

REFERENCES

- AAFCO. 2000. **Association of American Feed Control Officials: Official Publication.** The Association, Atlanta, GA.
- Ahn, S.H., Um, J.S., Kim, D.H. and Paik, I.K. 1998. Effects of the sources and levels of supplemental zinc on the performance of weanling pigs. **Korean J. Anim. Sci.** 40:9 – 20.
- Ahn, S.H., Um, J.S. and Paik, I.K. 1999. Effects of dietary sources and levels of zinc on the performance and characteristics of serum and faeces in weanling pigs. **Korean J. Anim. Sci.** 41:607 – 616.
- Albion. 1992. Zinc: The multifaceted trace mineral!. **Albion Research Notes.** 1(3):1 – 4.
- Albion. 1995. Albion's metal amino acid chelates 'dipeptide like'. **Albion Research Notes.** 4(1):1 – 6.
- Albion. 2000. Minimum chelation requirements. **Albion Research Notes.** 9(2):1 – 4.
- Albion. 2004. Zinc: A mineral of complex biological activity. **Albion Research Notes.** 13(1):1 – 3.
- AOAC. 1990. **Official method of analysis.** 15th ed. Washington, D.C.: Association of Official Analytical Chemists.
- Ashmead, H.D. 1992. **The role of amino acid chelates in animal nutrition.** New Jersey: Noyes Publications. 479 p.
- Ashmead, H.D., Graff, D.J. and Ashmead, H.H. 1985. **Intestinal absorption of metal ions and chelates.** Illinois: Charles C Thomas. 251 p.
- Borges, F.M.O. and Oliveira 2003. Zinc availability and plasmatic levels in cats supplemented with organic and inorganic sources. Final report. Universidade Federal de Lavras, MG. [Online]. Available from E-mail : borgesvet@ufla.br [2005, November 18]

- Borges, F.M.O. and Silva Jr., J.W. n.d. **Evaluation of three zinc sources administered in therapeutic doses to cats.** Final report. Universidade Federal de Lavras, MG. [Online]. Available from E-mail : borgesvet@ufla.br [2005, November 18]
- Brinkhaus, F., Mann, J., Zorich, C. and Greaves, J.A. 1998. Bioavailability of zinc propionate in dogs. *J. Nutr.* 128:2596S – 2597S.
- Burger, I.H. and Rivers J.P.W. 1989. **Nutrition of the dog and cat.** Cambridge: Cambridge University Press. 136 p.
- Cao, J., Henry, P.R, Guo, R., Holwerda, R.A., Toth, J.P., Littell, R.C., Miles, R.D. and Ammerman, C.B. 2000. Chemical characteristics and relative bioavailability of supplemental organic zinc sources for poultry and ruminants. *J. Anim. Sci.* 78:2039 – 2054.
- Carlson, M.S., Hill, G.M. and Link, J.E. 1999. Early-and traditionally weaned nursery pigs benefit from phase-feeding pharmacological concentrations of zinc oxide: Effect of metallothionein and mineral concentrations. *J. Anim. Sci.* 77:1199 – 1207.
- Carlson, M.S., Boren, C.A., Wu, C., Huntington, C.E., Bollinger, D.W. and Veum, T.L. 2004. Evaluation of various inclusion rates of organic zinc either as polysaccharide or proteinate complex on the growth performance, plasma, and excretion of nursery pigs. *J. Anim. Sci.* 82:1359 – 1366.
- Case, L.P., Carey, D.P., Hirakawa, D.A. and Daritotle, L. 2000. **Canine and feline nutrition : a resource for companion animal professionals.** 2nd ed. St. Louis: Mosby, 592 p.
- Colombini, S. 1999. Canine zinc-responsive dermatitis. *Dermatology.* 29(6):1373 – 1383.
- Edwards, H.M. and Baker, D.H. 2000. Zinc bioavailability in soybean meal. *J. Anim. Sci.* 78:1017 – 1021.

