Alternatives to in-feed antibiotics and their impact on the safety of animal products

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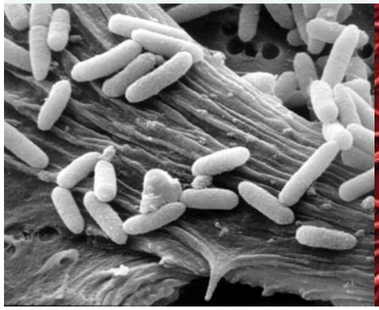
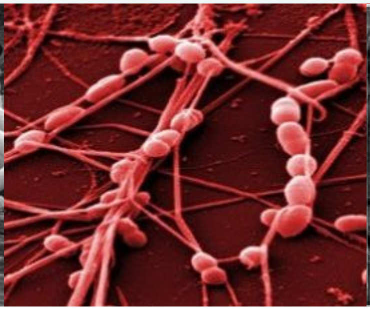
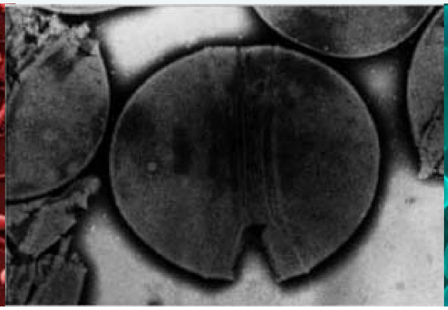
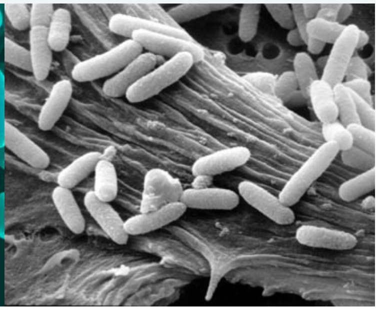






ANTIBIOTICS

- Penicillin: A. Fleming, 1929
- First „Clinical trial“
- 29. 11. 1942

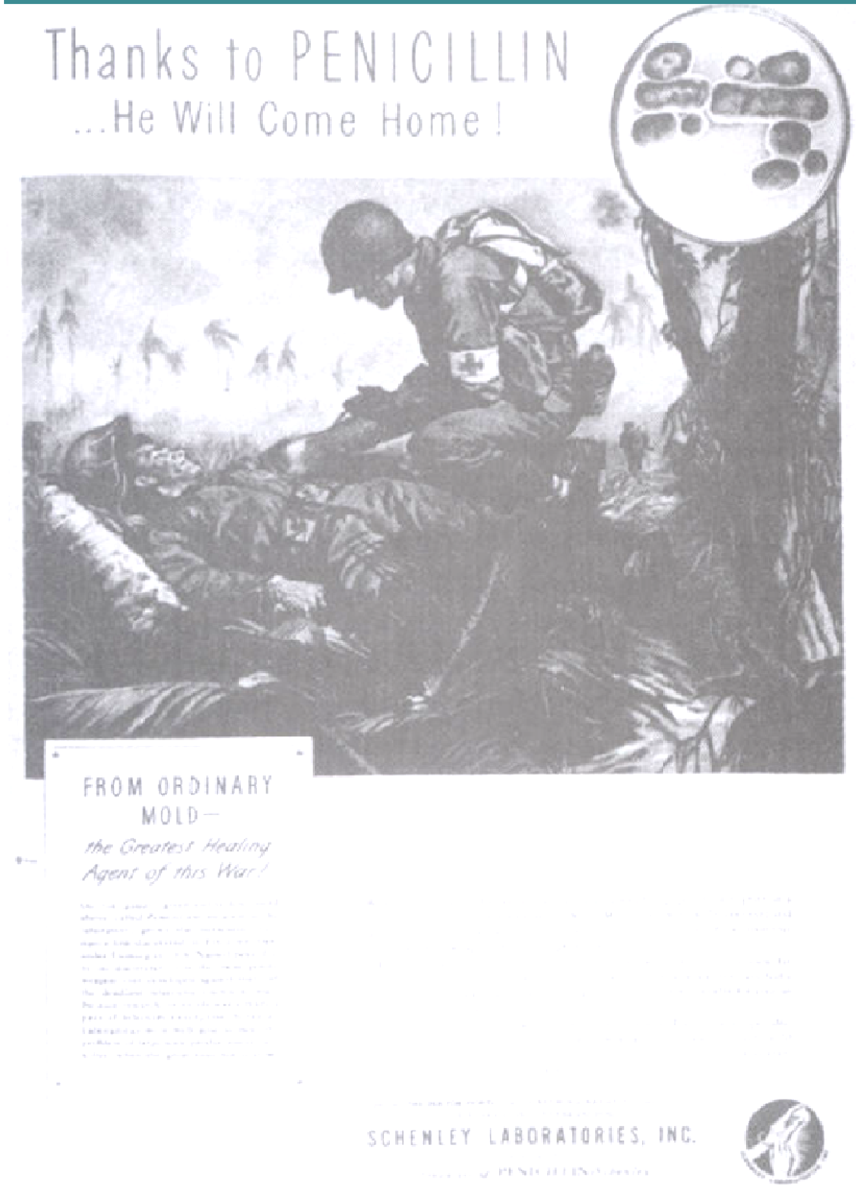

THE BOSTON HERALD 6 A.M. EXTRA

450 DIE AS FLAMES AND PANIC TRAP COCOANUT GROVE CROWD

- The most destructive fire accident in USA since 1903
- Penicillin has been given to patients with burn wounds
- Better skin grafts acceptance - prevention of infection in burned patients ans its spreading to their system – the best results achieved so far
- „Miracle drug“

