The effect of calcium and available phosphorus levels on the performances of growing meat type Japanese quail: 1. Effects on body weight, weight gain, feed consumption and feed efficiency

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Abstract

In a 28 day trial (7-35 day of age), 800 meat type Japanese quail chicks were used to determine the effect of different Ca and (aP) levels. The diets based on corn-wheat-corn gluten meal were formulated in a complete isonutrient basis except Ca and aP. Chicks were kept in a complete randomized 3 x 3 factorial design. Three level of Ca (1, 0.8 and 0.6%) and aP (0.4, 0.3 and 0.16 %) were used. There were 4 replicates of 20 chicks per treatment). First week was pre experimental and chicks were fed commercial starter quail diet. Next four weeks, chicks were fed ad libitum the experimental diets. Feed consumption (FC), feed conversion ratio (FCR); body weight (BW) and body weight gain (WG) were measured weekly. At the start of experiment body weight was not statistically different (>0.986). Body weight was statistically affected by different Ca and aP levels after 7 and 14 days of the experimental phase; (>0.0006 and 0.0024) but not after 21 and 28 days of experimental phase (0.406 and 0.861). WG was statistically significant immediately after first week of trial (>0.0001), but total WG (7-35days) was not statistically significant (>0.861). FC and FCR where statistically affected (P=0.039 and 0.0049) only during first 7 days of experiment. It is concluded that the best performances are achieved with 0.8% Ca and 0.30% aP but the quail were also able to maintain normal growth when fed extremely low Ca:aP levels (0.6 to 0.16%).

Keywords: Japanese quail; Calcium; Phosphorus; body weight; feed consumption

Introduction

Of 12 minerals considered to be essential for poultry, Calcium (Ca) and Phosphorus (P), still remains two of minerals attracting nutritionists and producers as well more than any other mineral (Coon et al., 2002). Ca and P are important and required because they are main constituents of skeleton. Their importance is quantitative, since they make up at least 50% of bone ash (Mc Donald et al., 2002; Underwood and Suttle, 1999), and qualitative being so much implicated in physiological activities that is difficult to find a process where Ca and P are not involved playing a direct or an indirect role (Pond et al., 1995; McDowel, 2003; Rama Rao et al., 2006)).

Albeit a 40 year history of research on the effects of Ca and P in poultry nutrition (Rama Rao et al., 2006), publications on the effects of Ca and P interaction are scarce. Compared to other game birds, requirements of Japanese quail are more documented (NRC, 1994) but are to fare to be compared with other domestic fowl and they are almost missing last 20 years. Nutrient requirements of Japanese quail

are often simple extrapolations of results from the other poultry (Minivielle (2004) but they are not the same with the chickens in terms of poultry production and what is true for chickens is not always true for quails (Cheng dhe Kimura, 1990). The most comprehensive review on the nutrition of Japanese quail is prepared by Shim and Vohra (1984). They have concluded that requirements of quails for Ca and aP seem to be higher than for other fowl at comparable ages.

The objective of this experiment was to see the effect of different Ca and aP levels, and their ratio on body weight and feed parameters of growing meat type Japanese quail from 7-35 day of age.

Material and methods

800 day old meat type Japanese quails hatched at Research Station Unterer Lindenhof of University of Hohenheim were used. Quails were grouped in 36 replicates and fed commercial quail starter diet for 7 days. This period is used to make replicates as uniform as possible in body weight (P=0.9857). In a fully controlled environment, 24h lightning quails were kept in wooden boxes for 14 days and then transferred to wired cages, having *ad libitum* access to feed and water. To minimize wastage, feeding by giving small amount of feed was done in 2-3 portions a day. Nine experimental diets were made based on corn-wheat-corn gluten meal. Isonutrient basal diet was first produced except Ca and available phosphorus (aP) then mono calcium phosphate and limestone were used to adjust three Ca (1.0; 0.8; 0.6%) and three aP levels (0.4; 0.3; and 0.16%). Density of the diet was regulated using sand. Body weight (BW) and feed consumption (FC) were measured every week of trial and weight gain (WG) and feed conversion ratio (FCR) are calculated. JMP IN 5.1 statistical software of SAS was used to analyze data.

