet. Microscopic lesions were suggestive of fumonisin action. In conclusion, the chronic mycotoxicosis diagnosis was based in clinical, pathological, and toxicological findings. Therefore, the importance of purchase ingredients from reputable suppliers with quality assurance for the feed formulation is emphasized to avoid mycotoxicosis and other disorders.

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## Outbreak of abomasal bloat in kid goats due to *Clostridium ventriculi* and *Clostridium perfringens* type A

Fernanda Martins Gonçalves<sup>1</sup>, Felipe Seabra Cardoso Leal<sup>1</sup>, Isabel Oliveira Cosentino<sup>1</sup>, Júlia Alves Vignoli<sup>1</sup>, Nathalia Xavier da Silva<sup>1</sup>, Alessandra Figueiredo de Castro Nassar<sup>2</sup>, Simone Miyashiro<sup>2</sup>, Nathalie Costa da Cunha<sup>1</sup>, Claudia Del Fava<sup>3</sup>, Mario Felipe Alvarez Balaro<sup>1</sup>

<sup>1</sup> Fluminense Federal University, Niteroi, RJ, Brazil.

<sup>2</sup> General Bacteriology Laboratory, Biological Institute, São Paulo, SP, Brazil.

<sup>3</sup> Pathological Anatomy Laboratory, Biological Institute, São Paulo, SP, Brazil.

**Contact:** Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Rua Vital Brasil Filho, 64, zip code: 24320-340, Niteroi, RJ, Brazil. E-mail address: [mariobalardo@id.uff.br](mailto:mariobalardo@id.uff.br) (MFA Balaro).

### **Abstract:**

This study aimed to describe an outbreak of abomasal bloat in kid goats and its clinical, pathological, microbiological, molecular, and epidemiological characteristics. The kidding season presented an increased mortality of kid goats with a history of abdominal bloating, dullness, and death. Clinical examinations were carried out, and biological samples from necropsied kids (n = 11) were collected for pathological, microbiological, and molecular diagnosis. Likewise, an epidemiological survey was carried out to verify possible associated factors related to the disorder. The main necropsy findings were dehydration, pale mucosa, ascites, abomasal and intestinal meteorism and congestion, emphysematous abomasitis, and consolidation of lung's cranial areas. Through staining techniques for cytological evaluations of the abomasum, it was possible to identify Gram positive bacteria, coccoid, with a cuboid shape suggestive of *Clostridium ventriculi*, Gram positive bacilli suggestive of *Clostridium perfringens* and ovoid basophilic yeasts compatible with *Saccharomyces cerevisiae*. By anaerobic culture and molecular tests, *C. ventriculi* and *C. perfringens* type A were confirmed. The main histopathological findings were cholangiohepatitis, nephrosis, emphysematous abomasitis, hyalinization of the gastric and intestinal walls, gastroenteritis, intestinal thromboembolism, pulmonary edema, and non-purulent pneumonia, overall suggesting a systemic enterotoxaemia picture. There was a final mortality rate of 24.4% (20/82). Regarding the possible associated factors, the erroneous use of the milk replacer associated with inadequate kid management was verified. Among the prophylactic measures, hygiene care, proper use of milk replacer, vaccination plan containing *C. perfringens* alpha toxoid associated with a good colostrum management were suggested.

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Genetic Resources

## Animal health:

Poster presentations



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### Computed Tomography and Magnetic Resonance Imaging in the diagnosis and follow-up of chronic Coenurosis in sheep (with spontaneous remission of clinical signs)

**Maria Pérez**

*Affiliation*

**Contact:**

**Abstract:**

## Local tree leaves for parasitic control in sheep of hilly areas Jammu and Kashmir, India.

**Mandeep Singh Azad<sup>1</sup>, Kwardeep Kour and Preeti Birwal**

<sup>1</sup> Scientist Animal Sciences, Krishi Vigyan Kendra, Reasi, Sher-e- Kashmir University of Agricultural Sciences and technology of Jammu-India

**Contact:** [mandeepsinghazad@gmail.com](mailto:mandeepsinghazad@gmail.com)

### **Abstract**

The performance and productivity of sheep is adversely affected by helminthic infections. Infected sheep either don't gain expected weight or lose weight, become lethargic, and may have diarrhoea. Sometimes losses occur which are undetected because the signs of parasitism are not obvious. The control of helminth infections has always been a challenge. Till now, the main control methods of these infections are treatments with broad spectrum synthetic anthelmintics like ivermectin, albendazole, levamisole, etc. However, the drug residues in animal products and the development of anthelmintic resistance has restricted their usage in animals. There is a need of an alternative and more sustainable approach to control these infections. supplementation of CT (1.5 %) through LMM improved the overall growth and production and thus can help poor hilly farmers in making goat farming an economically viable enterprise. Supplementation of CT through leaf meal mixture could be used as an alternative sustainable method to control H. Contortus infection.

In hilly areas of Jammu and Kashmir you can find many tree leaves with high condensed tannin content. Locally available tree leaves like Neem (*Azadirachta indica*) Guava (*Psidium guajava*), Mango (*Magniferra indica*), Jamun (*Syzygium Cumini*), Amla (*Embllica officinalis*), found in hilly areas of Jammu and Kashmir can be used in complete feed blocks to meet the protein deficiency as well as control the parasitic load of the sheep. Crude Protien content of these leaves were  $20.00 \pm 0.44$ ,  $10.58 \pm 0.54$ ,  $11.02 \pm 0.11$ ,  $25.56 \pm 0.48$ ,  $10.62 \pm 0.57$  respectively.