Levy, 2002

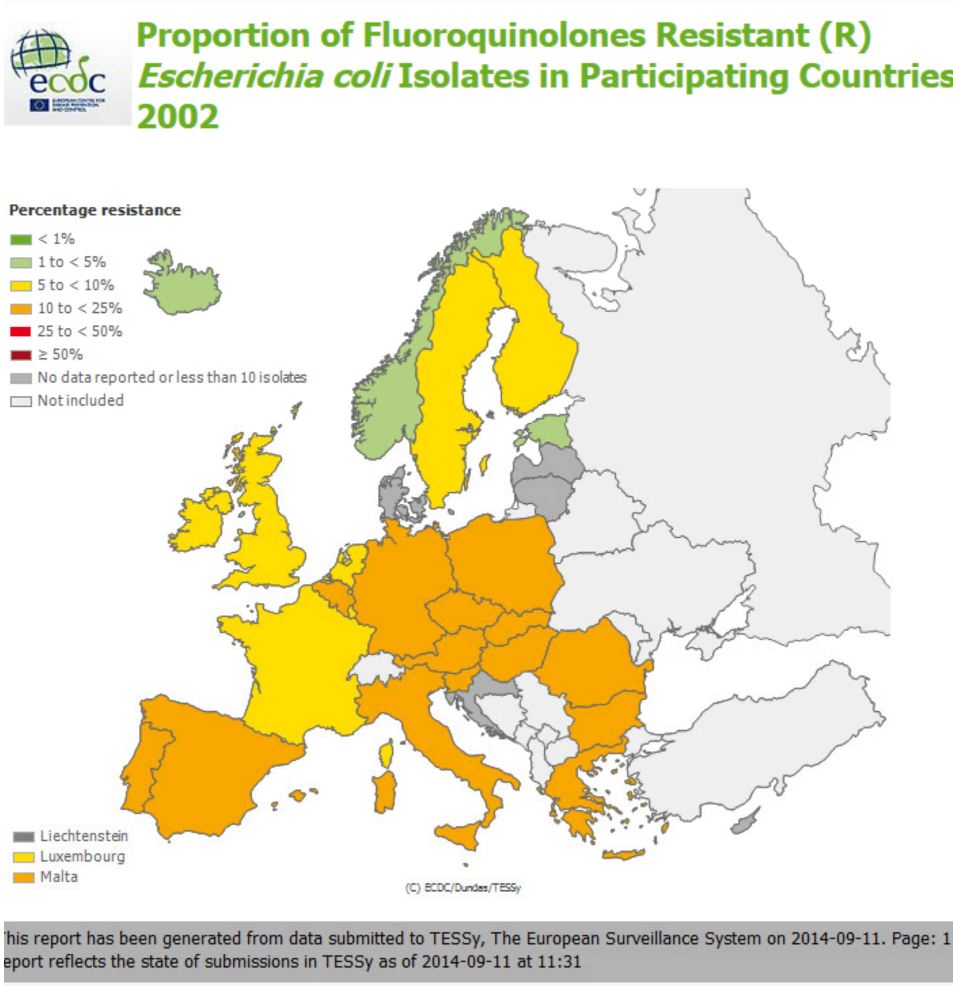
ANTIBIOTICS

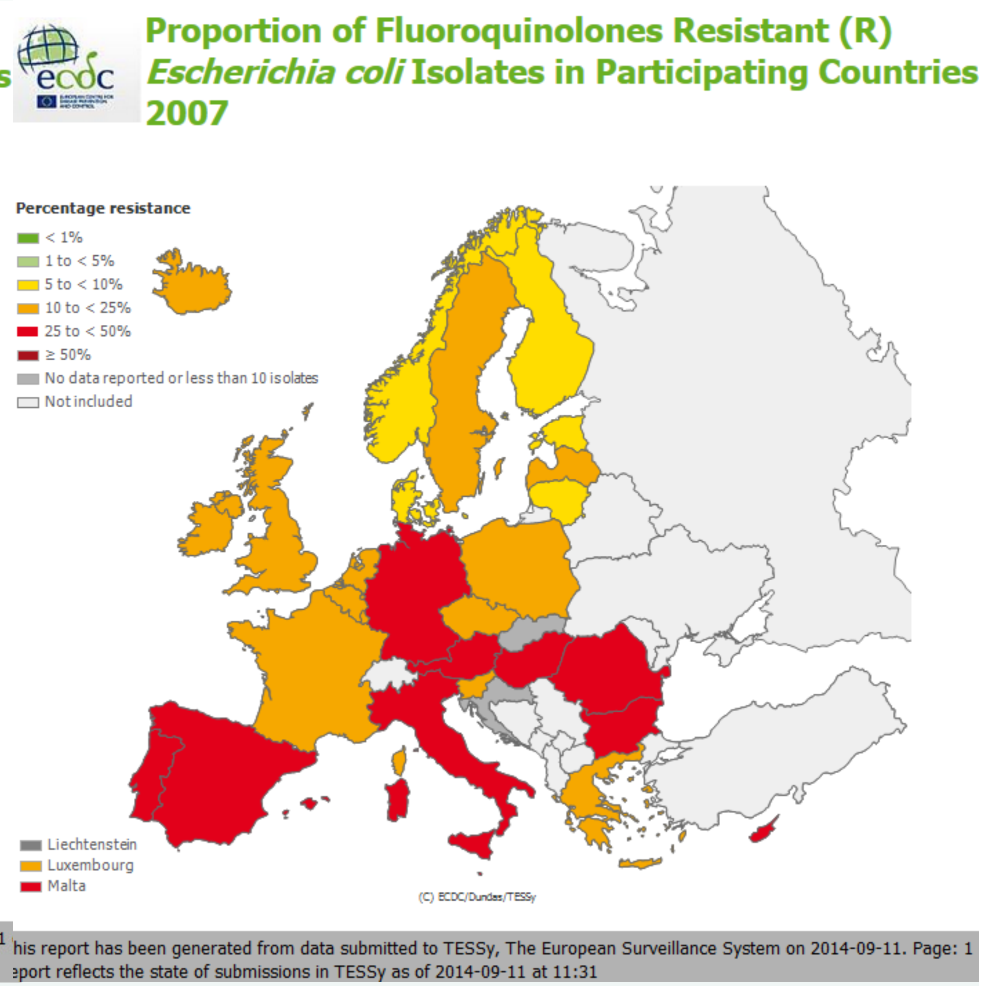


„There may be a danger, though, in ***underdosage****. It is not difficult to make microbes* ***resistant*** *to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them, and the same thing has occasionally happened in the body.“*

