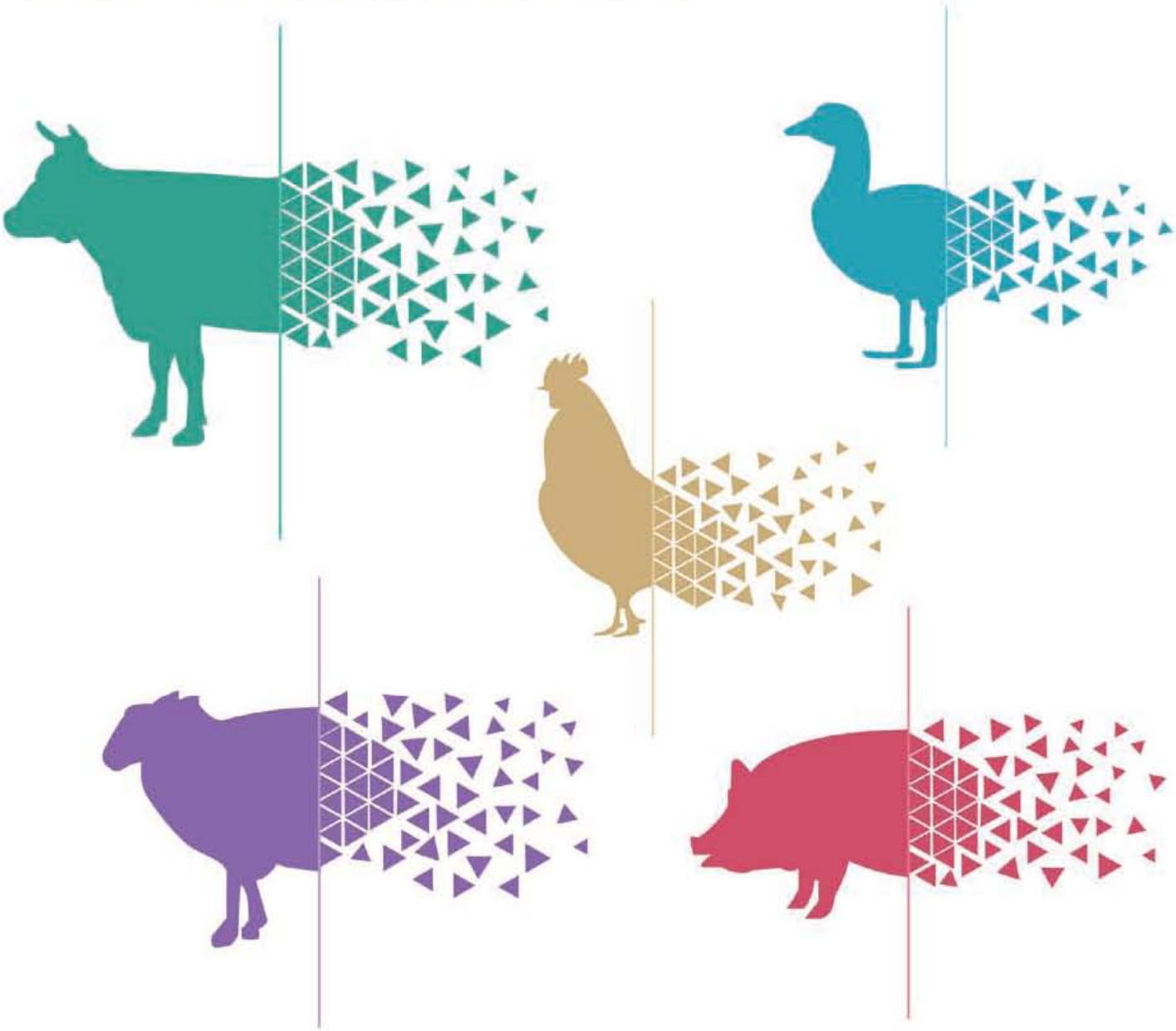
COST ACTION 1102: Farm Animal Imaging (FAIM)

FAIM IV:

Fourth Annual Conference on Body and Carcass Evaluation, Meat Quality, Software and Traceability

Edinburgh, United Kingdom. 22nd - 23rd September 2015

Conference Proceedings (Profiles/Abstracts)



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Action FA1102
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Food Quality Monitoring

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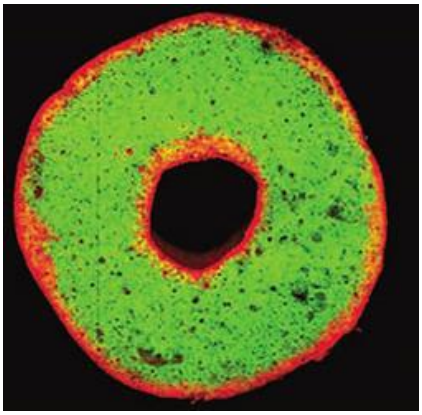
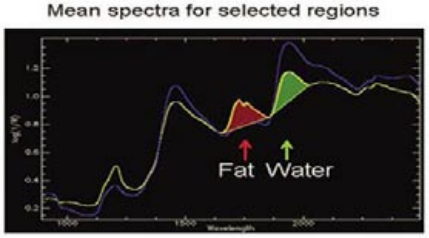


Mean spectra for selected regions



Frying – Fat and water content in a doughnut (Image from BFI Campden, UK)

We use the power of light and measure rainbows: the optical spectroscopy signature of materials to monitor food quality.

We design and manufacture the equipment and also the processing software to deploy for your application needs and on your site

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Contents

Programme Overview

21st September 2015	
17:00 - 20:00	Royal Society MC40 meeting

22nd September 2015	
07:35 & 07:45	Buses leave promptly from Edinburgh (2 buses, 2 stops: see map page 11)
08:00 - 09:00	Registration/coffee/poster boards get used
09:00 - 09:10	Opening by Action Chair
09:10 - 09:30	Prof Geoff Simm; SRUC - the grant holding institute for FAIM
09:30 - 10:30	WG1 Presentations Part 1
10:30 - 11:00	Coffee break
11:00 - 12:00	WG1 Presentations Part 2
12:00 - 13:00	Site visit: CT at the VetSchool
	Site visit: CT at SRUC
13:00 - 14:00	Lunch
14:00 - 15:00	WG1 Presentations Part 3
15:00 - 15:30	WG3 Presentations Part 1
15:30 - 16:00	Coffee break
16:00 - 16:30	WG3 Presentations Part 2
16:30 - 17:00	WG4 Presentation
17:00 - 17:30	WG2 Talk and chairs session talk 1 and 2
17:30 - 18:30	Posters, poster competition, snacks, wine…
18:35 - 19:15	Transport by Bus to Edinburgh (to Dynamic Earth)
20:00 - 22:00	Dinner and Ceilidh in Edinburgh (Dynamic Earth)

23th September 2015	
07:35 & 07:45	Buses leave promptly from Edinburgh (2 buses, 2 stops: see map page 11)
08:20 - 08:30	Opening the second day and poster competition results
08:30 - 10:30	WG2 Presentations
10:30 - 11:00	Coffee break
11:00 - 13:00	Chair's session (CS)
13:00 - 14:00	Lunch
13.30	One bus leaves for the airport

Detailed Scientific Programme

Tuesday 22nd September		
09:00-09:10	Lutz Bunger	Opening FAIM IV
09:10-09:30	Geoff Simm	Welcome and Introduction to SRUC

WG1 - Scientific session: Body and carcass evaluation by imaging technologies Classification of broilers using vision technology		
09:30-09:40	Paula Maas (DE)	In vivo phenotyping of carcass traits in mirror carps (Cyprinus carpio) using ultrasound, microwave and linear measurements
09:40-09:50	Sotiria Vouraki (GR)	The effect of breed, sex and degree of maturity of lambs on the ribeye area
09:50-10:00	Sofia-Afrodite Termatzidou (GR)	Relationship between body condition score and ultrasound measurements of back fat thickness in dairy Chios ewes
10:00-10:10	Neil Clelland (UK)	Genetic parameters for growth, carcass composition and IMF in Texel sheep measured by CT and US
10.10-10.30	Gérard Daumas (FR)	WG1 posters speed-presentation
11:00-11:10	Nicola Lambe (UK)	Genetic control of CT-based spine traits in elite Texel rams
11:10-11:20	Lutz Bünger (UK)	Selecting terminal sire breed rams for LMP- effects on their crossbred lambs
11:20-11:30	Maria Font i Furnols (ES)	Tissue volumes of live pigs from computed tomography images with and without viscera
11:30-11:40	Michael Judas (DE)	Hounsfield distributions from different CT protocols
11:40-11:50	Mathieu Monziols (FR)	Evaluation of performances on density and volume measurement accuracies of different European CT scanners
11:50-12:00	Gérard Daumas (FR)	Imaging facilities and image analysis for body composition of farm animals in Europe
14:00-14:20	Örs Petnehazy (HU)	From cross section to 3D anatomy (problems and solutions)
14:20-14:40	Tamas Donko (HU)	FAIM WG1 summary (2012-2015)
14:40-15:00	Eli V. Olsen (DK)	Looking into the future

Posters		
Poster 1	Ana Catharina Batista (PT)	Use of real time ultrasonography and image analysis to study relative growth of subcutaneous fat and muscle depths of ewes
Poster 2	Alfredo Teixeira (PT)	Linear modelling to predict simultaneously sheep and goat carcass parameters using in vivo ultrasound data and body weight
Poster 3	Severiano Silva (PT)	Using computer tomography to predict composition of light carcass kid goats
Poster 4	Peter Polak (SK)	Muscle development as characteristic for beef production in 3 indigenous breeds of cattle in Lithuania
Poster 5	Beata Grzegrzółka (PL)	CT phenotyping of carcass traits in mirror carps (Cyprinus carpio)
Poster 6	Beata Grzegrzółka (PL)	Image analysis of CT scans to predict fat content in mirror carps (Cyprinus carpio)
Poster 7	Stijn Hellebuyck (BE)	Evaluation of CT protocols for optimized volume regression of lean meat in pig carcasses
Poster 8	Cristina Zomeño (ES)	The influence of the sex type on the mineral component growth in pigs
Poster 9	Albert Brun (ES)	Influence of feeding restriction on body composition of growing gilts evaluated in vivo by computed tomography
Poster 10	Marina Gispert (ES)	Accuracy of computed tomography equation for simplified dissection to predict lean meat content from full dissection
Poster 11	Dennis Brandborg Nielsen (DK)	Analysis of lean meat percentage analysis of pig carcasses: Comparison of two different scanner settings and two different segmentation methods
Poster 12	Aneka Bauer (DE)	Validity of classification equations for boar carcasses
Poster 13	Antoine Vautier (FR)	Definition of standards for anatomical specifications of French cuts of pork meat

Detailed Scientific Programme

WG2 - Scientific session: Meat quality

Wednesday 23rd September		
08:30-09:00	Cameron Craigie (NZ)	Spectra-based techniques for predicting meat quality - an Australasian perspective
09:00-09:30	Heinar Schmidt (DE)	Raman Spectroscopy for the Assessment of Meat Quality
09:30-09:40	María Victoria Sarriés (ES)	Measurement of meat foal characteristics by Mid-infrared spectroscopy (MIR)
09:40-09:50	Silvia Ampuero Kragten (CH)	Physico-chemical data improves prediction models for drip loss with NIRS in pork slices
09:50-10:00	Elena Fulladosa (ES)	Laser backscattering imaging to determine proteolysis index and texture defects in dry-cured ham
10:00-10:10	Maren Bernau (DE)	Could the testicle volume be an indicator for Androstenon levels in the carcass fat? - preliminary results
10:10-10:20	Trinidad Pérez-Palacios (ES)	Low-field MRI and computational texture features to predict moisture and lipid content of loins
10:20-10:30	Maria Font i Furnols (ES)	Handbook on reference methods for meat quality determination and a WG2 summary
Posters		
Poster 1	Teresa Antequera (ES)	Low field-MRI to study the cohesion of dry-cured stuffed deboned shoulders from Iberian pigs
Poster 2	Mar Avila (ES)	Computational 3D texture features to predict sensorial traits of Iberian loin based on MRI
Poster 3	Pablo García Rodríguez (ES)	Using data mining and computational texture features on MRI to estimate salt content on Iberian ham
Poster 4	Pere Gou (ES)	Automated marbling grading system for dry-cured ham based on computer image analysis
Poster 5	Kizkitza Insausti (ES)	Effect of feeding diet on beef NIR-infrared spectra
Poster 6	M. Jose Beriain Apesteguia (ES)	Measurement of texture characteristics of beef by Mid-infrared spectroscopy (MIR)
Poster 7	Thierry Lhommeau (FR)	Thermal imaging use for heat treatment qualification: the case of singeing

Poster 8	Ana Catharina Batista (PT)	Using a computer vision system for the determination of muscle longissimus dorsi colour in CIELab space
Poster 9	Adam Stuart (NZ)	Real-time non-destructive spectral imaging technologies to determine lamb quality
Poster 10	Severiano Rocha e Silva (PT)	Intramuscular fat and adipocytes diameter in the longissimus thoracis et lumborum muscle from cull ewes with different body condition
Poster 11	Violeta Razmaitė (LT)	Intramuscular fat quality indices of farm and wild animals in relation to healthy nutrition
Poster 12	Martina Gondeková (SK)	Meat and sensory quality of different cattle categories in Slovakia
Poster 13	Daiva Ribikauskiene (LT)	Fatty acid composition of the Longissimus dorsi muscle and subcutaneous fats of different pig breeds

WG3 - Scientific session: Software & databases

Tuesday 22nd September		
15:00-15:15	Thomas Martini Jørgensen (DK)	Artefact removal in Differential Phase Contrast X-ray Computed Tomography
15:14-15:30	Harvey Ho (NZ)	Generic Software Modules for the Meat Industry
16:00-16:15	György Kovács (HU)	Alternatives of PLS regression for the estimation of weight from CT images
16:15-16:30	Daniel Caballero (ES)	From 2D to 3D texture features on MRI to analyse Iberian loin

WG 4- Scientific session: Traceability

Tuesday 22nd September		
16:30-17:00	Elly Navajas (UY)	Farm-to-fork individual traceability in Uruguay: applications in animal production and breeding
Posters		
Poster 1	Andrew Moxey (UK)	Electronic Tracing of Livestock in Scotland

Detailed Scientific Programme

WG2 - Scientific session: Meat quality

Tuesday 22nd September		
17.00-17.10	Maria Font i Furnols	WG2 Posters - speed presentations

Chairman's session

Tuesday 22nd September		
17:10-17:20	Willie Thomson	From 2D to 3D: Current and future use of live imaging in practical livestock production
17:20-17:30	Nigel Perry	Latest developments in the design of Computed Tomography for Animals
Wednesday 23rd September		
11:00-11:30	David Hopkins	Australian view on lamb carcass and meat quality- the role of measurement technologies in the Australian sheep industry
11:30-12:00	Graham Gardner	The use of X-ray technologies to determine carcase composition at abattoir "chain-speed",
12:00-12:30	Tobias Schwarz	Computed tomography of veterinary patients – And how to print them out in 3D
12:30-12:40	Axel Hinz	Assessment of Marbeling using VIA
12:40-12:50	John Gilchrist	Hyper-Spectral Imaging Across the Spectrum
12:50-13:00	Claire Morgan-Davies	Integrating EID technology into hill sheep farming management

Bus Stops On the Way to RIB

Introduction to FAIM

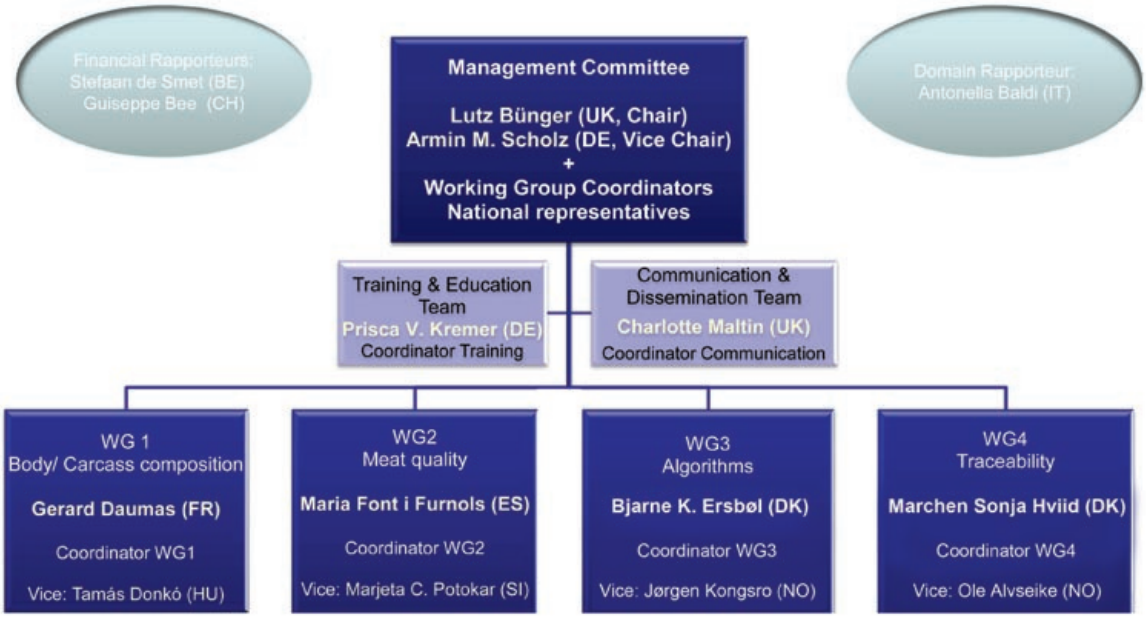
COST Action (FA 1102) from 20/11/2011 until 20/11/2015

Optimising and standardising non-destructive imaging and spectroscopic methods to improve the determination of body composition and meat quality in farm animals

Summary

This unique COST-Action FAIM brings together > 320 experts from 23 (27) EU countries (and beyond). It aims to optimise non-destructive *in vivo* (*iv*) and *post mortem* (*pm*) imaging and spectroscopic methods for the measurement of body composition and meat quality (MQ) in major farm animal species and to devise standardised principles of carcass classification and grading (CCG) across countries. This is necessary for the development of value-based- payment and marketing systems (VBMS) and to meet the urgent need for market orientated breeding programmes. FAIM encompasses collaboration of hard- and software manufacturers with livestock and imaging academic experts to develop required products for implementing the scientific work. FAIM will coordinate and strengthen EU scientific and technical research through improved cooperation and interactions. This will be essential for achieving the required advances in CCG systems to measure carcass yield and MQ, to meet the industry need for VBMS, and to improve production efficiency throughout the meat supply chain. FAIM will also support EU legislation on individual animal identification through showing additional benefits\ of feeding back abattoir data on individual animals for optimising management, breeding and providing phenotypic information, which will facilitate future implementation of genome-wide- selection. The main aim of FAIM is to identify, optimise and standardise non-invasive in vivo and post-mortem imaging and spectroscopic methods for the measurements of body composition and meat quality in major farm animal species, to integrate automated systems for their objective assessment, and to facilitate effective data capture and management at the individual animal level.

Organisational Structure



Objectives

The main aim is to identify, optimise and standardise non-invasive in vivo and post mortem imaging and spectroscopic methods for the measurements of body composition and meat quality in major farm animal species, to integrate automated systems for their objective assessment, and to facilitate effective data capture and management at the individual animal level.

- To review and develop robust references from imaging technologies for measuring body composition.
- To review and develop harmonised procedures for in vivo, post-mortem and on-line imaging methods of predicting compositional traits.
- To review and develop harmonised procedures for in vivo, post-mortem and on-line imaging and spectroscopic methods of predicting Meat Quality in livestock.
- If full automation cannot be achieved, a lesser option is provided by semi-automatic methods, where results are obtained though human-computer interaction.
- To review and harmonise methods and equipment for individual animal traceability to optimise management, breeding and permit the future use of genomics.

Working Group Activities

Working Group 1: Body/Carcass composition

- knowledge exchange to develop harmonised procedures for in vivo, post-mortem and on-line imaging methods of predicting compositional traits.
- to agree on a strategy for defining references for compositional traits and evaluating their robustness.
- to coordinate creating an imaging toolbox comprising phantoms and a 3D atlas/template of body composition as a reference tool for further research.
- to review available hardware and equipment.

Working Group 2: Meat Quality

- to review existing procedures and equipment for in vivo, post-mortem and on-line imaging and spectroscopic methods of predicting MQ in livestock and suggest models to harmonise those.

Working Group 3: Algorithms

- to develop algorithms for data capture and automated or semi-automated processing and to review available software.
- to coordinate building of a data warehouse (database structures and software) enabling efficient data storage and access, matching compositional and MQ data with pedigree and other performance records. This will allow across flock/herd, breed and country evaluations.

Working Group 4: Traceability

- to review and evaluate existing systems and implementations of individual animal traceability systems with special focus on traceability in the abattoir.
- to evaluate the importance of biopsying and electronic ID-tags, including data acquisition and storage from farm through abattoir for feedback to farmers to optimise management, breeding and the future use of genomics.

See also "memorandum of understanding": http://www.cost.eu/domains_actions/fa/Actions/FA1102?management

Management Committee Profiles

Prof. Lutz Bunger
Chair of COST Action FAIM

PROFILE

Lutz received the Dipl.-Biol. Degree 1975 from the Humboldt University in Berlin, and the PhD from the Academy of Agric. Sciences in 1979. He has been working for 37/20 years in the field of quantitative and molecular genetics, respectively in different species, from model animals (mice) to pigs and sheep; initially at an Institute in Germany, then at the University of Edinburgh and subsequently for an internationally operating pig breeding organisation (Cotswold, UK) and since 2002 at SRUC. Here he works in the Animal and Veterinary Sciences team and leads the growth Genetics Section working mainly on sheep breeding and genetics, but also on other farm animals. The computer tomography unit and the experimental sheep unit are also part of this section. Since working at SRUC he has been Project leader/Senior Researcher of several Defra, Scottish Government or LINK funded projects mainly related to the genetics of sheep, disease resistance, growth, body composition, meat quality and meat eating quality using computerised tomography and a video image analysis (VIA) system in an abattoir. His group recently evaluated the effects of some ovine muscling genes, trialled lamb VIA for its use in the UK and calibrated VIA and CT against dissection. Recent work aims to implement genome wide selection in small ruminants. He has been involved in numerous applications for funding to Defra, LINK, BBSRC, Wellcome Trust, European Funding bodies and to the TSB. Recently he became Reader for quantitative and molecular Genetics and Professor for Growth Genetics. The main fields of his research interests are the use of new technologies in animal breeding. He has published >150 papers in peer reviewed journals.

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Prof. Armin M. Scholz
Vice Chair of COST Action FAIM

PROFILE

Armin gained his Diploma in Animal Production after studying agriculture at University Leipzig and Humboldt University Berlin in 1988. He gained the Doctorate degree in Animal Breeding (lean tissue growth in swine selection) from Humboldt University Berlin in 1990.

He held Post Doc positions as Animal Breeding Scientist at Humboldt University Berlin, at the Institute of Animal Breeding of the Federal Research Institution in Mariensee, Germany, and at the Growth Biology Laboratory of the ARS-USDA in Beltsville in combination with Howard University Washington, DC between 1990 and 1999. The stay in Beltsville/Washington, DC was supported by a Feodor Lynen Fellowship of the Alexander von Humboldt Foundation, Bonn, Germany (18 months) and later by an OECD grant (6 weeks).

This was followed by a post as Senior Animal Breeding Scientist, Research Leader, and Lecturer at the Livestock Center of the Veterinary Faculty of Ludwig Maximilians University Munich in 1999.

Armin received his Venia Legendi for Animal Breeding and General Agriculture based on his Habilitation thesis with the main topics of magnetic resonance spectroscopy/imaging, and dual energy X-ray absorptiometry in pigs of different stress susceptibility in 2003. He became an Academic Director in 2011. His main research interests and expertise are farm animal imaging, breeding and genetics + dairy cattle management by using robot milking.

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Prof. Charlotte Maltin
Biomics Limited, UK

PROFILE

Charlotte Maltin is a muscle biologist and has worked in animal production and meat quality. She is interested in imaging, and in the use of imaging based methods to measure body composition and meat quality. She is the managing director of Biomics Ltd, a company specialising in research, innovation and technology exchange

Coordinator for Communication and Knowledge Exchange.

The aim of the COST Action FAIM is to optimise and standardise non-destructive imaging and spectroscopic methods to improve the determination of body composition and meat quality in farm animals.

Communications within FAIM are achieved through:

(i) working together in the training camps organised by the work group leaders, through visiting other science groups in the Short Term Scientific Training Missions (STSMS), through working together in the working groups (WG) and at the Management Committee (MC)-meetings and at the annual conference.

