

ProSafeBeef dissemination: an update

ProSafeBeef has established a network of over 300 contacts in 41 countries worldwide. To date, members of ProSafeBeef have published 134 peer reviewed articles and 43 technical articles, presented 203 oral and 242 poster presentations at international conferences, published 39 recorded popular media articles, completed four PhD theses, received one special student award and filed one patent! See <http://www.prosafebeef.eu/peer-reviewed-publications.asp> for more details.

ProSafeBeef will be holding its final event: an International Conference and Demonstration day on the 7th to 9th of February 2012 at Teagasc, Dublin. The event will incorporate a scientific conference and an industry focused workshop highlighting the key outputs of the project and possible future directions. See <http://www.prosafebeef.eu/ProSafeBeef-events.asp> for details on the event and registration.

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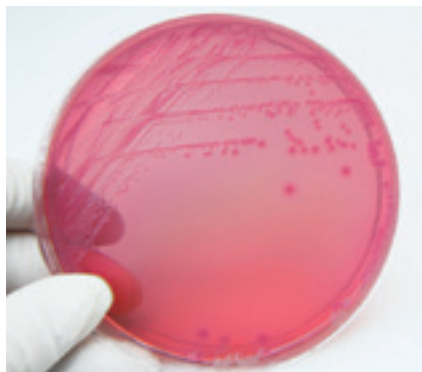
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Intervention strategies for microbial control to ensure safe beef

Prof. George-John Nychas (ProSafeBeef Pillar 2 leader) describes below recent work on the use of natural antimicrobial systems as alternative means for biofilm disinfection in food processing.

Most materials in contact with a natural fluid may rapidly become colonized by bacteria, leading to the formation of a biofilm (or slime). In the meat industry, biofilms can spoil food (leading to reduced shelf-life of products) and can lead to serious problems of food contamination. The risk becomes even more serious as the bacteria in biofilms have been shown to have an increased resistance to disinfectants.



ProSafeBeef PhD student



Bojan Blagojevic PhD student, Bojan Blagojevic, is conducting ProSafeBeef research in Pillar 2 on slaughter strategies and hide decontamination. The focus of his work, under the supervision of Prof. Buncic, is on the study of risk factors that can potentially affect the microbiological status of hide and corresponding dressed carcasses. His research examined: 1) risk categorisation of cattle before slaughter; and 2) risk categorisation of cattle abattoirs regarding process hygiene. These are described above.

ProSafeBeef work conducted at the Agricultural University of Athens, Greece examined the effectiveness of natural antimicrobial systems (e.g. essential oil and hydrosol from the plant *Satureja thymbra*) in destroying biofilms.

Seven natural antimicrobial solutions were tested against bacterial biofilms on stainless steel surfaces to compare their effectiveness with that of standard chemical disinfectants. The test surfaces were incubated for 10 days at 16°C in order to allow biofilm development. The surfaces were then exposed to the different decontaminating solutions.

S. thymbra essential oil and hydrosol caused the biggest reduction of bacterial cells grown in biofilms in comparison with the chemical disinfectants.

The use of natural antimicrobial agents as alternative means of disinfecting contaminated surfaces presents an effective way for reducing the

disinfection time, eliminating pathogenic microorganisms on surfaces in contact with food, thus enhancing food safety and saving time and money.

For more information see:
Chorianopoulos NG *et al.* (2008) Disinfectant test against monoculture and mixed-culture biofilms composed of technological, spoilage and pathogenic bacteria: bactericidal effect of essential oil and hydrosol of *Satureja thymbra* and comparison with standard acid-base sanitizers. *Journal of Applied Microbiology* 104: 1586-96
Chorianopoulos NG *et al.* (2011) Effect of acid tolerance response (ATR) on attachment of *Listeria monocytogenes* to stainless steel under extended exposure to acid or/and salt stress and resistance of sessile cells to subsequent strong acid challenges. *International Journal of Food Microbiology* 145: 400-6.

Or contact ProSafeBeef Pillar 2 leader Prof. George-John Nychas (gjn@aua.gr).