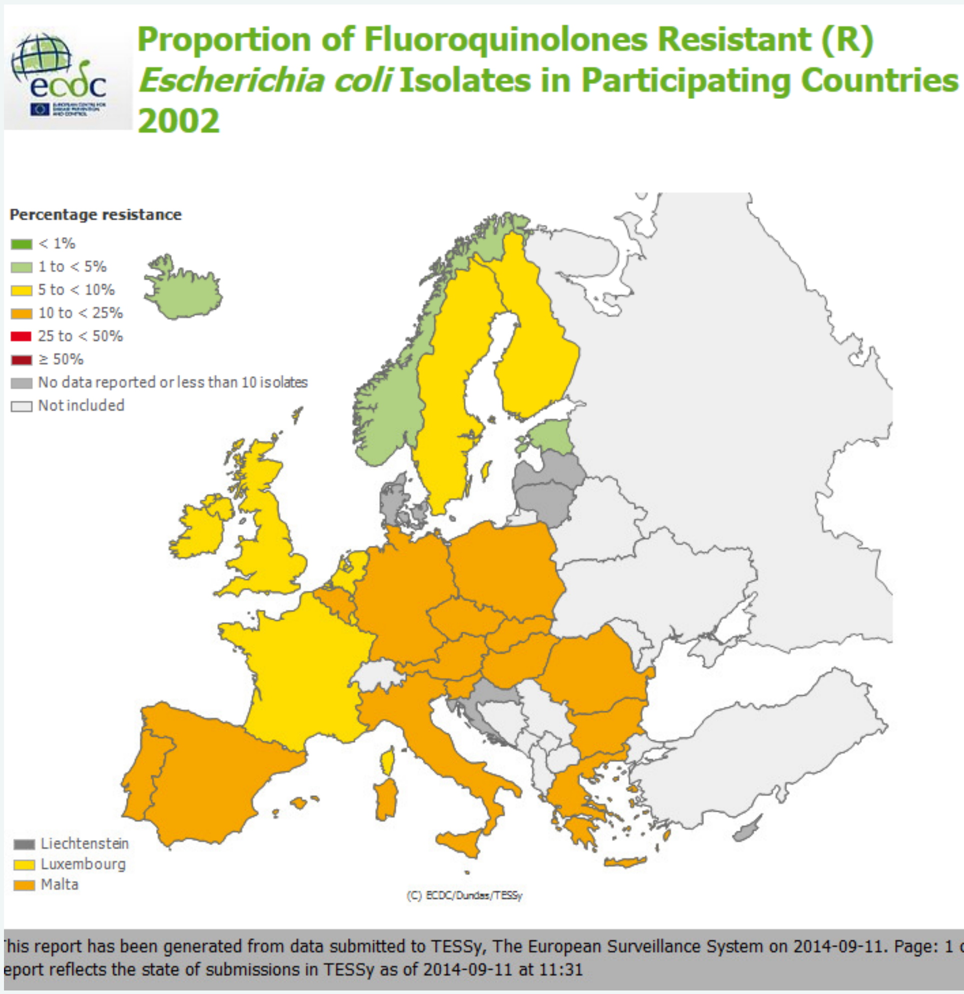
A. Fleming, Nobel Lecture, 1945

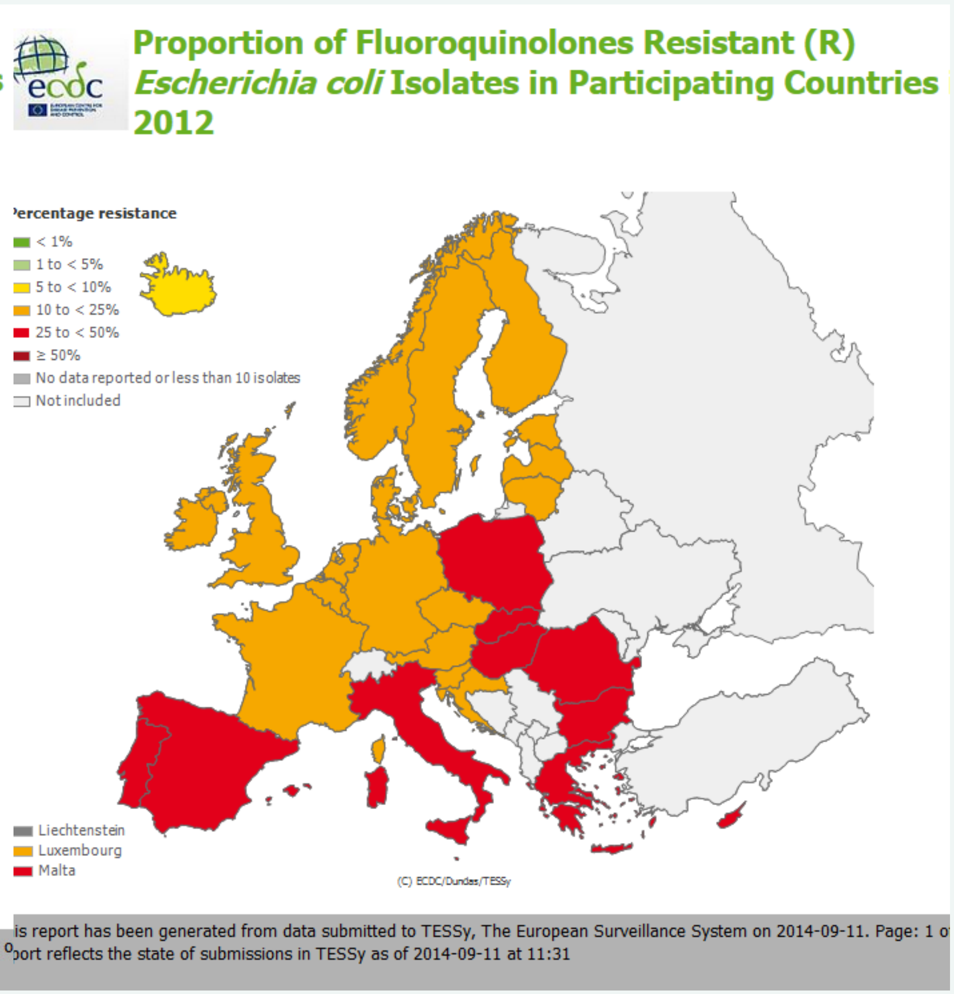
ATB resistance, Europe





ATB resistance, Europe





Antibiotics in animal nutrition

- Prevention of GIT infections (mainly after weaning)
- Lowering of the risk of contamination of animal products
- Production traits enhancement

Antibiotics in animal nutrition

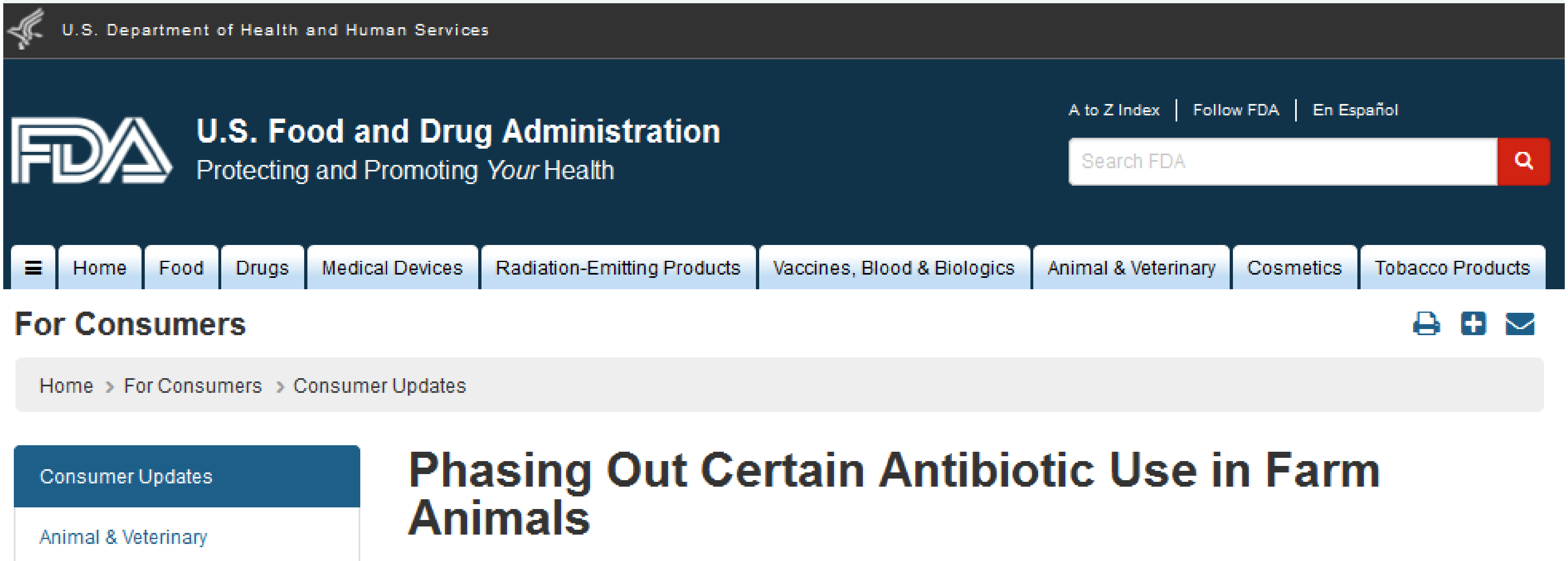
- Prevention of GIT infections (... after weaning)
- Lowering of the ... contamination of animal prod...
- Pr...ction traits enhancement

FEED SUPPLEMENTS

Antibiotics in animal nutrition

- Worldwide since 50-ies of the last century
- **Resistance**: reduction in their use
- January 2006: restricted in EU (based on the EU Regulation no. 1831/2003

Antibiotics in animal nutrition



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Consumer Updates

Animal & Veterinary

Phasing Out Certain Antibiotic Use in Farm Animals

December 2013

- **In-feed ATB restriction:**
  - ↓ production
  - ↓ health (GIT infections around weaning in particuar)
  - ↑ risk of bacterial contamination of animal products
  - ↑ costs

Alternatives to in-feed ATB

- **Probiotics, prebiotics**
- **Bacteriocins**
- **Enzymes**
- **Plant extracts, essential oils**
- **Antibodies**
- **Organic acids**

Organic acids

- Feed & food preservatives
- Animal nutrition:
  - Growth & performance enhancers
  - Antibacterial properties

Organic acids

- Feed & food preservatives

- Animal nutrition:
  - Growth & performance enhancers
  - Antibacterial properties

MCFA ($C_{8:0}$ – $C_{12:0}$)

Antibacterial effect of fatty acids in vivo

The natural feed additive caprylic acid decreases *Campylobacter jejuni* colonization in market-aged broiler chickens[1]

F. Solis de los Santos,* A. M. Donoghue,† K. Venkitanarayanan,‡ J. H. Metcalf,* I. Reyes-Herrera,* M. L. Dirain,* V. F. Aguiar,* P. J. Blore,* and D. J. Donoghue*[2]

