	CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[1]
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Deliverable:

Other Dissemination activities

Name:

International Conference on:

PREVENTION AND CONTROL OF
CAMPYLOBACTER IN THE POULTRY
PRODUCTION SYSTEM

Milano, 31 August 2015

Grant Agreement number	605835
Call (part) identifier	FP7-SME-2013
Funding scheme	Research for the benefit of specific groups
Project acronym	CAMPYBRO
Project title	Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination
Project website	www.campybro.eu
Project coordinator organization name	IMASDE AGROALIMENTARIA, S.L.
Project coordinator name & email address	Dr. Pedro Medel pmedel@e-imasde.com

Dissemination Level		
PU	Public	X
PP	Restricted to other program participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	







			CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[2]
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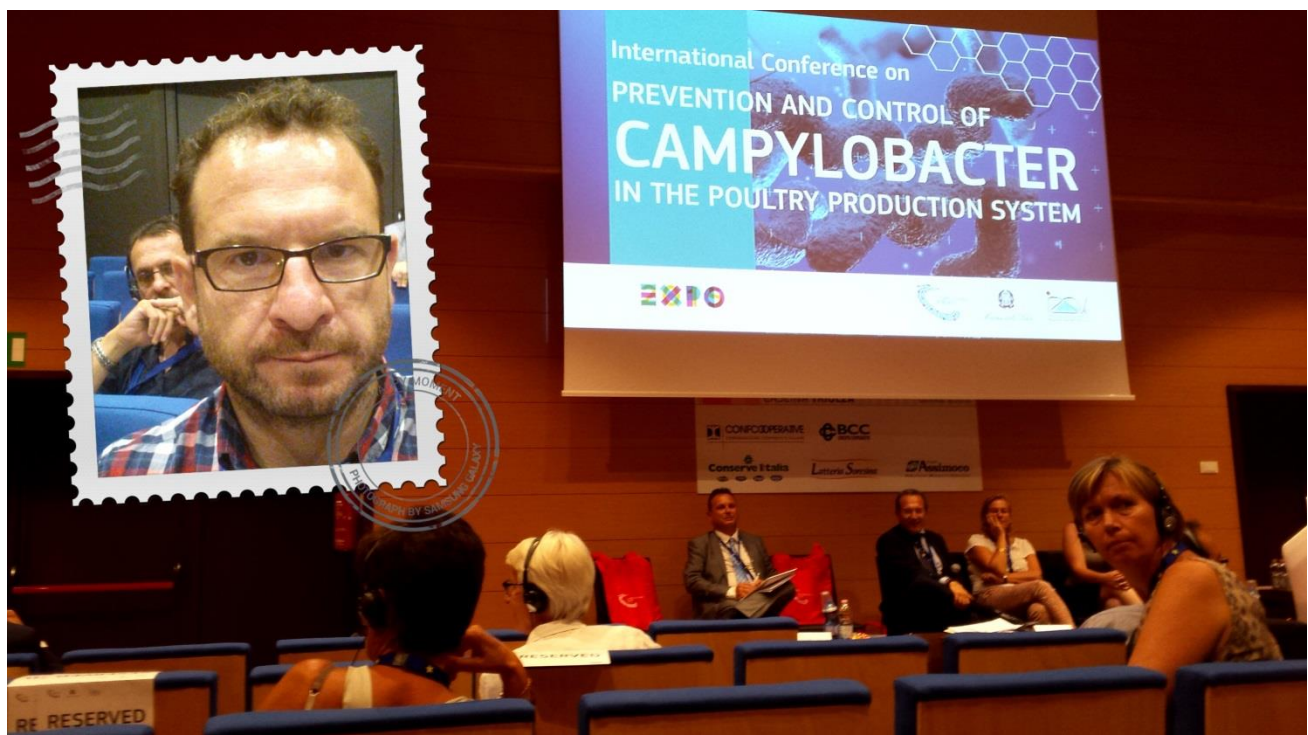
1. SUMMARY	3
2. Annexes: Agenda and presentation	6

			CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[3]
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1. SUMMARY

The International Conference on PREVENTION AND CONTROL OF CAMPYLOBACTER IN THE POULTRY PRODUCTION SYSTEM, was held in Milano, the 31st August 2015. The Director of the station of Ploufragan, ANSES, Dr. Gilles Salvat, was invited to give a talk called **“Reducing the risk of Campylobacteriosis from poultry: Feed interventions - blocking the colonisation of birds”**, which summarizes the results of the project Campybro until this moment.

Figure 1. Pedro Medel in the presentation of the event.






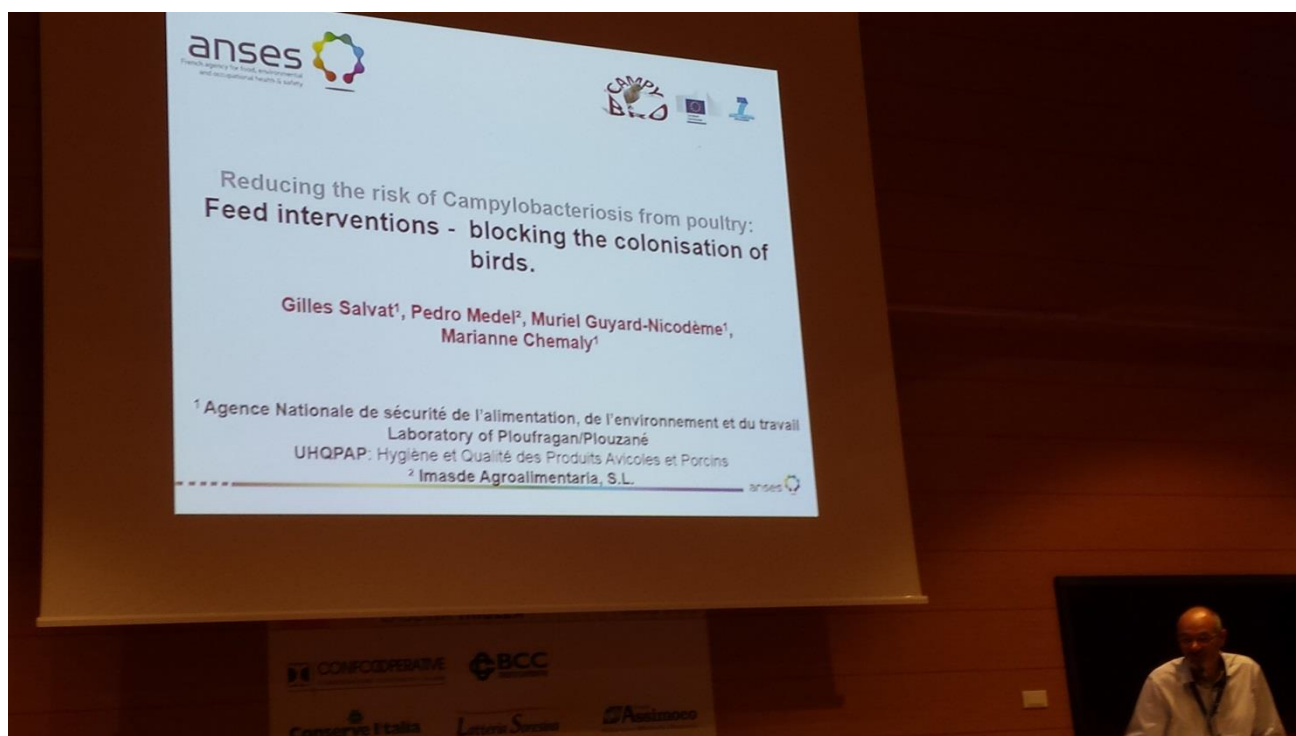
			CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[4]
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Figure 2. Dr. Guilles Salvat in the beginning of the presentation.