The study was carried out to assess the effect of Complete feed blocks and condensed tannins (CT) supplementation through leaf meal mixture (LMM) on feed intake and faecal egg counts in *Haemonchus contortus* infected Sheep. 24 sheep were randomly divided into three groups (C, T1 and T2) of 8 animals in each group in a completely randomized block design for a period of 3 months. T1 group was supplemented with complete feed blocks without any leaf meal mixture whereas T2 group was supplemented with leaf meal mixture @ 1.5%. Body weights were recorded at 0th day and then 15th day's interval for a period of 90 days to access feed intake and body weight changes. The faecal samples were collected at 0th, 7th, 15th day and thereafter at 15 days intervals for a period of 3 months for the assessment of *H. contortus* loads. The study showed that feed intake and weight gain was almost similar in both the treatment groups T1 and T2 but were comparatively better than the controlled group with normal feeding. The mean fecal egg counts were significantly ( $P < 0.001$ ) higher in T1 group as compared to T2 group. It may be concluded that dietary supplementation of CT (1.5 %) through LMM improved the overall growth and production and thus can help poor hilly farmers in making sheep farming an economically viable enterprise. Supplementation of CT through leaf meal mixture could be used as an alternative sustainable method to control *H. Contortus* infection.

Notes-This technology if properly disseminated can help in rejuvenating sheep and goat farming which due to low profit return is losing its popularity among rural youths.

## Vitamin E in the diet of lactating goats: bioavailability and influence on the passive immunity of kids.

Mercedes Roncero-Díaz<sup>1</sup>, Begoña Panea<sup>2</sup>, María de Guía Córdoba<sup>3</sup>, Anastasio Argüello<sup>4</sup> and María J. Alcalde<sup>1\*</sup>

<sup>1</sup> University de Sevilla, Seville, Spain.

<sup>2</sup> Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA). Instituto Agroalimentario de Aragón – IA2 (CITA-Universidad de Zaragoza), Zaragoza, Spain.

<sup>3</sup> University of Extremadura. Badajoz, Spain.

<sup>4</sup> University of Las Palmas de Gran Canaria. Las Palmas (Canarias). Spain.

**Contact:** Maria J. Alcalde: Department of Agricultural and Forestry Science, University de Sevilla, Ctra. Utrera km. 1, 41013 Seville, Spain. email: [aldea@us.es](mailto:aldea@us.es)

### **Abstract:**

A total of 30 male single-birth kids from the Payoya breed were used. During the trial, kids were only fed natural milk without any dietetic complement and remained stabled. Two batches of fifteen animals each were established according to the feeding systems of their dams: cultivated meadow (CM) and total mixed ration (TMR). The immunoregulatory potential of the different forms of vitamin E (natural/synthetic) provided to the kid through maternal diets (CM and TMR, respectively) was evaluated during lactation. Then,  $\alpha$ -tocopherol was quantified in the plasma of goats and their kids using high-performance liquid chromatography (HPLC). Additionally, the kidney fat of the kids was weighed. Correlation analysis and ANOVA with maternal diet as the principal effect were performed using the SPSS statistical package.

The health of a new-born is influenced by its nutritional level and hence influences visceral fat (Gall 1982). Therefore, kidney fat can be a good indicator of a kid's health and immunity. Colostrum and milk provide vitamin E that stimulates the immune system and is essential for the health of the new-born (Przybylska et al. 2007).

Positive correlations are noted between the plasma concentrations of  $\alpha$ -tocopherol in goats and their kids and between the plasma  $\alpha$ -tocopherol in kids and the weight of kidney fat ( $r=0.606$ ,  $p<0.001$ ;  $r=0.335$ ,  $p=0.013$ , respectively).

The increased bioavailability of natural vitamin E (Debier et al., 2005) from the diet of CM goats influences the health status of their kids [more kidney fat ( $p<0.001$ ), and compared with TMR kids, results in a higher plasma tocopherol concentration ( $p<0.001$ )].

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## Use of thermography for the diagnosis of chronic proliferative rhinitis in sheep and its application in the differential diagnosis of the first case affecting the dorsal and medial turbinate

Ceresuela, C.<sup>1</sup>; López-Tamayo, S.<sup>1</sup>; Bueso, J.P.<sup>2</sup>; Alzuguren, O.<sup>3</sup>; Rodríguez, A.<sup>1</sup>; Figueras, L.<sup>4</sup>; Ferrer, L.M.<sup>1</sup>

<sup>1</sup> Animal Pathology Department. Instituto Agroalimentario de Aragón-IA2 (Universidad de Zaragoza-CITA). Veterinary Faculty of Zaragoza. C/Miguel Servet 177. 50013 Zaragoza. Spain

<sup>2</sup> Laboratorio Agroambiental de Aragón, Montañana, Zaragoza, Spain.

<sup>3</sup> Laboratorios Exopol Diagnóstico y Atovacunas S.L., Polígono de San Mateo de Gállego, Zaragoza, Spain.

<sup>4</sup> Gabinete Técnico Veterinario S.L., C/ Isla Conejera s/n, Zaragoza, Spain.

**Contact:** [vet.ceresuela@gmail.com](mailto:vet.ceresuela@gmail.com)

### **Abstract:**

Chronic proliferative rhinitis (CPR) is an upper respiratory tract disease of sheep associated with *Salmonella enterica* subsp. *diarizonae* serotype 61:k:1:5:(7). It affects the ventral nasal turbinate and sometimes the proliferative tissue can be seen emerging from the nostril.

In the following case the animal affected was an ewe with a severely bilateral inflammatory process of the upper respiratory tract. The thermal imaging camera revealed an increase in the temperature of both nasal cavities and the hottest area in the middle part of the nose, which corresponded with the area of the swollen dorsal turbinate. The medial localization of the affection, exhibited by thermography, directed the diagnosis towards CPR and Enzootic Nasal Adenocarcinoma (a tumoral disease which affects the ethmoidal area).

The post-mortem examination confirmed the CPR diagnosis and revealed inflammation of the ventral nasal turbinates, and, for the first time, of the dorsal and medial ones of both nasal cavities, coinciding with the images obtained by thermography.

To date, in all the descriptions made of CPR the ventral turbinate was always affected and only minor changes were observed in dorsal turbinate or ethmoidal area. The affection of the dorsal and medial turbinates here described shows how this bacterium could deepen and damage more internal structures of the respiratory tract. This was easily observed by thermography, which helped to locate the affection and facilitated the diagnosis, proving to be a useful resource for clinical diagnosis of upper respiratory tract diseases of sheep.

