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Raw meat-based diets for companion animals: a new threat for spreading of multidrug-resistant Enterobacteriaceae?

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Research



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Raw meat-based diets for companion animals: a potential source of transmission of pathogenic and antimicrobial-resistant Enterobacteriaceae

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Agenda

- Introduction
- Working hypothesis
- Study set-up
- Results
- Study impact

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Biggest Threats and Data

2019 AR Threats Report

CDC's *Antibiotic Resistance Threats in the United States, 2019* (2019 AR Threats Report) includes the latest national death and infection estimates that underscore the continued threat of antibiotic resistance in the U.S.

According to the report, more than 2.8 million antibiotic-resistant infections occur in the U.S. each year, and more than 35,000 people die as a result. In addition, 223,900 cases of *Clostridioides difficile* occurred in 2017 and at least 12,800 people died.



Main intervention strategies:

- Prudent use of antibiotics
- Interrupt spreading of AMR bacteria

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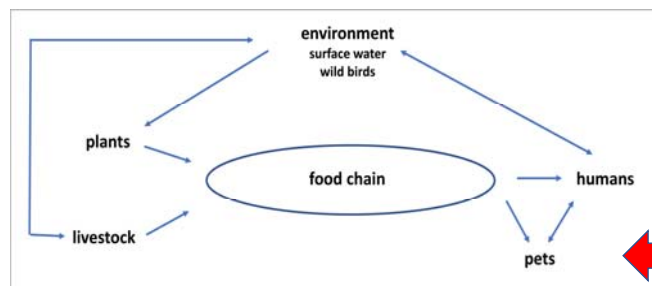
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Our main focus

- ESBL-producing Enterobacteriaceae in a „One health“ concept; molecular epidemiology

Geser et al. 2012, AAC
 Geser et al. 2012, BMC Veterinary Research
 Zurfluh et al. 2013, IJAA
 Zurfluh et al. 2013, AEM
 Zurfluh et al. 2014, Frontiers in Microbiology
 Zurfluh et al. 2015, AEM
 Nüesch-Inderbinen et al. 2015, JFP
 Zurfluh et al. 2015, Science of Total Environment
 Müller et al. 2016, Science of Total Environment
 Nüesch-Inderbinen et al. 2016, CCM
 Zurfluh et al. 2016, IJACC
 Zogg et al., 2018, Vet Microbiology
 Zogg et al., 2018, Frontiers in Vet Microbiology
 Zurfluh et al., 2019, JGAR



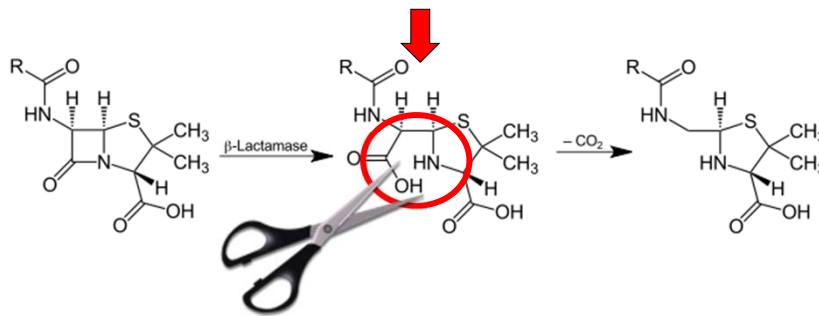
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ESBL producers



SHV, **TEM**, **CTX-M** ... (huge diversity; differences in regions; differences in hosts!!!)

Extended spectrum beta-lactamase (ESBL) enzymes that break down commonly used **penicillins** and **cephalosporins (1-4)**

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Starting point

frontiers
in Veterinary Science

ORIGINAL RESEARCH
Published: 27 March 2018
doi: 10.3389/fvets.2018.00002



High Prevalence of Extended-Spectrum β -Lactamase Producing Enterobacteriaceae Among Clinical Isolates From Cats and Dogs Admitted to a Veterinary Hospital in Switzerland

Anna Lena Zogg¹, Sabrina Simmen¹, Katrin Zurfluh¹, Roger Stephan¹, Sarah N. Schmitt² and Magdalena Nüesch-Inderbinen^{1*}

OPEN ACCESS

Edited by:
Timothy J. Johnson,
University of Minnesota

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University of Zürich, Zürich, Switzerland, ²Veterinary Faculty, Institute of
Switzerland

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



Antimicrobial resistance, multilocus sequence types and virulence profiles of ESBL producing and non-ESBL producing uropathogenic *Escherichia coli* isolated from cats and dogs in Switzerland