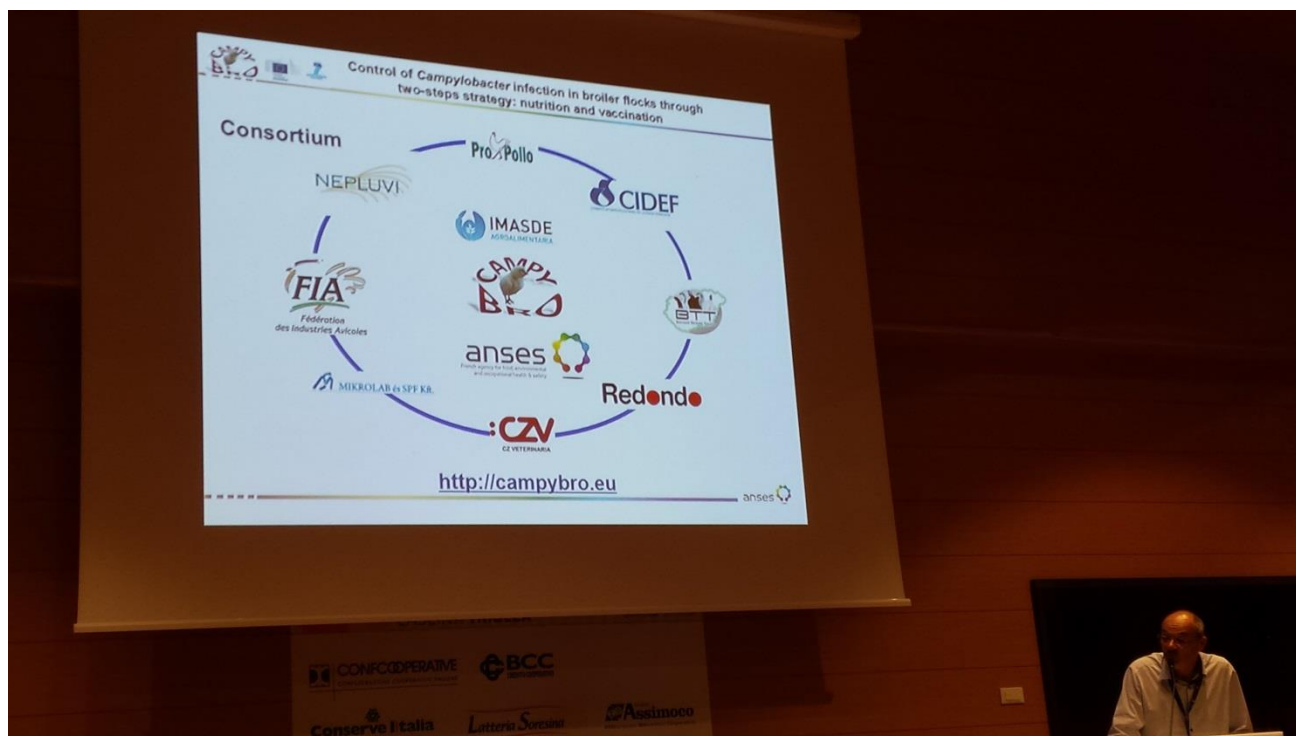



			CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[5]
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Figure 3Dr. Guilles Salvat presenting the Consortium of Campybro.



			CAMPYBRO GA: 605835	Other Dissemination activities. Control of Campylobacter infection in broiler flocks through two-steps strategy: nutrition and vaccination -CAMPYBRO-	[6]
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2. Annexes: Agenda, list of participants and presentations

AGENDA

TIME	SETTING THE CONTEXT	CHAIRMAN: SILVIO BORRELLO
10,30	Introduction	Silvio Borrello DGAH, MoH, IT
10,35	Welcome address (videomessage)	Beatrice Lorenzin Minister of Health, IT
10,45	Opening remarks	Stef Bronzwaer EFSA
10,50	Conference scope and concept	Silvio Borrello DGAH, MoH, IT
11,00	EU strategies on poultry: animal health and meat safety	Klaus Kostenzer EC
11,15	Campylobacteriosis in humans in the EU/EEA: health aspects and estimated burden	Alessandro Cassini ECDC
11,30	<i>Campylobacter</i> contamination levels in poultry meat in the EU and recommended reduction measures	EFSA
11,45	<i>Campylobacter</i> control strategies in poultry farms, biosecurity and innovative rapid diagnostic tests	Eva Olsson Engvall EURL for <i>Campylobacter</i> , SE
12,00	Fact and figures of poultry industry in EU	Paul Lopez AVEC
12,15	The UK experience in controlling <i>Campylobacter</i> along the poultry chain and communication campaign	Francisco Javier Dominguez Orive FSA, UK
12,30	Need for reliable disease burden estimates to support food safety decision making: the example of human campylobacteriosis in the EU	Ákos Józwiak NÉBIH, HU
12,45	Discussion	All Speakers involved
13,00	Lunch at the terrace of the EU Pavilion Visit to the EU Pavilion	
TIME	CAMPYLOBACTER PREVENTION, SURVEILLANCE AND CONTROL POLICIES	CHAIRMAN: GIUSEPPE RUOCCO
14,30	Introduction	GIUSEPPE RUOCCO DGFS, MoH, IT
14,35	Zoonotic <i>Campylobacter</i> : main microbiological and pathogenic features of a very successful bug	Antonia Ricci NRL for Salmonellosis, IT
14,50	Feed interventions – blocking the colonisation of birds	Gilles Salvat NRL for <i>Campylobacter</i> , FR
15,05	<i>Campylobacter</i> contamination in poultry meat production chain in Italy and the National monitoring system	Paolo Calistri NRL for <i>Campylobacter</i> , IT
15,20	Risk-based control strategies for <i>Campylobacter</i> in poultry meat	Louise Boysen DTU, DK
15,35	Discussion	All Speakers involved
15,50	Conclusions	Giuseppe Ruocco DGFS, MoH, IT
16,05	Visit to EXPO	

International Conference on

PREVENTION AND CONTROL OF

CAMPYLOBACTER IN THE POULTRY PRODUCTION SYSTEM



MILAN CIVIL SOCIETY PAVILION
CASCINA TRIULZA
AUGUST, 31, 2015



WHAT WE ARE DISCUSSING TODAY



Silvio Borrello
Conference chair

Human campylobacteriosis is the most frequent food-borne zoonosis notified by the EU Member States and the consumption of poultry meat is one of the main sources of human infection. The EU Member States are strongly committed to adopt appropriate methods to control the *Campylobacter* contamination along the whole poultry meat production chain, with the aim of reducing the exposure of European consumers to the infection and the consequences related to the gastro-intestinal illnesses and the serious sequelae due to this bacterium. The conference debates the risk factors and the effective control measures, including communication to consumers, sharing the point of view of the European Institutions, the National Competent Authorities, the European and National Reference Laboratories, the Stakeholders. Our common goal is to contribute to the current debate on the effective methods available for improving the quality and safety of poultry meats in the EU, providing the most recent valuable scientific experiences and technical solutions. I hope you will appreciate this initiative of the Italian Ministry of Health and enjoy the Universal Exposition of Milano.

OUR “TAKE-HOME MESSAGES”



Klaus Kostenzer
European Commission,
DG SANTE

A baseline survey on the prevalence of *Campylobacter* in broiler flocks and on broiler carcasses in EU shows a rather high prevalence on the EU average although the situation varies considerably between the different Member States and even slaughterhouses. EFSA has published a scientific opinion assessing the public health impact of control measures in broiler meat and the European Commission is currently evaluating the

economic and social impact of the suggested control measures in view of reducing human cases. A cost-benefit analysis on the most prominent control measures was also performed. The on-going revision of meat inspection in poultry includes suggested changes to improve hygiene in slaughterhouses and sets a focus on *Campylobacter* as being one of the main identified hazards. The Commission intends to continue its “farm to fork” approach, hence i.e. biosecurity measures on farm, good hygiene practices at the slaughter of broilers are important aspects.



Alessandro Cassini
European Centre for
Disease Prevention and
Control

In the European Union and European Economic Area Member States, the annual rate of exposure to *Campylobacter* spp. is estimated to be around 0.83 per person-year, more than 420 million yearly infections. The majority of exposed cases remain asymptomatic. The related incidence of campylobacteriosis is 475 per 100 000 or 2.4 million cases per year amongst European citizens. Underestimation of the disease, therefore, is considered to be 11 times the notification rate. Moreover, in a recent

burden of disease study, ECDC estimated that about 600 deaths are related to campylobacteriosis every year, largely among elderly people. Campylobacteriosis also resulted the food and water-borne disease producing the highest number of DALYs (disability adjusted life years), while 1% of cases require hospitalisation and 23% visit their general practitioner. Therefore, we can estimate that 24 000 European citizens are hospitalised and 0.5 million visit their GP following campylobacteriosis disease every year. For the purpose of monitoring campylobacteriosis, we recommend to continue efforts in investing into wide sero-epidemiological studies aimed at assessing actual occurrence of infections. These should be combined with community studies in order to assess the socio-economic impact of disease burden.



European Food Safety Authority

The European Food Safety Authority will present updates on the contamination levels of *Campylobacter* in poultry meat in the European Union and will describe the reduction measures, considered in EFSA risk assessments.



