Proceedings
of the
Fifth DairyCare Conference 2018

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DairyCare: An appreciation

It has been an immense pleasure to have been associated with DairyCare for the last four years, and to have had wonderful opportunities for scientific and social interaction with so many like-minded scientists from all corners of the EU. Much has happened during those years. We have discussed and researched very many aspects of dairy animal wellbeing, seen the introduction of numerous new husbandry technologies, witnessed animal welfare increasing as a priority for consumers, exchanged skills and expertise with colleagues in far-flung laboratories, worried over the withdrawal of the UK from the EU, travelled widely across our continent and invited experts from around the globe to our Conferences and Workshops. Have we been successful? That is not for me to say, but I certainly hope that it is the case. Have we achieved what we set out to achieve? During this Final Conference it will become obvious whether or not our formal deliverables have been met, but the real success or otherwise of networking goes far beyond such prescribed outcomes. Putting together these Proceedings, I was struck by the number of Abstracts that have come from large, multinational groups; clear evidence of effective interaction. In some cases this has involved scientists from different disciplines coming together to achieve the end result, although I do worry that this has perhaps not happened as often as it should have done. Should DairyCare continue? We are incredibly grateful for the COST Funding that has enabled our Action (including the additional funding allocated for dissemination in 2018), but there are no plans to seek further COST support. This Conference includes a panel session dedicated to other related and ongoing EU activities, so the baton is not dropped, it is passed on. What is needed next? We shall explore that in Thessaloniki, and expect to publish our DairyCare Blueprint for Action as a special issue of the Journal of Dairy Research later in the year. From this short commentary the reason for the Conference theme should have become apparent. My passion for animals and their welfare started at a very young age, growing up on a dairy farm. DairyCare has advanced the cause by accelerating the introduction of technologies that assist good husbandry, but there is more to be done. We are getting there!

Animal wellbeing is at the start of a chain that links to farmer profitability, product quality, consumer satisfaction and environmental sustainability.
Welcome to Thessaloniki!

Thessaloniki is an ancient city with a modern vibrant culture. With Constantinople it was the co-capital of the Byzantine Empire and today is Greece's second city and principal cultural hub. In 2014 the city was the European Youth Capital and was named "best mid-sized European city of the future for human capital and lifestyle". A popular tourist destination, Thessaloniki is located in the Macedonian region of Greece and in the north-western corner of the Aegean where it enjoys a subtropical climate: we are hoping that the temperature will be as just as warm as the famous Greek hospitality. The nearby town of Koufalia is home to Mevgal, or Macedonian Milk Industry, one of the country's biggest producers of dairy products including, of course, Greek yogurt. DairyCare are extremely grateful to the local organisers, Evangelia N. Sossidou and George Bartzanas, for extending the invitation come to Greece. The Veterinary Research Institute of Thessaloniki of the Hellenic Agricultural Organisation-DEMETER (HAO-VRI) and the Institute of Bio-Economy and Agri-Technologies of the Center for Research and Technology-HELLAS (IBO/CERTH) are the co-hosts of the conference which will be held at the CERTH Congress Centre. Located close to the airport and 20 minutes by local transport from the city centre, this is an ideal venue for our last DairyCare Conference. We look forward to welcoming you!
<table>
<thead>
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<th>Outline Programme</th>
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<tr>
<td><strong>Monday 19th March</strong></td>
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<td><strong>Tuesday 20th March</strong></td>
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<tr>
<td>0800</td>
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<td>0900</td>
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</tbody>
</table>
| 0920  | **1** Milk biomarkers to evaluate health status of mammary gland in high producing dairy cattle  
     Cinzia Marchitelli, Federica Signorelli, Francesco Napolitano, Clément Grelet, Nicolas Gengler, Frédéric Deharenge, Hélène Soyeurt, Klaus Lønne Ingvartsen, Martin Tang Sørensen, Torben Larsen, Mark Crowe & GplusE consortium [cinzia.marchitelli@crea.gov.it](mailto:cinzia.marchitelli@crea.gov.it) |
| 0930  | **2** Milk haptoglobin as an indicator of udder health in heifers after calving  
     Patrícia Simões, Mairead Campbell, Lorenzo Viora, James Gibbons, Timothy Geraghty, P David Eckersall & Ruth Zadoks [patriciasimoes@fmv.ulisboa.pt](mailto:patriciasimoes@fmv.ulisboa.pt) |
| 0940  | **3** Haptoglobin: A biomarker for selective dry cow therapy  
     Emily L. O’Reilly¹, Lorenzo Viora², Nicola Brady¹, Patricia Simões², Ruth Zadoks¹ & P. David Eckersall¹ [emily.oreilly@ed.ac.uk](mailto:emily.oreilly@ed.ac.uk) |
| 0950  | **4** Mid-infrared based biomarkers in milk as a non-invasive tool for early prediction of lameness caused by metabolic disorders  
     Axelle Mineur, Astrid Köck, Clément Grelet, Nicolas Gengler, Christa Egger-Danner & Johann Sölkner [axelle.mineur@uliege.be](mailto:axelle.mineur@uliege.be) |
| 1000  | **5** The effects of an ACTH challenge test on lame and non-lame dairy cows  
     Viktor Jurkovich, Enikő Laky, Levente Kovács, Andrea Bende, Ferenc Ruff, Luca Kézér & Mikolt Bakony [jurkovich.viktor@univet.hu](mailto:jurkovich.viktor@univet.hu) |
| 1010  | **6** Random forests prediction of blood metabolic clusters of dairy cows: comparing 3 types of milk biomarkers  
     Leslie Foldager, Miel Hostens, Mazdak Salavati, Clément Grelet, Martin Tang Sørensen, Mark Crowe, Klaus Lønne Ingvartsen & Genotype Plus Environment Consortium [leslie@anis.au.dk](mailto:leslie@anis.au.dk) |
| 1020  | **7** A Generalized Linear Mixed Regression Model of BHB to Early Detection of Nutritional and Management Problems in Dairy Herds  
     Cristina Conceição P, Inês Domingues, Pedro Vaz, Rui Moreira & Paulo Infante [ccp@uevora.pt](mailto:ccp@uevora.pt) |
| 1030  | **8** Using Omics to understand Seasonal Weight Loss in Dairy Goats: An overview of Project GOATOMICS major achievements  
     Mariana Palma, José Ricardo Parreira, Lorenzo E. Hernandez-Castellano, Juan Capote, Noemí Castro, Alexandre Campos, Anastasios Arguello, Manolis Matzapetakis, Susana S. Araújo & André M. Almeida [aalmeida@isa.ulisboa.pt](mailto:aalmeida@isa.ulisboa.pt) |
| 1040  | **9** Comparison of two methods of milk fatty acids composition to detect SARA (subacute rumen acidosis) in dairy goats  
     Sylvie Giger-Reverdin, Pablo G. Toral, Pilar Frutos, Gonzalo Hervas & Daniel Sauvant [sylvie.giger-reverdin@agroparistech.fr](mailto:sylvie.giger-reverdin@agroparistech.fr) |
| 1050  | Coffee and Posters                                                   |
| 1115  | **10** The acclimatisation process in dairy cows with different milk yield potential - searching for reliable biomarkers  
     Flávio Silva, Cristina Pinheiro, Liliana Cachuchó, Catarina Matos, Ana Geraldó, Elsa Lamy, Fernando Capela e Silva, Paulo Infante & Alfredo Pereira [ccp@uevora.pt](mailto:ccp@uevora.pt) |
| 1125  | **11** Effects of Spirulina spp. supplementation to dairy cows’ ration on animal heat stress  
     Maria-Anastasia C Karatzia, Evangelia S Sossidou [karatzia@rias.gr](mailto:karatzia@rias.gr) |
### Monday 19th March (continued)

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>1135</td>
<td><strong>Current Project Awareness Session</strong></td>
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<td></td>
<td>A panel of invited speakers will introduce their ongoing research projects. Please see the separate programme for details. If you are involved in a relevant project and would like to join the panel please email <a href="mailto:dairycare@sund.ku.dk">dairycare@sund.ku.dk</a></td>
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<tr>
<td>1235</td>
<td><strong>Scientific Session 2: Abstracts related to WG2 Activity</strong></td>
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<td></td>
<td><strong>12</strong> <strong>Effects of prenatal heat stress on emotional reactivity and behavioral reactions of female dairy goat kids</strong> Wellington Coloma-Garcia, Nabil Mehaba, Ahmed A.K. Salama, Xavier Such &amp; Gerardo Caja <a href="mailto:wongca_100583@hotmail.com">wongca_100583@hotmail.com</a></td>
</tr>
<tr>
<td></td>
<td><strong>13</strong> <strong>Evaluation of Heart Rate and Lying Behaviour to Predict Calving of Dairy Cows</strong> Heiko Georg, Silke Beintmann, Anja Schwalm, Gracia Ude <a href="mailto:heiko.georg@thuenen.de">heiko.georg@thuenen.de</a></td>
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<td><strong>14</strong> <strong>Relationship between metabolic status and behaviour in dairy cows in early lactation</strong> Renny J. van Hooij, Akke Kok, Rupert M. Bruckmaier, Marie J. Haskell, Bas Kemp &amp; Ariette T.M. van Knevel <a href="mailto:ariette.vanknevel@wur.nl">ariette.vanknevel@wur.nl</a></td>
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<td>1305</td>
<td><strong>Changes in the Social Network when Separating High- and Low-productive Dairy Cows</strong> Paul Koene <a href="mailto:paul.koene@wur.nl">paul.koene@wur.nl</a></td>
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<tr>
<td>1315</td>
<td><strong>16</strong> <strong>Automated detection of lameness in dairy cows compared with claw diagnosis and mobility score</strong> Vivi M Thorup &amp; Nick J Bell <a href="mailto:v.thorup@icerobotics.com">v.thorup@icerobotics.com</a></td>
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<tr>
<td>1325</td>
<td><strong>Lunch and Posters</strong></td>
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<td>1420</td>
<td><strong>Plenary Review of DairyCare’s Biomarker Research Achievements and Future Prospects</strong> (Ali Mobasher, Surrey and Andre Almeida, Lisbon)</td>
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<tr>
<td>1450</td>
<td><strong>Scientific Session: Cow and Calf Together Incubator Group</strong></td>
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<td><strong>17</strong> <strong>Managing Cow and Calf Together: Report of the DairyCare Incubator Group</strong> Sigrid Agenäs <a href="mailto:Sigrid.agenas@slu.se">Sigrid.agenas@slu.se</a></td>
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<tr>
<td>1505</td>
<td><strong>18</strong> <strong>Cow-calf contact systems for dairy: status of the literature</strong> Rebecca K. Meagher &amp; Marina A.G. von Keyserlingk <a href="mailto:r.k.meagher@reading.ac.uk">r.k.meagher@reading.ac.uk</a></td>
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<tr>
<td>1515</td>
<td><strong>19</strong> <strong>The Evaluation of Commingled Calves and Dams versus Separated Calves and Dams on Behavior, Physiology, and Production</strong> Amanda R Lee, Ashley D Campaeux, Melissa C Cantor, Joao HC Costa &amp; Peter D Krawczel <a href="mailto:aleee90@vols.utk.edu">aleee90@vols.utk.edu</a></td>
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<td>1525</td>
<td><strong>20</strong> <strong>Effects of suckling on milk yield and milk composition in dam rearing systems</strong> Kerstin Barth <a href="mailto:kerstin.barth@thuenen.de">kerstin.barth@thuenen.de</a></td>
</tr>
<tr>
<td>1535</td>
<td><strong>21</strong> <strong>Using an automated milk feeder during the suckling period will reduce stress behaviour at separation</strong> Julie Foske Johnsen, Cecilie M. Mejdell, Annabelle Beaver, Anne Marie dePassille, Jeffrey Rushen &amp; Daniel M. Weary <a href="mailto:cecilie.mejdell@vetinst.no">cecilie.mejdell@vetinst.no</a></td>
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<td>1545</td>
<td><strong>22</strong> <strong>Feeding behavior of dairy calves reared by the dam with access to automatic milk feeders</strong> Kristine Piccart, Stephanie Van Weyenberg &amp; Julie Johnsen <a href="mailto:kristine.piccart@ilvo.vlaanderen.be">kristine.piccart@ilvo.vlaanderen.be</a></td>
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<td>1555</td>
<td><strong>23</strong> <strong>Towards a validation protocol for sensor information in dairy herd management</strong> Amira Rachah, Olav Reksen, Dan Christoffer Jansen, Peter Løvendahl <a href="mailto:amira.rachah@nmbu.no">amira.rachah@nmbu.no</a></td>
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<td><strong>24</strong> <strong>Assessing ovulation time in dairy cows: experiences from estrus detection validation studies</strong> Ines Adriaens, Bart De Ketelaere, Wouter Saëys &amp; Ben Aernouts <a href="mailto:ines.adriaens@kuleuven.be">ines.adriaens@kuleuven.be</a></td>
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<td>1615</td>
<td><strong>25</strong> <strong>Real-time animal response to climate changes</strong> Harel Leit, S. Goldshtein, S. Pinto, A. K. Elazar, V. Bloch, V. Ben Meiri, E. Gershon, J. Miron, Halachmi <a href="mailto:harelle@volcani.agri.gov.il">harelle@volcani.agri.gov.il</a></td>
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<td>1625</td>
<td><strong>Coffee, Tea and Posters</strong></td>
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<td>1650</td>
<td><strong>Plenary Review of DairyCare’s Systems Research Achievements and Future Prospects</strong> (Tomas Norton, KU Leuven)</td>
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<td>1730</td>
<td><strong>Management Committee Meeting</strong></td>
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<td>1900</td>
<td><strong>Social Programme: Tour of Thessaloniki and Dinner</strong></td>
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<tr>
<td>Monday 19th March at 11.35 : 12.35</td>
<td>Current Project Awareness Session</td>
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<td>Katerina Marinou: Greek national animal welfare strategies</td>
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<td>David Eckersall: EU H2020 Marie Sklodowska-Curie Action MANNA</td>
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<td>George Stilwell: EU Erasmus+ ANICARE</td>
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<td>Chris Knight: UK Agri-EPI Centre <a href="https://www.agri-epicentre.com/">https://www.agri-epicentre.com/</a></td>
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<td>Christina Ligda: EU ERA-NET ARIMNet2 <a href="http://www.arim-perform.net">www.arim-perform.net</a></td>
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<tr>
<td>0830</td>
<td>Reflections on DairyCare</td>
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<tr>
<td>0850</td>
<td>Plenary Review of DairyCare’s Activity Research Achievements and Future Prospects</td>
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<tr>
<td>0920</td>
<td>Scientific Session: Abstracts related to WG3, Systems</td>
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<td>0930</td>
<td>Bayesian estimation of genetic parameters highly associated with health traits in</td>
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<td>cattle Radovan Kasarda, Michal Víček &amp; Nina Moravčíková, <a href="mailto:radovan.kasarda@uniag.sk">radovan.kasarda@uniag.sk</a></td>
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<tr>
<td>0940</td>
<td>Early Detection of Mastitis in Dairy Cattle through Sensor Data Combination</td>
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|       | Chris Davison, Craig Michie, Michael Gilroy, Ivan Andonovic,
|       |   andonovic.christopher.davison@strath.ac.uk                                    |
| 0950  | Rumination Detection in Dairy Cattle Using Acceleration Based Bolus Sensors       |
|       | Andrew Hamilton, Chris Davison, Ivan Andonovic, Craig Michie,
|       |   andrew.w.hamilton@strath.ac.uk                                                 |
| 1000  | Scientific Session: Small Ruminant Sensors Incubator Group                       |
| 1005  | Evaluation of Cow Feed Mass by Photogrammetry                                    |
|       | Victor Bloch, Harel Levit, and Ilan Halachmi, victor@volcani.agri.gov.il         |
| 1010  | Using recycled manure solids as a bedding material in a freestall dairy barn     |
|       | Lilli Frondelius, Heli Lindeberg, Jenni Laakso and Matti Pastell,
<p>|       |   <a href="mailto:lilli.frondelius@luke.fi">lilli.frondelius@luke.fi</a>                                                       |
| 1020  | Cattle and Sheep Welfare during Transport: What are the Good and the Best         |
|       | Practices to improve this? Sossidou E.N, Nalon E., De Briyne N. &amp; Spoolder H. A.|
|       | M., <a href="mailto:sossidou.arig@nagref.gr">sossidou.arig@nagref.gr</a>                                                       |
| 1030  | Coffee and Posters                                                               |
| 1050  | Sensors for Small Ruminants: Report of the DairyCare Incubator Group             |
|       | Gerardo Caja, <a href="mailto:gerardo.caja@uab.es">gerardo.caja@uab.es</a>                                                 |
| 1105  | Current and future prospects for the use individual animal data interpretation to |
|       | optimize dairy goat farm management                                             |
|       | Alejandro Belanche, Ignacio Martín-García, Javier Fernández &amp; David R. Yáñez-Ruiz|
|       | <a href="mailto:a.belanche@csic.es">a.belanche@csic.es</a>                                                               |
| 1115  | Embedding Sensor Technologies as Part of a Holistic Farming Concept              |
|       | Max Seybold, <a href="mailto:max@almweide.com">max@almweide.com</a>                                                    |
| 1125  | Automatic identification of very thin dairy goats using image technology         |
|       | George Stilwell, Susana Brandão, Ana Vieira, <a href="mailto:stilwell@fmy.ulisboa.pt">stilwell@fmy.ulisboa.pt</a>             |
| 1135  |Temperature rumen bolus able to record intake and drinking behavior for dairy    |
|       | small ruminants                                                                  |
|       | Joan Oliver, Carles Ferrer, Alejandro Peralta, Andreia Castro-Costa, Ahmed A. K.  |
|       | Salama &amp; Gerardo Caja, <a href="mailto:carles.ferrer@uab.cat">carles.ferrer@uab.cat</a>                                     |
| 1145  | Planning for Future Project Opportunities                                         |
|       | (Including introductory remarks from Denis Simonin, Head of Animal Welfare       |
|       | Sector at EU Commission)                                                         |
| 1300  | Lunch and Posters                                                                |
| 1400  | Invited Plenary: Welfare related research and funding opportunities in the USA   |
|       | (Joao HC Costa, USA)                                                             |
| 1415  | Invited Plenary: Technology use in the Australian dairy industry and its value to |
|       | the health and productivity of the individual dairy cow                          |
|       | (Cameron Clark, Australia)                                                       |
| 1445  | Plenary Review: Progress and prospects in optimized dairy husbandry             |
|       | (Jude Capper, UK)                                                                |
| 1500  | DairyCare Blueprint for Action and Dissemination                                 |
| 1600  | Coffee, Tea and Breakout Groups                                                  |
| 1645  | DairyCare Blueprint for Action and Dissemination                                 |
| 1730  | Close of Conference                                                             |
| 1930  | Social Programme: Conference Dinner                                              |</p>
<table>
<thead>
<tr>
<th>Posters</th>
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| **P1** The role of Staphylococcus aureus virulence factors in the infection of bovine mammary epithelial cells  
Karin Artursson, Yusak Budi Susilo, Lihong Liu, Jonas Bergquist & Jenny Schelin  
karin.artursson@sva.se |
| **P2** The effect of heat stress on some metabolic parameters and prevalence of metabolic disorders in lactating cows – a retrospective study  
Mikolt Bakony, László Könyves, Péter Hejel, Péter Kovács, Endre Brydl, Viktor Jurkovich  
bakony.mikolt@univet.hu |
| **P3** The differences in teat-end hyperkeratosis between Holstein and Jersey dairy cows  
Tina Bobić, Pero Mijić, Maja Gregić, Mirjana Baban, Marcela Šperanda, Vesna Gantner  
tbobic@pfos.hr |
| **P4** Comparison of biochemical markers in early lactated dairy cows kept in two different housing systems  
Irena Celeska, Igor Dzadzovski, Miroslav Radeski, Vlatko Ilieski & Danijela Kirovski  
iceleska@fvm.ukim.edu.mk |
| **P5** Metabolic status of dairy cows grouped by their anabolic and catabolic indicators of metabolic stress (insulin, insulin like growth factor-I and non-esterified fatty acids) in early lactation  
Marko R. Cincović, Branislava Belić, Radojica Doković, Jožica Ježek, Gordana Devecerski, Milun D. Petrović & Jože Starič  
jozje.staric@vf.uni-lj.si |
| **P6** Omics reveals a leaky gastrointestinal tract and hormone regulation impairment in heat-stressed dairy goat  
Alexandra Contreras-Jodar, Nazi Nayan, Soufiane Hamzaoui, Gerardo Caja & Ahmed A K Salama  
gerardo.caja@uab.es |
| **P7** Factors influencing the calf viability at birth  
Ludovic T. Cziszer, Daniela E. Ilie, Dinu Gavojdian & Radu I. Neamț  
cziszerl@animalsci-tm.ro |
| **P8** Blood and milk parameters in dairy cows kept on different slope of straw deep litter  
Mislav Đidara and Marcela Šperanda  
didara@pfos.hr |
| **P9** Dairy ewes adapt to the proportion of concentrate in the diet (30 to 60%) without effects on their milk performances from early-lactation  
Abdelali Elhadi, Gerardo Caja, Ahmed Salama, Miriam Mendivil, Eduardo Durán & Elena Albanell  
abdelali.elhadi@uab.cat |
| **P10** Relationship between some animal-based measures collected at herd-level and the exposure of dairy cows to poor management and housing conditions  
Francesca Fusi, Valentina Lorenzi, Alessandra Angelucci, Rosa Maria Strano, Jessica Ginestreti, Giandomenico Ferrara, Luigi Bertocchi  
francesca.fusi@izsler.it |
| **P11** Selection of optimal method for estimation of methane emission on dairy cattle farms  
Vesna Gantner, Maja Gregić, Tina Bobić, Pero Mijić & Marcela Šperanda  
gvantner@pfos.hr |
| **P12** Effects of horns on production efficiency in dual-purpose Fleckvieh cows  
Dinu Gavojdian, Radu Neamț, Ludovic Cziszer, Ioana Nicolae & Daniela Ilie  
gavojdian_dinu@animalsci-tm.ro |
| **P13** Sucking behaviour in Holstein calves with intensive milk feeding and butyrate supplementation  
Caroline Gerbert¹, Dörte Frieten², Christian Koch³, Georg Duse³ & Harald M. Hammon³  
hammon@fbn-dummerstorf.de |
| **P14** A preliminary study on antibiotic usage in Italian dairy herds: the DDDAit method  
Jessica Ginestreti, Valentina Lorenzi, Francesca Fusi, Alessandra Angelucci, Rosa Maria Strano, Giandomenico Ferrara, Federico Scali, Giovanni Loris Albordi & Luigi Bertocchi  
gin.jessica91@gmail.it |
| **P15** Biomarkers in exosomes in cattle diseases  
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leticiapontesproteomica@gmail.com |
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<th>No.</th>
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<td><a href="mailto:mgregic@pfos.hr">mgregic@pfos.hr</a></td>
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<td><a href="mailto:danialie@animalsci-tm.ro">danialie@animalsci-tm.ro</a></td>
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<td><a href="mailto:karatzia@rias.gr">karatzia@rias.gr</a></td>
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<td><a href="mailto:dani@vet.bg.ac.rs">dani@vet.bg.ac.rs</a></td>
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<td><a href="mailto:rzkwals@cyf-kr.edu.pl">rzkwals@cyf-kr.edu.pl</a></td>
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<td><a href="mailto:ekremlacin@hotmail.com">ekremlacin@hotmail.com</a></td>
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<td><a href="mailto:valentina.lorenzi@izsler.it">valentina.lorenzi@izsler.it</a></td>
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<td>Sarah E. Mac, Carissa M. Truman, and Joao H.C. Costa</td>
<td><a href="mailto:costacalving@uky.edu">costacalving@uky.edu</a></td>
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<td><a href="mailto:nabil-bra@hotmail.fr">nabil-bra@hotmail.fr</a></td>
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<td><a href="mailto:pmijic@pfos.hr">pmijic@pfos.hr</a></td>
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<td><a href="mailto:g02mamof@uco.es">g02mamof@uco.es</a></td>
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<td><a href="mailto:mikaela.mughal@uef.fi">mikaela.mughal@uef.fi</a></td>
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<td>P29</td>
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<td>Ioana Nicolae, Marinela Enculescu &amp; Dinu Gavojdian</td>
<td><a href="mailto:ioana_nicolae2002@yahoo.com">ioana_nicolae2002@yahoo.com</a></td>
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<td>Metin Petek</td>
<td><a href="mailto:petek@uludag.edu.tr">petek@uludag.edu.tr</a></td>
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Evangelia Sossidou, A. Gelasakis & A. Kalogianni sosidou.arig@nagref.gr |