Risk categorization of cattle before slaughter

96 cattle from 36 farms were slaughtered and subjected to official meat inspection and haptoglobin (Hp) testing. Haptoglobin is a protein which increases in concentration in the blood of cattle suffering from inflammation, infection, tissue damage, stress and presence of bacterial components. Therefore, Hp testing may provide an alternative mean of monitoring the health of cattle. The Hp level and post-mortem abnormalities (such as inflammation) found in individual cattle were not always related. However, among groups of live cattle, the average Hp levels were significantly higher in cattle with abnormalities than in those without.

The study indicated that the average Hp value in groups of cattle can be a useful indicator of the overall status of cattle batches when analyzing the food chain information as a part of the inspection at abattoirs before slaughter. It is difficult to set a single, reliable cut-off Hp value for categorizing cattle batches that pose a health risk from those that do not. Instead, establishing a range of Hp values that will enable batches of cattle to be categorised as unsatisfactory, marginal or satisfactory when considering the risk to human health is more promising. More studies in abattoirs are needed in order to achieve this.

For more information see: Blagojevic B *et al.* (2011) A study of Haptoglobin levels in groups of cattle and pigs with and without abnormalities at meat inspection *Foodborne Pathogens and Disease* [In press].

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Risk categorization of cattle abattoirs

In two abattoirs, 100 cattle were randomly selected. From each animal, two swab samples were taken: 1) immediately after sticking; and 2) at the end of slaughter line but before chilling. In each swab-sample (200 in total), total viable count (TVC) and *Enterobacteriaceae* count (EC) (which includes different types of bacteria such as *Salmonella* and *Escherichia coli*), as well as the occurrence of the bacteria *Escherichia coli* 0157, were determined and used to assess process hygiene in the abattoirs.

The results indicated that using the average of total number of bacteria and/or the number of *Enterobacteriaceae* to categorise carcasses into a satisfactory, acceptable or unsatisfactory process hygiene category did not reflect the ability of the process to reduce the transfer of incoming microbial loads (i.e. on hides) onto dressed carcasses.

Determining the ratio between average TVC and/or EC count on the carcasses and those on corresponding skins enabled more precise assessment of the hygiene of each abattoir process, as well as more reliable differentiation between abattoirs.



The occurrence of *E. coli* 0157 is dependant on various factors including those on-farm and before the cattle enter the abattoir. Because of this, *E. coli* 0157 did not appear to be very useful for assessing the process hygiene in the abattoir.

For more information see: Blagojevic B *et al.* (2011) Ratio between carcass- and skin-microflora as an abattoir process hygiene indicator *Food Control* 22: 186-90.

Bojan has also conducted similar research for his PhD with pigs and pig abattoirs, which was funded by the Serbian Ministry of Science.

Nutritional and quality improvements to meat

Some recent research for the *ProSafeBeef* Pillar 3 (Nutrition and quality improvements to meat and meat products) being conducted at the Leibniz Institute for Farm Animal Biology in Dummerstorf, Germany is described below.

The increasing consumer demands for improved sensory, nutritional and food technological characteristics have led to novel meat quality tailoring strategies. Supplementing cattle with exogenous fatty acid sources has been shown to improve meat quality and intramuscular fat development. The resulting meat is more tender, juicy and flavoursome, and also has an improved fatty acid composition (e.g. more omega-3 (*n*-3) and omega-6 (*n*-6) polyunsaturated fatty acids that are beneficial for human health).



German Holstein bulls used in this study

This study aimed to explain the biological mechanisms that enable the fatty acid profile of farm animal tissues to be tailored. The study assessed the effects of a grass-silage/*n*-3 fatty acid based diet vs. a maize-silage/*n*-6 fatty acid based diet on the expression of lipogenesis-related genes (which convert simple sugars into fatty acids) and the corresponding gene products in the cutlet muscle and adjacent fat tissue of German Holstein bulls.