**Poultry Science Department, University of Arkansas, Fayetteville 72701; †Poultry Production and Product Safety Research Unit, Agricultural Research Service, USDA, Fayetteville, AR 72701; and ‡Department of Animal Science, University of Connecticut, Storrs 06269*

2009 Poultry Science 88:61–64

-Experimental infection of chickens with *C. jejuni*
-Caprylic acid ($C_{8:0}$)
-Concentrations 0.35 % - 1.4 %
-Last week of the fattening period (7 days or 3 days)

Antibacterial effect of fatty acids in vivo

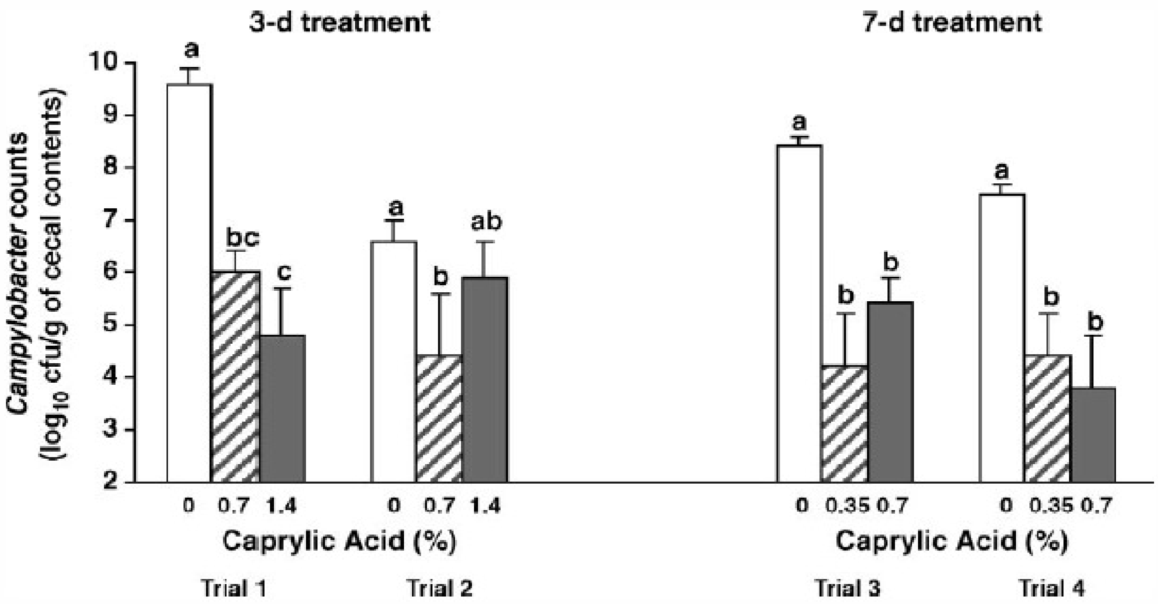

Figure 1. Cecal *Campylobacter jejuni* counts in 42-d-old broiler chickens (n = 10 birds/treatment per trial) fed caprylic acid 3 d (trial 1 and 2) or 7 d (trial 3 and 4) before necropsy. [a–c]Columns with no common letters differ significantly ($P < 0.05$).

S. de los Santos a kol., Poultry Science 2009

Antibacterial effect of fatty acids in vivo

Arch. Anim. Nutr., 2003, Vol. 57, pp. 49 – 63

Taylor & Francis
Taylor & Francis Group

THE COMBINED USE OF WHOLE *CUPHEA* SEEDS CONTAINING MEDIUM CHAIN FATTY ACIDS AND AN EXOGENOUS LIPASE IN PIGLET NUTRITION[1]

N.A. DIERICK*, J.A. DECUYPERE and I. DEGEYTER

Ghent University, Faculty of Agricultural and Applied Biological Sciences, Department of Animal Production, Melle, Belgium

- *Cuphea lanceolata* a *C. ignea* seeds
    - Rich in MCFA
    - 5 % addition to feed
    - Combined with exogenous lipase
- The effect on performance and GIT microflora
- Improvement was not statistically signifficant

Antibacterial effect of fatty acids in vivo: IAS Prague

- Experimental infections of rabbits & chickens
- Effect of MCFA on GIT microbiota
- Field experiments

Antibacterial effect of fatty acids in vivo: IAS Prague

- Experimental infections of rabbits & chickens
- Effect of MCFA on GIT microbiota
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I. Experimental infections

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Available online at www.sciencedirect.com

ScienceDirect

Veterinary Microbiology 126 (2008) 372–376

veterinary microbiology

www.elsevier.com/locate/vetmic

Short communication

Effects of caprylic acid and triacylglycerols of both caprylic and capric acid in rabbits experimentally infected with enteropathogenic *Escherichia coli* O103

Eva Skřivanová, Zuzana Molatová, Milan Marounek *

Institute of Animal Science, Prague-Uhříněves, Přátelství 815, CZ-104 00, Czech Republic

Received 8 June 2007; received in revised form 9 July 2007; accepted 10 July 2007