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Laura Vogel, M Gnoet, C Kröger-Koch, J Weitzel, A Trösch, A Starke and H. Hammon hammon@fbn-dummerstorf.de |

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Sema Yaman, Engin Ünay and Pinar Ozdemir semayaman60@yahoo.com |

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Kuai Yu, Manolis Matzapetakis, D Valent, Gary J. Salazar, Andre Almeida, Marta Terré, Anna Bassols kuiayu@uab.cat |

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Lourdes Soler, N García, M Bochniarz, R Dąbrowski, F Lampreave, M A Álava & M Piñeiro lourdes.soler.baigorri@gmail.com |

| P47 | The importance of the addition of vitamin and mineral mixture in dairy cow nutrition  
Tatjana Pirman & Andrej Lavrenčič tatjana.pirman@bf.uni-lj.si |
For several decades, in many countries, the focus of the dairy industry has been on maximizing milk yield, leading to the deterioration of many functional traits. In the transition period high producing dairy cows may be affected by several infectious diseases. A new approach is to utilize predictive milk biomarkers for health traits and intervene in a preventative manner. The aim was to discover potential biomarkers in milk to evaluate mammary gland health status. A total of 241 dairy cows from 6 experimental herds in Denmark, Ireland, UK, Italy, Belgium and Germany were enrolled. Milk samples were collected at 7, 14, 21 and 35 days in milk (DIM). Lactose, fat, protein content, SCC, β-hydroxybutyrate, isocitrate, urea, uric acid, glucose, glucose-6-phosphate, lactate dehydrogenase (LHD) and N-acetyl-β-d-glucosaminidase (NAGase) were determined. Furthermore, individual milk MIR spectra were collected at the same DIM, and prediction equations were used to predict mineral and fatty acid contents. Cows were assigned to one of three groups on the basis of milk SCC values (‘000 cells/mL): LOW (≤ 100), INTERMEDIATE (101≤SCC≤400), and HIGH (≥ 401). Mammary gland status was monitored during the trial period by veterinarian control. Milk parameters were analysed by MIXED GLM model in SAS to determine and compare means among different lactation day and between the three groups. A canonical discriminant analysis was performed by CANDISC procedure in SAS to obtain linear combinations of the quantitative variables that best summarize the differences among the three SCC health states. Mineral and lactose contents, NAGase, and LDH activity, and some fatty acid contents were significantly different between 7, 14, 21 and 35 DIM and in HIGH vs LOW cows. Two new canonical functions that grouped some of the milk parameters distinguished LOW, INTERMEDIATE and HIGH SCC cows. These identified milk biomarkers will be tested and validated using larger numbers of cows. These new milk biomarkers may be used by farmers for early detection of diseases. This research was supported by the GplusE project (EU FP7 613689).

http://www.gpluse.eu/

Replacement heifers are key elements for dairy farm sustainability. The lack of udder health information at heifers’ entrance into the milking herd represents, therefore, a potential threat for the farm. Intramammary infection is the main cause of mastitis in dairy cattle, affecting milk production, longevity and cattle welfare. The detection of mammary gland inflammation and infection relies on methods with limitations, in particular for on-farm diagnosis of subclinical mastitis after calving. Haptoglobin, an acute phase protein, has been suggested as an alternative indicator of udder health and diagnostic method. Milk haptoglobin measurements and development of measurement methods bring the advantage of a potential application as cow-side test with results in real time. The aim of this study was to evaluate milk haptoglobin concentration over the first week postpartum to explore its potential as indicator of udder health in dairy heifers. Colostrum and milk samples were obtained from 96 quarters of 24 heifers on the day of calving, third and fifth days of lactation, over a period of four weeks. Haptoglobin concentration was compared with a marker of inflammation and an indicator of infection status, somatic cell count (SCC) and bacteriological culture results respectively. Its concentration was higher on the third day of lactation and positively correlated with SCC (rs = 0.68). Infected quarters presented higher haptoglobin concentration than culture-negative quarters on the third and fifth days of lactation. Test accuracy (AUCROC), sensitivity and specificity of haptoglobin as diagnostic biomarker of intramammary infection at calving were low for both culture-based definitions used (0.60 or 0.65, 57% or 60% and 61% or 63%, for gland status based on lenient and strict definition respectively). The poor performance of milk haptoglobin to detect intramammary infection may be related with the predominant bacterial type isolated at calving, coagulase negative staphylococci, thus it may be valuable in situations of caused by major pathogens, such as Streptococcus uberis.
Haptoglobin: A biomarker for selective dry cow therapy
Emily L. O’Reilly1, Lorenzo Viora2, Nicola Brady1, Patricia Simoes2, Ruth Zadoks1 & P. David Eckersall1
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The absence of any visible signs makes diagnosis of subclinical mastitis (SM) difficult (1,2) leading to delays in treatment and control, allowing the spread of mastitis-causing pathogens and long-term reduction in milk yield (2,3). Haptoglobin (Hp) is a specific marker of mastitis as the Hp concentration in milk from healthy quarters is low or undetectable (4). Dry cows are routinely treated with long acting infusions of antimicrobials to rid the udder of bacteria that could cause mastitis and to treat any SM present. In the UK, blanket use of antimicrobials is extremely high: 99% of dairy cows receiving antimicrobials at this point (5). AMR concerns have led to restrictions on the use of antimicrobials in dry cows in Nordic countries and the Netherlands where antimicrobial treatment is recommended only where mastitis is present. Exploration of diagnostics to direct antibiosis is an important part of the AMR response (6) and in this context determination of the most appropriate biomarker to direct antibiotic treatment in dry cows is therefore timely. This study explored the use of Hp as a biomarker for subclinical mastitis in dry cows alongside SCC, CMT and bacteriology. Over 11 weeks 409 quarter milk samples were obtained at dry off from 104 cows. SCC, CMT, bacteriology and Hp concentrations were determined. Of the 409 samples 278 had no bacteria cultured, 61 were contaminated and in 70 a specific bacteria was isolated. Hp, determined by ELISA was found to have superior sensitivity as a marker for mastitis compared to either SCC or CMT, suggesting that Hp is the most suitable biomarker on which to select cases for antimicrobial therapy at dry off (Table 1), thus ensuring selective dry cow therapy does not compromise health, welfare and future productivity. For a point of care (POC) mastitis test sensitivity is the most important diagnostic criteria. Together with established bodies of research and recent work by other groups (7) our results demonstrate that Hp is potentially the single most useful biomarker of mastitis in milk, and as such is the most appropriate target for assessing udder health in dry cows at point of care.

Table 1: Sensitivity and Specificity for Hp, SCC and CMT with bacteriology as the gold standard.

<table>
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<th>SCC</th>
<th>CMT</th>
<th>Hp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>0.69</td>
<td>0.46</td>
<td>0.76</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.61</td>
<td>0.76</td>
<td>0.58</td>
</tr>
</tbody>
</table>
Mid-infrared based biomarkers in milk as a non-invasive tool for early prediction of lameness caused by metabolic disorders

Axelle Mineur 1, Astrid Köck 2, Clément Grelet 3, Nicolas Gengler 1, Christa Egger-Danner 3, Johann Sölkner 4

1: Université de Liége (ULg), Gembloux Agro-Bio Tech, Belgium; 2: ZuchtData EDV-Dienstleistungen GmbH, Austria; 3: Centre Wallon de Recherches Agronomiques (CRA-W), Belgium; 4: University of Natural Resources and Life Sciences (BOKU), Austria

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Lameness in dairy cows is a welfare issue that can vary greatly in severity, and is of concern for both producers and consumers. Metabolic disorders are a major problem in themselves, and, next to this, can cause lameness. Indeed, lameness is often occurring as consequence of various metabolic disorders, such as sub acute ruminal acidosis (SARA), ketosis or milk fever. The caused lameness event can occur weeks to months after the metabolic disorder making the detection of causality difficult. Moreover, detection of many metabolic disorders is very challenging and not straightforward. Mid-infrared (MIR) technology is already used for the prediction of major milk components, such as fat or protein, during routine milk recording and for milk payment. It was recently shown that this technology can also be used to predict novel components, linked to metabolic disorders of cows, such as ketone bodies, citrate and minerals. In the context of limiting the occurrence and severity of lameness, early prediction of lameness could help indicate the need to adapt the management and the environment of a cow at risk of lameness. Therefore, the aim of this study was to analyse the temporal link between metabolic disorders and lameness events, using locomotion scores of the cow and MIR based milk biomarkers for different metabolic disorders of her milk from previous test days. Research was based on data provided by RINDERZUCHT AUSTRIA, from their “Efficient Cow” project and were recorded between July 2014 and December 2014. First results obtained seemed to indicate that correct definition of the response variable is an important aspect as extremes in lameness severity, expressed on lameness scales, were more easily predictable. Results indicated also that using raw MIR spectra directly as predictor variables could be at least as efficient as using biomarkers that have to be predicted first from these spectra and then linked to lameness. Finally, these preliminary research results are currently challenged in complementary studies. If successful, MIR based information could form the basis for a novel managerial tool for lameness, based on expected occurrence of the disorder.

The effects of an ACTH challenge test on lame and non-lame dairy cows

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Chronic lameness is a serious welfare concern due to high prevalence and the pain and stress involved. The phenomenon of „adrenal fatigue” might also be present in animals exposed to long-term stress. The aim of this research was to assess physiological responses to acute stress triggered by ACTH load in cattle suffering from chronic intermittent stress (lameness). Based on locomotion scores (LS), we selected 11 chronically lame (LS: 3-5) and 11 non-lame (control, LS:1-2) animals (lactation number: 4.1 ± 1.0 vs. 4.3 ± 1.6; DIM: 190 ± 78 vs. 167 ± 73, milk yield: 31.8 ± 3.6 vs. 32.1 ± 7.0). Blood samples were taken for cortisol assay 30, 15 and 0 minutes prior to and 10, 20, 30, 40, 60, 120 and 240 minutes after administering 60 μg synthetic ACTH (tetraicosactide, Synacthen inj.). Heart rate variability (HRV) of each animal was also recorded by Polar heart rate monitors. Hair was also sampled for cortisol assay prior to ACTH challenge. Higher cortisol concentrations in hair (10.2 ± 2.5 vs. 7.8 ± 2.2; p Chronic intermittent stress caused by lameness had an influence on the HF component of HRV, but did not affect the responsiveness of the adrenal cortex. Authors are grateful for the following grants. VJ.: János Bolyai Research Scholarship (BO/29/16/4); EL.: New National Excellence Program (ÚNKP-17-2-I-ÁTE-4); LK.: János Bolyai Research Scholarship (BO/40/16/4), New National Excellence Program (ÚNKP-17-4-I/SZIE-7), OTKA Postdoctoral Scholarship (NKFIH-6493-1/2016). The research was supported by the EU and co-financed by the European Social Fund (EFOP-3.6.1-16-2016-00024).
Milk biomarkers as predictors of physiological imbalances and subclinical or clinical diseases in dairy cows may be used in management and selection. Cows were categorised into three clusters differentiating the metabolic status and defined by clustering of plasma hormone Insulin-like Growth Factor-1 (IGF-1) and three plasma metabolites: Glucose, beta-hydroxybutyrate (BHB), and non-esterified fatty acids (NEFA). We aimed to compare prediction of cluster category by use of milk metabolites and enzymes, selected milk MIR spectra wavenumbers, and milk IgG glycan profiles. Data between calving and 50 days in milk (DIM) were obtained from 235 Holstein Friesian cows in six research herds: AU (Denmark), UCD (Ireland) AFBI (UK), CRA-W (Belgium), FBN (Germany), CREA (Italy). Some diets were designed to challenge the cow and provoke production diseases but there were too few incidences to establish predictions. Instead, k-means clustering was performed over scaled residuals from linear mixed effects models for each of IGF-1, Glucose, log10(BHB) and log10(NEFA) measured around 14 and 35 DIM. Biomarker predictors were: Averages from 2 milkings/week of milk metabolites (free glucose, glucose-6-phosphate, BHB, isocitrate, uric acid, urea) and enzymes (LDH, NAGase) from same week as blood sampling; Closest MIR spectra sample within a limit of +/-3 days from blood sampling dates; IgG glycans sampled 14 and 35 days post-calving used for corresponding period. Random forests (RF) predictions by one biomarker-type and parity (1, 2 and 3+) were evaluated by leave-one-cow-out (internal) cross-validation. Results are shown in Table 1 as proportion of correctly classified observations (overall accuracy, i.e. diagonal of confusion matrix) for each of the three biomarkers and for each period (DIM14 and DIM35), and sensitivity, specificity and balanced accuracy (average of these) for each cluster. We obtained predictions of metabolic clusters from milk biomarkers of fair accuracy. Sample sizes may constrain both estimation of clusters, number of classes, and RF training. External validation in separate herds is warranted. Still, we see potential in using milk biomarkers to support management of dairy cows. Milk metabolites/enzymes resulted in slightly better accuracy of RF predictions but other methods should be investigated too. Practical matters may also influence choice of biomarkers.
Table 1 Random forests prediction of metabolic clusters established with k-means clustering of centre scaled observed values for each of plasma glucose, plasma log10(BOHB), plasma log10(NEFA), and plasma log10(IGF-1). The class numbers cannot be compared between periods (numbering is arbitrary) but it is the same clusters across the three types of milk biomarker predictors.

<table>
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<th>Milk biomarker</th>
<th>Period</th>
<th>Cluster</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Balanced accuracy</th>
<th>Overall accuracy (95% CI)</th>
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<tr>
<td>Milk enzymes and metabolites</td>
<td>DIM14</td>
<td>Class 1</td>
<td>211</td>
<td>0.54</td>
<td>0.78</td>
<td>0.66</td>
<td>0.59 (0.52-0.65)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class 2</td>
<td></td>
<td>0.78</td>
<td>0.69</td>
<td>0.73</td>
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<tr>
<td></td>
<td></td>
<td>Class 3</td>
<td></td>
<td>0.33</td>
<td>0.89</td>
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<tr>
<td></td>
<td>DIM35</td>
<td>Class 1</td>
<td>212</td>
<td>0.66</td>
<td>0.72</td>
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<td>Class 2</td>
<td></td>
<td>0.53</td>
<td>0.89</td>
<td>0.71</td>
<td>0.60 (0.53-0.67)</td>
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<td>Class 3</td>
<td></td>
<td>0.58</td>
<td>0.77</td>
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<td>MIR spectra (212 wavenos.)</td>
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<td>197</td>
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<td>0.68</td>
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A Generalized Linear Mixed Regression Model of BHB to Early Detection of Nutritional and Management Problems in Dairy Herds

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The interpretation of milk metabolites from milk recording, can be a possible nutritional and management tool for dairy farmers. The nutrient imbalances, as the relationship between carbohydrates fermentability and protein degradability in the rumen, can be diagnosed by the urea and protein concentration in milk. The metabolic imbalances, as the negative energy balance (NEB), hyperketonemia and ketosis, can be diagnosed by the Beta-hydroxybutyrate (BHB) concentration and the relation of fat/protein (F/P) in milk. A generalized linear mixed regression model (GLMM) was constructed to determine non-nutritional factors associated with a BHB greater than 0.2 mmol/L. The model included the cow as a random effect within the herd. The adjustment of the models was made using the R Project program. This study analysed 110,461 individual milk samples of 9,523 lactating dairy cows collected monthly from January 2015 to March 2017 from 27 herds of South of Portugal, with an official milk recording (Association for the Development of the Dairy Cattle- EABL). The model shows that milk production, the stage and number of lactation, somatic cells count (SCC), milk fat and the relation F/P in milk influenced the BHB concentration. A cow with 20 kg of milk production have 13 times more possibilities to have a BHB higher than 0.2 mmol/L, than a cow with a production of 40 kg (figure 1). Primiparous at 41 days after calving (0-41 Days in milk(DIM)) have the double of possibilities (IC95%(OR)=(1,48;2,69)) of having BHB over 0,2mmol/L, than primiparous at 42 to 55 DIM (peak of milk production). Multiparous with SCC between 200 and 400x10³cells/mL have 66% (IC95%(OR)=(1,44;1,92)) more possibilities to have the BHB over 2.0mmol/L than other multiparous with SCC below 200x10³cells/mL. Cows with F/P equal or over 1.4 have 2.3 more possibilities (IC95%(OR)=(2,12;2,51)) of having a BHB over 0.2mmol/L than cows with F/P below 1.4... In conclusion, the GLMM application optimize the potential using of milk recording to advise dairy farmers. Nevertheless, non-nutritional factors, should be considered in order to use milk metabolites as a tool to monitor milk farmers.

Figure 1 - The possibility of a cow having a BHB concentration greater than 0.2 with different milk production, and 95% confidence bands, taking as reference cows with daily milk production of 40 and 50 kg.
Using Omics to Understand Seasonal Weight Loss in Dairy Goats: An overview of Project GOATOMICS major achievements

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Seasonal weight loss (SWL) is a limiting factor to animal production. Understanding SWL adaptation molecular mechanisms is of high importance in animal selection. We studied the effect of SWL on the mammary gland secretory tissue proteome, metabolome and metabolome in 2 dairy goat breeds from the Canary Islands with different levels of tolerance to SWL: Majorera (tolerant) and Palmera (susceptible) in the framework of project GOATOMICS. Herein we present the main achievements of the project. Goats from both breeds were divided into two groups (n =5): control (constant weight) and underfed (15% liveweight reduction). At day 22, mammary gland biopsies were extracted and proteomics (Label-Free), metabolomics (NMR) and transcriptomics (NGS) profiles were obtained. Proteomics component: 1010 proteins were identified, 96 were significantly different among groups. SWL lead to an increase of apoptosis and stress processes in both breeds. Both breeds showed a decrease in the number of protein, carbohydrates and fat-biosynthesis proteins. When both breeds were compared after SWL, Majorera breed showed higher expression of immune system related proteins. In contrast, Palmera breed showed higher expression of proteins related to apoptosis, ketone bodies formation (fat liver) and protein metabolic processes. Metabolomics component: 47 different compounds were identified in the aqueous fraction of mammary gland extracts. Lactose, glutamate, glycine, lactate and glucose were found to be the most abundant. Statistical evaluation using Principal Component Analysis (PCA) and Partial Least Squares (PLS) revealed differences between control and underfed animals, although no differences between breeds were observed. Transcriptomics component: Results showed that a concerted reprogramming of genes expression occurs as result of the stress imposed, irrespective to the breed. Also suggesting a different behavior of both breeds in response to SWL. Moreover, an enrichment analysis of the differentially expressed genes provided some insight into what biological processes are related with the response to SWL during lactation. Finally, a validation of the RNA-Seq assay using RT-qPCR was performed on candidate genes differentially expressed: Glycerol kinase (GK) and Adrenoreceptor beta 2 (ADRB2). Conclusion: The two goat breeds have a different metabolic response to SWL, highlighting differences particularly related to the immune system and apoptosis.
Comparison of two methods of milk fatty acids composition to detect SARA (subacute rumen acidosis) in dairy goats
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Requirements of high producing ruminants can only be covered by diets of high nutritive value that can induce subacute rumen acidosis (SARA), but not for all animals at the same time and with the same intensity. A challenge is to find noninvasive biomarkers to detect animals suffering from SARA. Milk fatty acids composition is a good candidate as it is partly linked to rumen metabolism. The aim of this work was to compare two methods of measure of milk fatty acids composition: gas chromatography (GC) considered as a “standard”, but a time-consuming and expensive method and medium infrared analysis (MIR), a rapid and cheap method which can be applied on field. Eight rumen cannulated dairy goats adapted to a low concentrate diet (20 %) were abruptly switched to a high concentrate diet (50 %). Samples of milk were taken individually on the morning for 2 days before the change, the 4 days following the change and once weekly for 3 weeks. 91 fatty acids were detected by GC and 58 were estimated by MIR. Rumen fluid was sampled simultaneously before the morning feed (T0) and 1, 2, 4 and 6 hours after. Rumen samples were analysed for pH and volatile fatty acid (VFA) composition. A principal component analysis (PCA) was used to examine the relationships among milk fatty acids percentages measured by GC. The projection of the saturated fatty acids on the first two components showed an opposition between the short and medium fatty acids (SMFA) up to 13C and the long (L) chain fatty acids (LFA). An index was calculated as the ratio of SMFA/LFA. It was positively linked to the pH values and negatively to [VFA] ones. A similar ratio was calculated from the MIR estimation. Even if both ratios were correlated (r = 0.60, n = 72), the MIR ratio was higher (0.72 ± 0.06) than the GC ratio (0.50 ± 0.05) and was not correlated with pH and only poorly with VFA. MIR overestimated SMFA and underestimated LFA. In conclusion, GC is a useful tool to detect SARA in dairy goats from milk composition, but MIR is not a relevant method due to the inaccuracy in the prediction of FA.