FAIM III conference at Copenhagen 2014

Training school 2014

(ii) through the publication of joint papers based on our research and by publishing papers based on the presentations given at our annual meetings

(iii) through our website: http://www.cost-faim.eu which is now getting visits from people from many different countries all over the world.

Management Committee Profiles

Maren Bernau – Ludwig-Maximilians University Munich, Germany

PROFILE

Maren Bernau studied veterinary medicine at the Justus-Liebig-University Giessen from 2003-2009. She obtained her doctoral thesis at the Livestock Center Oberschleiss-heim of the Veterinary Faculty of the Ludwig-Maximilians University, Munich in 2011. Subsequently she worked at the Institute for Animal Science of the Rheinische Friedrich-Wilhelm-University, Bonn from 2010-2011. From 2011 until now, she works as a scientist at the Livestock Center Oberschleissheim. The main field of her research is the use of imaging methods in farm animals (mostly pigs, sheep and calves).

COST funding offers the possibility of so called Short-Term Scientific Missions (STSM). The aim of an STSM shall be contribute to the scientific objectives of FAIM. These missions are aimed at strengthening the existing networks by allowing scientist to go to an institution or laboratory in another COST country to foster collaboration, to learn a new technique or to take measurements using instruments and/or methods not available in their own institution/ laboratory. They are particularly intended for young scientists. STSMs can be from one week up to 3 months or even 6 months for early stage researchers (ESR; PhD + 8 years). The missions are supported by fixed grants of up to 2500, - EUR or 3500, - EUR in case of ESR and a duration of more than 3 month.

Since 2012, FAIM supported already 26 missions. The missions involved both industry and research facilities. Everybody in the FAIM network was invited to send an application for an STSM including a short project outline relevant to the FAIM objectives.

Furthermore, FAIM initiated Training Schools dealing with different FAIM topics. This year we planned two training schools.

The first was held in Monells-Girona, Spain, organized by Maria Font I Furnols and her team about "non-destructive on-line technologies to determine quality of meat and meat products: functioning principle and chemometrics". Trainees from 11 countries were supported by FAIM to join the training school.

Monells-Girona training school

Our latest training school was held in August 2015 in Lyngby, Denmark, only four weeks ago, dealing with "Big Data, Data Warehousing, and Data Analytics", organised by Marchen Hviid and Bjarne Kjaer Ersbøll.

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Neil Ramsay – Representative of the 'Grant Holding Institute': SRUC, Edinburgh, UK

PROFILE

Neil Ramsay is an administrator at Scotland's Rural College (SRUC) and is the FAIM grant holder. Neil is responsible for administration of European Commission funded research at SRUC including the FAIM COST Action for which Neil is the Grant holder, administrator and secretary to the Management committees (MC8 & MC40).

SRUC

You can learn more about SRUC at: http://www.sruc.ac.uk

Research at SRUC is focused on rural, environmental and land-based activity and underpins our education and consultancy. Our work addresses health and productivity in animals, animal welfare and crops, promotes low carbon farming and increases farm output through efficiency and innovation.

Our vision is to be a dynamic and innovative research community that benefits the rural economy and rural communities and enhances their environment through the following Research Groups:

Animal & Veterinary Sciences - Our strengths are in a number of science areas particularly genetics, animal behaviour, nutrition and epidemiology.

Crop & Soil Systems - Our vision is to be recognised for the quality of our science and knowledge exchange with stake-holders, to benefit crop production and health, the environment, and the rural economy.

Future Farming Systems - Our interdisciplinary research aims to understand and meet the needs of a wide range of future farming systems.

Land Economy, Environment & Society - Our research aims to improve the economic, environmental and social sustainability of rural areas in particular development of sustainable agricultural systems and food supply chain.

Our Research Strategy

- To do excellent strategic and applied research on the global and local food security issues, and to actively support the translation of research results into practice. Our research ethos is strongly collaborative, and we have a long history of industrial, NGO and academic partnerships locally and internationally.
- As well as having longstanding disciplinary strengths in several key areas, we actively promote interdisciplinary research, especially linking natural and social sciences.
- We have a particular interest in research that helps inform policy, with Scottish and UK Government rural affairs and environment departments and the EU as key research clients.

Our Key Resources

- Experimental farms including main livestock and crop species
- Plot-scale agronomy trial capability
- Nitrous oxide emission measurement equipment
- Individual food intake measurement facilities for dairy and beef cattle
- Methane measurement facilities for livestock
- Suite of techniques for monitoring animal behaviour
- CT and ultrasound scanning facilities
- Animal and crop science laboratory facilities

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WG1 – Body / Carcass composition

Chair of WG1

Gérard Daumas - Institute for Pig & Pork Industry, Le Rheu, France

■ PROFILE

Gérard graduated as agronomist engineer from the Agronomy High National School of Rennes in 1981. He has been working for 30 years in IFIP (formerly ITP: Technical Institute for Pig) and since 1989 in the carcass and meat quality department in Brittany. Since 1990, he has been the French expert for pig grading in the EU working group. He evaluated and calibrated several imaging techniques for carcass composition, including ultrasound, Video Image Analysis (VIA), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT).

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Vice Chair of WG1

Tamás Donkó - Kaposvár University, Institute of Diagnostic Imaging and Radiation Oncology, Kaposvár, Hungary

■ PROFILE

He obtained his MSc degree (1998) in animal science. Tamás undertook his PhD research studying the atrophic rhinitis of pigs using CT imaging. He has been working as a researcher at the Kaposvár University (Hungary), Institute of Diagnostic Imaging and Radiation Oncology since 2007. He is responsible for the CT based animal breeding programs (poultry, rabbits) and further research areas including in vivo and post-mortem CT and MRI examinations for animal breeding and veterinary purposes.

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WG1 – Summary of 2012-2015 activities and WG01T12

The main objectives of Workgroup 1 were to develop harmonised procedures for iv, pm and on-line imaging methods of predicting compositional traits and to coordinate the building of a 3D atlas/template per species as a reference tool for further research.

From 2012 to 2015 WG1 organised the scientific session of four Annual Conferences (AC), seven Workgroup Meetings (WM) and one Training School (TS); WG1 took part in seven Short-Term Scientific Missions (STSM).

Altogether 77 presentations were given at the AC, with a further 36 talks and 41 posters. There was an even spread of the presentations with a 50%-50% focus on in vivo and on carcass examinations. The majority of the presentations were on pigs (31), while there were 26 presentations on ruminants (cattle, sheep, goat), four on poultry as well as on rabbits, 2 on horses, 5 on fish, 1 on mice and 2 on phantoms.

CT imaging modality was the most popular modality appearing in 42 presentations, visual methods appeared 13 times, MRI 7 times, US 11 times and DEXA in 5 studies.

Most of the WM were in connection with the AC, but three were not: (1) in Jan. 2013 in Lyngby (DK) about "Use of phantoms in computed tomography", (2) in Aug. 2013 in Nantes (FR) during a specific combined WG1-WG2 session of EAAP, (3) in Nov. 2014 in Paris (FR) about "CT as a reference for carcass composition".

The TS was held over three days in October 2013 in Rennes. The topic was: "Pig carcass composition measurement by CT and MRI - Live Pig measurement by CT- From acquisition to data analysis". Twelve trainees from 12 countries took part in the TS as well as four trainers.

The seven STSM assigned only or partly to WG1 involved the eight following countries, once or several times: BE, DE, FR, HR, IT, LT, PL, SK.

WG2 - Meat Quality

Chair of WG2

Maria Font-i-Furnols - IRTA Monells, Catalonia, Spain

■ PROFILE

Maria Font-i–Furnols is Chair of Working Group 2 (WG2). She is researcher at the Institute of Food Research and Tech-nologies (IRTA) in Monells, Catalonia, Spain. She belongs to the Product Quality Program. She has a MSc in Agricultural Engineering (1994) from the University of Lleida and the PhD (2000) from the Polytechnics University of Catalonia. She has worked mainly on boar taint, consumer studies, carcass classification, statistics and in the use of computed tomography to evaluate carcass and meat quality. She has participated in several EU and National Projects and contracts with private enterprises. She coordinated National projects in which computed tomography is used to determine pigs' body composition. She is the author of more than fifty-five peer reviewed papers, a high amount of professional papers and conference contribution and six book chapters.

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Vice Chair of WG2

Marjeta Čandek-Potokar - Agricultural Institute of Slovenia

■ PROFILE

Marjeta (Meta) graduated from the Biotechnical faculty of University of Ljubljana as zootechnical engineer in 1988 and began in the same year her career as a researcher at the Agricultural Institute of Slovenia where she is still working. In 1991 she finished an MSc (food science; Université Blaise Pascal, Clermont-Ferrand, France) and in 1997 she got her PhD (food science) at the Biotechnical Faculty (University of Ljubljana). The main area of her research is the quality of animal products (carcass, meat) in connection to related zootechnical factors. She has been involved in several EU projects (e.g. EU-PIGCLASS, YOUNG TRAIN, PIGCAS TRUEFOOD) and coordinated several national projects. In 2004 she habilitated at the Faculty of Agriculture and Life Sciences (University of Maribor) and is a lecturer in field of carcass quality and meat processing. Current research topics comprise: (i) entire male issues (boar taint, immunocastration, nutrition, product quality), (ii) salt reduction in dry cured hams, (iii) developments in carcassclassification, (iv) use of NIRS for meat qualityassessment. She has published more than 60 peer-reviewed scientific papers, numerous professional articles, conference contributions and professional monographs.

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WG2 - Overview

The main objective of WG2 is to review existing procedures and equipment for in vivo, post-mortem and on-line imaging and spectroscopic methods of predicting meat quality in livestock and suggest models to harmonise those.

The detailed objectives are:

- Meat quality parameters evaluated with non-invasive techniques: errors and main traits;
- Imaging and spectroscopic methods: which ones, main characteristics, advantages and disadvantages of each method;
- Revision of the data analysis performed and study of the use of different statistical approaches;
- To develop standardised procedures for the calibration sampling according to meat quality traits and species;
- To investigate possible harmonisation among laboratories and methods for each technology and meat quality parameter.

To achieve these objectives the following has been done:

- Identify relevant meat quality parameters for pig, beef, sheep and poultry;
- Identify reference methods to determine the identified meat quality parameters and do a handbook of them, including statistical aspects and review of new technologies.
- Value of each outcome for the interested parties evaluated.

WG3 – Algorithms

Chair of WG3

Bjarne Kjær Ersbøll - Technical University of Denmark

■ PROFILE

Bjarne Kjær Ersbøll is Chair of WG3. His work is mainly on applied image analysis and statistics. He has considerable experience in the application of these disciplines in industrial, medical and remote sensing projects. His research and teaching is largely inspired by finding solutions to actual problems in industry and other institutions - and often in collaboration with these. Bjarne Kjær Ersbøll is a Professor in statistical consultancy at Department of Applied Mathematics and Computer Science at the Technical University of Denmark. In 1983 he received the M.Sc.(Eng.) degree and in 1990 the Ph.D. degree, both from the Technical University of Denmark (DTU). He has held his current position as Professor since 2010. He teaches image analysis (general) and statistics (especially multivariate statistics). He has supervised a very large number of master's thesis projects and also Ph.D. thesis projects. Furthermore, he has organised or co-organised a large number of conferences on image analysis and statistics.

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Vice Chair of WG3

Jørgen Kongsro - Norswin, Norway

■ PROFILE

Jørgen Kongsro is Deputy Chair of WG3. He received his M. Sc. Degree in Food Science in 2002 from the Norwegian University of Life Sciences (NMBU), and received his Ph.D. degree in Food Science / Bioinformatics at the same university in 2008. Kongsro worked as a project manager at Animalia (Norwegian Meat and Poultry Research Center) from 2002 to 2008 while taking his Ph. D. degree at NMBU from 2004 to 2008. In 2008, he started working in pig breeding for Norsvin. His main task is to develop and run the use of Computed Tomography (CT) and ultrasound in the large-scale boar and gilt test system at Norsvin, in addition to other task related to data collecting / phonemics. He enjoys working at the intersection between biology, agriculture, engineering and computers. Finding practical solutions based on science to improve the production of food from farm to fork. Improving animal and farmer welfare based on engineering and clever solutions. The main field of interests are meat science, computer programming, application development, image analysis, computed tomography and genetics.

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WG3 – Overview

The main objective of Work Group 3 is to develop algorithms for data capture, processing, storage and interrogation as well as review available software. The practical objectives are:

- To exchange ideas on data capture, data safeguard and data transfer
- To improve the tissues segmentation and its automation
- To develop algorithms for automation of image analysis
- To develop prediction equations for different tissues based on generated parameters from the image analysis and carcass dissection data
- To discuss ideas on formats for data storage
- To discuss methods of statistically analyzing the resulting predicted data for input into decision support tools for advising farmers and processors on how to produce the best quality product

The outcomes and deliverables will be:

- Algorithms, software, prediction equations and recommendations for data management, image analysis and statistical issues.
- Also, WG3 has held several successful training schools within its area.

The software used for image analysis in COST-FAIM can be found at:

https://sites.google.com/site/costfaimwg3

WG4 - Traceability

Chair of WG4

Marchen Hviid - Danish Meat Research Institute (DMRI), Denmark

■ PROFILE

Marchen Hviid is researcher at Danish Meat Research Institute (DMRI), a division in Danish Technological Institute. Marchen is Senior Project Manager and Scientist in Measuring Systems and IT. She is MSc in Animal Science and has been working with measuring of carcass and meat Quality in Beef and Pork, with requirement from consumer and the possibility to fulfil the requirements by different measuring techniques.

Documentation of the quality and tracking in the supply train is a naturally part of the quality work and Marchen had also projects in that area.

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Vice Chair of WG4

Ole Alvseike - Animalia, Norway

■ PROFILE

Ole Alvseike is Head of Division Quality & Processing at Animalia – the Norwegian Meat and Poultry Research Centre, Oslo. He has a veterinary degree from the Norwegian School of Veterinary Sciences. He has been large animal practitioner and worked for the National Food Authority locally and centrally. After his Ph.D. in food safety, he worked for a year at the National Institute of Public Health, Oslo and has been at Animalia for 12 years.

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WG4 - Overview

- The main objective for WG4 is to review and harmonise methods and equipment for individual animal traceability to optimise management, breeding and permit the future use of genomics. WG4 will focus on traceability from farm to fork, with special attention to transfer the data registered at the slaughterhouse back to the breeder.

The detailed objectives are:

- to review and evaluate existing systems and implementations of individual animal traceability systems with special focus on traceability in the abattoir
- to evaluate the importance of biopsying and electronic ID-tags, including data acquisition and storage from farm through abattoir for feedback to farmers to optimise management, breeding and the future use of genomics.
- Promote the use of individual animal data in the meat chain
- Develop the structure of information flow and data format between farmers, abattoirs and advisers

The tasks are the following:

- Identification and registration (I&R) at all stages of an animal's life, and in any part of the food production process regarding to:
- farm management,
- animal recording,
- animal breeding,
- health and disease surveillance.
- Individual animal based feedback system is essential if information on carcass and MQ is to be combined with other individual information
- The Challenges are the following:
- Ownership of data?
- Harmonize between partners in the chain and between chains?

WG1 Speaker Profiles & Abstracts

Paula Maas – University of Applied Sciences Weihenstephan-Triesdorf, Germany

PROFILE

Paula graduated from the faculty of veterinary medicine of the Ludwig Maximilians University Munich in March 2014.

Currently she is working on her PhD thesis on in vivo phenotyping of carcass traits in mirror carps (Cyprinus carpio) using ultrasound, computed tomography, microwave technology and linear measurements in order to determine the carcass quality. At the same time she is studying agricultural science at the Technical University Munich.

ABSTRACT (WG 01T01)

In vivo phenotyping of carcass traits in mirror carps (Cyprinus carpio) using ultrasound, microwave and linear measurements

In Germany, the carp is the second most important culinary fish after the rainbow trout. In order to insure product quality and achieve high customer acceptance, strict requirements such as regarding the fat content of the fish (maximum of 10% of the fillet including the skin) have been set. This product specification requires a reliable method to predict the carcass composition in live fish. Previous studies have shown high correlations between the fat content of the fish and its back fat layer, measured at the split carcass using a calliper. Therefore, during this study a total number of 307 live mirror carps originating from 6 different ponds were measured using a mobile ultrasound device (MicroMaxx, Fujifilm SonoSite, Frankfurt a. Main, Germany) and a Fish Fatmeter (Distell, Fauldhouse, Scotland, UK; microwave technology). Additionally their weight and several linear measurements (lengths, height and several circumferences) were taken. The ultrasound measurements were performed using a narrow water-filled bowl as fixation for the non-sedated fish. Within this set-up the water itself was used as transmission medium for the ultrasound waves. Two sagittal images per fish were taken, which were used to measure the back fat thickness at five different points. Subsequently the fish were taken out of the water and the Fish Fatmeter was used to determine the fat content of the whole body; Additionally the weight and linear measurements were taken using a scale and a measuring tape. After the in vivo measurements 10 fish per pond were slaughtered and dissected. The back fat thickness was measured using a calliper before chemical analysis of one fillet of the carcass was performed.

Using the statistic software RStudio (Boston, US), first results showed an R2 of 0.94 ($p<0.001$; $n=61$) for the measurements by using microwave technology in live fish and chemical analysis; therefore for further calculations the microwave technology will be used as the gold standard for the remaining 246 fishes. Furthermore preliminary results using single correlations showed an R2 of 0.52 between the back fat layer thickness measured by ultrasound and the fat content determined by chemical analysis. Using multiple linear regression models based on ultrasound and several different linear measurements, compared to chemical analysis, an R2 of 0.76 was generated.

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3. Bavarian State Institute of Fisheries, Höchstadt a. d. Aisch, Germany;
4. Ludwig-Maximilians-University Munich, Department of Food Safety, Oberschleissheim, Germany

Notes

WG1 Speaker Profiles & Abstracts

Sotiria Vouraki – Aristotle University of Thessaloniki, Greece

PROFILE

Sotiria graduated from the School of Veterinary Medicine of the Aristotle University of Thessaloniki in 2014 and she is currently a PhD candidate at the School. She is involved in two research projects: i) "Development methodology using best management practices for improving the functioning and efficiency of milking parlours" and ii) "Development and assessment of equipment and construction issues for the sustainable sheep and goat production" that are funded by industry and the Greek General Secretariat for Research, respectively

ABSTRACT (WG01T02)

The effect of breed, sex and degree of maturity of lambs on the rib-eye area

The objective was to assess the effect of breed, degree of maturity, sex, live weight at slaughter and post-weaning nutritional management on the rib-eye area of lamb carcasses of three indigenous dairy Greek breeds of sheep: Karagouniko (K), Boutsko (B) and Serres (S). Lambs were used in two different experiments. In trial 1, lambs were offered ad libitum a pelleted concentrate feed and Lucerne Hay (100g/head/day). Forty lambs of each breed (20 males and 20 females) were used. They were assigned to be slaughtered at five different degrees of maturity, 25%, 35%, 50%, 70% and 100% (4 lambs of each sex in each degree of maturity). In trial 2, 36 lambs (males) from each breed were used. They were offered ad libitum Lucerne Hay and a pelleted concentrate feed at three different levels: high (H), medium (M) and low (L). Lambs were slaughtered at three different live weights, 23kg, 28kg and 33kg (4 lambs per level of nutrition and live weight at slaughter). The cold carcass of lambs was split half in following the vertebral column. The left side was cut between the 12th and 13th rib in order to measure the rib-eye area. Acetate paper was used to draw the rib-eye area. Thereafter the resulted imprint was scanned and stored as a jpeg image. Those images were further processed to estimate the rib-eye area (cm2) using the Java-based software ImageJ. In trial 1, the increase of rib-eye area was proportional to changes in degree of maturity. With the exception of carcasses at 25% and 35%, in all the other degrees there were significant differences ($P<0.05$). The effect of sex was significant ($P<0.05$) for all breeds with male lambs having larger rib-eye areas than females. A significant interaction between degree and sex was observed only in Karagouniko lambs. In trial 2, the increase of live weight at slaughter resulted in increased rib-eye area. There were significant differences ($P<0.05$) in carcasses at 23kg and 33kg for all breeds. Level of nutrition did not have any significant effect but breed was a dominant factor regarding differences in rib-eye area ($P<0.05$) in both trials.

Co -Authors:
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Reference:
Ferreira O.G.L., Rossi F.D., Coelho R.A.T., Fucilini V.F., Benedetti M., 2012. Measurement of rib-eye area by the method of digital images, R. Bras. Zootec. Vol.41

Notes

WG1 Speaker Profiles & Abstracts

Sofia-Afrodite Termatzidou – Aristotle University of Thessaloniki, Greece

PROFILE

Sofia-Afrodite is on her 1st year of PhD studies at the Laboratory of Animal Husbandry. She has a master in Farm Animal Husbandry and Medicine and also works as a veterinarian in a sheep and goats' farmers association (Pieria, Greece). She attended the training school "Non destructive on-line technologies to determine quality of meat and meat products: functioning principles and chemometrics", organized by IRTA and financed by FAIM cost action. She is currently involved in two research projects: i) "Development methodology using best management practices for improving the functioning and efficiency of milking parlours" and ii) "Development and assessment of equipment and construction issues for the sustainable sheep and goat production" that are funded by industry and the Greek General Secretariat for Research, respectively.

Relevant presentation:
Termatzidou S.A., Valergakis G.E., Patsikas M., Bramis G, Arsenos G. "Relationship between body condition score and ultrasonic measurement of backfat thickness in dairy Chios ewes". BSAS, Chester, April 14th -15th 2015

ABSTRACT (WG01T03)

Relationship between body condition score and ultrasound measurements of backfat thickness in dairy Chios ewes

The objectives of this study were two-fold; (1) to compare ultrasound measurements between two different anatomical regions and (2) to investigate the relationship between estimations of BCS (Body Condition Score) and ultrasound measurements of backfat thickness in dairy ewes of Chios breed. Thirty six adult were selected on the basis of their stage of production as follows: Group A: ewes at 3rd-6th month of lactation, Group B: ewes at 7th-8th month of lactation and Group C: dry ewes. From each group, 12 ewes were randomly selected. BCS was performed by palpation of the dorsal lumbar region (5-point scale, with 0.25 and 0.5 increments). The thickness of subcutaneous adipose tissue was measured by ultrasound between transverse processes of 12th and 13th thoracic and 3rd and 4th lumbar vertebrae, using Agroscan A16 with 7.5 MHz linear probe. Statistical analysis was performed using descriptive statistics and analysis of variance. Pearson's correlation coefficient (r) was used to display the relationship between the measurements in the above anatomical regions and the relationship between ultrasound measurements and assessments of BCS. Across groups there was a significant difference ($P<0.05$) for both BCS and ultrasound measurements. Lumbar and thoracic vertebrae ultrasound measurements ranged from 2.5 to 9.0 mm and 2.0 to 9.0 mm, respectively. Increments of BCS at 0.25 points did not always correspond to distinct ultrasound measurements. The correlation between measurements in the two anatomical regions was high ($r = 0.974$, $P<0.05$). Correlation coefficients between BCS and ultrasound measurements in thoracic and lumbar regions were 0.931 ($P <0.05$) and 0.916 ($P <0.05$), respectively. The high correlation between BCS and ultrasound measurements suggests that the development of a scale for BCS in dairy sheep would be facilitated by ultrasound technique. More data are needed for the refinement of the scale. Considering that this was a pilot study, the application of such methodology to a larger sample of ewe or even at population level of certain breed will strengthen the results, providing a widely accepted methodology.

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Reference:
Ferreira O.G.L., Rossi F.D., Coelho R.A.T., Fucilini V.F., Benedetti M., 2012. Measurement of rib-eye area by the method of digital images, R. Bras. Zootec. Vol.41

Notes

WG1 Speaker Profiles & Abstracts

Neil Clelland – Scotland's Rural College (SRUC), Scotland, UK

PROFILE

Neil is a final year PhD student at SRUC. He gained an honours degree in agriculture at SAC, completing a research project investigating the effect of butchery techniques on the tenderness of retail beef cuts from the forequarter. This project identified cuts that would normally be batch-processed with other lower value cuts, to be as tender as higher value cuts from the hindquarter. He then worked as a research technician with SRUC and in Nov. 2011 started his PhD. Neil's research interests lie in the development and investigation of in vivo predictors of meat quality in lamb and the inclusion of potential predictors in sheep breeding programmes in the UK. Other research interests include the measurement of meat quality both in vivo and post mortem and the developments in improving meat quality through animal breeding strategies and novel processing techniques. In addition to research he is keen on knowledge transfer and engages with researchers and industry bodies regarding some of the current issues in animal breeding and meat quality.

Recent publications using CT include:
Clelland, N. et al. 2014. Prediction of intramuscular fat levels in Texel lamb loins using X-ray computed tomography scanning. Meat Sci. 98:263-271.