Eva Olsson Engvall
EURL for *Campylobacter*,
National Veterinary
Institute, Sweden

Control of *Campylobacter* in live poultry is an important strategy to reduce contamination of poultry meat and number of human campylobacteriosis cases. Different approaches are applied to prevent flock colonisation. Biosecurity measures including strict hygiene barriers are effective but other types of interventions are required and development of e.g. vaccines, probiotics, bacteriophages, etc. is in progress. New tests for rapid detection and identification of *Campylobacter* include culture independent diagnostic tests i.e. immunoassays, PCR-based assays, and use of mass spectrometry.



Paul Lopez
Association of
Poultry Processors
and Poultry Trade
in the EU

The EU poultry production amounts to about 14 million tons mainly chicken. The EU imports more than 0.8 million tons of boneless meat with a value of almost 2.2 billion Euros and has an export volume of more than 1.5 million tons with a value of almost 2.1 billion Euros. More than 300,000 EU citizens are involved in the poultry meat chain with a value of about 32 billion Euros. Poultry safety is a prerequisite for food business operators (FBO) pressed by both EU regulations and consumers, who penalise businesses by rejecting their products. It is essential that FBO demonstrate to be trustworthy by being accountable and transparent about using sustainable processes and techniques. Today poultry meat production costs in the EU are among the highest in the world, due to the high production standards and feed costs. Fair trade would need that similar requirements are imposed on imported poultry meat productions. The poultry sector has been successfully fighting against *Salmonella* for many years and is committed to achieve similar success with *Campylobacter*, hopefully implementing progressive step by step interventions supported by research.



Francisco Javier Dominguez Orive
Food Standard
Agency, UK

Javier Dominguez will provide an overview of the UK Food Standards Agency's (FSA) programme of work to reduce *Campylobacter* levels in poultry meat. Javier will present a summary of the main interventions trialled along the poultry chain, from farm to fork, including novel interventions developed by the UK poultry industry to effectively reduce *Campylobacter* levels on poultry carcasses. Data will be provided on the effect of the whole programme and the different interventions. Javier will also present FSA's communication initiatives to inform UK consumers about the risk of *Campylobacter* and how those have been received by consumers, farmers, poultry processors and retailers. Javier's presentation will show that the control of one of the main foodborne hazards across Europe is taking a lot of time and effort by both the regulator and the UK poultry industry but that there is hope that *Campylobacter* could be controlled if all players along the poultry chain play their part.



Ákos Józwiak
National Food Chain
Safety Office, Hungary

with the contribution of **János G. Pitter, Zoltán Vokó, Ádám Halmos**
The aim of our work was *Campylobacter* control measures in the EU-27: to gather country-specific cost of illness estimates, to generate a conservative estimate of *Campylobacter* related disease burden per case expressed in QALYs, and to assess the country-specific cost-effectiveness of control measures using the adapted model assumptions. The adjusted country-specific cost of illness estimates ranged from 38 to 311 EUR/case (versus the assumed 267 EUR/case). The overall, discounted health burden per case was calculated as 0.0152 QALY loss (versus the assumed 0.0389 DALYs). The combined application of currently available control measures of low/medium consumer impact was found to generate both cost saving in the EU-27 and health benefits, even when using the adjusted, conservative model input parameters. QALY was found to be a suitable methodology for disease burden estimation, with significant advantages.



Antonia Ricci
OIE/NRL for
Salmonellosis,
IZS Venezie, Italy

While global efforts to control the transmission of enteric pathogens have been effective at reducing the incidence of a number of major foodborne pathogens, the prevalence of *Campylobacter* infection has nevertheless continued to increase across most developed nations in the last decades. Factors underlying this rise, such as the interaction between *Campylobacter* and the host immune system or gut microbiota, or its capacity to acquire antimicrobial resistance will be discussed.



Gilles Salvat
NRL for *Campylobacter*,
Anses, France

with the contribution of **Marianne Chemaly, Muriel Guyard-Nicodème, Pedro Medel**
As *Campylobacter* should be considered as a “quite normal” host of poultry gut flora, eradication of the bug from poultry production is a myth. Despite that, reducing *Campylobacter* shedding in live birds at the day of slaughter from 1 to 3 log, may prevent the risk of campylobacteriosis for the consumer. The use of feed or drinking water additives such as organic acids, probiotics, prebiotics or plant extracts alone or in combination, with or without vaccination, may be a future solution to control the amount of *Campylobacter* carried by live birds before slaughtering, to reduce the risk of carcasse contamination. Different solutions evaluated by Anses laboratory will be presented.






Paolo Calistri
NRL for *Campylobacter*,
NRC for Veterinary
Epidemiology and
Risk Assessment,
IZSAM, Italy

with the contribution of **Elisabetta di Giannatale**
In the last years the Italian veterinary authority and the Italian poultry meat producers worked together to characterise the risk deriving from *Campylobacter* contamination in the Italian production chain. The NRL for *Campylobacter* and the NRC for Veterinary Epidemiology carried out several epidemiological studies, which highlighted the complexity of the contamination patterns and factors influencing the final risk for consumers. Due to this complexity, a national monitoring plan was launched in 2015 with the aim of defining some of the driving epidemiological factors affecting the contamination level and its variability in chicken carcasses, to support the choice of possible interventions along the production chain on a risk-based approach.



Louise Boysen
National Food Institute,
Technical University of
Denmark

Biosecurity is important when trying to control *Campylobacter* in the broiler production chain and crucial for preventing *Campylobacter* infection of broiler flocks. Combinations of interventions are most efficient in reducing the prevalence in *Campylobacter* flocks. Overall, the effect of control measures largely depends on their strict implementation. Furthermore, the implementation of a control measure like fly screens, can only be expected to be efficient if the biosecurity is in place.

Prevention and control of Campylobacter in the poultry production system			 <i>Ministero della Salute</i>
Monday 31/08/2015 hour: 10:30-16:30			
Civil Society Pavilion, Cascina Triulza, Expo 2015			
Virtual Ticket:	Prevention and control of Campylobacter in the poultry production system		
Guest:	PEDRO MEDEL		
Registration date:	07/08/2015 11:03:28	Nr. People: 1	
Ticket n.:	 7207305001438945408		

Reducing the risk of Campylobacteriosis from poultry: **Feed interventions - blocking the colonisation of birds.**

**Gilles Salvat¹, Pedro Medel², Muriel Guyard-Nicodème¹,
Marianne Chemaly¹**

**¹ Agence Nationale de sécurité de l'alimentation, de l'environnement et du travail
Laboratory of Ploufragan/Plouzané**

UHQPAP: Hygiène et Qualité des Produits Avicoles et Porcins

² Imasde Agroalimentaria, S.L.

Risk factors of *Campylobacter* contamination at the farm level

The main risk factors associated with an increasing risk of *Campylobacter* contamination of poultry flocks (FSA, 2010)

Variables	Modality	Identified risk factor with significant OR
Hatchery origin of day old chicks		Risk is hatchery dependant
Season of data collection	Summer/Falls	Increased risk
Type of ventilation system of the house	Static <i>vs</i> dynamic	Increased risk
Vertical ventilation	yes	Increased risk
Number of houses at the farm	≤ 2 houses <i>vs</i> > 2 houses	Increased risk
Acidification as water treatment	yes	Increased risk
Presence of litter beetles in the change room	yes	Increased risk
Presence of other farm animals	yes	Increased risk
Animals on nearby farm	yes	Increased risk
Use of ground water for cleaning the broiler houses	yes	Increased risk
Age at slaughter or at sampling	older	increased risk
Who performed Cleaning and disinfection	Farmer <i>vs</i> professional team	Increased risk
Thinning and hygiene of thinning	Yes together with poor hygiene	Increased risk
Presence of rodents	Yes	Increased risk
Flies as sources of <i>Campylobacter</i>	yes	Increased risk
Use of chick transport cartons as feed plates	yes	Increased risk
Manure disposal	Inside the farm <i>vs</i> outside	Increased risk
Children entering the houses	yes	Increased risk
Flock size	Higher flock size	Increased risk
Rodents control	Professional <i>vs</i> farmer administered	Increased risk
<i>Campylobacter</i> status of the previous batch	positive	Increased risk
Total free range flocks	yes	Increased risk
Visit by the farmer in the house	Twice a day <i>vs</i> three time or more	Increased risk
Transport personnel passing through the hygiene barrier when delivering day old chicks	Yes	Increased risk
Hired animal caretaker	Yes	Increased risk

Mainly : season, biosecurity, free range, thinning, age at slaughter

The main risk factors associated with a decreasing risk of *Campylobacter* contamination of poultry flocks (FSA, 2010)

