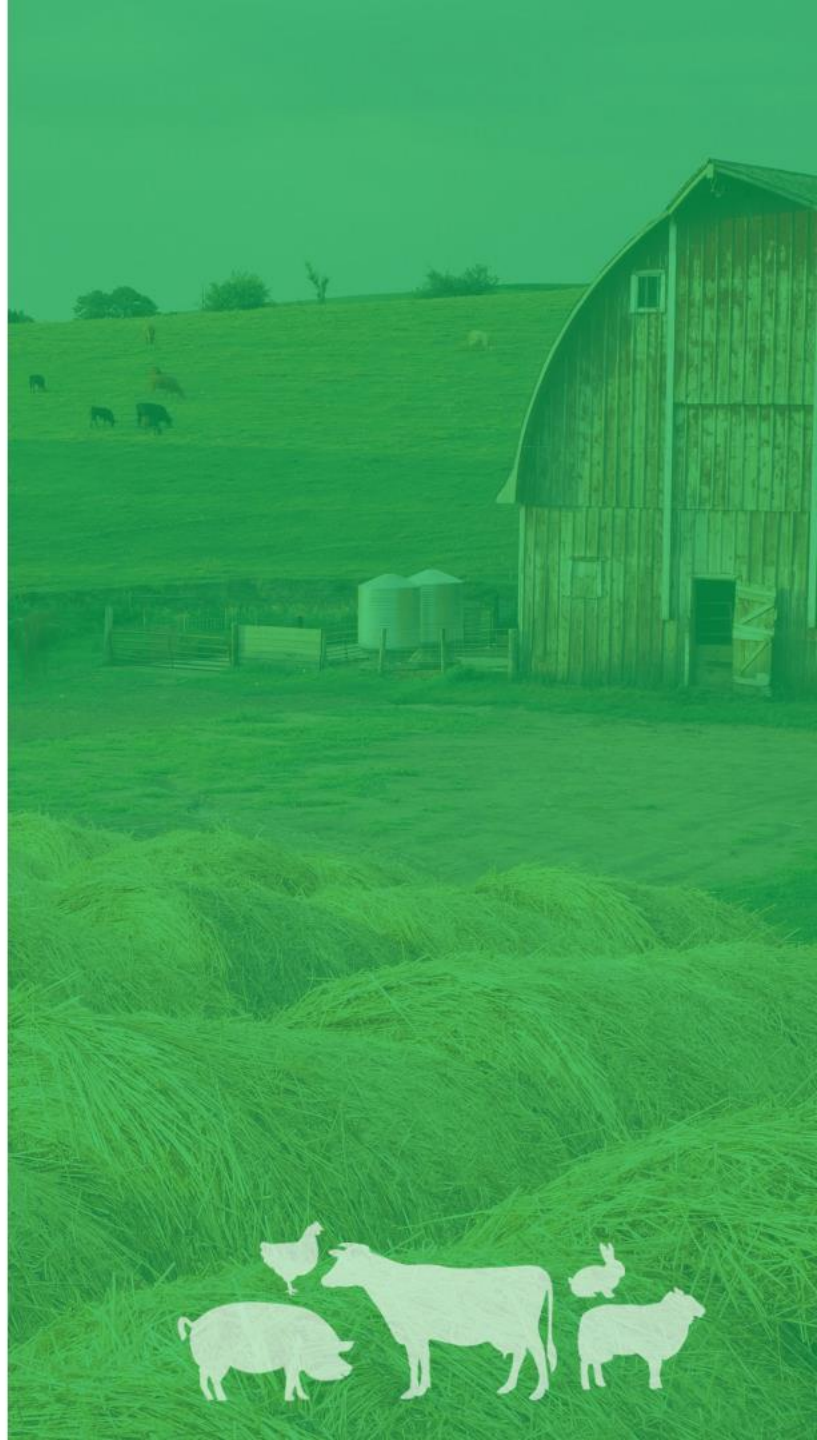
JH Biotech, Inc.
Innovation for a Greener Earth

Buffermin® Proteinate

Bring Minerals to Life

Trial Report by JH Biotech, Inc.

Animal Nutrition Division



Purpose

Buffermin Copper and Zinc Proteintae

- To compare performance of traditional inorganic minerals versus chelated minerals.

- To understand the quality and efficacy of JHB's Buffermin Proteinate products.