ABSTRACT (WG01T04)

Genetic parameters for growth, carcass composition and IMF in Texel sheep measured by CT and US

O: The aim of this study was to estimate the genetic parameters of recently developed novel CT traits, and the genetic relationship of these traits and current growth, US and CT traits included in multi-trait selection indices.
B: It has been reported that CT scanning provides very good in vivo estimates of intramuscular fat (IMF) in the loin of Texel sheep (Clelland et al. 2014, Clelland PhD Thesis. 2015). The next stage would be the inclusion of these estimates into current commercial multi-trait selection indices. To enable this, genetic parameters including heritabilities and genetic relationships with traits currently included in the indices are required.

M&M: Data were available for 1971 entire male lambs with CT scanning records from 2002 to 2013, the progeny of 525 sires and 1576 dams. Growth, CT and US measurements were available across the dataset, including IMF content as predicted by CT, firstly including CT carcass fat measures (PIMF1) and independent of CT carcass fat measures (PIMF2). Data were corrected for fixed effects and genetic analysis performed (REML) using ASReml3 (Gilmour et al. 2003).

R&C: Moderate heritabilities were estimated for growth traits, with moderate to high heritabilities estimated for US and CT traits. Heritability estimates for PIMF1 and PIMF2 were moderate and similar (h2 = 0.36 and 0.31 respectively). Strong genetic correlations were seen between PIMF1 and CT and US fat traits (rg = 0.83 and 0.64), whereas the same relationship was not seen in PIMF2 and CT and US fat traits (rg=0.59 and 0.60). PIMF1 generally had a stronger genetic relationship with growth, US and CT traits than PIMF2, however both traits were highly genetically correlated themselves (rg=0.89). This study is among the first to present genetic parameters of novel CT derived IMF estimates and shows that accurate estimations of IMF are heritable and have the potential to be included into current selection methods. The parameters reported in this study can now be used to develop future breeding programmes.

Co-authors:
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WG1 Speaker Profiles & Abstracts

Nicola Lambe – Scotland's Rural College (SRUC), Scotland, UK

PROFILE

Nicola graduated with a BSc(hons) in Environmental Biology from St. Andrews University in 1994, followed by an MSc in Animal Breeding (1999) and a PhD (2005) from Edinburgh University. Nicola has been working for 19 years at SRUC on sheep breeding research projects and is part of the Growth Genetics Section within the Animal and Veterinary Sciences research group. Since 1997, she has been closely involved with the work of the CT unit, undertaking a PhD based on CT scanning of breeding hill ewes to assess seasonal tissue changes. The sheep genetic projects that she has been involved in have mainly been associated with breeding for improvements in carcass and meat quality, alongside traditional production and reproductive traits, and have considered both hill and terminal sire breeds. These projects have also involved evaluation of several techniques for measuring carcass and meat quality in live animals and carcasses, including ultrasound, CT, video image analysis and several mechanical, chemical and sensory meat quality tests. She has supervised 4 PhD students in these subjects (2 currently). More recently she has been involved in similar projects with beef cattle and pigs, as well as projects concerned with understanding and selecting for new traits in sheep, such as greenhouse gas emissions and disease resistance. Nicola has published 49 peer-reviewed papers, 3 book chapters and >50 conference proceedings.

Recent examples:

Lambe NR, Wall E, Ludemann CI, Bunger L, Conington J. 2014. Genetic improvement of hill sheep: impacts on profitability & greenhouse gas emissions. Small Ruminant Res 120:27-34.

Donaldson CL, Lambe NR, Maltin CA, Knott S, Bunger L. 2014. Effect of the Texel muscling QTL (TM-QTL) on spine characteristics in purebred Texel lambs. Small Ruminant Res 117:34-40.

ABSTRACT (WG01T05)

Genetic control of CT-based spine traits in elite Texel rams

O: The aim was to determine the divergence in vertebrae number and spine length in the thoracic and lumbar regions of elite commercial Texel sires and determine their genetic control.

B: Previous SRUC studies found variation in spine traits (vertebra number, spine length) in research flocks of Texel sheep, measured using CT topograms (Donaldson et al., 2013), and evidence of genetic control of these traits (h2 low to moderate; Donaldson et al., 2014). However, the structure of the data set limited that initial genetic analysis. Application of these findings in practical sheep breeding requires that the traits of interest can be easily measured on rams during routine commercial CT. However, the divergence of spine traits in elite rams, pre-selected for improved growth and composition, requires investigation. Robust genetic parameters are also required.

M&M: CT and pedigree records from 2583 commercial Texel rams were collected over 15 years. For the thoracic (Th) and lumbar (Lum) spine regions, vertebrae number (VN) and spine lengths (SL) were measured from CT topograms. Data were corrected for fixed effects and genetic analysis performed using ASReml v3 (Gilmour et al., 2009).

R&C: Variation was observed in SL (CV 6-8%) and VN: VNLum was 6 (64%) or 7 (36%); VNTh was 12 (4%), 13 (95%) or 14 (<1%); giving VNTh+Lum of 18 (2%), 19 (64%) or 20 (34%). Heritabilities for VN were low (0.05-0.11; s.e. 0.05) and for SL moderate (0.21-0.43; s.e. 0.06). Correlations with carcass composition and muscularity traits were low (-0.18 to 0.01), suggesting potential to select for spine traits without affecting current breeding goals.

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WG1 Speaker Profiles & Abstracts

Lutz Bunger – Scotland's Rural College, UK

PROFILE

See also earlier Profile. My work has been recognised in a number of ways: Readership, Pro-fessorship, invited lectures at uni-versities in various countries, member of international advisory boards, member of the organising committee for the 4th ICQG, 2012 in Edinburgh and organising and chairing a full day Symposium at the EAAP (Nantes, 2013), with up to 300 participants. Impact findings from our model species (mice) work: (i) Development of a stan-dardised test to quantify stress resistance and demonstration that simultaneous selection against a strong negative correlation is fea-sible. (ii) A powerful experiment (> 2500 M-D pairs) tested if litter size (LS) can be increased via selection for ovulation rate (OR). Although OR increased, there was no correlated effect in LS, because of higher embryonic mortality; (iii) Mapping work led to several QTL with subsequent fine mapping revealing several genes in the QTL region. (iv) MAI showed selection for fat and growth produced polygenic models with little contribution of expected candidate genes; (v) Myostatin deficiency results in excessive muscle growth, but impaired force generation and substantial epistasis has been found. Impact findings of our research (mainly sheep) at SRUC: (i)Validation trials for ovine QTLs and available genetic tests (muscling QTL and footrot) evaluated the magnitude of direct and indirect effects; (ii) We trialled ovine video-image-analysis to quantify carcass value for UK lambs and demonstrated its superiority over existing standards, finding moderate to high heritabilities; (iii) We identified/ optimised a unique in vivo CT-based predictor for meat quality, allowing simultaneous selection for taste and against waste; (iv) The genetic basis of spine characteristics in sheep is being investigated, yielding moderate to high h2-values, allowing potential selection for more, or larger, chops.

ABSTRACT (WG01T06)

Selecting terminal sire breed rams for LMP-effects on their crossbred lambs

O: The aim was to evaluate the effects of using Texel rams, diverging in their CT based measurement of lean meat percentage (LMP, here muscle weight over liveweight), on carcass quality of their crossbred lambs.

B: Earlier studies at SRUC have shown that video image analysis allows accurate prediction of the amount of saleable meat from lamb carcasses at line speeds of ~800 lambs/h (Rius-Vilarrasa et al. 2009). The increasing use of electronic ID by farmers, and tracking facilities in the abattoirs, will allow feedback of individual carcass information to farmers and its use for animal breeding. A promising trait to be used in future sheep breeding programs is a simple ratio between lean meat weight and live weight (LMP), which addresses carcass quality and waste reduction. This trait can also be easily measured on rams during routine commercial CT and has, in sheep, a promising h2~ 0.34 (Donaldson et al. 2014).

M&M: From > 200 Texel rams commercially CT scanned in 2013, 12 rams (available for purchase, diverging in LMP from ~27-37%) were chosen and mated to Mule ewes. 201 crossbred lambs were CT scanned at 137d (SD 3.5) and at 167d (SD 3.3) were slaughtered in an abattoir with eTraceability and standard carcass grading. Regression and mixed model analysis (SAS 9.3) was used to quantify relationships between father and lamb traits.

R&C: Regression coefficient between father LMP and progeny LMP was 0.11 (sb = 0.027; P 0.0001)) indicating an increase of LMPsire by 10% leads to 1.1% increase in LMPprogeny. Lambs sired by high LMP rams had an increased (P=0.031) killing out % (1.7% per 10% LMPsire increase). How current payment systems reward this will be discussed.

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WG1 Speaker Profiles & Abstracts

Maria Font-i-Furnols – IRTA Monells, Catalonia, Spain

PROFILE

Maria Font-i-Furnols is researcher at the Institute of Food Research and Technologies (IRTA) in Monells, Catalonia, Spain. She belongs to the Product Quality Program. She has a MSc in Agricultural Engineering (1994) from the University of Lleida and the PhD (2000) from the Polytechnics University of Catalonia. She has worked mainly on boar taint, consumer studies, carcass classification and in the use of computed tomography to evaluate carcass and meat quality. She has participated in several EU projects (Eupigclass, Quality Pork Genes, Boar taint AIR project, Alcasde, Pigcas, Pigscan, among others) and National Projects. Nowadays she coordinates a national project entitled "Influence of feeding restriction and dietary P levels on body tissue composition evaluated in vivo by computed tomography, bone mineralization and sensory properties of meat from gilts". She is the author of more than fifty-five peer reviewed papers, a high amount of professional papers and six book chapters.

Some papers published in the topic of computed tomography are:

Font-i-Furnols, M., Brun, A., Tous, N., Gispert, M. (2013). Use of linear regression and partial least square regression to predict intramuscular fat of pig loin computed tomography images. Chemometrics and Intelligent Laboratory Systems, 122, 58-64.

Carabús, A., Sainz, R.D., Oltjen, J.W., Gispert, M., Font-i-Furnols, M. Predicting fat, lean and the weights of primal cuts for growing pigs of different genotypes and sexes using computed tomography. Journal of Animal Science, 93, 1388-1397.

Font-i-Furnols, M., Brun, A., Martí, S., Realini, CE., Pérez-Juan, M., Gonzalez, J., Devant, M. 2014. Composition and intramuscular fat estimation of Holstein bull and steer rib sections by using one or more computed tomography cross-sectional images. Livestock Science 170, 210-218.

ABSTRACT (WG01T07)

Tissue volumes of live pigs from computed tomography images with and without viscera

Computed tomography images from live pigs includes viscera that does not belong to the carcass. Removing viscera from the images is time consuming work, which can be done semi-automatically. The objective of the present work is to find the relationship between the volume distribution of Hounsfield (HU) values in images from live growing pigs with and without viscera. For this purpose 8 castrated pigs and 8 gilts were scanned, two of each sex at 30, 70, 100 and 120 kg. Scanning was performed with computed tomography (CT) HiSpeed Zx/I using the following acquisition parameters: 140 kV, 145 mA, 7 mm-thick (30 kg) and 10 mm-thick (70 to 120 kg). From the images of the whole pig the tissue volumes with HU values between -149 and -1 (fat), between 0 and +140 (lean), between -149 and 140 (fat-lean) and between -149 and +441 (fat, lean and mineral fraction) were calculated. Viscera were then removed using the ATAR software and the same volumes were re-calculated. Tissue volumes with and without viscera were compared. In each weight group the tissue volumes from images without viscera were on average between 78.7 and 85.5% of the volumes from images with viscera. The coefficient of determination (R2) of the relationship between tissue volumes with and without viscera varied from 0.995 to 0.999. Without viscera tissue volumes can be obtained by multiplying the with viscera volumes by a factor varying between 0.83 and 0.86. Therefore the carcass composition can be calculated, from the with viscera volumes, using a prediction equation which considers these differences and in this case the viscera will not influence the predicted results. This should be comparable to volumes calculated from images where viscera were segmented out.

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Notes

WG1 Speaker Profiles & Abstracts

Michael Judas – Max Rubner-Institute, Department of Safety and Quality of Meat, Kulmbach, Germany

PROFILE

Michael Judas studied Biology with emphasis on soil ecology and multi-varied statistics, and received a PhD in Biology in 1989 at the Institute of Zoology at the University of Göttingen, Germany. He worked as a lecturer in Zoology at the University of Göttingen from 1991–1997 and received a habilitation for Zoology in 2003.

Since 2004, he has been a senior research scientist at the Max Rubner-Institute, Department of Safety and Quality of Meat in Kulmbach, Germany. His focus is on biostatistics, CT operation and analysis, and he is designated as the national expert for pig carcass classification in Germany.

ABSTRACT (WG01T08)

Hounsfield distributions from different CT protocols

The possibilities and limitations of quantitative analysis of CT images for carcass tissue composition are currently under debate in the EU. Since different CT models and various analytic protocols are applied, an objective measure is required that allows to quantify differences between the separate approaches.

An ideal object for comparative studies is an artificial phantom that mimics densities and anatomic properties of the true study objects, namely pig carcasses. A close model was found with the 3D Torso phantom Model 602, produced by CIRS, Norfolk VA, USA. This phantom was newly acquired by the AVS at Easter Bush, Midlothian, UK, and kindly provided by Prof. Lutz Bünger and colleagues for a quantitative comparison of CT protocols. The MRI at Kulmbach recently switched from an outdated Siemens Somatom Plus 4 to a Siemens Scope. Since it was not self-evident to what extent parameter settings would allow comparable results between the two CTs, a range of CT protocols was devised with varying kV, mA, slice thickness, and reconstruction algorithm. The entire torso was scanned and the overall distribution of volume by Hounsfield value determined.

The presentation will illustrate the high variation both between protocols within scanner, and between scanners within protocol. A quantification of differences is outlined. In particular, a recently proposed volume regression approach (Daumas et al. 2014) is used to quantify the effect of varying CT protocols.

The results suggest some robustness of protocols, but scanners need a thorough quantification of their differences.

Relevant publication:
Daumas G, Donko T, Monziols M, Kongsro J, Čandek-Potokar M, Allen P, Scholz A, Bünger L (2014) A pragmatic short-term approach to establish a Computed Tomography (CT) based reference method for the measurement of lean meat percentage (LMP) in pig carcasses. In: C. Maltin, C. Craigie and L. Bünger (Eds), Farm Animal Imaging Copenhagen 2014, pp52-57. Edinburgh, West Mains Road, Edinburgh, EH9 3JT, UK.

Notes

WG1 Speaker Profiles & Abstracts

Mathieu Monziols – Institute for Pig & Pork Industry (IFIP), France

PROFILE

Mathieu is originally an agricultural engineer specialized in biochemistry and animal science. In 2005 he obtained a PhD in biology and agricultural sciences of the agricultural sciences school of Rennes. His PhD work was about the quantification and analysis of the intermuscular fat of pigs by MRI. He then continued his education in medical imaging by a post-doctoral position on image analysis of human brain MRI images.

Since 2007, Mathieu has been in charge of all the Computer Tomography (CT) applications at IFIP, French pig institute near Rennes. His works are about CT acquisition and images analysis for all the institute CT applications. Main applications are body composition in vivo, lean meat percentage of carcasses, bone density, diseases diagnosis and salting process.

Main publications:

Monziols M., Collewet G., Bonneau M., Mariette F., Davenel A., Kouba M, 2006. Quantification of muscle, subcutaneous fat and intermuscular fat in pig carcasses and cuts by magnetic resonance imaging. Meat Science, 72, 146-152.
Daumas G., Monziols M., 2011. An accurate and simple computed tomography approach for measuring the lean meat percentage of pig cuts. Proceedings of the 57th ICoMST, 7-12 August 2011, Ghent, Belgium.

ABSTRACT (WG01T09)

Evaluation of performances on density and volume measurement accuracies of different European CT scanners

One of the main subjects of the FAIM COST meetings discussions concerns differences between CT scanners. Indeed, supposed differences in CT density and volume measurements are a major issue for harmonising body composition measurement methods. Different approaches such as the use of phantoms have been proposed in order to evaluate the differences between CTs. In this work, a very simple protocol was sent to a panel of European CT owners in order to evaluate the accuracy of both density and volume measurements. The protocol consisted of two different parts.

Firstly, the accuracy of density measurement was evaluated by using different concentrations of KH2PO4 in water in order to mimic density differences. Dilution range was between 20 and 200 mg/cm3. These samples were scanned by the different CT owners and relationships between mean HU values and KH2PO4 densities were established for each machine.

Secondly, the accuracy of the volume measurement was evaluated by using different plastic bottles of water from 0.5 to 20l. Each bottle was scanned and the water volume was calculated by simple threshold. Reference water volume was confirmed by weighting the full and empty bottles considering a 1kg/l water density. Comparisons between CT measurements and reference volumes were established.

A panel of European CT owners performed the protocol and differences on this simple measurement protocol were analysed between CTs in Europe.

Co- authors:
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WG1 Speaker Profiles & Abstracts

Örs Petneházy – Kaposvár University, Hungary

PROFILE

Örs Petneházy has been working for 7 years at the Veterinary University of Budapest between 1999 and 2005 as a teacher of veterinary anatomy and topographical anatomy. He served as a research veterinarian for 10 years at the Kaposvár University Institute of Diagnostic Imaging and Radiation Therapy between 2005 and 2014. Between 2014 and 2015 he worked as an assistant professor for veterinary anatomy and diagnostic imaging at the University of Alaska Fairbanks. Very active in cross sectional anatomy of the domestic animals (pig, dog, cat, turkey, horse). His research area is the cross sectional anatomy and 3D reconstruction-3D printing of anatomical structures of the domestic animals based on RGB, MR and CT images.

Relevant publications:

Kertesz A M, Petneházy O, Lasso A, Garamvolgyi R, Donko T, Biro H, Bajzik G, Sotonyi P: Application of imaging techniques for visualization of mammary gland in lactating and pregnant sow. In: 7th European Symposium of Porcine Health Management: esphm: proceedings. 288 p. Conference: Nantes, France, 2015.04.22-2015.04.24. Paper P048. 1 p.

Petneházy Örs, Benczik Judit, Takács István, Petrási Zsolt, Sütő Zoltán, Horn Péter, Repa Imre: Computed Tomographical (CT) anatomy of the thoracoabdominal cavity of the male turkey (Meleagris gallopavo). Anatomia Histologia Embryologia 41:(1) pp. 12-20. (2012)

Petneházy Örs, Tóth Levente, Áipli Bernadett, Vinczen Eszter, Repa Imre: Computed tomographical examination of the cardiovascular system of the turkey (Meleagris gallopavo). Bulgarian Journal Of Veterinary Medicine 15:(Suppl. 1.) pp. 40-41. (2012) 29th Congress of the European Association of Veterinary Anatomists. Stara Zagora, Bulgária: 2012.07.25 -2012.07.28.

ABSTRACT (WG01T10)

From cross section to 3D anatomy. (Problems and solutions)

For body composition analysis, veterinary diagnostic work and for many research applications one should know the exact anatomy of the desired animal. 3D surgical planning and virtual anatomy teaching both require detailed 3D models of different body regions. There are detailed cross sectional atlases, books with colour images of the desired area without the possibility for later reconstruction of complex structures or body parts. With the use of cryomilling we are able to make very thin slices (50 microns) of the body with the original colour of the anatomical structures. From CT and MR data there is no possibility to reconstruct the original colour of the organs, muscles or bones and therefore a precise 3D visualisation will miss the chance of a high precision. With the combination of the cryomilling, CT and MR scanning we can fuse the images to one and make the best available reconstruction using the advantages of each separate modality. The reconstructed structures can be visualised in real colour in a very accurate 3D model. This model can be visualized, 3D printed and used for both, research and teaching.

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Notes

WG1 Speaker Profiles & Abstracts

Eli Vibeke Olsen – Danish Meat Research Institute, Denmark

PROFILE

Measuring methods aimed at pig carcass composition have become the main topic for Eli Vibeke Olsen's professional life. Her scientific background is a master degree in theoretical statistics from Copenhagen University in 1980 followed by an industrial PhD dealing with optical methods to measure meat quality online at the slaughterhouse.

The technique was subsequently implemented in both manual and automatic online instruments measuring the lean meat content. The experiences from practical implementation of the instruments in the industry highlighted that the metrological aspects of the methods are very important. Eli became part of the expert group, who gives advice to the EU Commission concerning harmonization of classification methods. She became coordinator of an EU project where one outcome was the use of CT as reference method to calibrate online classification methods in the pig slaughter industry.

Relevant publications:

Olsen, Eli V., L. B. Christensen, M.F. Hansen, M. Judas, R. Höreth (2007). Challenges developing an instrumental reference for classification of pigs. ICoMST conference paper.

Olsen, Eli V., Niels C. Kjaersgaard and Marchen Hviid. Virtual products can be used for optimizing slaughterhouse planning (2012). Fleischwirtschaft International 6. Volume 27, 16-26.

Olsen, Eli V., L. B. Christensen, Comparison of accuracy of reference methods based on CT and manual dissection. Conference Paper FAIM II (2013).

ABSTRACT (WG01T12)

Looking into the future

Since the idea of using CT as a reference method was explored in the European project eupigclass in the beginning of the century, ten member states have acquired CT scanners aimed at research in farmed animal sciences. The use of CT as a (secondary) reference method for calibration of online grading equipment is one of the applications. Using commercial CT scanners, developed for human medical purposes, inevitably includes some metrological problems. The different commercial CT scanners are characterized by different solutions for data generation and image reconstruction. A general measuring protocol does not exist to produce exactly the same 3D model on all CT scanners.

We want to be able to use CT measurements as a primary reference method. The advantages are obvious: The measurements are fast and the repeatability is good. The challenge is to define a method, where results from different CT scanners can be used as primary reference, i.e. a method characterized by high precision and negligible deviation from results obtained with other scanners.

An obvious solution would be to construct reference objects (phantoms), which mimic the pig carcasses. In contrast to the purposes for most medical applications, determination of the tissue densities is in principle less important than the measurement of volumes. The goal is to obtain a number of volume and the attenuation calibration phantoms, which can form an instrumental reference platform for the CT scanners available. The reference objects will be circulated between partners in a Round Robin procedure.

Once this problem is solved more detailed reference measures can be defined and possibly be used to improve the European populations of farmed animals.

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Notes

WG1 Poster Presenter Profiles & Abstracts

Ana Catharina Batista - CECAV, UTAD, Portugal

PROFILE

Ana Catharina Batista was born In Maceió, Alagoas, Brazil and went to the Universidade Federal de Alagoas (UFAL). At UFAL she obtained his degree in Zootecnia, in 2011. Currently she is PhD student of the Animal Science Department at Universidade de Trás-os-Montes e Alto Douro (UTAD) and member of the Animal and Veterinary Research Center (CECAV-UTAD). The main fields of research interests are sheep and goats meat production and techniques to predict carcass and body animal composition.

ABSTRACT (WG01P01)

Use of real time ultrasonography and image analysis to study relative growth of subcutaneous fat and muscle depths of ewes

In sheep extensive systems with large variation in feed supply along the year is important to understand whether the changes in body condition are related with body weight changes, or if there is a direct effect on fat and lean tissues. An in vivo technique such as real time ultrasonography (RTU) will be helpful to comprehend those relationships. Therefore the objective of this work is to study the relative growth of RTU fat and muscle depths described by the Huxley allometric model in which the RTU measurements are regressed against live weight. Nineteen Churra a Terra Quente ewes (live weight – LW- ranged 37 to 58 kg) were followed during 44 weeks and 226 records of LW and RTU measurements were obtained. Animals were scanned with a RTU machine (Aloka SSD500V) using a 7.5 MHz probe. RTU images were captured at the 13th thoracic and at the 4th lumbar vertebrae. The RTU images were analysed with ImageJ software and subcutaneous fat (SF13 and SF4) and the Longissimus dorsi muscle (LM13 and LM4) depths were obtained. It was also taken RTU depth fat measurement at sternum (SFS). To establish the relative growth the Huxley allometric equation in its logarithmic form was allometric coefficient (b) of the RTU measurement (Y) relative to the LW (X). The allometric coefficient (b) obtained for SF13 and SF4 was higher ($P < 0.05$) than 1 (b=1.89 and b=1.63, respectively) whereas the SFS show a $b = 0.83 < 1$ ($P<0.05$). The SFS is an early-maturing fat trait. The LM values decreased with increasing LW of ewes (b= 0.61 and 0.70, $P<0.05$, for LM13 and LM4, respectively. These results are consistent with the literature and indicate that the SF at thoracic and lumbar anatomical regions which exhibits a late development can be more sensitive to body fat changes. The ability of RTU to measure long term changes in ewe body composition makes this technique a useful tool to model the relative growth of body composition components. Further studies with larger number of ewes are required to specify the fat growth patterns in different production systems.