- França, J., Borges, F.M.O., Silva Júnior, J.W., Nimajiri, L.N., Nunes, M.B., Chunha, L.P.C., Salán, M.O., Chizzotti, A.F., Pinto, A.B.F., Valério, A.G. 2005. **Digestibility and retention of zinc in cats: The effects of three dietary supplements.** In: Alltech's 21st annual(Suppl. 1) symposium, Lexington, Create, innovate, elevate, nutritional in the feed and food industries. Lexington, Kentucky, USA: Alltech.
- Gropper, S.S., Smith, J.L. and Groff, J.L. 2005. **Advanced nutrition and human metabolism.** 4th ed. Australia: Thomson Wadsworth. 600 p.
- Hahn, J.D. and Baker, D.H. 1993. Growth and plasma zinc responses of young pigs fed pharmacologic levels of zinc. *J. Anim. Sci.* 71:3020 – 3024.
- Hall, V.L., Ewan, R.C. and Wannemuehler, M.J. 1993. Effect of zinc deficiency and zinc source on performance and immune response in young pigs. *J. Anim. Sci.* 71(Suppl.1):173. [Abstract]
- Hammond, G.M., Loewen, M.E. and Blakley, B.R. 2004. Diagnosis and treatment of zinc poisoning in a dog. *Vet. Human Toxicol.* 46(5):272 – 275.
- Hellman, H. and Carlson, M. 2003. **Feeding organic and inorganic sources of trace minerals for swine production.** [Online]. Available from : <http://muextension.missouri.edu/explorepdf/agguides/ansci/G02323.pdf> [2005, July 25]
- Kaji, M. 2001. Zinc in endocrinology. *Int. Pediatr.* 16(3):1 – 7.
- Kaneko, J.J. 1989. **Clinical biochemistry of domestic animals.** 4th ed. San Diego: Academic Press. 932 p.
- Kirk, R.W. and Bonagura, J.D. 1992. **Current veterinary therapy XI: small animal practice.** Philadelphia: W.B. Saunders. 1348 p.
- Kidd, M.T., Ferket, P.R. and Qureshi, M.A. 1996. Zinc metabolism with special reference to its role in immunity. *World's Poult. Sci. J.* 52:309 – 324.

- Kuhlman, G. and Rompala, R.E. 1998. The influence of dietary sources of zinc, copper and manganese on canine reproductive performance and hair mineral content. *J. Nutr.* 128:2603S – 2605S.
- Lowe, J.A., Wiseman, J. and Cole D.J.A. 1994a. Absorption and retention of zinc when administered as an amino-acid chelate in the dog. *J. Nutr.* 124:2572S – 2574S.
- Lowe, J.A., Wiseman, J. and Cole D.J.A. 1994b. Zinc source influences zinc retention in hair and hair growth in the dog. *J. Nutr.* 124:2575S – 2576S.
- Lowe, J.A. and Wiseman, J. 1998. A comparison of the bioavailability of three dietary zinc sources using four different physiologic parameters in dogs. *J. Nutr.* 128:2809S – 2811S.
- Lowell, J.A. 1993. *Pet skin and haircoat problems : tests and treatments : for veterinary technicians*. Trenton, N.J.: Veterinary Learning Systems. 1 v.
- Maison, T. 2001. *The effect of supplemental microbial phytase on the utilization of calcium, phosphorus, magnesium, iron, zinc, copper, and manganese in weanling pig diet*. Master's Thesis. Department of Animal Husbandry, Agriculture, Kasetsart University.
- Marsh, K.A., Ruedisueli, F.L., Coe, S.L. and Watson, T.D.G. 2000. Effect of zinc and linoleic acid supplementation on the skin and coat quality of dogs receiving a complete and balanced diet. *Vet. Derm.* 11:277 – 284.
- McDonald, P. 1995. *Animal nutrition*. 5th ed. Edinburgh: Peason Education Limited, 607 p.
- McDowell, L.R. 2003. *Minerals in animal and human nutrition*. 2nd ed. Amsterdam: Elsevier science. 644 p.
- Melman, S.A. 1994. *Skin diseases of dogs and cats*. Maryland: DermaPet. 264 p.
- Muller, G.H. and Kirk, R.W. 1976. *Small animal dermatology*. 2nd ed. Philadelphia: W.B. Saunders. 809 p.