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López-Tamayo, S., Rubira, I., De las Heras, M., Castells, E., Lacasta, D. (2020) Use of thermography for the diagnosis of chronic proliferative rhinitis in sheep and its application in the differential diagnosis of the first case affecting the dorsal turbinate. *Veterinary Record Case Reports* 8: e001070. doi: 10.1136/vetreccr-2020-001070

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## Valvular endocarditis in small ruminants: case reports

Ana Beatriz da Silva Carvalho<sup>1</sup>, Paula Renata Cortat<sup>1</sup>, Bruno Ribeiro Vieira<sup>1</sup>, Felipe Seabra Cardoso Leal<sup>1</sup>; Isabel Oliveira Cosentino<sup>1</sup>, Caroline Brito Dos Santos<sup>2</sup>, Fernanda Martins Gonçalves<sup>1</sup>, Mirela Balistrieri Dias<sup>1</sup>, Claudia Del Fava<sup>2</sup>, Mário Felipe Alvarez Balaro<sup>1</sup>

<sup>1</sup> Fluminense Federal University, Niteroi, RJ, Brazil.

<sup>2</sup> Pathological Anatomy Laboratory, Biological Institute, São Paulo, SP, Brazil

**Contact:** Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Rua Vital Brasil Filho, 64, zip code: 24320-340, Niteroi, RJ, Brazil. E-mail address: [mariobalaro@id.uff.br](mailto:mariobalaro@id.uff.br) (MFA Balaro).

### **Abstract:**

Endocarditis is the inflammation of the endocardium, which might be located on the heart wall and/or on the valve. This study aimed to describe two cases of valvular endocarditis in small ruminants located in Rio de Janeiro, Brazil. The first case occurred in a Saanen lactating goat (five-years-old), kept under intensive system. At the ultrasound scan for pregnancy diagnosis, a large amount of free anechoic fluid was found. The animal underwent a daily treatment with furosemide (2.5 mg/kg) but died two weeks later due to an acute respiratory distress. Postmortem examination revealed yellowish friable masses adhered to leaflets that compound the tricuspid valve, as well as intense ascites, hepatomegaly, congestion and pulmonary edema. Histopathological report revealed in the mass adhered to the valve, there was a focus of neutrophilic infiltration and Splendore-Hoeppli phenomenon, compatible with bacterial and mycotic valvular endocarditis. The second case occurred in a crossbred hair sheep (three-years-old) kept under semi-intensive system that died under suspicion of previous fight and cervical trauma. At necropsy, a friable mass was found in the tricuspid, diffuse whitish lesions on the epicardium and myocardium (suggestive of infarction), pale ocular conjunctiva, great amount of *Haemonchus* sp. within the abomasum, enlarged lung with diffuse congestion and whitish multifocal lesions on kidneys. In both cases, endocarditis may have been secondary to chronic bacteremia, such as pneumonia, subacute ruminal acidosis (SARA), periodontitis and others. Therefore, the diagnosis of valvular endocarditis is important to relate to other primary causes that can affect flock productivity and establish prophylactic measures.

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Genetic Resources

## Animal health:

Poster presentations



### Malignant neoplasms in sheep and goats in Sicily (Italy)

**Sebastian Alessandro Mignacca**

*Istituto Zooprofilattico Sperimentale della Sicilia, Barcellona Pozzo di Gotto, Italy*

Contact:

**Abstract**

### Study of the use of bronchoalveolar lavage as a in vivo diagnostic method to detect clinical pulmonary Maedi Visna

**Alba Magdalena**

*Affiliation*

Contact:

**Abstract:**

### Abdominal perforation in ewes due to fetal maceration

**Sebastian Alessandro Mignacca**

*Istituto Zooprofilattico Sperimentale della Sicilia, Barcellona Pozzo di Gotto, Italy*

Contact:

**Abstract**

## Ozonized oil can be used for topical treatment of sheep affected by Contagious Ecthyma

Helena Gomes Ferreira Pinto<sup>1</sup>, Lucas De Figueiredo Cardoso Barbosa<sup>1</sup>, Mariana Santos Ribeiro<sup>1</sup>, Bruna Ramalho Rigaud de Figueiredo<sup>1</sup>, Marta Maria Campos Pereira da Costa<sup>1</sup>, Caroline Brito Dos Santos<sup>2</sup>, Claudia Del Fava<sup>2</sup>, Mário Felipe Alvarez Balaro<sup>1</sup>

<sup>1</sup>Fluminense Federal University, Niteroi, RJ, Brazil.

<sup>2</sup>Biological Institute, São Paulo, SP, Brazil.

**Contact:** Department of Pathology and Clinical Veterinary, Faculty of Veterinary, Fluminense Federal University, Rua Vital Brasil Filho, 64, zip code: 24320-340, Niteroi, RJ, Brazil. E-mail address: [mariobalaro@id.uff.br](mailto:mariobalaro@id.uff.br) (MFA Balaro).

### **Abstract:**

Sunflower oil is ozonized directly by the flow of the gas (ozone), which reacts with the linoleic acid present forming hydrogen peroxide (antimicrobial, anti-inflammatory). Thus, the objective of the study was to test ozonized oil in cases of Contagious Ecthyma, in sheep located in Brazil's farm. A total of four adults Santa Ines ewes ( $2.9 \pm 0.5$  years old, BCS:  $3.0 \pm 0.2$ ) with similar pattern of lesion were organized in two groups to compare different topical treatments: G1 treated with 1% iodine, and G2 treated with ozonated sunflower oil, daily, for 2 consecutive weeks. From each ewe, skin biopsies were collected for histopathology evaluation and bacteriological and fungal culture, before, during and after treatments. First cultures performed showed the presence of opportunist infection by *Candida* sp., *Staphylococcus coagulase* negative and *Yersinia* sp., not shown in other collections. In the first biopsy, all tissues had ulcers and inflammation. In the second biopsy, both groups presented half of animals with complete tissue re-epithelialization and the other half in an intermediate process. In the third biopsy, all animals had tissues totally re-epithelialized. In the clinical analysis, the G1 still had crusts after one week of treatment, differently from G2, which no longer formed crusts at this moment. It can be concluded that both treatments were effective for the treatment. Nevertheless, ozonized oil facilitated the employee's work by the lower formation of crusts over the healing period, as well as avoiding tissue dryness (different from iodine), with greater safety for ocular and oral regions.