The acclimatisation process in dairy cows with different milk yield potential - searching for reliable biomarkers
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In dairy cattle, heat thermal stress is a major concern environmental stress that limits animal growth, metabolism, and productivity. Facing global warming tendency, the current increased environmental temperatures, the joint selection for productivity and adaptability should be an objective for dairy farms. This study aimed to evaluate the acclimatisation process of cows with different milk yield potential during summer and winter periods. 13 Holstein-Friesian cows were chosen from a dairy farm located in Alentejo, Portugal, 7 of those with high milk yield potential (HMP) and 6 with low milk yield potential (LMP). All cows were evaluated during summer and winter periods in respiratory frequency (RF), sweating rate (SR) and rectal temperature (RT) as well as milk, blood and saliva parameters. RF, SR and RT values were significantly higher in summer (64.13±12.78 mov./min., 76.89±46.77 g/m²/h and 38.82±0.68 °C) than in winter (36.13±7.67 mov./min., 24.69±7.30 g/m²/h and 38.06±0.52 °C), without differences between the two groups (HMP and LMP). Haematocrit and triiodothyronine levels were significantly lower in summer (23.80±9.39 % and 142.00±13.77 ng/dL) than in winter (30.70±5.00 % and 170.69±17.78 ng/dL) for both groups. However, in summer, HMP cows presented triiodothyronine blood concentrations (133.33±8.14 ng/dL) significantly lower than the LMP (152.40±11.97 ng/dL). Concerning salivary parameters, only HMP cows showed higher HSP70 concentrations during summer, without major changes in cortisol. Regarding milk analysis, urea levels were the only milk compound significantly different between groups (P<0.05): during summer the HMP group (293.62±35.97 mg/kg) had milk urea levels higher than LMP (253.69±33.81 mg/kg). These results showed that although HMP cows did not differed significantly in the first responses to heat (RF, SR and RT) from LMP cows, with the acclimatisation process, they showed higher physiological modifications, decreasing the metabolism, increasing HSP expression and changing milk composition. These results seem to indicate the potential use of HSP70 in saliva and urea in milk as potential biomarkers of heat stress.
Effect of Spirulina ssp. supplementation in heat stressed dairy cows’ ration on milk fatty acid profile

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Heat stress conditions are directly associated with a decline of overall production performance and specifically milk yield in dairy cows. Additionally, exposure to heat stress strongly modifies milk quality, altering its fatty acid profile. Different strategies regarding nutritional manipulations are proposed in order to ameliorate the negative effects of heat stress on production. This study attempted to estimate the effect of Spirulina sp.- a microalga, rich in proteins, vitamins and polyunsaturated fatty acids-supplementation in dairy cows’ ration, during heat stress, on milk fatty acid profile. The trial was undertaken in a commercial farm in Northern Greece. Twelve heat stressed (average T.H.I.=73.86±0.042) Holstein cows in early lactation were assigned to 2 groups (Controls-C, n=6 and Spirulina-S, n=6). Controls were fed a standard ration and S group consumed an extra 100g of Spirulina powder, daily for 61 days during June and July 2015. Milk was sampled on days 0, 31 and 61 and fatty acid (FA) composition was determined by gas chromatography. Saturated FA (SFA) (C6:0-C15:0) in the controls increased significantly (P≤0.05) between samplings. On the contrary, in S group, unsaturated FA C16:1 and C18:1 increased significantly (P≤0.05) between samplings. Moreover, polyunsaturated FA:SFA ratio increased significantly (P≤0.05) between 1st and 3rd sampling(1st:0.038±0.004 to 3rd:0.072±0.016) in S group. Spirulina powder supplementation enhances heat stressed cow milk with health-associated unsaturated FA, an observation that requires further investigation. This research project was funded under the Action ‘Research&Technology Development Innovation Projects’-AgroETAK, MIS453350, in the framework of the Operational Program ‘Human Resources Development’. It was co-funded by the European Social Fund through the National Strategic Reference Framework (Research Funding Program 2007-2013) coordinated by the Hellenic Agricultural Organization-DEMETER.

Effects of prenatal heat stress on the emotional reactivity and behavioral reactions of female dairy goat kids

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Stress during pregnancy can impair the normal development of the offspring. The aim of this study was to assess the effects of maternal heat-stress during the prenatal period on emotional reactivity of goat offspring. For this purpose, a total of 30 Murciano-Granadina dairy goats (41.8 ± 5.70 kg BW) were divided in 2 experimental groups based on environmental temperatures: Thermal-neutral (TN; 15 to 20°C, n = 15) and heat stress (HS; 30 to 37°C, n = 15). HR ranged between 35 and 40%. Goats were maintained to TN or HS conditions from d −15 to d 45 with regard to mating. Female kids born from TN (n = 16) and HS (n = 10) goats were weighed at birth and submitted to reactivity tests (NAT, novel arena test; NOT, novel object test) at d 30 ± 15 and 150 ± 30 of age, using a 4x4 m² arena with recording cameras. Variables measured were distance traveled and number of squares entered and jumps and sniffs done. NAT and NOT data were analyzed as repeated measures by using a simple linear model under a Poisson or Negative Binomial distribution. Compared to TN, pregnancy length of HS goats shortened 3 d (P < 0.01) and, consequently, HS kids showed lower birth (~7%; P < 0.12) and litter weight (~13%; P < 0.061). The 30-d old HS kids displayed a lower number of sniffs (P < 0.01) and vocalizations (P < 0.10) during NAT, whereas only tended to show a lower number of sniffs (P < 0.10) during NOT. Results of the same tests performed in 150-d old kids did not show differences between groups (P = 0.3 to 0.9). In conclusion, heat stress during the early pregnancy reduced the length of pregnancy with effects on the weight of the offspring. In addition, behavioral tests suggested an altered emotional reactivity during the postnatal life of the goat kids after the heat stress suffered in utero.
Evaluation of Heart Rate and Lying Behaviour to Predict Calving of Dairy Cows
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A regular calving process does not require any human assistance. A premature or unnecessary assistance at parturition could have an adverse effect. Despite that it is useful to supervise calving without disturbance of the process in order to recognize problems or abnormal position at an early stage. Thus automatic monitoring of calving can be a useful way to reduce mortality of calves. Together with an increasing herd size, automatic management tools may reduce labour intensive observations. With an experimental approach lying behaviour and heart rate of dairy cows was measured in order to predict calving. 28 individual dairy cows kept in 15 equally designed calving pens were used to record lying behaviour and heart rate 7-10 days prior to parturition. The time 24 hours before calving was characterized by significant changes in lying behaviour (fig. 1). Heart rate increased as well close to calving, particularly 60-90 min before calving. Results indicate, that lying behaviour and heart rate can be used as short term indicators to predict calving by means of electronic devices.

![Graph showing changes in lying behaviour and heart rate before calving](image-url)
The aim of this study was to analyze relationships between metabolic status (based on plasma metabolites), with feeding behaviour, lying behaviour, and daily motion and steps of dairy cows in week 4 postpartum after a 0-d or 30-d dry period (DP). Data from 81 Holstein-Friesian cows were collected using computerized feeders, accelerometers, and from analyses of EDTA plasma samples for free-fatty acid (FFA), β-hydroxybutyrate (BHB), glucose, insulin, insulin-like growth factor 1 (IGF-1), and growth hormone (GH) concentrations. Cluster analyses on plasma metabolite and metabolic hormone concentrations was used to categorize cows for poor, average, good, or very good metabolic status. Cows with a poor or average metabolic status had greater FPCM yield than cows with a good, or very good metabolic status. Furthermore, cows with a poor metabolic status had a lower DMI, daily number of feeder visits, and lower energy balance (EB) than cows with an average or good metabolic status. In contrast, cows with a poor metabolic status had more visits to the feeder than cows with a very good metabolic status. Cows with a very good metabolic status were all cows with a 0-d DP. These cows had fewer visits to the feeder which is likely related to the lower energy demand for the 12 kg lower daily FPCM yield compared with cows with a poor metabolic status. Feeding rate, daily meal time, lying bouts, steps and motion were not related with metabolic status. In conclusion, better metabolic status in dairy cows in early lactation was associated with a greater DMI, increased feeding activity, and more time spent lying, compared with a poor metabolic status. Lying time can be measured using sensor technology and can be a practical tool to monitor metabolic status in dairy cows in early lactation.
Dairy cows may graze more efficiently when allowed grazing in predefined areas with predictable sward height and grass quality. According to literature separating High- and Low yielding (HY and LY) dairy cows may have advantages for efficient grassland use, by allowing HY-animals to graze on a new grass strip first. In the control group 8 cHY and 8 cLY cows were grazing on a fixed area with every day a new strip of grass. In the experimental group 8 eHY- cows (matched with cHY) were also free to graze in the same fixed area, but 8 eLY cows (matched with cLY) were potentially stopped at a virtual fence and reduced the grazing area with possible social, welfare and production consequences. The virtual fence consisted of underground wires signalling a boundary that was received in the cow collar, producing a warning signal to the cow when approaching the boundary and a correction signal when crossing the boundary. All individual cows’ positions were recorded using GPS during day and night in the pasture and their locomotion and nearest neighbour were determined. The cows were moved to a milking parlour twice a day; individual milk production was recorded (liter per day). Data were recorded in three periods, i.e. P1 (learning), P2 (basis) and P3 (cross-over, i.e. experimental and control group were switched). The virtual fence was successful in preventing eLY-cows to reach the fresh grass. A reduction in their locomotion was found that might be related to a reduced welfare. However, no effect of the virtual fence and the restriction of the LY experimental group on milk production was found. Analysis of the Social Network showed a strong separation between eHY- and eLY-cows induced by the virtual fence leading to a new social structure. In the cross-over this social structure initially remained, but extinguished in 3 days.
Automated detection of lameness in dairy cows compared with claw diagnosis and mobility score

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A lame cow is in pain, produces less milk and her normal behaviour is impeded. Visual mobility scoring (MS) is the standard method of lameness detection, however, MS only provides a snapshot in time, is time-consuming and subjective. Claw diagnosis is extremely time-consuming, yet reflects claw health status. Automated lameness detection is objective and monitors cows around-the-clock every day. We compared an automated lameness probability (ALP) with claw diagnosis and MS. Five commercial UK dairy farms with 150 to 1,500 cows and lameness prevalence from 23.7 to 62.1% participated. Between 65 and 120 cows per farm were selected for trimming based on the MS (AHDB 4-unit scale from 0 to 3, scores >2 defined as lame) assessed by the same trained technician, aiming for 50% non-lame and 50% lame. The cows wore an IceQube sensor (IceRobotics, South Queensferry, Edinburgh, UK), which calculates a daily ALP on a 100-unit scale from 0 to 1.00. The cows were trimmed by a local trimmer. Claw lesions were diagnosed by the same veterinarian, who was blind to the MS. In total, 375 cows were analysed, the number of MS 0, 1, 2 and 3 were; 16, 151, 164 and 44. The primary lesions were categorised in five; No Claw Lesions (no lesion, digital dermatitis M4, 126 cows); Minor Claw Lesions (sole bruise, cork screw, thin sole, overgrowth, stone, 84 cows); Major Claw Lesions (ulcer, necrosis, white line, 87 cows); Major Skin Lesions (digital dermatitis, foul-in-the-foot, 66 cows) and Major Other Lesions (upper leg, shackles, 12 cows). No Claw Lesion was defined as non-lame. A maximum ALP during 2 weeks prior to trimming >0.50 was defined as lame. Figure 1 shows a cow with sole ulcer and MS=3. Compared to Claw Diagnosis, ALP and MS were equally precise (81%), ALP was more specific (82 vs 69%), but less sensitive (40 vs 68%) than MS. ALP was more sensitive (43 vs 40%) when compared with MS than with Claw Diagnosis, explained by the ALP being trained on MS. The ALP shows great potential for screening cows for treatment and for objectively benchmarking lameness levels between herds.

Fig. 1: Automated Lameness Probabilities of a cow two weeks prior to diagnosis.
Managing Cow and Calf Together Incubator Group

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A group of 19 scientist representing Croatia, Denmark, Estonia, Germany, Ireland, the Netherlands, Norway and Sweden met at Stockholm Arlanda Airport for a lunch to lunch workshop on calf management with and without access to the dam. The participants covered a wide range of scientific disciplines from mathematical modelling and epidemiology to ethology and physiology. The discussions included the status of ongoing projects and funding efforts as well as possible joint actions in the future. One research possibility that was put forward during the meeting was to gather existing data from studies and field records where details of housing of dairy calves is known, and that also includes information that can be used as indicators of robustness and longevity. We hope to be able to access several sets of such data and complete at least preliminary analyses before the closure of DairyCare. The main part of the discussions revolved around a large mindmap over possible effects of, and interesting aspects on, the possibility of calves being cared for by cows; either their own dam or foster cows. Time was shared between joint discussions and outbreaks in smaller groups. One of the most important contributions was made by Kerstin Barth, who shared very interesting unpublished data that also will be presented at the DairyCare meeting in Thessaloniki. We also managed to have a Skype meeting with Marina von Keyserlingk in Canada. The main outputs from the workshop were the previously-mentioned data project, the mapping factors that are relevant to study (this will be useful to all of us whenever there is a research possibility), getting to know each other better and that agreement on some basic terminology in this field. We will use “CowCalfCaring” to include management systems where calves are cared for by cows. These systems can include a varying degree of nutrition provided by the cows and be either “free contact” or have some kind of restriction, in time or regarding the possibility for calves to suckle the cows. The term bonding was discussed a lot and it was agreed to define bonding as a process, even if it often is used differently. The group is planning to issue a publication on proposed terminology and encourage all to be very clear when the type of contact is described, in research or field data. The format for the workshop worked very well and it was appreciated to be able to spend so much time on focused scientific discussions. We all want to thank DairyCare for the financial support.

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Cow-calf contact systems for dairy: status of the literature
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The public is largely unaware that cow-calf separation at birth is a routine practice in the dairy industry. However, a series of studies undertaken over the last few years indicates that when made aware, there is little public support for this practice. This lack of public and consumer acceptance may undermine the social sustainability of the dairy industry. Unfortunately, there is a dearth of research to guide decisions regarding postnatal management. We conclude that there is a breadth of work required to fully understand the fundamental costs and benefits of immediate vs. delayed cow-calf separation and that there is great need to develop practical systems for delayed separation. Moreover, the little work available must be viewed with caution given the tremendous challenges associated with interpreting the literature. Currently, behavioural research on early separation has focused predominantly on calves. Studies suggest immediate separation reduces certain acute distress responses (e.g. vocalizations), while allowing suckling from the dam over the first weeks of life can reduce non-nutritive sucking. Conflicting results regarding pre-weaning calf performance may result from differences in breed and management. Although early separation is often recommended to reduce health risks to calves, their morbidity and mortality rates remain high; research is needed to determine whether any increased risk outweighs potential immunosuppressive effects of this practice. In cows, meanwhile, research has often focused on health in early lactation, mainly driven by the observed high incidence rates of post-partum disease. A few studies indicate that disease risks in this vulnerable period might be reduced if dams were able to nurse their calves. The literature suggests multiple alternative systems including allowing restricted suckling, housing calves with access to their dams and another milk supply, or using nurse cows. Many questions remain regarding the relative effectiveness and economic sustainability of these options, and how best to reduce distress at separation. Literature from other species and the limited evidence from cattle predicts that such systems may have long-term benefits for calves’ learning, social and exploratory behaviour, and for the health and affective states of both cows and their offspring. These predictions merit investigation in dairy systems.
The Evaluation of Commingled Calves and Dams versus Separated Calves and Dams on Behavior, Physiology, and Production

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The public views early separation of cow-calf pairs negatively. The objective was to evaluate the effects of early separation versus commingling dams and calves at d 5 on milk production, behavior, and calf physiology. Cow-calf pairs (N = 20) were separated within 6 h of calving and randomly assigned to either: group housing on pasture nightly (20:00 to 6:00) and group housing plus dams on pasture nightly, starting at d 5 postpartum. Calves were fed 4 L of 26% crude protein, 20% fat BOV SC Clarifly Medicated Dairy Herd & Beef Calf Milk Replacer (Ag Central Co Op, Madisonville, TN) through d 4 and 6 L from d 5 to d 19. Dams were housed on sand bedded freestalls (6:00 to 19:30) and separated daily, with half remaining indoors and half mixed with their calves (20:00 to 6:00) from d 5 to d 19 postpartum. IceTags (IceRobotics, Edinburgh, Scotland) and HOBO data loggers (Onset, Bourne, MA) were attached to dams and calves, respectively, at d 5 postpartum. Milk production was recorded automatically twice daily. Milk components, SCC (TN DHIA Lab), quarter teat end swabs, and calf body weight were collected weekly. The MIXED procedure (SAS 9.4, Cary, NC) was used to evaluate the effect of treatment and sex on milk production and components and calf lying and standing time. T-tests were conducted to evaluate the effect of treatment on average daily gain (ADG) and quarter teat end swabs. Milk production was greater among dams housed indoors 24 h/d than dams housed nightly with calves, respectively (28.9 ± 1.9 vs 23.8 ± 1.7 kg, P < 0.05). Milk fat, protein, quarter teat end swabs, and SCS did not differ between dam treatment groups. Calves housed without dams spent 2 h/d more standing than calves housed with dams (490.9 ± 28.1 vs 370.1 ± 34.1 min/d, P < 0.01). Calf ADG did not differ between treatment groups. Housing cows with calves did not negatively impact ADG or milk components. Commingling dams and calves at night may provide an alternative method to address negative public perception of early separation.

Effects of suckling on milk yield and milk composition in dam rearing systems

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There is an increasing interest in dairy farming systems that allow a prolonged contact between cow and calf beyond colostrum period. Although various dam rearing systems can be found in dairy practice, the knowledge about the effect of these systems on the cows’ performance is limited. In collaboration with universities, we conducted some experiments at our research farm that was designed especially to study calf rearing by suckling. Based on four studies done between 2007 and 2014, the milk recording data of 135 cows with permanent, two times daily, nightly or no contact to their own calf were analysed using linear mixed models. Suckling as such had always an effect on the tested variables (Tab.1). All variants of calf contact affected the recorded milk yield before and after weaning but to different extent. On average the milk yield during the suckling period of 95 days was 13.6 kg per cow and day lower than in the control cows without calf contact. However, the restriction of the contact on the time between evening and morning milking caused an additional milk yield of 2.0 kg per cow and day. This surplus of that treatment persisted over the whole lactation. As expected, the milk fat content was lower during the suckling period while the milk protein content was higher compared to the control cows. Somatic cell count was also affected but only during the suckling period. Compared to the control cows, suckling cows showed marginal higher somatic cell counts; the estimated difference for the re-transformed data was 12 cells per ml. Thus, no relevant effect of cow contact in combination with machine milking on udder health could be revealed.

Tab. 1: Effects of tested variables on performance and milk quality (F-values and significance level given)

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<th>Protein [%]</th>
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</thead>
<tbody>
<tr>
<td>Breed</td>
<td>16.47***</td>
<td>83.75***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity status</td>
<td>133.65***</td>
<td>17.03***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIM</td>
<td>1595.65***</td>
<td>32.15***</td>
<td>721.51***</td>
<td>72.40***</td>
</tr>
<tr>
<td>Treatment</td>
<td>25.97***</td>
<td>9.14***</td>
<td>721.51***</td>
<td>72.40***</td>
</tr>
<tr>
<td>Calf contact</td>
<td>1223.01***</td>
<td>177.34***</td>
<td>23.52***</td>
<td>7.81**</td>
</tr>
</tbody>
</table>

***p<0.001  **p<0.01
Using an automated milk feeder during the suckling period will reduce stress behaviour at separation
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When dairy calves are reared with their mothers, they usually are separated much earlier than the natural age. Separation will usually cause a strong stress response with loud vocalizations, and is a major challenge in suckling systems for dairy cattle. This study investigated whether the integration of an automated milk feeder in the calf creep would alleviate stress at separation by making calves more nutritionally independent of their dams. 30 cow calf pairs were kept together at night but the calves were locked up in the calf creep during the day. 10 calves were prevented from suckling due to an udder net covering the teats and got all the milk (12 L/d) from the feeder. 10 calves suckled the dam (daytime) but were denied access to the milk feeder. 10 calves had access to both the dam (night) and the milk feeder (day and night). After 6 weeks the calves were moved to an adjacent pen but cow and calf still had fence line contact. The milk feeder was now open to all calves, but no training to use it was given and very few of the suckling-only calves started to use it. After another 4 days, the cows were moved to another barn, and the calves were weaned off milk. Calves’ responses were recorded by live observations for 7 days following separation, and calls were classified as high pitched (open mouth) or low pitched (closed mouth). After separation, the non-suckler calves produced significantly (p=0.001) less high pitched calls than the other groups. Calves using the automated feeder vocalized less than those not using it, which in practice were weaned at the time of separation. The number of high pitched vocalizations were strongly negatively correlated to daily milk intake (p<0.001). Calves using the milk feeder spent more time playing (p=0.047). Results show that in cow-calf rearing systems, disentangling weaning and loss of the dam in time, can improve calf welfare.


