Effect of humic substances on health, growth performance and meat quality of pigs

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Hustopeče 6.3. 2015

The group of Animal Nutrition

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Expertise

- impact of **different types of feed additives** on animal health and performance
- prevention and treatment of **diarrhoea in weaned piglets** caused by enterotoxigenic *Escherichia coli*

Services and consulting services

- **serum biochemical profiles** (Mindray BS200 biochemical analyser)
- determination of essential **nutrients in feed** (AOAC method)
- **experiments using experimental animals** and collection of samples (blood, organs, tissue, feces)

Effects of humic substances on growth performance of animals

- stabilization of gut **microflora** and **pH**
- **protective film** in the intestine
- **slower passage** of gut contents - prolonged digestion - enhanced **pancreatic enzymatic activity**
- ↑ **digestion** and **utilization** of nutrients
- ↑ **feed conversion**
- ↑ **resistence against (heat) stress**

↑ **anabolic processes and carcass weight**

Experiment

32 piglets

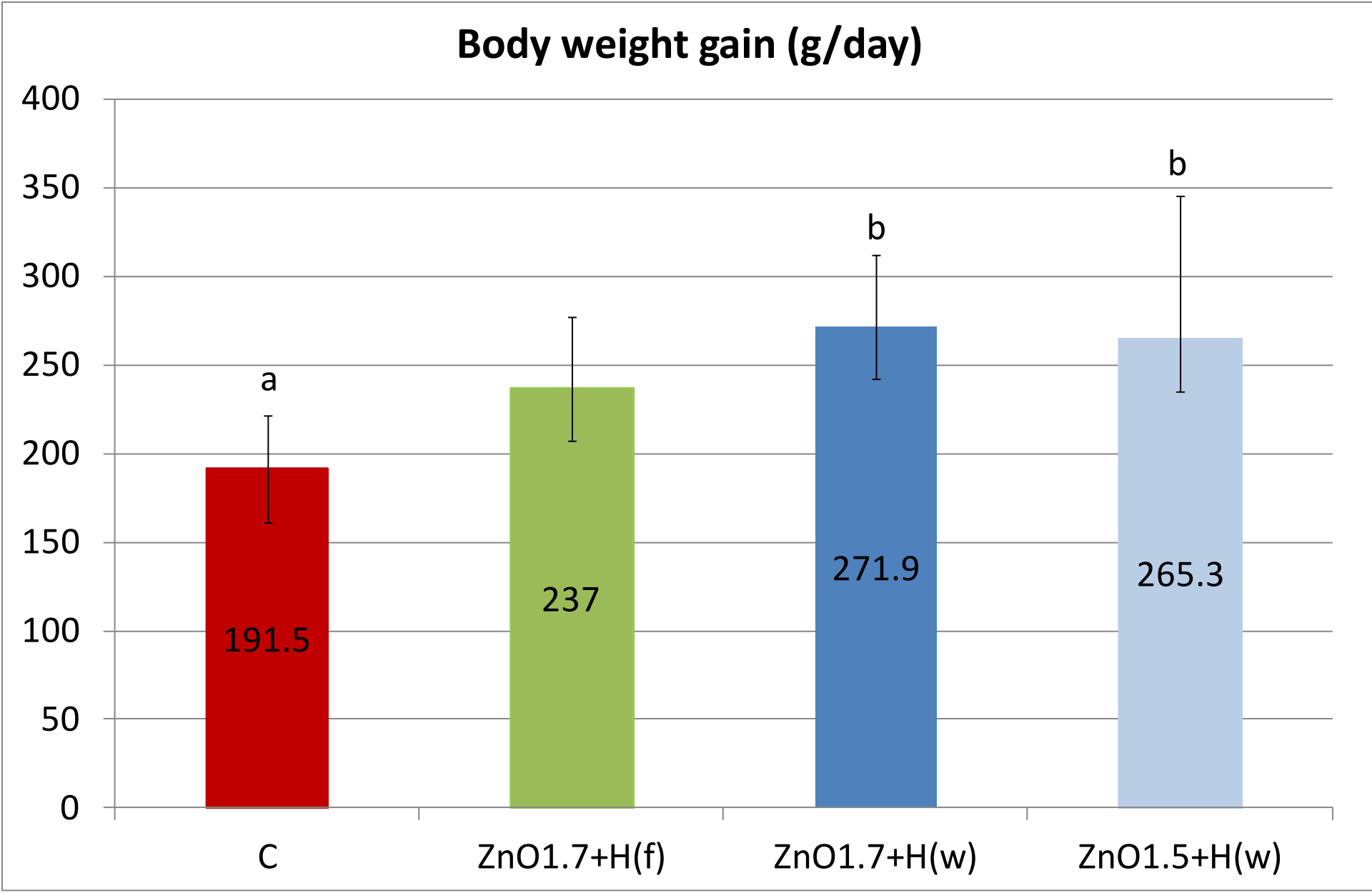
3 weeks post weaning

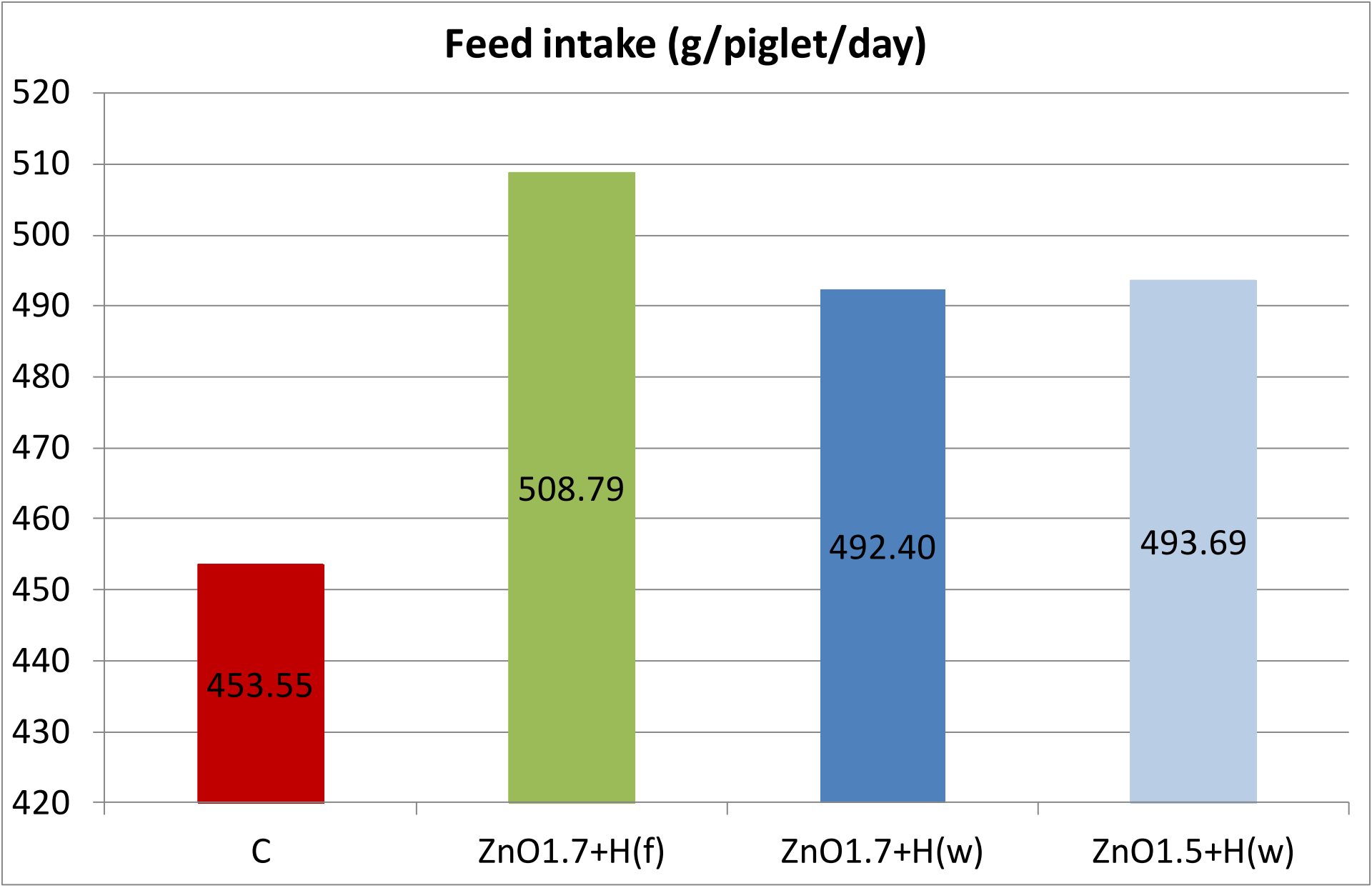
CONTROL - basal diet

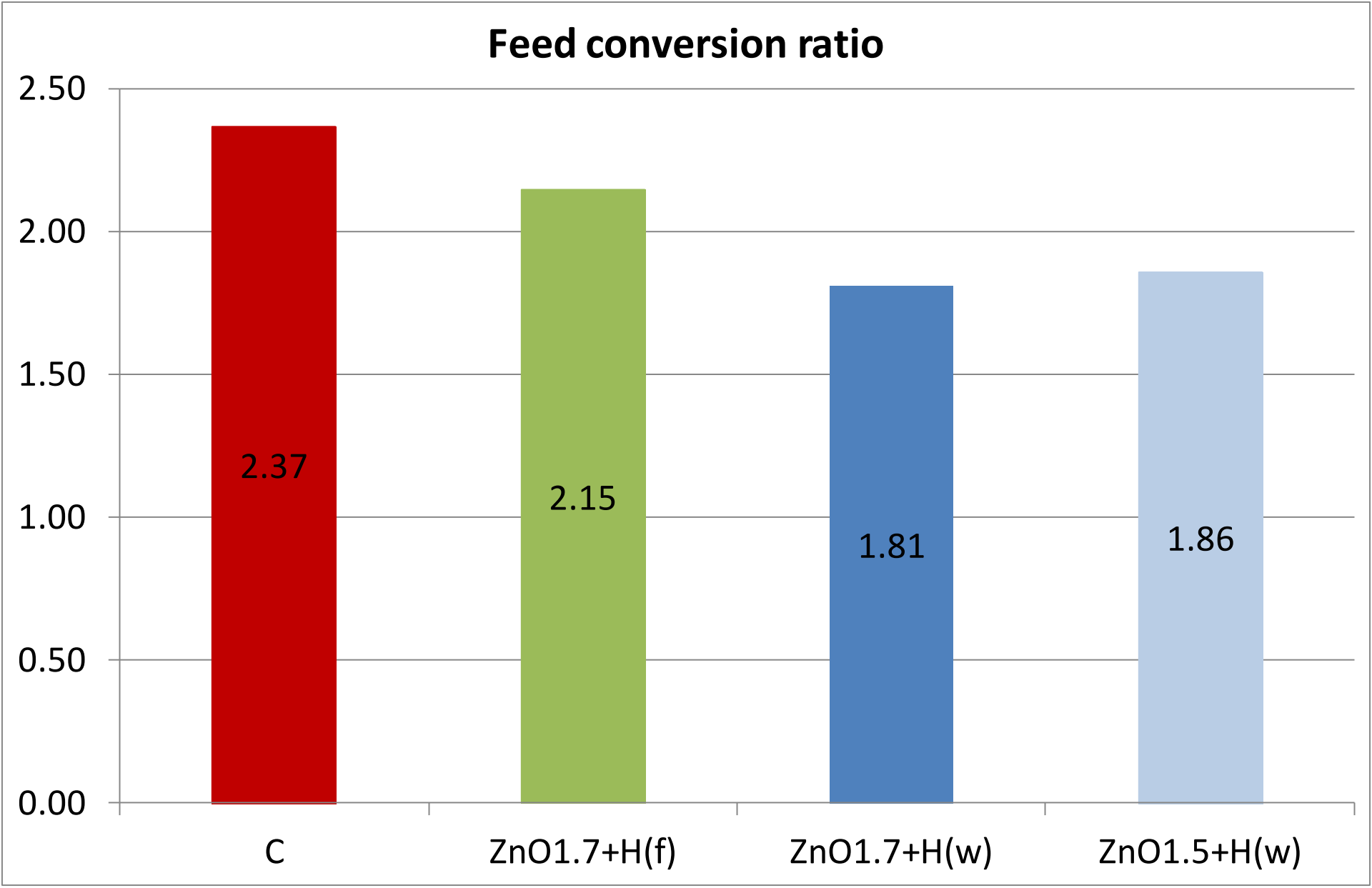
ZnO1.7+H(f) - **ZnO** (1.7 g/kg) and **H-Na** (20.0 g/kg) **to feed**

