180 Broiler chicks’ response to high dose of coccidia vaccine challenge on nutrient and energy utilization, gut inflammation, and nutrient transporters. S. A. Adedokun* and T. J. Applegate, Purdue University, Department of Animal Sciences, West Lafayette, IN.

One hundred twenty-eight 14-d-old broiler chicks were used to investigate the effect of high dose of coccidia vaccine challenge (25 times normal dose) on energy and nutrient digestibility and utilization and its effects of intestinal mucosal inflammation and gut integrity in 21- and 27-d-old broilers. All birds were fed a standard broiler starter diet from 0–14 after which they were allocated to 2 experimental treatments (not challenged, NCH and challenged, CHA) in a completely randomized design with 8 replicate cages/treatment and 8 birds/cage. All birds were divided into 2 groups of 64 birds each with similar average BW. One treatment group was orally gavaged (CHA) with high dose (25x) of coccidia vaccine on d 15 while birds in the second treatment group (NCH) were gavaged with similar volume of distilled water. Both treatment groups were fed a similar grower (d 14–27) diet that was adequate in all nutrients and energy. Coccidia vaccine challenge decreased ($P < 0.05$) BW gain (d 14–21), feed intake (d 14–21 and 21–27), and feed efficiency (d 14–21). Coccidia challenge showed a tendency ($P = 0.08$) to reduce ileal N digestibility 12-d post challenge. Total tract DM, N, and energy utilization was lower ($P < 0.05$) in CHA birds 12-d post challenge. Coccidia vaccine challenge resulted in an increased ($P < 0.05$) upregulation of some genes of marker of inflammation and mucosal integrity in the duodenum (interleukin, IL-1β, IL-6, and claudin-1), jejunum (IL-1β, IL-6, and IL-17, and claudin-1 and ileum (claudin-1) 6-d post challenge. Glucose (SGLT-1) and phosphate (NaPi-IIb) transporters in the duodenum and jejunum were downregulated ($P < 0.05$) in CHA birds 6-d post challenge. Jejunal IL-1β and claudin-1 gene expressions were upregulated ($P < 0.05$) and NaPi-Iib, SGLT-1, and MUC-2 gene expressions were downregulated ($P < 0.05$) in CHA birds 12-d post challenge. Results from this study showed that coccidia challenge could result in gut inflammation with a significant cost to nutrient and energy utilization and is partly explained by changes to marker of glucose transport.

Key Words: breeder, coccidia vaccine, gut inflammation

181 Effect of a severely restricted feed program at the onset of lay and corn particle size on performance of three weight classes of broiler breeders. Y. M. Lin*, C. R. Stark, and J. Brake, Prestage Department of Poultry Science, North Carolina State University, Raleigh.

Previous studies have shown that larger corn particle size either decreased or increased broiler BW but improved overall feed conversion ratio (FCR) under different scenarios. Furthermore, restricted feeding of broiler chickens reduced BW but improved mortality and FCR. Given the advantages found in broilers, the effect of corn particle size on restricted-fed broiler breeders was investigated during onset of lay when body reserves and feed intake were low. The objective of this study was to determine the effects of 2 different particle sizes of corn on proventriculus and gizzard weight, BW gain, and reproductive performance in a severely feed restricted scenario at the onset of lay. Two mash breeder diets with 0 or 50% coarse corn were fed from 24 wk of age into production. The restricted feed program started with 108 g of feed per bird per day at 24 wk. When production reached 5%, 1 g of feed was added per bird per day. Initially, 180 birds were moved from litter floor pens into individual cages. BW was measured weekly from 24 to 31 wk. The birds were categorized into 3 groups (Small, Medium, and Large) according to BW at 24 wk. Hens were necropsied to determine gizzard, proventriculus, ovary and oviduct weight at 24, 25, 26, and 32 wk of age. Gizzard weight decreased as the birds aged. In this severely restricted feeding scenario, the fine corn diet increased egg mass and number of eggs produced, while BW was smaller than in the coarse corn birds. Small birds came into production later and produced fewer and smaller eggs than Large birds. This indicated that the Small birds did not possess sufficient reserves at 24 wk required to produce eggs. The fine corn diet provided the birds with more energy in this restricted feeding cage scenario where the gizzard was fully functional at onset of the study.