Feeding behavior of dairy calves reared by the dam with access to automatic milk feeders
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Although dam rearing can have beneficial effects on both dairy cow and calf, the separation and weaning period may prove to be challenging. Providing supplementary milk using automated milk feeders (AMF) can support dam-reared calves during this period. Milk feeder data from a previous study in Canada was analyzed to characterize the feeding behavior in dairy calves with and without access to suckling. Data from 20 cow-calf pairs were analyzed. In the first 6 weeks during the day, all calves were housed in a calf creep next to the cow pen, allowing visual and auditory contact with the dam. During the night, all calves had access to the adjacent cow pen. Ten calves could suckle the dam (AMF + dam treatment), while the other 10 calves could not (AMF treatment) because of udder nets attached to the dams. All calves had 24h/d access to 12L of milk from the AMF. After 6 weeks, the calves were moved to the nearby separation pen. The separation period was divided into 2 phases: partial separation from day 43 to 46 (i.e. audiovisual contact with dam still possible, without suckling) and total separation from day 47 to 50 (i.e. no more contact with dam). All calves continued to have access to the AMF 24h/d during this period. Behaviors were also recorded during these phases. At day 51, the calves were gradually weaned with a reduced milk allowance of 1.5L per day. Throughout the study, the calves’ body weight did not differ between the two groups (interaction age x treatment: P = 0.78). We found no correlation between the number of AMF visits and the number of vocalizations in either treatment group (r = 0.14; P = 0.20 vs r = 0.04; P = 0.72).
Towards a validation protocol for sensor information in dairy herd management
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A growing variety of sensor-based technologies are finding their way into modern cow barns, claiming to be helpful in dairy herd management. Although developed with the best of intentions, many technologies fail to fulfil the promises for some reasons. Those reasons range from technical breakdowns, short battery life, hardware failure over user-unfriendly interfaces to missing integration with other technologies. A protocol for testing devices on a range of performance indicators that jointly describe quality and reliability would be very helpful for users of the technology. In this study, we focus on the description of the quality and reliability of a Body Condition Score (BCS) camera, in order to establish a validation protocol. Data were obtained from 3D overhead camera system from DeLaval. As an animal passes under the camera, it collects an image and analyzes it using the company’s proprietary algorithms to assign a score on the traditional 5-point BCS scale to 0.1 point increments. We investigated the performance of BCS Cameras on performance indicators such as sensor drift, variability in BCS within and between measurement days and handling of missing observations, outliers, randomness and trend. Several errors were detected in the BCS camera data. These errors were illustrated not only in the instrumental side but also in the BCS profile at the cow level. Time series model was used to develop forecasts with instrumental errors before and after correction. Forecasting model showed the importance of instrumental error correction in describing and predicting the correct profile of BCS at cow level.

Figure 1. BCS average over calendar time, showing intrumental errors: outliers, randomness, baseline, missing period.
Assessing ovulation time in dairy cows: experiences from estrus detection validation studies
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Detection of estrus and ovulation in dairy cows is essential to obtain a high insemination success rate and to optimize the calving interval. To identify the best moment of insemination, several detection systems, relying on different measurement principles, are commercially available. For an objective and thorough validation of these systems, different aspects should be considered including sensitivity, specificity and the optimal insemination moment within an estrous period. The latter mainly depends on the ovulation time, which may be influenced by different cow-specific factors such as energy and health status, hormone functioning and so on. Therefore, the accuracy of heat detection systems should also be evaluated in terms of their ability to predict the ovulation time. To answer these needs, different reference methods have been proposed, using (1) progesterone dynamics; (2) established gestation; (3) ultrasonography and (4) detection of the preovulatory LH surge. As the progesterone level is low within a period of 5 to 10 days around ovulation, it does not provide a small window for ovulation time. Moreover, a determined link between luteolysis and ovulation is not yet found. Using established gestation is a very insensitive method because successful conception does not guarantee gestation. Moreover, taking the viability of sperm and egg cells into account, it does not provide the desired time window. Monitoring the disappearance of the preovulatory follicle by ultrasonography requires high-frequent rectal scanning combined with synchronization of the ovaries or visual heat detection. Moreover, when manipulating the ovaries, there might be a chance to affect the preovulatory follicle. The last option to monitor the preovulatory LH surge requires high-frequent blood sampling. Because the analysis, in which a clear peak is monitored, is post-hoc, it has the advantage of objectivity and different people can perform the sampling. We conducted two trials in which either ultrasonography or LH monitoring was used to assess the ovulation time and evaluate the performance of 4 heat detection systems based on activity, visual observations and progesterone. This presentation will elaborate on our experiences learned from both trials in terms of approach, accuracy and (dis)advantages in relation to the state of the art.
The immense metabolic demand of high yielding cows requires to dispose of by panting, sweating and vasodilatation (large amount of metabolic heat). Inability to do so causes heat stress that results animal suffering and deteriorates production and reproduction. In many arid and semi-arid zones, fans and water sprinklers are used in barn, in cooling yards and/or in the feeding lane to help the cows to get rid of excessive heat. It is common to activate the cooling management by surrounding temperature-humidity index (THI) measurements and not by real time body temperature measurements of the cow that might be different (due to production level, body condition, gynecologic status, herd genetic variance) in response to heat stress etc. Real-time temperature can now be measured using reticulorumen bolus (SmaXtec). In the current study, we developed a model that calibrate the cow temperature from the reticulorumen to the vaginal temperature loggers - the vaginal temperature was our gold standard. A total of 30 lactating cows were randomly assigned to one of two treatment groups (evenly by lactation, energy corrected milk-ECM and days in milking), fed the same TMR: Treatment 1, which is the common cooling methods used in farms (time based cooling), was compare to sensor based cooling regime - treatment 2. The sensor based cooling group showed higher milk fat (3.65 vs 3.43%), milk protein (3.23 vs 3.13%), ECM (42.84 vs 41.48), FCM 4% (fat corrected milk; 42.76 vs 41.34) and lower body temperatures (38.6°C). As seen in figure 1. The preferred cooling regime, after carrying out a series of tests on cooling time and duration along the trial, result with a stabilize animal reaction. The sensor base cooling found to be an effective tool to detect and ease heat stress in intensive dairy cows in arid and semi-arid zones.

Figure 1. Green line-THI, Red line-39°C threshold on body temperature, blue line-time base cooling (Treatment 1), black line-sensor base cooling (Treatment 2). Blue and black squares mark for time and duration of the cooling groups (blue for time and black for sensor)
Bayesian estimation of genetic parameters highly associated with health traits in cattle
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The aim of this study was to estimate the heritability and genetic correlations for traits associated with dairy cattle health, including claw parameters, claw disorders and metabolic status. It is very well accepted that those traits are important especially in dairy cattle both, from economical and animals’ welfare point of view. The dataset consisted of 299 Holstein cows kept in two farms in west part of Slovakia, with a total of 382 functional trimming records. The records were collected after functional trimming in period from 2015 to 2017. Claw parameters as claw angle, claw length, heel depth, claw height, claw diagonal and width including total claw area and functional claw area were measured by use of computer digital images analysis with software NIS Elements 3.0. Average milk production was 10050 kg (3.85%fat and 3.12% protein). In the dataset, 38.91% of evaluated cows showed presence of interdigital dermatitis and heel erosion (IDHE) or digital dermatitis (DD), presence of the sole ulcers (SU) were registered as well. With use of animal model, based on observed claw measures, was estimated heritability of claw angle by 0.1, claw length by 0.2, claw height by 0.03 and claw diagonal by 0.02, confirming genetic background of analysed traits. Further analysis using advances of Bayesian methods were used to estimate the inheritance of claw disorder presence. Estimated heritability of IDHE was 0.012, DD 0.041 and SU 0.033. To better understand join influence of conformation traits as well as claw disorder traits, multi trait model was established to estimate genetic correlations within them. To connect prevalence of claw disorders with metabolic status of cows F/P ration was further considered. The study confirmed previous assumption that F/P ratio is inherited as well as original traits used in calculation (fat and protein content). Heritability of F/P ratio estimated using Bayesian single trait approach was 0.59 making it highly considerable for the further use in selection of metabolically resistant animals. Based on obtained results, construction of new selection indices, better responding to today’s welfare requests and use of new generation indicators made possible.
Within the past 20 years, digital technologies have become an increasingly relevant tool within agriculture. Low cost sensors, enabled with wireless communications, allows for rapid and widespread deployment of measurement systems that provide support for farm operations. Much of the focus has been the development of independent systems, however there exists significant potential to combine information from multiple sensor modalities to obtain greater insight on animal welfare. 172 milking cattle were equipped with neck mounted activity collars (Silent Herdsman), which provide oestrus detection as well as eating, rumination, and inactivity time budgets. This information was integrated with four quarter conductivity and milking visit variation from robotic milking units (Fullwood Merlin2). These measurands have been shown individually to relate to animal welfare events such as oestrus, lameness, and/or illness. We present here a study on whether a combination of the above measurands would facilitate early detection of mastitis, enabling automatic intervention (for example increased milking frequency) before clinical signs being visible to a skilled farm operative. 32 cases of mastitis were detected over a 9 month period from March 2017 to December 2017. Each of these cases was correlated with data from the robot milker for a period of one month before and after the observed mastitis event. The data was analysed to assess how far in advance of skilled operatives could each measure and detect the instance of mastitis. By combining measurands, it was possible to detect 75% of cases in advance of the herdsmen. Furthermore, in 72% of the cases, changes to eating and rumination alerted a welfare issue before changes in milk conductivity. This evaluation provides validation that combining currently separate on-farm systems and sensors can provide earlier detection of mastitis than skilled herdsmen.
Rumination Detection in Dairy Cattle Using Acceleration Based Bolus Sensors
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Behavioural changes in dairy cows are strongly correlated to health issues which has led to the development of a variety of sensors and analysis techniques to monitor these variations. Bolus sensors located in the reticulum of the cow’s digestive system are used to monitor pH and temperature, whilst accelerometer based sensors for monitoring eating and other activity have generally been confined to external collars or leg tags. New bolus sensors are now available with accelerometers included with the intention of behaviour such as eating and rumination from within the digestive system. This paper presents a method of classifying the behaviour of a dairy cow through the analysis of bolus-based accelerometers. The animals used in the trial were 6 Holstein dairy cows that had been fitted with a cannula to the reticulum. The cannula allowed the inspection of the contents of the rumen for other research purposes and the recovery of the bolus sensors form the reticulum. The management and monitoring of the animals throughout the trial was conducted by qualified veterinarian staff, including the oral insertion and retrieval of the sensors. A total period of 9 weeks monitoring was used during which challenge events in the form of dietary changes were introduced for 2 one week long periods where an increase in starch or sugar content aimed to disrupt the rumination behaviour of the animals. It was found through analysis of the inter-contraction-interval (ICI) and the derived activity measure of the animal, it was possible to generate 2 states of behaviour. One of the states was found to correspond to typical rumination behaviour whilst the other classed all other behaviour as one. Further work will aim to refine this classification method to accommodate other changes in the animals’ dietary intake.
"ProDairyWelfare" – proactive productivity and health management in Dairy Farming
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In the presentation, the H2020 Project “ProDairyWelfare” by smaXtec will be presented. The dairy industry has been changing significantly over the last decades. Cost pressure has been leading to farming intensification and consolidation, resulting in an increase in cow sickness and fertility, shorter lifetime of high-yield animals and lower per cow productivity. Other factors such as the increase in milk demand and the increase in regulations have also been influencing the work of dairy farmers in Europe. smaXtec developed a globally unique inside sensor-based monitoring solution for continuous management of heat, calving, health status and feeding of dairy cows. The objective of the project “ProDairyWelfare”, funded via EU H2020 SME Instrument, is to further develop a decision-making tool for dairy farmers based on intensive field research which enables farmers to produce milk both in a cost-effective and sustainable manner. The benefits of using this tool will be increased animal welfare and cow’s lifetime as well as the reduction of medication, especially antibiotics. European farmers will be able to satisfy the increasing demand in milk while working in a resource-saving and environment-friendly way thanks to optimised processes and feeding on the farm. Transparency plays a key role for consumers and all companies who are part of the food production chain. Milk production should be clearly traceable to ensure that the best quality is produced. A clear indication of origin and observation of methods of processing are indispensable to guarantee that high quality is given. With a sensor providing all relevant data over the cow’s lifetime transparency will be reinforced.

Evaluation of Cow Feed Mass by Photogrammetry
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Monitoring the individual cow feed intake is critical for detecting the inefficient and efficient cows, and then improving the cow genotype. A feed mass weighing system, which is a common method in research, requires multiple costly scales, making it inappropriate for commercial farms. However, feed mass can be estimated by its volume, which is measured by a small number of sensors, such as LIDAR or cameras with a light projector. In this research, the feed volume was achieved by the photogrammetry method. The method requires cameras along the feed-lane, photographing the feed before and after the cow visits the feed-lane, and calculating the feed volume. The installation of the cameras does not change existing infrastructure and routines of the cowshed, such as feed distribution and cleaning of the feed remnants. This study tested the precision evaluating feed mass by its volume. The following principal factors were examined in order to analyze the sensitivity and precision of this evaluation method: camera quality, lighting conditions, image resolution, number of images, and feed density. To design a commercializable feed measuring system, a designer has to find an optimal trade-off between these factors: minimal camera cost, worst lighting conditions, minimal image number and maximal feed density diversity. Based on the analysis of conducted experiments, the following camera type and installation method were chosen: a high-quality camera in the laboratory experiment; and medium quality cameras, installed above the feeding lane, for the experiment in a cowshed. Under laboratory conditions, the mass evaluation error was 0.293 kg, while in the cowshed, using the aforementioned cameras and simple installation system, the precision was 3.06 kg. A separate experiment was conducted to examine the effect of the feed compressibility.
Using recycled manure solids as a bedding material in a freestall dairy barn
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Interest in using recycled manure solids (RMS) as a bedding material for dairy cattle is increasing. RMS could provide farmers more economical and renewable option for bedding. Research on the effects of RMS on animal health and welfare is still sparse, and most of the available information is from deep-bedded systems. Thus we wanted to study use of RMS-bedding in freestall dairy barn with mattresses. In this study, we followed two groups of 24 lactating dairy cows during cross-over study of two three-month periods; first the other group with RMS-bedding and the second group with peat-bedding and then vice versa for the next three months. Both RMS and peat were spread in stalls three times a week, minimum of 10 l/stall/day, on average 500 liters at a time. Manure was separated on the same day with screw separator (sievers 0.5 mm). Dry matter content (DM) of RMS was analyzed weekly. Every second week animals were scored for cleanliness (hind legs/hind quarter/udder) and milk somatic cell count (SCC) was analyzed. Bacteriological milk samples were taken, if the SCC exceeded 400 000 cells/ml. Generalized estimating equations were used to model the effect of bedding, group and period on cleanliness, and a linear mixed model for the effect of bedding, group, period, parity and milk yield on SCC. DM of RMS was low, on average 24.6±2.0% (±SD), compared to recommended 35%. There were 1.51 higher odds (p<0.05) for udder to be clean when RMS was used compared to peat-bedding. In hind legs (p<0.01) and hind quarter (p<0.05) period only affected cleanliness significantly. Bedding material did not affect SCC, but with higher parity (p<0.0001) and lower milk yield (p<0.001) SCC was higher. The group also affected SCC (p<0.05). The most prevalent bacteriological finding with both bedding materials was coagulase-negative Staphylococcus. Environmental mastitis occurred four times, with RMS-bedding only. Connection between these infections and RMS cannot be ruled out. However, considering cleanliness and SCC, RMS did not adversely affect the health and welfare of dairy cows. Still, proper management of hygiene is vital for minimizing the potential risks associated with RMS-bedding.

Cattle and Sheep Welfare during Transport: What are the Good and the Best Practices to improve this?
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The COUNCIL REGULATION (EC) No 1/2005 applies to anyone transporting live vertebrate animals in connection with an economic activity and set up rules intended to improve the welfare of animals (with specific provisions for dairy species) during transport. The Regulation has had beneficial impact on the welfare of animals during transport. However, it appears that there is a knowledge gap between the legislation and its practical implementation. Scientific evidence can address this gap and support the development and adoption of guides to good practices (EC, 2011). The aim of this paper is to present the ‘Cattle Transport Guide’ and the ‘Sheep Transport Guide’ developed within the ‘Animal Transport Guides’ project, funded by DG SANTE of the European Commission (http://animaltransportguides.eu/). The project’s ambition is to facilitate understanding and practical implementation of Regulation on the transport of animals. It will help transporters to further protect dairy animals from being subject to stressors arising from catching or handling, food and water deprivation, exposure to thermal challenges, loud noises or other. The Guide is structured in five Chapters according to different phases of the journey: (1) Competence, (2) Preparation and Planning, (3) Handling and Loading Animals, (4) Travelling and (5) Unloading Animals. Numerous ‘good practices’ are included in the Guides defined as procedures and processes that support compliance with requirements of legislation designed to protect the animals’ welfare. Moreover, a collection of ‘best practices’ are included, defined as providing methods of improvement of procedures and operations to exceed any legally defined minimum welfare requirement. The Animal Transport Guides are currently being translated in several European languages and it is widely disseminated among stakeholders through Road Shows, Seminars, etc. to support the animal transport industry in complying with welfare standards during poultry transport.
Incubator Group Report: Development of Sensor Technologies for Small Ruminants
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Hotel Tryp Palma Bellver was the venue for a very successful meeting of the Small Ruminant Sensors Incubator Group. Sixteen delegates from Spain, Italy, France, Turkey, Israel, UK and Sweden participated in presentations, discussions and planning of future activities and STSMs. Numerous disciplines were represented, including animal science, genetics/genomics, electrical engineering, computing science, veterinary medicine and physiology. The meeting started with presentations on previous research involving small ruminants, using either cattle sensor devices or specialist technologies intended for research use. Since these approaches are not likely to be applicable in commercially managed small ruminants, new research to develop better devices was then presented. A number of approaches were discussed, including specialist weigh stations for monitoring growth and water consumption of sheep or goats (from Israel), a miniaturized rumen bolus device for temperature (from Spain) and an ear-tag sensor for various health-related measurements (from Italy). The first day concluded with lively discussion over dinner, and a promise to reconvene early the next day for the brainstorming session. The flipchart was soon in use, and much scribbling was done as ideas were put forward, discussed and either rejected or progressed. Small ruminants are different to cattle. They share some of the same problems, in some cases (rumen acidosis in goats, for instance) perhaps to a greater extent, and may benefit from the same basic technological approaches. Their sheer size makes issues such as battery life more difficult, and there is no doubt that applicable technologies currently lag behind. The absence of commercially available technologies for small ruminants may be a cloud with a silver lining, since it provides an opportunity to plan strategically, considering options such as a service-provider approach to wellbeing sensing rather than direct sales of individual sensors. The Workshop concluded with the recognition that significant opportunities existed and networking should continue and be expanded to ensure successful development of appropriate technologies. In this regard, it is gratifying to note that various delegates were actively involved in other related EU projects including 4D4F, EraNet SUSAN EcoLamb and IoF2020 (Internet of Food and Farm).

Current and future prospects for using individual animal data interpretation to optimize dairy goat farm management
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Dairy goat production systems are currently experiencing an intensification process consisting in farm size increase, electronic identification, reproductive intensification, genetic selection and milking automation. This new situation generates “big data” susceptible of being used as a strategy for optimizing farm management. Cabrandalucía has developed a new concept of farming base on the use of “Eskardillo”, a platform with a smart-phone terminal which relies on three principles: i) systematic individual data recording (milking control, genetic merit, morphology, phylogeny), ii) big data processing and interpretation and iii) interactive feedback to the farmer. This study evaluated the effectiveness of this platform by monitoring the productive parameters over 4 consecutive years in 12 control (CTL) and 12 Murciano-Granadina dairy goat farms before and after the Eskardillo implementation (ESK). Results demonstrated that Eskardillo allowed optimizing the selection of animals for breeding, replacement or culling based on individual productivity data. As a result, goats from ESK farms decreased their unproductive periods such as the first partum age and the dry period length, and accelerated the milk yield increase (+26 kg/year) in comparison to the situation before (+7.2%) or in CTL farms (+5.6%). This intensification did not negatively affect animal health and wellbeing in terms of longevity (5.0 years), functional longevity (3.7 lactations) and exiting rate (23.5%) across farms. However, a moderate increase in milk SSC was noted in ESK farms (+0.11 logs) without clinical mastitis possibly as a result of shorter dry period length or longer lactations. In conclusion, it was demonstrated that Eskardillo platform can be considered a useful strategy to optimize farm management and to contribute to the sustainable intensification of modern dairy goat farms. A further development of this platform could integrate indicators of animal health and welfare and technical-economical parameters.
Embedding Sensor Technologies as Part of a Holistic Farming Concept
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Combining advanced sensor technologies, Artificial Intelligence, Ethereum blockchain protocol and smart contracts, we are building a trusted, community-driven ecosystem of trusted regional organic brands to assure the origin, quality, and safety of artisan, organic products as well as optimize animal welfare and nature preservation.