Method

Buffermin Copper and Zinc Proteintae

- Animal: Ross 308 broiler
- Count: 400 heads → 5 groups
- Location: National Chung Hsing University, Taiwan
- Groups:
  - Control: $CuSO_4$ + $ZnSO_4$
  - JCu: Buffermin Cu Proteinate + $ZnSO_4$
  - CCu: Competitor Cu Proteinate + $ZnSO_4$
  - JZn: $CuSO_4$ + Buffermin Zn Proteinate
  - CZn: $CuSO_4$ + Competitor Zn Proteinate

Materials

Buffermin Copper and Zinc Proteintae

- Inorganic Minerals:
  - Copper sulfate pentahydrate
  - Zinc sulfate monohydrate
- Organic Minerals:
  - Buffermin Copper Proteinate 15%
  - Buffermin Zinc Proteinate 15%
  - Competitor Copper Proteinate 10%
  - Competitor Zinc Proteinate 12%
- All minerals were added in the ratio to yield the same mineral content in complete feed in each group

Diet

Item	Grower	Finisher
	1-21 day old	22-35 day old
Ingredients (%)		
Corn	47.25	51.84
Soybean meal, CP 44%	34.53	29.57
Full fat soybean meal	10.00	10.00
Limestone, pulverized	1.61	1.34
Monocalcium phosphate	1.86	1.66
Salt	0.39	0.38
Soybean oil	3.51	4.49
Lysin	0.20	0.13
Methionine	0.38	0.32
Choline chloride, 50%	0.96	0.96
Vitamin premix[1]	0.10	0.10
Mineral premix[2]	0.10	0.10
Calculated value (%)		
Dry matter	88.39	88.41
Crude protein	23.00	21.00
Crude fat	7.25	8.28
ME, Kcal/kg	3050	3175
Ca	1.05	0.90
Na	0.17	0.17
Available phosphate	0.50	0.45

Vitamin Premix

(premix content per kg diet)

Ingredients	Amount
Vit. A	15000 IU
Vit. D3	3000 IU
Vit. E	30 mg
Vit. K3	4 mg
Thiamin	3 mg
Riboflavin	8 mg
Pyridoxine	5 mg
Vit. B12	25 µg
Ca-pantothenate	19 mg
Niacin	50 mg
Folic acid	1.5 mg
Biotin	60µg

Mineral Premix

(premix content per kg diet)

Ingredients	Amount
$CoCO_3$	0.255 mg
$FeSO_4 \cdot H_2O$	90 mg
$MnSO_4 \cdot H_2O$	90 mg
Na_2SeO_3	0.18 mg

Copper and Zinc

Cu and Zn Source and Dosage of Each Group

Groups	Mineral Sources		Copper Dosage (mg/kg, ppm)	Zinc Dosage (mg/kg, ppm)	Equivalent Copper Content (mg/kg, ppm)	Equivalent Zinc Content (mg/kg, ppm)
Control	$CuSO_4 \cdot 5H_2O$	$ZnSO_4 \cdot 1H_2O$	90	83	22.5	30
JCu	Buffermin® Copper Proteinate	$ZnSO_4 \cdot 1H_2O$	150	83	22.5	30
Ccu	Competitor Copper Proteinate	$ZnSO_4 \cdot 1H_2O$	225	83	22.5	30
JZn	$CuSO_4 \cdot 5H_2O$	Buffermin® Zinc Proteinate	90	200	22.5	30
ZZn	$CuSO_4 \cdot 5H_2O$	Competitor Zinc Proteinate	90	250	22.5	30

Results

Body Weight and FCR

Item	Groups				
	Control	JCu	CCu	JZn	CZn
0-21 age in days	—g/chicken—				
Body weight	912 [b]	948 [a]	936 [ab]	935 [ab]	925 [ab]
Feed consumption	1092	1079	1069	1102	1101
Weight gain	869	905	893	893	882
FCR	1.26 [a]	1.19 [b]	1.20 [b]	1.23 [a]	1.25 [a]
21-35 age in days					
Body weight	2294	2302	2299	2312	2254
Feed consumption	2117	2109	2143	2065	2059
Weight gain	1382	1354	1363	1377	1329
FCR	1.54	1.56	1.57	1.50	1.55
0-35 age in days					
Feed consumption	3210	3188	3212	3167	3160
Weight gain	2252	2259	2256	2269	2210
FCR	1.43	1.41	1.42	1.40	1.43

1. Substitution of inorganic copper with Buffermin Copper Proteinate significantly improved body weight and FCR at 21 days of age compared with control and competitor's chelated copper .
2. Although not statistically significant, JHB's products perform better than Competitor's products in either group at all growing phases.

Results

Cu Sources vs Blood Parameters

Item	Groups		
35 age in days	Control	JCu	CCu
CHOL, mg/dL	87.25	86.75	91.5
Cu in blood (ug/L)	125	117.5	113.75

1. Bakalli et al. (1995) reported that high copper intake (250 mg/kg) can significantly reduce total cholesterol content in blood. Later reports demonstrated normal copper intake may not have significant impact on cholesterol level.
2. In this study, no significant effect was found on copper content in blood and total cholesterol level across all groups. It is concluded that normal copper intake level will not affect cholesterol level.

