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Influence of zinc source and level on performance and tissue mineral content in fattening pigs.

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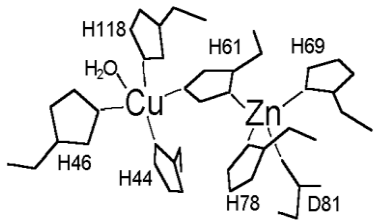
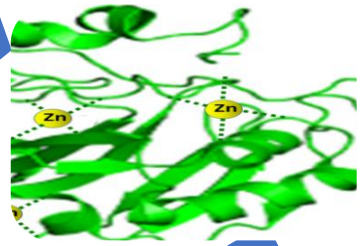
SNiBA Servei de Nutrició i Benestar Animal

UAB

Introduction: Zinc as essential nutrient

Cofactor of SOD enzyme



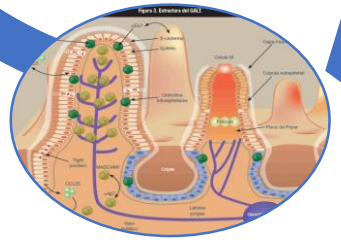


Enzymatic reactions

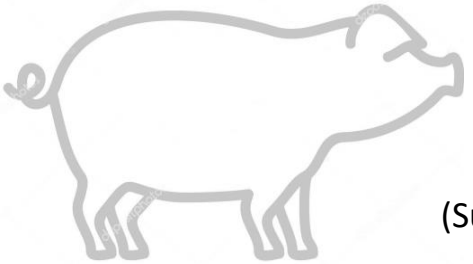
Zn

Collagen and keratin formation

Cellular differentiation



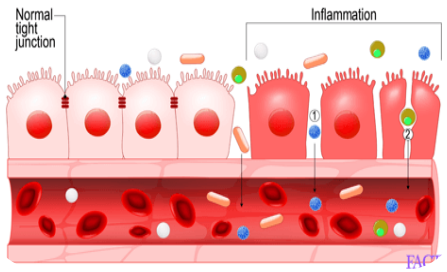
Intestinal barrier

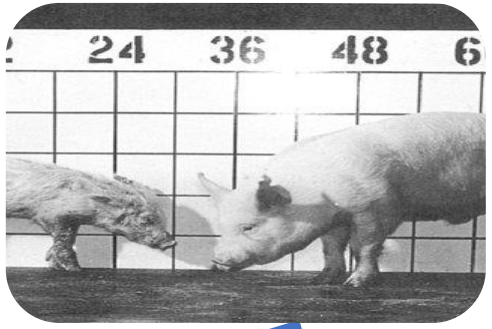


(Suttle, 2010)

Zinc in deficient situations

Intestinal disturbances



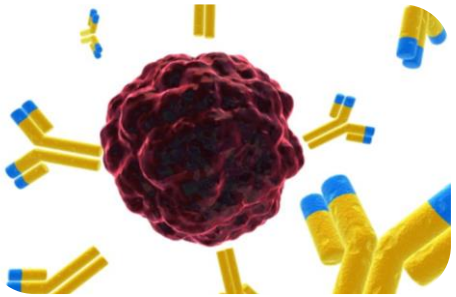


Decreased growth

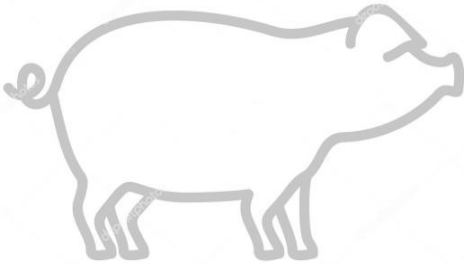
(Photo: Conrad & Beeson, Purdue University)

Zn

Parakeratosis



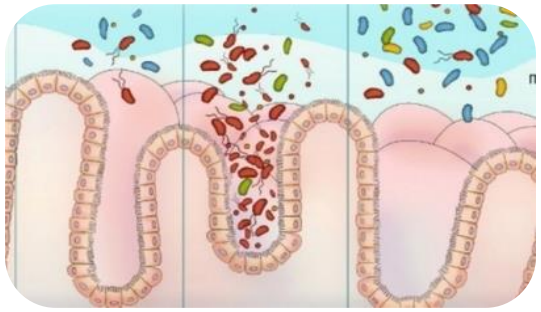
Decreased immune function



ZnO pharmacological levels: piglets PW

Growth performance
(Namkung et al., 2006)

>2500 ppm



Intestinal morphology and function
(Zhu et al., 2017)

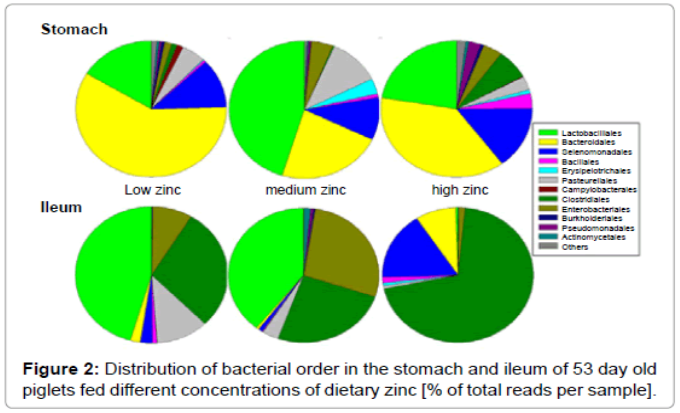


Figure 2: Distribution of bacterial order in the stomach and ileum of 53 day old piglets fed different concentrations of dietary zinc [% of total reads per sample].