Key Words: breeder, proventriculus, feed restriction, gizzard, particle size

182 Effects of diet type and nutrient density on small intestine morphology in broiler chicks from day 8 to 21 post-hatch. X. Wang*, E. D. Peebles, T. W. Morgan, R. L. Harkess, and W. Zhai, Mississippi State University, Mississippi State.

The effects of diet type and amino acid (AA) and apparent metabolizable energy (AME) levels on small intestinal length and morphology and coccidia vaccine challenge to investigate the interaction among diet types [high distillers dried grains with solubles diet (hDDGS) or high meat and bone meal diet (hMBM)], AA densities (moderate or high), and AME densities (moderate or high) of diets fed from d 8 to 21 of post-hatch age on small intestine morphology of the chicks. Two chicks per pen were euthanized by CO2 asphyxiation and small intestine sections (duodenum, jejunum, and ileum) were collected and measured individually using linear distance from starting point to end point of each section on d 21 post-hatch. Jejunum sections were then formalin-fixed and processed for histological measurement of villi and goblet cells. Chicks fed hDDGS diets exhibited longer small intestines than did chicks fed hMBM diets ($P = 0.04$). Particularly, when fed high AA density diets, jejunum were longer in groups fed hDDGS diets than groups fed hMBM diets ($P = 0.02$). Furthermore, morphological examination showed that diet did not affect jejunal crypt depth, or goblet cell size and density. However, in the MBM diet group, the jejunal villi of chicks fed a higher AA density diet were longer ($P = 0.06$) and narrower ($P = 0.08$). In birds fed diets containing hDDGS and with a high AME density, a higher AA level increased jejunal muscle thickness ($P = 0.03$). These results suggest that diet type and nutrient density alter the length and muscle thickness of jejenum and may subsequently influence muscular contraction and peristalsis.

Key Words: amino acid, metabolizable energy, small intestine length, goblet cell, villus

Evidence from emerging studies indicates that an early life nutrition strategy may have a long-term impact on growth performance and nutrient digestibility in chicks. Additionally, it has been demonstrated that delayed access to feed affects post-hatch performance in broilers. The present study was designed to address the effects of a proprietary conditioning diet (PN Post Hatch Broiler, Alltech, Inc.) and holding time on growth performance and carcass characteristics of broiler chicks. A control corn-soy diet or the PN Post Hatch Broiler diet was fed on day of hatch, 24 h or 48 h post-hatch for a 3d period in a 2 × 3 factorial arrangement. Seven replicate groups of 24 male chicks were randomly assigned to each treatment. Following the initial 3d period, all chicks were fed the same diet containing decreased levels of ME, minerals and vitamin E. Chicks were raised in environmentally controlled floor pens for 41 d. Chicks fed the PN diet were heavier than chicks fed the control diet at 19 d of age (503 vs. 479 g, P = 0.02) and at 30 d of age (1191 vs. 1162 g, P = 0.08). Post-hatch holding time linearly decreased weight gain and feed intake through d 19. The 48 h holding time decreased weight gain (P = 0.09) and feed intake (P < 0.01) compared with the other 2 holding times through 30 d. By d 41, 48 h holding time decreased feed intake (P = 0.02), and improved gain to feed ratio (P = 0.01). Birds fed the PN diet had higher post (P = 0.02) and cold (P = 0.04) carcass yields compared with birds fed the control diet. Birds held for 48 h compared with the other 2 holding times had a lower carcass percentage of live weight (P = 0.04) and yield of pectoralis minor muscle as a percentage of cold carcass weight (P = 0.04). The results of this experiment indicated that the PN Post Hatch Broiler diet improved performance of broiler chicks and carcass yield and that a post-hatch holding time of 48 h was detrimental to the performance of the chicks.