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## Control of a *Pseudomonas aeruginosa* mastitis case in a sheep herd by the use of an autogenous vaccine

Petridou E.J.<sup>1</sup>, Fragkou I.<sup>2</sup>, Giadinis N.D.<sup>3</sup>

<sup>1</sup> Faculty of Veterinary Medicine, Thessaloniki, GREECE

<sup>2</sup> Veterinary Services, Ministry of Agriculture and Rural Development, Athens, GREECE

<sup>3</sup> Faculty of Veterinary Medicine, Thessaloniki, GREECE

**Contact:** Evanthia Petridou, Laboratory of Microbiology and Infectious Diseases, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, University Campus, 54124, Thessaloniki, GREECE. E-mail : [epetri@vet.auth.gr](mailto:epetri@vet.auth.gr)

### **Abstract:**

In a dairy sheep flock clinical cases of mastitis were observed 1-3 months after lambing in 30 out of 400 Assaf-E sheep showing no systemic clinical findings. The affected udders were swollen and painful while the udder secretions were clotted. Bacterial cultures of the milk revealed *P.aeruginosa* to be the only pathogen.

Bacteriological investigation for the detection of the possible source of *P.aeruginosa* included samples from farm water and from the dry off equipment. All cultures were negative.

Treatment with broad-spectrum antibiotics parenterally were proved ineffective, as well as with intra-mammary ones. An autogenous vaccine was prepared and administrated to the rest animals of the flock. Forty five (45) days after vaccination only 5 mastitis cases due to *P.aeruginosa* were observed.

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## Intake, weight gain and haematological profile of West African dwarf does fed African yam beans-based diets

O. M. A. Jesuyon<sup>1</sup>, O. V. Boluwaji<sup>1</sup>, E. O. Ewuola<sup>2</sup>, F. O. Adejoro<sup>1</sup>, S. O. Baiyeri<sup>3</sup>, T. A. Sanni<sup>4</sup> and O. O. Ajayi<sup>1</sup>

<sup>1</sup> Department of Animal Production and Health, Federal University Oye, Oye - Ekiti, Nigeria.

<sup>2</sup> Department of Animal Science, University of Ibadan, Ibadan, Nigeria

<sup>3</sup> Department of Crop Science and Horticulture, Federal University Oye, Oye - Ekiti, Nigeria.

<sup>4</sup> Department of Food Science and Technology, Federal University Oye, Oye – Ekiti, Nigeria.

**Contact:** Federal University Oye, Are Road, P. M. B. 373, Oye - Ekiti, Ekiti State, Nigeria. Email: [dr.oluwatosinjesuyon14@gmail.com](mailto:dr.oluwatosinjesuyon14@gmail.com)

### **Abstract:**

A Study was conducted to evaluate the effect of African yam beans (AYB) and cassava peels-based diets on feed intake, weight gain and haematological parameters of West African Dwarf (WAD) breeding Does. Forty WAD breeding does received ad-libitum of assigned African Yam Beans-based diets in randomized complete block design (RCBD) in factorial for 60 days. Data were collected on feed consumption, body weight and full blood count. Results revealed superior average daily dry matter intake, average daily weight gain, feed conversion efficiency (ADMI, g/day, ADWG, g/day and FCE, %) of 0.170, 0.022 and 13.08; and 0.165, 0.019 and 11.50 for soakedAYB1 and rawAYB diets respectively. Time interval was important on dry matter feed intake, DMFI, ADMI, dry matter intake as percent of mean body weight, DM%MW ( $P=0.0001$ ), MCH and basophils counts ( $P<0.05$ ) positively. SoakedAYB1 presented highest Hb, Neutrophils, and eosinophils (77.4g/dl, 42.6% and 6.1%); soakedAYB2 produced superior PCV, MCV, MCH, WBC (25.4%, 0.065fl, 20.7Pg and  $16.04 \times 10^9/l$ ) while rawAYB diet revealed highest value of monocytes (13.23%) respectively. MCH was positively correlated with PCV, RBC, Hb and MCV ( $P=0.01-0.0001$ ); while lymphocytes were correlated with PCV, MCV, MCH and Neutrophils ( $P=0.05-0.0001$ ). Interaction between time and diet revealed positive WBC and lymphocytes ( $10.5 \times 10^9/l$  and 7.23%); PCV and Hb (9.11% and 23.11g/dl) and; monocytes and eosinophils (58.63% and 10.85%) for rawAYB, soakedAYB1 and soakedAYB2 respectively. Based on FCE and haematological profiles of does, the AYBbased diets were ranked in order of superiority as: soakedAYB1 > rawAYB > soakedAYB2 respectively.

**Keywords:** Haematology, health profile, *Sphenostylis stenocarpa* beans, cassava peels, tropical-forest environment.

## Sustainability assessment of Sheep and Goat Production Systems in Peri-urban areas of southern Benin (West Africa)

**Bossima Ivan Koura<sup>1</sup>, Esteban Henoc Medenou<sup>2</sup>, Fifame Panine Yassegoungbe<sup>2</sup>, Ulriche Cossi Afatondji<sup>2</sup>, Luc Hippolyte Dossa<sup>2</sup>**

<sup>1</sup> School of Animal Production, National University of Agriculture, Porto-Novo, Benin

<sup>2</sup> Faculty of Agricultural Science, University of Abomey-Calavi, Abomey-Calavi, Benin

**Contact:** School of Animal Production, National University of Agriculture, BP 43 Ketou, Benin, e-mail:

[kouraivan@gmail.com](mailto:kouraivan@gmail.com)

