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Effects of oral administered garlic on postweaning pig's health and performance

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70th Annual Meeting of EAAP
Ghent, Belgium
26. – 30. 8. 2019

gcb Graduate School for Cellular and Biomedical Sciences

Multi-factorial diseases call for a multi-target therapy

- Most important diseases of calves and piglets affect the
  - **gastrointestinal tract**
  - **respiratory tract**

- Provoked by several **pathogens** and suboptimal **management**

- **Various symptoms**

- Still often prevented and treated with **antibiotics**

→ **antimicrobial resistances**

→ need for **alternatives**

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Medicinal plants as a rediscovered option?

- Used worldwide for centuries
- **Fundament of the modern pharmacotherapy**
- **Multi-component compositions** of plant secondary metabolites
- Plant species-specific **multi-target effects**

e.g. *Matricaria recutita* L. **- chamomille**

- Contains **essential oils** (a-Bisabolol, b-Farnesen, Chamazulen), **flavonoids**, **cumarins, mucins**…

→ **Spasmolytic** (inhibition of PDE)
→ **Antibacterial** (destruction of bacterial membranes)
→ **Antiinflammatory** (COX-2 inhibition)

(McKay et al., *Phytother Res* 20 (7):519-30, 2006)

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Allium sativum L. (garlic) in piglets

- **Background: Post-weaning diarrhoea** common reason for antibiotics

- **Garlic**: used for treatment of cardiovascular, respiratory and **gastro-intestinal** diseases and as a spice
- **Antibacterial activity:** allyl-sulphides (alliin/allicin)
- *In vitro/in vivo*: **anti-inflammatory**, **immune stimulating**, **antidiarrheal** and **antiprotozoal** effects (Ayrle et al., 2016)
- Swine: **growth performance** ⇧ , fecal ***E. coli* counts** ⇩, **red/white blood cells** ⇧ (Yan et al., 2013, Dudek et al., 2006, Tatara et al., 2005, Grela et al., 2007)

→ Effect of dried garlic (not processed) on piglets reared under recent European on-farm conditions **still remains unknown**!

- Yan et al., *Journal of Animal Physiology and Animal Nutrition* 97 (3):457-464, 2013
- Dudek et al., *Bulletin of the Veterinary Institute in Pulawy* 50, 263-267, 2006
- Tatara et al., *Bulletin of the Veterinary Institute in Pulawy* 49 (3):349-355, 2005
- Grela et al., *Medycyna Weterynaryjna* 63 (3), 2007

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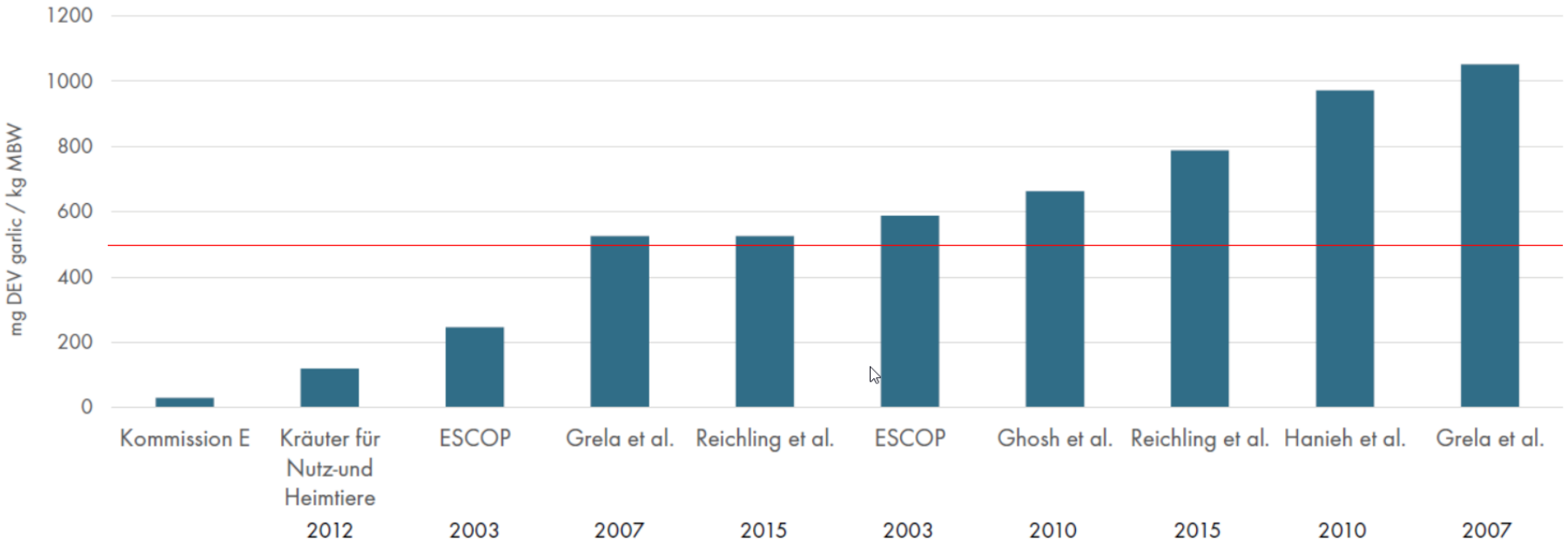
Dosage finding garlic – median: 500mg/kgMBW