Automatic identification of very thin dairy goats using image technology.
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Body condition score (BCS) of dairy goats is traditionally achieved by palpation of the lumbar and sternal fat deposits. To accomplish a reliable value with this method training is needed as is restraining of the animal. The AWIN project validated a scale for BCS by using some rump measures to identify very thin or very fat goats. This score is now used in the protocol for welfare assessment recently published. Further investigation, in cooperation with teams from the Technology Faculty of our university, developed a set of descriptors for rump’s 3D surfaces, collected by an RGB-D camera. In this way automatic identification on farm of the extreme scores may be possible. A Heat Based Rump Descriptor (HBRD), using diffusion geometry concepts to address the difficulty in defining the region of interest and to handle the large variability in rump shapes, was conceived. HBRD uses heat diffusion to represent distances between points in two equivalent surfaces. The volume is assessed by having the surfaces differ only on the characteristic that we want to measure. The application of the descriptor shows that temperature in thinner animals converges faster to that of a planar rump. The preliminary results show that this method allows for correctly clustering very thin goats. So it seems possible to use a camera over the milking parlour corridor to identify goats with a low BCS that may be chronically ill or malnourished. Further investigation will also try to identify obese goats as these are more prone to diseases such as pregnancy toxaemia.
Temperature rumen bolus able to record intake and drinking behavior for dairy small ruminants
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Active rumen boluses suitable for dairy sheep and goats (BIOSENS; external diameter, 22 mm; length, 80 mm; weight, 50 g) were developed in the frame of the DairyCare Incubator Grants for small ruminants based on the prototypes previously produced and tested in dairy sheep (Oliver et al., 2016, DairyCare 4th Annual Conference, Lisbon). The rumen boluses contained an internal temperature sensing device, connected to an external programmable receiver by high radiofrequency (HRF) ranging from 433.4 MHz. The core of the bolus was an ATMEL microprocessor configured for low power operation and powered with a small cylindrical Li battery (3.3 V, 2.1 Ah, 2/3AA) which proved to be operative at the mid-term (6 to 10 mo) logged to a temperature sensor collecting data every 2 s. The radiofrequency signal was able to be transmitted from inside the rumen to a small designed transceiver located at more than 5 m or placed in a collar of the sheep. A total of 100 boluses were produced and administered to dairy sheep in different stages of lactation. Current signals recorded showed rumen changes according to feed intake and drinking behavior and are being related to the type and amount of feed and water daily eaten as shown in Figure 1. Rumen temperature ranged between 34 and 40°C and averaged 38.49 ± 0.43°C, the peaks corresponding to feeding and drinking episodes.

Figure 1

Acknowledgement: SWIG DairyCare (Cost Action FA-1308) and Ministerio de Economía y Competitividad, Spain, Project BIOSENS (AGL2013-44061-R).
POSTERS
The role of Staphylococcus aureus virulence factors in the infection of bovine mammary epithelial cells

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One of the main bacteria associated with bovine mastitis is Staphylococcus (S.) aureus. Mastitis is a constant problem in the dairy industry. The infection has a significant negative impact on the welfare of the animal and causes financial losses for the farmers and the dairy industry. It still remains unclear why some strains have the ability to cause infection and others do not. We have studied the in vitro infection of bovine mammary epithelial, BME-UV, cells and especially the impact of enterotoxin C and TSST-1. Initially, differences were demonstrated between S. aureus wild type strains, isolated from the milk of cows with mastitis, in their ability to infect BME-UV cells. The infection capability was investigated by lysing the BME-UV cells at different time points after infection and calculating the S. aureus colony forming units recovered from the lysate. Analysis of cellular proteomic data demonstrated an altered proteomic profile of cells infected with S. aureus compared to non-infected. Processes affected were e.g. necrosis, cell death and organismal death, which all were down-regulated in BME-UV cells exposed to S. aureus. This might indicate a bacterial process to keep the host cell alive during the initial phase of infection. Further, five different S. aureus sec or tst-1 deletion mutants, derived from three wild type strains of bovine S. aureus, were constructed, verified, and characterized. These mutant and wild type strains were then used in infection experiments with BME-UV cells. Deletion of the sec gene from one of the wild type strains showed a reduction in infection ratio of up to 630-fold, suggesting that the presence of SEC may play a role during the establishment of the infection. In contrast, only a 5.5-fold lower infection ratio was found in the tst-1 deletion mutant compared to the isogenic wild type strain. Furthermore, preliminary results show considerably fewer up- and down-regulated proteins in the BME-UV cells when infected with the mutant strains, compared to the isogenic wild types. The reduced infection ratios and altered protein profiles suggest that both SEC and TSST-1 may play a role in the S. aureus infection process in bovine mastitis.

S. aureus inhibit necrosis, cell death and organismal death in BME-UV cells, as demonstrated by infection with two different bovine isolates of S. aureus, Mas 146 and Mas 106, exposure time 30 min. followed by 5 h incubation.
P2
The effect of heat stress on some metabolic parameters and prevalence of metabolic disorders in lactating cows - a retrospective study
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Negative energy balance resulting from decreased dry matter intake coupled with the energy demands of maintaining physiological body temperature and milk production makes heat stressed cows more prone to metabolic disorders. Circulating insulin concentrations increase in heat stress conditions that limit the rate of fatty acid utilization and increase glucose disposal. Meeting nutritional needs in heat stress can thus be a challenge in dairy herds. We have compared data collected during regular herd health monitoring visits in large scale dairy herds in the past 3 years to study how heat induced changes are reflected in the metabolic profiles of cows. Data on metabolic parameters have been collected from thermoneutral (Mar-Apr, 925 cows, 30 farms) and hot weather conditions (Jun-Aug, 667 cows, 21 farms). Comparisons were made between animals similar in stage of lactation (production groups of DIM 1-5, DIM 6-40 and DIM >40, respectively). Plasma free fatty acid (FFA) concentrations were lower in summer by an average of 39% in the DIM 6-40 group (p<0.05). Heat stress abatement is particularly important in the periparturient period. The tendency of reduced lipolysis and increased glucose utilization could be confirmed, however, clinical relevance of the observed differences are questionable. The research was supported by the projects No. EFOP-3.6.2-16-2017-00012 and BO/29/16/4.

P3
The differences in teat-end hyperkeratosis between Holstein and Jersey dairy cows
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Healthy teat skin enable easier cleaning, minimises milking preparation, and finally minimises the risk of new mastitis infections. The changes in teat tissue, particularly in the skin of the teat-end (hyperkeratosis; TEH) increases the risk of new mastitis infections. Quick detection and removal of the cause of the poor teat condition can contribute to reduction of the somatic cell counts and incidence of the mastitis. The objective of this study was to compare teat-end condition score of Holstein (HB) and Jersey (JB) cows, which were housed in the same farm conditions and milking management. The cows were divided in three groups depending of the lactation number: cows in first, second and third and higher lactation. The statistical analyses were performed in SAS/STAT (ANOVA, Fisher LSD test). Very good score of the TEH in interval between 70 to 88% were determined in both breeds. Furthermore, JB cows had better score for the front teats, but worse for the rear teats comparing to HB cows. Regarding the order of lactation, a significant (p<0.05) difference was found between breeds. The TEH of the front teats in JB cows in third lactation were significantly (p<0.05) lower comparing to the same lactation group of HB cows. Regarding the rear teats of the observed cows, significantly (p<0.05) higher hyperkeratosis score was found in Jersey cows in first lactation comparing to Holstein cows in same lactation. The somatic cell count was found to be higher in JB comparing to the HB cows, but not significantly. The obtained results indicate that breed influence on the level of the teat tissue condition. These results could be due to possibly unadjusted milking machines for JB cows, since these two breeds are quite different in body measures.
Key words: teat-end hyperkeratosis, dairy cows, Holstein, Jersey
Comparison of biochemical markers in early lactated dairy cows kept in two different housing systems

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Neuro-endocrinology changes that occur during transition period in high yielding dairy cows are very important, due to maintaining of homeothermic condition after parturition and milk production. Parturition is a stress period that can affect the welfare of dairy cows. Multifactorial etiology of subclinical production diseases has direct effect of intensity of clinical manifestation. Environmental condition, temperature, diet, zootechnical and many other factors can emphasised or alleviate clinical and subclinical manifestation of the most common disease in dairy herds. Great changes in energy and mineral metabolism appeared in the first three weeks after parturition. For that purposes serum samples were examine from two different dairy farms with similar diet and during the same period of the year. Dairy cows from the first farm (n=30) was kept in tie stall system and dairy cows form the second farm (n=30) was kept in free stall system. Blood samples were taken from v. jugularis, approximately three weeks after parturition. Biochemical markers were analyzed by standard colorimetric methods according to manufacture instruction, such as markers represents for energy status (glucose, NEFA, BHBA, triglycerides, cholesterol), protein status (urea, albumins and total proteins), and represents of mineral status (calcium, phosphorus, sodium, potassium, magnesium, chlorides). Statistical comparison of biochemical markers revealed statistical significant difference (p<0.05) in some energy and protein biochemical markers i.e. markedly decreased glucose, NEFA and BHBA and increased serum urea in the tie stall system. These differences can be explained by higher incidence of subclinical production diseases and possible disturbance of animal welfare in the tie stall system. Similar situation was observed in mineral metabolism, by significant decrease in calcium, phosphorus and magnesium and significant increase of chlorides in tie stall system, as a result of hormonal disturbances and most common production disease. According to these findings we conclude that subclinical production diseases have high prevalence in dairy herds kept in tie stall system with possible consequential effect on their welfare.

Metabolic status of dairy cows grouped by their anabolic and catabolic indicators of metabolic stress (insulin, insulin like growth factor-I and non-esterified fatty acids) in early lactation


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Early lactation is characterised by steeply increasing milk production resulting in negative nutrient and energy balance, causing significant metabolic stress. Aim of this study was to examine differences in metabolic adaptation by measuring different metabolic parameters and BCS of HF cows in early lactation in relation to anabolic (insulin, IGF-I) and catabolic (NEFA) parameters. Cows (N = 50), 3 to 5 days after calving, were divided in metabolic stress group (indicators of anabolism > median (Me-): indicators of catabolism > median (Me+)) and control cows (indicators of anabolism > median (Me+): indicators of catabolism < median (Me-)) and observed for 4 weeks. Criteria for comparison of cows were based on one indicator of metabolic load (insulin Me-: insulin Me+: IGF-I Me- : IGF-I Me+ and NEFA Me- : NEFA Me+ ) or two indicators (insulin Me- + NEFA Me+: insulin Me+ + NEFA Me- and IGF-I Me-+ NEFA Me- : IGF-I Me+ + NEFA Me+). Metabolic stress group had higher values of STH, BHB (criteria were insulin, IGF-I, NEFA, insulin + NEFA, IGF-I + NEFA), higher values of bilirubin, AST, GGT, AP (criteria NEFA and IGF-I + NEFA) and MDA (criteria NEFA) while BCS differed most in later weeks. NEFA + IGF-I indicators in the first week after calving allows the most robust classification of cows (ROC AUC = 0.87 and 0.76). Metabolic parameters in cows from the metabolic stress group classified only by NEFA showed higher distance from overall mean value of parameter then cows classified by criteria insulin, IGF-I, insulin + NEFA, IGF-I + NEFA. In addition, high catabolic load of adipose tissue will contribute to metabolic variation and adaptation in the first four weeks of lactation much more than decrease of anabolic factor such as insulin and IGF-I. This information is important for understanding and identification cows that are most at need for intervention.

Key words: metabolism, cow, anabolism, catabolism, NEFA, IGF-1
Omics reveals a leaky gastrointestinal tract and hormone regulation impairment in heat-stressed dairy goat
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With the aim of completing a previous study on whole blood transcriptomics of heat stressed dairy goats (Contreras-Jodar et al., 2016; EAAP Annual Meeting, Belfast, UK, p. 126), urine biomarkers were investigated by 1H nuclear magnetic resonance spectroscopy (1H-NMR Bruker Avance-III; 600.13 MHz; 298°K) in samples collected after 19-d thermo-neutral (TN) or heat stressed (HS) lactating does. Multivariate data analyses included principal component and PLS–discriminant analyses with cross validation to identify HS biomarkers. Urine metabolites were identified using the Human Metabolome Data Base (www.hmdb.ca/). PLS–discriminant analyses revealed 2 separated clusters (i.e., TN and HS). Discriminative metabolites included phenylalanine (Phe) metabolic compounds (i.e., OH-phenylacetic acid, OH-phenylacetylglycine, phenylglyoxylic acid and hippurate), which increased in HS does (P = 0.001 to 0.0001). Their greater excretion in urine, together with the previously observed up-regulation of nucleotide catabolism and lower rumen pH (Castro-Costa et al., 2015) suggest that HS resulted in acidosis leading to microbiota overgrowth and a leaky stage in the digestive tract. Phe compounds generated by harmful microbiota are toxic, absorbed mostly in the blood and excreted in urine. Concurrently, the HGD (homogentisate di-hydrogenase) gene is strongly down-regulated, decreasing the ability of HS goats to synthesize tyrosine (Tyr) from its precursor Phe. As a consequence, HS reduced the synthesis of thyroid hormones and L-DOPA for thermal regulation purposes. As a side effect of the L-DOPA fall, a rise in plasma prolactin (PRL) is expected to stimulate the secretion of HSP to protect cells from hyperthermia (Stocco et al., 2011). Although plasma PRL increased, a down-regulation of PRL signaling pathways in the mammary gland was also expected, as reported by Alamer (2011). Therefore, the HS impairment of milk production may be a consequence of the reduced availability of Phe for milk protein and of the decreased synthesis of L-DOPA and thyroid hormones. In conclusion, HS caused significant changes in the urine metabolome of dairy goats. These changes were related to a leaky gastrointestinal tract, reduced synthesis of neurotransmitters and impairment of the hormonal regulation of metabolism. Acknowledgements: Project AGL2013-44061-R (MINECO, Spain).

Factors influencing the calf viability at birth
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The study was carried out in order to assess the effect of some factors on calf viability. The database consisted of 111 calvings of the Romanian Spotted cows during year 2017, out of which 118 calves were obtained: 82 viable calves, 29 calves with reduced viability and 7 calves were dead at birth. A normal log model was employed to assess the effects of some categorical factors and continuous predictors on the calf viability. The categorical factors were season of birth (summer or winter), sex of the calf (male or female), type of birth (single or twin), calving ease (eutocic or dystocic) and parity of the dam (1, 2, 3 or 4). The continuous predictors were calf body weight at birth, dam body weight, dam rump length, dam rump width at hips and at pins. Lower body weight of calf at birth was associated with higher viability (P<0.05). Type of birth was significantly associated with calf viability at birth (P<0.05).
Bedding and bedding management have great impact on cow comfort and udder health and are directly related to animal welfare. A comfortable stall bed encourages resting, minimizes injury and fatigue. In Croatia major bedding material is straw. The goal of the research was to evaluate blood metabolic profile and milk quality of lactating cows, kept on straw deep litter with different bedding slopes: horizontal bedding and slope bedding (25°). Blood samples were collected from coccygeal vein to Li-heparin tubes, centrifuged and plasma analysed on clinical chemistry analyser Beckman Coulter AU400 (Beckman Coulter, USA). Data on milk quality was collected through regular milk quality testing and milk sampling took place on the same day as blood collection. Data were processed by STATISTICA 10 (StatSoft, Inc., USA) using linear model to assess the fixed effect of bedding, phase of lactation and parity. We found significantly (P<0.05) higher albumin and triglycerides concentration in plasma of cows kept on horizontal bedding compared to the cows kept on slope bedding. Concentration of Ca and Mg was also higher (P<0.01) in cows kept on horizontal bedding. Milk urea was significantly (P<0.05) higher in milk of cows kept on horizontal bedding. Milk urea reflects protein availability, which is in correlation with higher albumin concentration in blood of cows kept on horizontal bedding. On both bedding types, BSS were above recommended limits for high quality milk, which reflects problems with organic bedding materials and associated higher mastitis rate. Glucose concentration and mineral concentration of P and Mg were significantly lower (P<0.05) in early lactation cows (<90 DIM) compared to the cows with more than 90 days in lactation. Cows in early lactation due to the higher milk production have higher need for nutrients and mineral components and therefore concentration of these in plasma is lower. Although metabolic rate is higher in early lactation, we found significantly lower AST and ALP activity in plasma of cows in early lactation (P<0.05). Milk protein and non-fat dry matter were significantly (P<0.05) higher in milk of cows kept on horizontal bedding. Total protein and globulin concentration were significantly (P<0.05) higher in multiparous cows compared to the primiparous. The higher (P<0.05) ALP activity determined in primiparous cows can be associated with increased osteoblastic activity in younger still growing cows. Similar thing goes for the P concentration, which is higher in younger animals due to the higher intestinal phosphate absorption under influence of growth hormone. Cows kept on both bedding types had their blood metabolic values within reference intervals but BSS was above recommended limits.

Dairy ewes adapt to the proportion of concentrate in the diet (30 to 60%) without effects on their milk performances from early-lactation
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Seventy-two dairy ewes (Manchega, MN, n = 36, 70.0 ± 1.3 kg BW; Lacaune, LC, n = 36, 71.5 ± 1.7 kg BW), after the suckling of their lambs (30 d), were used to study the effects of the forage:concentrate ratio (F:C, %) during lactation. Ewes were sheltered in group pens (n = 6) by breed, fed a TMR ad libitum and machine milked twice-daily. Experimental design was a factorial 2×3, lasting 8 wk. Treatments were the F:C ratio resulting of adding concentrate (0, 0.5 or 1 kg/d, as fed) to a basal diet (1.8 Mcal NEL and 15.9 % CP, DM basis): high forage (HF, 70:30), medium concentrate (MC, 55:45) and high concentrate (HC, 40:60). Ewes were fed the HF diet for 4 wk and the experimental diets thereafter (wk 5 to 8). Milk recording was done at each milking and milk sampled on wk 3 and 7 for composition (NIR system). No differences in total DM intake were detected by diet, but forage intake decreased 28 and 37% with HC diet, in LC and MN ewes, respectively (P 0.05). In conclusion, the use of high concentrate diets had not effect on milk yield and milk composition, producing remarkable BW gains during lactation, without modifying the behavior of the ewes. On dairy sheep feeding practice, the final decision on the amount of concentrate to be used will be dependent on the feedstuffs prices and the previous BCS of the ewes.
Relationship between some animal-based measures collected at herd-level and the exposure of dairy cows to poor management and housing conditions

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Nowadays, public awareness of farm animal welfare (AW) issues is increasing and several countries have implemented different on-farm welfare assessment systems to better tackle them. To foster continuous monitoring, the use of some routinely collected animal-based measures (ABMs) as “iceberg indicators” of overall AW could represent a good tool to early identify at-risk herds and focus further controls on them.

For investigating this hypothesis, the results from 1516 dairy cow welfare assessments (years 2014-2017) were selected from the Italian Animal Welfare Reference Centre (CreNBA) database. It includes the outputs from the application of the CreNBA protocol1 used at national level for on-farm controls. The frequencies of four herd-level ABMs, categorized in three levels (see Table1 for details), were compared with the scores gained by the farms in terms of management and housing conditions. Herds with poorer scenarios (scores ≤60.00%) showed more often, in a statistically significant way, worse levels of ABMs (Table1), suggesting that cows found it hard to adapt to such conditions. Then, the number of herds with the worst category of each ABM was tested, using 2x2 contingency tables, against their exposure to each managerial and housing hazard (n=52) measured in the protocol. Some of the strongest associations were seen for i) lameness >8% and poor feeding (OR=2.42; 95% CI=1.40-4.18; P=0.0015), lack of foot trimmings (OR=1.74; 95% CI=1.18-2.56; P=0.0051), slippery floors for lactating-cows (OR=2.47; 95% CI=1.43-4.27; P=0.0012), long waiting-time in the holding area (OR=1.76; 95% CI=1.12-2.76; P=0.014); ii) BTSCC >400,000 cells/ml and poor hygienic conditions in lactating-cow lying area (OR=3.22; 95% CI=1.10-9.47; P=0.033), poor calving-pen management (OR=2.91; 95% CI=1.44-5.87; P=0.0029), poor milking hygiene (OR=4.01; 95% CI=1.36-11.87; P=0.012), overstocking in lactating-cows (OR=2.70; 95% CI=1.26-5.78; P=0.011), overstocking in calving pen (OR=2.45; 95% CI=1.04-5.77; P=0.040); iii) No of mastitis antibiotic treatments >80% and overstocking in lactating-cows (OR=1.84; 95% CI=1.08-3.14; P=0.026), overstocking in dry-cows (OR=1.98; 95% CI=1.16-3.39; P=0.012), long waiting-time in the holding area (OR=2.09; 95% CI=1.12-3.90; P=0.020).

These preliminary results suggested that some ABMs routinely monitored could be indicators of herds at risk of poor welfare; however further analyses should be performed.


Table 1 - Frequencies of the four herd-level animal-based measures (ABMs), categorized in three levels, compared with the exposure to poor management and housing conditions (score ≤60.00% according to the Italian Animal Welfare Reference Centre protocol for dairy cows). Results from 1516 Italian dairy herds visited in the period 2014-2017 (average No lactating cows 119; range 4-1,300 – average production 27.9 kg/A per cow; range 5-42 kg/d/cow).

<table>
<thead>
<tr>
<th>Environmental scenario</th>
<th>% Herds with poor management practices (score ≤60.00%)</th>
<th>% Herds with good management practices (score &gt;60.00%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lameness &gt; 8%</td>
<td>35.05%</td>
<td>10.17%</td>
<td>0.072</td>
</tr>
<tr>
<td>Lameness 8-4%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>Lameness 4-0%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>Abm &gt; 5%</td>
<td>35.05%</td>
<td>10.17%</td>
<td>0.072</td>
</tr>
<tr>
<td>Abm 5-3%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>Abm &lt; 3%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>BTSCC &gt; 400,000 cells/ml</td>
<td>35.05%</td>
<td>10.17%</td>
<td>0.072</td>
</tr>
<tr>
<td>BTSCC 300,000</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>BTSCC &lt; 300,000</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>No mastitis antibiotic treatments &gt; 80%</td>
<td>35.05%</td>
<td>10.17%</td>
<td>0.072</td>
</tr>
<tr>
<td>No mastitis antibiotic treatments 50-80%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
<tr>
<td>No mastitis antibiotic treatments 0-50%</td>
<td>50.00%</td>
<td>50.00%</td>
<td>1.000</td>
</tr>
</tbody>
</table>

1JAR = annual calving rate of adult cows
2Acromion score defined with the ordinal scale (BTSCC)
3Number of antibiotic treatments for clinical mastitis in a year on the total number of milking cows
In the last decades we have witnessed increasingly pronounced climate change worldwide resulting in environment transformation in various regions by making it not convenient for agricultural and livestock production. FAO experts stated that with purpose to avoid dangerous climate change, global GHG emissions have to be significantly decreased worldwide. The global livestock sector contributes to anthropogenic GHG emission, but at the other hand, it can also deliver a significant share of the necessary mitigation effort. It is estimated that total GHG emissions from livestock supply chains represents 14.5% of all anthropogenic emissions. Regarding the species, cattle are the main contributor to the sector’s emissions with about 65% (about 30% comes from milk production). The main source of GHG emissions in ruminants is enteric fermentation and feed production. Furthermore, grazing system, comparing to the mixed one, produce more GHG. Also, in ruminant production systems, there is a strong negative relationship between productivity and emission intensity. One of the most significant greenhouse gas, highly correlated with global warming (1g CH₄ heats the atmosphere 21 times more than 1 g CO₂) is methane. Furthermore, about 44% of all greenhouses gases from livestock sector is methane. Cattle sector, with a daily methane production per animal in the amount 250-500 L, in the next 50 to 100 years will contribute to the global warming for 8% - 10%. Methods for the methane emissions reduction in cattle can be classified as short, medium and long term. Short-term methods implies increase in productivity per animal and consequently reduction in the number animals. Furthermore, increase of cows’ feeding efficiency and optimization of feeding management can result in a significant reduction in methane emissions. Long term methods implies genetic evaluation and selection of dairy cattle for methane emission. The first step in genetic evaluation is selection of optimal method for estimation of methane emission in dairy cattle based on Animal Recoding data. Therefore, the aims of this study is to evaluate various methods for estimation of methane emission in dairy cattle as well as to select optimal estimation method from the point of accuracy and simplicity for routine use.