I. Experimental infections

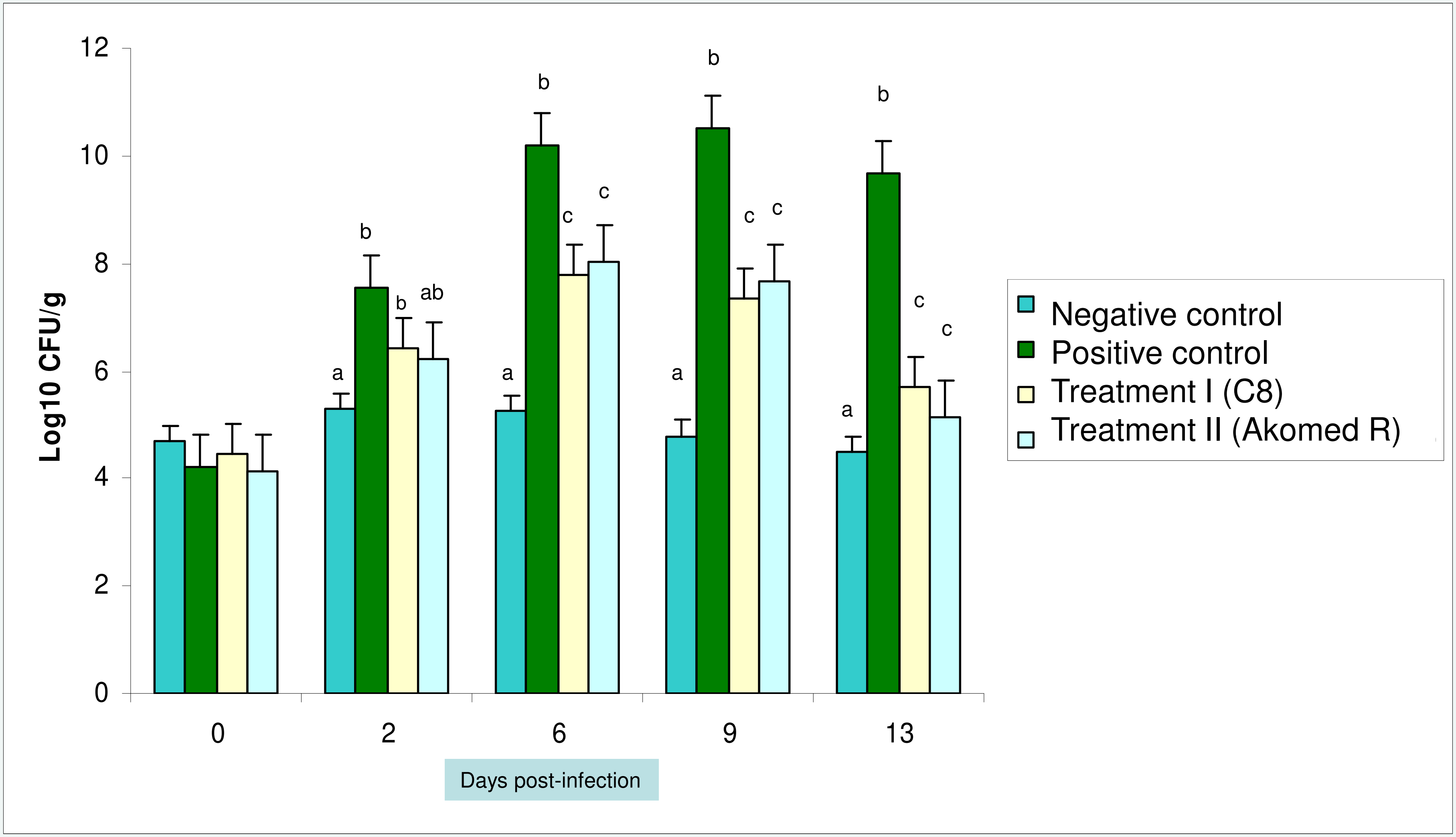
- 88 broiler Hypuls rabbits, weaned at 35D
- Individual cages

- Negative control
- Positive control
- 0.5 % C8 FA
- 1 % C8 + C10 TAG

→ *E. coli* O103

- Bacterial shedding
- Performance
- Health status

The effect of C_8 and Akomed R on *E. coli* shedding in terms of experimental infection of broiler rabbits



[abc]Columns with a different superscript are significantly different within the group ($p < 0{,}05$)

Skřivanová et al., Veterinary Microbiology 2008

I. Experimental infections

Veterinary Microbiology 135 (2009) 358–362

ELSEVIER

Contents lists available at ScienceDirect

Veterinary Microbiology

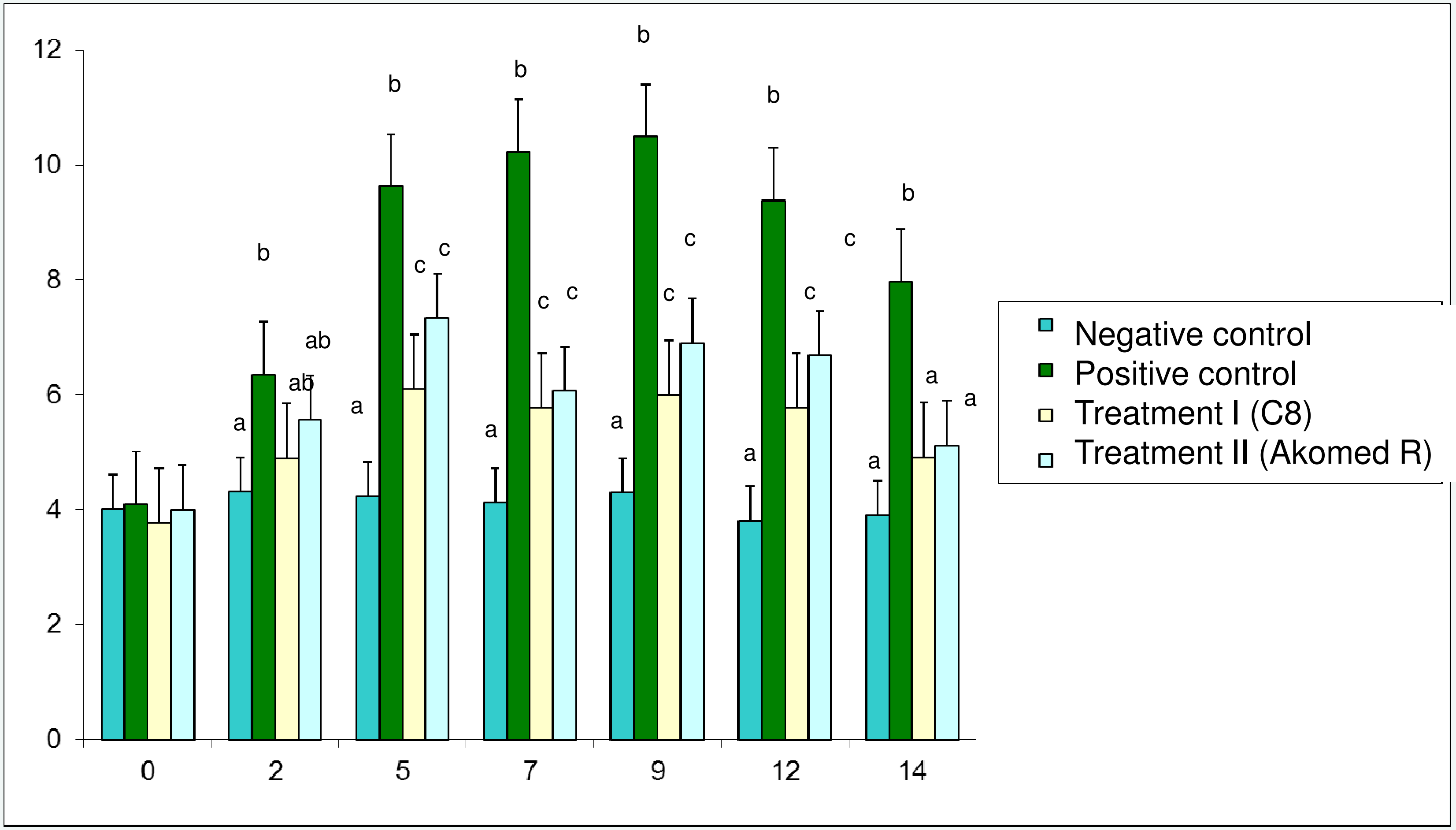
journal homepage: www.elsevier.com/locate/vetmic

