Biological Evaluation of Different Di-calcium Phosphate Produced in Iran and Comparison of Their Impacts on Performance and Bone Characteristics in Male Broiler Chicks

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Abstract

The objective of this study was to determine the relative biological value of several different di-calcium phosphates (DCPs) produced in Iran. The samples of DCPs were randomly taken from the final product of 26 domestic DCP production factories that were active at the time of the study in 12 different provinces. After analyzing and determine the standard indices, only 7 samples of Di-calcium phosphate which had the national standard were chosen. Seven hundred and twenty day-old male Ross 308 broiler chicks were purchased and randomly divided into 8 dietary treatments with 6 replicates of 15 birds in each. The birds were kept and reared in battery cage system for 21 days. Phosphoric acid (85%) was used to provide the phosphorus in control and different DCP samples were included as the source of phosphorus in other treatments. Body weight gain, feed consumption, and feed conversion ratio were calculated on days of 10 and 21. At the end experimental period (21 days) the amount of ash, calcium and phosphorus of tibia bones was measured. There was no significant difference between control and experimental treatments in terms of the production indices on 21 days of age, but a significant difference was observed in body weight gain between control and treatment F on 10 days of age. There was no significant difference in bone ash content of control and experimental treatments. The amounts of tibia calcium were significantly lower in treatments F and G than those of control. Amount of bone phosphorus in B, C, F and G treatments were significantly lower than control. The relative biological values of the experimental samples (DCPs), according to two indices of body weight gain and bone ash for the samples of Di-calcium phosphate A, B, C, D, E, F, and G were estimated 98.1, 103.3, 96.9, 100.2, 97.9, 94.0, and 100.2 percent, respectively. According to the results of this study it could be concluded that some of the domestic DCPs had not the necessary standards, while some of them have high and acceptable biological value.

Key world: Di-calcium Phosphate, Biological Evaluation, Performance, Bone, Broilers

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Refrencses

Adeola, O. and Cowieson, A.J. (2011). Opportunities and challenges in using exogenous enzymes to improve non-ruminant animal production. Journal of Animal Science, 89: 3189-3218.

Ammerman, C.B. (1995). Methods for estimation of mineral bioavailability, in: Ammerman, B., Baker, D.H. and Lewis, A.J. Bioavailability of Nutrients for Animals: Amino Acids, Minerals, and Vitamins, San Diego, Academic Press, Pp: 83-94.

Bikker, P.; Spek, J.W.; Van Emous, R.A. and Van Krimpen, M.M. (2016). Precaecal phosphorus digestibility of inorganic phosphate sources in male broilers. British Poultry Science, 57(6): 810-817.

Coon, C.N.; Seo, S. and Manangi, M.K. (2007). The determination of retainablephosphorus, relativebiological availability, and relative biological value of phosphorus sources for broilers. Poultry Science, 86: 857-868.

Coon, C.; Leske, K. and Seo, S. (2002). The availability of calcium and phosphorus in feedstuffs. In: McNab, J.M. and Boorman, K.N. Poultry Feedstuffs: Supply, Composition and Nutritive Value, (CAB International). Pp: 151-179.

De groote, G. and Huyghebaert, G. (1997). The bioavailability of phosphorus from feed phosphates for broilers as influenced by bio-assay method, dietary Ca-level and feed form. Animal Feed Science and Technology, 69(4): 329-340.

Fernandes, J.I.M.; Lima, F.R.; Mendonca, Jr., C.X., Mabe, I., Albuquerque, R. and Leal, P.M. (1999). Relative bioavailability of phosphorus in feed and agricultural phosphates for poultry. Poultry Science, 78(12): 1729-1736.

Fritz, J.C.; Roberts Fritz, T.; Boehne, J.W. and Hove, E.L. (1969). Factors affecting the chicks requirement for phosphorus. Poultry Science, 48(1): 307-320.

Gillis, M.B.; Edwards, Jr., H.M. and Young, R.J. (1962). Studies on the availability of calcium orthophosphates to chickens and turkeys. Journal of Nutrition, 78(2): 155-161.

Huyghebaert, G.; De Groote, G. and Keppens, L. (1980). The relative biological availability of phosphorus in feed phosphates for broilers. Annales de Zootechnic, 29: 245-263.

Khattak, F.M.; Shahzad, M.A.; Pasha, T.N. and Saleem, G. (2016). Comparative evaluation of commercially available supplementary sources of inorganic phosphorus in broiler feed. The Journal of Animal and Plant Sciences, 26(6): 1576-1581.

Li, X.; Zhang, D.; Yang, T.Y. and Bryden, W.L. (2016). Phosphorus Bioavailability: A Key Aspect for Conserving this Critical Animal Feed Resource with Reference to Broiler Nutrition. Agriculture, 6(2): 1-15.