Variables	Modality	Identified risk factor with significant OR
Curative antibiotic treatment	yes	Decreased risk
Lactic acid as water treatment	yes	Decreased risk
Number of persons taking care of the house	1 vs >2	Decreased risk
Use of a detergent for cleaning the broiler houses	yes	Decreased risk
Cleaning and disinfection of the farm yard between successive broiler cycles	yes	Decreased risk
Use of separate boots for each broiler house	yes	Decreased risk
Washing hands before tending the broiler flocks	yes	Decreased risk
Use of clean footbath disinfection when entering the broiler house	yes	Decreased risk
Length of time the house remains empty	Long	Decreased risk
Disinfection of rearing equipments	yes	Decreased risk
Water source	Tap vs ground	Decreased risk
Chlorination of drinking water	yes	Decreased risk
Cleanliness of ante room	Clean vs untidy	Decreased risk
Use of fly screens	yes	Decreased risk
Poultry house with cement floor	yes	Decreased risk
Specific clothes for farm workers	yes	Decreased risk
Gate use for day old chick placement	Specific gate vs manure disposal gate	Decreased risk

Mainly : biosecurity, gut flora

No references to feed, only water treatment

Campylobacter: link caeca and carcasses

Food Microbiology 28 (2011) 862–868



Contents lists available at ScienceDirect

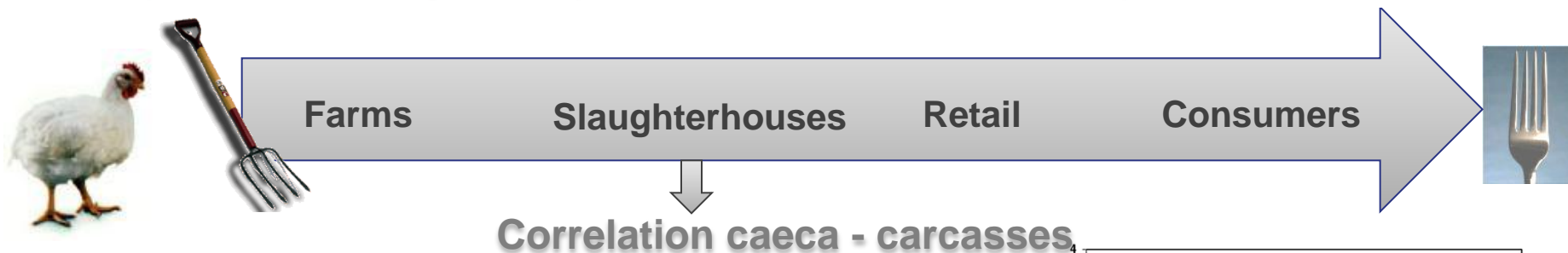
Food Microbiology

journal homepage: www.elsevier.com/locate/fm

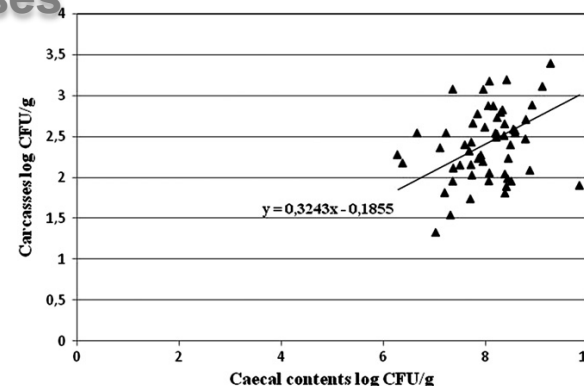


Campylobacter contamination of broiler caeca and carcasses at the slaughterhouse and correlation with *Salmonella* contamination

Olivier Hue^{a,b}, Virginie Allain^{a,c}, Marie-José Laisney^{a,b}, Sophie Le Bouquin^{a,c}, Françoise Lalande^{a,b}, Isabelle Petetin^{a,c}, Sandra Rouxel^{a,b}, Ségolène Quesne^{a,b}, Pierre-Yves Gloaguen^{a,b}, Mélanie Picherot^{a,e}, Julien Santolini^{a,e}, Stéphanie Bougeard^{a,d}, Gilles Salvat^{a,b}, Marianne Chemaly^{a,b,*}



- Positive caeca : carcass contamination significantly ($p < 0.001$) higher than carcasses from negative batches



What should be done at preharvest level ?



Objectives of a control plan against *Campylobacter* in poultry

- Eradication is illusory
- No vertical transmission
- Objectives :
 - At least 2 log reduction on carcasses
 - Reduction of consumer exposure
 - Reduction of campylobacteriosis in humans
- No use of carcasses disinfection

Campylobacter : control strategies



Reduction in live animals

Reduction on carcasses

Reduction on products

Reduction of campylobacteriosis

Interventions	Estimated risk reduction
In primary production	
Improved hygiene/biosecurity in indoor flocks	16% ^a
Application of fly screens in indoor flocks	60% ^a
Discontinued thinning of indoor flocks	1.8–25% ^b
Reduction of slaughter age of indoor flocks	
- to 42 days	0–5% ^b
- to 35 days	0.6–18% ^b
- to 28 days	21–43% ^b
Reduced colonization in caecal contents of indoor and outdoor flocks by	
- 1 log ₁₀ units	48–83% ^{b,c}
- 2 log ₁₀ units	76–98% ^{b,c}
- 3 log ₁₀ units	90–100% ^{b,c}
- 6 log ₁₀ units	100% ^{b,c}



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Food Control

journal homepage: www.elsevier.com/locate/foodcont



Quantitative microbiological risk assessment (QMRA) of food-borne zoonoses at the European level

P. Romero-Barrios, M. Hempen, W. Messens, P. Stella, M. Hugas*

Possible methods of risk management : at the farm level

- **Biosecurity:** changing room, specific boots, clothes, washing of hands, efficient ventilation, drinking water treatment, rodents, flies, dark beetle ...
- **Bacteriophages :** provides 1 to 2 log reduction of intestinal carriage : Highly specific, possible resistance may be reduce by short time period of treatment
- **Competitive exclusion:** evidence of the efficiency of CE treatment issued from young birds but antagonistic with prevention of *Salmonella*
- **Vaccination:** no commercial vaccine available: needs further research
- **Pro & prebiotics:** convincing published results but need field trial evaluation
- **Plant extracts:** variable results
- **Organic acids:** short and medium chain fatty acids
- **Feed form:** particle size or presentation can change bacterial populations, including *Campylobacter*



Control of *Campylobacter* infection in broiler flocks through two-steps strategy: nutrition and vaccination