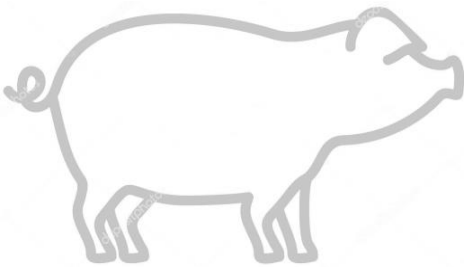
Gut microbiota modulation
(Starke et al., 2014)

Zinc G-F pigs: requirement vs recommendations

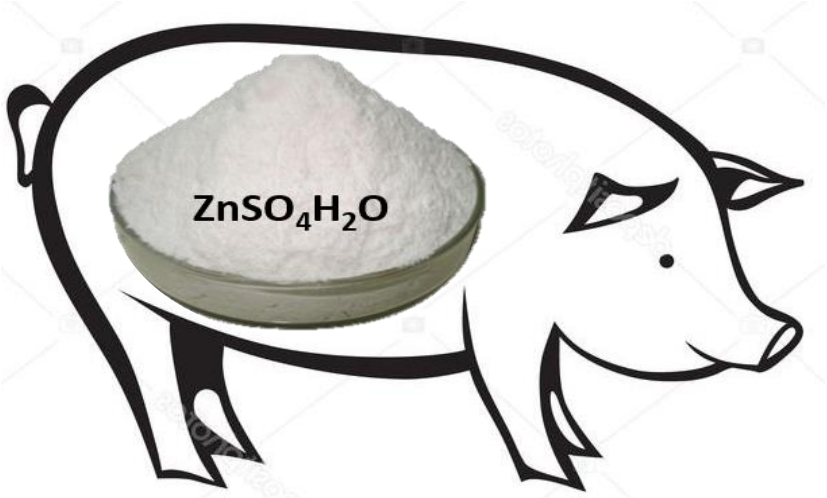
NRC (2012)	→	50-60 ppm
Industry	→	150 ppm
Regulation (EU) 2016/1095	→	120 ppm Complete feed

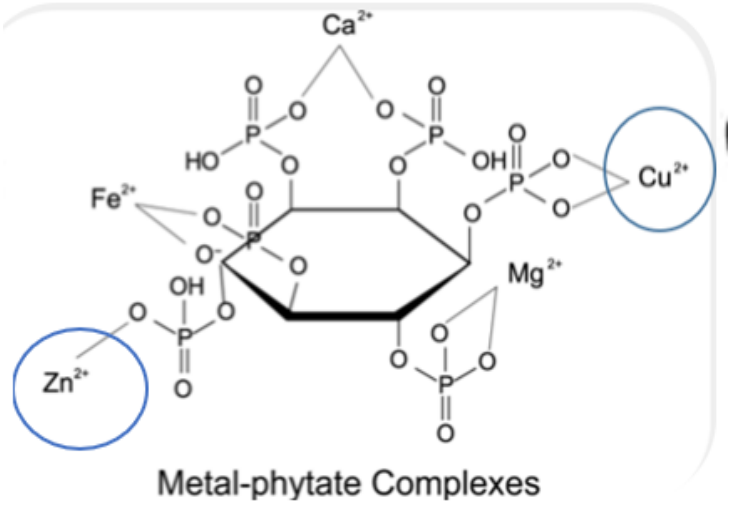
(Pang and Applegate, 2006)

(Van Noten et al., 2016; EFSA FEEDAP Panel, 2016)

