

# Abstract #879473: Interactive effects of copper sources and superdosing phytase on growth performance, nutrient digestibility and tissue mineral concentrations in nursery pigs



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## BACKGROUND

- High levels of copper sulfate (CuSO<sub>4</sub>; 150 to 250 mg/kg Cu) are widely used in nursery pigs to promote growth and improve feed efficiency (Cromwell et al., 1989; Ma et al., 2015)
- Copper methionine hydroxy analogue chelate (Cu-MHAC; MINTREX® Cu, Novus International, Inc., St. Charles, MO) is composed of one mole of Cu chelated with two moles of DL-2-hydroxy-4-(methylthio)butanoic acid (HMTBa) in coordinate covalent bonds. It is stable in the upper gastrointestinal tract, which may minimize the formation of Cu-phytate complex, therefore allowing more Cu be absorbed by enterocyte. It has been demonstrated that Cu-MHAC supplementation led to greater growth performance in nursery pigs compared with CuSO<sub>4</sub> or tribasic copper chloride (TBCC) at the same supplemental Cu levels (Carpenter et al., 2019; Ren et al., 2020). Additionally, the reduced Cu-phytate complex by Cu-MHAC supplementation may improve phytase efficacy, compared with CuSO<sub>4</sub> or TBCC

## OBJECTIVE

- The objective of this study was to investigate the interactive effects of copper sources and superdosing phytase on growth performance, nutrient digestibility and tissue mineral concentrations in nursery pigs

## MATERIALS AND METHODS

### Animals, experimental design and sample collection

- A total of 288 weaning barrows (BW = 6.06 ± 0.99 kg) were selected and allotted to 1 of 6 dietary treatments using a randomized complete block design with 12 pens per treatment and 4 pigs per pen
- The 6 dietary treatments were arranged using a 3 x 2 factorial design

Trt	Cu sources	Cu level, ppm	Phytase <sup>1</sup> , FTU/kg
1	CuSO <sub>4</sub>	125	0
2	TBCC	125	0
3	Cu-MHAC	125	0
4	CuSO <sub>4</sub>	125	1,500
5	TBCC	125	1,500
6	Cu-MHAC	125	1,500

<sup>1</sup>Phytase used in this study is a commercial phytase with the brand name CIBENZA® PHYTAVERSE® G10, which is manufactured by Novus International, Inc., St. Charles, MO

- Pigs were fed their respective experimental diets from d 0 to 42 post-weaning, with d 0 to 14 as phase 1, d 14 to 28 as phase 2 and d 28 to 42 as phase 3
- Fecal samples were collected via grab sampling at the end of phase 3 (d 36 to 41) to determine nutrient digestibility
- One pig per pen with the BW near the average BW of the pen on d 42 was harvested for metacarpal, liver and kidney samples

### Statistical analysis

- The GLIMMIX procedure of SAS 9.4 (SAS Institute, Inc., Cary, NC) was used to analyze all the data. Copper source, phytase (PHY) and their interaction were considered as the fixed effects, whereas block was considered as the random effect
- Pen served as the experimental unit; LSMEANS statement was used to calculate the least square means
- $P \leq 0.05$  was considered as significant and  $0.05 < P \leq 0.1$  was considered as a trend