Disbudding in ruminants represents a widely accepted welfare concern, given that animals experience high levels of pain. Dehorning in calves in Europe is being performed in most farms that practice loose-housing, with estimates of over 80% when conventional dairy farming is concerned. However, under organic production systems, practices such as disbudding are regarded as undesirable given that the integrity of the animal is impaired. Up-to-date, the use of genetically polled cattle strains is being limited due to the lower number of polled bulls available for artificial insemination and reluctance of farmers to use bulls that have generally lower estimated breeding values. Aim of the current pilot research was to evaluate the effects of horns on production and reproduction efficiency in dual-purpose Fleckvieh cows. The study was carried out at the Research and Development Station for Bovine Arad (46°10ʹ36ʺN 21°18ʹ4ʺE) Romania, where 100 purebred multiparous Fleckvieh cows, managed under identical conditions, in a loose system with zero grazing were included in the research herd. Cows were either horned (n=50) or polled as a result of disbudding during first month of age (n=50), and kept mixed. Body weight was on average 629.6±4.80 kg and 601.8±3.06 kg in horned and polled cows, respectively (p≤0.01). Factors related to reproduction efficiency, such as the number of inseminations per gestation and the calving interval were not influenced by the phenotype (p>0.05). Milk yield was significantly influenced (p≤0.001) by the phenotype, with horned cows producing on average 5890.5±99.1 kg compared to 5591.6±49.0 kg the polled group. The number of steps taken per 24 hours was not influenced by the presence of horns (p>0.05), with horned animals taking 6114±20.7 steps/day, compared to 6485±33.3 steps for the polled animals. Current partial results suggest that horned animals achieve greater body weights and higher milk yields, compared to polled animals when kept under identical feeding and management conditions. This might be attributed to the social hierarchy established within the herd, with polled animals being less dominant and having restricted access to resources such as feed and resting areas.
Previous studies have shown that an elevated milk feeding intensity during the first weeks of life plays an important role for growth and development in preweaning calves. Furthermore, butyric acid (BA) is known to stimulate intestinal maturation and health. We have tested the hypothesis that intensive milk replacer (MR) feeding together with BA supplementation affects feeding behaviour in calves before weaning. Holstein calves (n=64; half male and half female) were studied from birth until wk 11 of life. All calves received 2.5 kg of first colostrum from their dams, respectively. Subsequent feeding with transition milk from their dams was supplied ad libitum (Adlib; max. 25 L/d, n=32) or in restricted amounts (Res; 6 L/d, n=32) until d 4. Afterwards, Adlib and Res groups were subdivided (n = 16/group) to MR feeding at 12.5 % dry matter with or without 0.24 % butyrate, resulting in 4 treatment groups. Gradually weaning took place from wk 9 to 10 of age, whereas 2 L/d of MR were offered until the end of trial. MR was provided by an automatic feeding system and calves had free access to water, hay and concentrate. Data for unrewarded visits and sucking rate were provided by the automatic milk feeding system. Data were analysed by the Mixed procedure of SAS with milk feeding intensity and BA as main effects. Intensive MR feeding resulted in a higher milk and MR intake (P < 0.001), higher MR intake per meal (P < 0.001), a slower sucking rate (P < 0.001) and a higher body weight gain (P < 0.001), but in a lower number of unrewarded visits at the automatic milk feeder (P < 0.001) and lower concentrate intake (P < 0.001) when compared to restrictive MR feeding. BA supplement reduced sucking rate (P < 0.001) but increased MR intake per meal (P < 0.05). Intensive milk feeding reduced the number of unrewarded visits and sucking rate, which may also lead to less detrimental feeding behaviour in ad libitum MR-fed calves.
A preliminary study on antibiotic usage in Italian dairy herds: the DDDAit method
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It has been estimated that in the European Union the 50% of all antimicrobials, consumed annually, are used in livestock animals1. Even if the transmission of antimicrobial resistance from animals to humans is not fully explored, it is recognized that an unreasonable antimicrobial usage (AMU) in food producing animals relates to the selection of resistant bacteria or genes2. Promotion of antibiotic correct use can thus preserve the efficacy of molecules that are “critically important” for human medicine.

In 2017, Italy was confirmed as the third country in Europe with the highest veterinary antimicrobial consumption based on wholesale data3. Currently, there is no an internationally accepted standard to quantify and report veterinary AMU in Europe, but the use of the Defined Daily Dose method4 is given high priority also in veterinary medicine. Since there are still no data about AMU in Italian dairy farms, based on DDD metrics, the aim of this preliminary study was to quantify AMU in 20 Italian herds. Farm records of antibiotic treatments used during 2016 (whole year) were collected and analysed. Animal category, treatment indication and administration route were also registered. The AMU index, expressed as number of days per cow per year, was calculated using Defined Daily Dose Animal for Italy (DDDAit), based on Italian summaries of product characteristics. Considering the studied farms, mean AMU for adult cows was 11.18 days/year (range 3.47-21.17). In adult cows, antibiotics were mostly used for udder problems (40.67%), dry cow therapy (33.66%), locomotion problems (14.24%) and urogenital diseases (6.81%). Intramammary (51.51%) and injectable routes (46.42%) were the most common routes of administration. Most used antimicrobials in adult cows are reported in Figure 1. A significant correlation was found between AMU for adult cows and herd size (Pearson’s r: 0.48; P-value=0.03). Despite the few sampled herds, the preliminary results confirmed the primary role of udder problems and dry cow therapy in boosting antibiotic consumption in dairy farms.

References

Figure 1. Most used antimicrobial active ingredients in adult dairy cows.
Exosomes are small vesicles with a diameter varying between 40 and 100 nm, produced by the endocytic system. Recent interest in exosomes is attributed to their role in the spread of pathogenic organisms, as well as their role in promoting and regulating the immune response. The objective of this work was raise new approaches related to the exosomes in cattle diseases, their formation, function and their relevance for the use of new diagnostic and therapeutic techniques, and during the parasite-host interaction in cattle diseases. The analyzes revealed that exosomes have been attributed to different biological functions, among them are the influence on the immune system, transfer of receptors from one cell to another, as well as the delivery of specific mRNAs and miRNAs. Exosomes also facilitate the transport and dissemination of pathogens. Its analysis has been described in diagnostic and therapeutic approaches. The isolation of miRNAs from easily and non-invasively obtained serum exosomes with subsequent characterization of the miRNA expression patterns is promising for the development of future biomarkers of the diagnosis and prognosis of various in cattle diseases. Based on the currently available data, exosomes seem to reflect the diverse functional and dysfunctional states of the releasing cells and tissues along the complete individual pathogenetic pathways underlying metabolic diseases. A critical step in further validation of exosomes as biomarkers will rely on the identification of unequivocal correlations between critical disease states and specific exosomes signatures, which in future may be determined in rapid and convenient fashion using nanoparticle-driven biosensors.

Figure 1. (A) Interaction network among proteins identified in the after exosomes extraction in blood of cows. The stronger associations are represented by thicker lines. (B) In red are the proteins that participated in the complement system and blood exosomes coagulation cascade, one of the signaling pathways of the immune system. The protein network was analyzed using STRING software.
P16
Potential of domestic equine for milk production in Croatia
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The aim of this paper was to show the potential of domestic equine population in Croatia for production of milk of mares and donkeys. In Croatia, in year 2016, total of 25,655 equine animals were registered. 11% (2,862) of all equine were donkeys. Coldblooded breeds of horses were the most numerous among horses population in Croatia with 55% (12,520), while warm-blooded breeds represents 40% (9,183), and finally ponies 5% (1,072) of total horses population. In the last decade, the number of warm-blooded horses under selection increased for 44% (6,033 individuals), cold-blooded horses for 43% (5,229 individuals) and donkeys for 42% (1,766 individuals). From the total horses’ population in year 2016, 7,087 animals were breeding mares (54% cold-blooded and 46% warm-blooded horses). Furthermore, in year 2016, 30.5% of the total number of equine population in Croatia could be introduced to milk production. Potential for milk production depends on species (mares or donkeys), and genetic potential of breed (cold or warm blooded). In accordance to the literature, warm-blooded mares in 8 months of lactation could produce between 1500-2500 kg of milk, while cold-blooded breeds have 13% higher potential for milk production. In accordance to the literature, donkeys could produce 1000-2400 kg of milk during lactation. Considering the number of animals that could be introduced to milk production and production potential of equine animals, production of 11,116,700 kg of mares’ milk and 747,000 kg of donkeys’ milk could be projected. Highest amount in total equine milk production is expected from coldblooded mares (65%).

The economic income from production of donkeys’ milk could be 40,000 euros per lactation. Furthermore, the economic income from milking of coldblooded mares could amount 48,000 euros per lactation (and 200 euros per foal). Lower income from milk production of warm-blooded mares would be compensated by higher prices of foals. Based on this analysis it could be concluded that production of mares and donkeys milk could have significant effect on economic feasibility of equine breeding in Croatia. Key words: equine breeding, mare’s milk, donkey’s milk, Croatia

P17
Evaluating SNPs in BoLA-DRB3 gene for association with lameness in the Romanian cattle breeds
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Lameness is a significant health problem influencing welfare, behaviour and efficiency of dairy farms. This disease is mainly attributed to environmental effects, including management and housing. However, several studies have shown correlations between genetics and lameness with different degrees of heritable susceptibility. Moreover, the different BoLA-DRB3 alleles have been reported in previous studies as being associated with lameness susceptibility in dairy cattle breeds. To date, there are no cattle single nucleotide polymorphisms (SNPs) documented in candidate genes involved in genetic resistance to lameness in the Romanian cattle breeds. The major goal of our study was to evaluate the association of 27 SNPs in BoLA-DRB3 gene with lameness in 298 individuals from Romanian Spotted (n = 250) and Romanian Brown (n = 48) cattle breeds using Kompetitive Allele Specific PCR (KASP™) assay. The study was carried out on one large cattle herd in the western part of Romania (46°10′36″N 21°18′4″E) where animals are managed under identical conditions. The lameness prevalence ranged on average from 2.89±0.82 to 4.76±3.32% in Romanian Spotted and Romanian Brown, respectively (p > 0.05). A large number of SNPs (n = 24) were not polymorphic in the studied individuals. Polymorphic SNPs was detected in rs42309897 (BoLA-DRB3 g.25472281G>A), rs208816121 (BoLA-DRB3 g.25475692C>T) and rs110124025 (BoLA-DRB3 g.25476219A>G) loci with call rate >87% and MAF >10%. All three SNPs are located in exon regions. The results showed that rs42309897 and rs110124025 were significantly associated with lameness prevalence in the Romanian Spotted (p ≤ 0.001) and Romanian Brown (p ≤ 0.05), respectively. However, when both breeds collectively were analysed a statistical significance of the effect of polymorphisms on lameness prevalence was only found for rs42309897 (p ≤ 0.05). The results from this study are relevant for future cattle genomic studies and suggesting that rs42309897 locus could be considered in marker assisted selection as a candidate gene for lameness susceptibility.
P18

Cows’ monitoring scheme in Croatia using milk recording data
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Milk recording scheme according to ICAR rules (The International Committee for Animal Recording) provides wide range dairy information of cows. This information is very useful in dairy breeding and management ensuring constant monitoring of animal care, which is reflected in the establishment of appropriate production and breeding systems. The optimal feeding, health and reproductive status of cows contributes to its natural behaviour. Determination of feeding status through the milk content (milk fat and protein or their ratio, urea) allows for the establishment of a rational feeding system based on the real cows’ needs. This reduces the frequency of metabolic disease (ketosis or acidosis), achieves a desirable body condition, and allows a more successful transition period before and after calving. Positive effects could be a reduction of the calving problems due to the good cow body condition related good feeding system, and better breeding healthy and vital calves. Somatic cells count is important to determine the health status, which is the main indicator of mastitis, most commonly the disease of dairy cows. Urea level also could be a parameter in determining health status since high milk urea level increased liver activity due to of elimination of excess urea. Therefore the liver load is growing and unnecessary energy consumption. It should not be ignored negative urea impact on the environment. Protein content helps in determining the reproductive status and is an indicator of the readiness cow for insemination. A good way is laboratory milk pregnancy test, as a method of early detection pregnant or non-pregnant cows. Milk recording scheme in Croatia includes around 90,000 cows and the data are used in described way.

Keywords: milk recording data, dairy cows, nutrition status, health status, reproductive status

P19

Effects of Spirulina spp. supplementation to dairy cows’ ration on animal heat stress
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Heat stress (HS) in dairy cows is directly related with reduced dry matter intake (-56% DMI), decreased milk yield (-38%) and differentiation in behavioral traits, while severely suppressing farm profits (-417.3€/cow/year). In Greece, where cows are exposed to HS-inducing weather conditions for 5 months annually, the above mentioned consequences have been recently confirmed (significantly lower milk yield and DMI). Previous research indicated diverse feeding practices and management adjustments in order to minimize the effects of HS. Spirulina is a microalgae, rich in proteins (≈70% Dry Matter), vitamins and polyunsaturated fatty acids. The aim of this study was to investigate the effect of spirulina powder, when incorporated into total mixed rations, on the alleviation of the consequences induced by HS on productivity, milk fatty acid profile and parameters determining animal welfare and behavior. Two experiments (one during winter and one during summer) were carried out at a typical Greek Holstein dairy farm. Measurements included milk composition and fatty acid profile, hematological profile, albumin, urea, cortisol and oxidative stress levels. Body condition score was evaluated, rumination, breathing rate and behavior were monitored. Results clarified whether spirulina powder can serve as a nutritive tool to minimize the adverse effects that HS has on dairy cows, whilst supporting their health, productivity and welfare, as well as the economic profitability of farms. This research project was funded under the Action ‘Research & Technology Development Innovation Projects’-AgroETAK, MIS 453350, in the framework of the Operational Program ‘Human Resources Development’. It was co-funded by the European Social Fund through the National Strategic Reference Framework (Research Funding Program 2007-2013) coordinated by the Hellenic Agricultural Organization – DEMETER.
**P20**

**The effect of body condition during pregnancy on the cow’s colostrum quality**

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Over-conditioning during pregnancy is usually consequence of overfeeding or prolonged dry period. A fat cows are more susceptible to metabolic problems after calving. Due to negative impact on fetus development, newborns that originate from obese dams are usually less vital. Colostrum is only food for newborns, during first days of life, and its quality is essential for calf’s survival. Therefore, we have examined colostrum quality of cows with significantly different body condition scores during pregnancy. Twenty Holstein-Friesian cows were divided into 2 equal groups based on their body condition score (BCS) as non-obese (3.25 ≤ BCS ≤ 3.5) and obese (4.0 ≤ BCS ≤ 4.25). Our results showed that colostrum quality in obese cows was poor compared to non-obese cows. Concentrations of protein, fat, IgG, IGF-I and most macrominerals and trace elements were significantly lower in obese cow’s colostrum indicating that the health of calves from obese cows is not compromised only by poor vitality at birth but also due to feeding of lower quality colostrum.

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**P21**

**How many ketotic cows are unable to be diagnosed for ketosis using a glucometer?**

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The dataset of 1 817 205 records representing milk samples collected in Poland within the period from 1-04-2013 to 31-03-2015 was elaborated in this study. The milk samples were collected within milk recording provided by Polish Federation of Cattle Breeders and Dairy Farmers (PFCBDF). There were 553 592 and 1 263 613 records from cows being within 6-21 and 22-60 days in milk (DIM), respectively. The data on milk composition included milk acetone (ACE) and β-hydroxybutyrate (BHB) contents determined in 4 PFCBDF laboratories, using FTIR technology (MilkoScan FT6000). We considered cows as ketotic when milk ACE was ≥ 0.15 mmol/L or milk BHB ≥ than 0.10 mmol/L (de Roos et al., 2007). The aim of our study was to calculate how many cows in our dataset have elevated milk ACE content over the threshold 0.15 mmol/L but not milk BHB over the threshold of 0.10 mmol/L (ACE ≥ 0.15 mmol/L and BHB < 0.10 mmol/L). Such cows could not have been diagnosed as ketotic when using glucometer since so called ketone bodies determined in the blood by this device represent only blood BHB concentration. The results presented in table show that using above criterion more than 33% of milk samples originated from “probable” ketotic cows (40% within 6-21 DIM). However, about 6.7% of them were ketotic due to elevated milk ACE, but not milk BHB content. Within 6-21 DIM about 10% of “probable” ketotic cows may not be diagnosed using glucometer.

<table>
<thead>
<tr>
<th>Items</th>
<th>DIM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 - 60</td>
</tr>
<tr>
<td>N milk samples</td>
<td>1 817 205</td>
</tr>
<tr>
<td>N milk samples with ACE ≥ 0.15 mmol/L or BHB ≥ 0.10 mmol/L¹</td>
<td>602 603</td>
</tr>
<tr>
<td>% total</td>
<td>33.2</td>
</tr>
<tr>
<td>N cows with ACE ≥ 0.15 mmol/L and BHB &lt; 0.10 mmol/L</td>
<td>40 110</td>
</tr>
<tr>
<td>% total</td>
<td>2.21</td>
</tr>
<tr>
<td>% ketotic</td>
<td>6.66</td>
</tr>
</tbody>
</table>

¹ considered as ketotic
The aim of the present research was to examine the usability of welfare quality criteria that were accepted by EU countries, in Turkey’s dairy farm level. Some of the welfare quality criteria were introduced in Ataturk University’s Dairy Farm in Erzurum, Turkey. The herd consisted of three kinds of breeds (Holstein, Brown Swiss, and Simmental) and the cattle were examined in terms of welfare level, illness, injury, stereotype behaviors and physiological differences related to stress. Farm management programmes and welfare criteria of the animals were defined by scoring method. Body condition score was significantly differed within breeds (P In conclusion, animal welfare level in Ataturk University dairy farm unit was scored as 70.92 and this level was thought to be very close to those EU standards.

Heifers represent the future of a dairy cow herd, but farmers’ attention is usually focused on the producing animals rather than on the young stock. However, management and housing of heifers could have an important impact on the expected milk production and quality as well as on herd health. The goal of the present study was to verify and analyse the differences between farmers’ practices towards lactating cows (LC) and towards heifers (HF). During the two-year period 2016-2017, 854 Italian dairy farms (range: 5-1,300 lactating cows and 1-910 heifers) were visited by trained assessors to collect data about rearing routines of LC and HF. The management-, resource- and animal-based measures listed in Table 1 were recorded in each herd for both LC and HF groups. The obtained data were analysed using odds ratios with 95% confidence intervals. “To be HF” or “not to be HF (i.e. to be LC)” was the exposure variable, while on-farm measure answers were the outcomes. Results are reported in Table 1. Frequencies of poor hygiene and inadequate type of bedding material were found to be higher in HF group than in LC group. Also cleanliness of floor in the walking area and space availability in the lying area were found to be insufficient more frequently in the HF group than in the LC group. Considering the animal-based measures, HF were found to be more difficult to approach and dirtier than LC. On the other hand, LC group suffered for an inadequate number of feeding places and of water points and was found to have integument alterations with higher frequency than HF group. Cleanliness and inadequate lying area were the two main problems of HF group. This lack of attention could cause problems, such as mastitis, in freshly calved heifers with important welfare and economic consequences.

