Effect of a Chelated Source of Copper, MINTREX® Cu, on Growth Performance and Tissue Copper Concentration In Weaned Piglets

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The Role of Copper in Pig Nutrition

- Copper (Cu) plays a key role in the:
  - activation of enzymes involved in metabolism
  - transport of iron for haemoglobin synthesis
  - Activation of the enzyme, thiol oxidase, responsible for the formation of disulphide bonds between cysteine residues in keratin
  - Control of microbial activity in the gastrointestinal tract.

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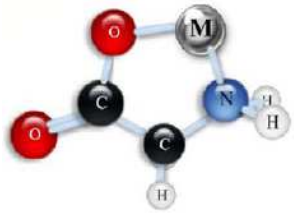
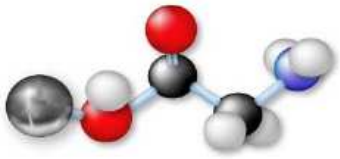
Organic Trace Minerals – Different Structures Different Properties

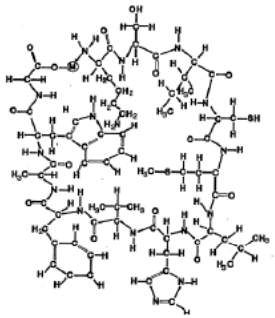


Metal Amino Acid Chelates

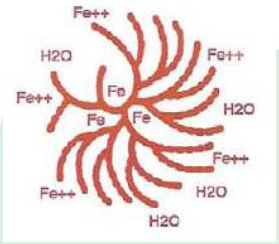


Specific Metal Amino Acid Complexes

Metal Amino Acid Complexes



Metal Proteinates



Metal Polysaccharide Complexes

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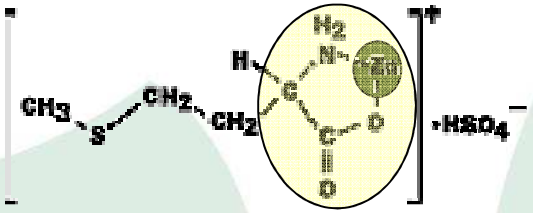
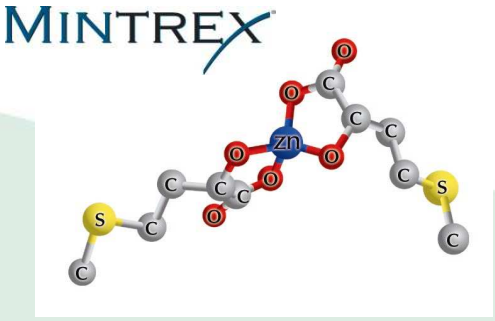
MINTREX® has a stable structure and a unique ligand

- **One atom of mineral bonded to two molecule of HMTBa**
  - Ligand = hydroxy analogue of methionine
- **Coordinate covalent bonds**
  - Higher stability in the gut, higher mineral bioavailability
- **Residual benefit of the ligand**
  - Methionine source

$Zn^{+}SO_4^{-}$		
Simple salt	**Simple chelate**	**Coordinate covalent bonds**

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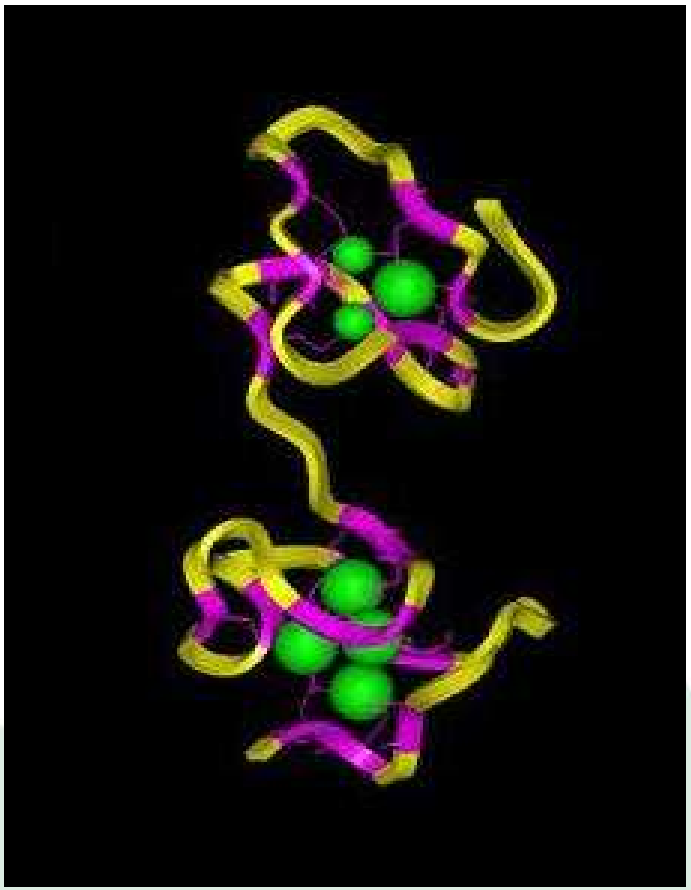
Improved Zn bioavailability from MINTREX Zn has bee measured using metallothionein (MT) mRNA expression in gut tissues