## RESULTS

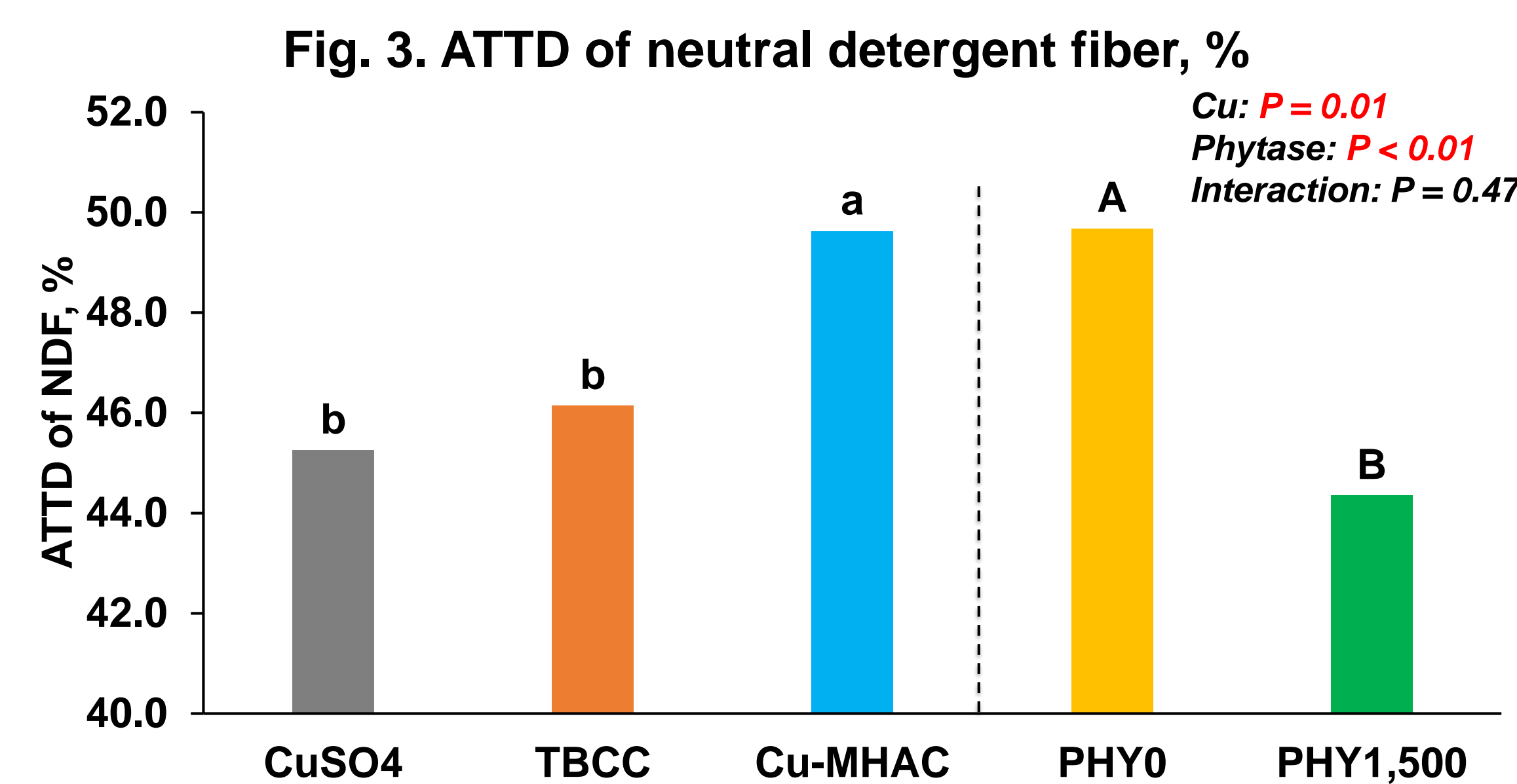