ZnO1.7+H(w) - **ZnO** (1.7 g/kg) **to feed** and **H-Na** (0.2%) **to drinking water**

ZnO1.5+H(w) - **ZnO** (1.5 g/kg) **to feed** and **H-Na** (0.2%) **to drinking water**


Body weight gain (g/day)
400
350
300
250
200
150
100
50
0
a
b
b
191.5
237
271.9
265.3
C
ZnO1.7+H(f)
ZnO1.7+H(w)
ZnO1.5+H(w)


Feed intake (g/piglet/day)
520
510
500
490
480
470
460
450
440
430
420
453.55
508.79
492.40
493.69
C
ZnO1.7+H(f)
ZnO1.7+H(w)
ZnO1.5+H(w)


Feed conversion ratio
2.50
2.00
1.50
1.00
0.50
0.00
2.37
2.15
1.81
1.86
C
ZnO1.7+H(f)
ZnO1.7+H(w)
ZnO1.5+H(w)

Effects of humic substances on meat quality

- **redistribution of proteins and lipids**

✓ higher **fat** content of meat (broiler)

✓ reduced backfat thickness (pig)

✓ increased **marbling score** (pig)

✓ changes in **fatty acid profile** of meat and egg yolk

- ↓x↑ **lipid peroxidation** **??**
- ↓ **pH of meat** (broiler, pig)
- ↓ **bacteria of meat spoilage**

} during storrage

Effects of humic substances on meat quality

- **color of meat**

⬆ **lighteness** (L*) and **redness** (a* value) ⬅ Fe, Cu, enhanced myoglobin synthesis

⬇ b* value (yellowness)

- ⬆ **Fe, Ca** content of meat
- ⬇ **cholesterol** (LDL) and triacylglycerols in serum
- tendency to a **better meat flavour and tenderness**
- influence of **water holding capacity**

The weaning period in piglet´s life

- social, dietary, environmental changes
- anorexia, digestive dysfunction
- impaired immune response

+

- ⬆ **oxidative stress**

reactive oxygen species, lipid peroxidation ➡ cellular damage, dysfunction, lipid degradation

oxidative injuries in the small intestine

Effects of humic substances supplementation on oxidative stress

ANTIOXIDANT ACTIVITY (phenolics)

- negating the effects of oxidative stress
- lowering of lipid peroxidation
- mild chemical stress – training of antioxidant enzyme system

⬇**malonaldehyde**/kg meat during storage

⬇ratio of oxydized:reduced glutathione (**GSSG:GSH**)

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Effects of humic substances supplementation on oxidative stress

INDUCTION OF OXIDATIVE STRESS

administered for long time at high levels

- accumulation of intracellular **Fe**
- generation of **reactive oxygen species** (ROS)
- antioxidative **enzyme inhibitors**
- induction of **lipid peroxidation**