- Metallothionein (MT) proteins bind to Zn and other metals
- One MT protein can bind up to 7 cations, such as Zn
- Increased uptake of Zn by the cell stimulates MT synthesis
- mRNA level in the cell is a measure of protein production

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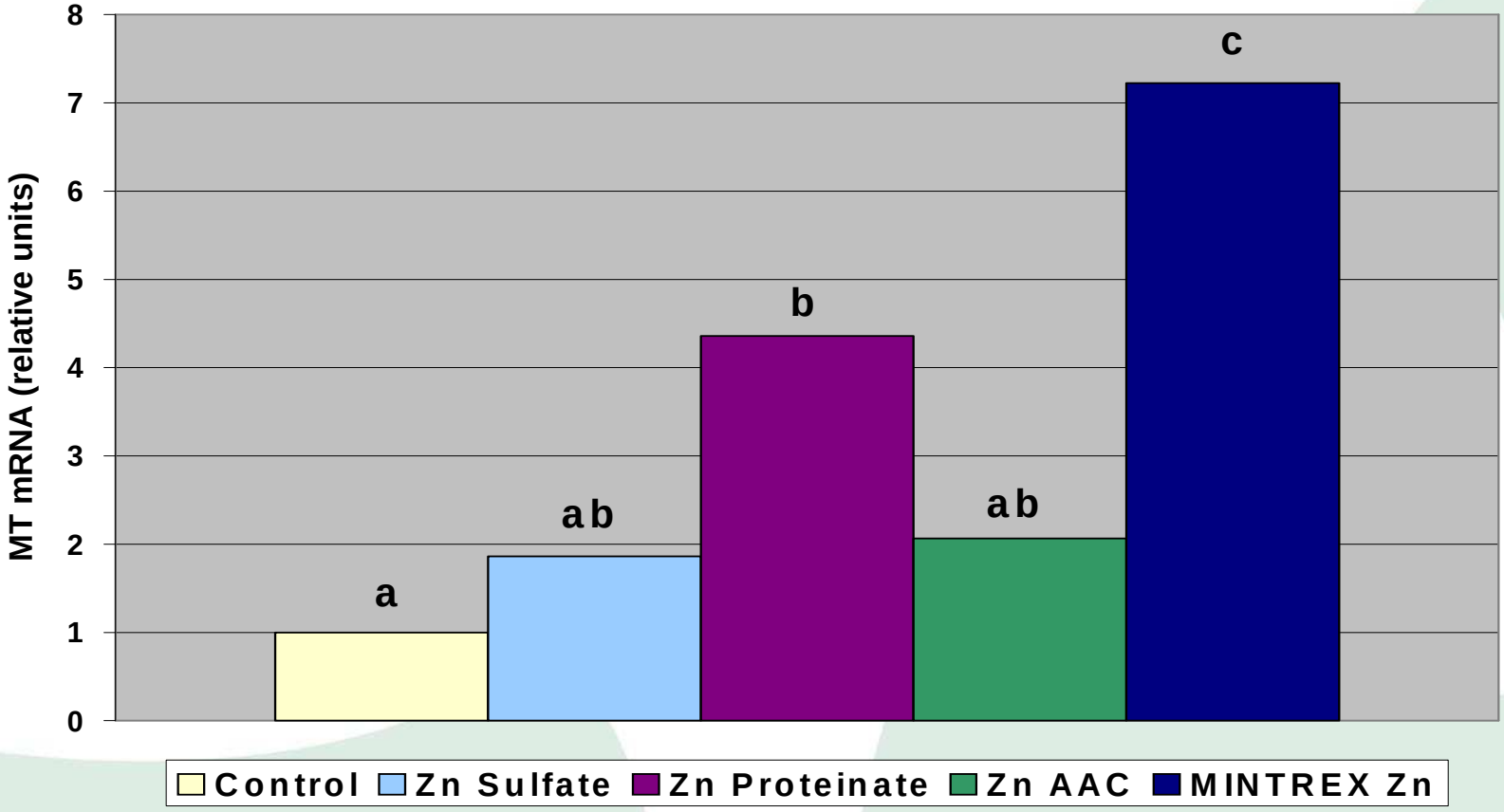
MT mRNA assay in duodenal mucosa of broilers demonstrates superior bio-availability of Zn from MINTREX®