Co-authors:
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2. CECAV, ESA-IPB, Bragança, Portugal

Notes

WG1 Poster Presenter Profiles & Abstracts

Alfredo Teixeira - CECAV, ESA-IPB, Portugal

PROFILE

Alfredo Teixeira was born in 1959, Vila Real-Portugal. Degree in Animal Science at (UTAD) University of Trás-os-Montes and Alto Douro. MSc in Animal Science at IAMZ (Zaragoza-Spain). Doctor in Animal Science by UTAD in 1991. He has been working as full professor in ESA-IPB for 30 years. Since 1984 he has been working in sheep and goat carcass evaluation and meat quality. He also has been working in methodologies to assess in vivo body and carcass composition using the Real Time Ultrasound (RTU) technology as well as image analysis techniques and recently Near Infrared Spectroscopy technology (NIRs). He coordinated several research projects in the areas of sheep and goat production and meat science. He is the editor and referee for several international journals and publications in the area of animal science and meat science. He has authored and co-authored several scientific articles and book chapters.

Relevant publications:

Teixeira, A., Matos, S., Rodrigues, S., Delfa, R. and Cadavez, V., 2006. In vivo estimation of lamb carcass composition by real-time ultrasonography. Meat Science, 74: 289-295.

Teixeira A., 2008. Basic Composition: Rapid Methodologies. In Handbook of Muscle Foods Analysis. Ed. Leo Nollet and Fidel Toldrá. CRC Press Taylor&Francis Group. 291-314.ISBN 978-1-4200-4529-1.

Teixeira, A., Joy, M. and Delfa, R., 2008. In vivo estimation of goat carcass composition and body fat partition by real-time ultrasonography. J. Anim. Sci. 86:2369-2376.

Rodrigues, S. and Teixeira, A., 2009. Effect of sex and carcass weight on sensory quality of goat meat of Cabrito Transmontana. J. Anim. Sci. 87:711-715.

Ripoll, G., Joy, M., Álvarez-Rodrigues, J., Sanz, A. and Teixeira, A., 2009. Estimation of light lamb carcass composition by in vivo real-time ultrasonography at four anatomical locations. J. Anim. Sci. 87:1455-1463.

ABSTRACT (WG01P02)

Linear modelling to predict simultaneously sheep and goat carcass parameters using in vivo ultrasound data and body weight.

This work involves the study of single predictive models to assess body and carcass components (muscle, fat and bone) of different goat and sheep breeds using in vivo animal measurements: body weight and ultrasonic measurements of fat thickness (lumbar subcutaneous fat depth and sternum fat depth). In this study, it was used a database of 125 animals of three sheep and two goat breeds, respectively: 19 Rasa Aragonesa, 22 Roya and 8 Ojinegra de Teruel Ternasco lambs and 20 Serrana goats and 56 Blanca Celtiberica goats.

As an example, it is shown the ability of a single multiple linear regression model established to predict the muscle mass of the animals under study. The linear model was obtained by applying a k-folds cross-validation procedure and the best model obtained was evaluated in its prediction performance using a samples' test group (40% of original data). The model obtained showed good predictability since, the linear relationships obtained between the muscle mass experimental values and the established by the model for the different breeds and species of goats and sheep presented slopes and intercept which may be considered the theoretical (one and zero respectively) and adjusted coefficient of determination greater than 0.97.

This work allows us to infer that it is possible to obtain a linear model to predict simultaneously body and carcass components of different breeds and species of animals.

Co-authors:
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WG1 Poster Presenter Profiles & Abstracts

Severiano Rocha e Silva – CECAV, UTAD, Portugal

PROFILE

Severiano Rocha e Silva was born in Baltar, Oporto, Portugal and went to the Universidade de Trás-os-Montes e Alto Douro (UTAD). At UTAD he obtained his degree in Animal Science, in 1987. After doing his military service in 1989 he became Assistant at UTAD and in 2001 obtained his PhD degree in Animal Science. Currently he is Associate Professor of the Animal Science Department at UTAD and member of the Animal and Veterinary Research Centre (CECAV-UTAD). The main fields of research interests are animal welfare and techniques to predict carcass and animal body composition. He has authored and co-authored several scientific articles and book chapters.

Relevant publications:

Quaresma, M., Payan, R., Silva, S.R. 2013. Relationships between body fat reserves ultrasound measurements and body condition score in jennets. The Veterinary Journal, 197, 329-334.

Silva, S.R., Cadavez, V.P., 2012. Real-time ultrasound (RTU) imaging methods for quality control of meats. In Computer vision technology in the food and beverage industries. Editor Da-Wen Sun. Woodhead Publishing, Cambridge, UK. 277-329.

ABSTRACT (WG01P03)

Using computer tomography to predict composition of light carcass kid goats

Evaluation of carcass characteristics of farm animals is an important objective either for production or for scientific knowledge. Unfortunately the gold standard methods for determining carcass composition are destructive and laborious. The computing tomography (CT) has emerged as the most promising technique and several papers have been published in pigs and sheep. However little work with goats has been conducted. Therefore the objective of this study is to perform the use of CT to predict light carcass composition of kids. In this work 19 carcasses of kids of Serrana breed with a live weight 13.4 ± 5.2 kg were used. After 24 hours cooling at 4°C carcasses were split down by the dorsal middle line with a band saw and the left side was fully dissected into muscle (M), subcutaneous fat (SF), intermuscular fat (IF), dissected fat (DF) (subcutaneous fat plus intermuscular fat) and bone (B). The right carcasses halves were CT fully-scanned at the University Veterinary Hospital - UTAD using a GE Brivo CT scanner in the spiral mode with a slice thickness of 5 mm. The data were reconstructed by the equipment software using (512 X 512) image matrix tomograms. The scanner settings for electrical current and voltage were Auto mA and 120 kV, respectively. The frequency distributions of pixel HU values (histogram) were used for tissue segmentation and volume calculation. The muscle tissue was segmented using a -22 to 146 HU range, the fat tissue was segmented using a -194 to -23 HU range and for bone was considered HU value between 146 and 1000.

Regression analysis was established between CT carcass tissue and dissected tissues. A similar variation was found for CT and dissected components (CV between 36 and 48%). The coefficients of determinations (R2) between CT and dissected components range from 0.648 to 0.951 ($P<0.001$). The lower R2 was observed for fat which is very scarce in this specie and especially in light carcasses. This results encouraging the use of CT as an alternative to dissection and further work is needed with a larger sample and using more advanced image analysis to improve fat prediction.

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WG1 Poster Presenter Profiles & Abstracts

Peter Polák – Research Institute for Animal Production, Slovakia

PROFILE

Peter Polák graduated with Ing. in Animal husbandry from Slovak University of Agriculture in Nitra in 1996, followed a PhD (2006) from the same university. The topic of the PhD study was Using Ultrasound and Video Image Analysis in Prediction of Carcass Value in Cattle.

Since 1997 he has been working as a scientist at the Animal Production Research Centre in Nitra, at the Department of Animal Breeding and Product Quality. His scientist work is based on in vivo assessment of carcass quality and meat quality as well as beef cattle production. He has been involved in the projects focused on beef quality, carcass quality and meat quality assessment by means of ultrasound and video image analysis. More research projects he has been involved in similar projects with beef, dual purpose cattle and sheep, low input production, using sensors for management of body condition in dairy herds as well as animal genetic resources. Peter has been involved in numerous applications for founding in national and European schemes. He published 20 papers in peer reviewed journals. He actively cooperate with beef and Simmental farmers associations in Slovakia.

ABSTRACT (WG01P04)

Muscle development as characteristic for beef production in 3 indigenous breeds of cattle in Lithuania

The aim of the investigation was to judge possibility of 3 indigenous breeds of cattle for in Lithuania currently used in dairy system for beef production in cow – calf system. Muscle thickness measured by ultrasound muscle and body development evaluated by trained classificatory as information of body conformations as well as milk production were taken in to consideration. There were 19 heifers of Lithuanian whitebacked (LWB) 13 heifers of Lithuanian ashgray (LAG) and 3 heifers of Lithuanian red breed (LR) of old genotypes analysed. Age of heifers was between 14 and 28 months. Muscle and fat thickness were measured by Aloka PS 2, with probe UST-5044-3,5 MHz, 172 mm on five position of the body. Average daily gain, body and muscle development were evaluated by means of linear evaluation of exterior used for beef cattle in Slovakia done by certified person. Average daily gain in all breeds was 730 g LR, 740 g LWB and 751 g LAG. Total layer of muscle was higher in LR 268 mm (249 LWB, 258 LAG). The highest score for linear evaluation was in LR too 15.33 points (13.05 LWB and 14.07 LAG). Also score for muscle development was the highest in red cattle. However the results could be affected by number of animals and herds of origin. LR heifers originated from the herd where animals had best results. Because all 3 breeds are considered as rare endangered breeds within the scheme of genetic resources conservation and because the work was done during one week STSM of FAIM project the number of animals in breeds was lover and range of age was higher. All measured traits were affected by overall condition on farms.

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Notes

WG1 Poster Presenter Profiles & Abstracts

Beata Grzegrzółka – Warsaw University of Life Sciences - SGGW, Poland.

PROFILE

Beata Grzegrzółka studied Animal Science at the Warsaw University of Life Sciences – SGGW, Poland. She finished her doctorate thesis focused on embryo development in Japanese quail BW selection and received a PhD in Agricultural Sciences in 2010 at the Faculty of Animal Sciences at the WULS – SGGW, Poland. Since 2009 she works as a lecturer and researcher in the Department of Genetics and Animal Breeding, Faculty of Animal Sciences, WULS – SGGW, Poland. She is also responsible for the experimental flock of Japanese quail breeding at the University. The main fields of her research interests are correlated response to selection in quails, avian embryology, population and animal genetics, animal behaviour, biostatistics, and imaging techniques in animal sciences.

ABSTRACT (WG01P05)

CT phenotyping of carcass traits in mirror carps (Cyprinus carpio)

The carp is the most important culinary fish within the EU after the salmonides. In Germany, some regions produce carps protected by the EU as Protected Geographical Indication (PGI). Since 2012, also the Aischground carp is listed as a PGI. The specification for this carp includes – among others – a maximum body weight of 1700g and a max. fat content of 10% within the fillet including the skin. As carps are sold alive, the production of carp, fulfilling the specifications requires a method to predict the meat quality in live fish.

During this study, 60 mirror carps (Cyprinus carpio), originating from 6 different ponds of the Bavarian region 'Aischground', were measured in vivo for their body weight using an electronic scale, and different linear body measurements using a measuring tape. Finally, all carps were slaughtered in order to measure different carcass traits including the backfat thickness of the split carcass. After slaughtering, before dissection, the whole carps were scanned, using a computed tomography scanner (Siemens Somatom Plus 4 with 140 kV, 146 mA, 30 cm FOV, and 3 mm slice thickness). After dissection and collecting all carcass traits, one fillet including the skin of each carcass was analyzed chemically for reference fat content.

Single in vivo measurements showed poor prediction of fat content. Linear measurements taken on single CT slices of special regions of the fish in some cases revealed higher relationship with fat content ($R2 \leq 0.81$) or fillet weight ($R2 \leq 0.87$). As CT technology is possible without slaughtering, multiple linear regression models based on several in vivo traits and chosen CT measurements would be useful in prediction of fat content and fillet weight in live fish, as these two traits seem to be among the most important for carp consumers.

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WG1 Poster Presenter Profiles & Abstracts

Beata Grzegrzółka – Warsaw University of Life Sciences – SGGW, Poland.

PROFILE

Beata Grzegrzółka studied Animal Science at the Warsaw University of Life Sciences – SGGW, Poland. She finished her doctorate thesis focused on embryo development in Japanese quail BW selection and received a PhD in Agricultural Sciences in 2010 at the Faculty of Animal Sciences at the WULS – SGGW, Poland. Since 2009 she works as a lecturer and researcher in the Department of Genetics and Animal Breeding, Faculty of Animal Sciences, WULS – SGGW, Poland. She is also responsible for the experimental flock of Japanese quail breeding at the University. The main fields of her research interests are correlated response to selection in quails, avian embryology, population and animal genetics, animal behaviour, biostatistics, and imaging techniques in animal sciences.

ABSTRACT (WG01P06)

Image analysis of CT scans to predict fat content in mirror carps (Cyprinus carpio)

Carp consumption, after rainbow trout, is second highest for fishin Germany. Since 2012, carp from the Bavarian region `Aischground' is protected by the EU and listed as Protected Geographical Indication. In response to consumer expectations there are strict requirements for this regional Aischground carp regarding, inter alia, low fat content within the fillet (max. 10%, including the skin), and body weight not exceeding 1700g. Therefore, a breeding program including precise methods to predict and control these parameters in live fish is required.

For this study, 10 mirror carps (Cyprinus carpio) from each of 6 different ponds of the Aischground region were measured in vivo for their body weight using an electronic scale, and different linear body traits using a measuring tape. Afterwards, all fish were slaughtered and the whole carps were scanned in groups of 4 fish per box, using a computed tomography scanner (Siemens Somatom Plus 4 with 3 mm slice thickness, 140 kV, and 146 mA). After scanning, the reference fat content of each carcass was determined by chemical analysis of one fillet including the skin.

Two image analysis programs were evaluated for the segmentation and analysis of single carps. First, carps were manually segmented from the scanning boxes with TurtleSeq. Then, the binary 3D mask was exported to ImageJ to segment the single carps from the 3D scans. From the segmented carps, we produced histograms of volume by Hounsfield units (HU). With simple thresholding, volumetric fat content was determined with -200 – 0 HU for fat, and -200 through maximum HU for total volume. On a large scale, with 2–24 % fat, our approach could differentiate lean from fat carps (R^2=0.89). On a fine scale <10 % fat, carps could not completely be differentiated.

Co-authors:
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Notes

WG1 Poster Presenter Profiles & Abstracts

Stijn Hellebuyck – Ghent University, Belgium

PROFILE

Stijn studied bio-science engineering at Ghent University from 2006 to 2011. After these studies, he started working at the CBKc. The CBKc is an independent carcass classification organization, which operates from the Department of Animal Production at Ghent University. The main tasks of the CBKc are to train classifiers of pig and bovine carcasses, to assist the competent authority in their policies, to perform the dissection trials in Belgium and to update all the involved parties with scientific progress in pig and bovine carcass classification.

ABSTRACT (WG01P07)

Evaluation of CT protocols for optimized volume regression of lean meat in pig carcasses

In Belgium a calibration of the current pig carcass classification devices is legally required before the end of 2019. The goal is that in this calibration trial, computed tomography (CT) will be used to measure the body composition of the selected pig carcasses. As a first step in developing an accurate CT protocol for the Belgian pig population, one random pig carcass was selected. The carcass was chilled overnight and cut according the EU reference method. The four main parts (ham, loin, shoulder and belly) were scanned. CT images were acquired using a 4 slice helical CT scanner (Lightspeed Qx/i, General Electric Medical Systems, Milwaukee, WI). Transversal images were obtained in bone (B) and soft tissue (ST) reconstruction algorithm. The scanned parts were dissected in separated tissues (meat, fat and bones). During a Short Term Scientific Mission (STSM), Matlab was used to analyse the CT images under the supervision of Dr M. Judas (Max Rubner Institut, Kulmbach, Germany). The total muscle volume was calculated in 7 different HU ranges ((15 85), (10 90), (5 95), (0 100), (0 105), (0 110), (0 120)). Each total volume was multiplied with 2 different densities (1.04 g/dm^3 and 1.05 g/dm^3).

With a presumed muscle density of 1.04 g/dm^3 the total weight difference between the dissected muscles and the CT muscles was smallest in the HU range (0 120), for both the B and ST reconstruction algorithm. For the ST reconstruction algorithm there was an underestimation of the dissected muscles with 161.1 g. For the B reconstruction there was an overestimation of 50.8 g. With a presumed muscle density of 1.05 g/dm^3 the smallest difference between the weight of the dissected muscle and the weight of the CT muscle was found in the HU range (0 110) for the ST reconstruction modus, with a negligible weight difference of 1.3 g. For the B reconstruction modus the HU range (0 105) showed the smallest difference with an underestimation of 24.2 g.

These data need to be confirmed in further research. This is merely a first step and more pig carcases will be scanned and dissected in order to obtain an accurate and precise CT method in Belgian trial conditions.

Co-authors:
Michael Judas[1], Marc Seynaeve[2], Stefaan De Smet[2], Ingrid Gielen[3].

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Notes

WG1 Poster Presenter Profiles & Abstracts

Cristina Zomeño – IRTA Monells, Catalonia, Spain

PROFILE

Cristina Zomeño has a degree in Veterinary Science by the Cardenal Herrera CEU University (Valencia, Spain) and a master´s degree in Animal Husbandry by the Polytechnic University of Valencia. She accomplished her doctorate in Science and Technology of Animal Husbandry at the Polytechnic University of Valencia in 2013. Her PhD work combined meat quality and genetic areas, and allow her to acquire experience in Near Infrared Reflectance Spectroscopy (NIRS) applied to measure different meat quality parameters such as fat, protein and fatty acid content. She worked as a researcher at IRTA (Monells) within the Product Quality Programme from April 2014 to February 2015. She participated in a European Project (FP7-KBBE 2012) entitled "Automatic grading system for determining lean-fat distribution in pig carcasses". She also collaborated on the analysis of part of the data of a Research Project focused on the in vivo evaluation of the growth of fat and muscle pig tissues using computed tomography.

Relevant publications:

Zomeño C., Gispert M., Brun A., Carabús A., Font-i-Furnols M. 2014. Prediction of carcass protein and fat chemical content using Computed Tomography in live pigs and pig carcasses. In: Maltin CA, Craigie C, Bunger L eds. FARM ANIMAL IMAGING Copenhagen 2014. Edinburgh: SRUC. 2014: 44-47

Zomeño C., Juste V., Hernández P. 2012. Application of NIRS for predicting fatty acids in intramuscular fat of rabbit. Meat Science. 91, 155-159.

Zomeño C., Hernández P., Blasco A. 2011. Use of near infrared spectroscopy for intramuscular fat selection in rabbits. World Rabbit Science. 19, 203 – 208.

ABSTRACT (WG01P08)

The influence of the sex type on the mineral component growth in pigs

The aim of this study was to compare the development of the calcium (Ca) and phosphorus (P) during the growing period among four pig sex types using computed tomography (CT). Forty-eight Pietrain x (Landrace x Duroc) pigs from four different sexes (12 entire males, 12 surgically castrated males, 12 immuno-castrated males and 12 females) were used in this study. Animals were scanned in vivo at four different target body weights (30, 70, 100 and 120 kg) using a General Electric HiSpeed Zx/I tomograph located at the IRTA-Monells facilities. They were anaesthetized prior the scanning. The content of the Ca and P was estimated in each animal using two CT prediction equations, previously developed (with an R2 of 0.66 and 0.76 and a prediction error of 144 and 71 grams, respectively). The allometric growth coefficients of Ca and P were estimated using the function: Y=aXb, where Y is the weight of the component, X is the body weight, a is a constant and b is the allometric growth coefficient. The parameters a and b were estimated using SAS Software. Then, Bayesian inference was used to study the differences between sexes. The allometric growth coefficients were 0.93 for Ca and 0.88 for P, showing a proportionally slow growth rate of both components in relation to the BW. In comparing the coefficients among sexes, the immuno-castrated males showed a higher b for Ca and P than females and entire males, with an estimated difference for Ca of 0.07 and 0.08 and for P of 0.04 and 0.06, respectively. No differences were found among the other sexes. The different deposition pattern of immuno-castrated males could be evidenced at earlier ages, between 50-60 kg of body weight. These results could be explained by the effect of the first vaccination dose applied to this type of males.

Co-authors:
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Notes

WG1 Poster Presenter Profiles & Abstracts

Albert Brun – IRTA Monells, Catalonia, Spain

PROFILE

Albert Brun studied Agri-cultural Engineering and a Master in Food Biotechnology at the University of Girona, Spain. Since 2009 he works at IRTA (Monells) in the Product Quality programme. He works with computed tomography in order to determine the lean meat percentage in pork carcasses, the intramuscular fat in pork and beef chops, and the beef cuts composition. He has participated in two European projects (PIGSCAN and ECO-FCE). He also works in several national projects where Computed Tomography is used as a tool to determine the body composition of live growing pigs.

Relevant publications

Font-i-Furnols, M., Brun, A., Tous, N., Gispert, M. 2013. Use of lineal regression and partial least square regression to predict intramuscular fat of pig loin computed tomography images. Chemometrics and Intelligent Laboratory Systems 122, 58-64.

Font-i-Furnols, M., Brun, A., Martí, S., Realini, CE., Pérez-Juan, M., Gonzalez, J., Devant, M. 2014. Composition and intramuscular fat estimation of Holstein bull and steer rib sections by using one or more computed tomography cross-sectional images. Livestock Science 170, 210-218.

Carabús, A., Gispert, M., Brun, A., Rodriguez, P., Font-i-Furnols, M. (2014). In vivo pigs evaluation of carcass and cuts composition growth of three commercial crossbreeds using Computed Tomography. Livestock Science, 170:181–192.

ABSTRACT (WG01P09)

Influence of feeding restriction on body tissue composition of growing gilts evaluated in vivo by computed tomography

The main objective was to evaluate the effect of feeding restriction strategy on fat thickness and area at the loin region by means of computed tomography (CT) images obtained in Pietrain x (Large White x Landrace) live growing (from 30 to 100 kg) swine. A total of 48 gilts were selected and allocated to 4 different feeding strategies: 1) ad libitum (AL) from 30 to 100 kg, 2) AL from 30 to 75 kg and restricted in volume (RESV=-14%) from 75 to 100 kg, 3) RESV (-22%) from 30 to 75 kg and AL from 75 to 100 kg and 4) restricted in energy (-20%) from 30 to 75 kg and AL from 75 to 100 kg. Animals were fully CT scanned (General Electric HiSpeed Zx/I). Images between 11th-12th ribs and 3rd-4th lumbar vertebrae were analysed. Subcutaneous fat thickness and area were determined using VisualPork software. Results showed that during RESV period fat increased very little. Fat area in the two loin images from AL-RESV pigs was lower than AL-AL at 100 kg being in between the other treatments. No differences were found at the other weights. Regarding fat thickness in the loin, the differences were only found at 75 kg (RESV-AL lower). Results showed that fat accretion was limited as a consequence of volumetric restriction.

Co-authors:
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3. IRTA-Monogastric Nutrition, Ctra. Reus-El Morell, km. 4.5, 43120 Constantí, Tarragona.

Notes

WG1 Poster Presenter Profiles & Abstracts

Marina Gispert – IRTA-Monells, Catalonia, Spain

PROFILE

Marina Gispert studied Chemical and Agricultural Engineering in the Polytechnics University of Catalonia. She is a researcher at IRTA-Monells, in the Product Quality Program, especially in carcass and meat quality issues. She is in charge of the Pig Carcass Grading in Spain since 2000 and assessor of the Agricultural Ministry of Spain in these issues. She has participated in several European projects such as FAIR, EUPIGCLASS, SABRE, PORK QUALITY GENES, PORK QUALITY CHAIN, PIGSCAN, ECO-FCE. She has also participated in calls related with boar taint such as AIR, ALCASDE and PIGCAS. She is author of a high amount of scientific papers, congress presentations and professional papers.

Since 2008 IRTA has a General Electric Computed Tomography equipment. It has been used for pig carcass grading purposes and evaluation of live pigs.

Relevant publications:

Font i Furnols, M., Fabiana, M., Gispert, M. 2009. Estimation of the lean meat content in pig carcasses using X-ray Computed tomography and PLS regression. Chemometrics and Intelligent Laboratory Systems 98, 31-37.

Carabús, A., Gispert, M., Brun, A., Rodriguez, P., Font-i-Furnols, M. (2014). In vivo pigs evaluation of carcass and cuts composition growth of three commercial crossbreeds using Computed Tomography. Livestock Science, 170:181–192.

Font-i-Furnols, M., Carabús, A., Pomar, C., Gispert, M. (2014). Estimation of carcass and cuts composition from computed tomography images of growing live pigs of different genotypes. Animal, 9:1: 166-178.

ABSTRACT (WG01P10)

Accuracy of computed tomography equation for simplified dissection to predict lean meat content from full dissection

Reference lean meat content can be obtained by means of the simplified manual dissection of lean from the four main cuts (LMP089) or from the full dissection of the 12 cuts of the carcass (LMPFULL). Computed tomography (CT) can be used as a reference method if comparable results are provided. Spain has a CT equation to predict LMP089 but, since CT measures the entire half carcass and not only the four main cuts, it seems that LMPFULL could be more adequate for CT measure. The objective of the present work is to know the relationship between LMPFULL and LMPCT as well as between LMPFULL and LMP089. A total of 18 carcasses with an average carcass weight of 83.4 kg were CT scanned (General Electric HiSpeed Zx/I, 140 kV, 145 mA, 10 mm thick, 512x512, helical pitch 1) and then fully dissected. From the full dissection, both LMPFULL and LMP089 were obtained, according to the EU legislation. Results show that the relationship between LMP089 and LMPFULL when intercept is forced to be zero is important (r=0.9999) and the slope is 0.967 (0.962, 0.973). Between LMP089 and LMPCT when intercept is forced to be zero is also very strong (r=0.9998) and the slope is 0.958 (0.951, 0.965). Results show that with the equation to estimate LMP with CT, calibrated for simplified dissection it is possible to evaluate the LMPFULL by multiplying the result by a constant to correct the bias.

