Feed Additives may play a role in animal welfare?

J. Brufau
IRTA

28 /8/2013, Nantes
The objective of the presentation is:

- Improvement of performances through gut health is Animal Welfare indicator?
- Is the health improvement easily measurable?
- What are the main indicators to be considered?
- Can these indicators be connected to animal performance?
- How is immunity involved in animal performance?
Naturally, Farm animals are challenged by different stressors

“All farm animals will experience some level of stress during their lives. Stress reduces the fitness of an animal, which can be simply expressed through failure to achieve production performance standards or targets, or more drastically, through disease and death” (Rostagno 2009).

Stress factors excessively affect animal production:
I. Inadequate nutrition
II. Deprivation of water/ or feed
III. Heat/Cold
IV. Overcrowding
V. Handling (interaction human manipulation)
"Stress and the Gastrointestinal Tract"

# The enteric nervous system (ENS) is an integrated network located within the wall of the gastrointestinal tract. (Brain-Gut interaction).

# Stress may not only be responsible for functional disorders, but may contribute to inflammatory disorders and infections of gastrointestinal tract.

# Neurotransmitters play a role in animal responses to challenges/stressors (Norepinephrine-naturally intestinal mucosal).

# There is crosstalk between neuroendocrine and immune systems.

# An imbalance on these systems in response stress can lead to significant change in immune response and consequently susceptibility to infection.
Campylobacter in chickens and potential interactions with welfare

Are happy chickens safer chickens? Poultry welfare and disease susceptibility

TOM HUMPHREY
School of Clinical Veterinary Science, University of Bristol, Langford, England

Abstract: 1. Contaminated chicken meat remains an internationally important vehicle for human infection with Salmonella and Campylobacter spp. In addition, the last 50 years has seen an international pandemic of human salmonellosis caused by the contamination of eggs with Salmonella Enteritidis. 2. It has been long held scientific view that Campylobacter spp. and, most, if not all of the common azoturia salmonella, are essentially commensal in chickens. They usually form part of the gut flora and commensurate chicken carcasses, for example, in faecal spillage at slaughter. Even when certain salmonella serovars like S. Enteritidis are invasive in laying hens overt evidence of clinical disease is rare and the birds appear to behave normally. 3. Are these bacteria just passing through the avian host and only transient members of the bacterial flora or is there a more dynamic perspective to this infection/colonisation process? Chickens mount antibody responses to both pathogens, which indicate something other than commensalism. Such immune responses, however, do not always result in the clearance of the pathogen. 4. Not all animals in a group will carry salmonella or campylobacter, even under experimental conditions, and will vary, especially those that are outbred. In their responses to pathogen challenge, identifying the reasons behind this could have important implications for disease control. 5. Both salmonella and campylobacter are more likely to be found in animals which are compromised and this may explain at least part of the variations seen. Animals are more susceptible to infection when they are in a poor environment, fed a poor diet and/or under physical or psychological stress. 6. Work in this area has naturally focused on pathogens of medical significance and has shown that neurotransmitters such as noradrenaline can markedly alter pathogen behaviour. Other host responses like interleukin-2 can also affect host tissues in a way, which facilitates invasion by pathogens and may also interact directly with certain bacteria. 7. From a food safety perspective, there is evidence that egg contents contamination in egg may be linked to stresses in the hen. Current work at the University of Bristol on the epidemiology of campylobacter in broiler production is also showing a potential link between gut health and campylobacter colonisation and challenging the concept that these bacteria are commensal organisms. 8. The poor economic returns received by the egg and poultry industries mean that intensive production methods are common. Is it possible to rear chickens under these conditions in such a way as to exclude avian pathogens like salmonella and campylobacter? Data from the UK strongly suggest that this is possible with the former pathogen. Can similar advances be achieved with campylobacter?

Effect of NA on the growth of C.jejuni
Stress and the Gastrointestinal Tract

Stress releases catecholamine and results in:

I. Decrease gastric acid production
II. Delayed gastric emptying
III. Accelerated intestinal motility
IV. Accelerated colonic transit

Consequently increased pH in the stomach increases probability of survival of food borne pathogens (E. coli, salmonella and Campylobacter) and colonization of the gastrointestinal tract.
Why Animal Welfare criteria are not yet implemented in the evaluation of Feed Additives?

When we talk about Animal Welfare: there is a big question “Are animals conscientious”.