Key Words: programmed nutrition strategy, post-hatch holding time, chicks, performance, carcass characteristic


This study was conducted to determine the nutrient and energy intake of alternative chicken breeds used for meat production through a self-selection feeding program. Seventy-five day-old chicks per breed/strain (Cornish Cross males (CCM), Cornish Cross females (CCF), Red Rangers males (RR), and males from 3 heritage breeds of Rhode Island Red (RIR), Barred Plymouth Rock (BPR), and Black Australorp (BA)) were divided into 3 replicate groups and randomly assigned to floor pens at a density of 929 cm²/bird. All chicks received a complete diet for the first 2 weeks, and then were transitioned to a self-selection feeding program using 4 feed choices provided on an ad libitum basis. The feed choices included a protein concentrate (39% CP) without added methionine and 3 grains that were similar in energy content, but differed in protein and methionine content (cracked corn, naked oats, and pearl millet). The feeds were randomly allocated to 4 identical feeders within each pen and the location of the feeders was rotated 2–3 times per week. All birds were grown to 2300 g. CCM, CCF, RR, and the heritage breeds reached this weight at 7, 8, 9, and 20 weeks respectively. During the self-selection feeding program, the average daily gain was 51.0, 45.1, 35.2, and 10.5 g/bird/day for CCM, CCF, RR, and the heritage breeds respectively (P < 0.0001). The heritage breeds had a significantly poorer (P < 0.0001) feed efficiency (feed/gain = 5.79) than CCM (2.00), CCF (2.07), and RR (2.56). CCM, CCF, and RR selected diets lower in energy (2887 vs. 2950 vs. 2982 vs. 3068 kcal/kg, P < 0.0001), and higher in protein (20.8 vs. 19.2 vs. 18.3 vs. 16.2%, P < 0.0001) than the heritage breeds. Methionine intake varied significantly (P < 0.0001) by breed/strain with CCM having the highest (0.32%), followed by the CCF and RR (0.31%), and was lowest in the heritage breeds (0.27%). Based on self-selection, the nutrient and energy intake varied by breed/strain and should be taken into consideration when formulating diets for alternative breeds/strains.

Key Words: self-selection feeding, alternative breed, broiler

185 The effect of different mineral sources on growth performance of turkeys. S. M. Al-Sherify*,1, C. I. Robison1, S. A. Adedokun2, and D. M. Karcher1,1Michigan State University, East Lansing, 2Purdue University, West Lafayette, IN.

Two studies were conducted to test the hypothesis that gasification will result in decreased calcium (Ca) and phosphorus (P) availability due to non-specific binding to other minerals. The aim was to evaluate the effect of Ca and P from turkey litter on Ca and P digestibility and growth performance of turkey poults. The first experiment had limestone as the Ca source in the first 4 diets at the levels 9.2, 10.4, 11.7, and 12.9 g/kg diets; however, litter ash was used as the Ca source with the other 3 diets at the levels 9.9, 11.0, and 12.1 g/kg diet. The second experiment had monosodium phosphate as the P source in the first 4 diets at the levels 7.9, 9.4, 10.9, and 12.4 g/kg diet; however, litter ash was used as the P source with the other 3 diets at the levels 7.4, 8.4, and 9.3 g/kg diet. All poults were fed standard starter diet during the first week. Each experiment had 6 replicates per treatment with 8 birds per pen from d 7–28. In the first experiment, no significant differences were found in feed consumption, conversion or bone measurements. Ileal Ca digestibility for low limestone was higher (P < 0.05) than low litter ash diet; however, the digestibility of Ca in the ileum for high limestone was lower (P < 0.003) than high litter ash diet. The results suggest that using approximately 11 g/kg Ca from turkey litter ash in the diet is comparable to a standard limestone diet 11.7 g/kg. Phosphorus source in the second experiment had an effect on the body weight gain (P ≤ 0.01), feed intake (P ≤ 0.02), and bone parameters (P ≤ 0.05) when the body weight gain and feed intake found to be highest with litter ash compare with limestone source, specifically between the highest levels; however, the opposite was found with bone parameters, specifically tibia and femur ash. The ileal P digestibility was not different between the litter ash and monosodium phosphate diets. The data indicated that using 8.4 g/kg P from the litter ash in the diet resulted in performance similar to the monosodium phosphate diet 10.9 g/kg. Therefore, litter ash substituted into turkey starter diets for the first 28 d of production had no significant impact on production parameters.