Co-authors:
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WG1 Poster Presenter Profiles & Abstracts

Dennis Brandborg Nielsen –Danish Meat Research Institute (DMRI), Denmark

PROFILE

Dennis Brandborg Nielsen is a consultant at the Danish Meat Research Institute (DMRI), Danish Technology Institute. He studied Biomedical engineering at Aarhus University, Denmark and further took a specialization as a Business engineer. Before joining the DMRI he worked at Aarhus University and Odense University Hospital, Denmark as a researcher in the areas of 3 dimensional motion analysis and radiographic/imaging analysis.

ABSTRACT (WG01P11)

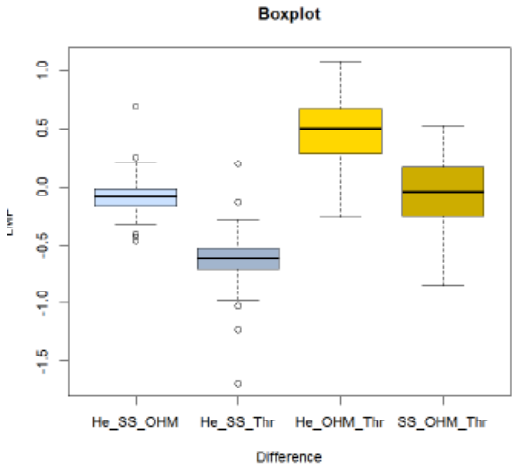
Analysis of lean meat percentage in pig carcasses: Comparison of two different scanner settings and two different segmentation methods

The aims of this study were to investigate variation in two scanner settings and two segmentation methods in the determination of Lean Meat Percentage (LMP).

A precise detection of muscle tissue allows for a better estimation of LMP, which is important for the payment to the farmers. Computed tomography (CT) is considered the most promising method for calibration of online equipment estimating LMP, but CT is currently only used as a secondary reference method.

In medical diagnostics, comparing tissue volumes it has been stated that it is important to use the same scanner and the same settings. It is therefore important to investigating the variation in the different scanner settings and segmentation methods. This study will contribute with estimates for the variation between two scanner methods and two segmentation methods enabling the use of CT as a primary reference for LMP calibrations.

Ninety carcasses were scanned consecutively: first with a step-and-shoot (8mm slice) followed by a helical (10mm slice) scan. The CT scanner was a Toshiba Aquilion S16 TSX-101 with a voltage of 135 kV, current of 200 mA and exposure time of 1500 ms. Second two different



segmentation methods (Threshold and Owen-Hjort-Mohn) were used to segment meat, fat and bone using a custom made Matlab® function. Average densities estimated in previous studies have been used to estimate the weight of meat, fat and bone.

Comparison between the scanner settings and segmentation method was performed using paired sample t-test in R (R Core Team 2015).

In summary, our results show that the standard variation of the differences between two set of results, i.e. between two segmentation methods and the same scanning method and vice versa are in the range 0.15 to 0.22 LMP. We found a significant variation up to 0.6 LMP. The variation was highest between the segmentation methods. The OHM method seems to be the most robust method independent of scanning method.

Co-authors:
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Notes

WG1 Poster Presenter Profiles & Abstracts

Aneka Bauer – Max Rubner-Institute, Kulmbach, Germany

PROFILE

Aneka Bauer studied Agricultural Biology with emphasis on farm animal biology, and graduated with a Diploma thesis in 2006 at the University of Hohenheim, Germany, followed by a PhD in Agricultural Science (2010) at the Institute of Animal Husbandry and Animal Breeding, Department of Animal Breeding and Regulation Physiology, University of Hohenheim, Germany. Her PhD thesis was on effects of immunological castration on the regulation of metabolism in boars.

Since 2009, she has been a principal scientist in the Max Rubner-Institute, Department of Safety and Quality of Meat in Kulmbach, Germany. She is heading various projects related to meat quality. One project investigates different aspects of meat production with entire male pigs. One question was, if boar carcasses are classified correctly with currently valid formulas.

Relevant publication:

Bauer A. and Judas M., 2014. Schlachtkörperqualität von Mastebern im Vergleich zu Sauen und Börgen. Züchtungskunde 86 (5/6), 374-389.

ABSTRACT (WG01P12)

Validity of classification equations for boar carcasses

The fattening of entire male pigs is an alternative to surgical piglet castration. But there are still some open questions which are investigated in many projects. It is known that boars have a different shape and carcass tissue composition compared to gilts and barrows (e.g. Bauer and Judas, 2014). This may have an impact on the correct estimation of lean meat percentage and weight of carcass parts with classification systems like AutoFOM based on ultrasound image analysis. Thus, we compared carcass data from full manual dissection (Bauer and Judas, 2014) with estimates from AutoFOM 1 and AutoFOM 3 systems. The sample comprised ca. 80 carcasses of boars, gilts and barrows each, representative for German slaughter pigs, with five major morphological types in three weight groups.

The largest deviation was found for boar carcasses. The RSME for lean meat was between 1.9-2.3 for AutoFOM 1 and 3 which is still within the official limits. The lean meat percentage was under-estimated by AutoFOM 1 (bias = -0.8) and over-estimated by AutoFOM 3 (bias = +0.9). The distortion for gilts and barrows was between lower with 0.1-0.3 %-points. Within different morphological types, boars showed deviations in the same range as for some subgroups of gilts and barrows.

The weight estimation of carcass parts for boars resulted in RMSEs of more than 5 % for some parts, e.g. ham. In total, the results were less accurate than for gilts and barrows.

Although distorted, the classification of boar carcasses was within the official limits.

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Notes

WG1 Poster Presenter Profiles & Abstracts

Antoine Vautier – Institute for Pig & Pork Industry (IFIP), France

PROFILE

Antoine Vautier studied agronomic engineering and animal science in the University of Rennes. He works at IFIP in Le Rheu (France) since 2002 on meat quality. His main research fields are predicting methods for meat quality and porcine myology. Since 2007, he is involved in several research programs based on NIRS spectroscopy.

Relevant publications :

Vautier A., Lhommeau T., Daumas G., 2013. Near infrared spectroscopy (NIRS) as a tool for predicting the technological quality of ham. FAIM II, Oct. 29th-30th 2013, Hungary.

Vautier A., Lhommeau T., Daumas G., 2013. A feasibility study for the prediction of the technological quality of ham with NIR spectroscopy. Proceedings of EAAP 2013.

Vautier A., Lhommeau T., Monziols M. 2014. Vis-NIR spectroscopy to predict the cooking yield of loins. FAIM III 25th and 26th of September 2014, Denmark.

ABSTRACT (WG01P13)

Definition of standards for anatomical specifications of French cuts of pork meat

The proportion of carcasses cut into the French pork slaughterhouses is now very important and is still increasing. To assess the cuts flows it is needed to have standards of pork cuts. This would avoid any confusion when describing all the specific meat cuts that could be recorded in the French market.

Moreover, these standards could be helpful to re-normalize a French industrial cutting for grading and marketing carcasses based on the quality of the cuts.

This work is based at first on a large survey performed in 16 French cutting rooms from varying regions. Meat cuts name, description and anatomical landmarks were recorded and the data were put together in four diagrams, corresponding to the four main cuts (ham, loin, shoulder and belly). These diagrams were logically constructed from raw primary cuts to deboned, defatted and trimmed cuts, and all the combinations were included. The idea was to use these diagrams as a tool to identify without any doubt a specific meat cut, then an identification number can be used to open the dedicated data sheet. The data sheets include three standardized pictures of the meat cut (medial, lateral, and other view) and an identification number from other standards (UNECE meat standards, FrenchPorkCuts.com) when anatomical specifications match. The anatomical specifications include the kind of cutting that is needed to get this cut from a previous cut in the diagram. It includes too the amount of each muscle that can be found in the cuts, according to the dissection guidelines published by the IFIP.

Medial, lateral and other view of "Jambon sel sec" ref. 30.101

Co-authors:
Nictou A.[1], T. Lhommeau[2], Monziols M.[2] and Daumas G.[2]

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Notes

WG2 Speaker Profiles & Abstracts

Cameron Craigie – AgResearch, New Zealand

PROFILE

Cameron Craigie holds a BSc (Hons) in Genetics, and BCom in Business Management from Otago University and a PhD in Animal Science from Massey University and SRUC Edinburgh. After studying and working in Scotland from 2007-2013, Cameron returned to New Zealand in January 2014 to take up a position at AgResearch Ruakura as a Science Impact Leader – Meat Products and Supply. In his role as a science impact leader, Cameron has oversight of all meat-related research work across AgResearch and plays a strategic role of shaping the research direction and capability in meat science. In his role as a senior scientist, Cameron currently leads two major industry-funded spectral imaging projects and a number of other meat science projects focussing on carcass, meat and co-product value streams in beef, lamb and venison. Cameron has been involved in FAIM since the start and is pleased to return to FAIM IV in Edinburgh to give an Australasian perspective on spectra-based techniques for predicting meat quality. Some recent publications are listed below:

Qiao, T., Ren, J., Craigie, C., Zabalza, J., Maltin, C., Marshall, S. (2015) Quantitative prediction of beef quality using visible spectroscopy with large data samples under industry conditions, Journal of Applied Spectroscopy, 82 (1), 137-144.

Qiao, T., Ren, J., Craigie, C., Zabalza, J., Maltin, C., Marshall, S. (2015) Singular spectrum analysis for improving hyperspectral imaging based beef eating quality evaluation, Computers and Electronics in Agriculture, 115, 21-25

Craigie, C.R., Purchas, R., Maltin, C., Roehe, R., Morris, S.T. (2014) Assessing the meat quality of venison short-loin from farmed red deer using visible near infrared spectroscopy. Proceedings of the New Zealand Society of Animal Production, Napier, 74, 17-22.

ABSTRACT (WG02T01)

Spectra-based techniques for predicting meat quality - an Australasian perspective

Australia and New Zealand red meat production accounts for a large share of the global red meat export trade. A largely unsubsidized farming system, favourable environments for livestock production, large distances to key off shore markets, relatively high production costs have shaped the Australasian red meat industries. This coupled with high market demand for Australasian meat products has fostered innovation and large scale operations in a drive to increase efficiency and improve meat product quality. Advances in animal breeding, meat processing and meat preservation techniques have been instrumental to industry success, yet there is still considerable variation in meat product quality. Variation presents both a challenge and an opportunity for the red meat value chain. Meat eating quality is a very valuable aspect of meat products. Firstly consumers are willing to pay a premium for meat products with superior eating quality characteristics, and secondly a positive eating experience is an important driver of repeat purchase events. Consequently, there has been an enduring interest in ways to measure meat eating quality without destroying the product. This has been both to harness and control variation, and to capture value. Spectra-based techniques such as Visible-Near Infrared Spectroscopy, Raman Spectroscopy and Hyperspectral Imaging Systems have a potential application in the red meat sector as tools for rapid non-invasive assessment of various meat quality parameters. A brief overview of the research work in Australia and New Zealand involving the application of these technologies for meat quality prediction along with future research directions will be discussed.

Co-authors:
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3. AgResearch Limited, Ruakura research Centre, 10 Bisley Road, Hamilton, 3214, New Zealand.

Notes

WG2 Speaker Profiles & Abstracts

Heinar Schmidt – University of Bayreuth, Germany

PROFILE

Heinar Schmidt is senior researcher at the University of Bayreuth. Since 2009, he is heading the group "In-situ Analytics" at the Research Centre of Food Quality (ForN) in Kulmbach, Germany which focuses on the application of non-invasive real-time technologies for the recording of quality relevant parameters for process control and quality management.

He graduated from Berlin University of Technology (TU Berlin) with a diploma in chemistry in 1988 and with a doctoral degree in chemistry (Dr. rer. nat.) in 1992.

Then, he moved to the department of Physics at TU Berlin to study laser technology, spectroscopy, optics and photonics to develop Raman probes and surface-enhanced Raman spectroscopy (SERS) for the trace analysis of polycondensated aromatic hydrocarbons in water and seawater (PAHs). He co-ordinated two EU projects which resulted a field-tested prototype of a sea-worthy instrument based on absorption, fluorescence and Raman spectroscopy.

After a period of science management at the Research Centre of Photonics at TU Berlin, he addressed research to food science with the development of a hand-held Raman probe for the rapid detection of meat spoilage.

His current research focuses on the application of Raman spectroscopy for a rapid and online assessment of meat quality. This involves studies on the prediction of pork quality from early post mortem Raman spectra, the assessment of technological quality parameters and the determination of the microbial status of meat.

The latest paper published on the topic is:

Scheier, R., Scheeder, M., Schmidt, H. (2015). Prediction of pork quality at the slaughter line using a portable Raman device. Meat Science, 103, 96-103.

ABSTRACT (WG02T02)

Raman Spectroscopy for the Assessment of Meat Quality

Raman spectroscopy is one of the non-destructive methods which came under scrutiny in WG2 Meat Quality of COST action FAIM for the determination of relevant quality parameters.

Raman spectroscopy is based on the inelastic scattering of light which is providing information of molecular vibrations of the probed material. In doing so, Raman spectra are complementary to infrared absorption spectra but they have the benefit that virtually no sample preparation is required and that water is not interfering. Therefore, Raman spectra can be used for qualitative and quantitative analysis of food with high water content, such as meat. Yet, it is an emerging technique in this field.

The presentation reviews recent applications of Raman spectroscopy in meat science for a non-invasive determination of quality characteristics such as pH value, water holding capacity (or drip loss), colour, tenderness (or shear force), intramuscular fat content, iodine value and fatty acid composition.

Emphasis is put on technological and sensory quality parameters which have been investigated with beef, pork, lamb and poultry. Furthermore, the feasibility to predict quality parameters of pork early (i.e. pre-rigor) in the production process is highlighted and implications are discussed. The potential of Raman spectroscopy to discriminate between animal species is also referred to.

The presentation is responsive to recent developments in the field of Raman instrumentation such as compact and portable Raman devices and their application.

In summary, benefits and drawbacks of using Raman spectroscopy for the assessment of meat quality will be discussed and perspectives for the determination or a prediction of quality parameters will be shown.

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WG2 Speaker Profiles & Abstracts

Maria Victoria Sarries – Public
University of Navarra , Spain

PROFILE

Maria Victoria Sarries, is teacher of Animal Production in the Public University of Navarra (Spain). She has participated in 18 research projects with public funding and in 11 projects with private SMEs funding. She has published 27 papers in peer reviews, more than 3 chapters in books and she has presented more than 54 proceedings to national and international congresses. These projects have mainly been associated with the evaluation of meat quality and improvement animal production system. These projects have also involved the evaluation of several techniques for measuring carcass and meat quality, including ultrasounds, image analysis, and colour measurements on the carcass to predict meat colour stability, especially at meat foal.

ABSTRACT (WG02T03)

Measurement of meat foal characteristics by Mid-infrared spectroscopy (MIR)

The main objective of this work was to use fast measurements recorded at MIR spectrum to determine the chemical composition (protein, fat content, water content), colour coordinates L*a*b*, texture characteristics, TBA value and visual sensory attributes on meat foal at 24 hours post-mortem based on the relationship between the MIR spectrum measurements and the determinations recorded directly on the meat foal (physico-chemical parameters).

	Range	R^2 Val (%)	MSEVC Val	R^2 Cal (%)	MSEVC Cal	Wavenumber (cm^{-1})	Model
Water %	5	55,36	1,03	79,94	0,76	2300-1540. 1150-980.	Multiplicative correlation of dispersion
Protein %	2	28,67	0,66	55,55	0,54	1150-980.	Vector of normalization
Intramuscular fat %	5	45,11	0,94	67,51	0,77	3000-2800.	First derivative + MSC
Ash %	9	49,89	0,03	90,07	0,01	3000-2800. 1150-980.	First derivative + MSC
OxyMioglobin %	7	30,64	13,2	82,67	7,35	3200-300. 1150-980.	Normalization of Min-Max.
pH	3	59,7	0,05	75,19	0,04	3200-2800. 1950-1850.	First derivative + MSC

Table 1. Relationship between the MIR spectrum measurements and the physico-chemical parameters using the spectral information (range: 1951 - 980 cm-1) from foal meat samples at 24 hours post-mortem

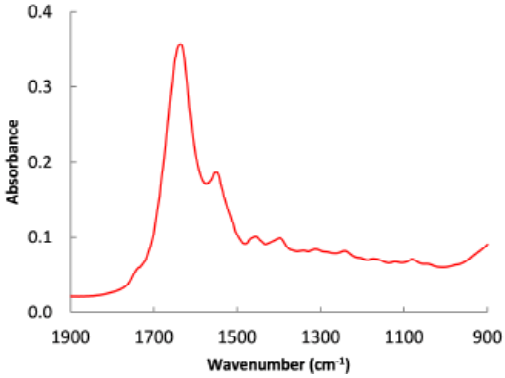

Figure 1. Representative spectrum in the region between 1900 and 900 cm-1.

Samples of Longissimus dorsi muscle between the sixth and eighth rib were used in this study. All samples were kept at 4º C and the ageing periods used was 24 h from the slaughter. The texture analyses were performed by a Stable Micro System Model TA-XT2i texture analyser (Stable Micro Systems, Godalming, England). MIR spectra were collected using Fourier transform mid-infrared (Vertex 80v, Bruker) between 4000-400 cm-1. All measurements were performed with an Attenuated Total Reflectance accessory A225/QPlatinum-ATR (Bruker, Ettlingen, Germany) with a diamond crystal. The models were built by a Partial Least Square (PLS) regression and a specific program of chemometrics was employed, OPUS Quant v.7 (Bruker, Ettlingen, Germany). To evaluate the performance of the robustness of models, regression coefficient of calibration, prediction and validation were used by comparing the actual and predicted values. In table 1 appears the prediction models and the relationship between the MIR spectrum measurements with the determinations recorded directly on the meat foal (physico-chemical parameters) from the analysis. It is possible to say that further research would be focused on the development of this technique to predict the physic and chemical characteristics of the foal meat.

Co-authors:
Ruiz, M., Lozano, M., Beriain M.J., Rodriguez, P., Insausti, K., Beruete, M.

Notes

WG2 Speaker Profiles & Abstracts

Silvia Ampuero Kragten –
Agroscope, Institute for Livestock Sciences ILS, Posieux, Switzerland

PROFILE

After a chemical engineering and a PhD degree obtained at the "Ecole Poly-technique Fédérale de Lausanne" in Switzerland, I worked with chemo-metry at the Swiss Federal Station for Milk and Dairy Products. There, we could develop a number of projects with an electronic nose based on mass spectroscopy for the identification of the botanical/geographical origin of cheese products, honey as well as the detection of off-flavours, such as TMA in milk.

For more than 10 years now, I am working at the Institute for Livestock Sciences, at Agroscope. One of our research topics is boar taint, for which we have adapted an HPLC method for the detection of boar taint compounds, developed a method for biopsy samples and for the quantification of boar compounds in meat and meat products. Within a SANCO project, we proposed a strategy to include sensory analysis to chemometric methods with an electronic nose. We have performed a series of studies on sensory analysis both in relation to commercial production as well as to in-house boar production projects linked to special animal nutrition, rearing conditions and vaccination against GnRF (Improvac). An interesting contribution is the harmonization of analytical techniques for the reference analysis of boar taint within a SABRE project. Among different contributions are the following: An in-vitro method for the determination of the digestible fraction of phosphorus content in pork feed and feed ingredients. Tannins analysis both spectrophotometric and with NIRS within a Marie Curie project. NIRS methods for the determination of fatty acids profile in feed ingredients, nutrient content, composition of compound feed, etc. The development of a NIRS predictive method for fat quality based on iodine value in pork carcasses' adipose tissue applied on-line at the Swiss abattoirs, within a national project.

ABSTRACT (WG02T04)

Physico-chemical data improves pre-diction models for drip loss with NIRS in pork slices

O: The aim of this work was to evaluate the possibility to improve NIRS models to predict drip loss in intact meat (pork) slices by including easily available physico-chemical signals, such as temperature and pH.

B: Although NIRS is an approved method for the determination of the nutritional content of meat and meat products (AOAC, Anderson 2007) meat quality parameters, e.g. drip loss, are difficult to predict by NIRS (in general, literature reports R2 below 0.6)

M&M: 86 pigs (Duroc, Pietrain, Large White, Swiss Landrace and crossbreeds) were slaughtered at the Swiss pig performance testing station (Suisag). Temperature and pH were taken at 1.5 and 24 h. Drip loss (DL) was performed (48 h at 2-4°C) in longissimus dorsi samples, dissected 24 h post mortem, via: a) DLsm, a mass-standardized method with 3 cm thick chops of ~80 g and b) DLb, a normal bag method with 2 cm thick whole chops (3-4 replicates). NIR spectra was taken with a NIRFlex N-500 (Büchi, Flawil, Switzerland) on whole chops, along three different ~180° archs, 21 scans per replicate, between 4000 and 10000 cm-1. NIRCal, R software and Unscrambler were used to build chemometric models.

R&C: Low correlation between DL methods was observed (R2 = 0.42). A low range (2.59 - 11.12%, for DLb, and 1.52 - 9.70% for DLsm) combined with a relatively high SD (up to 1.6%) are challenging conditions to build NIRS models. Chemometric models including NIR spectra, temperature and pH data (1.5 and 24h) improve SEP values (1.05% compared to 1.3%), and drastically reduce the necessary PC number (from >13 to 2).

Co-authors:
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Notes

WG2 Speaker Profiles & Abstracts

Elena Fulladosa – IRTA Monells, Catalonia, Spain

PROFILE

Elena Fulladosa obtained a PhD in Biotechnology from the University of Girona in 2004. Currently, she is working as a researcher at the Food Technology Program in IRTA. She works for the implementation of new technologies to food industry. She has been dealing with different X-ray-based equipments (Computed tomography, dual X-ray absorptiometry and X-ray inspectors) and other technologies such as dielectric time domain reflectometry and NIR.

Relevant publications:

Picouet, P., Muñoz, I, Fulladosa, E., Daumas, G., Gou P. (2014). Partial scanning using computed tomography for fat weight prediction in green hams: scanning protocols and modelling. Journal of food engineering, 142, 146-152.

Fulladosa E., Muñoz, I., Serra, X., Arnau, J., Gou P. (2014). X-ray absorptiometry for non-destructive monitoring of the salt uptake in bone-in raw hams during salting. Food control, DOI: 10.1016/j.foodcont.2014.06.023.

Gou, P., Santos-Garcés, E., Høy, M., Wold, J. P., Liland, K. H., & Fulladosa, E. (2013) Feasibility of NIR interactance hyperspectral imaging for on-line measurement of crude composition in vacuum packed dry-cured ham slices, 95(2), 250-255.

Santos-Garcés, E., Laverse, J., Gou, P., Fulladosa, E., Frisullo, P. & Del Nobile, M. A. (2013). Feasibility of X-ray microcomputed tomography for microstructure analysis and its relationship with hardness in non-acid lean fermented sausages. Meat Science, 93 (3), 639-644.

ABSTRACT (WG02T05)

Laser backscattering imaging to determine proteolysis index and texture defects in dry-cured ham

Texture is an important quality criterion in dry-cured ham. Texture defects such as pastiness are related to the excessive proteolysis occurred during the elaboration process. Therefore, the proteolysis index, defined as the percentage of the ratio between non-protein nitrogen and total nitrogen, may be considered as the best parameter to predict pastiness defects. Investigations on technologies which may evaluate non-destructively this defect are of interest. Laser backscattering imaging is an emergent technology based on the scattering behavior of light in a material due to its physicochemical properties and interaction with molecules. The aim of this work was to evaluate the feasibility of this technology to estimate the proteolysis index and pastiness defect in dry cured ham samples. To do so, a laser diode operating at a wavelength of 635 nm (red) and a digital CCD camera were used. Light intensity and scattering area were evaluated on dry-cured ham samples with different proteolysis index. Microstructural differences of these samples were analyzed by optical microscopy. Results obtained show that light intensity was similar in samples with a higher proteolysis index but scattering area was higher, probably due to the altered tissue structure. Microscope images show more intramuscular spaces and less robust cell walls which could produce a higher scattering of light. More experimental work is needed to obtain definitive results.

Co-authors:
M. Rubio, I. Muñoz, P. Gou, P. Picouet.