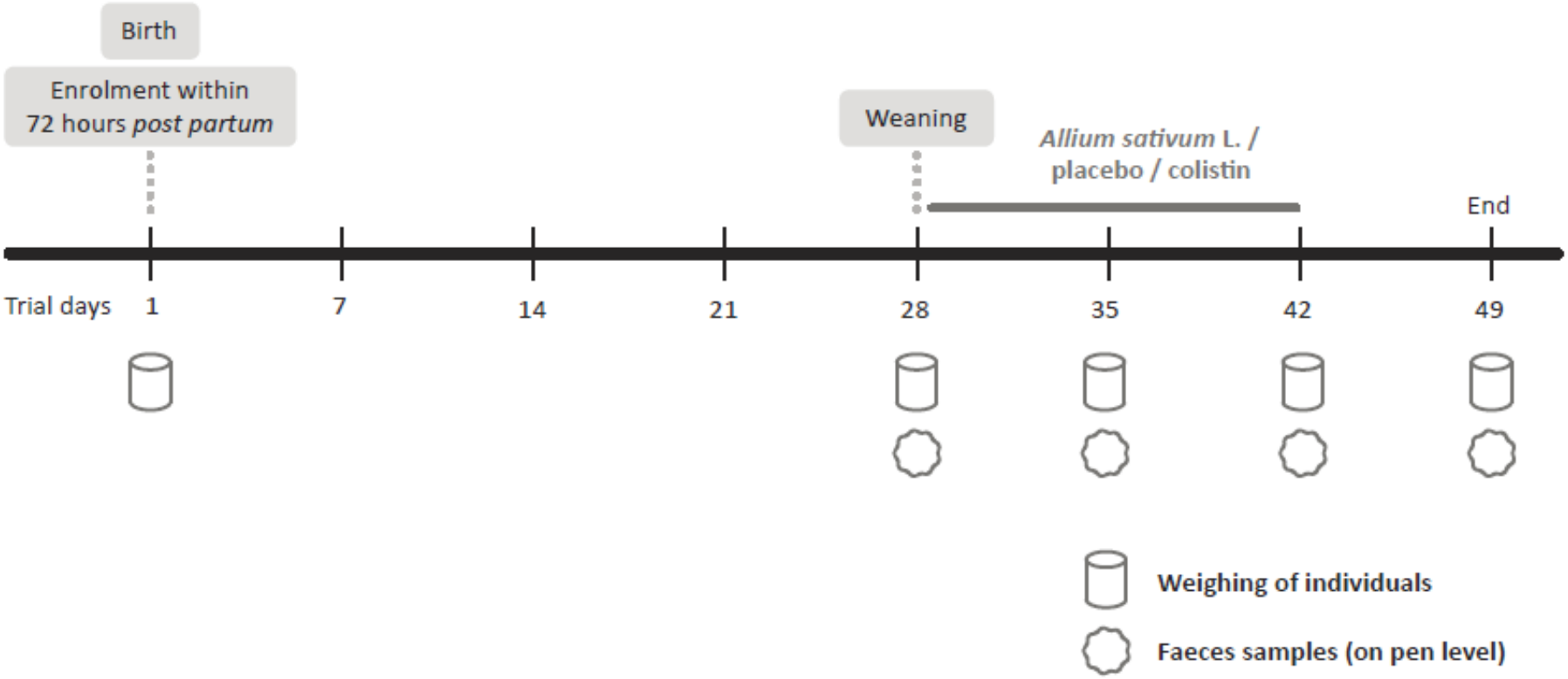
Graph 1: Daily dosages for garlic in screened references