Consortium



<http://campybro.eu>

Campylobacter: control through the feed

CAMPYBRO project
24 feed additives



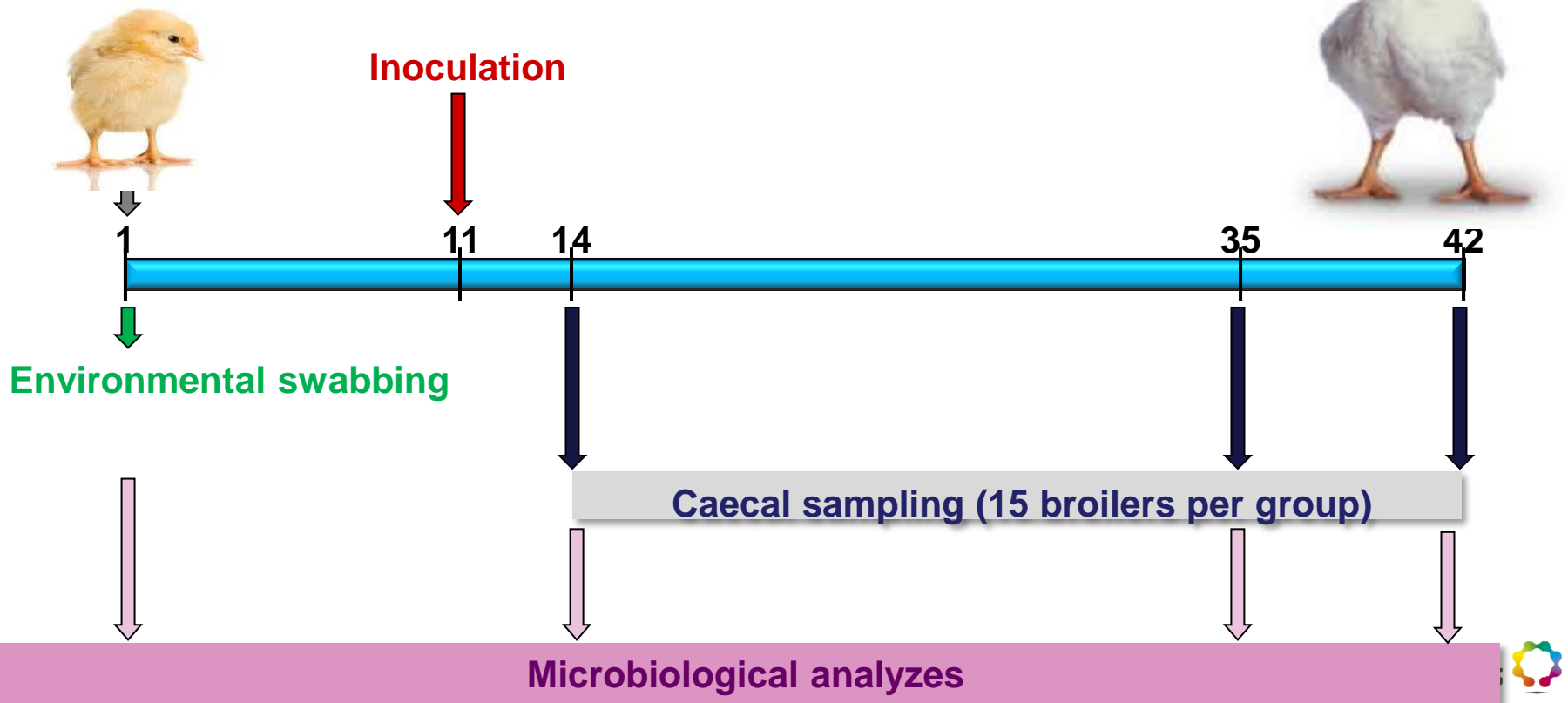
Organic acids

Feed additives

Probiotics

Plant extracts

Prebiotics

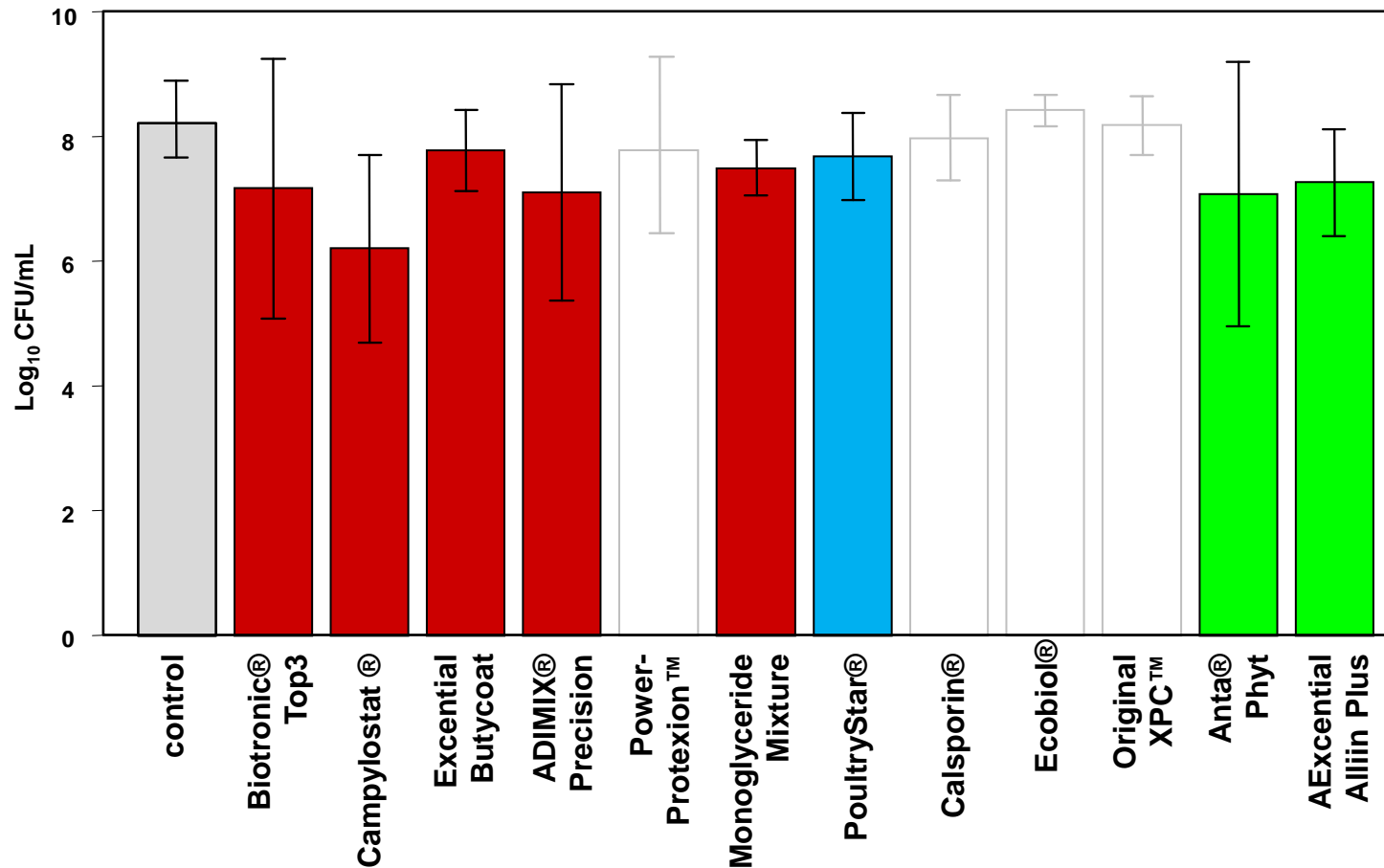


12 Feed additives were tested



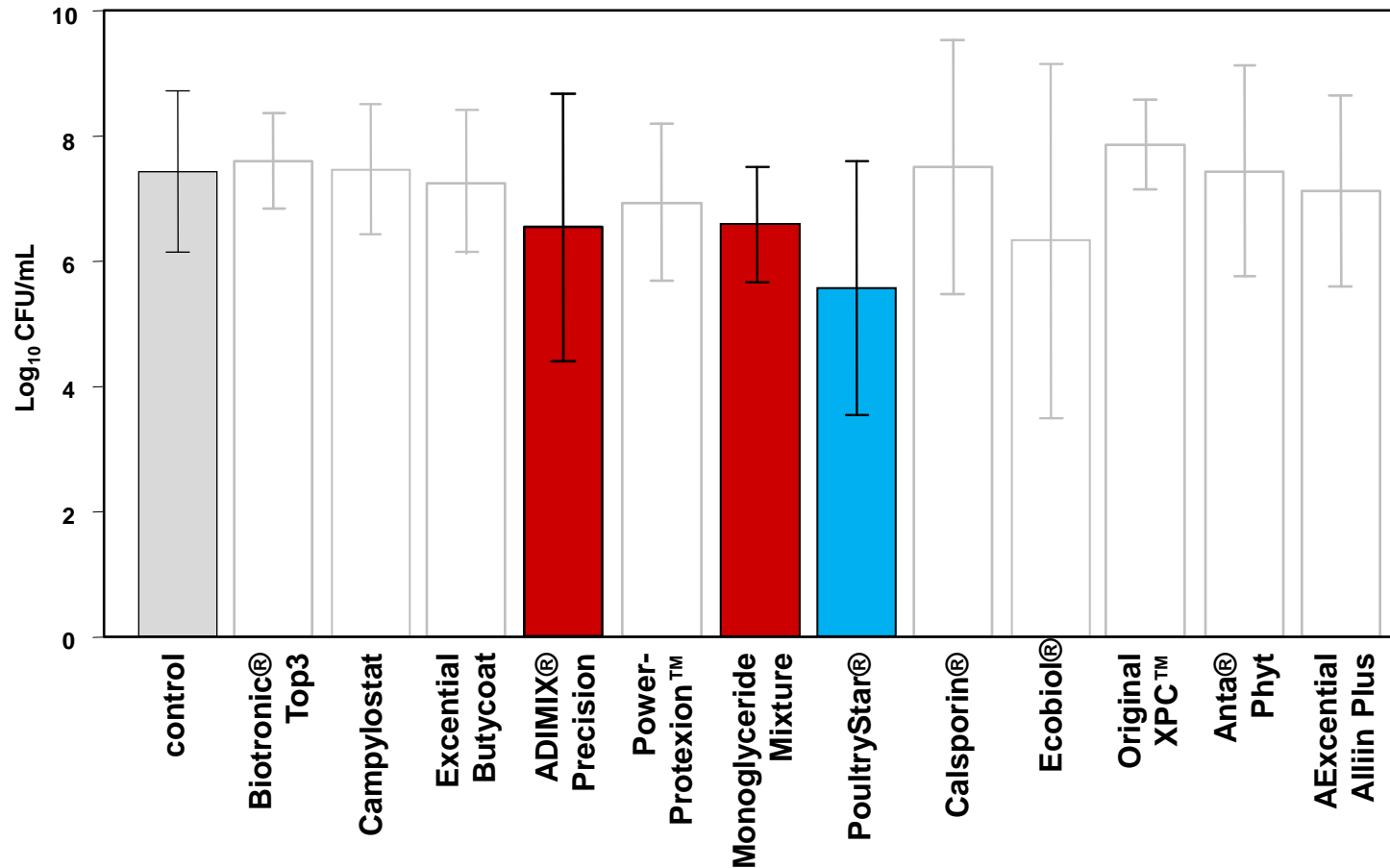
COMPOSITION	PRODUCT	DOSE
SCFA mixture	Biotronic® Top3	0.10% (wt/wt)
SCFA mixture + Monoglycerides	Campylostat	4.50% (wt/wt)
SCFA	ADIMIX® Precision	0.30% (wt/wt)
SCFA	Excential Butycoat	0.10% (wt/wt)
SCFA	Power-Protexion™	0.15% (wt/wt) 0.10% (wt/wt) 0.10% (wt/wt)
Monoglycerides Mixture	Monoglycerides MCFA	0.60% (wt/wt)
Probiotic	Calsporin®	0.01% (wt/wt)
Probiotic	Ecobiol®	0.10% (wt/wt)
Multispecies Probiotic	PoultryStar®	0.10% (wt/wt)
Prebiotic-Like	Original XPC™	0.125% (wt/wt)
Plant based product	Anta® Phyt	0.10% (wt/wt)
Plant based product	Excential Alliin Plus	0.10% (wt/wt)

