Effect of phytase and limestone particle size on performance, eggshell quality, bone mineralization and mineral digestibility in laying hens

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The objective of this trial was to investigate the interaction between microbial phytase and limestone particle size (LmPS) in Lohmann Tradition laying hens. Seventy-two hens were used in a randomized complete block design according to a 2 × 2 factorial arrangement to evaluate the effect of two coarse limestone (CL) inclusion, *i.e.* a mix (MIX) of 75% CL (2-4 mm) and 25% fine particles (FL, <0.5 mm) or 100% FL, in two different basal diets formulated without (MIX0 and FL0) or with 300 FTU of phytase/kg diet (MIX300 and FL300). Diets contained equivalent levels of Ca (3.5%) and *a*P (0.30%) considering the P equivalency of phytase in MIX300 and FL300 diets. Performance and eggshell quality (eggshell proportion, weight, thickness and breaking strength) were measured from 31 to 35 week of age. At the end of the trial, bone parameters (tibia breaking strength, elasticity and ash), the apparent pre-caecal digestibility (APCD) of P and Ca and the phytic P (PP) disappearance at the ileal level were determined. No differences were observed between treatments on feed intake, feed conversion ratio and bone parameters, confirming the phytase equivalency. Feeding MIX diet increased the eggshell proportion, weight and thickness in the group receiving the diet without phytase (+6.5%, +6.9%, and +4.5%, respectively; Phytase × LmPS, $P < 0.05$) in comparison to group fed FL0 diet. Phytic P disappearance at the ileal level was increased with phytase in hens receiving the MIX diet (+30 percentage points; Phytase × LmPS, $P = 0.005$). The APCD of P was reduced in diets with phytase and FL (Phytase × LmPS, $P < 0.001$). The lower availability of P observed when using exclusively FL can be explained by the formation of complexes between Ca and phytic acid within the gastrointestinal tract. Phytase and MIX together increased the APCD of Ca by 7.3 percentage points (Phytase × LmPS, $P < 0.001$) in comparison to FL diet. In conclusion, addition of CL heightens the effect of microbial phytase on P and Ca digestibility, partly by reducing the formation of phytate-Ca complexation.

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