Key Words: calcium, phosphorus, litter ash, turkey

186 Starch source and feeding frequency affect the performance of broiler breeders during the early laying phase. A. Deep*, T. A. Scott, A. G. Van Kessel, and H. L. Classen, University of Saskatchewan, Saskatoon, SK, Canada.

An experiment was conducted to study the impact of feeding slowly (pea) or rapidly (wheat) degraded starch on a once or twice a day basis on the reproductive performance of broiler breeders (21–35 wk) and the growth performance of their offspring (0–20 d). A total of 160 broiler breeder pullets (Ross 308) were housed in individual cages and fed either a pea- or wheat-based diet once (08:00) or twice (08:00, 15:00) a day. A group of 5 birds served as a replicate and each treatment was replicated 8 times. Hens were inseminated twice weekly (29, 30, 31 and
Energy partitioned towards follicular growth in commercial and heritage single comb White Leghorn hens. E. S. Backer* and M. J. Zuidhof, University of Alberta, Edmonton, AB, Canada.

The objective of the current experiment was to investigate energy partitioned for follicular growth in 32-wk-old modern commercial line (CL) and heritage line (HL) Single Comb White Leghorn hens. The volume of yolk deposited during the rapid growth phase was estimated using a double dye technique. For 21 d, between 0730 and 0800h, 8 CL and 8 HL were fed capsules (no. 1) containing Sudan dye. Eight control CL were fed empty capsules. All birds were fed a standard layer diet ad libitum. Bird BW and feed consumption were measured daily. An empirical nutrient requirement model was used to estimate energy requirements. Eggs were collected, weighed, and biced. The yolks were isolated, weighed and bisected. Duplicate perpendicular dye ring radii were measured from the center of the yolk to the inner edge of each ring and the volume of yolk deposited was estimated. Data were reported as significant where \( P \leq 0.05 \). Average BW was 1.637 kg for CL and 1.596 kg for HL. The ME intake was 321 kcal/d for CL and 270 kcal/d for HL. Egg weight was 61.4 and 56.4 g in CL and HL, respectively. Dye had no significant effect on BW, ME intake, or egg weight. Empirical estimates of the maintenance ME requirement for CL was 191.6 kcal/kg\(^0.60\) and 176.6 kcal/kg\(^0.68\) for HL. The ME requirement for BW gain and egg mass were 0.56 kcal/g and 0.74 kcal/g, respectively. Hen-day production was 97% for CL and 75% for HL. Average ovum weight was 16.5 g for CL and 14.9 g for HL. The volume of yolk deposited for the 8 d preceding oviposition was: 0.17, 0.28, 0.43, 0.99, 1.84, 2.47, 2.82, 2.86, and 2.51 cm\(^3\) in CL, and in HL was: 0.17, 0.33, 0.72, 1.40, 2.15, 2.46, 2.48, 2.32, and 1.93 cm\(^3\). Total yolk GE content was 43.1 and 41.8 kcal in CL and HL, respectively. The HL had a higher rate of yolk deposition 3 to 1 d before oviposition with no significant difference between lines on 4 d before oviposition. The HL had an elongated rapid growth phase compared with CL.

Key Words: follicular growth, hen, energy requirement

Effect of roller mill ground corn inclusion and floor types on gastric development, live performance, and litter moisture in broilers. Y. Xu*, C. Stark, P. Ferket, and J. Brake, Department of Poultry Science, North Carolina State University, Raleigh.