Results at Day 14



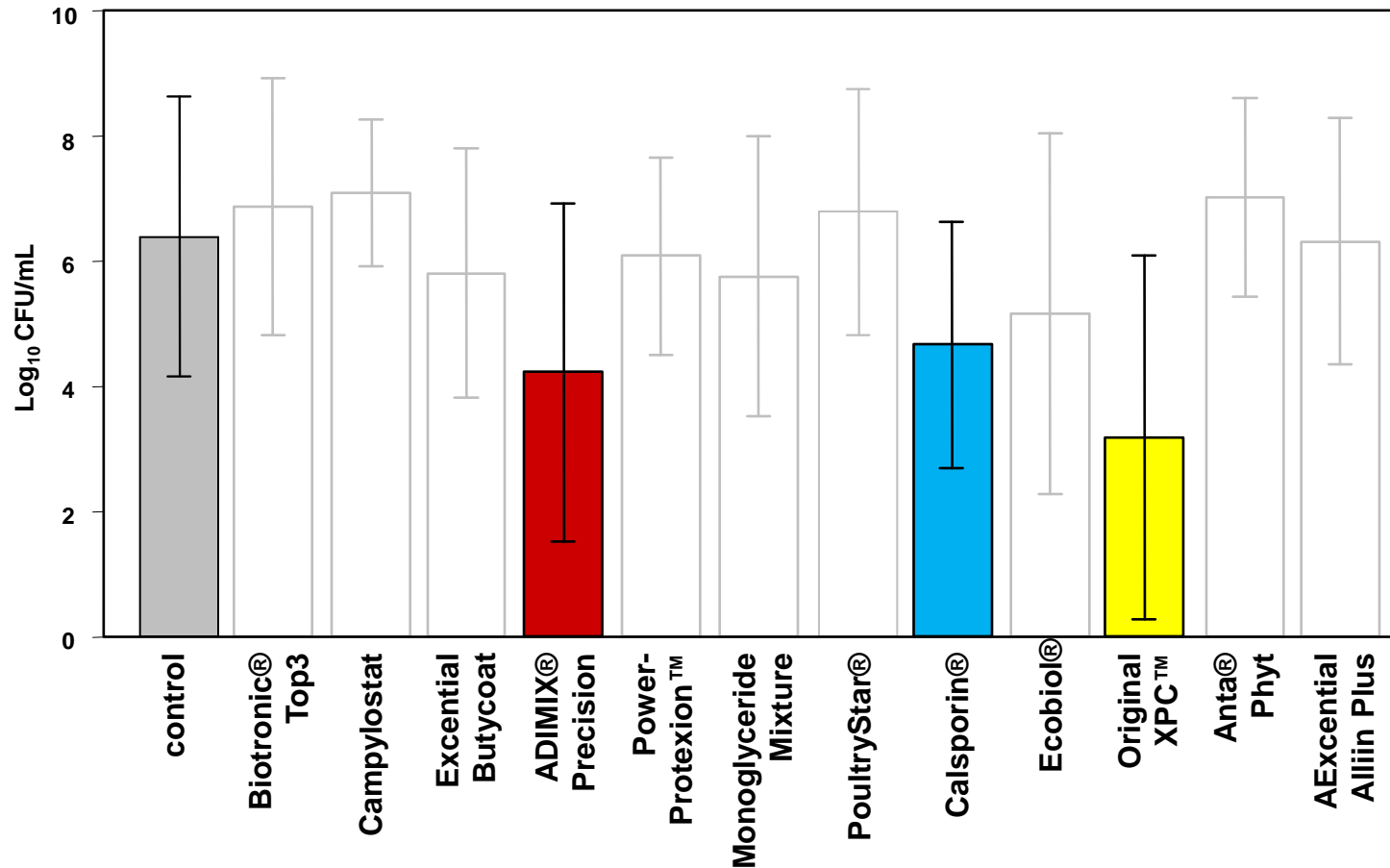
- no product was able to completely prevent the contamination
- 8/12 products significantly decreased the contamination

Results at Day 35



- 3 products significantly decreased the contamination
- 2 efficient treatments presented a high variability

Results at Day 42



- High individual variability regarding the contamination
- 3 products significantly decreased the contamination

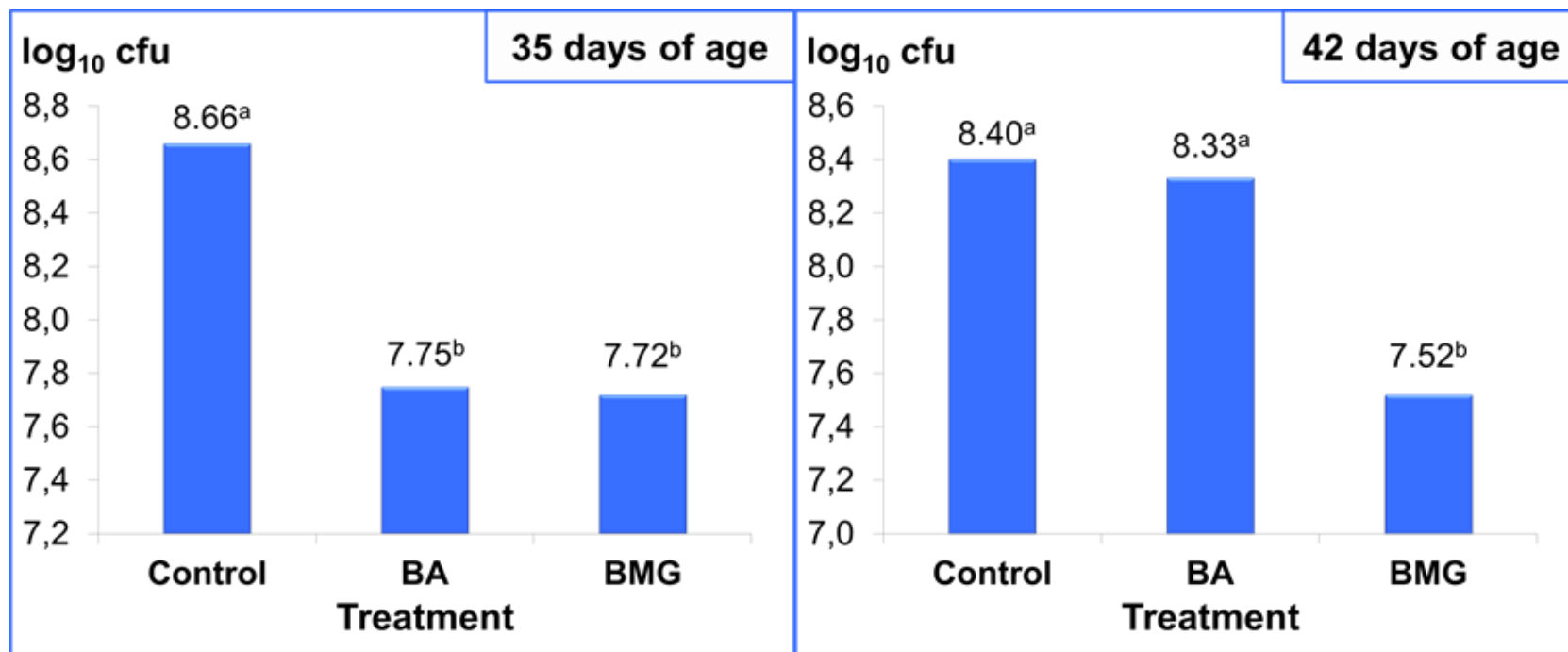
Conclusion of these trials



- No treatment was able to completely prevent the colonization
- 10/12 additives reduced *Campylobacter* loads for at least one sampling time. Onset time and duration of action varied according to the product.
- High individual variation among birds regarding *Campylobacter* contamination, even in the control group

