B-TRAXIM 2C

Pancosma

Bioavailability of the zinc glycinate complex B-TRAXIM® 2C in beef

Technical Bulletin

KEY FINDINGS

B-TRAXIM® 2C G/Zn (code 9522) showed:

- ***Increased absorbability and bio-availability compared to zinc sulfate and other organic zinc source.***
- ***Increased ruminal zinc concentration in soluble form.***
- ***Increased propionate concentration and reduced acetate / propionate ratio by ruminal micro-organisms.***

INTRODUCTION AND OBJECTIVE

Numerous studies show that addition of organic zinc to beef diets improves growth performances and hoof quality compared to inorganic zinc supplementation. Reason to this is their improved bioavailability. However, study results are variable due to different factors like, nature of protocol, animals, diet, … but also due to different forms of organic trace minerals used which may partly reflect the heterogeneity of bioavailability data.

The goal of this study was to investigate the zinc metabolism in steers with three different supplemental sources, as well as, eventual effects on rumen metabolism.

MATERIALS AND METHOD

The study was conducted at North Carolina State University (U.S.A.).

Experimental design:
24 Angus steers with an average initial body weight of 314 kg, housed in covered pens, were assigned to 4 treatments (table 1). A Zinc depletion period of 42 days was conducted for all animals in order to lower body zinc content. A zinc repletion period of 42 days with the defined treatments followed the depletion period.
On day 7 of the repletion period, steers were placed in metabolism crates designed for feces and urine collection during 12 days (7 days acclimatisation, 5 days collection).

Table 1: Treatments

Zn – Source	Added Zn
Control (no supplemental Zn)	0 ppm
Zn – Sulfate ($ZnSO_4$)	20 ppm
B-TRAXIM® 2C G/Zn	20 ppm
Zn – Methionine (ZnMet)	20 ppm

Experimental diets:
Steers were individually fed using electronic Calan Gate feeders. The ad-libitum fed basal diet is presented in table 2.

Table 2: Diet formulations

Ingredient		Content
Dried citrus pulp	[% DM]	46.4
Cottonseed hulls	[% DM]	39.3
Corn	[% DM]	5.0
Soybean meal	[% DM]	7.0
Urea	[% DM]	1.2
Premix	[% DM]	1.1
Analyzed Zn	[ppm]	18.8

Statistical Analysis:
Analysis of variance using General linear model procedure. Differences between treatment means were determined by using least significant difference test.

Measurements:
The data was collected during the repletion period.

- Feed intake (daily)
- Zn content in feces, urine (days 15 to 19)
- Zn content in plasma, 2h post-feeding (days 0, 2, 19, 42)
- Zn content in liver (days 0 and 42)
- Ruminal fluid samples for volatile fatty acids (VFA) and soluble Zn concentrations, 2h post-feeding (day 42).

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RESULTS AND CONCLUSION

Zinc absorbability:
Apparent absorption and retention of Zn are presented in table 3.
Zn intake was, as expected, lower ($p<0.01$) for the control treatment compared to the supplemented treatments, which resulted in lower Zn-losses.
Within supplemented treatments, urinary Zn losses were similar and low. The calculated Zn absorption data were equal between $ZnSO_4$ and ZnMet, but for B-TRAXIM® 2C its absorbability doubled. The body retention of Zn showed similar results.