Higher amounts of *n*-3 fatty acids and decreased *n*-6:*n*-3 fatty acid ratios in both the muscle and fat tissue were found with the grass-silage/*n*-3 fatty acid based diet. These beneficial changes

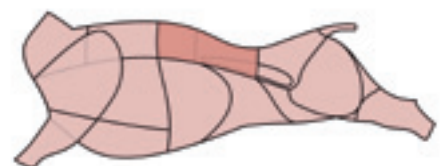


Maize-silage/*n*-6 fatty acid fed animals

in fatty acid profiles were associated with reduced expression of specific lipogenesis-related genes, as well as reduced activity of specific lipogenic enzymes in both the muscle and fat tissue. Effects of diet on fatty acid composition and lipogenic gene expression were more obvious in muscle than in fat tissue.

The study explains mechanisms that improve the fat composition of meat and shows that feeding cattle a diet high in *n*-3 fatty acids makes beef healthier for human consumption.

For more information contact: Dr Beate Hiller (hiller@fhn-dummerstorf.de) or see: Hiller B *et al.* (2011) Dietary *n*-3 fatty acids significantly suppress lipogenesis in bovine muscle and adipose tissue: A functional genomics approach *Lipids* 46: 557-67.



Location of cutlet muscle and adjacent fat tissue in the carcass

Ensuring ruminant products are microbiologically and nutritionally safe for consumers

Sharon Huws describes below the Pillar 3 (Nutrition and quality improvements) ProSafeBeef work she has been conducting at the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University, Wales.



Dr Sharon Huws

Current estimates show that by 2050 the global demand for meat and milk will have doubled due to an expanding population and increased consumption by Asian countries.

Whilst ensuring future accessibility, it is also paramount that the ruminant products are microbiologically and nutritionally safe for consumers.

The World Health Organisation guidelines suggest that in order to reduce the risk of coronary heart disease (CHD), saturated fatty acid (SFA) intake should not provide more than 10% of our dietary energy and the ratio of omega 6: omega 3 (*n-6:n-3*) polyunsaturated fatty acids (PUFA) should be less than four for the whole diet. Ruminants consume forages rich in *n-3* PUFA and low in SFA, yet meat and milk are comparatively low in PUFA content and

high in SFA content. This is due to the action of rumen bacteria rapidly releasing free fatty acids from their respective backbone (lipolysis) followed by hydrogenation of double bonds (biohydrogenation) within the fatty acids. Rumen bacteria are believed to biohydrogenate due to the fact that released PUFAs are toxic to them.

Until recently our knowledge of the rumen bacteria involved in biohydrogenation was limited. As just 1% of the rumen bacteria can be cultivated, a large proportion of rumen microbial functionality remained unknown until relatively recently. However, many uncultured bacteria are potentially capable of biohydrogenation. This presents quite a challenge for manipulation of rumen bacteria in order to improve the fatty acid nutritional content of meat and milk.

Irrespective of biohydrogenation, microbes flowing to the intestine themselves offer a source of fatty acids

which are incorporated into meat and milk products. We have shown that rumen protozoa commonly ingest chloroplast making them rich in *n-3* PUFA. Thus, increasing ciliate flow to the duodenum, whilst maintaining rumen densities, presents a potential novel strategy of improving the *n-3* PUFA content of meat and milk.

As biohydrogenation can only occur after microbial breakdown of fatty acids, prevention of this breakdown could provide a way of improving the quality of ruminant products (e.g. milk and meat). Conversely, due to the fact that released fatty acids are toxic to rumen biohydrogenating bacteria, increasing lipolysis could also reduce biohydrogenation and improve the beneficial fatty acid content of ruminant products.

Using revolutionary techniques such as genomics, metagenomics and metatranscriptomics will undoubtedly increase our understanding of rumen lipid metabolism. This information should lead to novel ways of manipulating rumen lipid metabolism to the benefit of consumer health.



Training session on marinating processes

A training session took place on the 9th June 2011 in Clermont-Ferrand, France following ProSafeBeef Pillar 4 work on the "Optimisation of tenderisation, injection and tumbling operation in marinating processes."

Those that attended the training session compared the different processes of marination, including the mechanisms involved and the impact of the marinating processes on tenderness

and technological yield. The group also studied the choice of equipment to conduct the marination, and the types of techniques. Following a lunch break, during which attendee's tasted the



Meat samples prepared using different processes of marination

products of the different marination processes, the group learnt about the use of different brine formulations in marination.