Material and Methods

- Randomized, placebo-controlled field trial, not blinded

Placebo	Equivalent amount of lactose and dextrose	N=200	Ø 21 pigs/pen; 9 repetitions per treatment
Garlic	0.3 g dried powder/kg BW/day	N=200	
Colistin	6 mg/kg BW/day	N=200	



Results - group treatments, mortality, number of animals

Antibiotic group treatments due to severe diarrhoea:

- Placebo: **3** of **9** pens (33.3 %)
- Garlic: **3** of **9** pens (33.3 %)
- Colistin: **all** pens (100 %) due to the trial

Mortality:

- Placebo: 0.56 %
- Garlic: 1.1 %
- Colistin 3.5 %
- (aim: < 2%)

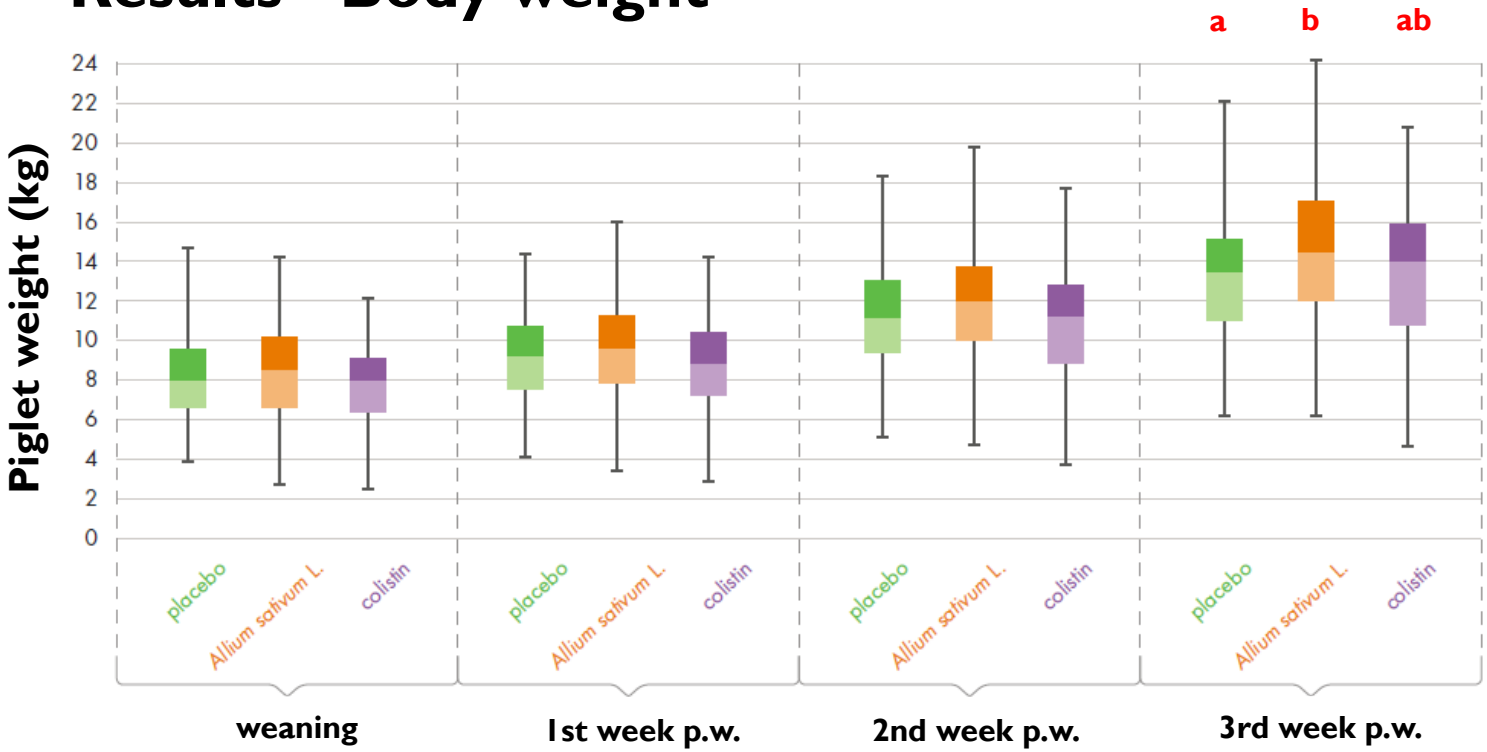
Additionally treated or deceased pigs: **excluded from statistics**