### **Abstract:**

A study was carried out in southern Benin with the aims to understand sheep and goat farmers' resilience strategies face to climate change and urbanization, to assess the sustainability of their production systems and assist them in increasing their animals' performances. Individual interviews were conducted with 125 small ruminant farmers, using a questionnaire which included questions on their socioeconomic characteristics and farming practices. The farms were typified using the categorical principal component analysis followed by a Two-Step cluster analysis. Subsequently, the French IDEA (Farm Sustainability Indicators) method was adapted to local production conditions and used to assess the agro-ecological, socio-territorial and economic sustainability of the obtained farm types. Six small ruminant farm types were identified as follows: Goat only (36.80%), Sheep only (12%), Sheep-goat (8.80%), Mixed sheep-goat-crop (12.80%), Mixed sheep-crop (5.60%) and Mixed goat-crop (24%). As perceived by the respondents, rapid urbanization, agricultural expansion and climate variability affect negatively the availability of grazing areas (76%), biomass production in grasslands (98%), animals' access to forage (97%) and animal growth. Farmers' coping strategies included adoption of free scavenging systems (94%) and feed supplementation with agro-processing by-products (82%) or tree fodders (64%). The agro-ecological and economic sustainability components scores varied ( $p \leq 0.05$ ) across farm types. The Mixed sheep-goat-crop farm type obtained the highest ( $p \leq 0.001$ ) total sustainability score (149.88) whereas the lowest score (122.09) was obtained by Goat only farm type. These results highlight the importance of farm activities diversification in enhancing the sustainability of smallholder small ruminant farms.

**Key words:** Climate variability, diversification, resilience, small ruminant, smallholder, urbanization

## Characteristics of goat transhumance and its benefits for environmental sustainability

**Sezen Ocak Yetişgin, Hasan Alp Şahin**

*Ondokuz Mayıs University, Department of Animal Science, Samsun, Turkey*

**Contact:** *Sezen Ocak Yetişgin, Ondokuz Mayıs University, Faculty of Agriculture, Department of Animal Science- 55139 Samsun, Turkey; [sezenocak1@gmail.com](mailto:sezenocak1@gmail.com); +905322151989*

### **Abstract:**

Transhumance- seasonal migration of livestock and human, is a dynamic production strategy between spatial and temporal environments in many parts of the world. Beyond their benefits to the ecosystem, they face various challenges at different scales around the globe. The origins of transhumance in Turkey dates back to the Neolithic period, and today- two different transhumance systems are present in Turkey (sheep and goat transhumance). This type of production is an historical and traditional strategy to the climatic changes and inaccessibility. In addition to its cultural significance they have an important role on maintaining cultural landscapes and ecosystem services. Transhumance practice in Turkey has been affected by many factors resulting with a dramatic decline of the herders although they shaped for more than 1000 years the ecosystem in the mountainous areas and contributed economically to the livelihoods. In this paper we will focus on goat transhumance, an ancient transhumance system where Turkish herders for centuries move with their goats from Mediterranean lowlands -where they winter, to the central Anatolian highlands for rich summer grazing areas. For this aim a qualitative research approach with in depth-face to face interviews were used to interview 26 transhumant families from the same community named” Sarıkeçili”. Participant observation was conducted in the research area during one year by spending a week /month in order to observe the daily routines. The aim was to characterize their spatial-temporal movement patterns, contemporary production practices and ecosystem services they provide. Land use/cover information for 1990 and 2018 was analyzed by Geographic Information Systems (GIS) and Remote Sensing (UA) systems. According to the results, shrublands and natural grasslands have decreased during the study period, %13.9 and 8.2, respectively while urban & industrial areas and agriculture lands increased %87 and 10, respectively. Number of herders were decreased 134,7% in the last 30 years. Transhumance abandonment caused a significant reduction in shrublands and natural grasslands. Considering biodiversity and ecosystem sustainability it is already a critical issue in the Mediterranean region of Turkey and affecting a whole system.

## Strategies for improving feed management of Batur sheep on smallholder farmers in Batur Subdistrict

**Gresy Eva Tresia, Zuratih, Bess Tiesnamurti**

*Indonesian Center for Animal Research and Development*

**Contact:** Jalan Raya Pajajaran Kav. E-59, Bogor 16151, Indonesia, (+62) 251 8322185

[gresy@pertanian.go.id](mailto:gresy@pertanian.go.id)

### **Abstract:**

Batur Sheep is one of the superior animal genetic resources which have important contribution to development of livestock in Banjarnegara District of Central Java. However, its genetic potential has not yet been managed optimally by smallholder lead to small business of Batur sheep, which become less economical and not competitive. Provide feed management should be streamlined to increase economic efficiency livestock. This research was aimed to study feed management at smallholder farmers and the level of feed accessibility in Batur Subdistrict. This research was conducted using purposive sampling method involving three farmers groups of Batur sheep, where the primary data were collected through interviews and field observations. The secondary data were obtained from existing records in the Statistics Indonesia and Livestock Service of Banjarnegara. Data were analyzed using analysis of variance. The result showed that feeding management in Batur smallholder was classified good criteria and feed accessibility was considered to be pretty accesible. The body condition score and body weight of Batur sheep in 3 farmer group are not significantly different ( $P > 0.05$ ). The average body weight of Batur sheep at the ages of I0, I1, I2, I3, and I4 were  $35,16 \pm 8,47$  kg,  $51,67 \pm 7,54$  kg,  $55,68 \pm 15,32$  kg,  $54,82 \pm 8,08$  kg, and  $52,54 \pm 12,13$  kg, respectively. Feed formulation was based on crops by product , however the feed technology to provide quality feed throughout the year has not been implemented. Feed based crops in Batur subdistrict estimated has capacity of 724,16 livestock units. The result of proximate analysis and in vitro digestibility of long beans, carrots, and cabbage was indicated better than grass, where they can be used as rations for Batur sheep up to 40-100%.

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## What policy and future do sheep and goats need in Iran?