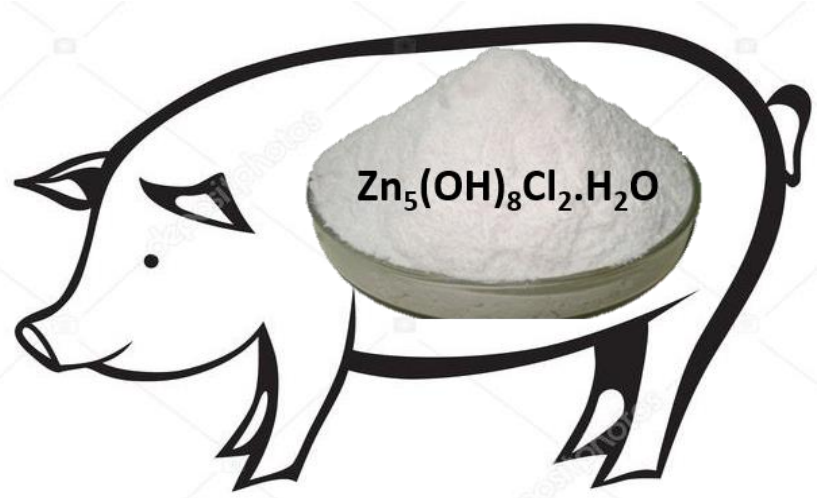


Zn Sulfate vs Zn Hydroxychloride





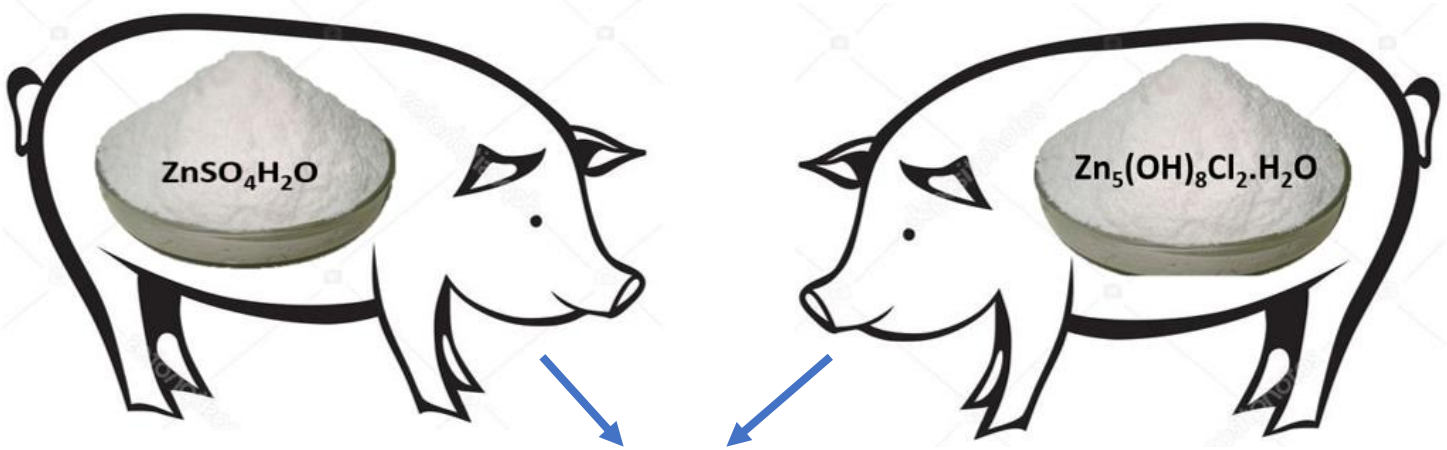
Metal-phytate Complexes



- 35% Zn
- Ionic bond.
- High solubility in water and acid solutions(Park & Kim, 2016)

- 55% Zn
- Covalent bonds, slow solubility in GIT (Cohen & Steward, 2014).
- Insoluble water (non hygroscopic), completely soluble in 0.4% HCl (Cao et al., 2000)

Hypothesis - Objective



Nutritional ← 80 ppm

Low ← 20 ppm

Added to feed

Hypothesis:

The productive performance of G-F pigs fed hydroxychloride will be superior or similar to those fed sulfate, even at doses lower than those recommended by NRC (2012).

Objective:

Evaluate the effects of two reduced levels of Zn through two sources on growth performance, organ mineral concentration, ATTD and carcass characteristics on G-F pigs.

Materials and Methods: Experimental design

444 Total

36 pens

9 replicates per treatment

Zn Source

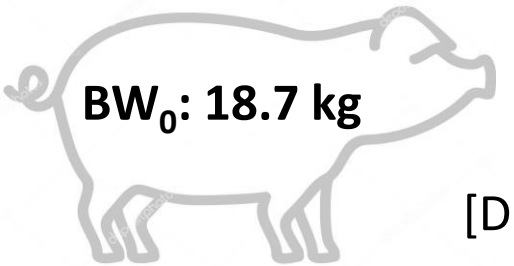
Sulfate

Hydroxychloride

Zn Level

20 ppm

80 ppm



BW_0: 18.7 kg

[Duroc x Landrace] x Pietrain

Reared in previous dirty pens

Materials and Methods

Ingredients, %	Pre-grower	Grower	Finisher
Corn	30.00	32.00	32.00
Barley	21.33	13.68	14.65
Wheat	15.01	32.00	32.00
Soybean meal 47.5%	13.37	12.64	11.99
Others	15.82	5.34	5.16
Lard	1.64	1.77	1.69
Mono Ca phosph.	0.86	0.24	0.21
Calcium carbonate	0.66	0.97	0.91
L-Lysine	0.45	0.50	0.46
DL-Methionine	0.11	0.07	0.04
Salt	0.35	0.40	0.49
Vit-Min premix	0.40	0.40	0.40

Phytase: 500 FTU

Calculated composition

Nutrients, %	Pre-grower	Grower	Finisher
EN, kcal/kg	2375	2400	2400
CP	16.0	15.8	15.5
EE	4.7	4.0	3.9
Ca	0.60	0.65	0.62
P total	0.56	0.42	0.42
P dig	0.35	0.26	0.26

Analyzed feed Zn

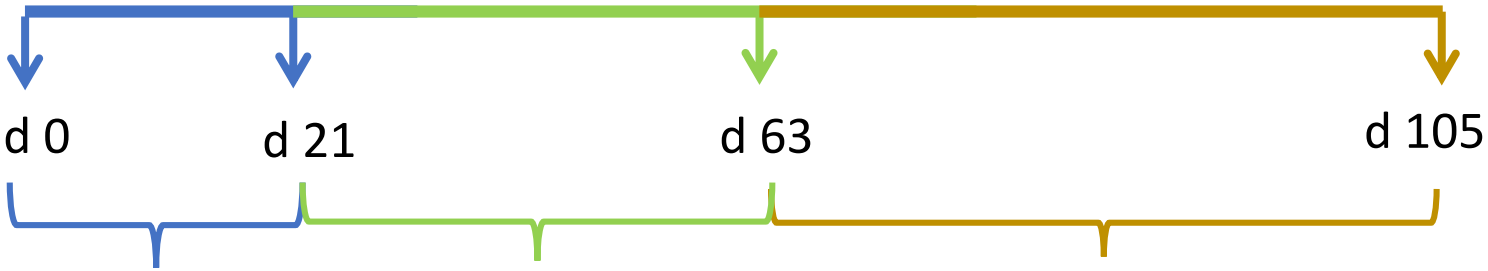
Diets	Pre-grower	Grower	Finisher
Zn, ppm			
Sulf-Low	54.1	73.4	60.7
Sulf-Nut	116.6	117.6	115.2
Hcl-Low	50.7	90.0	62.0
Hcl-Nut	109.6	130.0	97.6