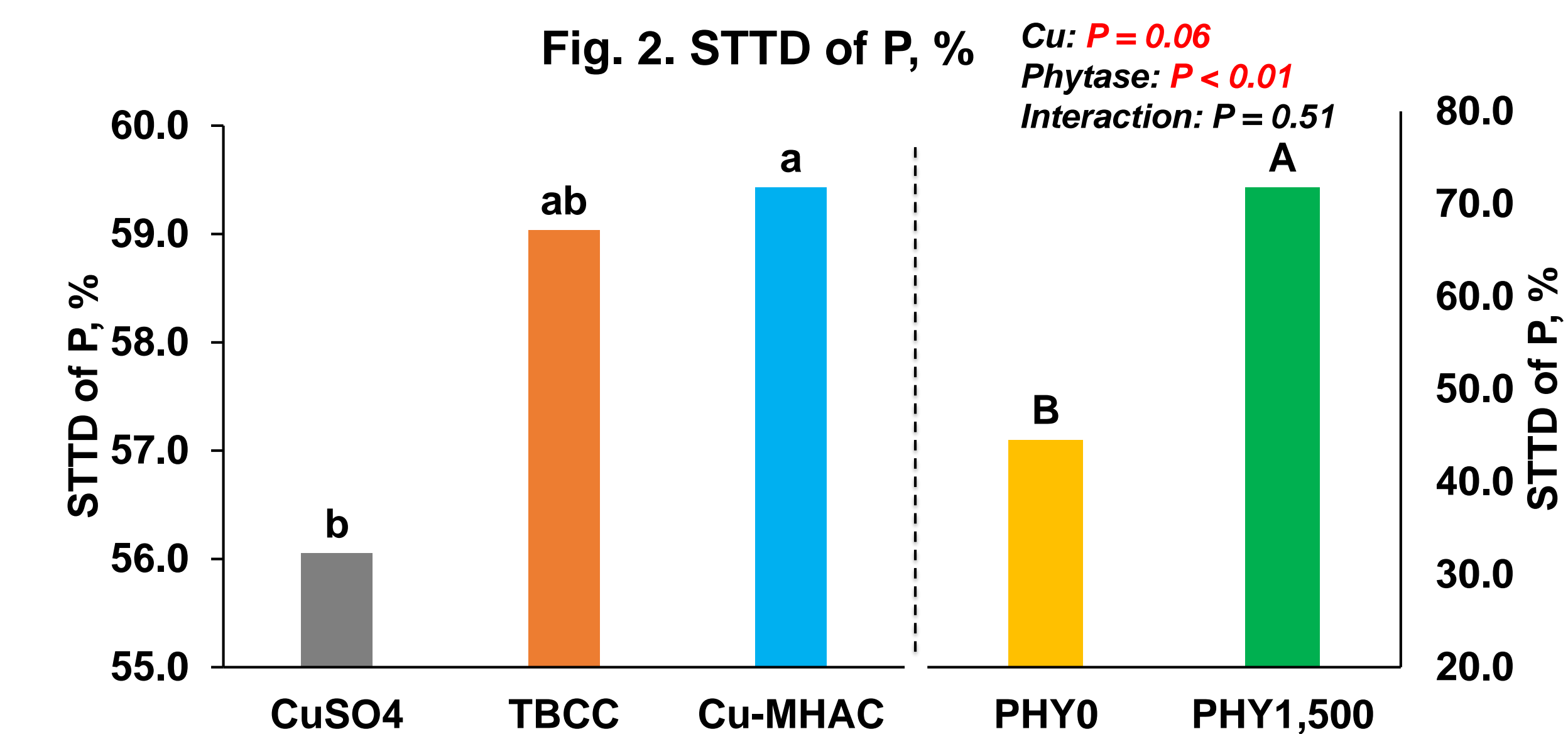
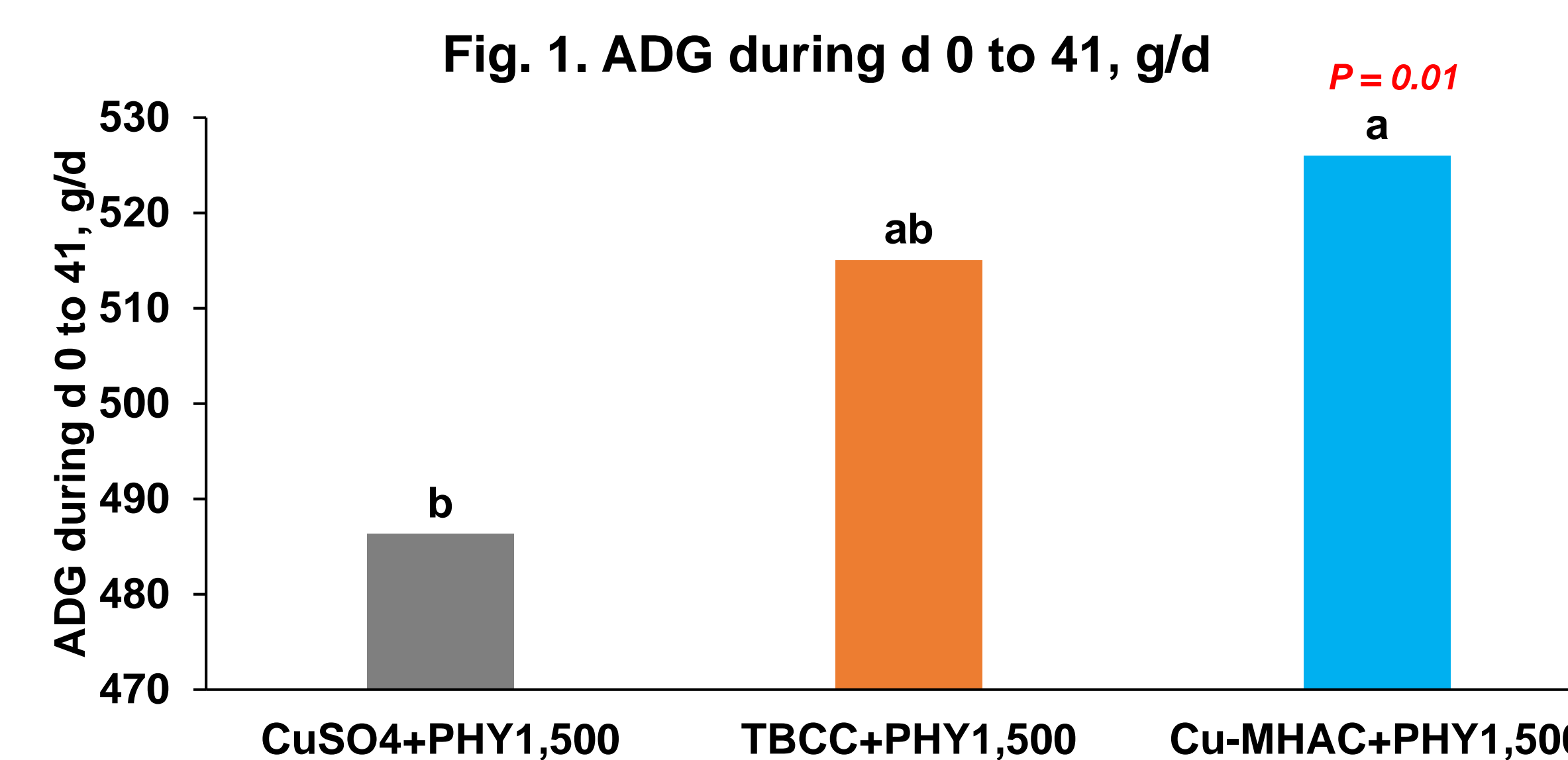