Notes

WG2 Speaker Profiles & Abstracts

Maren Bernau – Livestock Center Oberschleissheim, Ludwig-Maximilians-University Munich, Germany

PROFILE

Maren Bernau studied veterinary medicine at the Justus-Liebig-University Giessen from 2003-2009. She obtained her doctoral thesis at the Livestock Center Oberschleissheim of the Veterinary Faculty of the Ludwig-Maximilians-University, Munich in 2011. Subsequently she worked at the Institute for Animal Science of the Rheinische Friedrich-Wilhelm-University, Bonn from 2010-2011. From 2011 until now, she works as a scientist at the Livestock Center Oberschleissheim. One field of research is the evaluation of body and carcass composition of pigs and sheep using magnetic resonance imaging and dual-energy X-Ray absorptiometry. Her second field of research is the use of magnetic resonance imaging for the detection and evaluation of local reactions after vaccination in pigs, sheep and calves.

ABSTRACT (WG02T06)

Could the testicle volume be an indicator for androstenone levels in the carcass fat?

The aim of this study was to evaluate, whether it is possible to predict boar taint (or especially androstenone, Skatol, or Indol level) in boar carcasses by evaluating different variables at the boar in vivo. Therefore a total of 34 intact boars (Piétrain x German Landrace; divided into 3 groups) were scanned three times during their growth (ø 30, 60 & 90 kg live body weight). Magnetic resonance imaging was used, to scan the whole body, using a spin echo sequence (TR 380s; TE 15ms) with 10 slices of 15 mm thickness (distance factor 0.25). The images were evaluated semi-automatically using the Able 3D Doctor Software®. Different variables were created to determine the fat and muscle composition of the shoulder, loin, belly and ham region. Additionally the testicle volume was determined. After slaughtering boar taint probes were sampled, one cheek and salivary glands probe for the organoleptic analysis (microwave + cook + melt testing) and a second probe from the back fat layer for a stable isotope dilution assay, to measure the exact androstenone, skatole, and indole levels.

Using the MRI testicle volume at 90 kg, the androstenone level can be predicted with an R2 of 0.23 (RMSE=524 ng/g). Interestingly, slight differences were found between the left (239.5 ±71.6 cm^3) and the right (246.4 ±72.5 cm^3) testicle volume. Using the left testicle volume to estimate the androstenone level, an R2 of 0.23 could be received, whereas the right testicle volume yielded an R2 of 0.21.

Additionally, analyzing the data within three different seasonal growth groups, the 13 boars of the winter season showed a relationship between testicle volume and androstenone level of R2 = 0.93 (RMSE = 26.5 ng/g) by using a cubic regression equation for the testicle volume. When adding the sensory data of these 13 boars, 4 out of 13 probes were classified as boar taint. A number of 2 probes belong to boars having the largest testicle volume and the highest androstenone levels and 2 probes belong to boars having the lowest testicle volume and the lowest androstenone levels. Generally, organoleptic positive pigs (n =19) - only after microwave heating - had a testicle volume (LSM) of 520 ± 60 cm^3 and negative pigs (n = 15) of 451 ± 62 cm^3 (p = 0.0778).

These findings could be interpreted, that the testicle volume shows a positive relationship with the androstenone level. But, there seems to be a seasonal effect, which calls for further research in this area.

Co-authors:
M. Bernau[1], S. Schwanitz[1], L.S. Kreuzer[1], P.V. Kremer[2] and A.M. Scholz[1].

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Notes

WG2 Speaker Profiles & Abstracts

Trinidad Perez-Palacios – University of Extremadura Cáceres, Spain

PROFILE

Trinidad Perez-Palacios got the Veterinary degree at the University of Extremadura (UEx) in July 2004. She got a pre-doctoral grant in competitive calls from the Extremadura govern for carrying out the doctoral thesis in the Food Science group (TECAL) at the UEx, under the supervision of Dr. Teresa Antequera Rojas and Dr. Jorge Ruiz Carrascal. She also got a grant for doing a pre-doctoral stay in Gent (Belgium) during three months. In 2009 she defended the doctoral thesis, obtaining the maximum mark, the European Doctorate and also the Extraordinary Doctorate Award of the UEx. Then, she got a post-doctoral grant in competitive calls of the Extremadura govern for doing the post-doctoral stay during 24 months (2011-2012) in the Faculty of Pharmacy at the University of Porto (Portugal), under the supervision of Dr. Isabel Ferreira, participating in the CQUP group (Centro de Química da Universidade do Porto integrado no Laboratório associado REQUIMTE). After that, she has had several contracts as researcher working with TECAL group. During all these activities, she has participated in 4 projects/contracts, one of them being a European project, and she has achieved the following publications: 40 papers in peer reviewed journals, 6 in technical journals, 24 international and national congress publications and 4 chapters in international edited books. In relation to teaching activities, she has had two temporary contracts as official teaching in Food Technology. She has also supervised six master theses. Currently, she has supervising two doctorate theses and three master theses.

Most relevant papers related to MRI:
J. Food Eng. (2010) 101, 152-157
Food Res. Int. (2010) 43, 248-254
Food Chem. (2011) 126, 1366-1372
J. Food Eng. (2014) 131, 82-88

ABSTRACT (WG02T07)

Low-field MRI and computational texture features to predict moisture and lipid content of loins.

Most works carried out to determine quality characteristics of dry-cured products by MRI have been centred on hams, with loins being much less studied. High field MRI scanners are normally used in food research, which allow high quality images but also imply a high cost. Low field systems are cheaper but give lower signal to noise ratio. To maximize the signal to noise ratio and obtain an appropriate image, it is important the selection of the adequate sequence. The MRI acquisition should be followed by a computer system that analyses the images, being computational texture feature algorithms highly used. The main objective of this study was to configure the acquisition and analysis of low-field MRI to determine moisture and lipid content of Iberian loin. The use of different MRI sequences (spin echo, SE; gradient echo, GE; turbo 3D, T3D) and computational texture feature algorithms (GLCM, NGLDM, GLRLM, GLCM+NGLDM+GLRLM) was evaluated. Multiple linear regression was used as predictive technique. For both, moisture and lipid prediction, the highest correlation coefficients were found when applying GLCM and GLCM+NGLDM+GLRLM on MRI acquired with SE or GE. Nevertheless, SE obtained a bit higher correlation coefficients (0.771-0.954) than GE (0.703-0.890). Considering not only the accuracy of the methodology, but also time consumed and resources required, it could be indicated the use of SE sequences, for MRI acquisition, and GLCM algorithm, for MRI analysis, for prediction moisture and lipid content of loin.

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Notes

WG2 Speaker Profiles & Abstracts

Maria Font-i-Furnols – IRTA Monells, Catalonia, Spain

PROFILE

Maria Font-i-Furnols is researcher at the Institute of Food Research and Technologies (IRTA) in Monells, Catalonia, Spain. She belongs to the Product Quality Program. She has a MSc in Agricultural Engineering (1994) from the University of Lleida and the PhD (2000) from the Polytechnics University of Catalonia. She has worked mainly on boar taint, consumer studies, carcass classification and in the use of computed tomography to evaluate carcass and meat quality. She has participated in several EU projects (Eupigclass, Quality Pork Genes, Boar taint AIR project, Alcasde, Pigcas, Pigscan, among others) and National Projects. Nowadays she coordinates a national project entitled "Influence of feeding restriction and dietary P levels on body tissue composition evaluated in vivo by computed tomography, bone mineralization and sensory properties of meat from gilts". She is the author of more than fifty-five peer reviewed papers, a high amount of professional papers and six book chapters.

Some papers published in the topic of computed tomography are:

Font-i-Furnols, M., Brun, A., Tous, N., Gispert, M. (2013). Use of linear regression and partial least square regression to predict intramuscular fat of pig loin computed tomography images. Chemometrics and Intelligent Laboratory Systems, 122, 58-64.

Carabús, A., Sainz, R.D., Oltjen, J.W., Gispert, M., Font-i-Furnols, M. Predicting fat, lean and the weights of primal cuts for growing pigs of different genotypes and sexes using computed tomography. Journal of Animal Science, 93, 1388-1397.

Font-i-Furnols, M., Brun, A., Martí, S., Realini, CE., Pérez-Juan, M., Gonzalez, J., Devant, M. 2014. Composition and intramuscular fat estimation of Holstein bull and steer rib sections by using one or more computed tomography cross-sectional images. Livestock Science 170, 210-218.

ABSTRACT (WG02T08)

Handbook on reference methods for meat quality determination

Within the framework of the Cost Action FAIM, one of the milestones of WG2 (Meat Quality) was to write a handbook of reference methods for previously selected meat quality traits. The handbook is a conjoint work created thanks to the networking created within the Cost Action FAIM. The handbook is the result of the work performed by 17 researchers from 10 EU institutions and 8 EU countries. This work could not be done without the previous participation of several FAIM members, from 14 countries and 19 institutions, in a questionnaire to collect information about references methods used in their labs. Furthermore, the selected attributes included in the handbook were also selected after a questionnaire and a discussion session in FAIM II conference in 2013.

The handbook will be presented and distributed at FAIM IV and it has the following chapters:

1. Protein, fat, moisture and ash.
2. Intramuscular fat and marbling.
3. pH value and water-holding capacity
4. Muscle and fat colour.
5. Instrumental tenderness – shear force.
6. Fatty acid analysis in meat and meat products.
7. Reference measurement for sensory attributes: tenderness, juiciness, flavour and taint.
8. General aspects of chemometrics for calibration and validation of spectroscopic technologies.
9. Future trends in non-invasive technologies suitable for quality determinations.

The editors of the handbook hope that it will be a useful tool for scientist and technicians.

Co-authors:
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Notes

WG2 Poster Presenter Profiles & Abstracts

Teresa Antequera – University of Extremadura, Cáceres, Spain

PROFILE

Teresa Antequera received her Ph.D. degree in Chemistry in 1990 (University of Extremadura, Spain). She is an Associate Professor in the Department of Animal Production and Food Science at the University of Extremadura, where she teaches "Food Technology", and "Physicochemical Analyses" in a Master of Meat Science and Technology. The official Ph.D. program in which she is currently involved, "Food Science", has been awarded with Mention to Excellence. Her research interest is focused on the area of Food Technology. Through her participation in projects, she has addressed issues related to animal systems (feeding, breeding, using of different genetic lines and their influences in the composition of the meat), and the processing system of Iberian ham (freezing the raw material, conditions of the ripening process, different salt systems, etc.).. She has launched a line of work focused on adding bioactive compounds to meat foods. In 2000, a research line on applications of non-destructive techniques, mainly magnetic resonance imaging (MRI) to find issues that may affect the quality of Iberian pig products and their classification was started. She has participated in 40 projects and research contracts and is co-author of 90 papers in journals included in SCI, 35 papers in technical journals, one invention patent, 9 book chapters, and 60 conference contributions. She has supervised 10 doctoral theses, being three of them of "European Doctor" mention, and another three "Extraordinary Doctorate Award" based on their scientific production. She has leaded the research group of "Technology and Quality of Food", and she is currently part of the management team of the Faculty of Veterinary Medicine at University of Extremadura.

ABSTRACT (WG02P01)

Low field-MRI to study the cohesion of dry-cured stuffed deboned shoulders from Iberian pigs.

This work aims to analyze the use of low field Magnetic Resonance Imaging (MRI) and computer vision procedures to study the cohesion of stuffed deboned shoulders from Iberian pigs. Deboned Iberian shoulders were folded, and subsequently vacuum pressured and stuffed into casings. Three batches of samples were produced, two with binding commercial additives, fibrinogen-thrombin (FT) and carragenates (CA), and a control group (CO, without binding additives). The binding additives were added before folding. The three batches followed the same curing process: 1.5 months at 5-6 ºC – 1 month at 18 ºC – 1 month at 25 ºC – 5 months at 12-15 ºC. At the end of the processing, the dry-cured products were MRI scanned (ET=24 ms; RT=900 ms). The images were analysed by means of 26 computational texture features. Throughout the visual comparison of the MRI images, there were found marked differences among CO, FT and CA batches. Noticeable holes were observed in FT and CA dry-cured products, while they were not so perceptible in CO batch. As for the MRI computational analysis, 21 in 26 computational texture features showed significant differences among CO, FT and CA batches, with CO having higher values for most computational texture features than FT and CA batches. Thus, MRI allows monitoring the cohesion of dry-cured products from stuffed deboned muscles by means of computational texture features, and also visually.

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Notes

WG2 Poster Presenter Profiles & Abstracts

María del Mar Ávila – University of Extremadura, Cáceres, Spain

PROFILE

María del Mar Ávila received her B.Sc. degree in 1997, and the M.Sc. degree in 1999, both in Computer Science from the University of Extremadura. After obtaining the Diploma of Advanced Studies (European certification of research competence and higher studies diploma), she is currently finishing her Ph.D. studies. She is an assistant professor in the Department of Computer Science at the University of Extremadura. Her research interest includes Image Processing, and 3D reconstruction, based on Magnetic Resonance Imaging (MRI) from meat products. She is researching in computer algorithms that can help to achieve non-destructive applications, based on MRI, to find quality parameters of pig products. She has participated in five research projects and is co-author of more than sixteen papers. She has supervised several degree and master theses.

Relevant publications:

M. Ávila,M. Durán, T. Antequera, R. Palacios and M. Luquero. 2007. 3D Reconstruction on MRI to Analyse Marbling and Fat Level in Iberian Loin. Lectures Notes in Computer Science (LNCS-4477) 145-152. Girona, Spain.

T. Pérez-Palacios, D. Caballero, T. Antequera, M. Durán, M. Ávila and A. Caro. Low-field MRI and computational texture features to predict quality traits of loins. Elsevier. System for Food Chemistry. 2015. (Under revision)

M. Ávila, D. Caballero, M. Durán, A. Caro, T. Pérez-Palacios and T. Antequera, 2015. Including 3D-textures in a Computer Vision System to analyse quality traits of loin. Proceedings of the International Conference on Computer Vision Systems 2015, 6-9 July 2015, Copenhagen, Denmark. Paper 041. Interprofesional para el Desarrollo Agrario, (Editor), Zaragoza, 2, 649-651 (In Spanish)

Xavier, C., Gonzales-Barron, U., Paula, V., Estevinho, L., Cadavez, V. (2014). Meta-Analysis of the Incidence of Food-Borne Pathogens in Portuguese Meats and their Products. *Food Research International,* 55, 311-323.

ABSTRACT (WG02P02)

Computational 3D texture features to predict sensorial traits of Iberian loin based on MRI

Usually, physical-chemical procedures are the only verified way to analyse parameters in meat products. The final quality of these products has also been evaluated by sensorial tests. These methods are tedious and destructive. Image processing techniques could be applied on MRI avoiding the destruction of the pieces. This work aims to study the relationship between computational 3D texture features resulting from analysing MRI and sensorial characteristics evaluated by trained panellists.

Five cured loins were scanned using MRI Spin-Echo sequences (ESAOTE VET-MR E-SCAN XQ 0.18 T). The images were analysed by applying three texture algorithms in their 3D versions: GLCM, GLRLM, and NGLDM. Then 26 computational texture features have been obtained. Evaluated sensorial characteristics were named as: redness, brightness, marbling, odour intensity, hardness, juiciness, salt, flavour intensity, cured flavour, rancid flavour, and persistence flavour.

Linear regression between all the characteristics has been studied. Results show high correlations (R>0.7) between most of the predicted parameters and the ones obtained by sensorial analysis, except for the cured flavour. From the three texture methods, GLCM present the better results, and NGLDM the worst correlations.

Therefore the use of 3D texture characteristics obtained from Spin-Echo MRI provides good correlations for predicting loin sensory characteristics.

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Notes

WG2 Poster Presenter Profiles & Abstracts

Pablo García Rodríguez – University of Extremadura, Cáceres, Spain

PROFILE

Pablo García Rodríguez was born in Pontevedra (Spain) in 1969. He received his B.Sc. degree in Physical Science with the specialization in Electronics and Computing in 1992 (University of Santiago de Compostela). He received his Ph.D. degree in Computer Science in 2000 (University of Extremadura), working in Digital Mammography, and with the first mention as a European Ph.D. in the University of Extremadura. He is an Associate Professor in the Department of Computer Science at the University of Extremadura since 1997. Currently he is Subdirector of New Technologies and Researching in the Polytechnic School center in the University of Extremadura. He has 16 articles with JCR impact factor. His research area is related to the development of Pattern Recognition and Image Analysis techniques, and CBIR (Content-Based Image Retrieval).

Relevant publications:

Barrena, M., Caro, A., Durán, M. L., Rodríguez, P. G., Arias-Nicolás, P.G., and Alonso, T. 2015. Qatris iManager a general purpose CBIR System. Machine Vision and applications, 26 (4), 423-442.

Mera, D., Cotos, J.M., Varela-Pet, J., Rodríguez, P. G., and Caro, A. 2014. Automatic decision support System based on sar data for oil spill detection. Computers & Geosciences, 72, 184-197.

Pérez-Palacios, T., Caballero, D., Caro, A., Rodriguez, P. G., and Antequera, T. 2014. Applying data mining and Computer Vision Techniques to MRI to estimate quality traits in Iberian hams. Journal of food engineering, 131, 82-88.

ABSTRACT (WG02P03)

Using data mining and computational texture features on MRI to estimate salt content on Iberian ham.

The analysis of salt in ham is crucial due to its influence on the microbiological and sensory quality. Traditional methods of salt analysis are laborious, time consuming and destroying the sample. As alternative, non-destructive techniques, as Magnetic Resonance Imaging (MRI) and computational texture analyses are being proposed. For touching up the computational data obtained, data mining technique seems to be appropriate, since it allows predicting future models from current data by exploring and analysing large volumes of data and their trend analysis. This study aims to predict salt content in hams by applying data mining on computational texture features from MRI. For that, 20 dry-cured hams were first MRI scanned, that were analysed by three computational texture feature algorithm (GLCM, NGLDM and GLRLM). Then, salt content was analysed by traditional method. Finally, all data obtained were touched up by data mining (multiple linear regression, MLR). The correlation coefficient (R) was used to analyse and validate the results. The highest R values were found when applying MLR on GLCM method (R>0.986), proving the effectiveness of the obtained prediction equations. In conclusion, the use of data mining to touch up computational texture features from MRI of hams allows determining the salt content.

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Notes

WG2 Poster Presenter Profiles & Abstracts

Pere Gou – IRTA Monells, Catalonia, Spain

PROFILE

Pere Gou obtained a PhD in Agronomic Engineering from the Polytechnic University of Valencia (Spain) in 1993. Since 1991 he has been working at the Food Technology Program in the Institute of Agrifood Research and Technology (IRTA). Since 2009 he is Director of Food Engineering Subprogram at IRTA.

His main lines of research are: optimization of traditional food technologies, mainly drying of meat products, and development of new technologies for food preservation and for at-line, on-line and in-line analysis of product quality and process monitoring.

Relevant publications:

Gou, P., Santos-Garcés, E., Høy, M., Wold, J.P., Liland, K.H., & Fulladosa, E. (2013). Feasibility of NIR interactance hyperspectral imaging for on-line measurement of crude composition in vacuum packed dry-cured ham slices. Meat Science, 95(2): 250-255.

Santos-Garcés, E., Muñoz, I., Gou, P., Garcia-Gil, N., & Fulladosa, E. (2014). Including estimated intramuscular fat content from computed tomography images improves prediction accuracy of dry-cured ham composition. Meat Science, 96(2A): 943-947.

Picouet, P.A., Muñoz, I., Fulladosa, E., Daumas, G., Gou, P. (2014). Partial scanning using computed tomography for fat weight prediction in green hams: Scanning protocols and modelling. Journal of Food Engineering, 142: 146-152.

Fulladosa, E., I. Muñoz, Serra, X., Arnau, J., & Gou, P. (2015). X- ray absorptiometry for non-destructive monitoring of the salt uptake in bone-in raw hams during salting. Food Control, 47: 37-42.

ABSTRACT (WG02P04)

Automated marbling grading system for dry-cured ham based on computer image analysis

Marbling in sliced dry-cured ham affects the sensory quality of the product. The aim of this study was to build up an automated marbling grading system for dry-cured ham slices. Firstly, a sensory marbling grading scale was developed by a panel of experts who did not only take into account the amount of visual fat content, but also the distribution of the fat flecks. This scale was used for the design of an automatic classification system of dry-cured ham based on segmenting intramuscular fat. Six-hundred and forty-three regions of interest (ROI) of the slice were categorized by a panel of experts using the marbling grading scale and later segmented by the computer system. From the segmented ROI, 48 features (geometrical and textural) were extracted. Using all the data several classifiers were built using two machine learning techniques namely Support Vector Machines (SVM) and Neural Networks (NN). Different feature selection algorithms were tested to select the optimal subset of features. The feasibility of these classifier systems on computed tomography images was also evaluated.

The best results were obtained with the Support Vector Machines classifier combining several features showing an accuracy performance of 89%. This system is accurate enough to develop a future automatic grading system in terms of marbling for industrial processing lines.

Co-authors:
I. Muñoz, M. Rubio, E. Fulladosa

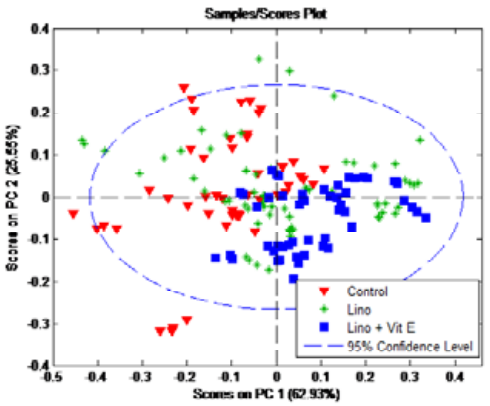
Notes

WG2 Poster Presenter Profiles & Abstracts

Kizkitza Insausti Barrenetxea – Public University of Navarra (Spain)

PROFILE

Kizkitza Insausti Barrenetxea obtained a PhD in Agricultural Engineering from the Public University of Navarra (Spain) in 2001. Subsequently, she has worked at the Agricultural Engineering School at this University as a lecturer and researcher in Animal Science and Meat Science until now. She has participated in 16 research projects with public funding and in 10 projects with private SMEs funding. She has published 28 papers in peer reviews, 6 chapters in books and she has presented more than 80 proceedings to national and international congresses. In this research, she has used ultrasounds, image analysis, NIR, and colour spectra on the carcass to predict meat quality in beef and lamb. She is MC Substitute Member (Spain) of the Cost Faim1102.



PCA feeding groups applying the pretreatment MSC+DT with 8 PC

ABSTRACT (WG02P05)

Effect of feeding diet on beef NIR-infrared spectra

The main objective of this work was to use fast measurements recorded at NIR spectrum to examine the effect of feeding a concentrate diet rich in n-3 fatty acids including whole linseed, or linseed plus vitamin E on beef. Samples of Longissimus dorsi muscle of 46 animals were used in this study (control, n= 14; whole linseed, n= 16; linseed plus vitamin E, n= 16). All samples were aged 7 days after slaughter at 4º C. NIR spectra were collected using a NIR Luminar 503l0 Miniature `Hand held'. The models were built by a Partial Least Square (PLS) Toolbox 731 and Matlab program (8.3) was used.

Different pre-treatments were applied to the obtained spectra with the aim of trying to segregate beef samples based on the effect of diet.

For beef, and under the present experimental conditions, the best results were obtained when applying the PLS discriminate analysis (PLS-DA) to the best results of the PCA. Beef samples from control diet and from linseed plus vitamin E were correctly classified with a percentage higher than 83%.

Further research would focus on the application of this technology on-line at the slaughter house to control and certify the different diet of animals that might justify a higher price at the market.

Co-authors:
Insausti K, López A, Ruiz M, Lozano M, Butirica J, Gómez I, Sarriés MV, Beriain MJ

Notes

WG2 Poster Presenter Profiles & Abstracts

María Jose Beriain Apesteguia – Public University of Navarra, Spain

PROFILE

Maria Jose Beriain is professor of Nutrition and Food Science in the Public University of Navarra (Spain). She has participated in 40 research projects with public funding and in 25 projects with private SMEs funding. She has published 70 papers in peer reviews, more than 15 chapters in books and she has presented more than 100 proceedings to national and international congresses and she has directed more than 13 PhD students. These projects have mainly been associated with the evaluation of meat quality and improvement of meat products. These projects have also involved the evaluation of several techniques for measuring carcass and meat quality, including ultrasounds, image analysis, and colour measurements on the carcass to predict meat colour stability. More recently, she has been involved in projects to develop new meat products, with especial interest in improving the nutritional profile of intramuscular fat.

		Predicted group		
	Ageing (days)	4	18	Number of spectra
Original (%)	4	71.7	28.3	120
	18	30.0	70.0	120
Cross validation (%)	4	69.2	30.8	120
	18	30.0	70.0	120

Table 1. Classification of the meat samples at 4 and 18 days using the spectral information (range: 1951 - 980 cm-1).