The attendee's found the training session extremely interesting. One attendee said that the company she works for is now beginning to produce beef marinating products, and so her job requires her to learn all about marination. She said she found the session invaluable to her work!

Attendees taste meat products prepared using different processes of marination



Meat from steers is more tender than bulls

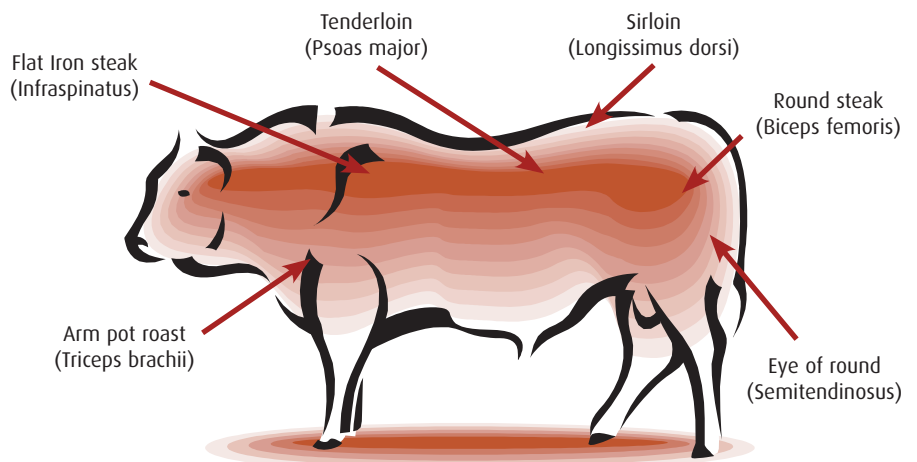


Dr Rune Rødbotten

Dr Rune Rødbotten from Nofima (the Norwegian Institute of Food, Fisheries and Aquaculture Research) describes below some work conducted in ProSafeBeef Pillar 4 (Innovations in processing to develop nutritive, convenient and added-value beef products).

Several different muscles from steers and bulls were studied. Meat quality measures like intramuscular fat content, Warner-Bratzler (WB) shear force and sensory texture were obtained from the samples.

All studied muscles obtained from steers had lower WB shear force values (which means they were more tender), than corresponding muscle obtained from bull



Location of muscles

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carcasses. Tender loin (*Psoas major*) and Flat Iron steak (*infraspinatus*) were the most tender muscles from both bulls and steers. The Flat Iron steak is sold at relatively low value in Norway today, but has a great potential for upgrading. Also the Arm pot roast (*triceps brachii*) located in the chuck had favourable WB shear force compared with the Sirloin (*longissimus dorsi*). The Sirloin obtained from bulls showed a larger range in WB shear force than steer muscles. Round steak (*Biceps femoris*) obtained from bulls was the toughest of all muscles.



In the subset of muscles collected from steers Eye of round (*semitendinosus*) was the only muscle which had average WB shear force above 50 N/cm². It is known from previous studies that the majority of people find meat which achieves WB values below 50 N/cm² as "very tender", whereas samples that obtain values above 70 N/cm² are considered as "tough". The Sirloin from bulls had mean WB value of 70.4 N/cm² which means finding tender meat from steers is more likely than from bulls.

Four different breeds or crossbreeds were used in the steer experiment. For the three muscles Sirloin, Tenderloin and Flat Iron steak there was no difference in WB shear force between the breeds/crossbreeds. A highly significant correlation was found between intramuscular fat content and WB shear force, indicating that muscles with higher fat content were more tender than lean samples.

For more information contact:
Dr Rune Rødbotten
(rune.rodboten@nofima.no).

European consumers' acceptance of beef technologies

Work conducted in ProSafeBeef Pillar 5 focuses on consumer perception, attitude and expectation with respect to beef safety, novel processing methods and new beef products. The application of technology delivers safe, convenient and high quality beef products to consumers. However, the benefits of these technologies may not be as clear to consumers as they are to the beef industry.