Dietary coarse ground corn or new litter has been shown to improve broiler live performance and enhance gut function. The objectives of the present study were to evaluate the effect of coarse ground corn (CC) inclusion and different floor types on broiler growth performance, gastric development, and litter moisture. The experiment was a factorial arrangement of 2 dietary levels of CC (0 and 50%) and 3 floor types (wire net (NET), new wood chip litter (NWL), and recycled old litter (RCL)). A total of 1008 d-old male broiler chicks were randomly assigned to one of 6 treatments with 6 replicate pens per treatment and 32 birds per pen. Fine corn (FC) was produced with a hammermill (271 μm) while the CC was produced with a roller mill (1,145 μm). From 0 to 14 d, a common crumbly diet with 100% FC was fed. The grower and finisher diets were fed as pellets and contained either 100% FC or a blend of 50% FC and 50% CC. Feed intake (FI), BW and litter moisture were determined weekly, and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of all dead birds. No CC × floor type interaction effects were observed. The birds fed 50% CC had increased 49 d BW (3,932 g vs. 3,732 g, \( P < 0.01 \)), improved 1–49 d AdjFCR (2.04 vs. 2.07, \( P < 0.01 \)), and FI (7,285 g vs. 7,032 g, \( P < 0.05 \)). The addition of CC increased gizzard weight (\( P < 0.01 \)), and decreased litter moisture after 35 d of age (\( P < 0.01 \)). FI was only increased with NET at 14 d of age (\( P < 0.01 \)), and NWL increased BW at 28 (\( P < 0.05 \)) and 35 d (\( P < 0.01 \)) of age as compared with NET birds, but there was no difference between NWL and RCL. The broilers reared on litter exhibited better 1–35 d AdjFCR, but after 35 d the only difference was found between NWL and NET. At 49 d of age, the NWL resulted in greater gizzard weight than NET and RCL (\( P < 0.05 \)). Broilers fed diets containing 50% CC exhibited improved AdjFCR, increased BW, and lower litter moisture. Raising broilers on NWL resulted in a similar effect as dietary CC, indicating broilers may need a coarse textural component in the diet to facilitate gastric development and function.

Key Words: corn particle size, dietary texture, broiler, pellet, gizzard


In the United States, broiler feed pellets have typically been manufactured between 4 and 4.5 mm in diameter. This size has been thought to facilitate consumption over the entire broiler BW range while also maintaining pellet mill throughput. However, it has been suggested that smaller diameter pellets may have a positive impact on bird performance as well as finished feed quality. This study evaluated the effects of pellet diameter on broiler live performance. A total of 1,152 Ross 708 female broilers were randomly assigned to 3 treatments with 12 replicate pens per treatment. A common starter diet was fed as crumbles. The 3 treatments were then fed throughout the grower phase. The 3 treatments applied during the grower phase were 100% pellet fines, 3.5 mm pellets, and 4.37 mm pellets. All treatments were manufactured from a common basal diet and fines were removed from the pellet treatments. Feed intake (FI) and BW were determined at 14 and 35 d of age, and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of mortality. Birds fed pellets had greater BW at 35 d than birds fed the pellet fines (\( P < 0.01 \)), but there was no difference in BW between the pellet treatments. During the period from 15 to 35 d, there
was a significant difference in FI ($P < 0.01$), with FI increasing with morsel size (fines: 2.76 kg, 3.5 mm pellets: 2.87 kg, 4.37 mm pellets: 2.98 kg). There was also a significant difference in AdjFCR ($P < 0.01$) with the 3.5 mm pellets (1.57 kg feed/kg gain) leading to a significantly improved AdjFCR as compared with either the fines (1.64 kg/kg) or 4.37 mm pellets (1.62 kg/kg). The results of this experiment indicated that birds performed more efficiently when fed the smaller diameter pellets.

**Key Words:** pellet diameter, feed form, pellet quality, growth performance, feed manufacturing

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**190 Effects of varying conditioning temperature and fat application on a broiler finisher diet.** R. E. Loar II*, K. G. S. Wamsley1, A. Evans2, J. S. Moritz2, and A. Corzo1, 1Mississippi State University, Mississippi State, 2West Virginia University, Morgantown.