Inhibitory activity of rabbit milk and medium-chain fatty acids against enteropathogenic *Escherichia coli* O128

Eva Skřivanová, Zuzana Molatová, Věra Skřivanová, Milan Marounek *

Institute of Animal Science, Přátelství 815 CZ-104 00, Prague, Czech Republic

The effect of C_8 and Akomed R on *E. coli* shedding in terms of experimental infection of broiler rabbits



[abc]Columns with a different superscript are significantly different within the group ($p < 0,05$)

Skřivanová et al., Veterinary Microbiology 2009

I. Experimental infections

Journal of
Animal Physiology and Animal Nutrition

DOI: 10.1111/j.1439-0396.2010.01100.x

ORIGINAL ARTICLE

Effect of coated and non-coated fatty acid supplementation on broiler chickens experimentally infected with *Campylobacter jejuni*

Z. Molatová[1], E. Skřivanová[1], J. Baré[2], K. Houf[2], G. Bruggeman[3] and M. Marounek[1]

1 Institute of Animal Science, Prague, Czechia,
2 Department of Veterinary Public Health and Food Safety, Ghent University, Merelbeke, Belgium, and
3 Nutrition Sciences N.V., Drongen, Belgium

I. Experimental infections

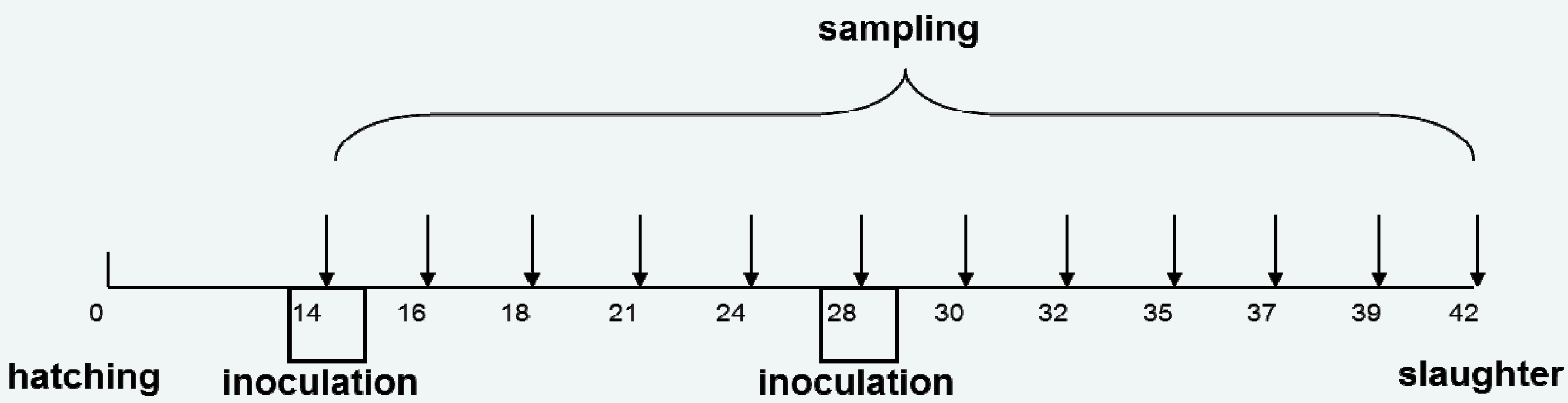
- 48 broiler chickens
- Induvidual cages

- Negative control
- Positive control
- C8 + C10 free, 0.5 %
- C8 + C10 coated, 0.5 %

→ *Campylobacter jejuni*

- Bacterial shedding
- Performance
- Health status

Experimental timeline



The effect of free and coated MCFA on *C. jejuni* shedding in terms of experimental infection of broiler chickens