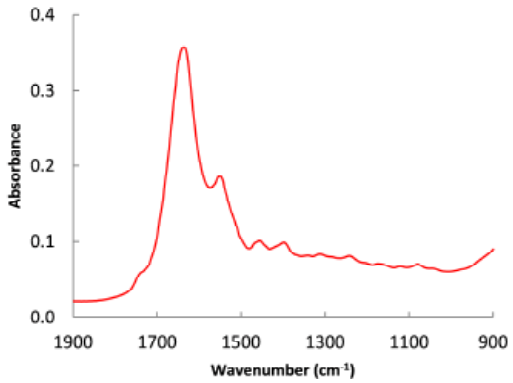


Figure 1. Representative spectrum in the region between 1900 and 900 cm-1.

ABSTRACT (WG02P06)

Measurement of texture characteristics of beef by Mid-infrared spectroscopy (MIR)

The main objective of this study was to use medium infrared spectroscopy as an alternative method to analyse meat tenderness, using instrumental techniques as references methods. Classification of the samples by ageing is explored by means of Principal Component Analysis (PCA) and discriminant analysis. A total of 20 male beef belonging to the "Ternera de Navarra-Nafarroako Aratxea" a label meat protected as geographical indication (PGI) were used. The average weight at slaughter was 326 ± 24 kg and the average age was 379 ± 39 days. Samples of Longissimuss dorsi muscle between the sixth and eighth rib were used in this study. All samples were kept at 4 oC and the ageing periods used were 4, 6, 11 and 18 days from the slaughter. The texture analyses were performed by a Stable Micro System Model TA-XT2i texture analyser (Stable Micro Systems, Godalming, England). MIR spectra were collected using Fourier transform mid-infrared (Vertex 80v, Bruker) between 4000-400 cm-1. All measurements were performed with an Attenuated Total Reflectance accessory A225/QPlatinum-ATR (Bruker, Ettlingen, Germany) with a diamond crystal. The models were built by a Partial Least Square (PLS) regression and a specific program of chemometrics was employed, OPUS Quant v.7 (Bruker, Ettlingen, Germany). To evaluate the robustness of the models, the regression coefficients of calibration and validation were compared. Moreover, using SPSS v.20, samples were classified by the ageing period (Table 1). Further research would focus on the development of this technique to predict sensory scores and nutritional compounds.

Co-authors:
Lozano, M., Echeverría, J., Rodriguez, P., Beruete, E., Beruete, M., Sarriés, M.V., Insausti, K.

Notes

WG2 Poster Presenter Profiles & Abstracts

Thierry Lhommeau – Institute for Pig & Pork Industry (IFIP), France

PROFILE

Thierry Lhommeau works at IFIP since 8 years; he has been recently graduated engineer in bioengineering. His main interests are meat process technologies and muscle to meat conversion.

Relevant publications:

Lhommeau T., Vautier A., Goujon J-M., Le Page R. Visible and Near Infrared spectroscopy for PSE-like zones classification at different post mortem times. Proceedings of the 61st International Congress of Meat Science and Technology, 23-28th August 2015, Clermont-Ferrand, France.

Vautier A., Lhommeau T., Daumas G. 2013. A feasibility study for the prediction of the technological quality of ham with NIR spectroscopy. Proceedings of the EAAP, Nantes.

Vautier A., Lhommeau T., Daumas G. 2013. Near infrared spectroscopy (NIRS) as a tool for predicting the technological quality of ham. FAIM II second annual conference KAPOSVAR, Oct. 29th-30th 2013, Hungary.

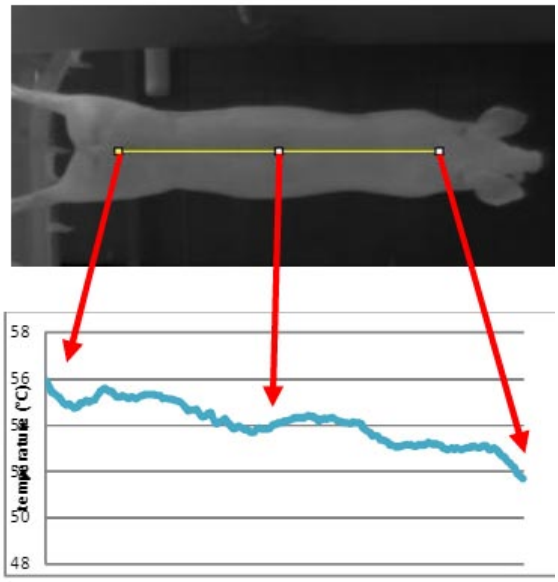


Fig. 1: Individual temperatures file and its line profile analysis

ABSTRACT (WG02P07)

Thermal imaging use for heat treatment qualification: the case of singeing

We developed and validated a relevant and simple method of thermal image analysis in order to assess the variability of the surface temperatures of pig carcasses at the singeing step of the slaughtering line, and its potential impact on the bacterial decontamination. Thermal images of carcasses exiting singeing equipment were acquired in standardized conditions with an E60 FLIR® Camera in 4 slaughterhouses. Conversion of the images was performed with the Flir Tool® software, and ImageJ© was used to treat and analyse the files with temperatures data. Three different thermal image treatments were developed and compared for sets of 20 carcasses: a method by line profile, in which a standard segment is (manually) applied on the back of each carcass from the tail to the neck, and the surface temperatures from this segment are analysed (Fig. 1). The second method was based on the superposition of the carcass images, to obtain an averaged matrix of surface temperatures expunged from movements and differences of shape or size of the carcasses. The third method uses the profile line method on the averaged matrix obtained with the superposition method. Data analysis (mean, variance and distribution) showed that the first method was the most appropriate in our project, and that sets of 5 carcasses were sufficient. The validated method was then applied to qualify the efficiency of singeing and its variability in the different slaughterhouses, and further assess its microbial impact.

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WG2 Poster Presenter Profiles & Abstracts

Ana Catharina Batista – CECAV, UTAD, Portugal

PROFILE

Ana Catharina Batista was born In Maceió, Alagoas, Brazil and went to the Universidade Federal de Alagoas (UFAL). At UFAL she obtained his degree in Zootecnia, in 2011. Currently she is PhD student of the Animal Science Departament at Universidade de Trás-os-Montes e Alto Douro (UTAD) and member of the Animal and Veterinary Research Center (CECAV-UTAD). The main fields of research interests are sheep and goats and techniques to predict carcass and body animal composition.

ABSTRACT (WG02P08)

Using a computer vision system for the determination of muscle longissimus dorsi colour in CIELab space

The meat colour evaluation is a subjective human judgment which can be inconsistent. In general, the research conducted to determine the colour of meat are performed using a colorimeter, however, the use of rapid and objective systems, such as those resulting from the evaluation of digital images, offer an consistent and non-destructive alternative meat colour determination. Thus, the objective of this work was to study the relationship between the colour values in the CIELab space obtained by a colorimeter and a computer vision system (CVS). Forty five samples of Longissimus dorsi (LD) muscle obtained from the lumbar region of carcass steers with 254±36 kg cold carcass weight were used. The colorimetric characteristics L* (lightness), a* (from green if negative to red if positive) and b* (from blue if negative to yellow if positive) were measured using a Minolta colorimeter CR-10. The CVS consists in a camera Olympus EM-5 with 16 Megapixel sensors equipped with an M. Zuiko ED 12-50mm f3.5-6.3 EZ lens at 24 mm and open at f8 with a circular polarizer filter. For illumination it was used an Olympus OM T28 Macro Twin Flash with polarizer filters in both heads. The camera was mounted on a stand. All LM samples were placed in a frame with a black opaque cloth. For image analysis it was employed the Adobe Photoshop CS6 software. The L*, a*, and b* values were measured on JPEG images. ANOVA and correlations analysis were established. The results show significant differences (P<0.001) between the values obtained using the two equipments for the three parameters analysed. The brightness L* of the LD measured with the colorimeter was higher (P<0.05) than that obtained using the CVS. The values of a* and b* were higher (P<0.05) when measured with the CVS. The correlation coefficients between the colour parameters were significant (P<0.01) and higher than 0.8; with r = 0.842 for L*, r = 0.803 for a* and r = 0.850 for b*. The use of CVS allows a robust relationship for L*, a* and b* measured with colorimetric method. This work shows that there is a relationship in parameters L*, a* and b* obtained from the assessment of colour on the surface of LD by both methods under study. Although differences in colour values between both methods, the use of a CVS is an alternative method because is faster, versatile and with low cost.

Co-authors:
A.C.S. Batista[1], C.M. Guedes[1], A.M. Jorge[2], J.H. Almeida[1], V.C. Santos[1], A. Teixeira[3], S.R. Silva[1]

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WG2 Poster Presenter Profiles & Abstracts

Adam Stuart – AgResearch, New Zealand

PROFILE

Adam Stuart holds a Bachelor of Environmental Sciences from The University of Waikato and is a senior meat technician with over 10 years' experience working in the Food Assurance & Meat Quality team at AgResearch, Ruakura in New Zealand. Adam has extensive experience in meat quality assessment and has contributed to numerous meat science projects. Adam is currently undertaking a Masters project in Food Technology at Massey University and AgResearch focused on proof-of-concept evaluation of Hyperspectral Imaging and Near Infrared Spectroscopic technologies for use in an on-line system for assessment of lamb meat quality. Adam's research is industry-funded by Beef + Lamb New Zealand Genetics Limited.

Relevant publications:

Kim, Y. H. B., Stuart, A., Rosenvold, K., & Maclennan, G. (2013). Effect of forage and retail packaging types on meat quality of long-term chilled lamb loins. Journal of Animal Science, 91(12), 5998-6007.

Wiklund, E., Dobbie, P., Stuart, A., & Littlejohn, R. P. (2010). Seasonal variation in red deer (Cervus elaphus) venison (M. longissimus dorsi) drip loss, calpain activity, colour and tenderness. Meat Science, 86(3), 720-727.

Farouk, M. M., Beggan, M., Hurst, S., Stuart, A., Dobbie, P. M., & Bekhit, A. E. D. (2007). Meat quality attributes of chilled venison and beef. Journal of Food Quality, 30(6), 1023-1039.

ABSTRACT (WG02P09)

Real-time non-destructive spectral imaging technologies to determine lamb quality

Producing and supplying high quality lamb meat to market is a key goal of the New Zealand lamb value chain. At present, the measurement of meat quality attributes is unsuitable for routine application in processing plants and there is no suitable tool to assist the value chain to capture value from superior quality lamb, and improve product consistency.

The ability to grade lamb carcasses based on meat quality parameter(s) that are demanded by the customer and consumer is critical and would allow the industry to: 1. Target carcasses for specific market requirements; 2. Market lamb based on measurable quality parameters for increased product differentiation; 3. Inform the value chain of the impacts of management and breeding decisions on lamb product quality for continual improvement.

Routine measures of meat quality that are safe, objective, rapid, non-destructive, and real-time are required to enable lamb meat quality assessment at processing. The latest spectral imaging technologies including Hyperspectral Imaging (HSI) and Visible-Near Infrared Spectroscopy (NIRS) are well suited to this application, but remain largely untested in a lamb processing environment. This current research overview outlines an ongoing work plan to evaluate spectral imaging technologies and their suitability for assessing lamb meat quality on the production chain. An assessment of these technologies will be undertaken by testing their ability to predict intramuscular fat content, intramuscular fat composition, tenderness, colour and pH through calibration and validation studies involving >1,500 lamb loins.

The overall objective of this project is to investigate the feasibility for real-time non-destructive prediction of meat tenderness, pH, colour, intramuscular fat content and fat composition of lamb loins at 24 hours post mortem in three commercial meat processing plants. Data from 2500 lambs has been collected so far and currently we are investigating automated selection of "region of interest" (ROI) that we plan to use in the future for the implementation of an online system. The progress to date of this investigation will be discussed.

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WG2 Poster Presenter Profiles & Abstracts

Severiano Silva – CECAV, UTAD, Portugal

PROFILE

Severiano Rocha e Silva was born in Baltar, Porto, Portugal and went to the Universidade de Trás-os-Montes e Alto Douro (UTAD). At UTAD he obtained his degree in Animal Science, in 1987. After doing his military service in 1989 he became Assistant at UTAD and in 2001 obtained his PhD degree in Animal Science. Currently he is Associate Professor of the Animal Science Department at UTAD and member of the Animal and Veterinary Research Centre (CECAV-UTAD). The main fields of research interests are animal welfare and techniques to predict carcass and animal body composition. He has authored and co-authored several scientific articles and book chapters.

Relevant publications:

Silva, S.R., Cadavez, V.P., 2012. Real-time ultrasound (RTU) imaging methods for quality control of meats. In Computer vision technology in the food and beverage industries. Editor Da-Wen Sun. Woodhead Publishing, Cambridge, UK. 277-329.

Francisco, C.L., Jorge, A.M., Dal-Pai-Silva, M., Carani, F.R., Cabeço, L.C., Silva, S.R. 2011. Muscle fibre type characterization and myosin heavy chain (MyHC) isoform expression in Mediterranean buffaloes. Meat Science, 88:535-541

ABSTRACT (WG02P10)

Intramuscular fat and adipocytes diameter in the longissimus thoracis et lumborum muscle from cull ewes with different body condition

In sheep production culled animals represents 10-20% of all effective. In general the carcasses from the culled sheep have very low consumer acceptability. In recent years some strategies have been conducted to increase value of those carcasses. On other hand it is recognized that increasing the nutritional plane of cull sheep before slaughter improves carcass characteristics and meat quality. This can be utilized for the culled sheep, particularly the younger individuals, to increase value of the carcass and primal cuts and improve the meat quality. It is recognized that intramuscular fat (IMF) plays an important role in sheep meat quality but very little information is available concerning this trait in cull sheep. Therefore, the objective of this study was to determine the effect of body condition on LM intramuscular fat and adipocytes diameter in culled ewes. Longissimus thoracis et lumborum muscle (LM) samples from lumbar (LML) and thoracic (LMT) cuts of 45 ewe carcasses (18±3.7 kg) were used. The IMF chemical content of LM samples was obtained in triplicates after ether-extraction in a Tecator Soxtec HT 1043 using petroleum ether as solvent. For adipocytes diameter (AD) fat tissues were fixed for 24 h in Bouin fluid, dehydrated and embedded in paraffin. The samples were sectioned (5µm thick), stained with haematoxylin and eosin and observed at 20X magnification in a microscope equipped with a camera (Nikon FXA). Digital images were analysed with the ImageJ for AD determination. The IMF and the AD in both lumbar regions are similar (P>0.05). IMF range from 1.3 to 9.3% and AD range from 25.6 to 111.3 µm. Regarding the variation of body condition differences were observed for both IMF and AD. A positive correlation between IMF and AD and carcass, subcutaneous and intermuscular fat was observed (r between 0.78 to 0.82, P<0.01). The body condition of culled ewes influences IMF and AD which may have impact on meat quality. Further studies must detail this impact on meat quality traits in order to establish a carcass fat limit to optimize quality and cost.

Co-authors:
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WG2 Poster Presenter Profiles & Abstracts

Violeta Razmaitė – ASI of LUHS, Lithuania

PROFILE

She obtained a PhD degree in Agricultural Sciences in 1986. The main fields of research interests are pig production, meat quality and conservation of farm animal genetic resources. She is the author and co-author of numerous scientific peer-reviewed papers. She has been work package leader of many national research projects. Currently she works on a national project "Quality of meat of farm and wild animals from different rearing systems in relation to healthy nutrition" and international H2020 project Treasure.

Relevant publications:

Razmaitė V., Šveistienė R., Švirmickas G. J. Compositional characteristics and nutritional quality of Eurasian beaver (Castor fiber) meat. Czech Journal of Food Science. 2011. Vol. 29(5). P. 480-486.

Razmaitė V., Švirmickas G. J., Šiukščius A. Effect of weight, sex and hunting period on fatty acid composition of intramuscular and subcutaneous fat from wild boar. Italian Journal of Animal Science. 2012. Vol. 11. No 2. P. 174-179

Razmaitė V. and Švirmickas G. J Fatty acid composition in hybrid pigs as based on local fatty Lithuanian breed and wild boar. Food Science and Technology International. 2012. Vol. 18(6) P. 515–522.

This research work was funded by a grant No SVE-07/2012 from the Research Council of Lithuania

ABSTRACT (WG02P11)

Intramuscular fat quality indices of farm and wild animals in relation to healthy nutrition

Meat has distinct characteristics, fat composition and quality indices which differ between animal species, breeds and production systems. The PUFA/SFA and n-6 PUFA/n-3 PUFA ratios in IMF as measures of the propensity of the human diet to influence the incidences of diseases could be added by lipid quality indices of atherogenicity (AI), thrombogenicity (TI), hypocholestero-lemic/ hypercholesterolemic ratio (h/H). The aim of the study was to determine the fatty acid composition and cholesterol content in the meat of various domestic and wild animal species pertaining to different production systems in Lithuania. The most favourable PUFA/SFA ratio was found in the intramuscular fat of the brown hare (1.39) followed by beaver (1.28), roe deer (1.12), red deer (0.85), wild boar during winter hunting season (0.76) and rabbit (0.76), whereas the most favourable lowest n-6 PUFA/n-3 PUFA ratio was in the horse meat (0.72) followed by the brown hare (1.4), beaver (2.19), free living red deer (2.33) and roe deer (2.89). The lowest AI was shown by the goose (0.26) and roe deer (0.33) muscles followed by wild boar (0.38) and beaver (0.41), whereas the lowest TI was found in the meat of the brown hare (0.40) followed by the horse (0.46), beaver, roe deer and goose. The highest and most favourable h/H ratio was estimated in the roe deer and goose (3.3) muscles followed by beaver (2.72), wild boar and brown hare. However, the lowest cholesterol (39.9 mg/100g) was detected in the longissimus muscle of pigs, whereas the cholesterol content in the same muscle of the rabbit, red deer and brown hare was 42.7, 48.1 and 63.1 mg/100 g, respectively.

Co-authors:
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Notes

WG2 Poster Presenter Profiles & Abstracts

Martina Gondeková – Animal Production Research Centre Nitra, Slovak Republik

PROFILE

Martina Gondeková graduated with Ing. (Hons) in Scientific Nutrition of Human at Slovak Agricultural University in Nitra in 2001, followed a PhD (2011) from the same University. The topic of the PhD study was Carcass quality, nutritional, physico - technological and sensory quality of musculus longissimus dorsi of slaughtered cows. Since 2007 she has been working as a scientist at the Research Institute for Animal Production in Nitra (RIAP), at the Department of Institute of Animal Husbandry Systems, Breeding and Product Quality.

Her scientific work is based on assessment of carcass and meat quality of pork and beef. She has been involved in the project concerned the alternative methods to surgical castration of pigs with regard on consumer's acceptability and economics of production. Project includes ultrasound, chemical and sensory meat quality tests. She is part of early stage researchers group (ESR = from PhD until 8 years after) and she has published 6 papers in peer reviewed journals.

Relevant publications:

RM. Gondeková, I. Bahelka, K. Zaujec, P. Polák: Evaluation of quality acceptance of cow´s meat in respect to certain social aspects of consumers. Slov. J. Anim. Sci., 47/2 (2014), p. 105-110.

K. Zaujec, M. Gondeková: Marbling of meat I. Chemical and physico-technological parameters of cows´meat. Slov. J. Anim. Sci., 44/4 (2011), p. 162-166.

ABSTRACT (WG02P12)

Meat and sensory quality of different cattle categories in Slovakia

The aim of the study was to compare quality of beef related to different categories of cattle slaughtered in 2010-2012. Meat samples were taken from 181 cows, 78 bulls and 41 heifers. The place of sampling was MLD (9/11 rib) approximately 800/1000g from the right side of the carcass 48h pm. The chemical composition, measurements of colour, pH48, water holding capacity were performed within 48 hours p.m. Degree of marbling using a 10-point scale (1-very abundant to 10-practically devoid) was determined. 7 days after slaughter a consumer test and measurement of shear force and drip loss was performed. The samples were sliced into 2.0 cm thick steaks and grilled for 4 minutes. Sensory traits (odour, taste, tenderness and juiciness) were evaluated by 5-point scale (1-the worst). Comparison of the cattle categories suggested significant higher total water content in meat of bulls than the other two groups ($P<0.05$). The content of intramuscular fat was statistically higher in meat of cows and heifers than in bulls (3.54 and 3.49 vs. 1.98 %, $P<0.05$). Statistically significant differences were found in pH48, colour lightness L and drip loss ($P<0.05$). Cows had the darkest meat and together with heifers had significantly lower degree of marbling than bulls (7.92 and 7.90 vs. 8.5, $P<0.05$). Sensory evaluation of the organoleptic qualities showed statistically significant differences between cows and bulls in taste and odour ($P<0.05$). Generally, the best evaluation of all parameters was found in meat of bulls.

Co-authors:
I. Bahelka, P.Polák

Notes

WG2 Poster Presenter Profiles & Abstracts

Daiva Ribikauskiene – Lithuanian University of Health Sciences, Lithuania

PROFILE

Daiva Ribikauskiene studied Veterinary medicine at the Lithuanian Veterinary Academy, Lithuania from 1990-1995. She finished her doctorate thesis in 2001. Doctoral thesis: "The effects of crossing Lithuanian white pigs with different genotype boars on lean meat content and meat quality of crossbreds". The main fields of her research interest are animal breeding, carcass and meat quality. She participates in the nation research programme "Healthy and Safe Food" (2013-2015) and international projects "Study on Education and information activities in Animal Welfare" (acronym: EDUCAWEL, EC DG SANCO, 2013-2014), "Organic Dairy Health", (FP7, 2014-2016). She published more than 30 scientific papers.

Relevant publications:

Ribikauskienė D., Razmaitė R., Stimbirys A. Influence of carcass weight and fatness on precision of lean meat prediction in the carcasses. Veterinary Medicine and Zootechnics. Lithuania. 47(69), 2009, P.71-75.

Macijauskiene V., Ribikauskiene D. Meat quality differences between purebred and crossbred New Zealand rabbits. Acta Biol. Univ. Daugavp., Latvia. 10(2), 2010, P. 177 - 181.

Razmaite V., Ribikauskiene D. and Stimbirys A. Effects of carcass weight on major carcass cuts, their composition, and meat in Lithuanian slaughter pig population. Acta Veterinaria (Beograd, Serbia). Vol. 61, No. 2-3, 2011, P. 259-268.

Razmaitė V., Ribikauskienė D., Šveistienė R. Meat quality in Lithuanian commercial pigs of different leanness. Veterinary Medicine and Zootechnics. Lithuania. 65(87), 2014, P. 68-71.

ABSTRACT (WG02P12)

Fatty acid composition of the Longissimus dorsi muscle and subcutaneous fat of different pig breeds

The amounts of n-3 (C18:3, C22:6) and n-6 (C18:2, C20:3, C20:4, C22:4) fatty acids in the meat and subcutaneous fat of various pig breeds were defined. Three groups of different pig breeds were formed: group 1 comprised of Lithuanian White (commercial type), group 2 was made of Yorkshire and group 3 Landrace pigs. The content of fatty acids was analysed at the Analytical Laboratory of the Institute of Animal Science of LUHS. The subcutaneous fat of the Yorkshire breed was biologically more valuable. It contained, respectively, 0.6 and 4.3% ($P<0.001$) more indispensable polyunsaturated fatty acids (PUFA) compared with the subcutaneous fat of Landrace and Lithuanian White (commercial type) pigs. However, the intramuscular fat in M. Longissimus dorsi of the Yorkshire breed had the lowest (12.3%) PUFA amount. The amount of PUFA in the lipids of Landrace pig meat was 3.6 and 3.9% ($P<0,025$) higher than that in Lithuanian White (commercial type) and Yorkshire intramuscular fat. The Landrace breed showed a more favourable n-6/n-3 ratio than the Yorkshire and Lithuanian White, and it exceeded current nutritional recommendations. According to the total amount of saturated and polyunsaturated fatty acids in intramuscular fat of M. Longissimus dorsi and subcutaneous fat, Lithuanian White had more saturated ($P<0.05$ - $P<0.025$) and less polyunsaturated ($P<0.025$ - $P<0.005$) fatty acids than Yorkshire and Landrace breeds. The generalisation of the data indicated, that the meat of Landrace pigs is more valuable if compared with other breeds and the subcutaneous fat is more valuable than that of the Yorkshire pig breed.

Notes

WG3 Speaker Profiles & Abstracts

Thomas Jørgensen – Technical University of Denmark

PROFILE

Thomas graduated with a MSc. in Electrical Engineering (1989) and a PhD in Optical Physics (1992), both from The Technical University of Denmark. Thomas Martini Jørgensen is today working as a senior researcher at the Department of Applied Mathematics and Computer Science of the Technical University of Denmark. He is presently participating in the NEXIM project (New X-ray Imaging Modalities for safe and high quality Food) funded by The Danish Council for Strategic Research. His current focus of research is on image analysis and machine learning but he has many years of experience within the area of biomedical optics and biosensors. He has published 61 peer-reviewed papers, 6 book chapters, and > 50 conference proceedings.