Promising results concerning the use of feed additives to reduce *Campylobacter* infection in flocks

Campylobacter: control through the feed

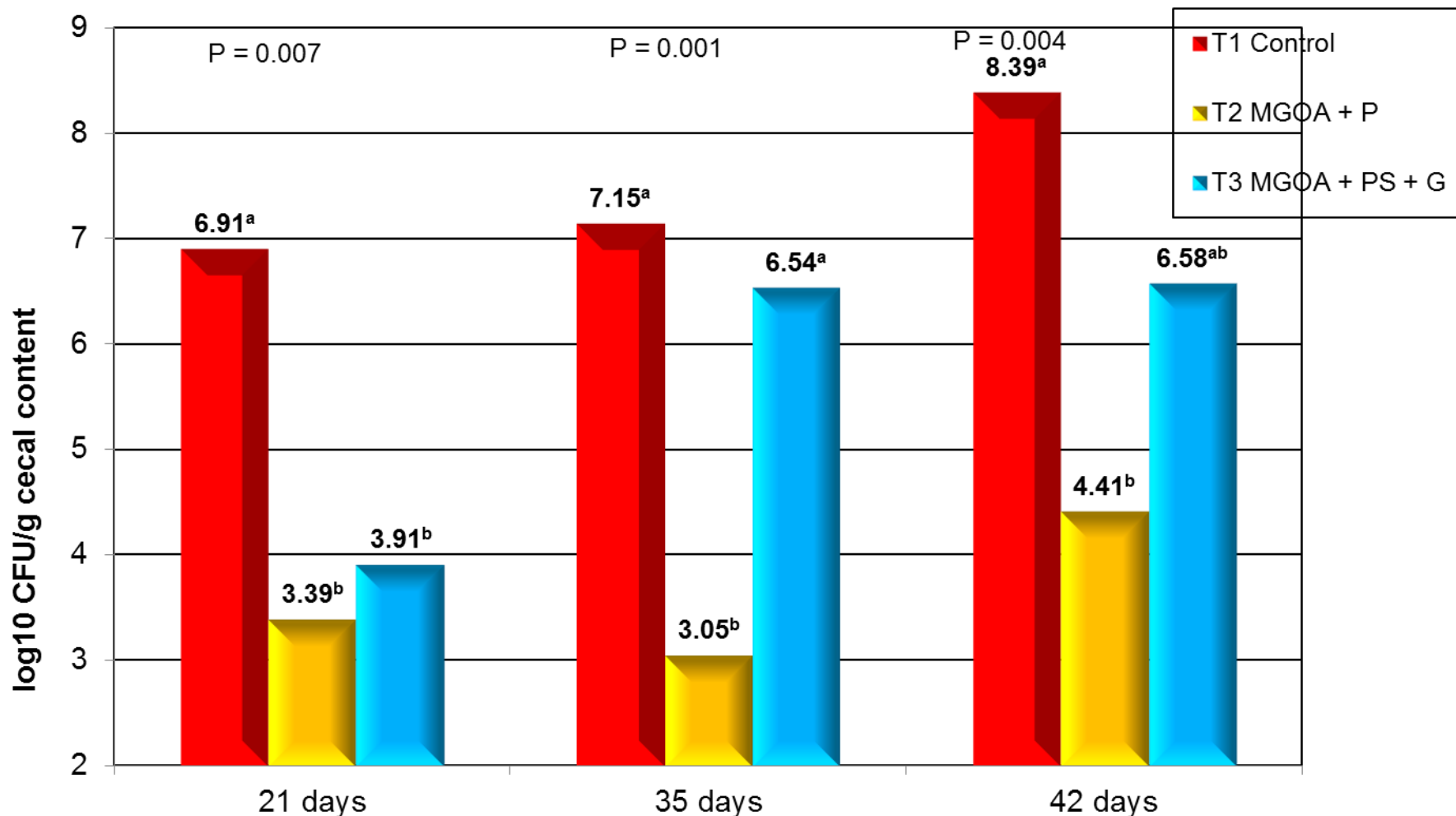


Millán et al., 2014. XIVth European POULTRY CONFERENCE. Stavanger, Norway

From another 12 products tested:

Positive results with a blend of medium chain fatty acids (BA, 60% capric and caprylic acids, 35% silica) and a blend monoglycerides of capric and caprylic acids (BMG, 48% C8-C10 monoglycerides, 35% silica)

Control through the feed: *Combination of additives*



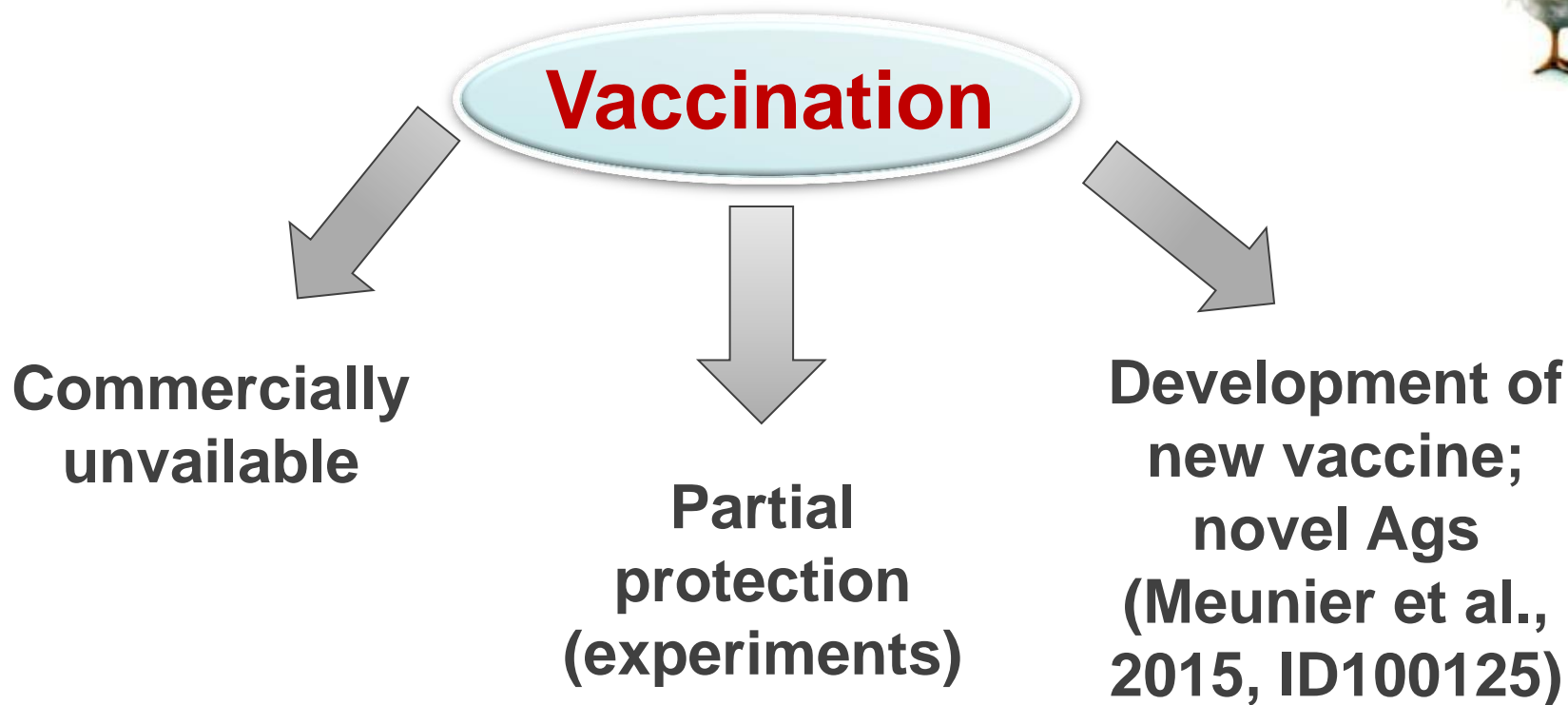
Promising results: monoglycerides of medium chain fatty acids and organic acids (MGOA) with a probiotic (*B. subtilis* C-3102, P)