Materials and Methods



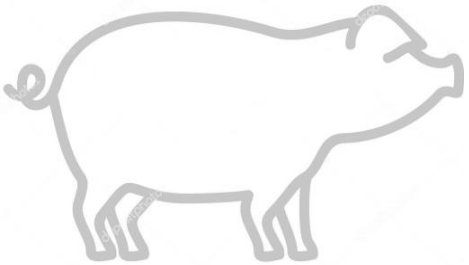




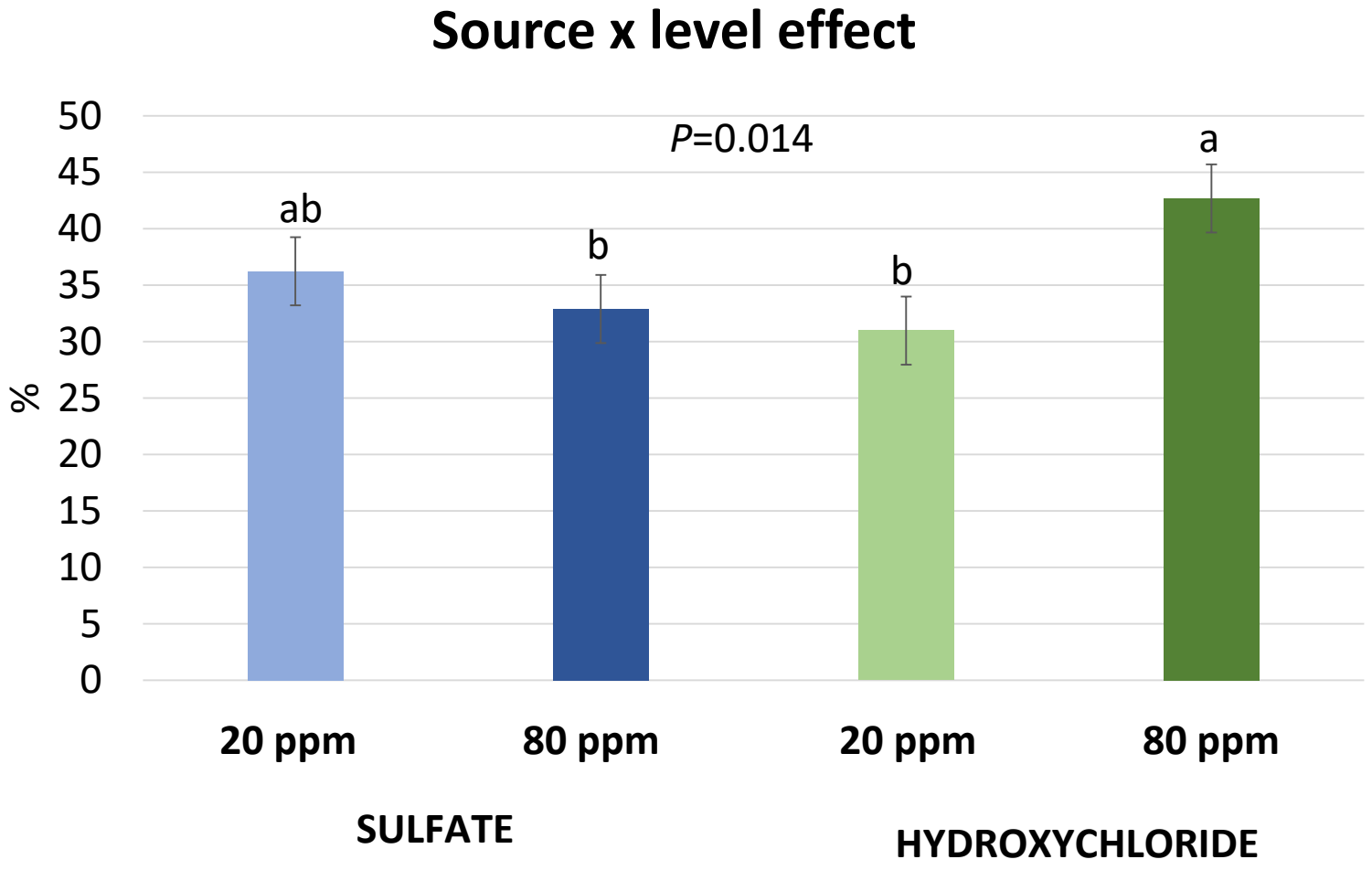


GLM

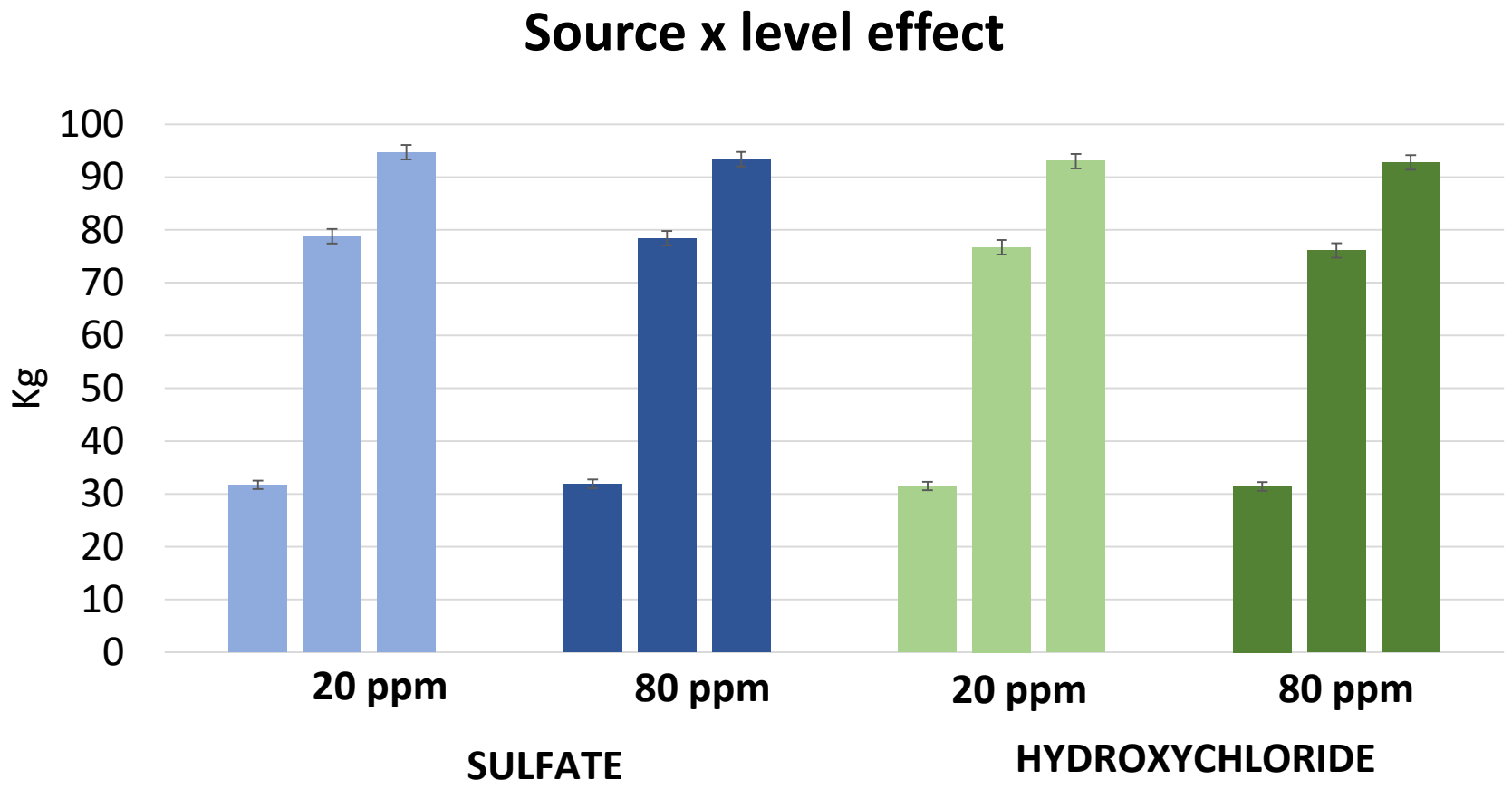
TUKEY TEST



Results: Apparent total tract digestibility



Live body weight

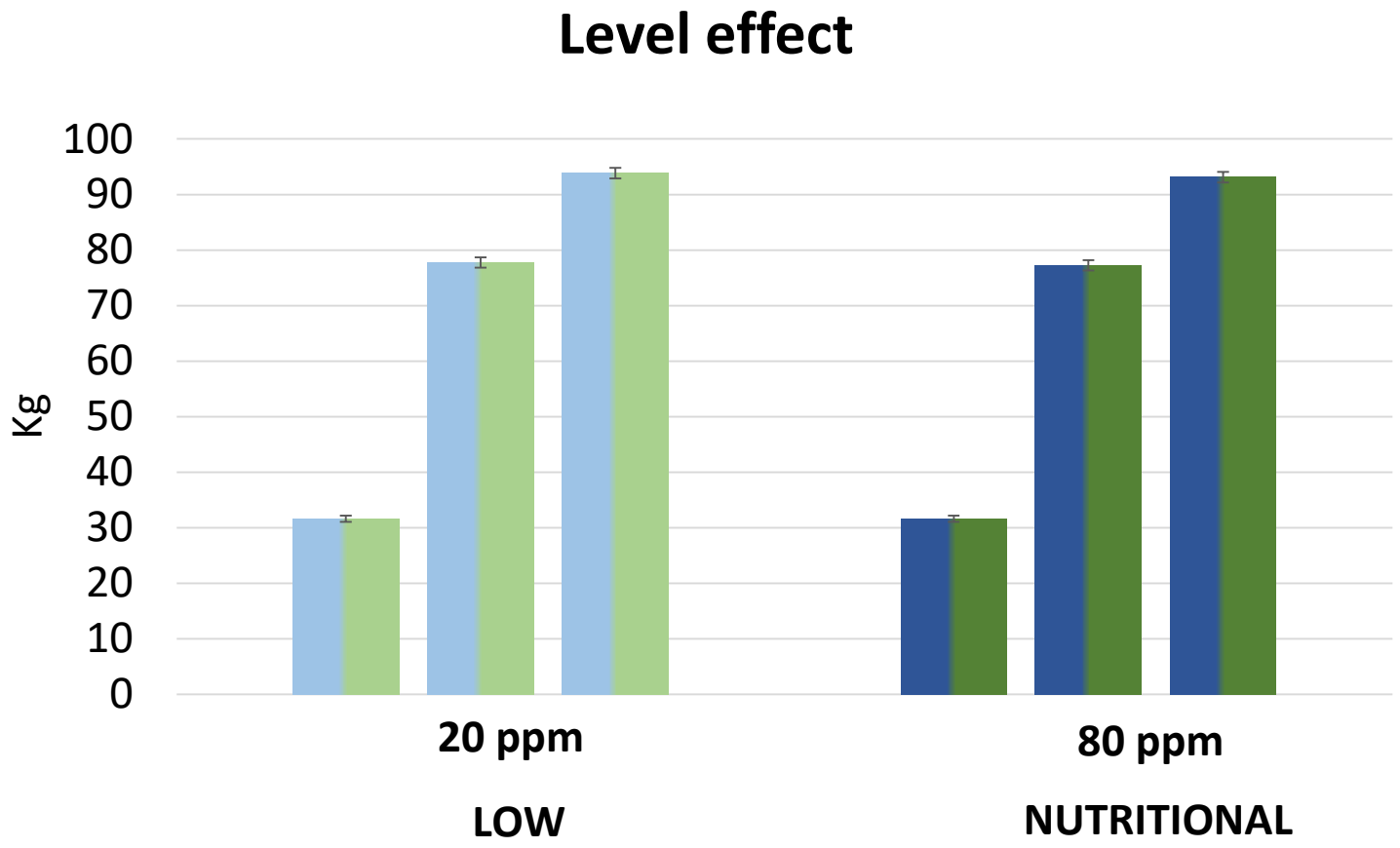


¤ Pre-grower *P*=0.840