Previous ProSafeBeef consumer research revealed that consumers prefer 'natural' beef over processed beef. Traditional and familiar processes were more easily accepted, while excessive intervention in meat chains was criticised. To provide more conclusive results on consumer acceptance of beef technologies aiming to improve beef safety, a consumer survey was conducted in five European countries among 2,520 beef consumers.

The results confirmed that the processing stage was not the consumers' favourite stage to intervene to improve beef safety. The large majority of consumers considered hide decontamination at the slaughtering stage as an acceptable stage to intervene to improve beef safety.

Enhancing beef safety at the packaging stage (especially by using unfamiliar packaging technologies) was found to be not acceptable for a large group of consumers. Consumer acceptance of technologies to enhance beef-safety seemed to be due to a variety of

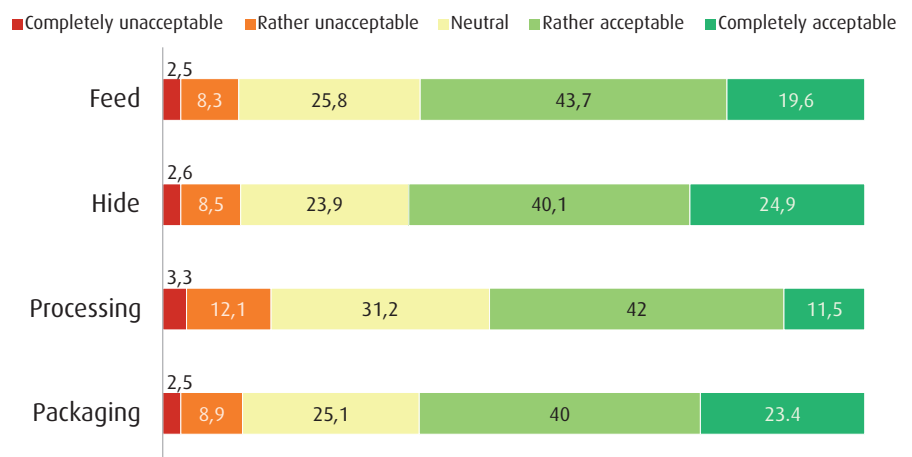
reasons: either because consumers were confident that what the industry will do is the right thing to do to secure beef safety, or because they felt that such safety interventions are heavily needed, which is fuelled by elevated safety concerns.

These results have been published as:

Van Wezemael L *et al.* (2011) European consumer response to packaging technologies for improved beef safety. *Meat Science* 89: 45-51 and

Van Wezemael L *et al.* (2011) European consumer acceptance of safety-improving interventions in the beef chain. *Food Control* 22: 1776-84.

For more information, please contact ProSafeBeef Pillar 5 leader Wim Verbeke (wim.verbeke@ugent.be) or Lynn Van Wezemael (lynn.vanwezemael@ugent.be).



Consumer acceptance of beef technologies aimed at improving beef safety

Upcoming workshop

Tenderness of beef meat: current status and prospects for the beef chain

This workshop will take place from 2pm to 5pm on the 5th October during the International beef breeding trade show the Sommet de l'Élevage in Clermont-Ferrand, France. The programme for the workshop is provided below.

Introduction: ProSafeBeef project presentation and research works related to beef tenderness.

*Eric Lemoine,
ADIV (Technical Centre for the Meat Industry)*

National survey on beef tenderness.

*Jérôme Normand,
Institute of Animal Husbandry*

Presentation of the Meat Standard Australia (MSA) system.

*Isabelle Legrand,
Institute of Animal Husbandry*

Celtic Pride: a "Food-Chain Initiative" and control of product from "Gate to Plate".

*Tim Rowe,
Celtic Pride*

Modelling tools to predict beef tenderness from muscular characteristics.

*Jean-François Hocquette,
INRA (National Institute for Agronomic Research)*

Ways for improving beef tenderness by process.

*Emilie Parafita,
ADIV (Technical Centre for the Meat Industry)*

The Sommet de l'Élevage is one of the largest international trade shows specialising in livestock production. Over 1,250 exhibitors and 75,000 professional visitors are expected to attend the conference. See 'Upcoming Events' below for more details of this conference.