- Muller, G.H. 1995. **Small animal dermatology**. 5th ed. Philadelphia: W.B. Saunders Company. 1213 p.
- NRC. 2006. **Nutrient requirements of dogs and cats**. Washington, D.C.: National Academies Press. 398 p.
- O'Dell, B., Miller, E.R. and Miller, W.J. 1979. **NFIA Literature review on copper and zinc in poultry, swine and ruminant nutrition**. West Des Moines: National Feed Ingredients Association. 72 p.
- O'Keefe, L. n.d. **Dog skin anatomy illustration**. [Online]. Available from : <https://www.ivart.com/html/title2/illustration/dogskinanatomy.htm> [2007, June 23]
- Pond, W.G., Church, D.C. and Pond, K.R. 1995. **Basic animal nutrition and feeding**. 4th ed. New York: John Wiley & sons. 615 p.
- Puls, R. 1990. **Mineral levels in animal health**. 3rd ed. British Columbia: Sherpa international. 240 p.
- Qualitech. n.d. **SQM and organic production**. [Online]. Available from : http://www.qualitechco.com/europe/sqm_organic_production.htm [2005, June 24]
- Revy, P.S., Jondreville, C., Dourmad, J.Y., Guinotte, F. and Nys, Y. 2002. Bioavailability of two sources of zinc in weanling pigs. *Anim. Res.* 51:315 – 326.
- Rink, L. and Gabriel, P. 2000. Zinc and immune system. *Proc. Nutr. Soc.* 59:541 – 552.
- Rink, L. and Kirchmer, H. 2000. Zinc-altered immune function and cytokine production. *J. Nutr.* 130:1407S – 1411S.
- Rook, J. and Walton, G.S. 1965. **Comparative physiology and pathology of the skin**. Oxford: Blackwell Scientific. 794 p.
- Rupic, V., Ivandija, L., Luterotti, S. and Dominis-Kramaric, M. 1997. Influence of inorganic and organic dietary zinc on its concentration in blood serum, bone and hair and on catalytical activity of some serum enzymes in pigs. *Acta Vet. Brno.* 66:75 – 85.

- SAS. 1988. **SAS User's guide : Statistics**. North Carolina: SAS Institute Inc. 584 p.
- Schell, T.C. and Kornegay, E.T. 1996. Zinc concentration in tissues and performance of weanling pigs fed pharmacological levels of zinc from ZnO, Zn-Methionine, Zn-Lysine, or ZnSO₄. **J. Anim. Sci.** 74:1584 – 1593.
- Scott, M.L., Nesheim, M.C. and Young, R.J. 1976. **Nutrition of the chicken**. 2nd ed. New York: M.L. Scott & Associates. 555 p.
- Scrimgeour III, W.A. 2004. **Building an effective organic trace mineral**. [Online]. Available from : http://www.afma.co.za/AFMA_Template/feedpaper13.html [2005, July 23]
- Spears, J.W. 1996. Organic trace mineral in ruminant nutrition. **Anim. Feed Sci. Tech.** 58:151 – 163.
- Sullivan, D.M. and Carpenter, D.E. 1993. **Method of analysis for nutrition labeling**. Virginia: AOAC International. 624 p.
- Swanson, K.S., Kuzmuk, K.N., Schook, L.B. and Fahey, Jr., G.C. 2004. Diet affects nutrient digestibility, hematology, and serum chemistry of senior and weanling dogs. **J. Anim. Sci.** 82:1713 – 1724.
- Swinkels, J.W.G.M., Kornegay, E.T., Zhou, W., Lindemann, M.D., Webb, Jr., K.E. and Verstegen, M.W.A. 1996. Effectiveness of a zinc amino acid chelate and zinc sulfate in restoring serum and soft tissue zinc concentrations when fed to zinc-depleted pigs. **J. Anim. Sci.** 74:2420 – 2430.
- Thoday, K.L. 1989. Diet-related zinc-responsive skin disease in dogs: a dying dermatosis?. **J. Small. Anim. Prac.** 30:213 – 215.
- Tomlinson, D.J., Mülling, C.H. and Fakler, T.M. 2004. Invited review: Formation of keratins in the bovine claw: Roles of hormones, minerals, and vitamins in functional claw integrity. **J. Dairy Sci.** 87:797 – 809.
- Toya, T., Jotaki, R. and Kato, A. 1986. **Specimen preparation in EPMA and SEM**. Tokyo: JEOL. 119 p.