Results and discussion

Body weight of growing Japanese quail was significantly influenced after 7 and 14 day feeding experimental diets (P>0.0006 and 0.0024). The lowest body weight is observed in quails fed low aP and high Ca level (0.16 to 0.8 and 1%). This indicates that wide Ca:aP ratio (5 and 6.25:1) has negatively affected normal growth of Japanese quail (Table 1 and Fig.1).

Different Ca and aP levels has significantly affected weight gain of quails after 7 day of feeding (P=0.0001), but with the age quails have compensated this negative effect (P=0.4062) at the end of experiment. The overall weight gain was not significantly different between treatments (P=0.8610). Quails fed different Ca and aP levels shows different feed consumption and feed conversion results, but the effects are statistically significant only after first phase (for both FC and FCR) and after third phase just for FC. Level of either Ca nor aP or their interaction has not any significant effect at the end of experiment and on total FC (7-35d).

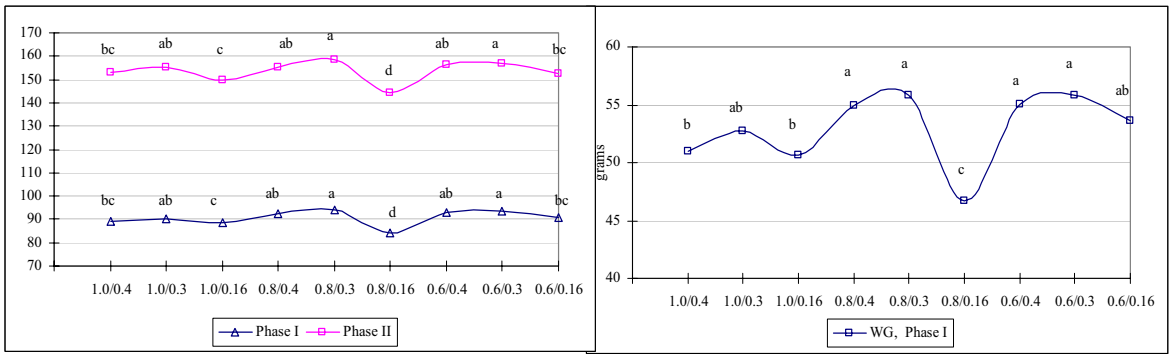

Figure 1. Effect of Ca and aP level on body weight after 7d and 14d and weight gain after 7 day

It is observed that low aP combined with three Ca levels ore wide Ca:aP ratio has depressed FC but these effect is not so expressed having in consideration that the Ca:ap ratio has ranged between 1.5-6.25:1).

As summarized by Shim and Vohra (1984), requirements of growing Japanese quail should be 0.8% for Ca and 0.3% aP. Results of present experiment are in a full agreement with this conclusion because best performances during first two phases of experiment are achieved with this level of Ca and aP. Effects of Ca and aP level on body weight in broilers are reported by many researchers (Rama Rao et al., 1999a and 1999b; Shafey et al., 1993, Driver et al., 2005, Karimi, 2005; Lillie et al., 1964; Lima et al., 1997). In general, results of these authors suggest that the level and the ratio of Ca and aP should be maintained in accordance and should be as close as possible to 2:1.