**Table 1. Management, resource and animal-based measures recorded for lactating cow and heifer groups in the analysed farms and odds ratio results.**

<table>
<thead>
<tr>
<th>Measure category</th>
<th>Type of measure</th>
<th>Answer option</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management-based measures</td>
<td>Cleanliness of the water points</td>
<td>Dirty/Clean</td>
<td>1.37 (0.91-2.04)</td>
</tr>
<tr>
<td></td>
<td>Cleanliness of floor in the walking area</td>
<td>Dirty/Clean</td>
<td>1.33 (0.94-1.70)</td>
</tr>
<tr>
<td></td>
<td>Cleanliness of bedding materials</td>
<td>Dirty/Clean</td>
<td>6.51 (4.24-10.01)</td>
</tr>
<tr>
<td>Resource-based measures</td>
<td>Space availability in the lying area (m per cow)</td>
<td>Insufficient/Sufficient</td>
<td>1.34 (1.05-1.71)</td>
</tr>
<tr>
<td></td>
<td>Type of bedding material</td>
<td>Inadequate/Adequate</td>
<td>6.77 (4.12-11.11)</td>
</tr>
<tr>
<td></td>
<td>Type of floor in the walking area</td>
<td>Inadequate/Adequate</td>
<td>1.13 (0.66-1.86)</td>
</tr>
<tr>
<td></td>
<td>Available space at feed bunk</td>
<td>Inadequate/Sufficient</td>
<td>0.56 (0.37-0.83)</td>
</tr>
<tr>
<td></td>
<td>Functioning and number of water points</td>
<td>Inadequate/Adequate</td>
<td>0.60 (0.50-0.70)</td>
</tr>
<tr>
<td>Animal-based measures</td>
<td>Avoidance distance test</td>
<td>No approach/approach</td>
<td>3.56 (1.62-7.91)</td>
</tr>
<tr>
<td></td>
<td>Body condition score</td>
<td>Lean/or fat</td>
<td>0.66 (0.35-1.17)</td>
</tr>
<tr>
<td></td>
<td>Cleanliness (flank, upper, lower, leg, udder)</td>
<td>Dirty/Clean</td>
<td>1.61 (1.32-1.96)</td>
</tr>
<tr>
<td></td>
<td>Integument alterations</td>
<td>&gt;30%&lt;30%</td>
<td>0.22 (0.14-0.37)</td>
</tr>
</tbody>
</table>

(1) Sample size according to Welfare Quality® assessment protocol for cattle (2009)

*p-value < 0.05

**p-value < 0.01
Evaluation of a calving time detection technology that monitors tail movement in dairy cattle
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Predicting calving time allows the farmer to be present during calving and to monitor cases of dystocia, or difficulty calving in dairy cattle. Dystocia, when not assisted, has the potential to increase calf mortality, decrease milk yield, lower conception rate, and increase uterine disorders. The objective of this study was to evaluate the ability of a precision technology (Moocall, Dublin, Ireland) to detect and alert the onset of calving. Accuracy of the calving device was evaluated by comparing the alert times to the actual time of calving. The calving detection device was attached to the tail 4 ± 3 days (mean ± SD) before expected calving date, and video was recorded for behavior analysis. Monitoring tail behavior was analyzed into three categories: an hour before the hour of the first alert (baseline period), the hour before the first alert (alert one data) and the hour before the second alert (alert two data). Using PROC TTEST (SAS Institute Inc., Cary, NC) a lower one-sided (H0=150) analysis for significance was performed. The average time interval between the first alert and calving was 107 ± 10 minutes (mean ± SEM, P=0.01) and the average time interval of the second alert and calving was 71 ± 10 minutes (P<0.01). Video was evaluated for the frequency and duration of tail lifts during the control period, hour of the first alert, and the hour of the second alert. Mean frequencies were 3.37, 7.95, and 8.47, respectively. Mean durations of tail lifts were 55, 124, and 134 seconds, respectively. The calving detection device has the potential to alert farmers around two hours before calving. The farmer being present during birth creates the potential to reduce dystocia problems, deliver colostrum in a timely matter, and overall be a positive economical investment to the farm.

Effects of heat stress on the lactational performances of Lacaune dairy ewes at late lactation
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With the aim of assessing the effects of heat stress on lactating dairy ewes, 8 multiparous Lacaune ewes at late-lactation (2.31 ± 0.04 L/d; 165 ± 4 DIM, 75.5 ± 3.2 kg BW) were used. Ewes were in individual pens and submitted to thermoneutral (TN; 15 to 20°C, 50 ± 5% humidity, THI = 59 to 65) and heat stress (HS; 35°C from 0900 to 2100 and 28°C from 2100 to 0900, 45 ± 5% humidity, THI = 75 to 83) conditions according to a crossover experimental design (2 x 21 d, 5 d washout). Diet consisted of a TMR (70:30% forage:concentrate). Rectal temperature and respiration rates were recorded x3 daily and ewes were milked x2 daily (0800 and 1700). Feed and water intake, and milk yield were recorded daily. Milk composition was determined weekly by MIR (MilkoScan FT2) and main blood metabolites analyzed by an iSTAT analyzer on the last day of each period. Data were analyzed by the PROC MIXED for repeated measurements of SAS (v.9.1.3). Rectal temperature and respiration rates increased from 0800 to 1700 h and were greater in HS than in TN ewes (P<0.001). Water intake increased by 28% and DMI decreased by 10% in HS compared to TN ewes (P < 0.001) but milk yield did not vary (P > 0.05). Milk fat and protein contents decreased by 16%, whereas lactose content increased by 7% (P < 0.01) in HS compared to TN ewes. No differences were detected on glucose, urea, hematocrit, and hemoglobin concentrations in blood (P > 0.05). Blood values of total CO₂ were lower, as a consequence of hyperventilation, and those of creatinine were greater by a reduction in renal clearance and increase in muscle catabolism, in HS compared to TN ewes (P < 0.01). In conclusion, HS ewes reduced feed intake but produced similar milk yield, with lower fat and protein contents in late lactation, than TN ewes. However, milk protein and fat contents decreased in the HS ewes. Values are similar to those previously reported in dairy goats but further studies are needed to evaluate the effects of heat stress during early lactation.
Almost all EU countries are trying to respond to the changes that take place in the dairy sector. They do this by exploring new opportunities for survival of the existing production and even its increase. There is a noticeable increase in input costs both in primary and in manufacturing. Some countries (such as the Netherlands) have seen great potential in pastures, or grassy areas. This mode of action can be a good example for milk producers in the Republic of Croatia. The Republic of Croatia has about 3 million ha of agricultural land. Of this, approximately 33 % of the area (1.08 million ha) is suitable or moderately suitable for processing and agricultural production. In 2013, about 350,000 ha were statistically run as permanent grasslands. However, in the ARKOD system for 2014 only 130,000 ha of meadows and pastures have been entered, which represents only 37 % of permanent grassland areas. Although these surfaces were apparently sufficient for the current number of cows in milk production (about 170,000 cows), we need to keep in mind that our current milk production capacity is only 50 %. One of the key agricultural policy measures for the stability of cattle production that would be recommended in terms of increasing milk production in the Republic of Croatia is certainly the involvement of grassland. This also includes a number of agrotechnical measures and interventions in the same, with the aim of raising the quality and fertility of the soil. Taking into account that the input costs of milk production on farms using the grasslands can be reduced by 50 %, we consider that we have great untapped potential to improve milk production in the Republic of Croatia.

Prediction of calving time is a key element in livestock farming, mostly to decide whether human supervision or intervention is needed. Behavioral changes of periparturient dams have been described based on direct observation. In practice, however, the frequency of observation of animals is low, especially in beef cows grazing on rangelands. Sensors can replace direct observation, but there are some constraints for their use in extensive systems. Besides robustness, data transmission and battery life are major challenges. Existing devices normally use IoT networks, which allow the transmission of small amounts of data every several minutes in order to maximize battery life. The objective of this piece of research is to test if behavioral changes around calving can be monitored by using the low temporal resolution data provided by IoT sensors. Eight beef cows grazing on three different Spanish farms were equipped with DIGITANIMAL® smart collars. These collars include location and acceleration sensors transmitting data every 30 minutes. Data from seven days before to seven days after calving date were used. Daily walked distance was calculated as the sum of distances between successive GPS locations. A decrease of 28% of walked distance was observed on calving date, compared to the average value of the previous seven days. This decrease ranges from 59% to 2% for different animals, being higher when cows are grazing on bigger paddocks. In fact, paddock size explains 19% of variance of daily walked distance. In some cows, the decrease of daily walked distance is maintained up to two days after calving. A change of average location (latitude, longitude) was also observed on calving date, as cows seek isolation at calving. Again, these changes are more evident when cows are grazing on large paddocks. No changes were observed in acceleration data. To conclude, low temporal resolution location data could be useful to predict calving time. However, other factors, such as paddock size, influence changes in location data patterns, so it is desirable to include these metadata in prediction algorithms in order to avoid false positives and false negatives.
The lack of common legislation for dairy cow welfare in Europe and the growing public concern over the ethics of livestock production have brought several research groups and private industries to develop different on-farm welfare assessment systems. Among these, the Welfare Quality® (WQ) can be considered the gold standard. The Italian Reference Centre for Animal Welfare (CReNBA) has developed a dairy cow welfare assessment protocol based on WQ and EFSA publications to be used routinely at national level for supporting official on-farm controls and for certifying animal-friendly products. This preliminary study tested the compatibility of the CReNBA system with WQ. The welfare of dairy cattle was assessed on 5 loose housed Italian farms (18–54 lactating cows) simultaneously by one qualified CReNBA assessor and one trained WQ assessor. The farms’ overall welfare score (OWS) and principle scores (PS) obtained from WQ and CReNBA protocols were compared using Pearson’s correlation. Only data for lactating and dry cows were considered, except for disbudding practices that concerned calves. In WQ, PS are calculated through measure and criteria scores by applying different weights. CReNBA assessment involves animal-, resource- and management-based measures, that can be related to the WQ principles (Table 1). Each CReNBA measure has a different weight, which was assigned by expert opinion elicitation. The single measure scores are aggregated and normalized between 0-100% to obtain the PS and the OWS. According to both protocols, the OWS was “enhanced” for four farms and “acceptable” for one farm. However, a different farm was classified “acceptable” according to WQ and CReNBA. The systems agreed well in three of the four PS (Table 1). Differences in the remaining principle might derive from the great importance given to the water provision measures in the WQ system, as underlined in other studies. This preliminary test showed that, on welfare principle level, the CReNBA system can produce results that are compatible with WQ, even though the measures in CReNBA system and WQ are partly different. However, the sample size in this test was very small and thus further experiments are needed to confirm the results.

Table 1. Welfare Quality® and CReNBA measures included in the 4 welfare principles and results of the Pearson’s correlation at principle level

<table>
<thead>
<tr>
<th>Welfare Principles</th>
<th>WQ measures</th>
<th>CReNBA measures</th>
<th>Pearson’s r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good feeding</td>
<td>Body condition score; water provision; cleanliness of water points; water flow; functioning of water points.</td>
<td>Body condition score; feeding strategy; use of concentrate feeds (daily dose); available space at feed bunk; feeding places dimension and accessibility; functioning and number of water points; cleanliness of water points; water provision.</td>
<td>r = 0.07    p-value = 0.91</td>
</tr>
<tr>
<td>Good housing</td>
<td>Time needed to lie down; animals colliding with housing equipment during lying down; animals lying partly or completely outside the lying area; cleanliness of udders; cleanliness of flank/upper legs; cleanliness of lower legs; presence of tethering; access to outdoor loafing area or pasture.</td>
<td>Cleanliness of flank, upper leg, lower leg and udder; bedding material management; space availability in the lying area (m²/cow or number of cubicles per animal); design of the lying area; type of bedding material; temperature, humidity and ventilation; housing of animals older than 6 months of age.</td>
<td>r = 0.88    p-value &lt; 0.05</td>
</tr>
<tr>
<td>Good health</td>
<td>Lameness; integument alternations; coughing; nasal discharge; ocular discharge; hampered respiration; diarrhea; vulvar discharge; milk somatic cell count; mortality; dystocia; downer cows; disbudding/dehorning; tail docking.</td>
<td>Lameness; integument alterations; type of floor in walking areas; foot inspection and foot bathing; milk somatic cell count; number of antibiotic treatments for clinical mastitis in 1 year; milking routine; milking machine or milking robot maintenance; annual mortality rate of adult cows; biosecurity measures; facilities for sick animals; gas (NH₃, H₂S, CO₂) concentration; mutilations (disbudding, dehorning, tail docking)</td>
<td>r = 0.94    p-value &lt; 0.05</td>
</tr>
<tr>
<td>Appropriate behavior</td>
<td>Agonistic behaviors; access to pasture; avoidance distance; qualitative behavior assessment.</td>
<td>Access to pasture; avoidance distance test</td>
<td>r = 0.96    p-value &lt; 0.05</td>
</tr>
</tbody>
</table>
**P29**

**Functional and production traits in Romanian Black Spotted dairy cows**

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Selection for functional traits in dairy cattle has recently increased in importance due to growing concerns for animal health, animal welfare, food safety and the overall farm efficiency. Aim of the current pilot study was to evaluate the functional traits related to reproductive efficiency and production outputs in primiparous and multiparous Romanian Black Spotted dairy cows. The study was carried out at the Research and Development Institute for Bovine Balotesti (44°36'46"N 26°4'43"E) Romania, where 70 purebred Romanian Black and White cows were managed under identical conditions and housed in a tie-stall barn. Body weight of primiparous cows (n=30) was on average 484.3±1.91 kg, while the multiparous group (n=40) had on average 511.3±1.60 kg, with differences between the two groups being significant (p≤0.001). The average number of artificial inseminations per gestation was of 1.8±0.16 in primiparous cows, while for the multiparous cows the average was of 2.2±0.22. Average length for the days open was 140.6±12.2 in primiparous cows and 144.0±13.6 for the multiparous group. Parity of the cows had no significant (p>0.05) influence on the duration of days open or the number of inseminations per gestation. Lameness incidence was of 10.0±0.55% in primiparous cows and of 23.0±0.06% in adult multiparous, with significant (p≤0.05) differences between the two age-groups. Milk yield in multiparous cows was on average of 5767.8±28.5kg. The functional traits related to reproductive efficiency and animal health are very important coordinates for the future genetic improvement schemes and the sustainable development of the Romanian Black Spotted breed.

**P30**

**Dairy calf management and animal welfare**

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Dairy calves are susceptible to a range of welfare issues including poor health, social deprivation, abnormal behaviour and stressful practices; which are mainly arise from their environments and management procedures. The risk factor assessment was the first step in an intervention strategy to improve calf welfare on a dairy farms. Some of the major risk factors for poor calf welfare related to management procedures can be identified as; 1) precalving impacts, 2) no use of calving pen, 3) no disinfection of newborn’s navel and delayed identification, 4) health disorders such as enteric and respiratory disease, 5) inadequate colostrum management and calf feeding at growing period, 4) improper care and management 4) dehorning without adequate pain control, 5) unsuitable weaning 6) individual housing. This study was planned to determine main risk factors that might affect dairy calf welfare in commercial dairy farms in Turkey. Data collection is ongoing and preliminary results are expected to be published by the end of the year.
Dietary supplement of conjugated linoleic acids or polyunsaturated fatty acids suppressed the mobilization of body fat reserves in dairy cows at early lactation through different pathways

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Milk fat depression (MFD) is an effective way to reduce the metabolic stress of dairy cows during lactation. Dietary supplement of fatty acids can induce MFD by inhibiting mammary lipid synthesis. To investigate the impacts of MFD on the metabolism in the adipose tissue (AT), 30 cows were randomly assigned to a control diet, a conjugated linoleic acid supplemented diet (as CLA diet), or a high-starch diet supplemented with polyunsaturated fatty acids (sunflower oil: fish oil = 2:1; as HSO diet). Measurements of animal performance, milk yield, milk composition, energy balance, and blood metabolites were conducted at intervals during lactation. The expression of candidate genes in AT was analyzed by quantitative PCR at wk 3 and 15 of lactation. Milk fat yield and content were effectively depressed by the CLA and HSO diets at wk 3 and wk 15 of lactation. Surprisingly, milk yield was also considerably decreased in the HSO group. The CLA and HSO diets improved energy balance at early lactation, supported by the reduced body weight loss and decreased plasma non-esterified fatty acid and β-hydroxybutyrate concentrations in these two groups. Lipolysis in AT was suppressed by the CLA and HSO diets at early lactation through the downregulation of hormone-sensitive lipase and fatty acid binding protein 4 and the upregulation of perilipin 2. Lipogenesis in AT was promoted only by the HSO diet at wk 15 through the upregulation of 1-acylglycerol-3-phosphate O-acyltransferase 2, mitochondrial glycerol-3-phosphate acyltransferase, perilipin 2, and peroxisome proliferator-activated receptor γ. In addition, the CLA diet led to increasing transcription of various genes involved in insulin signaling, inflammatory responses, and ceramide metabolism, including protein kinase B2, nuclear factor κ B1, toll-like receptor 4, caveolin 1, serine palmitoyltransferase long chain base subunit 1, and N-acylphosphoglyceride amidohydrolase 1. The changes in these insulin-related pathways suggest likely altered insulin sensitivity in AT of the CLA group. In contrast, the HSO diet resulted in little or no change in these insulin-related pathways. In conclusion, the CLA and HSO diets shifted energy partitioning towards AT instead of mammary gland at early lactation through the regulation of different pathways.
Calves' health and welfare issues in small-scale farms
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The health and welfare of calves have a key importance for the future high milk and meat production. Regarding that, husbandry systems and management practices both have a great influence. Purpose of this study was to obtain information from different small-scale farms in Slovenia and Serbia, about the possible threats on the welfare and health of calves in the first months of their life. Preliminary results are presented. In both countries, for data collecting the same type of questionnaire-based survey has been used. Questionnaires were distributed among the farmers, and their participation in the survey was voluntary. The survey consisted of several groups of questions concerning general data about the farm, calving procedures, and calves management related to feeding, watering, weaning, housing, and common diseases. Data from surveys were used for identification of failures in rearing procedures. There were a total of 353 farmers who responded to the survey. The results revealed there are many factors affecting calves welfare and health in both countries. As the major welfare and health risks i.e. failures noticed at more than 50% of the farms, the following may be pointed out: use of any colostrum for feeding calves disregarding its quality, unknown temperature of colostrum/milk for feeding calves (it is determined by hand or not measured at all), no ad libitum access to water from the 1st day of calf's life; housing different species and categories of animals in the same building; non-fulfillment or irregular performance of the most important hygienic measures like cleaning/disinfection the box after each calf. In both countries, the incidence of diarrhoea is higher than incidence of respiratory diseases. The results also indicate poor knowledge about certain diseases and farmers’ ability to recognize the problem. According to the preliminary results, similar methods for calf rearing in both countries are in use. Failures in the management are also similar, indicating that additional education of farmers in both countries could be beneficial to their calves’ health and welfare improvement. The results indicate that there is still a sufficient margin for improving management in calf rearing.

Digital radiographic of distal extremities of limbs in sheep with acute ruminal lactic acidosis experimentally induced
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The acute ruminal lactic acidosis (ARA) is known to cause economic losses, and this disorder is a result of rapid and excessive intake of easily fermentable carbohydrates, causing different clinical signs. The development of reliable diagnostic method can help control it, and this study aimed to verify the effectiveness of digital radiological examination as a diagnostic tool of laminitis in sheep with ARA. It was used 10 healthy ewes, with basal diet of Tifton hay ad libitum, free access to water and mineral mixture. Three times before the beginning of the experiment, it was obtained, weekly, digital X-ray images of distal extremities of all limbs. For ARA induction, the animals received 15 g/kg of body weight of sucrose orally, and the analysis were performed at the moments: 24, 48, 72, 96, 120,144 hours; and on the second, third and fourth week completing one month. Radiographic images of the podal region of all limbs, in anterior-posterior position, were obtained in direct digital X-ray equipment (Portable DR system PDX-1417, Poskom Co.), under physical restraint in hoof trimming crush, using 2.9 kV and 60 mAs. This study received ethical approval from Ethics Commission in Use of Animals (Protocol 03888/14). All animals developed ARA and five of them showed clinical signs of acute laminitis that started with 24 hours and was noticed until 72 hours. Although the clinical signs were noticed, the X-rays images showed that it could not be detected any radiographic changes indicative of laminitis and no other pathological alteration in the region. It is noticed that the use of digital radiography facilitates the scientific research by the short time required to obtain the image, the possibility of immediate analysis and the high quality of the images. Although it was observed clinical signs of acute laminitis, during all experimental period it could not be detected any X-rays changes indicative of laminitis and no other pathological alteration at phalanges. It can be concluded that digital radiology is not an efficient tool for early detection of laminitis in sheep, besides the occurrence of acute laminitis after ARA experimental induction.
Health and welfare status of intensively reared dairy sheep in Greece
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During the last decade, intensive production systems have been popular between sheep farmers in Greece, although, low-input systems are still the predominant ones. The aim of this study was to investigate the relationship between sheep health and welfare status and the quality of the milk in Greek dairy farms. Three hundred and fifty intensively reared dairy ewes were randomly selected from 7 farms located in Northern Greece. The AWIN protocol for Sheep (AWIN, 2015) was applied to individually investigate and assess various animal-based indicators of health and welfare such as, the occurrence of lesions in the body, the Body Condition Score, the cleanliness and quality of the wool, the occurrence of renal discharge, lesions/abscesses/mastitis in the udder, overgrown claws, lameness, coughing etc. Also, a structured questionnaire about the herd management was filled in by personal interviews with the farmers. Data was summarized using descriptive statistical methods and SPSS© v.21. Skin lesions, papillomatosis, asymmetry and abscesses in the udder were found in 158 (45.1%), 25 (7.1%), 54 (15.4%), 63 (18.0%) animals, respectively. Overgrown claws were scored with 2, 3 and 4 (according to the severity of the overgrowth) in 76 (21.8%), 23 (6.6%) and 7 (2.0%), respectively. Fleece cleanliness was also assessed as indicator of good housing and was found wet and dirty in 57 cases (16.2%). Mean Body Condition Score was 2.52 (±0.37). A pale color of mucosa, indicating the presence of anaemia was observed in 7 (2.0%) of the animals. In conclusion, it can be anticipated that problems related to udder and foot are among the dominant health and welfare problems in intensive sheep farms in Greece. This study is still in progress and is expected to conclude with the investigation of possible relationships between animal health and welfare traits and milk quality parameters.

Main causes of culling in dairy cows: preliminary study in Northern Italy herds
Main causes of culling in dairy cows: preliminary study in Northern Italy herds
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Farmer’s financial return is the most important reason for culling dairy cows. Animals addressed to slaughterhouse have often problems that could affect their welfare status. The aim of this study was to investigate the major causes that lead to dairy cows culling in Northern Italy and the animal welfare conditions of the culled animals. Three loose housing dairy farms (average number of lactating cows=360), were involved in the study. From April to December 2017, 41 cows were culled. At the day of culling for each cow, the following data were collected: culling reason and indicators of poor animal welfare. These latter were assessed using animal-based measures (i.e. cleanliness, presence of lameness, skin lesions) recorded both before the loading on the truck at the farm and then after the unloading at the slaughterhouse. In addition, it was verified if there were any signs of poor welfare detectable on the carcass during the post mortem inspection. Culling reasons are shown in Figure 1. There were some changes in animal conditions before and after the journey from herd to slaughterhouse: regarding cleanliness before the loading 35 animals were clean while after the journey only 12 cows were still clean; regarding lameness only one cow showed lameness after the journey; finally skin lesions were the same both before and after the journey. No signs of poor welfare were detected on the carcass during the post mortem inspection. Based on the collected data the situation in the assessed herds reflects what it is reported in literature confirming that reproductive problems and udder health are the most important reasons for culling. Besides it is also interesting to underline that the transport has a big influence on the animal welfare as it was shown by the cleanliness of animals and the presence of lameness before and after the journey.