Age of chickens (days)	Treatment group			
	1	2	3	4
	Basal diet **No infection**	**Free acids** **Infection**	**Protected acids** **Infection**	**Basal diet** **Infection**
16	<DL^{a}	<DL^{a}	<DL^{a}	<DL^{a}
18	<DL^{a}	3.41 ± 0.67^{b}	3.38 ± 0.66^{b}	3.73 ± 0.68^{b}
21	<DL^{a}	<DL^{a}	<DL^{a}	<DL^{a}
24	<DL^{a}	3.09 ± 20^{b}	3.37 ± 0.90^{b}	3.25 ± 0.45^{b}
28	<DL^{a}	3.67 ± 0.58^{b}	3.37 ± 0.60^{b}	3.40 ± 0.49^{b}
30	<DL^{a}	5.31 ± 0.62^{b}	3.09 ± 0.29^{c}	7.27 ± 0.65^{d}
32	<DL^{a}	6.97 ± 1.06^{b}	6.39 ± 1.65^{b}	8.20 ± 0.49^{c}
35	<DL^{a}	7.64 ± 0.98^{b}	5.95 ± 1.50^{c}	7.11 ± 0.98^{b}
37	<DL^{a}	6.29 ± 1.31^{b}	6.56 ± 1.43^{bc}	7.51 ± 0.95^{c}
39	<DL^{a}	5.89 ± 1.55^{b}	6.81 ± 1.54^{b}	6.89 ± 0.72^{b}

Foodborne Pathogens and Disease

Foodborne Pathogens and Disease: http://mc.manuscriptcentral.com/foodborne

The potential use of caprylic acid in broiler chickens: effect on Salmonella Enteritidis

Journal:	*Foodborne Pathogens and Disease*
Manuscript ID:	FPD-2014-1833.R1
Manuscript Type:	Original Research Article
Date Submitted by the Author:	n/a
Complete List of Authors:	Skrivanova, Eva; Czech University of Life Sciences Prague, Department of Microbiology, Nutrition and Dietetics; Institute of Animal Science, Department of Physiology of Nutrition and Quality of Animal Products Hovorkova, Petra; Czech University of Life Sciences in Prague, Department of Microbiology, Nutrition and Dietetics; Institute of Animal Science, Department of Physiology of Nutrition and Quality of Animal Products Cermak, Ladislav; Institute of Animal Science, Department of Physiology of Nutrition and Quality of Animal Products Marounek, Milan; Czech University of Life Sciences in Prague, Department of Microbiology, Nutrition and Dietetics; Institute of Animal Science, Department of Physiology of Nutrition and Quality of Animal Products
Keyword:	Antimicrobials, Antimicrobial Susceptibility, Food Microbiology, Poultry, Salmonella

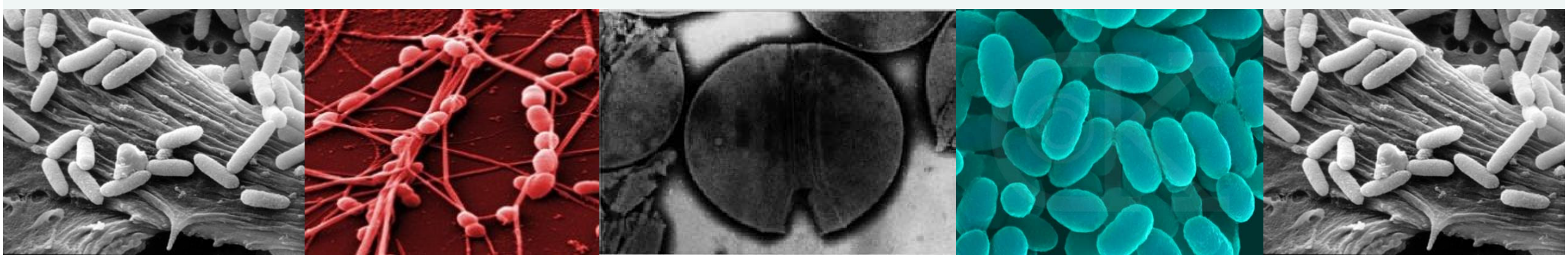
2014

Salmonella enterica var. Enteritidis

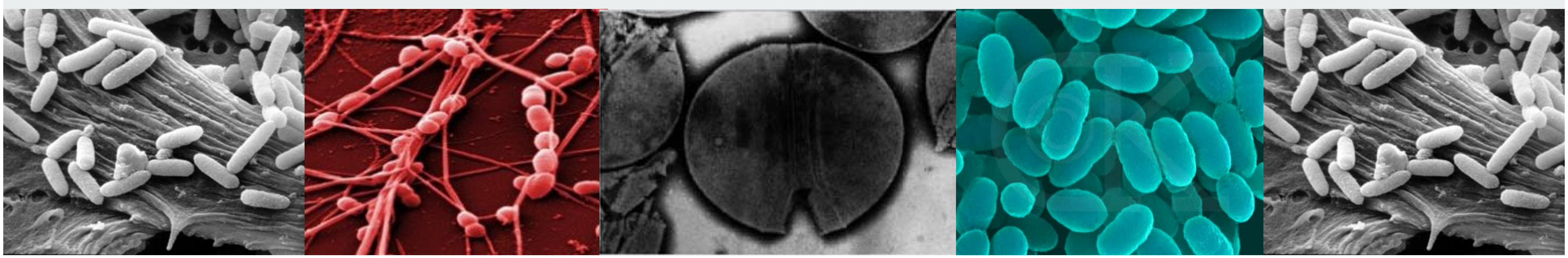
- Dietary supplementation of $C_{8:0}$
  - 0.25 % and 0.5 %
  - reduction of salmonellas in crop and caecum
- Surface treatment of chilled chicken carcasses
  - 0.125 % and 0.25 %
  - reduced salmonellas on a surface by 1 – 2 Log_{10} CFU/g of skin
  - sensory traits

Fatty acids in animal nutrition

- Effective in young animals or during the entire fattening
- Prevention of GIT infections
- Lower bacterial shedding
- Lower risk of contamination of animal products
- Can be used as a surface-treatment (with some limitations)
- Broiler rabbits, chickens, pigs



Thank you for your attention!



Consumption of veterinary chemotherapeuticals in the Czech Republic: ANTIBIOTICS (Hera et al., 2009)