Research Now

Progeny Skeletal Development Improved When Broiler Breeders Fed Zn, Mn and Cu from Availa®ZMC

Introduction:

Previous studies have demonstrated improvements in chick quality (size, weight, livability) with the use of trace minerals in the form of Zinpro Performance Minerals® in broiler breeder diets.

Bone deposition starts early in embryo development and is important for overall growth and health. Zinc, manganese and copper each play an important role in calcium metabolism and bone formation. The objective of this study was to investigate the effects of maternal dietary Zn, Mn and Cu source and level on egg composition, embryo bone development (at d 10, 14 and 18 of incubation) and histological tibia morphometry (at hatch).

Material and Methods:

- 1920 embryos (Cobb 500)
- Samples taken at different breeder ages (30, 40, 50 and 60 weeks of age)
- Embryo long bones were stained (Alcian Blue for cartilage; Alizarin Red for calcified bones) and bone width and length were recorded
- Tibia and femur length and thickness were measured at d 10, 14, 18 of incubation and at hatch

Treatments:

Three treatments (two-diets regimen during production cycle wk 22 to 32 and wk 33 to 68):

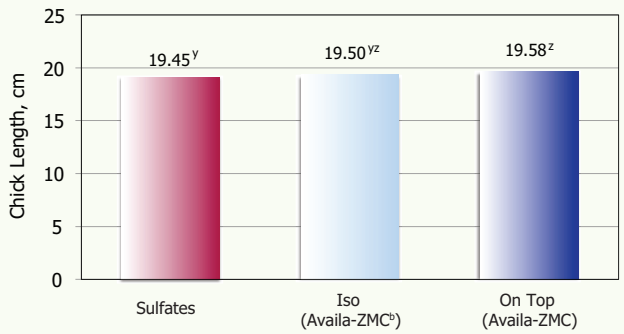
- Sulfates (100 ppm Zn, 100 ppm Mn and 10 ppm Cu)
- Iso (60 ppm Zn, 60 ppm Mn and 3 ppm Cu from Sulfates plus 40 ppm Zn, 40 ppm Mn and 7 ppm Cu from Availa®ZMC)
- On Top (Sulfates plus 40 ppm Zn, 40 ppm of Mn and 7 ppm Cu, from Availa-ZMC)

Results:

Embryos from breeders fed Availa-ZMC had:

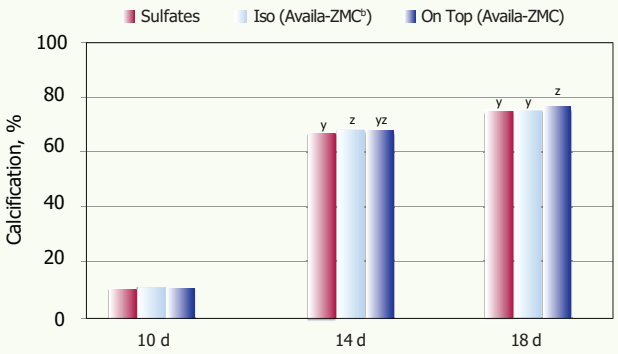
- Higher relative calcification of tibia and femur at 18 d
- Thicker tibias and femurs at 18 d, $P < 0.05$
- Thicker tibias at hatch
- Larger size at hatch

Chick Length[a] At Hatch



[a] Chick length taken from beak tip to middle toe end
[b] Availa-ZMC: Availa®Zn zinc amino acid complex, Availa®Mn manganese amino acid complex and Availa®Cu copper amino acid complex
[yz] Means lacking a common superscript letter differ, $P < 0.05$

Relative Calcification of Embryo Tibias[a]



[a] Values expressed as percentages of the total length (mm)
[b] Availa-ZMC: Availa-Zn zinc amino acid complex, Availa-Mn manganese amino acid complex and Availa-Cu copper amino acid complex
[yz] Within a day, means lacking a common superscript letter differ, $P < 0.05$

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Abstract

Embryo Bone Development of Cobb 500 Breeder Hens Fed Diets Supplemented with Organic and Inorganic Sources of Zinc, Manganese and Copper A. Favero*[1], S. L. Vieira[1], R. Angel[2], D. Taschetto[1], T. Ward[3], and M. A. Rebollo[3]. [1]Departamento de Zootecnia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, [2]University of Maryland, College Park, MD, [3]Zinpro Corporation, Eden Prairie, Minnesota.

The trace minerals Zn, Mn and Cu are important and essential for the normal growth of the broiler embryo. The increased bioavailability of organic trace minerals compared to inorganic forms has been demonstrated and can influence embryo development. The objective of this study was to investigate the effects of maternal dietary Zn, Mn and Cu source and level on egg composition, embryo bone development at d 10, 14 and 18 of incubation and histological tibia morphometry at hatch. The inorganic source was from sulfate sources whereas the organic form was from a commercial metal-amino acid (metal-AA) complex combination (Availa®Mins). The treatments were fed to Cobb 500 broiler breeder hens (in ppm of Zn, Mn and Cu, respectively): 100, 100 and 10 from sulfate (Control); a mixture of 60, 60, and 3 from sulfate plus 40, 40, and 7 from the metal-AA complex (Iso); and the Control treatment plus 40, 40 and 7 from the metal-AA complex (On Top). Treatments were fed from 22 to 68 weeks. Each treatment had 10 replications of 20 females and 2 males. Eggs were incubated from eggs produced at 30, 40, 50 and 60 weeks of breeder age and 5 embryos per replicate were collected at d 10, 14 and 18 of incubation. Bone length, mid-shaft width and mineralization [(calcified tissue/whole bone)*100] were measured for tibia and femur stained with Alcian Blue and Alizarin Red S. At hatch, the right tibias of five chicks per replicate were sampled to evaluate diaphysis bone plate thickness and mid-shaft width and epiphysis growth plate thickness and area. Data were analyzed using repeated measures (PROC Mixed) of SAS. Feeding Iso treatment compared to the Control diet increased the Zn content of the yolk and albumen blend ($P < 0.05$), however, the same effect was not observed for Mn and Cu ($P > 0.05$). No differences were found in bone development for 10 d embryos ($P > 0.05$). At 14 d the embryos from the Iso and On Top treatments had greater tibia mineralization [(1.6% and 1%, respectively ($P < 0.07$)]. The 18 d embryo from hens fed Iso and On Top treatments had 2% thicker tibiae and femurs compared to embryos from hens fed the Control, regardless of hen age ($P < 0.05$). Tibia mineralization in 18 d embryo was greater (1.1%) from hens fed the On Top treatment ($P < 0.05$). At hatch the diaphysis mid-shaft width increased for chicks from hens fed the Iso and On Top treatments compared to the Control diet ($P < 0.05$). The addition of amino acid-complexed source of Zn, Mn and Cu increased embryonic and post-hatch bone development.

Key Words: broiler breeder, organic minerals, egg composition, tibia, femur, bone development

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