Anna Lena Zogg^a, Katrin Zurfluh^b, Sarah Schmitt^b, Magdalena Nüesch-Inderbinen^a, Roger Stephan^a

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Main results

- 346 non-duplicate Enterobacteriaceae isolates (2012-2016) from diseased cats (n=115) and dogs (n=231)
- 72 (21%) were confirmed ESBL producers; >>dogs (58 *E. coli*, 11 *Klebsiella pneumoniae*, 3 *Enterbacter cloacae*)
- Predominantly *bla*_{CTX-M15}, *bla*_{CTX-M1}
- > 20% belonged to major lineages of human pathogenic *K. pneumoniae* ST11, ST15, ST147 and *E. coli* ST131

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Working hypothesis

- Feeding



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Facts about „dog population“ and „pet food“

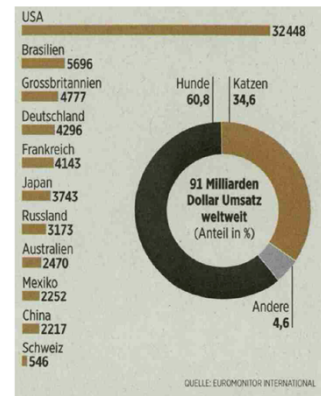
• Dog population

- In CH: >500'000
- In D: 9.4 Mio
- In UK: 9 Mio
- In P: 7.6 Mio
- In I: 7 Mio
- In F: 7 Mio
- In USA: 89.7 Mio

• Pet food

- A huge market
- Worldwide 91 billion\$/year

Die zehn wichtigsten globalen Märkte für Tierfutter und die Schweiz Umsätze 2018 (in Millionen Dollar)



Handelszeitung 25.4.2019

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Raw meat based diets (RMBD)

- „New“ trend
- Has become increasingly popular
- Health claims
- By-products of animals slaughtered for human consumption
- Vector for pathogens: e.g. *Salmonella*; *E. coli* O157



BARF: biologically appropriate raw food

CDC 2019; Public Health England (PHE) 2018

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Study set-up

- Cross-sectional study
- Sampling 09 – 10/2018
- 51 RMBD in pet shops in 6 cities
- Types of meat beef, chicken, horse, lamb, turkey, rabbit, salmon, deer, duck, moose, ostrich, pangasius, quail, reindeer
- 31 meat from Switzerland; 20 imported meat



BARF: biologically appropriate raw food

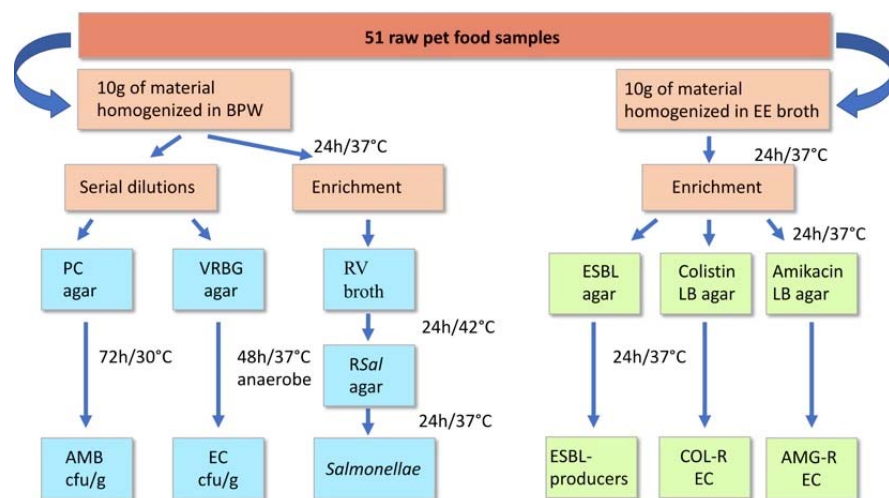
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Methods



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Results

- ESBL producers from 61% of the samples (from all suppliers)
- Meat from different animal species: beef, poultry, horse...
- Majority of the *bla*_{ESBL}: CTX-M1 and CTX-M15
- *E. coli*, *Klebsiella* spp., *Citrobacter* spp.