→ Placebo: 117 piglets

→ Garlic: 105 piglets

→ Colistin: 156 piglets for **final analysis**

Results - Body weight



→ Significantly higher body weight (+**1 kg**; 7.5%) in **3. week p.w.** in **garlic** group (14.1 kg) compared to placebo (13.1 kg)

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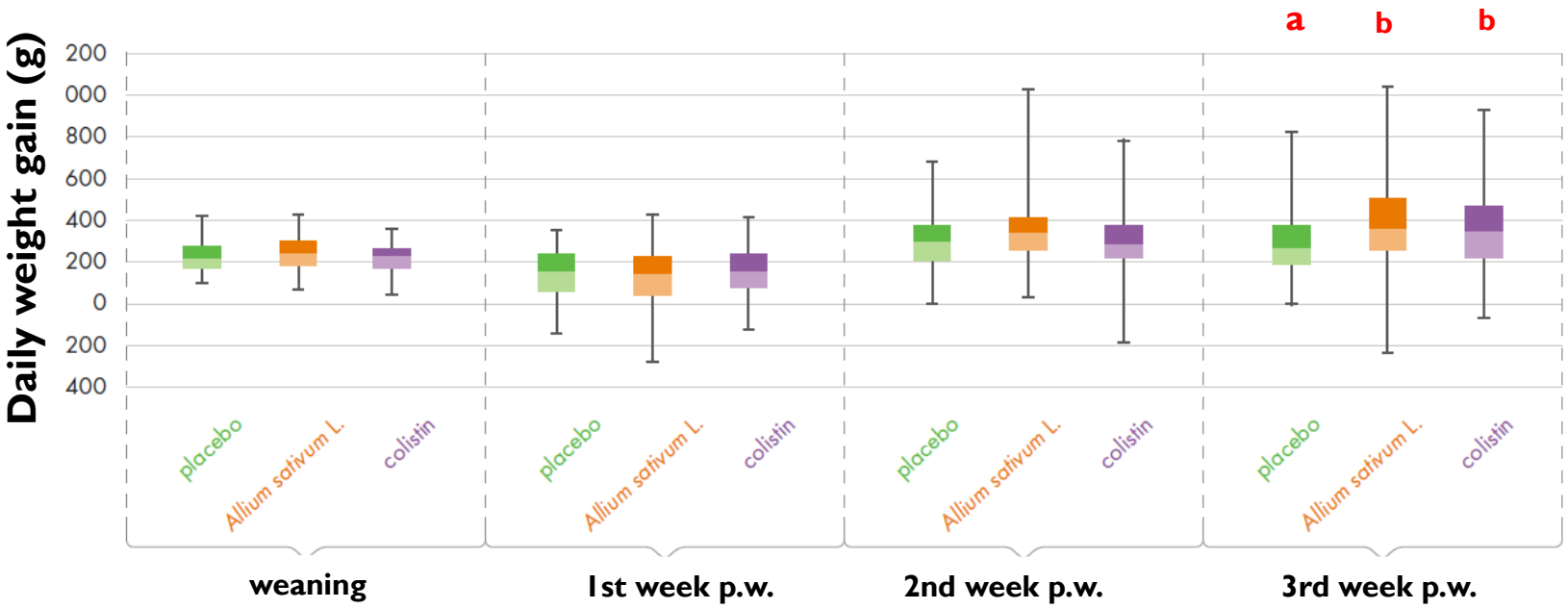
Results - Daily weight gain (DWG)



→ Significantly increased gains (**+61g/day**; 21%) in **3. week p.w.** in garlic and colistin groups (both 340 g/day) compared to placebo (280 g/day)

- In accordance with **previous studies** (+64-78 g/day)
- Due to antibacterial and growth-promoting effects of garlic?