A study was performed to evaluate the effects of different conditioning temperatures and alternate fat application methods on a standard broiler finisher diet. Data were collected to determine feed mill efficiency, amino acid (AA) digestibility and broiler growth and yield. There were 3 conditioning temperatures, 74, 85, and 96°C, and 2 methods of fat application, pre- and post-pellet, which resulted in a 3 × 2 factorial for a total of 6 treatments. Ross x Ross 708 females were used and fed identical industry standard rations from 0 – 28 d. The experimental period occurred from 28 – 42 d of age. Increased temperature and pre-pellet fat application both resulted in decreased energy usage at the pellet mill ($P < 0.001$). Post-pellet fat application also resulted in greater bulk density compared with pre-pellet application ($P < 0.001$). A temperature × fat application interaction was seen for both pellet durability index and modified pellet durability index ($P < 0.001$) as well as feed conversion ($P = 0.07$). Feed conversion increased with increasing conditioning temperature and post-pellet fat application in the 85°C treatment. No other responses were observed for the carcass traits monitored. All treatments were analyzed for true digestible AA content via the use of precision-fed eccentrored roosters. Data from the AA digestibility assay points toward conditioning temperature having the most pronounced effect, as multiple AA showed significantly decreased digestibility with increasing temperature. Fat application method and conditioning temperature impact multiple aspects of broiler production. Increased steam conditioning temperature can lead to decreased feed mill energy usage and increased pellet quality and while increased temperatures may lead to nutrient degradation, pre-pellet fat application may help to alleviate some of that effect. Pre-pellet fat application can also aide in decreased energy usage in the mill, while post pellet fat application leads to increased pellet quality.

**Key Words:** conditioning, fat application, PDI, MPDI, amino acid

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**191 Quantification of small differences of ME in laying hen diets.** N. A. Nachtrieb* and M. E. Persia, Iowa State University, Ames.

The increase in the cost of corn and oil has necessitated the use of alternative energy sources, including feed additives, to cost effectively produce birds and eggs. To properly evaluate feed additives that claim to release energy from laying hen diets, the quantification of relatively small differences in dietary energy needs to be considered and has been a limitation when using a laying hen model. Three concentrations of dietary energy were evaluated over a 16 wk period in first cycle Hy-Line W-36 laying hens. The highest energy diet contained 2,850 and 2,800 kcal/kg over 1 to 11 and 12 to 16 wk, respectively, and met or exceeded typical industry recommendations for all other nutrients. The remaining diets contained the same basal diet with reduction in energy of 30 and 60 kcal/kg coming from a reduction in dietary oil. Each diet was fed to 8 replicate groups of 9 hens housed 3 hens per cage in 3 consecutive cages (439 cm²/bird) in a randomized complete block design. There were no significant differences among dietary groups in performance including egg production, feed intake, egg mass, feed conversion ratio or mortality over the 16 wk period ($P > 0.05$). At the end of the 16 wk period all hens were weighed and both groups of hens receiving reduced energy diets resulted in a small (40 to 50g) but significant reduction in body weight in comparison to the higher energy fed birds. One bird from each cage (3 per replicate group) was euthanized by CO2 asphyxiation to determine abdominal fat pad weight and one bird per replicate group was utilized for fat mass determination using dual-energy x-ray absorptiometry (DXA). Fat mass determined via DXA scan was not sensitive enough to determine difference ($P > 0.05$), but abdominal fat pad weight was significantly reduced with decreasing dietary energy content resulting in 59.3, 49.0 and 47.9g total weight, respectively. It appears that both body weight and abdominal fat pad weight are more responsive and more sensitive to relatively small differences in dietary energy compared with laying hen performance.

**Key Words:** layer, energy, performance, abdominal fat pad

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**192 Effect of source and level of fiber of the pullet diets and energy content of the laying diets on performance of brown egg-laying hens from 17 to 48 weeks of age.** O. Bouali1, A. Pérez-Bonilla2, J. García2, P. Guzmán1, B. Saldaña1, and G. G. Mateos*1, 1Universidad Politécnica de Madrid, Madrid, Spain, 2Camar Agroalimentaria S.L., Toledo, Spain.