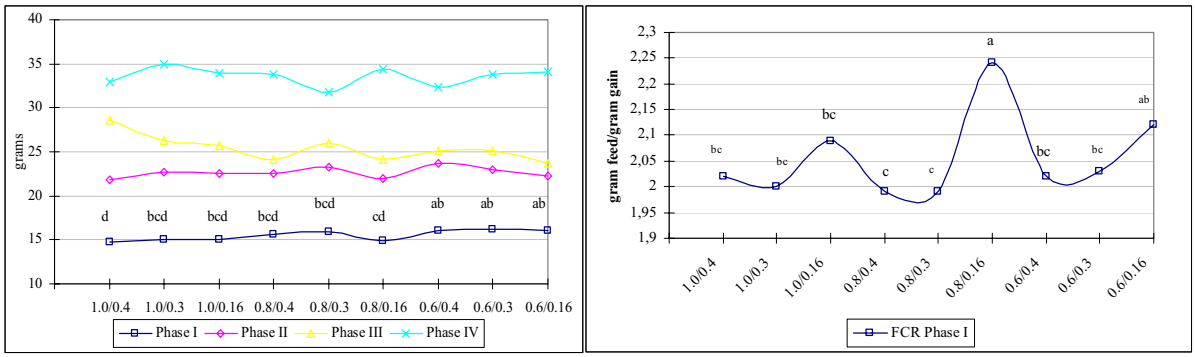

Figure 2. Effect of Ca and aP level on feed consumption and feed conversion ratio

Our results on the effects of these minerals on final age of Japanese quail shows no significant effect of level and the ratio of Ca and aP on body weight (P=0.6302), weight gain (P=0.8610), total feed consumption (P=0.7810). and feed conversion ratio (P=0.1369) This is in agreement with results of Redy et al., (1980) obtained in 4-5 week female Japanese quails who have observed no significant effect of the levels of Ca (0.5, 0.7, 0.9 and 1.1%) and P (0.5, 0.6 and 0.7%) respectively on body weight. Sacakli et al., (2006), have also reported no significant effect on body performances when the levels of aP and Ca were decreased from 0.35 to 0.2 and 1 to 0.8% respectively.

Ability of Japanese quails to be well adapted to different Ca and aP levels and/or ratios, demonstrated in present experiment is confirmed by Alfoteih and Bessei (University of Hohenheim, Germany-personal correspondence) who concluded that 21-28 day Japanese quail were able to manage without any adverse effects of the level of Ca up to 3.2% and aP 0.1%. This can possibly be explained as a result of feeding adequate Ca and aP prior to feeding experimental diets (seven days in our study and 21 day in experiment of Alfoteih and Bessei). The best FCR observed in quails fed low levels of Ca and all three aP levels in our experiment, is not in full agreement with results of Driver et al., (2005a) obtained in 16 day old broilers. They observed higher FC but better FCR for chicks fed 0.47% Ca and 0.24% aP (2:1 ratio) compared to those fed 0.86% Ca and 0.2% aP (4:1 ratio). Our results shows no big differences between ratios of 1.5; 2,5; 5 and even 6.25:1. Depressed feed consumption by decreasing aP level is not in accordance with results of Adeola and Sands, (2004), who reported significantly lower FC when aP level is increased over 0.45%. In present experiment high level of aP (0.4%) resulted in depressed FC only at the beginning of the experiment. In his experiments with broilers, Karimi (2005) found no significant effect of aP level on FC at any phase of the experiment but also reports improved FCR when chicks where fed 0.38 and 0.36% aP during starter and finisher phase respectively. There are also contradictory results of some other authors on the effect of Ca and aP level on feed consumption. Rama-Rao et al., (2006), reported that level of Ca, aP and their interaction had significantly depressed FC of broilers at 14, 28 and 42 when aP level was decreased from 0.35 to 0.3%. This is in contrast with our results but also with results of Redy et al., (1980) obtained in quails where Ca and aP level has not shown any negative effect on FC and FCR. Our results agree with those of Sacakli et al., (2006). Based on their research in Japanese quail, lowering aP level up to 0.2% associated with 0.8% Ca has not any significant effect on FC and FCR.