- We tried:
 - Particle size
 - Type of cereal (corn, wheat, barley)
 - Insoluble fiber addition (oat hulls)
 - Feed form (mash vs pellets)
 - Whole wheat (WW) addition (15-30%)
- Huge effect on gastrointestinal morphology
 - Size and development of proventriculus and gizzard
 - pH
- Low or any effect on *Campylobacter* cecal counts
 - Positive effects only with a combination of oat hulls and WW with a very high infection in control animals (Gracia et al., 2015)
 - No consistent among experiments
 - No interaction/synergism between feed form and additives

According with those results, it does not worth to continue this line of research and focus into feed additives

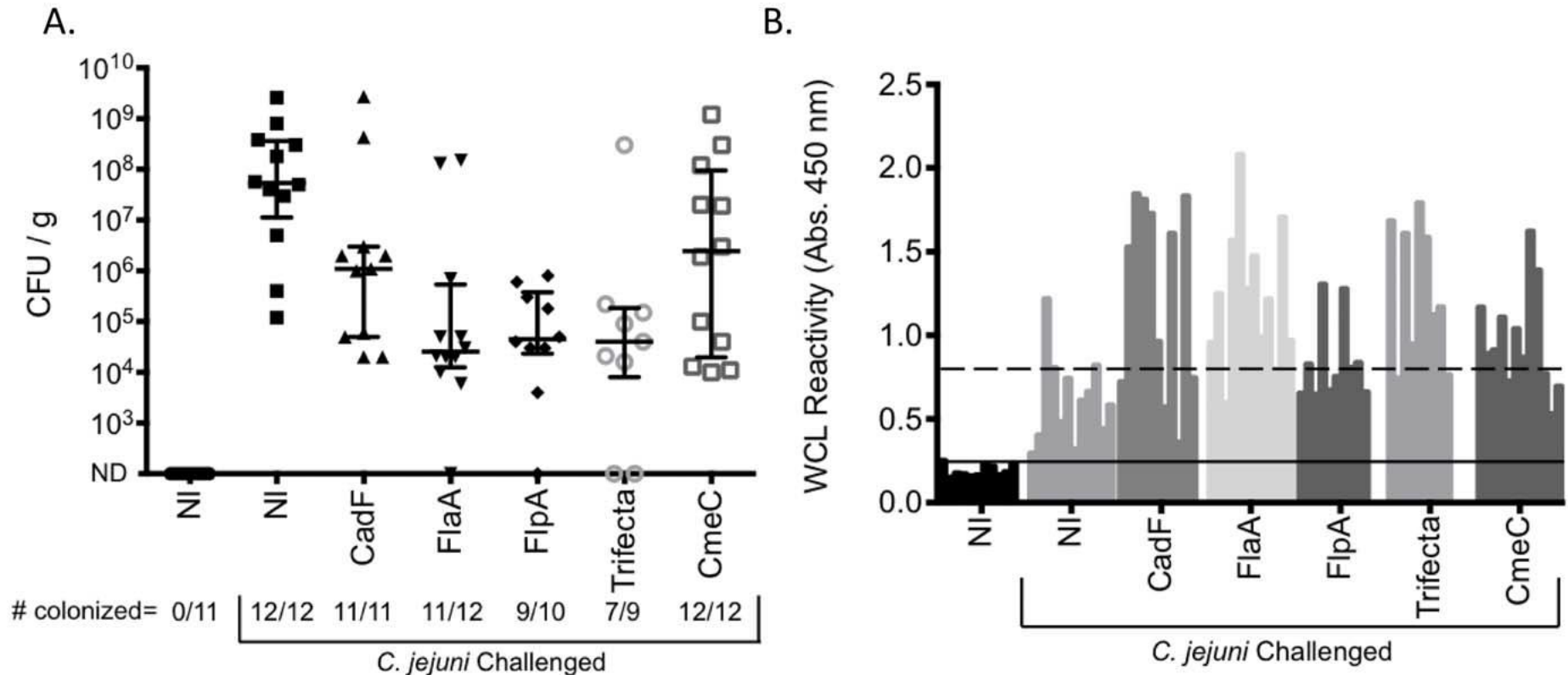
Campylobacter: Vaccination



 **Combinations of strategies**

Potential effect of vaccination of live birds

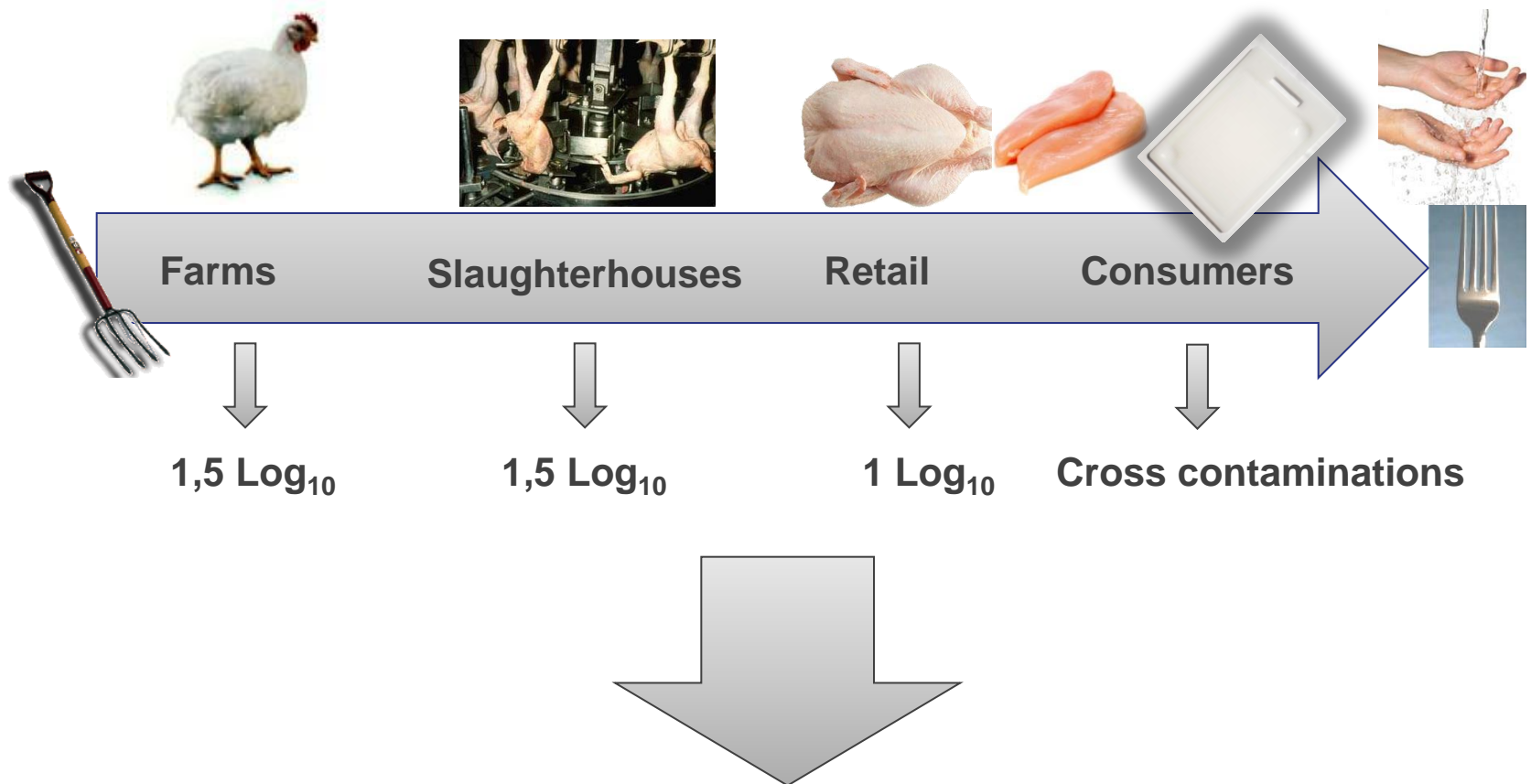
(Neal-McKinney et al., 2014)



Vaccination with surface exposed colonization proteins

Conclusion

Multi Scale Collaborative Approach



Reduction of campylobacteriosis

Acknowledgements

- EU (Campybro project, DGAL, ANR)
- Collaborators (Anses Units,...)