ABSTRACT (WG03T01)

Artefact removal in Differential Phase Contrast X-ray Computed Tomography

The novel imaging modalities of X-ray computed tomography have recently gained increased attention in the area of food science. The additional contrast obtained using phase contrast or dark field imaging (as opposed to absorption) opens up for new applications of CT scanning. This includes quality testing of porcine fat and rind, detection of foreign bodies in food, and distinguishing raw food from frozen. In addition there are currently research efforts to implement robust online CT scanners that could operate at cutting lines at pig slaughterhouses. Measurements should result in the spatial distribution of meat, fat and bones and deliver an optimal recipe for automatic cutting of pork middles. With such systems the capacity becomes more important than the obtained image resolution and quality. The handling of image artefacts can especially play a crucial role for the resulting performance of such a system.

Here we suggest a novel method for dealing with the so-called ring artefacts in Differential Phase Contrast X-ray CT (DPC-CT). We compare the performance of our method with state-of-the art algorithms applied to DPC-CT tomograms of meat samples. We also illustrate how we might suppress image distortions that occur as spurious spatial variations in the measurement values across the scanned volume.

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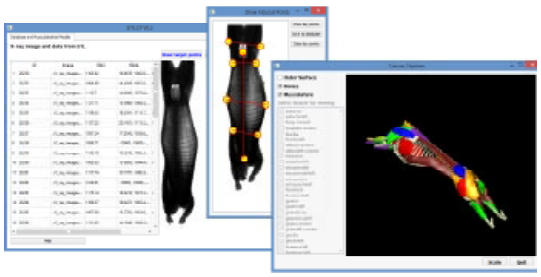
Notes

WG3 Speaker Profiles & Abstracts

Harvey Ho – Auckland Bioengineering Institute (ABI), New Zealand

PROFILE

Harvey Ho received his PhD in Bioengineering from the University of Auckland in 2010. He is now a Research Fellow in the Auckland Bioengineering Institute (ABI), where he is involved in the R&D of multiple biomedical and agricultural projects. His research interests include medical image computing, 3D re-construction, biomechanics and devices. He has published 29 peer-reviewed research papers on medical image computing and physiological flow analysis, including those published in top medical imaging and biomedical engineering journals. From 2013-2015 Harvey was the manager of a lamb carcass modelling project in collaboration with Silver Fern Farms, New Zealand's leading procurer, processor and marketer of sheep, lamb, beef and venison. Currently he also collaborates with experts in other meat industry sectors.



ABSTRACT (WG03T02)

Generic Software Modules for the Meat Industry

Large amounts of data in the meat industry, sourcing from abattoirs, production lines, laboratories and markets need to be analysed to serve customer requirements and marketing strategies. These data exist in different forms and formats, from ASCII text files, Word and Excel files, to images and even 3D models. A software framework containing generic software modules for database, statistical analysis, image processing and 3D modelling can be quickly customised to address specific problems and to add value to the meat industry. We propose such a framework which is based on open source software and has been successfully applied to the Silver Fern Farms lamb carcass modelling project. A brief description of the main modules:

- Database system: SQLite is used to provide the underlying database system. SQLite is serverless and compact, and this allows for easy distribution of the heterogeneous data.
- 3D modelling: OpenCMISS-Zinc is utilised to display and manipulate graphics. The Python bindings of this package allow for the work done in CMGUI to be used in the new software.
- Image processing: Java-based ImageJ is used to test image filters and pipelines. The algorithms are then implemented in Scikit-image in the Python programming environment.
- Statistical analysis: R is used for statistical analysis of the carcass data. The equations from the regression analysis performed are implemented in the Python application.
- Graphical User Interface (GUI): The Python bindings of the Qt framework allow for simple yet comprehensive representations of complex modelling concepts and features.

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Notes

WG3 Speaker Profiles & Abstracts

György Kovács – Analytical Minds Ltd., Hungary

PROFILE

György Kovács has obtained the MSc. degree in Computer Science (2007), in Applied Mathematics (2012) and in Physics (2014) at the University of Debrecen. He is a PhD-student in the Discrete Mathematics, Image Processing and Computer Graphics PhD program at the University of Debrecen. His main research interests include medical image analysis with statistical approaches, tomographic image reconstruction (CT, PET, MRI) techniques, pattern recognition, machine learning and 3D stereoscopic reconstruction. He has attended several conferences and summer schools related to image processing and computer vision, and published papers in peer reviewed journals. Currently he is the CEO of the Analytical Minds Ltd. providing pattern recognition solutions in various R+D projects.

ABSTRACT (WG03T03)

Introduction:
In computed tomography (CT) aided studies of farm animals a common goal is to carry out CT based weight prediction of various tissues, organs and body parts. The input of prediction is usually a (manually or automatically selected) region of the volumetric CT image and some previously trained regression technique is used to assign a weight value to the region of interest. In the most basic form of prediction, the volume of the region is determined and multiplied by the mean density of the tissues covered by the region. The precision of prediction can be improved by extracting the histogram of densities in the region of interest and applying advanced regression techniques on the histogram vector. In the last decades several techniques have been developed for weight prediction, an overview can be found in (1). Nowadays the state of the art regression technique used for weight prediction is Partial Least Squares (PLS) regression. In this work we examine some alternatives of PLS regression for weight prediction. Although PLS regression handles the multi-colinearity of histogram bins, it has some weaknesses, particularly, PLS regression does not take into account that the training vectors are histograms. PLS regression does not satisfy the natural expectation that the higher the density of a voxel is, the higher its contribution to the overall weight should be. Thus, PLS regression is likely to overfit the prediction model to the training data.

Materials and methods:
Based on the simple and natural expectation on the proportionality of density to the overall weight, we have developed some novel regression techniques for the prediction of weights from histograms. The proposed methods have been applied to several histogram based weight prediction problems and the results have been compared to that of PLS regression.

Results:
In several cases the proposed regression techniques have had lower mean square errors than PLS regression. We can conclude that the consideration of alternative regression techniques can improve the accuracy of certain studies in farm animal imaging.

References:
(1) C. A. Glasbey and C. D. Robinson, "Estimators of tissue proportions from x-ray CT images". Biometrics. 58:928-936, 2002.
(2) M. Font I Furnols, A. Brun, N. Tous and M. Gispert, "Use of linear regression and partial least square regression to predict intramuscular fat of pig loin computed tomography images", Chemometrics and Intelligent Laboratory Systems, 122:58-64, 2013.
(3) M. Font I Furnols, M. F. Teran and M. Gispert, "Estimation of lean meat content in pig carcasses using X-ray computed tomography and PLS regression", Chemometrics and *Intelligent Laboratory Systems, 98:31-37, 2009*

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WG3 Speaker Profiles & Abstracts

Daniel Caballero – University of Extremadura, Cáceres, Spain

PROFILE

Daniel Caballero was born in Madrid, Spain, in 1985. He received his B. Sc. and M. Sc. degree in 2013, both in computer science engineering from the University of Extremadura. Currently, he is a researcher in Animal source foodstuffs innovation services (SiPA). He is working on his doctoral thesis in Computer Science enrolled in the Technology and Quality of Food (TECAL) research group of the Research Institute of Meat and Meat Product (IproCar) from the University of Extremadura.

His research interests are focused in the area of image and data analysis applied to meat products. Special interest lies on the application of non-destructive techniques such as Magnetic Resonance Imaging employing texture features and predictive models based on data mining to obtain quality parameters of meat products.

Relevant publications

Pérez-Palacios, T., Caballero, D., Caro, A., Rodríguez, P. G., and Antequera, T. 2014. Applying data mining and Computer Vision Techniques to MRI to estimate quality traits in Iberian hams. Journal of Food Engineering, 131, 82-88.

Caballero, D., Caro, A., Pérez-Palacios, T., Rodríguez, P. G., and Palacios, R. 2014. Prediction of quality features in Iberian ham by applying data mining on data from MRI and Computer Vision Techniques. International Journal of Data Mining and Knowledge Management Process, 4 (2), 1-11.

Ávila, M. M., Caballero D., Durán, M. L., Caro, A., Pérez-Palacios, T., and Antequera, T. 2015. Including 3-D textures in a Computer Vision System to analyse quality traits of loin. In 10th International Conference on Computer Vision Systems 2015, Copenhagen, Denmark.

ABSTRACT (WG03T04)

From 2D to 3D texture features on MRI to analyse Iberian loin

In the last decade, the use of computational texture features from bi-dimensional (2D) images is very common in order to determine parameters related to food quality. In this sense, texture analyses on Magnetic Resonance Imaging (MRI) have been used frequently to predict quality traits of meat products. Research into the development of appropriate techniques for evaluating 3D objects and scenes is being pursued. MRI allows volumetric scans, however, the extraction of features from MRI are only carried out by sets of 2D images. The use of 2D images to analyse the quality of Iberian loin has been validated in previous studies. The aim of this work was to compute volumetric (3D) textural features and evaluate their performance in comparison to classical 2D approaches. For that, 10 loins were scanned obtaining 2D MRI images. Then, 3D images were generated from 2D MRI through an interpolation and reconstruction process. The 2D and 3D computational texture feature algorithms were applied to extract numerical data. To validate the proposed 3D texture approach, correlation between values of the texture features obtained by 3D and 2D methods were determined. 14 of 26 computational texture features reached very good to excellent correlation (R>0.75), and 6 of them achieved good to very good correlation (R>0.5). In conclusion, volumetric textural features have shown similar performance as their 2D counterparts, since they achieved high correlation coefficients. In addition, it is therefore indicated that the studied methodology for extracting 3D textures could be useful in order to determine quality traits of loins.

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WG4 Speaker Profiles & Abstracts

Elly Navajas – National Agricultural Research Institute, Uruguay

PROFILE

I graduated from the Universidad de la República (Uruguay) as Engineer in Agriculture. In 1994, I started my career as researcher in Animal Genetics and Genetic Improvement, and Meat Science. After completing my MSc degree at Massey University (New Zealand), I moved to Edinburgh in 2002 where I got a position as Scientist at the Scottish Agricultural College. Simultaneously, I completed my PhD degree in Animal Breeding and Genetics at the University of Edinburgh.

Since 2011, I am a senior researcher working at the National Agriculture Research Institute (INIA-Uruguay) dedicated to the integration of genomics into the livestock breeding programmes, with focus on carcass and meat quality and other "non-traditional" economically traits, such as feed efficiency and methane emissions.

From the very beginning, the development and calibration of novel objective and accurate methods to assess difficult-to-measure traits have been included in the research work. The powerful tools available for data recording and analysis provide a great potential for new developments and applications.

I have been involved in many activities in different countries: undergraduate and graduate lecturing at the Faculties of Veterinary and Agronomy in Uruguay, invited lecturer of the University of São Paulo (Brazil) and the University of Concepción (Chile); consultancies in animal genetic improvement and genomics; participated in 15 research projects, national and international, leading 5 of them, with 32 peer-reviewed articles, 6 chapters in books and 75 presentations in congresses and workshops.

ABSTRACT (WG04T01)

Farm-to-fork individual traceability in Uruguay: applications in animal production and breeding

Uruguay has implemented a national cattle traceability system from farm of origin to final cut by integrating two existing schemes: the Traceability Program managed by the National Livestock Information System (SNIGϕ) at the Ministry of Agriculture (MGAPϕ) and an Electronic Information System of the Meat Industry (SEIICϕ) ordered by Government to be implemented in all abattoirs. This comprehensive traceability system allows the access to the information on date and place of birth, sex, breed, physical movements within national borders, changes of ownership, date and place of slaughter/death. For those animals that are slaughtered, it is also complemented by carcass weights and quality data recorded by SEIIC. Based on scales located along the slaughter and processing lines, it automatically records carcass weights and primal and retail cuts weights. Originally, SNIG and SEIIC databases worked independently because they were created and defined for different purposes: disease management, and monitoring taxes information, respectively. Nowadays, both databases are linked and it is possible to have all animal information using the animal identification number. The National Traceability Systems provides a unique opportunity to collect large volume of carcass and cut data at national level, which can be use with different goals. One of the first approaches is building the training populations for genomic selection of carcass quality. Solving the challenges of this implementation is one the objectives of a large project carried out by public and private partners with the aim of implementing genomic selection by 2017.

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2. OPYPA
3. INIA
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Notes

WG4 Poster Presenter Profiles & Abstracts

Andrew Moxey – ScotEID, UK

PROFILE

ScotEID is a partnership between the Scottish Government and its livestock industry to develop a multi-species data system based on electronic identification (EID). The system currently provides real time traceability for sheep and pigs plus registers of sheep and pigs and BVD status of cattle. Sheep recording is fully automated from farm through markets to abattoirs, utilising low frequency (LF) EID. ScotEID is currently conducting research into cattle EID, including ultra high frequency (UHF) applications, with a focus on using dual LF-UHF tags and readers to offer flexibility to users across the supply chain.

ScotEID has been running since 2008 and proactive engagement with stakeholders has been used throughout to conceptualise, design and test EID solutions. In particular, volunteer partner farms, marts and abattoirs have been involved in the process of developing hardware, software and management procedures. Hardware components and equipment (i.e. antennae, transponders, readers and tags) have been sourced from a variety of commercial providers. Software for the database has been written in-house using open source standards, as have the numerous interfaces with the different hardware (e.g. readers) and proprietary management software (e.g. farm recording systems) in use across the industry.

In addition, considerable attention has been paid to establishing clear protocols for how livestock data owned and provided by individuals are held centrally and shared for use by other parties. Equally, negotiation has been required to explore the implications and rigidity of various regulations and standards relating to tagging and livestock identification.

Recent documentation includes:
ScotEID (2015) Bovine EID numbering.
ScotEID (2015) Phase 4 Report.
ScotEID (2015) Co-existence of LF & UHF in dual-technology tags.

ABSTRACT (WG04P01)

Electronic Tracing of Livestock in Scotland

O: The aim is to utilise applied R&D in modern data systems to meet the need for more accurate and faster tracing of animals through their various supply chains, in a manner that meets regulatory requirements and is understood and accepted by industry.

B: The introduction of mandatory EID for sheep and the impending introduction of voluntary EID for cattle across the EU has prompted government and industry to seek workable EID applications. ScotEID was created as a vehicle for developing and implementing practical solutions to suit the varying needs of different users.

M&M: A combination of testing under controlled (workshop) and commercial (field) conditions has been used to configure hardware, software and management procedures across the supply-chain. Feedback from users has been used to improve hardware, software, management procedures and governance protocols.

R&C: EID for livestock traceability is achievable. However, care has to be taken over the choice and configuration of hardware and in designing software and management procedures to suit diverse local circumstances. This means offering users some flexibility in how they use EID, including a choice between LF or UHF. Moreover, traceability depends on the ability and willingness of users to share information in a timely and accurate manner and this depends on more than simply technological choices – it depends crucially on governance arrangements for how data are held, shared and used.

Contributing staff: John Hotchin, Andrew Moxey, Hamish Stuart and Bob Yuill.
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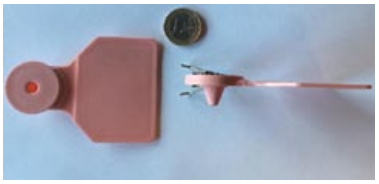
Electronic Tracing of Livestock in Scotland

John Hotchin, Andrew Moxey, Hamish Stuart and Bob Yuill

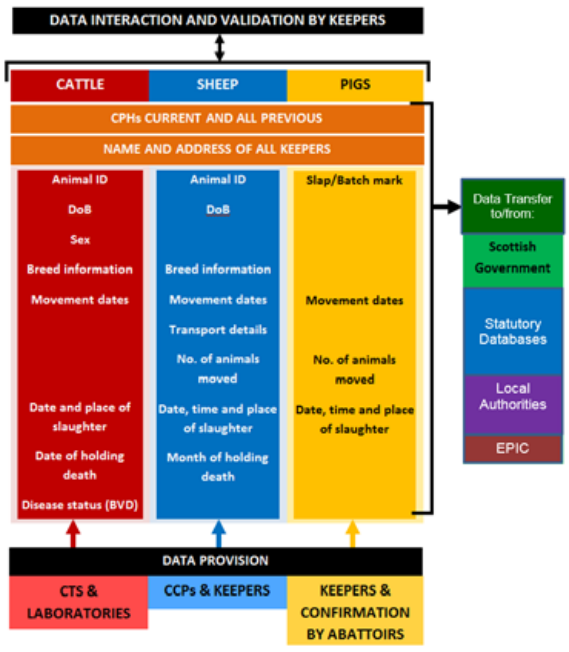
Introduction

ScotEID, a partnership between the Scottish Government and the livestock industry, is the Scottish multi-species data system providing real time traceability for sheep and pigs plus registers of sheep and pigs and BVD status of cattle. Sheep recording is fully automated from farm through markets to abattoirs, utilising LF EID. ScotEID is currently conducting research into cattle EID with a focus on using dual LF-UHF tags and readers to offer flexibility to users across the supply chain.



Methods

ScotEID has been running since 2008 and proactive engagement with stakeholders has been used throughout to conceptualise, design and test EID solutions. In particular, volunteer partner farms, marts and abattoirs have been involved in the process of developing hardware, software and management procedures. Hence research has been conducted under both controlled workshop conditions and more variable and challenging commercial field conditions. Hardware components and equipment (i.e. antennae, transponders, readers and tags) have been sourced from a variety of commercial providers. Software for the database has been written in-house using open source standards, as have the numerous interfaces with the different hardware (e.g. readers) and proprietary management software (e.g. farm recording systems) in use across the industry. Although EU regulatory requirements restrict sheep EID to Low Frequency (LF) systems, Ultra High Frequency (UHF) remains a possibility for cattle and is currently undergoing field trials.



Discussion

A number of key points emerge from the process of identifying and implementing practical EID solutions across a diverse sector with many reluctant adopters.

First, the technical performance of EID hardware is highly variable – the quality and design of tags and readers makes a difference. Moreover, the absence of standardised outputs from EID readers or existing proprietary (local) recording software means that considerable effort is required to ensure cross-compatibility. across different combinations of existing set-ups (e.g. operating systems, management software). Consequently care has to be taken in the choice and configuration of equipment in relation to the demands placed upon it and compatibility with pre-existing management systems (both procedural and software).

Second, UHF has considerable merit as an alternative to conventional or advanced LF for cattle EID – faster reading at a greater distance offers time savings and a reduction in health & safety risks (i.e. beef cattle unused to human handling have less need to be physically restrained to be read). Potential performance impairment arising from signal blocking by animals' body tissue and/or wet conditions has not been detected in field trials and many users report a preference for UHF.

Third, traceability depends upon the willingness and capability of livestock keepers to record and share information in a timely and accurate manner and upon how such data are held and analysed. The latter requires a consolidated central database, but also clear governance arrangements (e.g. protocols for the sharing, control, processing and protection of data) as to who owns the data and how they are to be used (e.g. statutory reporting, regulatory inspection and enforcement, food chain quality assurance, academic analysis) plus realistic expectations of system performance and pragmatic procedures for handling data imperfections. Appropriate governance engenders trust and encourages users to share information, but variation in users' preferences for different modes of recording means that offering some flexibility (e.g. LF and UHF and manual reading) can increase the efficiency and coverage with which information is gathered relative to imposing a single system-wide technical solution.

Fourth, making EID attractive to users also entails working to identify how regulatory controls and standards can be interpreted or amended to maximise gains/minimise costs. For example, using derogations to reduce paper recording if EID is adopted. In some cases, interpretations of prevailing regulations and standards can be problematic (e.g. cattle numbering, primary tag formats).

Conclusions

EID for livestock traceability is achievable. However, rather than promoting a single technical solution the focus should be on how best to promote the timely and accurate recording and sharing of data through using flexibility and good governance arrangements to best meet user preferences.

Acknowledgements and further information

ScotEID is funded entirely by the Scottish Government, with SAOS coordinating research and operations on behalf of a joint Government-Industry Working Group. The progress made to date could not have been achieved without the cooperation and support of industry partners willing to trial EID solutions and share data. Further information may be obtained from www.scoteid.com or via help@scoteid.com.

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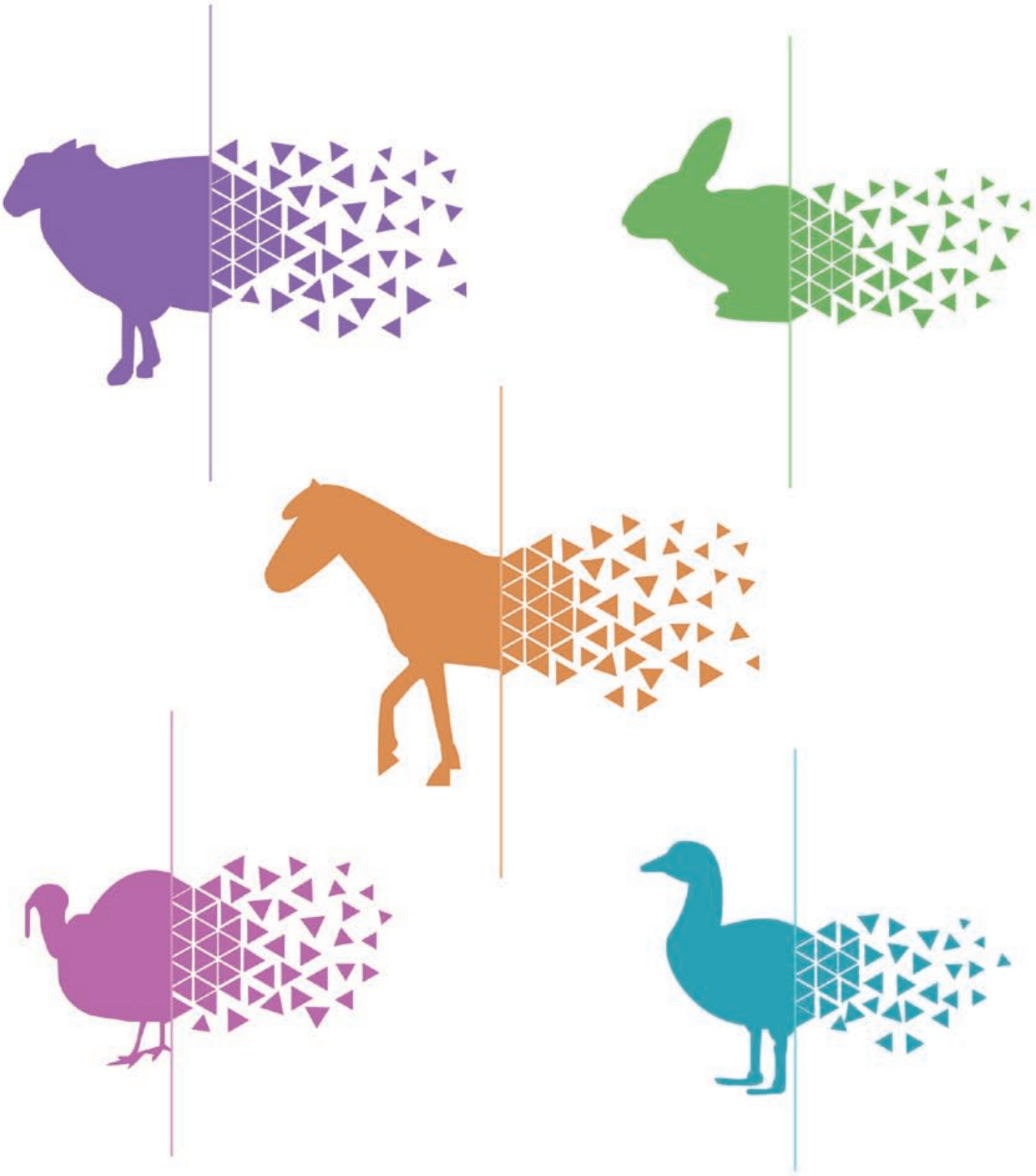
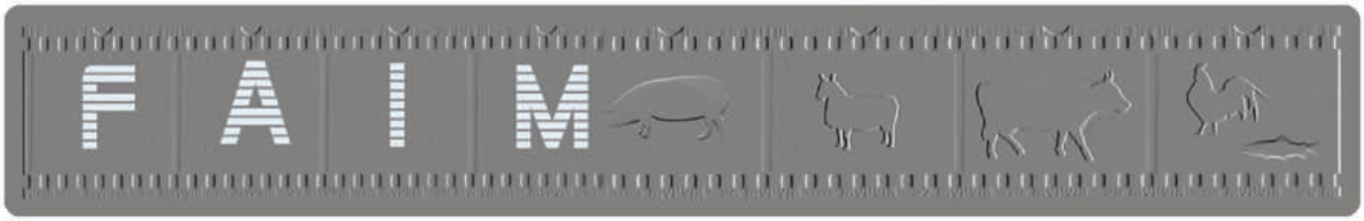


COST ACTION FA 1102: Farm Animal Imaging (FAIM)



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