**Farhad Mirzaei**

*Animal Science Research Institute of Iran, Karaj, Iran*

**Contact:** [farmir2001@gmail.com](mailto:farmir2001@gmail.com)

### **Abstract:**

Livestock agriculture in Iran covers over 40% of the agricultural activities. Sheep and goat production is one of the oldest productions in the country as it is considered the origin sheep and goat domestication in the world. Currently, more than 57% of the available animal units in the country are sheep and goats (mostly sheep and goats are together). Desertification, deforestation, water shortage, erosion, low efficiency, output, and illiterate small farmers are the typical Iranian shepherds' obstacles. Currently it has more than 44 million sheep and 19 million goat. Iranian sheep and goat are providing an important part of the demand for red meat at about 321000 tons and 93000 tons in 2018 respectively as a main product, but considerable production of milk, wool and hair too Utilization of pastures, crops' post-harvest and agricultural wastes in small ruminants' feed, which are not mainly used for other livestock, and the taste of sheep and goats meat, and various delicious food made of their products are a part of the necessity of their production, development and stability across the country. More than 20 native breeds of these small ruminants are going to be threatened by socio – ecological issues in addition to economic challenges that it is discussed in this paper It also covers different production systems and their problems solving how the present situation can be overcome to maintain and sustain sheep and goat driven hundred thousand livelihoods presently. Another purpose of this study is to analyze the factors that influence and determine accessible needs and appropriate policies for the sustainable future of sheep and goat production systems. The results of the study will explain that the condition factors (natural resources, human resources, infrastructure and technology) were the most important factors in increasing of the hopefulness of nomads and villagers to prevent critical effects on animal-based food security, if they move on their jobs. Therefore, more attention is required from the government and non-governmental organizations for handling this trend to the well-managed and right direction.

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## Evaluation of dried citrus pulp based total mixed ration (TMR) for mutton (goat) production

**Abdur Rahman<sup>1</sup>, Huma Kalsoom<sup>1</sup>, Sadia Khanum<sup>1</sup>, Muhammad Sajid<sup>2</sup>**

<sup>1</sup>Department of Animal Sciences, University of Veterinary and Animal Sciences, Jhang Campus, 35200, Pakistan

<sup>2</sup>Department of Pathobiology, University of Veterinary and Animal Sciences, Jhang Campus, 35200, Pakistan

**Contact:** [abdurrehman@uvas.edu.pk](mailto:abdurrehman@uvas.edu.pk); Tel: +92-346-4607300

### **Abstract:**

Pakistan contributes about 7% of mutton production, ranked 3<sup>rd</sup> in goat rearing countries in the world after China and India. In Pakistan per capita consumption of animal protein is 17grams compared to 27grams in developed countries. Pakistan rank at 30<sup>th</sup> number among 163 nations with food security. Mutton need and demand will be overwhelmingly increasing in coming years and it needs attention to enhance its efficient production. The major factor in cost effective production is feeding. The use of non-conventional feed resources, like citrus pulp waste as a replacement of energy and protein feeds may support the economical farming. In current study, a total of 12 bucks were divided into 4 groups each having 3 animals and fed total mixed ration for 90 days including 7 days as adaptation. Rations were formulated having dried citrus pulp at 0% (control), 10%, 15% and 20% replacing corn, respectively. Performance parameters including feed intake, body weight gain, feed conversion ratio, hematological and serological parameters were evaluated. Results showed non-significant differences between all the treatment groups as compared to control group, which revealed that dried citrus pulp have equal potential to corn grains as an energy rich concentrate. In conclusion, dried citrus pulp has shown no adverse impact on buck health, proving that dried citrus pulp can replace corn grains in goat feeding and disposed in better way avoiding environmental pollution.

**Keywords:** Mutton production, Citrus pulp, Non-conventional feed resources

## Effects of supplementation with graded levels of pigeon pea foliage on the performance of Arsi-Bale goats fed a basal diet of maize stover treated with effective microorganisms

**Eleni Assegid**<sup>1,2</sup>, **A dugna Tolera**<sup>2</sup>, and **Ajebu Nurfeta**<sup>2</sup>

<sup>1</sup> Department of Animal and Range Science, Wolaita Sodo University, Ethiopia.

<sup>2</sup> School of Animal and Range Science, Hawassa University, Ethiopia

**Contact:** [asseleni@gmail.com](mailto:asseleni@gmail.com)

### **Abstract**

A study was conducted to evaluate feed intake, digestibility, weight gain and carcass characteristics of goats fed *maize stover treated with effective microorganisms (EM) and supplemented with graded levels of pigeon pea foliage*. Twenty four male yearling Arsi Bale goats with mean initial body weight of  $15.5 \pm 0.06$  were assigned in completely randomized block design in to the following treatments: EM treated maize stover *ad libitum* + 100 g (T1), 200 g (T2), 300 g (T3) and 400 g (T4) pigeon pea foliage on as fed basis. The feeding and digestibility experiment lasted for 80 and 7 days, respectively. The dry matter (DM) and organic matter (OM) intake of treated maize stover decreased with increasing level of pigeon pea foliage supplementation. The CP intake from maize stover was lower ( $P < 0.05$ ) in T3 than in the other treatment groups. The total DM, OM and CP intake increased ( $P < 0.05$ ) with increasing supplementation of pigeon pea foliage. The DM digestibility for T3 and T4 was higher ( $P < 0.05$ ) than T1 while T2 had an intermediate value. The OM digestibility in T4 was greater ( $p < 0.05$ ) than those goats fed T1, while T2 and T3 diets had similar ( $P > 0.05$ ) OM digestibility. The CP digestibility increased ( $p < 0.05$ ) with increasing levels of pigeon pea foliage. The average daily gain for T3 and T4 was greater ( $p < 0.05$ ) than those fed T1 and T2 diets. In conclusion, supplementation of 300 g pigeon pea foliage to growing Arsi Bale goats could be used as dry season feed supplement for small holder farmers endowed with similar feed resource base

**Key words:** Maize stover, pigeon pea, effective microorganism, intake, digestibility

## Growth response of West African Dwarf sheep fed detoxified *neem* (*Azadirachta indica*) seed cake diets

**David Aderemi Ajayi<sup>1</sup>, Micheal Kolawole Adewumi<sup>2</sup>**

<sup>1</sup>National Centre for Genetic Resources and Biotechnology, Moor Plantation, Ibadan, Nigeria

<sup>2</sup>Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

**Contact:** Department of Animal Genetic Resources, National Centre for Genetic Resources and Biotechnology, PMB 5382 Moor Plantation, Ibadan, Nigeria. [rhemiajayi@gmail.com](mailto:rhemiajayi@gmail.com) +2348034073868

### **Abstract:**

Neem seed cake has potential to replace expensive soyabean meal in livestock diets but requires the removal of toxic bitter triterpenoids. Utilisation of detoxified neem seed cake in ruminant feeding has not been adequately documented, hence, performance of West African Dwarf sheep fed detoxified neem seed cake based diets were assessed.