Supplemental zinc sources provided 70 mg/kg Zn in the diet

Richards et al, 2007

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Objectives

To investigate the effect of MINTREX® Cu on

- **Growth Performance**
  - **Daily liveweight gain, feed intake and feed conversion ratio between 26 and 68 days of age**
- **Copper Bioavailability**
  - **Mineral concentration in body tissues**

in weaned piglets

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Study Design: Treatments

Dietary Treatments					
	Added Cu Level (mg/kg)				
ITM Control NRC	6				
ITM Control at EU Max	150				
MINTREX Cu at EU Max	150				
Timeline: Piglets on trial from 26 to 68 days of age					
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Prestarter Feed		Starter Feed			

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Analyzed feed Cu content (mg/kg)

	Prestarter 26-40d			Starter 40-68d		
	T1 ITM Control	**T2 ITM Cu 150**	**T3 Mintrex Cu 150**	**T1 ITM Control**	**T2 ITM Cu 150**	**T3 Mintrex Cu 150**
Added Cu	6	150	150	5	150	50
Analyzed Cu	15	149	169	11	145	160

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Study Design: Experimental Design

Table x: Number of Piglets, Pens and Replicates	
No. of Treatments	3
Replicates (Pens) per treatment	8
Total Number of replicates (pens)	40
Piglets per Replicate	10
Piglets per treatment	80
Total Number of Piglets	240

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Study Design: Observations and Measurements

Observations and Measurements	
• Feed Intake • Bodyweights • Weight Gains • Feed Efficiency	Day 0, 14 and 42 on trial
• Culling • Mortality • Health	Daily Records including probable causes of any culling, illness or deaths

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Effect of Treatment on Bodyweight and Mortality
(26 – 68 days of Age)

Treatment	Bodyweight (kg)			Mortality (%)	
	26 days of Age	40 days of Age	68 days of Age	26 – 40 d	26 – 68 d
ITM control	7.36	10.44[b]	22.07[b]	0.00	5.00
ITM at EU Maximum	7.36	10.54[b]	22.07[b]	1.25	3.75
MINTREX® Cu EU Max	7.35	11.27[a]	23.40[a]	1.25	3.75
SEM (n=8)		0.144	0.416	1.104	2.430
P		0.0001	<0.0001	0.6376	0.3132
Significance of Contrasts					
ITM vs MINTREX®, EU Max		0.0012	0.0314	1.0000	1.0000

SEM: Standard Error of the Mean
P: Probability. Different letters (a-d) in the same column indicate significant differences (P<0.05)

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Effect of Treatment on Zootechnical Performance
(26 – 68 days of age)

Treatment	Average Daily Liveweight Gain (g/d)	Average Daily Feed Intake (g/d)	Food Conversion ratio (g feed/g gain)
ITM Control, NRC	346.3[b]	534.0[ab]	1.54[b]
ITM Control at EU Maximum	346.4[b]	510.0[b]	1.47[ab]
MINTREX® Cu EU Maximum	377.6[a]	544.0[a]	1.44[a]
SEM (n=8)	9.77	10.80	0.035
P	<0.0001	<0.0001	0.0419
Significance of Contrasts			
ITM vs MINTREX®, EU Max	0.0318	0.0340	0.5015

SEM: Standard Error of the Mean
P: Probability. Different letters (a-d) in the same column indicate significant differences (P<0.05)