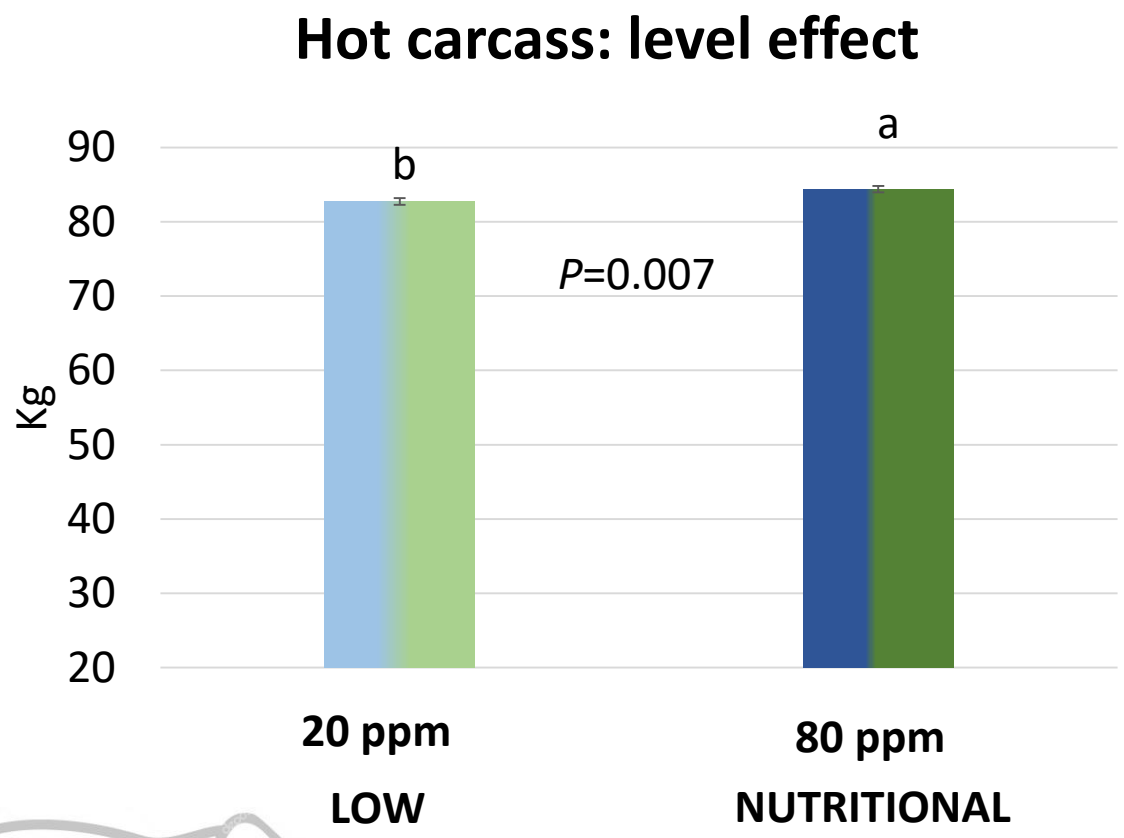
¥ Grower *P*=0.925

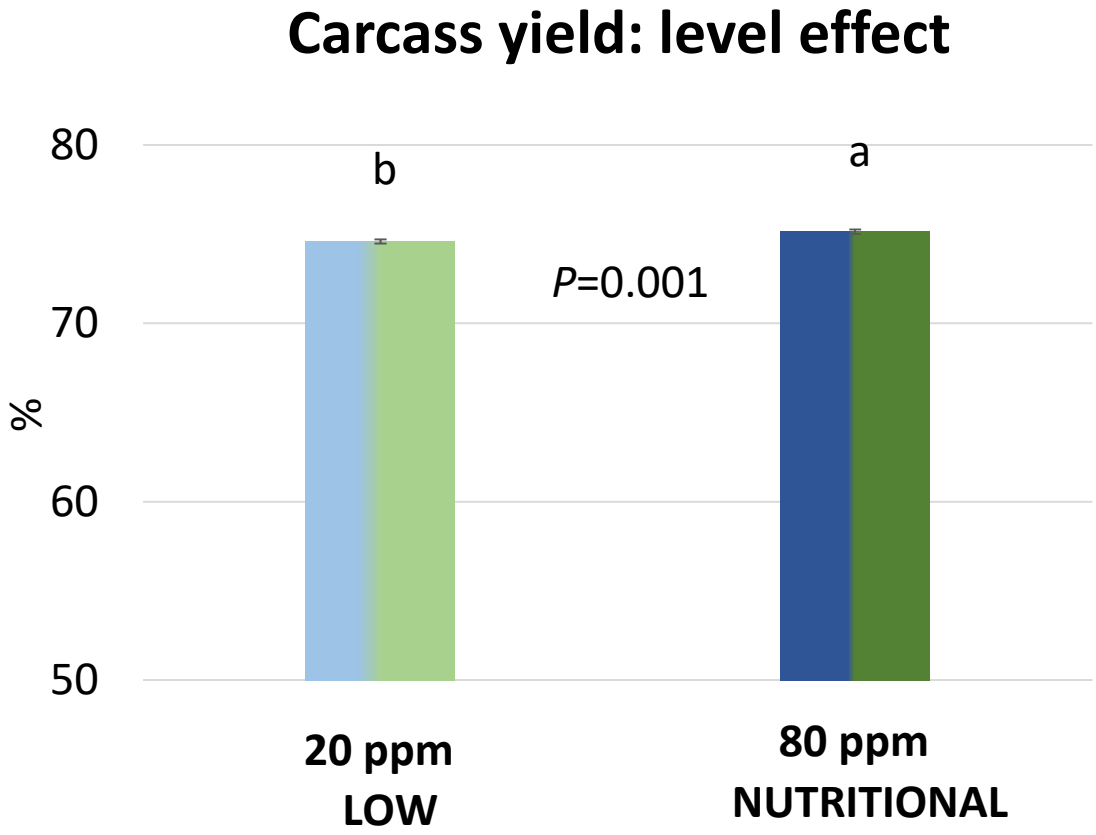
§ Finisher *P*=0.699

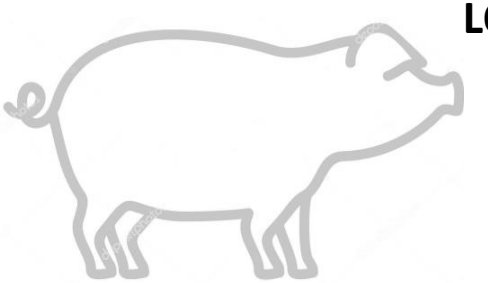
Live body weight



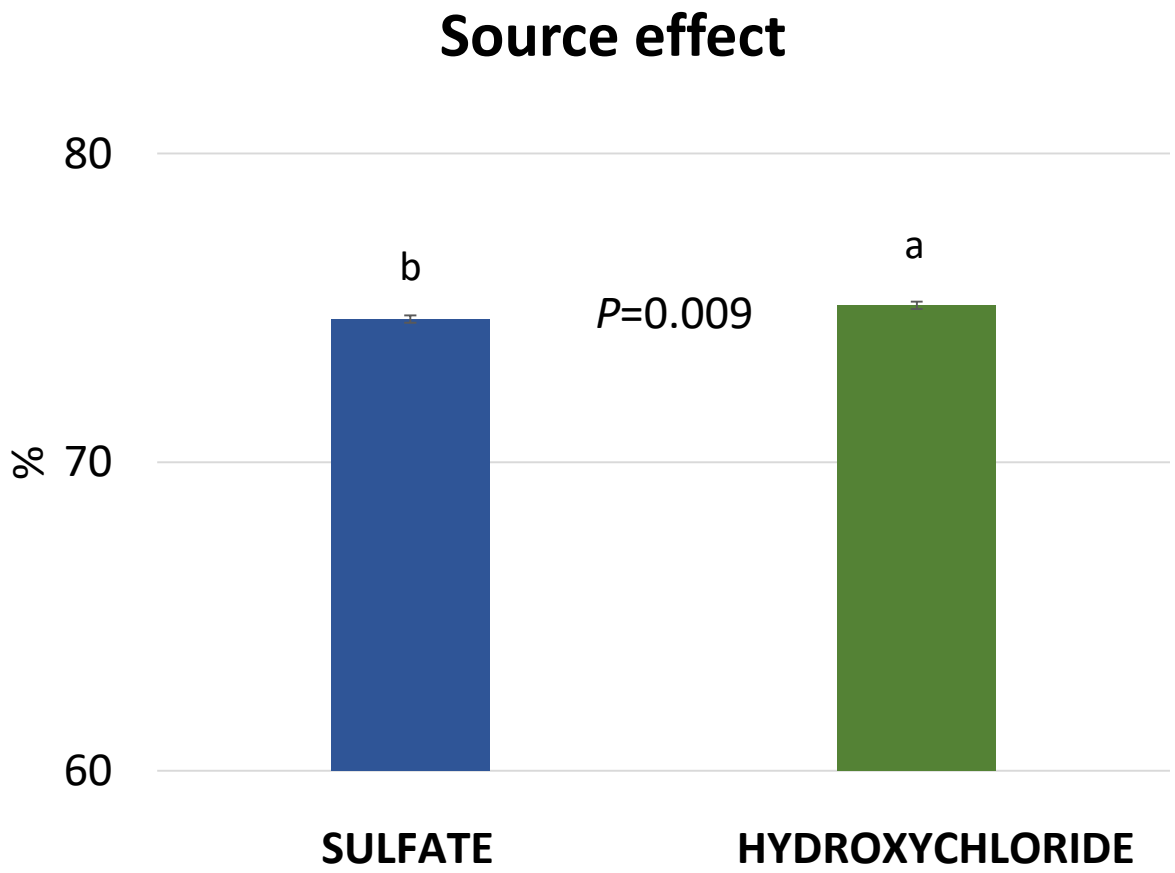
Carcass characteristics



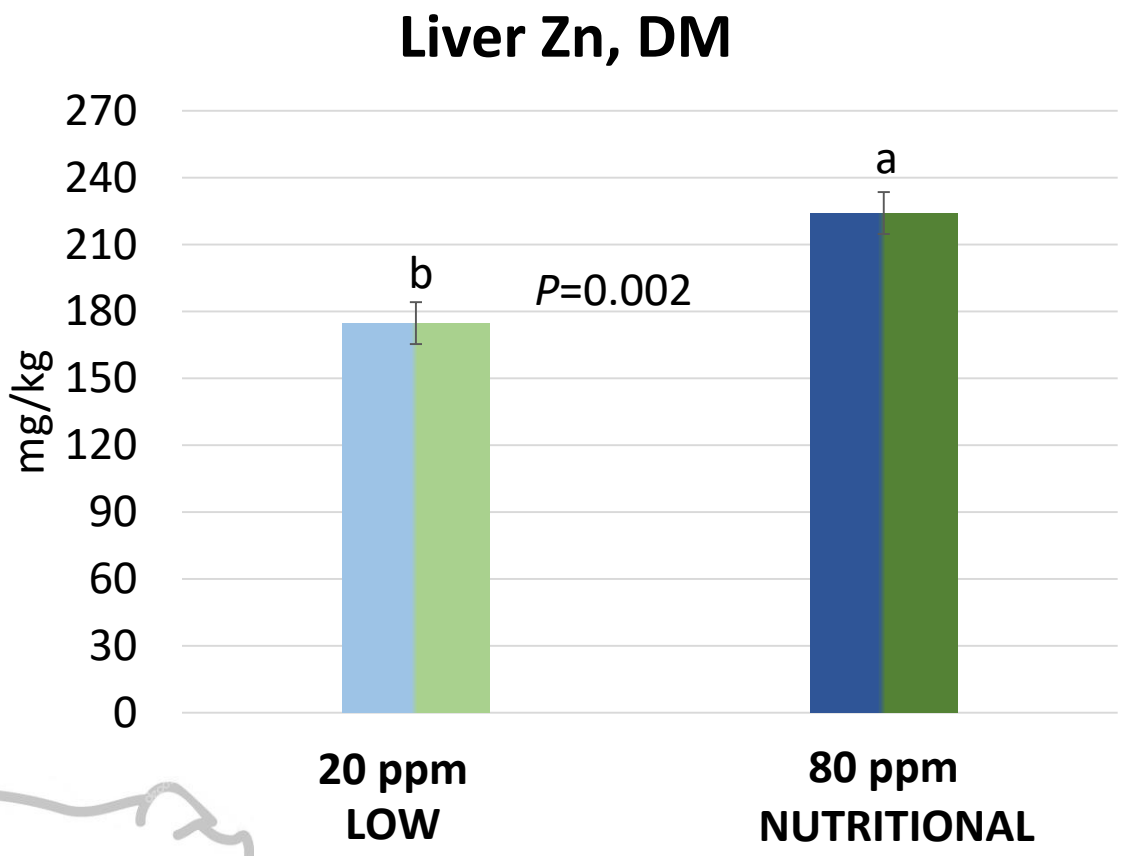


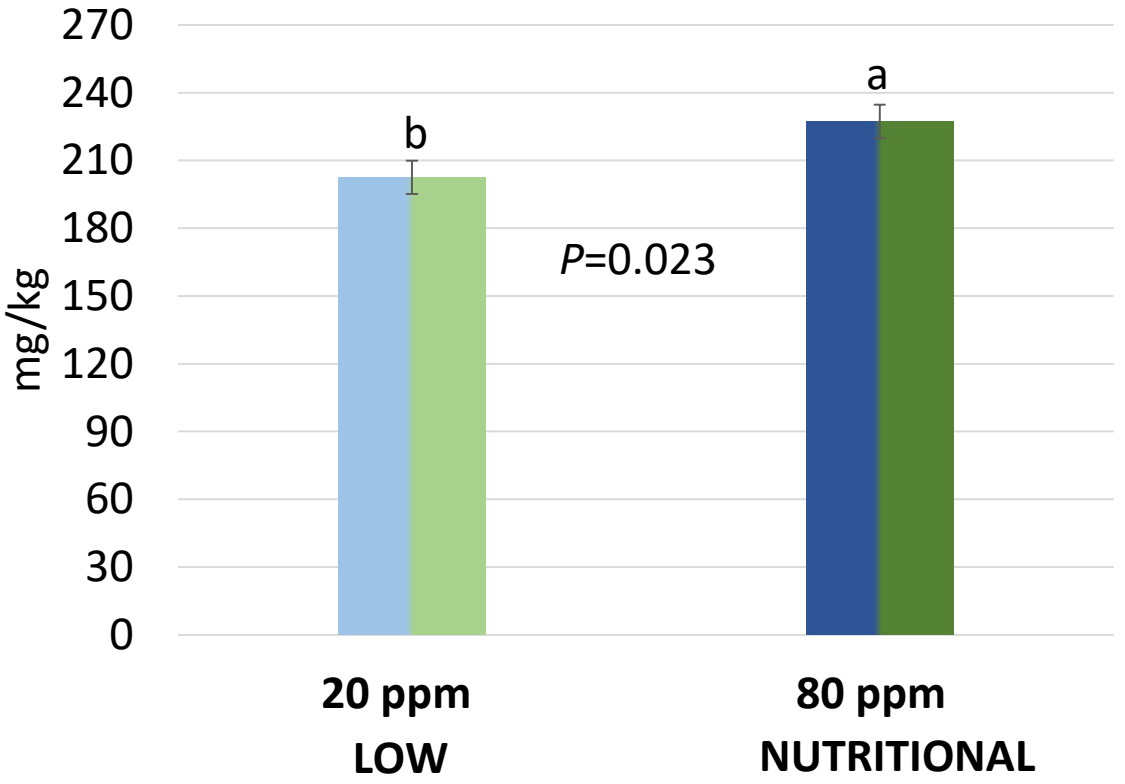