Toxic effect of humic acids in human

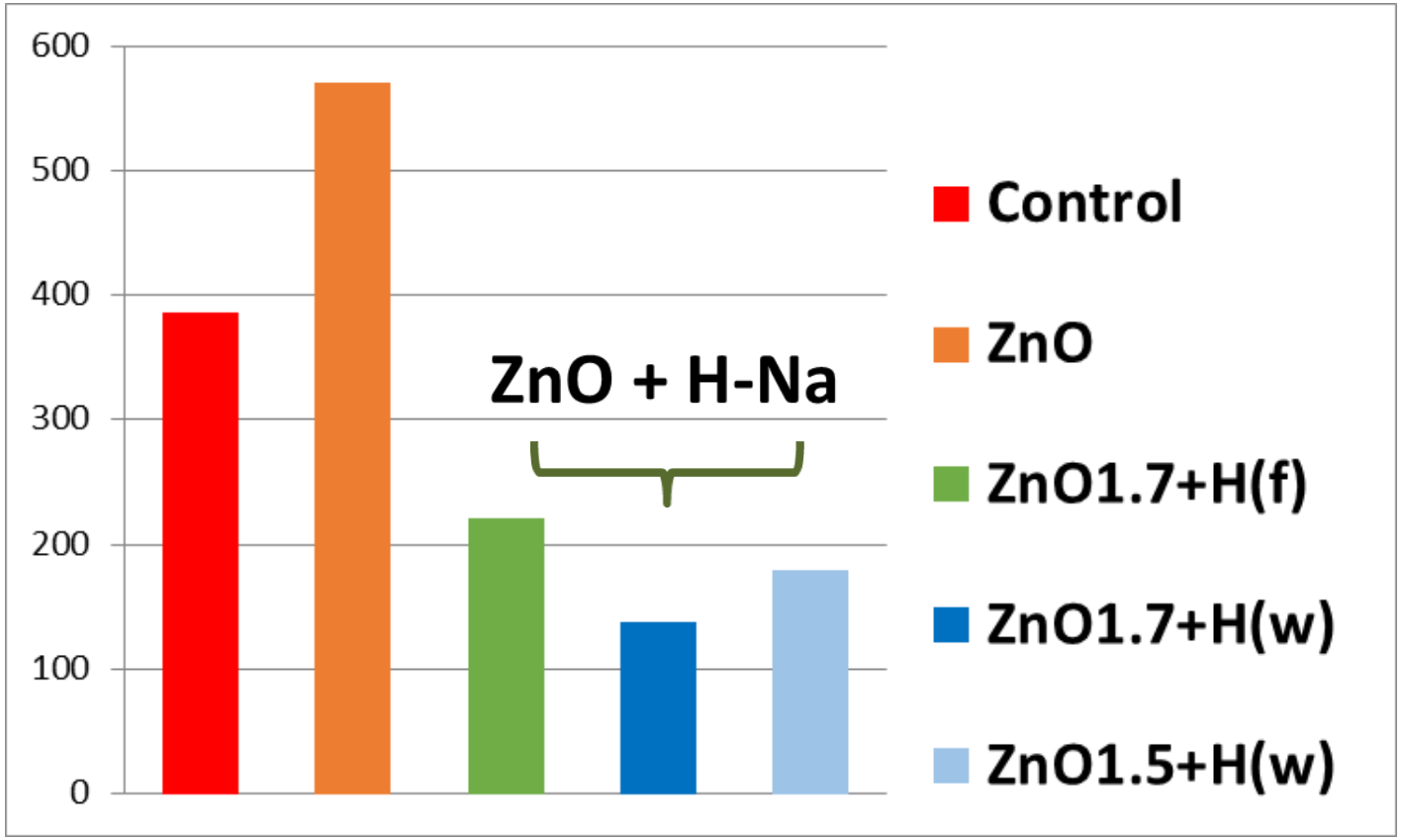
INDUCTION OF OXIDATIVE STRESS BY HA ??

damage of cells and tissues, chromosome abnormalities (daily intake of 400 mg HA)

Possible role in pathogenesis of

- Blackfoot disease – atherothrombotic disease
- Kashin-Back disease – chronic osteoarthritis
- goiter, cancer
- lung emphysema and fibrosis in smokers and coal workers

Concentrations of isoprostanes - markers of oxidative stress in the blood serum of piglets with different diet supplementation



Conclusion

1.7 mg/kg ZnO + **H-Na** in drinking water

⬇

beneficial effect on **HEALTH, GROWTH PERFORMANCE and decrease of OXIDATIVE STRESS** in piglets post weaning

This work was supported by grant QJ1210112 and project LO1218 under the NPU I program.

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