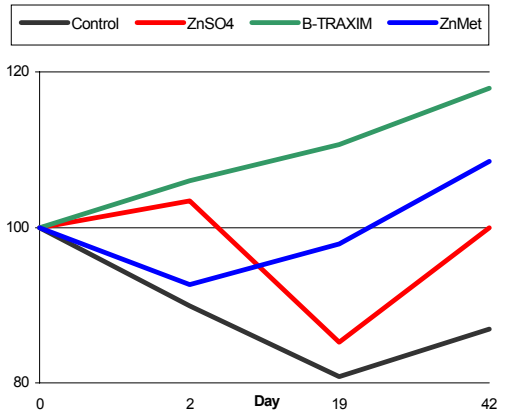
Table 3: Zinc balance

[mg / d]	Control	$ZnSO_4$	B-TRAXIM	ZnMet
Zn intake	152.0^{a}	332.8^{b}	344.3^{b}	315.3^{c}
Fecal Zn	134.5^{a}	311.3^{b}	298.5^{b}	294.0^{b}
Urinary Zn	0.85^{B}	1.05^{AB}	1.45^{A}	1.43^{A}
Absorbed Zn	17.5	21.5	45.8	21.3
Retained Zn	16.7	20.7	44.3	19.8
Zn absorption [%]		6.5	13.3	6.8
Zn retention [%]		6.2	12.9	6.3

Values with different lower case superscripts = $p<0.01$
Values with different higher case superscripts = $p<0.05$

Zinc bioavailability:
In addition to absorbability data, plasma (transport) and liver (storage) were also analysed on their Zinc contents.
The supplementation of ZnSO4 and ZnMet had a stabilising effect on Zn concentration in plasma compared to its decrease without any supplementation (graph 1). But with B-TRAXIM® 2C Zn plasma level increased constantly (+17.9% on day 42).

Graph 1: Plasma Zn evolution relative to day 0



No change in liver Zn concentration (table 4) occurred with $ZnSO_4$ and ZnMet, as in plasma Zn; but was significantly ($p<0.05$) increased by 31.3% with B-TRAXIM® 2C.

Table 4: Liver zinc contents

[mg / kg]	Control	$ZnSO_4$	B-TRAXIM	ZnMet
Day 0	95.2	91.6	86.8	98.8
Day 42	90.5^{b}	89.7^{b}	114.0^{a}	92.2^{b}
Change	- 3.1^{b}	- 2.6^{b}	+ 23.4^{a}	- 2.7^{b}

Values with different lower case superscripts = $p<0.05$

These results are consistent with the absorbability and retention data. Collectively, they show that B-TRAXIM® 2C had a higher bioavailability than $ZnSO_4$ and ZnMet in steers.

Ruminal soluble zinc and VFA concentration:
Higher ruminal soluble zinc concentrations suggest that the metal interacts to a lesser degree in the rumen to form insoluble complexes with other feed components. This was the case for the two supplemented organic forms (+57% for B-TRAXIM® 2C and +107% for ZnMet) compared to $ZnSO_4$ [mg / l] shown in table 5.
The total VFA concentration [mM] was decreased with organic trace mineral sources. Proportions [mol / 100 mol] in acetate were not affected by treatments, but in propionate (+10% and +31%) for B-TRAXIM® 2C and ZnMet (table 5). The acetate / propionate ratio decreased therefore favourably for both organic trace mineral sources. Energy utilization in beef cattle is improved with lower acetate / propionate ratios.

Table 5: Soluble zinc and rumen metabolism

	$ZnSO_4$	B-TRAXIM	Zn - Met
Soluble Zn	0.40^{b}	0.63^{ab}	0.81^{a}
Total VFA	118.2^{a}	96.0^{b}	97.0^{b}
Acetate	67.6	64.6	65.1
Propionate	13.8^{b}	15.2^{b}	18.1^{a}
Acet / prop	4.96^{a}	4.29^{a}	3.72^{b}

Values with different lower case superscripts = $p<0.05$

In the rumen, reactions clearly occurred between both organic zinc sources and the micro-organisms, but finally, only B-TRAXIM® 2C demonstrated a highly better bioavailability in steers. The eventual influence on ruminal fermentation and the bioavailability of the trace mineral seems therefore not correlated.

This study finally demonstrates that B-TRAXIM® 2C G/Zn (code 9522) was better absorbed and used by beef cattle than $ZnSO_4$ and other organic trace mineral sources.

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