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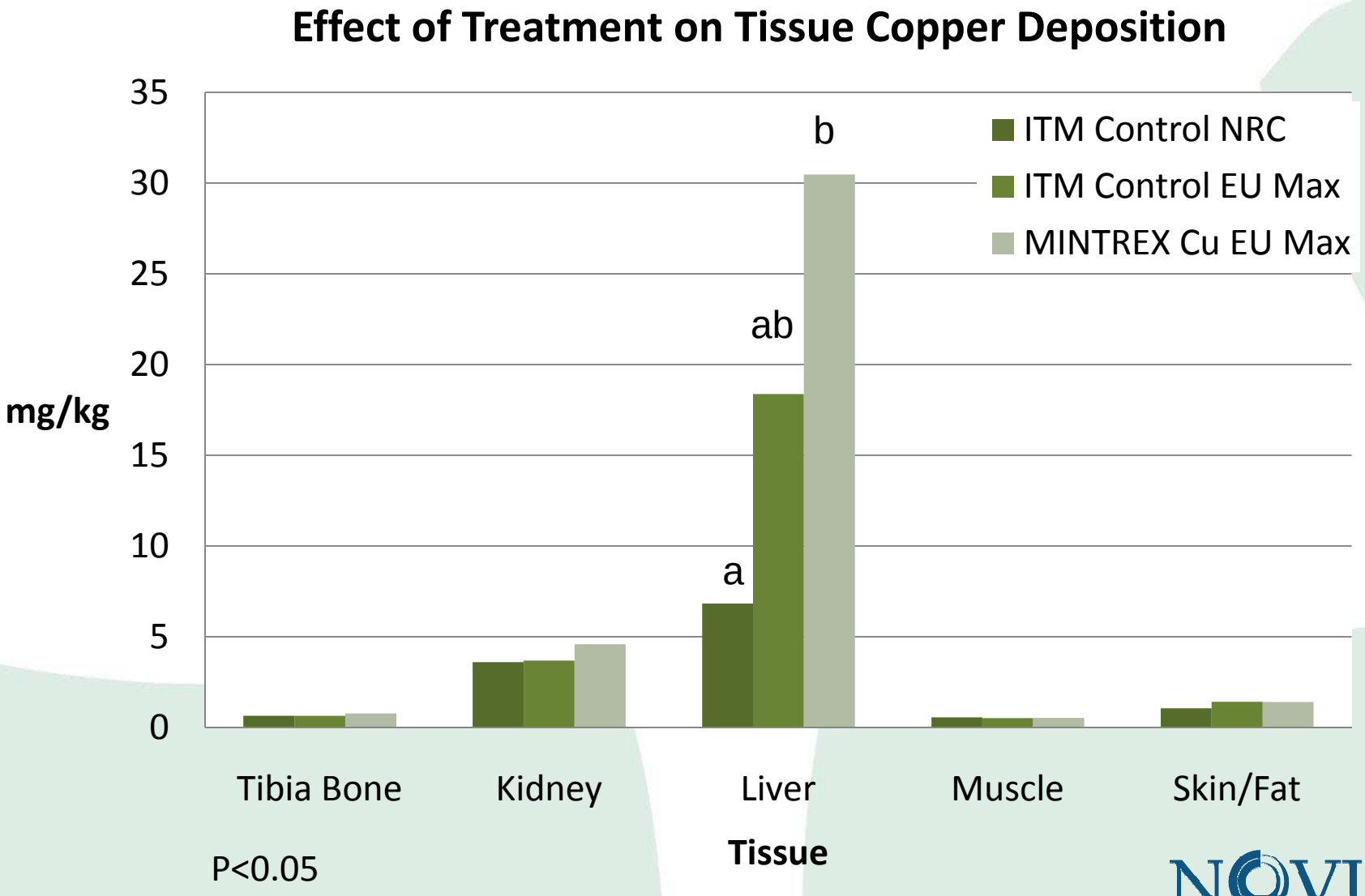
Results: Copper Deposition



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Summary of animal performance

- Use of MINTREX Cu significantly increased body weight of piglets at 40 and 68 days of age
- MINTREX use resulted in a significant incease in feed intake over the 42 day experimental period
- Liver copper level at 68 days of age was significantly increased by MINTREX use

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Conclusions

- Use of MINTREX Cu in the diets of weaned piglets improved animal performance when compared to an inorganic source
- Increased bioavailability of Cu from the chelate source is demonstrated by higher concentrations of Cu in the liver
- Improved bioavailability provides an opportunity to reduce diet inclusion rates while maintaining performance in young pigs

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