Results - Clinical score

Mean* ± SE	1st week p.w.	2nd week p.w.	3rd week p.w.
Placebo	0.34 (±0.04)^{ab}	0.22 (±0.04)^{ab}	0.24 (±0.04)^{ab}
Garlic	0.29 (±0.04)^{a}	0.17 (±0.04)^{a}	0.20 (±0.04)^{a}
Colistin	0.42 (±0.04)^{b}	0.30 (±0.04)^{b}	0.32 (±0.04)^{b}
$p < 0.05$; *method: least-squares means; y = treatment+week+run+(pen/pig)			

clinical score: 0=healthy, 5=highly disordered condition
weekly determined on individual animal basis

→ **Significantly lower** in **garlic pigs** compared to colistin pigs

- Indication for general **better health** due to garlic?
- Deceased and treated piglets were excluded
- Severe PWD could not be reduced

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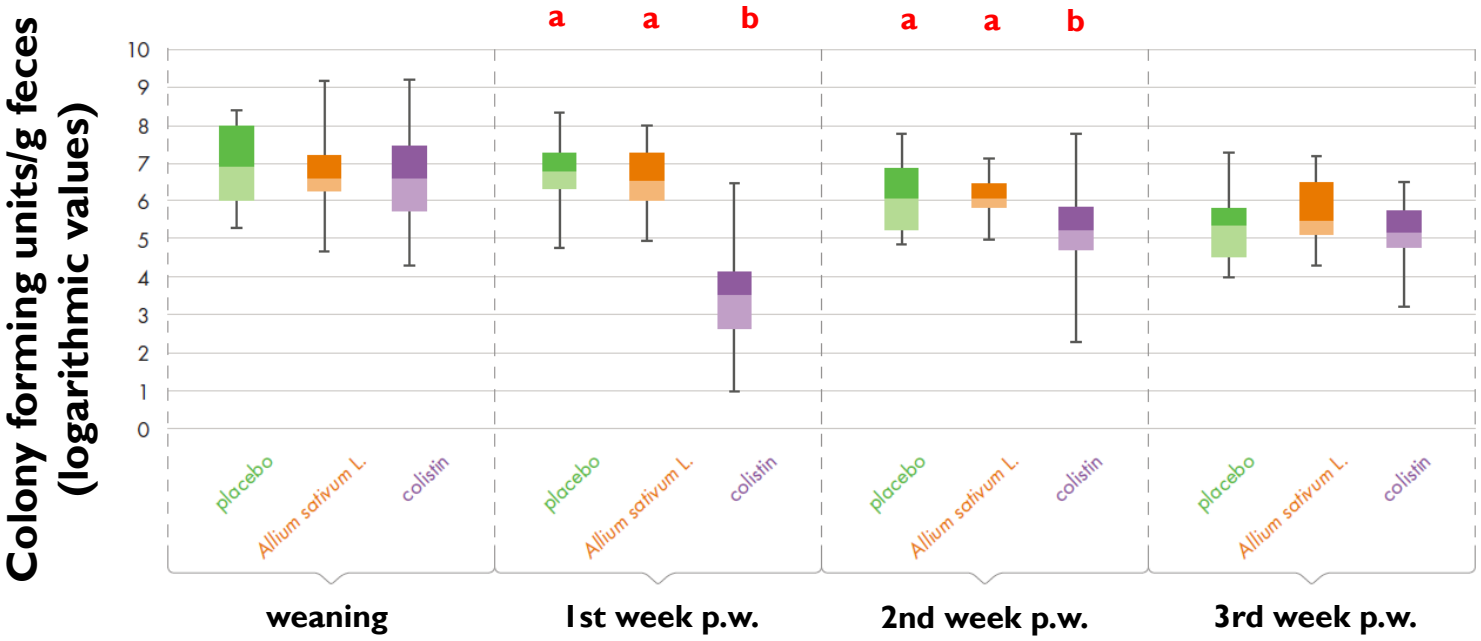
Results - Number coliform bacteria



→ **No antibacterial effect** of garlic measurable

- Dosage **too low**?
- Active substances alliin and allicin might have lost their effectivity due to their **volatile character**
- Studies proving antibacterial effects used **fermented/aged** garlic