It is a common practice to increase the fiber content of the feed during the rearing period to enhance the ability of the pullets to consume more feed at the onset of the laying cycle. The inclusion in the diet of certain sources of fiber in adequate amounts might help to adapt the gastrointestinal tract (GIT) of the bird to the laying diet and improve hen productivity. In this experiment, 480 Lohmann Brown hens were fed previously (1 to 17 wk of age) 6 different diets: 2 of them differed in the main cereal used (corn vs. barley) and the remaining 4 diets formed a 2x2 factorial with 2 fiber sources (straw and sugar beet pulp) at 2 levels of inclusion (2 and 4%). The fiber source was included at expense (wt:wt) of the corn diet. From 17 to 48 wk of age, hens were fed diets that differed in AMEn (2,650 or 2,750 kcal AMEn/kg) but had similar nutrient content per unit of AMEn. The experimental design was completely randomized with 12 treatments arranged as a 6 x 2 factorial with 6 diets during the rearing phase and 2 diets during the laying phase. Rearing feeds did not affect any of the production variables studied during the laying phase. At 48 wk of age, the composition of the rearing feeds did not affect the relative weight (% BW) of the GIT, the length (cm/kg BW) of the hen, tarsus, or small intestine, or the pH of the gizzard contents. Hens fed the high energy diet during the laying period, ate less feed ($P < 0.001$) but had better FCR ($P < 0.01$) and higher BW gain ($P < 0.05$) than hens fed the low energy diet. We conclude that neither the main cereal nor the fiber content of the diet fed during the rearing phase, affected subsequent egg production. Also, the use of high energy diets during the laying phase reduced ADFI and improved FCR, but did not affect egg production or egg weight.

**Key Words:** barley, egg production, pullet diet, straw, sugar beet pulp

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**193 Influence of main cereal and mean particle size of the diet on productive performance and egg quality of brown-egg laying hens.** M. de Vega1, A. Pérez-Bonilla2, B. Saldaña1, H. A. Manda­lawi1, P. Guzmán1, P. G. Rebollar1, and G. G. Mateos*1, 1Universidad
Politécnica de Madrid, Madrid, Spain, ²Camar Agroalimentaria S.L., Toledo, Spain.

In total, 500 Lohmann Brown hens were used to study the effects of the main cereal and mean particle size (MPS) of the cereal on productive performance and egg quality from 17 to 49 wk of age. The experiment was completely randomized with 10 treatments organized as a 2 × 5 factorial with 2 main cereals (barley vs. corn) and 5 MPS that resulted from grinding the main cereal of the diet with a hammer-mill provided with a 4, 6, 8, 10, or 12 mm screen. Diets were isonutritive for major nutrients and included in all cases a carbohydrase and a phytase enzyme. Each treatment was replicated 5 times and the experimental unit was an enriched cage with 10 birds. Treatment sums of squares for effects of MPS of the main cereal on the different variables studied were partitioned into linear (L) and quadratic (Q) effects. No interactions between main effects were detected for any of the variables studied and therefore, only main effects are presented. Main cereal of the diet affected ADFI (P < 0.05), egg weight (P = 0.10), and egg mass (P = 0.06) that were higher with barley that with corn feeding. Unexpectedly, the incidence of dirty eggs was higher (P < 0.05) with corn that with barley feeding. In contrast, egg production, feed conversion ratio per kilogram of eggs and per dozen of eggs, and BW gain. Egg quality was not affected by the main cereal of the diet. The MPS of the cereal had little effect on any of the traits studied except for BW gain that was higher (P = 0.06) for hens fed the diet ground to 4 mm than for the average of hens fed the other 4 diets. We conclude that type of cereal affect productive performance but that particle size had little effect on productivity of commercial laying hens.

**Key Words:** barley, corn, egg quality, hen performance, mean particle size