Results of our study demonstrates strong tolerance of growing meat type Japanese quail to Ca and aP levels and their interactions as well, when expressing these effects on body and feed parameters. It can be concluded that the best performances are achieved with 0.8% Ca and 0.30% aP but the ability of Japanese quail to compensate the negative effects of Ca and aP level and their ratio on body and feed parameters expressed at the start of experiment, leads to another conclusion that it is possible to reduce the level of Ca and aP up to 0.6 and 0.16% respectively.

References

ADEOLA O., and J. S. SANDS, 2004. Growth Performance, Bone Mineralization, and Nutrient Retention Responses of Chicks to Dietary Crude Protein and Non-phytate Phosphorus Concentrations. *International Journal. of Poultry. Science.* **3**:563-569.

CHENG, K.M., and M. KIMURA, 1990. Mutations and major variants in Japanese Quail. *In Poultry Breeding and genetics*, pp.333-363.

COON, C., K.LESKE, and S.SEO, 2002. The availability of calcium and phosphorus in feedstuffs. *In Poultry Feedstuffs*: Supply, composition and nutritive value. **26**:151-179.

DRIVER J.P, G.M. PESTI, R.I. BAKALLI, and H.M. EDWARDS JR. 2005. Effects of calcium and non phytate phosphorus concentrations on phytase efficacy in broiler chicks. *Poult Sci.,* **84**:1406-1417.

KARIMI A.,2005. Effect of Different Non-Phytate Phosphorus Levels and Phytase Sources on Performance in Broiler Chicks. *International Journal of Poultry Science* **4**:1001-1005.

LILLIE, R.J., P.F. TWINING and C,A. DENTON, 1964. Calcium and Phosphorus requirements of broilers as influenced by energy, sex and strain. *Poultry Science*, 1126-1131.

LIMA, F.R., C.X. MENDONÇA Jr., J.C. ALVAREZ, J.M.F. GARZILLO, E.GHION, and P.M. LEAL, 1997. Biological Evaluations of commercial di calcium phosphates as sources of available phosphorus for broiler chicks. *Poultry .Science*. **76**:1707–1713.

MCDONALD, P., R.A. EDWARDS, J.F.D. GREENHALGH and C.A. MORGAN, 2002. In: *Animal Nutrition*, 6th edition.

MCDOWEL. L.R., 2003. In: *Minerals in Animal and Human Nutrition*. 2nd Ed. Elsevier.

MINVIELLE, F., 2004.The future of Japanese quail for research and production. *World's Poultry Science Journal*, **60**:500-507.

National Research Council,1994. *Nutrient Requirements of Poultry*, 9th Edition. National Academy Press, Washington DC.

POND, W.G., D.C. CHURCH and K.R. POND, 1995. In: *Basic Animal Nutrition. and Feeding* (4th ed. 169-180.

RAMA RAO, S.V., V.R. REDDY and V.R.REDDY, 1999a. Enhancement of phytate phosphorus availability in the diets of commercial broilers and layers. *Animal Feed Science. and Technology*, **79**:211-222.

RAMA RAO, S.V.R., V.R. REDDY, and V.R. REDDY, 1999b. Non-phytate phosphorus requirements of commercial broilers and White Leghorn layers. *Anim. Feed Sci.Technol*, **80**:1-10.

RAMA RAO,S.V.,M.V.L.N.RAJU, M.R.REDDY, and P.PAVANI, 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**: 133–148

REDDY V.R., A.K.SHRIVASTAV, and V.R.SADAGOPAN, 1980. Calcium and phosphorus requirements of growing Japanese quail. *Brit. Poultry Science.* **21**:385-87.

SACAKLI, P., A.SEHU, A.ERGÜN, B.GENC and Z.SELCUK, 2006. The effect of Phytase and organic acid on growth performance, carcass yield and tibia ash in quails fed diets with low levels of non phytate phosphorus. *Asian-Aust. J.Anim. Sci.,* **19**:198-202.

SHIM, K.F., and P.VOHRA, 1984. A review of the nutrition of Japanese Quail. *World's Poultry Science Journal,* **40**:261-274.