Results – Feces dry matter

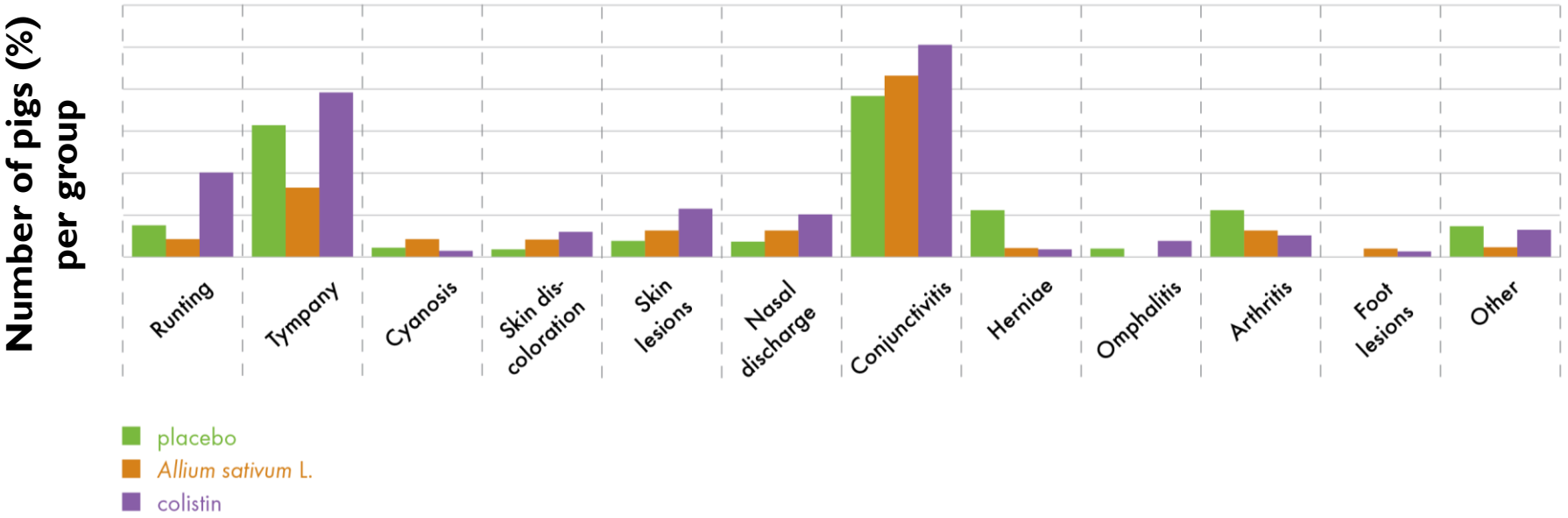
Objective parameter for intensity of diarrhoea (10 samples/pen) – the higher the better

Mean* ± SE	1st week p.w.	2nd week p.w.	3rd week p.w.
Placebo	19 % (±0.007)	17 % (±0.007)	20 % (±0.007)
Garlic	19 % (±0.007)	17 % (±0.007)	20 % (±0.007)
Colistin	20 % (±0.006)	18 % (±0.007)	20 % (±0.006)
$p < 0.05$; *method: least-squares means; y = treatment+week+run+pig			

- **No** significant **differences** between groups

→ Neither garlic nor colistin led to higher fecal dry matter

Results – symptoms of pig diseases



→ **Lower** incidences of **runting** and **tympany** in garlic pigs compared to others

- **Bias: Exclusion** of treated and deceased pigs

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Conclusions – Garlic in piglets

- Indication that garlic in piglets **improves growth performance** but does **not reduce severe post-weaning diarrhoea**

- **Results** of this trial are **biased** by the exclusion of data from additionally treated and deceased pigs

- Garlic might be fed for **prophylaxis**, but not for treatment of PWD

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Many thanks to

University of Bern:
Meike Mevissen (Supervisor; Division Veterinary Pharmacology & Toxicology)
Heiko Nathues (Swine Clinic)
Rupert Bruckmaier (Veterinary Physiology)
Olga Wellnitz (Veterinary Physiology)
Andrea Vögtlin (Institute of Virology and Immunology)
Raffael Fricker (Institute of Virology and Immunology)
Isabel Hauri + Manuela Durrer (Master students)

University of Zurich:
Martin Kaske (Kälber-Gesundheitsdienst, Department Of Farm Animals)

Research Institute of Organic Agriculture (FiBL):
Michael Walkenhorst (Co-supervisor; Department of Livestock Sciences)
Anna Bieber (Department of Livestock Sciences)
Nele Quander (Department of Livestock Sciences)

Willy Hofstetter (Mentor; Department for BioMedical Research, Uni Bern)
Matthias Hamburger (Co-referee; Department of Pharmaceutical Sciences, Uni Basel)

Funded by MIGROS

Migros Genossenschaftsbund, Zürich