Table 1. Copper sources and superdose phytase on tissue copper concentrations in nursery pigs

Items, mg/kg	Cu source			Phytase		P value		
	CuSO <sub>4</sub>	TBCC	Cu-MHAC	no	yes	Cu source	Phytase	Interaction
Bone Cu	2.36	2.46	2.20	2.76 <sup>a</sup>	1.92 <sup>b</sup>	0.56	< 0.01	0.74
Liver Cu	19.31	17.73	20.29	21.29 <sup>a</sup>	16.93 <sup>b</sup>	0.31	< 0.01	0.56
Kidney Cu	44.21	37.8	45.05	26.69 <sup>b</sup>	58.02 <sup>a</sup>	0.42	< 0.01	0.76

Note: ADG, average daily gain; ATTD, apparent total tract digestibility; STTD, standardized total tract digestibility

## SUMMARY AND CONCLUSION

- In the presence of superdosing phytase, Cu-MHAC improved overall ADG and P digestibility, followed by TBCC and CuSO<sub>4</sub>, whereas in high P deficient diet no difference was observed among Cu sources in terms of overall ADG
- Copper methionine hydroxyl analogue chelate improved neutral detergent fiber digestibility compared with TBCC and CuSO<sub>4</sub>
- Superdosing phytase improved growth performance, P digestibility, and Cu concentration in kidney, but reduced neutral detergent fiber digestibility, and Cu concentration in bone and liver; the latter may be due to Zn antagonism<sup>5</sup>
- In conclusion, under the condition of the current study, Cu-MHAC may be more effective in improving growth rate, P and fiber digestibility of nursery pigs in the presence of superdosing phytase, compared with TBCC and CuSO<sub>4</sub>

## REFERENCE

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