The neem seed cake was subjected to be either water-washing, sodium hydroxide-soaking, ammoniation or sun-curing. Six diets were formulated: I (20% soyabean meal, control), II (raw neem seed cake), while the detoxified cakes were used to replace soyabean meal in four concentrate diets: III (water-washed), IV (sodium hydroxide-soaked), V (ammoniated) and VI (sun-cured). In a completely randomised design, thirty-six West African Dwarf sheep were randomly allotted to the six treatments with six replicates per treatment and were fed basal Guinea grass and experimental diets in ratio 70:30 for 105 days. Dry matter intake, crude protein intake, feed conversion ratio and daily weight changes were recorded. Data were analysed using ANOVA at  $\alpha_{0.05}$ .

The dry matter intake ranged from  $218.14 \pm 29.23$  (II) to  $330.69 \pm 7.74$  g/day (V). The feed conversion ratio in sheep fed treated neem seed cake diets were similar to the control and better than raw neem seed cake diet, while daily weight changes in treatments I (54.95 g/day) and V (51.28 g/day) were higher than others. The crude protein intake were 39.00, 25.46, 37.06, 35.16, 32.27 and 31.39 g/day for treatments I to VI respectively.

Ammoniated neem seed cake supplemented diet supports best performance in sheep growth response.



## Precision in shoats selection using telomeres

Mercy Mulandi, Rawlynce Bett, Joseph Jung'a

University of Nairobi, Nairobi, Kenya

Contact: [mercykabondo@gmail.com](mailto:mercykabondo@gmail.com) +254 700649328

### **Abstract:**

Time wastage in the farm due to 'unseen' genetic and health disorders contributes to economic losses and high levels of methane, this occurs due to unprecise selection criteria. The heritable nature, correlation between lifespan, genetic diseases to telomere length is of great impact to the selection of suitable sheep in early life stages. Sheep and goat telomere length is heritable making it a possible parameter for selection. Telomeres are protective structures at the end of chromosomes that maintain the integrity of the genome by ensuring that chromosomes are not recognised as sites of DNA damage. This study followed the telomere measurement guidelines as described by Cawthon, 2002. We conducted two separate PCRs simultaneously, a Telomere PCR and a Single copy gene (beta-2-microglobulin (B2M) PCR for all samples. This was as such in order to get the ratio between the two as the average telomere length is usually presented as the amount of single copy gene which is a constant to the amount of telomeric DNA. B2M was used as it has been previously used in soay sheep and freshian cattle telomere dynamics experiments and has shown stable qPCR results.

The fluorescence thresholds were different across all samples. The single gene copy had an average of 2.081 while the TEL gene had an average of 2.123. The lengths are shorter for animals with lower growth rates, lower milk production, more disease manifestations and more reproductive disorders like abortions. The telomeres are longer for animals described to have a better quality life.

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## Milk composition of Chusca goat (*Capra aeagrus hircus*) in husbandry extensive environment in the dry forest of the Southern of Ecuador

**Edgar Lenin Aguirre<sup>1</sup>, Ramiro Armijos<sup>1</sup>, Miriam Puchaicela<sup>2</sup>, Belén Gahona<sup>2</sup>, Priscila Pineda<sup>2</sup>, Juan Pablo Riofrio<sup>2</sup>.**

<sup>1</sup>Agricultural Faculty, Veterinary Medicine and Zootechnics School, National University of Loja-Ecuador.

<sup>2</sup>Graduation Students in Veterinary Medicine and Zootechnics, National University of Loja-Ecuador.

**Contact:** Av. Pio Jaramillo, Ciudadela "La Argelia", Loja city, Ecuador-South America. Telf. +593-986448562.  
[edgar.aguirre@unl.edu.ec](mailto:edgar.aguirre@unl.edu.ec), [leninaguirrer@yahoo.es](mailto:leninaguirrer@yahoo.es)

### **Abstract:**

The goat "Chusca Lojana" which is found in the tropical zone of the Dry Forest of the Province of Loja-Ecuador, where 73% of the goat population of the nationwide is found in this place. Is important to study the productive characteristics and the milk quality of this population, because this genetic resource represents a valuable socio-economic element for the habitants of this region. Production and milk quality of 198 goats managed extensively and from different herds were evaluated, for this, 4 periodic visits were made where production was recorded at the different stages of lactation and milk samples were taken for analysis using Lactoscan Milk Analyzer. It was determined that 64% has a globular udder, 93% have pigmented nipples, the productive life curve increases in third calving and reaches its peak in fourth, and then declines ( $R^2=0.82$ ), lactation duration is  $140\pm 20$  days, lactation curve follows a two period mobile trend, showing two peaks, one higher (30 days) and another of less intensity between 120-150 days coinciding with the post-weaning period, the mean production day is  $390\pm 231$  ml. Both production and composition of milk, it is statistically affected by the place husbandry, calving number, lactation stage ( $P<0.05$ ) and the biotype ( $P<0.1$ ). The milk composition of this goat presents  $5.5\pm 1.9\%$  Fat,  $8.2\pm 0.83\%$  NFS,  $13.7\pm 2.1\%$  Total Solids,  $4.5\pm 0.47\%$  Lactose,  $3\pm 0.3\%$  Protein,  $0.68\pm 0.07\%$  Mineral Salts and  $6.7\pm 0.26$  PH. With the information obtained from this study, those animals with a tendency to produce quality milk can be standardized for the purposes of selection, management and multiplication.

