

DIETARY CHROMIUM SUPPLEMENTATION

A Review of Mode of Action and Its Effects on Productivity

In the field of swine nutrition, there is an emerging profusion of data which clearly suggest the positive effects on chromium supplementation on productivity.

Its mode of action has also been firmly established.

Previously, data has been limited to its positive effects on muscle deposition and leanness character. As the data from replacement gilts which have been continuously supplemented with chromium up the present third parity are now coming in, such data reveal more positive effects on increased ovulation rate, litter size and piglet survival.

MODE OF ACTION

Chromium appears to be directly related to insulin function. Insulin is the hormone responsible for stimulation of transport into cells of metabolites and ions (glucose, amino acids, fatty acids and minerals) and eventual biosynthesis of molecules and macromolecules, and cell growth (Gilman and Goodman, 1985).

Glucose is the primary fuel of cell activity and development.

Chromium appears to be necessary for optimal insulin function and cellular glucose uptake (Anderson et.al, 1985). and chromium supplementation is reported to improve glucose tolerance in man (Mertz, 1993). Lindemann et.al. postulated that chromium improves insulin sensitivity of body cells.

Effect on Musculature and Fat Deposition

Increased uptake of glucose by muscles as a result of chromium induced insulin sensitivity of muscle cells result to improved cellular activity and size. Increased cell activity and size also require increased amino-acid deposition.

Thus, muscle fibers tend to increase in size and mass.

The increased cellular uptake of glucose also directly reduces the amount of energy

bearing nutrients circulating in the blood, resulting to reduced conversion by the liver of excess energy materials into fat and eventual decrease in fat deposition.

Effect on Reproductive Function.

Insulin has been shown to exert effect at the brain level by increasing the frequency of luteinizing hormone release (Flower et.al. 1989; Tokach et.al. 1992) The increase in luteinizing hormone results to improved ovarian follicular maturation and the resultant increased ovulation rate.

Insulin also increases production and release of progesterone by the corpus luteal cells, thus helping improve embryo attachment to the uterus proper survival/maintenance of the fetus to term (Roberts et al 1993, Kemp et.al 1995).

Chromium supplementation increases the sensitivity of reproductive cells to insulin, leading to improved reproductive functions.

ESTABLISHED EFFECTS OF CHROMIUM SUPPLEMENTATION ON SWINE PRODUCTIVITY

Effect on Reproduction

- Improved follicular maturation
- Increased ovulation rate
- Increased blood progesterone concentration
- Improved uterine function
- Improved embryonic survival
- Improved litter size

Effect on Musculature and Leanness

- Improves musculature development
- Increases muscle fiber size and mass
- Decreases fat deposition

SUMMARY DATA ON EFFECTS OF CHROMIUM SUPPLEMENTATION

Available data suggests 200 ppb chromium supplementation supports;

Reproductive

- Absolute improvement of 13% in farrowing rate response in parity 1 and 2 sows
- Improvement of 2.3 pigs born alive/litter over 2 parities observed
- Absolute improvements of .4-1 piglet/litter
- Lengthening of sow productive lifespan > reduced culling level

Musculature and Leanness

- Positive reduction in backfat
- Positive increase in Loin eye area
- Positive increase in carcass protein and dressing percentage
- No improvement in ADG is expected
- Improvement in FCR from 0 - 7%

Sources:

1. Effect of Dietary Chromium on Sow Productivity
K.W. Purser, Quincy, ILL.
2. Guidelines for Use of Chromium Picolinate in Swine Diets
Chromium Leadership Conference
3. Chromium and Enhanced Reproductive Efficiency in Swine
W.E. Trout, Univ. of Missouri

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