- Tscharner, C.V. and Halliwell, R.E.W. 1990. *Advances in veterinary dermatology*. Philadelphia: Billier Tindall. 500 p.
- Underwood, E.J. 1977. *Trace elements in human and animal nutrition*. 4th ed. New York: Academic Press. 545 p.
- Valberg, L.S., Flanagan, P.R., Brennan, J. and Chamberlain, M.J. 1985. Does the oral zinc tolerance test measure zinc absorption. *Amer. J. Clin. Nutr.* 41:37 – 42.
- Van den Broek, A.H.M. 1988. Diagnostic value of zinc concentrations in serum, leucocytes and hair of dogs with zinc-responsive dermatosis. *Res. Vet. Sci.* 44:41 – 44.
- Van den Broek, A.H.M. 1993. A standardized oral zinc tolerance test for assessment of zinc absorption in dogs. *Vet. Res. Com.* 17:3 – 11.
- van Heugten, E., Spears, J.W., Kegley, E.B., Ward, J.D. and Qureshi, M.A. 2003. Effects of organic forms of zinc on growth performance, tissue zinc distribution, and immune response of weanling pigs. *J. Anim. Sci.* 81:2063 – 2071.
- Vandergrift, B. 1994. *Bioplexes trace mineral proteinate*. New York: Alltech, Inc. 331 p.
- Volmer, P.A., Roberts, I. and Meerdink, G.L. 2004. Anuric renal failure associated with zinc toxicosis in dog. *Vet. Human Toxicol.* 46(5):276 – 278.
- Ward, T.L., Asche, G.L., Louis, G.F. and Pollmann, D.S. 1996. Zinc-methionine improves growth performance of starter pigs. *J. Anim. Sci.* 74 (Suppl. 1):182. [Abstract]
- Wedekind, K.J., Lewis, A.J., Giesemann, M.A. and Miller, P.S. 1994. Bioavailability of zinc from inorganic and organic sources of pigs fed corn-soybean meal diets. *J. Anim. Sci.* 72:2681 – 2689.
- Wilaison, S. 2002. *Responses of Zn-proteinate supplementation on pig performance and serum Zn concentration*. Master's Thesis. Department of Animal Husbandry, Agriculture, Kasetsart University.

- Williams, C.H., David, D.J. and Iismaa, O. 1962. The determination of chromic oxide in feces samples by atomic absorption spectrophotometry. *J. Agr. Sci.* 59:381.
- Yu, Z.P., Le, G.W. and Shi, Y.H. 2005. Effect of zinc sulphate and zinc methionine on growth, plasma growth hormone concentration, growth hormone receptor and insulin-like growth factor-I gene expression in mice. *Clin. Exp. Pharm. Physiol.* 32:273 – 278.
- Zgurski, J. n.d. **The origin of the domestic dog, *Canis familiaris*.** [Online]. Available from : <http://canidae.ca/dog.htm> [2005, December 17]
- Ziegler, E.E. and Filer, L.J. 1996. **Present knowledge in nutrition.** 7th ed. Washington, D.C.: ILSI Press. 684 p.
- Zinpro. 2005. **Product information.** [Online]. Available from : <http://us.zinpro.com/information/productinfo.htm> [2005, September 15]
- Zinpro. n.d. **Zinc supplement for dogs.** [Online]. Available from : <http://www.lincolnbiotech.com/p0000047.htm> [2005, July 14]

BIOGRAPHY

Miss Thanisara Preedapattaraong was born on May 9, 1982 in Bangkok, Thailand. She graduated from the Faculty of Agro-Industry, Kasetsart University. She received Bachelor degree of Science of the Physico-Chemical Processing Technology in 2004. She admitted with the degree of Master of Science, Department of Animal Husbandry, Faculty of Veterinary Science, Chulalongkorn University in 2004.