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## *In vitro* assessment of the larval exsheathment inhibition of extracts of *Lentinula edodes* (Shiitake) against *Haemonchus contortus* (L<sub>3</sub>)

**Tania María Rodríguez-Barrera<sup>1,2</sup>, Jetzabelt Ambrosio-Bautista<sup>3</sup>, Maura Téllez-Téllez<sup>2</sup>, José E. Sánchez<sup>4</sup>, Gloria Sarahí Castañeda-Ramírez<sup>1</sup>, María de Lourdes Acosta-Urdapilleta<sup>2</sup>, Liliana Aguilar-Marcelino<sup>1</sup>**

<sup>1</sup>Centro Nacional de Investigación Disciplinaria en Salud Animal e Inocuidad, INIFAP, Km 11 Carretera Federal Cuernavaca-Cuautla, No. 8534, Col. Progreso, Jiutepec, Morelos, México, C.P. 62550.

<sup>2</sup>Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Morelos, Av. Universidad No. 1001, Col Chamilpa Cuernavaca, Morelos, México. C.P. 62209.

<sup>3</sup>Facultad de Medicina Veterinaria y Zootecnia. Universidad Mesoamericana, Privada de la Soledad No. 311, Puebla de Zaragoza, México. C.P. 45575.

<sup>4</sup>El Colegio de la Frontera Sur, Apdo. Postal 36, Tapachula, Chiapas, México, C.P. 30700.

**Contact:** Dr Liliana Aguilar-Marcelino, [aguilar.liliana@inifap.gob.mx](mailto:aguilar.liliana@inifap.gob.mx); Phone.: +52 777 319 28 60 ext. 121.

### **Abstract:**

Livestock is one of the most important economic activities in Mexico, is a profitable sector that guarantees the production and supply of food. This sector is affected by parasites such as gastrointestinal nematodes. One of the main ones is the nematode *H. contortus*, this etiological agent is considered the cause of diseases that afflict small ruminants. An alternative to this problem is the edible mushroom *L. edodes* which is a natural antagonist of parasitic nematodes of sheep (Al-ani et al., 2020; Pineda-Alegría et al., 2020). The objective of the present study was the determination of anthelmintic activity *in vitro* was carried out with the larval unsheath inhibition test. This study used the larval exsheathment test, which is based on measuring the inhibitory capacity of unsheathing using L<sub>3</sub> *H. contortus* to interrupt the life cycle. Statistical analysis based on determining the percentage of inhibition of the unsheathing larvae L<sub>3</sub> *H. contortus* with the formula: percentage of unsheathing = (L<sub>3</sub> larvae without sheath)/(larvae with sheath + larvae without sheath) x 100. The results of the five concentration of the extract (150, 312.5, 625, 1250 and 2500 µg/mL) were evaluated with one-way ANOVA comparing means. The results show that a *L. edodes* obtained a percentage of 100% inhibition of larval unsheathing at a concentration of 2500 µg/mL. In conclusion, the extract of *L. edodes* can be used as a sustainable integral control method in the livestock area. The present study was financed by the National Problems, CONACYT, project number 9342634372.

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## *In vitro* assessment of the larval exsheathment inhibition of extracts of edible mushroom *Pleurotus djamor* against *Haemonchus contortus* (L3)

Jaime Cristóbal Hernández-Rodríguez<sup>1,2</sup>, Jetzabelt Ambrosio-Bautista<sup>4</sup>, Ivan Flores-Pérez<sup>2</sup>, Juan Felipe de Jesús Torres-Acosta<sup>3</sup>, Gloria Sarahí Castañeda-Ramírez<sup>1</sup>, Claudia Hallal-Calleros, Liliana Aguilar-Marcelino<sup>1</sup>

<sup>1</sup>Centro Nacional de Investigación Disciplinaria en Salud Animal e Inocuidad, INIFAP, Km 11 Carretera Federal Cuernavaca-Cuautla, No. 8534, Col. Progreso, Jiutepec, Morelos, México, C.P. 62550.

<sup>2</sup>Facultad de Ciencias Agropecuarias, Universidad Autónoma del Estado de Morelos. Av. Universidad 1001, Col. Chamilpa, Cuernavaca, Morelos, Mexico, C.P. 62209.

<sup>3</sup>Facultad de Medicina Veterinaria y Zootecnia. Universidad Autónoma de Yucatán. Km 15.5 Carretera Mérida-Xmatkuil, CP 97100, Mérida, Yucatán. México.

<sup>4</sup>Facultad de Medicina Veterinaria y Zootecnia. Universidad Mesoamericana, Privada de la Soledad No. 311, Puebla de Zaragoza, México. C.P. 45575.

**Contact:** Dr Liliana Aguilar-Marcelino, [aguilar.liliana@inifap.gob.mx](mailto:aguilar.liliana@inifap.gob.mx); Phone.: +52 777 319 28 60 ext. 121.

### **Abstract:**

In the present study, it was carried out in vitro assessment of the larval exsheathment inhibition of extracts of *Pleurotus djamor* against *Haemonchus contortus* (L3). They were used in series 6 (n=4). Series 1, (control group) contained PBS pH 7.4; series 2) 150, 3) 312.5, 4) 625, 5) 1250, 6) 2500 µg/mL of extract. The chlorine concentration was determined to induce the larvae exsheathment of an extra series of PBS (control group), the concentrations of chlorine (sodium hypochlorite (4.0 to 6.0%) and sodium hydroxide (0.002-0.10%)) were: 20, 30, 40, 45 and 60 µL (Chan et al., 2017). It is taken in 50 µL of each concentration of the extract and placed on the slide. To add chlorine solution to induce larvae, select and the number of sheathed and unsheathed larvae that were observed at each concentration (0, 20, 40, and 60 minutes). The following formula is used to determine the inhibition percentage of exsheathment (ID) at 60 min for each extract: exsheathment % = (larvae L3 without sheath) / (larvae with sheath + larvae without sheath) x 100. ID% = 100- exsheathment . ANOVA and the media comparison test were performed. The percentage of inhibition of larval exsheathment presented by the *P. djamor* extract was 100% at a concentration of 2,500 µg/mL, 99.2% at the concentration of 1,250 µg/mL, 60.4% at a concentration of 625 µg / mL, 8.2 with a concentration of 312.5 µg / mL, 2.6 with a concentration of 150 µg / mL. The present study was financed by the National Problems, CONACYT, project number 9342634372.

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