Lima, F.R.; Mendonca, Jr., C.X.; Alvarez, J.C.; Garzillo, J.M.F.; Ghion, E. and Leal, P.M. (1997). Biological evaluations of commercial di-calcium phosphates as sources of available phosphorus for broiler chicks. Poultry Science, 76(12): 1707-1713.

Lima, F.R.; Mendonca, C.X. Jr.; Alvarez, J.C.; Ratti, G.; Lenharo, S.L.R.; Kahn, H. and Garzillo, J.M.F. (1995). Chemical and physical evaluations of commercial di-calcium phosphates as sources of P in animal nutrition. Poultry Science, 74(10): 1659-1670.

Littell, R.C.; Lewis, A.J. and Henry, P.R. Statistical Evaluation of Bioavailability Assays. In: Ammerman, B., Baker, D.H. and Lewis, A.J. (1995). Bioavailability of Nutrients for Animals: Amino Acids, Minerals, and Vitamins. San Diego, Academic Press, Pp: 5-12.

Liu, Y.; Villalba, G.; Ayres, R.U. and Schroder, H. (2008). Global phosphorus flows and environmental impacts from a consumption perspective. Journal of Industrial Ecology, 12(2): 229-247.

Moshgeli, A.; Pourreza, J. and Samie, A. (2008). Assessment of phosphorus bioavailability of several different samples of Di-calcium phosphate and their effects on performance of laying hens. Journal of Water and Soil Science. 12 (43) :483-493.

Nelson, T.S. (1967). The utilization of phytate phosphorus by poultry-A review. Poultry Science 46(4): 862-871.

NRC (National Research Council). (1994). Nutrient Requirements of Poultry. Ninth Revised Edition, National Academy Press, Washington, D.C. P: 27.

Potchanakorn, M. and Potter, L.M. (1987). Biological values of phosphorus in various sources for young turkeys. Poultry Science, 66(3): 505-513.

Potter, L.M.; Potchanakorn, M.; Ravindran, V. and Kornegay, E.T. (1995). Bioavailability of phosphorus in various phosphate sources using body weight and toe ash as response criteria. Poultry Science, 74(5): 813-820.

Rama Rao, S.V.; Raju M.V.L.N.; Reddy, M.R. and Pavani P. (2006). Interaction between dietary calcium and non-phytate phosphorus levels on growth, bone mineralization and mineral excretion in commercial broilers. Animal Feed Science and Technology, 131(1-2): 135-150.

Shastak Y. and Rodehutscord, M. (2013). Determination and estimation of phosphorus availability in growing poultry and their historical development. World's Poultry Science Journal, 69(3): 569-586.

Shastak, Y.; Witzing, M.; Hartung, K. and Rodehutscord, M. (2012). Comparison and evaluation of bone measurements for the assessment of mineral phosphorus sources in broilers. Poultry Science, 91(9): 2210-2220.

Steel, R.G.D. and Torrie, J.H. (1980). Principles and Procedures of Statistics: A Biometrical Approach. 2nd ed. McGraw-Hill Book Co., New York, NY. Pp: 334-367.

Suttle, N.F. (2010). Mineral Nutrition of Livestock: 4th ed Wallingford, UK, CABI Pp: 122-167.

Sullivan, T.W. (1966). A triple response method for determining biological value of phosphorus sources with young turkeys. Poultry Science, 45(6): 1236-1245.

Sullivan, T.W.; Douglas, J.H.; Gonzalez, N.J. and Bond Jr., P.L. (1992). Correlation of biological value of feed phosphates with their solubility in water, dilute hydrogen chloride, dilute citric acid, and neutral ammonium citrate. Poultry Science, 71(12): 2065-2074.

Vandepopuliere, J.M.; Ammerman, C.B. and Harms, R.H. (1961). The relationship of calcium/phosphorus ratios to the utilization of plant and inorganic phosphorus by the chick. Poultry Science, 40(4): 951-957.

Yoshida, M.; Ishikawa, M.; Nakajima, H. and Hotta, S. (1979). Solubility of phosphorus in citric acid solution as an index of biological availability. Japanese Poultry Science, 16(5): 290-292.

Yoshida, M. and Hoshii, H. (1979). Monobasic calcium-phosphate as a standard for bioassay of phosphorus availability. Japanese Poultry Science, 16(5): 271-276.

Yan, F.; Kersey, .J.H. and Waldroup, P.W. (2001). Phosphorus requirements of broiler chicks three to six weeks of age as influenced by phytase supplementation. Poultry Science, 80(4): 455-459.