Bakalli, R. I., G. M. Pesti, W. L. Ragland, and V. Konjufca, 1995. Dietary copper in excess of nutritional requirement reduces plasma and breast muscle cholesterol of chickens. Poultry Sci. 74:360-365.

Results

Zn Sources vs Tibia and Blood Parameters

Item	Groups		
35 age in days	Control	JZn	CZn
Tibia weight (g)	7.08	7.54	7.31
Tibia length (cm)	9.96	10.07	9.96
Weight/length	0.71	0.75	0.73

Item	Groups		
35 age in days	Control	JZn	CZn
Zn in blood (ug/L)	1313	1438	1358

Control

JZn

CZn

1. Substitution of inorganic zinc with chelated zinc significantly improved tibia weight and has no significant effects on tibia length.
2. Groups treated with JHB's Buffermin Zinc Proteinate showed the highest tibia weight and zinc content in blood while maintaining normal tibia length. It is expected that this group will show highest bone density and tibia strength.
3. Zinc is part of the essential elements for bone development. From the results above, Buffermin Zinc Proteinate showed the highest bioavailability and utilization rate.

Conclusions

Buffermin Copper and Zinc Proteintae

- Buffermin Copper Proteinate significantly increases weight gain and improves FCR on early growing stage (0-21 days)
- Buffermin Zinc Proteinate drastically improves tibia parameters with higher zinc in blood showing higher bioavailability and utilization rate
- Conclusion: Buffermin Copper and Zinc Proteinate have better product performance over inorganic and competitor's copper source

Labels

Buffermin Copper and Zinc Proteinates

POWDER

BUFFERMIN® COPPER PROTEINATE

Amino Acids Chelated Copper

Product Information

BUFFERMIN COPPER PROTEINATE results from the chelation of copper with amino acids and/or partially hydrolyzed proteins as defined by the Association of American Feed Control Officials. It is a nutritional animal feed supplement formulated to prevent and/or correct copper deficiency in animals.

GUARANTEED ANALYSIS

Crude Protein, not less than.....25.0%
Copper (Cu), not less than.....15.0%

INGREDIENTS: hydrolyzed protein and copper proteinate

KEEP OUT OF REACH OF CHILDREN

Directions and General Recommendations

FEEDING INSTRUCTIONS

Recommended rates per ton of complete feed:
Cattle (Dairy, Beef): 1g/head/day
Sow: 120 – 150g
Poultry: 150g
Horses: 1g/head/day

CAUTION: Product contains copper. Do not feed to sheep or related species.

STORAGE

BUFFERMIN COPPER PROTEINATE is stable under normal storage conditions. Store in dry, cool places. Avoid exposure to moisture, heat, and direct sunlight.

NET CONTENTS: 25 lb. (11.3 kg)
Manufacturing Date:
Expiration Date:
Lot #:

OMRI LISTED GMP+ FSA ASSURED Made in USA

LIMITED WARRANTY

Manufacturer or seller makes no warranty product other than for the purposes indic for any injury or damage caused by this p specifically described on the label.

JHBiotech, Inc. Innovation for a Greener Earth

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POWDER

BUFFERMIN® ZINC PROTEINATE

Amino Acids Chelated Zinc

Product Information

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Zinc (Zn), not less than.....15.0%

INGREDIENTS: hydrolyzed protein and zinc proteinate

KEEP OUT OF REACH OF CHILDREN

Directions and General Recommendations

FEEDING INSTRUCTIONS

Recommended rates per metric ton of complete feed:

Cattle (Dairy, Beef):	80 – 240g
Swine (Sow – before pregnancy):	330g
(Sow – after pregnancy):	450 – 650g
(Piglets):	450 – 600g
(Growers/Finishing):	200g
(Late Hog):	200 – 330g
Poultry:	65 – 200g
All-Species Average:	65 – 200g

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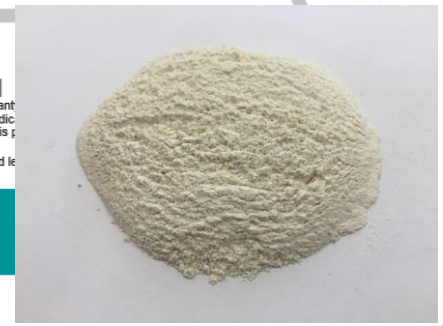
Information regarding the contents and le www.aapfco.org/metals.html



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Thank You