References
Incidence and impact of lameness on ewes’ milk production of new breed Slovak dairy ewe and Lacaune
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Currently, there is effort to breed a new national breed of sheep (Slovak dairy ewe – SD, based on the following breeds: Merino, Tsigai, Improved Valachian, Lacaune, East Friesian) to increase the milk production of traditionally bred sheep in Slovakia. The aim of this study was to evaluate the lameness incidence in an experimental herd (belong to NPPC Nitra) of ewes composed of the new breed of Slovak dairy ewes (210 pieces) and Lacaune ewes – LC (53 pieces) (project APVV-15-0072). The aim was also to find out the effect of lameness, lactation number and order of entry into the milking parlour on milk production and possible relationships to studied breeds. Milk yield was recorded in two periods (June, July) during the morning milking only. At the same time the lameness (three groups created: non-lame, slightly lame, strong lame) and order of entry of ewes into the milking parlour (three groups created: first, second, third) were also recorded. More of lame ewes were found out within the breed LC (33.2%) compared to SD (17.6%). Significant influence of lameness on the milk yield of ewes in LC (P < 0.0135) and SD (P < 0.0047) was detected. In both breed, the highest milk production per milking was found out in group non-lame ewes (LC, 600 ± 179 ml; SD, 473 ± 151 ml) and the lowest production had strong lame ewes (LC, 487 ± 152 ml; SD, 403 ± 153 ml). Order of entry into parlour had no effect on milk yield in both breeds. The ewes entering the parlour in third group had highest incidences of lameness. The strongest lameness was found out in ewes on their fourth and higher lactations. In conclusion, the lameness significantly reduced milk yield and could postpone the entering of ewes into parlour. As expected, SD ewes were more resistant to lameness than LC ones.

Influence of seasonal heat stress on reproductive performance in dairy cows
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Seasonal heat stress is one of the major factor contributing to decreased fertility and poor reproductive performance in dairy cows. High environmental temperature might directly influence fertility by impairing cellular function of reproductive cells. Additionally, heat stress can affect reproduction by decreased appetite and reduced nutrient intake with a consequence of lower energy balance. The aim of this study was to investigate the influence of seasonal heat stress on reproductive capability in dairy heifers. The study was conducted on thirty-two healthy Holstein-Frisian dairy heifers kept in an open free-stall barn assigned into two groups according to season: winter (N=14) and summer (N=18). Reproduction parameters were recorded from the time of first insemination of heifers until successful insemination after the first calving. Additionally, blood samples were taken at the time of insemination and during the transition for antioxidant and metabolic status measurement. The calving-to-conception (CC) interval was prolonged in the summer group (159 ± 76.4 days) as compared to the winter one (91 ± 46.7 days). A conception rate (CR) was significantly lower (P<0.05) in summer than in winter after the first calving, whereas no difference was observed in the CR in heifers at the first service between summer and winter. The concentrations of NEFA and BHB were significantly higher (P<0.05) during the transition in summer than in winter. Antioxidant status measured by the total antioxidant status (TAS) and paraoxonase-1 (PON1) activity was significantly decreased (P<0.05) in summer as compared to winter during the transition period. The results demonstrated that heat-stressed cows inseminated during hot months had lower fertility rate coupled by a higher degree of NEB and lower antioxidant status.
Modeling the attitudes of Greek sheep farmers towards Animal Health and Welfare
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This study aims to define Greek sheep farmers’ awareness of issues related to animal health and welfare legal framework. The data was collected from a stratified random sample of 150 sheep farms located in the prefectures of Etoloakarnania, Serres, and Drama. Statistics mean values obtained for farmers were compared using chi-square tests or Fisher exact tests for nonmetric discrete (qualitative) variables. Furthermore, a series of one-way analyses of variances (ANOVAs) and standard t-tests for metric (quantitative) variables were also performed to access differences in attitudes. Probit analysis was used to better explain the influences of farm, farmer attitudes and techno-economic variables to the knowledge of EU Regulations. The probit model estimated indicates that 80.6% of the observations were correctly predicted. The overall model is significant at the 0.0000 level according to the Model chi-Square Statistic (89.99). The McFadden R² is 0.4337. It was concluded that men are better informed about animal welfare regulation aspects in comparison with women. Age and education are not statistical significant variables, but their sign follows the appropriate trend, which means that young farmers and more educated have positive views for the knowledge of animal health and welfare Regulations. The results also indicate that well-informed farmers face a higher medicine cost, which may be an indication of more appropriate and precautionary management of sheep health and welfare. Though not significant, feed cost and labour cost per livestock unit have a negative sign showing that farmers who are aware of animal welfare legal framework allocate resources more efficiently. Finally, capital intensification mainly characterizes well-informed farmers.
Reproductive failure has been the most important problem of dairy herds in the last decade. The research and dairy sector has been spending much efforts and money for solving this problem. This study is a part of the thesis which aims to investigate the relationship between nutrition and reproduction in Holstein Friesian cows. The objective of the study was to find out whether nutritional requirements of the Holstein Friesian cows in a state dairy farm were met in particular periods: 40 days before calving, 40 to 50 days after calving and 25 to 30 days just after insemination. The total mixed rations (TMR) were evaluated in terms of nutritional content. The study was conducted on 191 head Holstein Friesian cows in Koçaş State Farm in Central Anatolia. The cows were fed with TMR according age, lactation number, milk yield, pregnancy and milked twice a day. Total Mixed Ration (TMR) was consist of concentrated feed, hay and corn silage. The samples of feed ingredients and TMR were analysed for nutritional components. The nutritional requirements of cows were calculated according to NRC (2001). Therefore, dry matter intake (DMI), digestible energy (DE), metabolisable energy (NE), net energy for maintenance (NEm), net energy for lactation (NEL), maintenance for metabolisable protein (MPm), rumen degradable (RDPReq) and undegradable protein requirements (RUPReq) were calculated. The requirements for DMI in dry, peak lactation and insemination periods were determined 13.8±0.10 kg/day/head, 19.4±0.15 kg/day/head and 20.5±0.17 kg/day/head respectively. The requirements for NE in dry, peak lactation and insemination periods were determined 13.8±0.06 Mcal/day/head, 30.3±0.31 Mcal/day/head and 29.9±0.34 Mcal/day/head respectively. The requirements of the cows for DMI, MP and NEL were found to be significant (P<0.05) in terms of lactation number and the periods. The requirements of DMI in peak lactation and dry periods were not met fully and more DM was consumed during insemination period than its needed. As a result of the data explication, it was evident that the nutrient requirements were not fully met particularly in the peak lactation and insemination periods. Therefore, many reproductive parameters in the herd were affected negatively by this situation.

Table 1 The Comparison of Nutrient Requirements and Nutrient Intake of Holstein Friesian Cows Fed by TMR

<table>
<thead>
<tr>
<th>Period</th>
<th>Number of animals</th>
<th>Requirement for DMI, Kg/d</th>
<th>Met by TMR DMI, Kg/d</th>
<th>Requirement for NEL, Mcal/d</th>
<th>Met by TMR NEL, Mcal/d</th>
<th>Requirement for MP, g/d</th>
<th>Met by TMR MP, g/d</th>
<th>Requirement for RDP, g/d</th>
<th>Met by TMR RDP, g/d</th>
<th>Requirement for RUP, g/d</th>
<th>Met by TMR RUP, g/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>133</td>
<td>13.8±0.10</td>
<td>10.4±0.10</td>
<td>13.8±0.06</td>
<td>746.9±2.78</td>
<td>15.5±0</td>
<td>738.2±8.54</td>
<td>1015±4.81</td>
<td>855±9.3</td>
<td>295±3.2</td>
<td>314±6.3</td>
</tr>
<tr>
<td>Peak Lactation</td>
<td>133</td>
<td>19.4±0.15</td>
<td>22.1±0.10</td>
<td>30.3±0.31</td>
<td>2219.5±27.7</td>
<td>32.7±0</td>
<td>2163.5±22.7</td>
<td>2121±20</td>
<td>2027±20</td>
<td>1231±18</td>
<td>920±31</td>
</tr>
<tr>
<td>Insemination</td>
<td>133</td>
<td>20.5±0.17</td>
<td>21.9±0.10</td>
<td>29.9±0.34</td>
<td>2166.5±31.1</td>
<td>32.4±0</td>
<td>2105±23.1</td>
<td>2105±23</td>
<td>2004±23</td>
<td>1209±20</td>
<td>908±13</td>
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</table>

P (significance)

<table>
<thead>
<tr>
<th>Period</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
<th>&lt;0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactation number</td>
<td>&lt;0.001</td>
<td>0.018</td>
<td>&lt;0.001</td>
<td>0.018</td>
<td>0.008</td>
<td>0.063</td>
<td>0.191</td>
<td>0.018</td>
<td>0.004</td>
<td>0.064</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period X Lactation</td>
<td>0.227</td>
<td>0.534</td>
<td>0.339</td>
<td>0.169</td>
<td>0.385</td>
<td>0.257</td>
<td>0.236</td>
<td>0.133</td>
<td>0.739</td>
<td>0.431</td>
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<td></td>
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</table>
Due to the increased metabolic rate of dairy cows during the transition from pregnancy to lactation, more reactive oxygen species (ROS) are produced and the available antioxidants may be insufficient to neutralize them. The resulting oxidative stress is considered as one reason for metabolic and infectious diseases. Cows with higher body condition score (BCS) during the dry period or at calving are at a higher risk for production diseases and have more oxidative stress. We tested whether cows that are normal or over-conditioned well before dry-off differ in their oxidative status in terms of the derivatives of oxygen metabolites (dROM), the ferric reducing ability of plasma (FRAP) and the oxidative stress index (OSi; dROM/FRAP). Based on their history of BCS and back fat thickness (BFT) cows were allocated to either the normal BCS (NBCS: BCS <3.5; BFT<1.2 cm; n=19) or high BCS (HBCS: BCS>3.75; BFT>1.4 cm; n=19) group 15 weeks before calving. To accentuate the difference in BCS, they received different diets from then until dry-off (NBSC: 6.8 MJ NE/kg DM; HBCS: 7.2 MJ NE/kg DM), but were at the same diet thereafter. Blood was collected weekly from 49 days before until 84 days after calving. The dROM ($\mu g \text{H}_2\text{O}_2/\text{mL}$) and FRAP ($\mu M \text{Fe}^{2+}/\text{mL}$) were measured in serum (means±SEM). The linear mixed model (SPSS 25) was used for statistical analysis (fixed effects: time, group, time*group; random effect: cow). The difference in BCS was maintained during the study period. The dROM, FRAP, and OSi changed over time (p<0.05). There were no group differences for dROM (p=0.13), but NBCS cows had higher FRAP values (2.16±0.03) than HBCS cows (2.04±0.03; p=0.012). The OSi tended to be higher in HBCS cows (31.85±2.169) than in NBCS cows (25.68±2.14; p=0.05). Hence the higher risk for diseases of over-conditioned cows may result, amongst others, from a lower capacity to cope with oxidative metabolites. Thus a supplementation of antioxidants could be a good option for cows over-conditioned at dry-off.

1 Schulz et al., J Dairy Res (2014), 81: 257–266
In many studies, results have shown that Y. schidigera saponins have strong antiprotozoal effects, increase VFA production in favour of propionate, reduce NH3-N in the rumen and nitrogen in urine. The aim of this study was to evaluate the effect of 0, 100, 200, 300, 400, 500, 600 ppm doses of Yucca schidigera extract (YSE) on in vitro nutrient digestibility of barley (B), soybean meal (SBM), and alfalfa hay to find out appropriate doses and then to use these doses in the ration of 4 cannulated Holstein Frisian cows fed a 60% forage and 40% concentrate feed at 0.014 of their live weight to evaluate biological blood parameters, antioxidant capacity, and rumen VFA’s, protozoa counts. The YSE doses of 100 and 200 ppm were found effective lowering the SBM crude protein digestibility (68.29±0.459 % and 71.09±0.789 % respectively) and increasing barley dry matter digestibility without any detrimental effect on alfalfa dry matter and NDF digestibility. The total rumen protozoa count of 100 ppm YSE group was found significantly lower (P <0.05) than those of control and 200 ppm YSE group before feeding. There was no significant difference in the serum glucose, total protein and TOS parameters of 0, 100 and 200 ppm experimental groups (P> 0.05). At 4 hours after feeding, there was significant difference between the blood urea N (BUN) concentration of 200 ppm YSE group (10.22 ± 0.594) and that of 0 ppm YSE group (4.73 ± 0.408). There was no significant difference between experimental groups in VFA concentrations. Two hours after feeding, the level of cholesterol decreased with increasing YSE dose and the difference between 200 ppm YSE group and control group was significant (P <0.05). Serum Triglyceride, TAS and Albumin concentrations were found to be significantly different between the groups only before the feeding (P <0.05). There was no antibacterial effect observed in the doses of YSE applied. Tannin and saponin compounds can be excreted by faeces without showing any effect by compounding with certain proteins in saliva in ruminants. Therefore possibly due to this fact, the significant differences on protozoa counts after meals were not found.

Table 1 Effect of YSE on protozoa counts in the rumen fluid (counts / mL)

<table>
<thead>
<tr>
<th>Hours after feeding</th>
<th>0. hour</th>
<th>2. hour</th>
<th>4. hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ppm (control)</td>
<td>64333±</td>
<td>61000</td>
<td>50333</td>
</tr>
<tr>
<td>100 ppm</td>
<td>34666±</td>
<td>30000</td>
<td>29333</td>
</tr>
<tr>
<td>200 ppm</td>
<td>52666±</td>
<td>53667</td>
<td>53333</td>
</tr>
<tr>
<td>P</td>
<td>0.017</td>
<td>0.146</td>
<td>0.082</td>
</tr>
</tbody>
</table>
Amino acid (AAs) supplementation in milk replacers (MR) is widely used in the pre-ruminant calf industry due to several benefits for milk production. Herein, the effects of different AA supplementations of milk protein-based MRs (MPMRs) in pre-ruminant calves from 3 days to 7 weeks were analyzed. Thirty-two calves were divided into 4 groups of 8 animals each: Ctrl) Control group fed with MPMR without supplementation and three groups with AA supplemented Ctrl diet. These were GP) 0.1% glycine and 0.3% proline added; FY) 0.2% phenylalanine and 0.2% tyrosine added; and MKT) 0.62% lysine, 0.22% methionine and 0.61% threonine added. At week 7, average daily gain (ADG) was calculated; blood was collected and semitendinosus muscle biopsies obtained. Serum biochemistry profiles and plasma AAs were measured and a 1H-NMR metabolomic analysis of skeletal muscle aqueous extracts obtained. MKT group showed a tendency to higher ADG and serum creatinine increase, which may indicate an increased anabolic activity in these individuals. The plasma concentrations of these three AAs as well as arginine were higher than in the Ctrl group. Glycine/proline didn’t show higher concentration in GP group while in FY group only phenylalanine is higher compared with Ctrl. Although the AA supplementation in the GP and FY groups did not influence the ADG and it did not affect the blood metabolic profile, the metabolome analysis of skeletal muscle revealed several differences between the GP/FY groups and the Ctrl/MKT groups, suggesting a metabolic adaptation especially in GP ad FY groups. In conclusion, supplementation of MPMR with MKT improved performance by modulating protein metabolism, whereas supplementation with GP or FY did not affect performance, but influenced muscle metabolism.

<table>
<thead>
<tr>
<th>Ctrl</th>
<th>GP</th>
<th>FY</th>
<th>MKT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctrl</td>
<td></td>
<td></td>
<td>Threonine** Methionine**</td>
</tr>
<tr>
<td>GP</td>
<td>Nicotinurate*</td>
<td>Threonine** Methionine**</td>
<td></td>
</tr>
<tr>
<td>FY</td>
<td>Carotnine Carnosine NAD* Nicotinurate*</td>
<td>Cadaverine* Carnosine* NAD* Methionine** Phenylalanine*</td>
<td></td>
</tr>
<tr>
<td>MKT</td>
<td>Carotnine Carnosine NAD* Nicotinurate*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure.** Schematic overview of Tukey HSD multiple comparisons between treatment groups. Blood parameters are shown in the upper-right corner, and muscle metabolites are shown in the down-left corner. Parameters at higher concentration in the row-group vs the column-group are presented in underlined font, whereas parameters at higher concentration in the column-group vs the row-group are presented in italic font. (*P<0.05, **P<0.01, no asterisk: tendency 0.05<P<0.1).
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Loose Housing Systems Affect the Welfare Indicators Parameters in Dairy Farms in Southern Spain
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In the last century, dairy cattle housing in Southern Spain have been mainly based on communal resting areas since the farm size was limited. However, the farm size development is currently faster, having the same surface; then, the use of cubicles becomes mandatory. The present study analyses the pros and cons of the different loose housing system regarding welfare indexes in dairy cattle. A total of 20 farms (n=1650 cows), with capacity between 33 to 189 cows, and located in Dos Torres (Cordoba, Spain) were involved in this study. Animals were housed under loose system based on 1) deep-bedded resting area (DBRA): deep-bedded with straw yard (DBSY, n=4) or deep-bedded with recycled manure solids (DBMS, n=3); and 2) on cubicles (C): with sands (CS, n=1), and with recycled manure solids (CMS, n=12). Welfare Quality® assessment protocol was used for the animals evaluation. In brief, the results obtained about feeding reveal that the percentage of lean cows is lower in both types of deep-bedded resting area than in cubicles (11.7 vs 17.0). About housing, severe cleanliness deficiencies were detected under DBRA systems (dirtiness of lower legs, hindquarters and udder were 60.5, 56.6 and 32.8%, respectively). In reference to time needed to lie down, collisions and animals lying outside resting area, worse values were detected in C housing due to poor bed maintenance. In reference to health, integument alterations was higher in DBRA, mainly in hock and neck, due to reduced quantity of bedding and poor sizing of the feeder. And about severe lameness, more cows were detected in C than in DBRA (5.4% vs 3.5%). To sum up, this study shows that animal welfare (at different levels) is affected by housing system. While not an only type of housing system could be recommended, some critical points have been identified in each housing system, which should be monitored.

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Using ICT Technologies to Compile Life Cycle Inventories of Cow-Milk Production Chains
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The ultimate goal of PLF technologies is to render livestock production processes sustainable. However, few applications of PLF which deal with the environmental aspect of sustainability have been presented in the scientific literature to date. The Life Cycle Assessment (LCA) methodology performs an integrated estimation of the environmental impacts of a livestock product along its supply chain. The credibility of LCA increases in line with the quality of the data that is used to compile the Life Cycle Inventory (LCI) of natural resources’ use and emissions for the livestock product under study. Taking into account that the farm’s operation is an important contributor to some of the environmental impact categories associated with the product’s supply chain (e.g. Global Warming), collection of reliable data at the farm level for LCI development is of increased importance. The aim of this paper is to review the potential of the ICT technologies to facilitate the generation and enhance the quality of LCIs for cow-milk production. Data needs and data quality issues are discussed. Since monitoring of emissions at every different emission source in a dairy farm (e.g. naturally ventilated house, grazing location) shows difficulties, all developed ICT applications providing data to be readily used in existing emission estimation methodologies (such as precision feeding, automatic and robotic milking systems, on-farm raw milk chemical analysis and electronic management of grazing pastures) show great potential for use in LCI compilations.
Development of an ELISA for the measurement of the acute phase protein inter alpha trypsin inhibitor heavy chain 4 (ITIH4) in serum and milk samples from cows

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Inter alpha trypsin inhibitor heavy chain 4 (ITIH4) is a serum protein belonging to the inter alpha trypsin inhibitor (ITI) family, which was previously characterized by our group as a new APP in cattle. This protein was first described in pigs, where is known to be a major acute phase protein, commonly known as Pig-MAP. ITIH4 has also been identified as APP in other species such as human, dogs, mice and rat. Increases of ITIH4 of up to 12 times the pre-infection values were reported in the serum of heifers with experimentally induced summer mastitis, however no data was available about the presence of this protein in the milk of cows affected by mastitis, as has been reported for other APPs such as haptoglobin or SAA. In this study we developed an ELISA method which allowed the quantification of bovine ITIH4 in serum and milk samples. The ELISA developed showed a low imprecision, with inter and intra assay coefficients of variation lower than 10 % for serum and milk samples. The assay kept linearity under dilution for both serum and milk samples. A good correlation was found with the radial immunodiffusion, method previously used for the measurement of ITIH4 in serum, but not sensitive enough to quantify ITIH4 in milk. ITIH4 was quantified in serum and milk samples from naturally infected cows that developed subclinical mastitis. ITIH4 showed a significant increase in the serum and milk from cows with subclinical mastitis compared with healthy cows.

The importance of the addition of vitamin and mineral mixture in dairy cow nutrition

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Dairy cows demand nutritionally balanced ration, which is adjusted to their needs by the all nutrients and economy of milk production depends not only on the amount of milk production and composition of milk, but also on the fertility of the cattle, health status in the herd and consequently the number of culled cows. The focus of our study was in the connection of appropriate content of minerals in the dairy cow ration and the fertility parameters of cow in the herd.

In the first family farm, the daily ration for cows was not balanced and the vitamin and mineral mixture was not applied in the daily ration for cows, the fertility parameters at the farm were fairly poor, the average calving interval was rather long, between 394 days and even 521 days in last years. However, after few months of supervising the nutrition and introduction of mineral and vitamin mixture in the ration for dairy cows, the milk yield increased and the fertility parameters improved.

In the second family farm, the mineral and vitamin mixture was applied in the daily ration of the cows, but it was unsuitable. In the daily ration was already to high amount of Ca (almost 10 g/kg DM), because of high amount of Ca in grass silage (14.34 g/kg DM) and with addition of inappropriate mineral mixture the level in daily ration was even more increased, otherwise the daily ration was balanced. The milk yield was lower as expected and the fertility parameters were poor. The average calving interval was 403 days, the average postnatal interval was 123 days, the average service interval was too long, 82 days and average time between two inseminations was 55 days. More than 30% of culled cows in the herd and the reason for more than 50% were fertility problems.

Balance mineral content in the ration for dairy cows play an important role in fertility parameters and consequently on economy of milk production.