According to Darwin the evaluation of consciousness: differences between species are differences in degree rather than kind.
New European model of animal production since 2002

# AP should be sustainable in the EU and based on:

# Animal Protection.
# Consumer Protection.
# Environment protection.

Travelling to 2030
Outline questions

1. Why Animal Welfare criteria are not yet implemented in Feed Additive evaluation?

2. The concept of Animal welfare is under revision in EU. Strategies are in progress 2012-2015.

3. Which parameters are much more accepted by farmers in order to consider Animal Welfare benefits

4. Feed additive have to be evaluated under GOOD HEALTH conditions.

5. Feed additives may play a role on animal welfare assessment?
Feed additives

Regulated By EC 1831/2003

Substances, micro-organisms or preparations, other than feed material and premixtures, which are intentionally added to feed or water in order to perform, in particular, one or more of the functions mentioned in Article 5(3)

- Favourably affect the characteristics of feed or animal products
- Favourably affect the colour of ornamental fish and birds
- Satisfy the nutritional needs of animals
- Favourably affect animal production, performance or welfare
- Have a coccidiostat or histomonostatic effect
A zootechnical additive is any additive used to favourably affect the performance of animals in good health, or to favourably affect the environment.
The purpose was to:
- examine the scientific basis for the existing functional groups
- propose, if necessary, based on this review, the establishment of additional functional groups (or categories).

Potential new categories
1. Additives which favorably affect animal welfare:
   Metabolic regulators. Immuno-modulators, Detoxifiers.

2. Additives which improve product quality:
   Microbial contamination controllers, Nutritional value enhancers, Sensory additives
Assessment of alternatives substances
Animal nutrition and Gut microflora interactions (Animal protection).

Gut microflora

- Reduced antigenic load
- Increased nutrient bioavailability (?)
- Improved health status

- Nutrient sparing
- Performance response

- Reduced mortality/morbidity

Growth promoting agents

Improved sanitation/husbandry

Andrew Chesson
Mucosal surfaces place for “dialogue”

The intestinal epithelium: an interactive barrier

.- Physical barrier

.- Innate immunity

.- Adaptive immunity

Crosstalk between commensals and mucosae

Crosstalk between pathogens and mucosae

Philipe J. Sansonetti 2004
Alternatives feed additive products

- **Organic acids.**
- **Enzymes preparations.**
- **Micro-organisms (Probiotics).**
- **Oligosaccharides (Prebiotics).**
- **Immunity enhancers.**
- **Highly available minerals.**
- **Herbs and essential oils.**
Nutrition plays a role on animal welfare
Effects of enzymes on birds vaccinated against coccidiosis fed with maize or wheat-barley

FCR from 0 to 44 days

Effects of low and high NSP diets (maize or wheat-barley) and enzyme addition on performance and coccidial and necrotic enteritis (NE) lesions of broilers vaccinated for coccidiosis.

Francesch et al., 2006
## Effects of enzymes in vaccinated birds fed with maize or wheat-barley

Degree and incidence of shedding of *C. perfringens* counts and Necrotic Enteritis lesions at day 22

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>M+E</th>
<th>WB</th>
<th>WB+E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paracox Log CFU/g</strong></td>
<td>0.09 c</td>
<td>0.13 c</td>
<td>2.44 a</td>
<td>0.68 b</td>
</tr>
<tr>
<td><strong>Incidence Cl. +</strong></td>
<td>1/12</td>
<td>1/12</td>
<td>12/12</td>
<td>6/12</td>
</tr>
<tr>
<td><strong>No Lesions NE</strong></td>
<td>3/12</td>
<td>4/12</td>
<td>1/12</td>
<td>6/12</td>
</tr>
</tbody>
</table>

Francesch et al., 2006
Examples: Efficacy assessment on immune processes

β 1-4 mannobiose enhances *Salmonella*-killing activity and activates innate immune responses in chicken macrophages

Masahisa Ibuki, Jennifer Kovacs-Nolan, Kensuke Fukui, Hiroyuki Kanatani, Yoshinori Mine

British Poultry Science

Immune-modulatory effects of dietary Saccharomyces cerevisiae cell wall in broiler chickens inoculated with *Escherichia coli* lipopolysaccharide

R. Morales-Lopez & J. Brufau

IRTA - Animal Nutrition, Health and Welfare, E-43120, Constantí, Spain

Accepted author version posted online: 11 Mar 2013. Published online: 07 May 2013.
Suggested **End-points** for Efficacy demonstration/ Animal welfare

**In vitro studies**: (majority of the experimental conducted until now). However they are essential for the first step.

**In vivo studies**: to conduct studies with animals under certain conditions and to look the benefits of the products on the mucosal and epithelial cells from intestine. Morphology, Immunity reaction and microflora development should be performed.
- *Blood analysis*: cortisol, heat shock protein, Neutrophils /linfocites,
- *Mucosal*: epithelial morphology, innate immunity of IEC.
- *Microflora*: Reduction of zoonotic bacteria population.

The animal performances studies may be also involved in order to justify the interaction, mainly Feed Intake.
Are we able to answer all the questions generated?

The most important action will be to understand the interaction between Animal welfare and the concept of stress and the physiology of the gastrointestinal tract.

Animal health improvement is difficult to assess, especially when we are dealing with benefits of Feed Additives in order to satisfy Animal welfare indicators.

The indicators should be clearly well identified under stress conditions first.

Immune indicators must be considered to determine the degree of animal defense in order to prevent damage by the stressors.