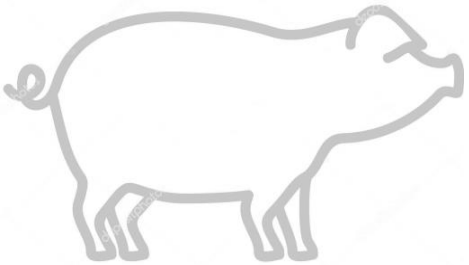
Carcass yield



Tissue mineral concentration







Conclusions

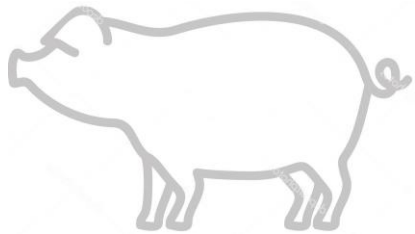
- DOSE EFFECT

  - Supplementing diets with zinc levels below and close to those recommended by the NRC (2012) have no detrimental effects on productive performance of fattening pigs. However the carcass yield and weight, and the storage level of Zn in the tissues were affected.

- SOURCE EFFECT

  - Feeding diets with hydroxychloride Zn promoted a higher carcass yield, however the performance during the fattening period was similar to those fed sulfate.

  - The ATTD analysis suggests that diets supplemented with hydroxychloride at 80 ppm could be used more efficiently compared to those with sulfate at 80 ppm.



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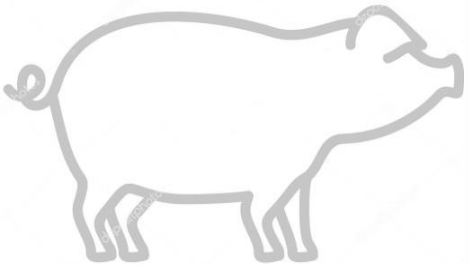
Thank you for your attention



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