Upcoming events

2011 Joint Meeting of the American Society of Animal Science (ASAS) and the Asociación Argentina de Producción Animal (AAPA)

4th – 7th October 2011

Buenos Aires, Argentina

The 2011 Joint Meeting of the American Society of Animal Science (ASAS) and the Asociación Argentina de Producción (AAPA) will be held from the 4th – 7th October 2011 in Mar del Plata, Buenos Aires, Argentina. This conference will provide an international forum for scientific exchange among animal scientists throughout the world. The three-day conference will include plenary sessions by invited speakers from around the world discussing animal science related topics, as well as regular AAPA scientific sessions, on topics including nutrition, pastures, reproduction, production systems, animal health, genetics; animal food technology and wildlife. Poster presentations on these topics will also take place.

For more information please visit: <http://www.asas.org/asas-aapa11/>

Sommet de l'Élevage international trade show

5th – 7th October 2011

Clermont-Ferrand, France

The Sommet de l'Élevage international trade show, the leading European forum for livestock professionals, will take place from the 5th – 7th October 2011 at the Grande-Halle d'Auvergne exhibition centre in Clermont-Ferrand, France. The three-day Sommet de l'Élevage event offers a wide-ranging programme including farm visits, professional events, quality demonstrations and several conferences and symposia dealing with current affairs in agriculture.

For more information, see: <http://www.sommet-elevage.fr/en/>

ProSafeBeef Student Internship

Edith Patissier recently completed her Internship at ADIV, the French Technical centre partner of ProSafeBeef, based in Clermont-Ferrand. Edith is currently studying at the Polytech-Clermont-Ferrand, to obtain a Master's degree in biological engineering. Below, Edith talks about her experience on the ProSafeBeef project.



Edith Patissier

What is your role in the ProSafeBeef project?

My objective was the optimisation of beef tenderness by injecting fruit juices powder in the brine. During my six months at ADIV I worked with Dr Emilie Parafita and others who are involved in the ProSafeBeef work for Pillar 4.

What did you enjoy about being involved in the ProSafeBeef project?

For me, it was the opportunity to conduct my first experiment in research and development on food industry particularly in the meat sector.

What did you learn from the programme? How do you feel this will help you in your future career?

I learnt a lot about the various processes used in the meat industry, and it was really interesting to be involved in fundamental research as well in the practical industrial application. This theme matches with my professional plan which is to work in research and development for food companies.

Update on opportunities for new exchange programmes

Proposals for training and exchange programmes within ProSafeBeef can be made at any time. If you would also like to enjoy the benefits of an exchange programme please contact Catherine Souty-Dametto by email (Catherine.dametto@adiv.fr) for further details.

The Future for Dairy Farming in Ireland is Excellent

Teagasc, Dublin opened its gates to all dairy farmers' on the 29 June for an Open Day event to commence planning for EU milk quota abolition in 2015.

Irish dairy farming is entering a period of considerable opportunity as the abolition of milk quotas in the EU will allow dairy farming businesses to expand for the first time in 25 years. Teagasc Head of Animal & Grassland Research and Innovation Dr Pat Dillon believes that the challenge now for Irish dairy farmers is to further increase the competitiveness of their farming business through the adoption of modern technology. Teagasc profit monitors completed in 2010 show that there is scope for further profitability gains on Irish farms.

The purpose of the Open Day was to prepare dairy farmers for the future by highlighting new research technologies and describing how these modern innovations can be incorporated into the Irish production system to increase overall industry efficiency.

ProSafeBeef, Advancing Beef Safety and Quality through Research and Innovation: European Framework Programme 6: (FOOD-CT-2006-36241)

More Information

For more information on ProSafeBeef please visit our website at www.prosafebeef.eu or contact Robert Mooney, Project Manager, at robert.mooney@teagasc.ie.

ProSafeBeef is an Integrated Project coordinated by Dr Geraldine Duffy at Teagasc, Ashtown Food Research Centre, supported under the 6th Framework Programme of the European Union. It involves 41 leading research and industrial organisations working in 18 different countries. ProSafeBeef is a five year project which commenced on March 1st 2007.



Ashtown Food Research Centre