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Results

- Most *E. coli* CC155, CC10
- But also CC648 and ST69 major lineages of human pathogenic strains (CC648 extraintestinal); (ST69 uropathogenic)
- *K. pneumoniae* ST45, ST54, ST219
- 74% of isolates MDR



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Additional results

- *E. coli* harbouring the colistin resistance genes *mcr-1* (4% of the samples)
- *Citrobacter freundii* harbouring the 16S rRNA methylase *rmtB* gene (2% of the samples)
- *Salmonella* Typhimurium; *Salmonella* London

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BARF a risk factor for shedding of ESBL-E



RESEARCH ARTICLE

Raw pet food as a risk factor for shedding of extended-spectrum beta-lactamase-producing *Enterobacteriaceae* in household cats

Valérie O. Baede^{1*}, Els M. Broens¹, Mirilin P. Spaninks¹, Arjen J. Timmerman¹,
Haitse Gravetand¹, Jaap A. Wagenaar^{1,2}, Birgitta Duim¹, Joost Hordijk^{1*}

¹ Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands, ² Wageningen Bioveterinary Research, Lelystad, the Netherlands

* Current address: Department of Medical Microbiology and Infectious Diseases, Erasmus MC, University Medical Center, Rotterdam, the Netherlands
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A significant association was found between ESBL shedding and feeding raw pet food products (OR = 31.5). No other risk factors were identified in this study.

Baede et al. (2017) PLoS ONE 12(11): e0187239.

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BARF a risk factor for shedding of ESBL-E

J Antimicrob Chemother
doi:10.1093/jac/dkz462

Journal of
Antimicrobial
Chemotherapy

Faecal carriage, risk factors, acquisition and persistence of ESBL-producing Enterobacteriaceae in dogs and cats and co-carriage with humans belonging to the same household

G. van den Bunt^{1,2}, A. C. Fluit³, M. P. Spaninks⁴, A. J. Timmerman⁵, Y. Geurts⁵, A. Kant⁵, J. Scharringa³, D. Mevius^{6,7}, J. A. Wagenaar^{8,9}, M. J. M. Bonten^{10,11}, W. van Pelt¹² and J. Hordijk^{1*}

¹Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht (UMCU), Utrecht, The Netherlands; ²Centre for Infectious Disease Control, National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands; ³Department of Medical Microbiology, University Medical Center Utrecht (UMCU), Utrecht, The Netherlands; ⁴Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands; ⁵Department of Bacteriology and Epidemiology, Wageningen Bioveterinary Research, Lelystad, The Netherlands

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Online 15.11.2019

«Eating **raw meat** [OR: **8.8**, 95% CI: 4.7–16.4; population attributable risk (PAR): 46.5%, 95% CI: 41.3%–49.3%] and **dry food** (OR: **0.2**, 95% CI: 0.1–0.5; PAR: 56.5%, 95% CI: 33.2% – 66.6%) were predictors for ESBL-E carriage in dogs. Human–dog co-carriage was demonstrated in five households.»

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Paper impact



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Statistics from Altmetric



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Keywords

animal and public health

pet food


raw meat

antimicrobial resistance

pathogens


within 4 weeks after publication


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Impact of the topic





My Client Is Feeding Their Pet a Raw Meat Diet. Are There Any Concerns for the Family?

J. Scott Weese, DVM, DVSc, DACVIM
University of Guelph



RAW MEAT DIETS

For safety reasons, raw meat diets are not allowed in the Foster Hospital for Small Animals.

In addition to the nutritional imbalances of these diets, raw meat products are likely to carry bacteria (like any raw meat products we encounter at home or in restaurants). These diets pose a health risk, not only to the

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Impact of the topic

Evaluation of the Risks of Shedding *Salmonellae* and Other Potential Pathogens by Therapy Dogs Fed Raw Diets in Ontario and Alberta

S. L. Lefebvre, R. Reid-Smith, P. Boerlin, J. S. Weese

We recommend that dogs fed raw meat should be excluded from AAI programmes, particularly when the programmes involve interaction with humans at high risk of infection or adverse sequelae attributable to infection.

Q: Do other veterinary or public health groups have policies or statements about raw diets for pets?

A: Yes. The U.S. Food and Drug Administration Center for Veterinary Medicine (FDA-CVM) makes the following [statement](#) on its website:

FDA does not believe raw meat foods for animals are consistent with the goal of protecting the public from significant health risks, particularly when such products are brought into the home and/or used to feed domestic pets; however, we understand that some people prefer to feed these types of diets to their pets.

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Conclusions

- RMBDs represent an emerging route of exposure of pets and their owners to MDR Enterobacteriaceae
- Appropriate measures, such as activities that raise the awareness of the hazards and information of pet owners on the correct handling of RMBDs should be established



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Thank you!