

**0826 Effect of a square-toe or perimeter-fit horseshoe on quality of movement and gait kinematics of the western pleasure horse.** P. Q. Underwood<sup>1</sup>,

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Hoof-care professionals often manipulate the thoracic hooves of the western pleasure horse by squaring the toe and moving the horseshoe caudally on the hoof capsule, which is thought to shorten the point of breakover, allowing for a flatter knee and more extension out of the shoulder during the swing phase. Manipulating the shape of the shoe in this way may compromise hoof capsule integrity and could contribute to chronic lameness. Our objective was to evaluate gait quality and kinematics of the western pleasure horse shod with a square-toe aluminum shoe (ST) in comparison to a perimeter-fit aluminum shoe (PF) on the thoracic digit. Quarter horses ( $n = 9$ ; 5 geldings, 4 mares;  $8.4 \pm 1.9$  yr;  $545.9 \pm 34.8$  kg) trained in western pleasure were utilized in an 85-d repeated measures study and randomly selected on Day 1 to be shod with either an ST or PF shoe for 6 wk, then reshod with the opposing treatment on Day 43. Horses were videoed being ridden at the walk, jog, extended jog, and lope for 3 repetitions over 50 m on Days 15 and 57 wearing each treatment. EquineTec® software was used to evaluate humeroradial extension measured as the minimal elbow angle (extension out of the shoulder) at the end of the swing phase, metacarpal flexion measured as the minimal carpal angle (knee action), and metacarpalphalangeal flexion measured as the minimal fetlock angle (lower leg action), both at the beginning of the swing phase. Equine judges ( $n = 11$ ) assessed quality of movement by scoring each gait from  $-1.5$  (extremely poor) to  $1.5$  (excellent), where 0 was considered average. The PF treatment improved quality of movement for some parameters, including humeroradial extension for all gaits ( $P < 0.034$ ) and metacarpal flexion for all gaits ( $P < 0.0132$ ) except the jog ( $P = 0.079$ ). Metacarpalphalangeal flexion and judge evaluations were not different between treatments ( $P > 0.3$ ). Kinematic evaluation revealed quality-of-movement advantages when the PF treatment was applied by allowing for more ideal western pleasure movement seen as decreased knee action and increased extension out of the shoulder, although professional judges did not score treatments differently. The PF treatment achieves equal or superior quality of movement compared to the ST, thus providing a more appropriate shoe for the western pleasure industry that may amplify the longevity of the western pleasure horse.

**Key Words:** horse, square-toe horseshoe, perimeter-fit horseshoe, western pleasure

**INTERNATIONAL ANIMAL AGRICULTURE**

**0827 Carcass quality of guinea pigs: Age effects on weights, yields, and linear carcass measurements.**

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Guinea pigs are used for meat production in South America, Africa, and Asia. The increased interest in this product is due to the low production price, their relatively rapid reproduction, and the large litter size. The objective of the present study was to evaluate the effect of age on weight, yield, and drip loss in guinea pig carcasses. Fattening guinea pigs reared to different ages were used: 3 months (3M,  $n = 48$ ), 4 months (4M,  $n = 37$ ), and 6 months (6M,  $n = 41$ ). The animals were fasted for 14 h before slaughter. Live weight at slaughter (LWS), empty body weight (EBW), and hot and cold carcass weights (HCW and CCW) were recorded. The following measurements were also recorded: carcass length (L), loin length (Lo), hind limb length (F), width of the buttocks (G), lumbar circumference (LC), thorax circumference (ThC), and thorax width (ThW). Furthermore, carcass compactness (CarC) was calculated. Hot carcass yield (HCY), cold carcass yield (CCY), yields and drip loss were calculated. LWS values increased as animals got older (888 g, 1060 g, and 1168 g, for 3M, 4M, and 6M, respectively). The gastrointestinal content for the three guinea pig groups was similar, around 90 g. The lowest values of hot or cold carcass yields were observed in 3M guinea pigs (52% and 49%, respectively), and no differences were found between the 4M and 6M groups (55–56% for HCY and 53 to 54% for CCY). With respect to drip losses, expressed as percentages, the 3M guinea pig group had the highest loss (5.8%), while the 4M and 6M groups had the lowest losses (3.7 and 3.8%, respectively). L, Lo, F, LC, ThW, and G increased as guinea pigs were reared for longer times. ThC values were similar (19 cm) in all studied animals. When CarC was analyzed, it was possible to see evidence for an age effect: the 4M and 6M groups, without significant differences between them, showed approximately  $30 \text{ g cm}^{-1}$  of carcass weight vs.  $24 \text{ g cm}^{-1}$  in 3M guinea pigs. In conclusion, rearing guinea pigs from 3 to 4 months of age increases not only the LWS but also the carcass yields and compactness. However, rearing the guinea pigs from 4 to 6 months of age does not

improve the productivity of the system.

**Key Words:** guinea pig, carcass yield, linear carcass measurement

**0828 Effect of age on the regional composition of fattening guinea pig carcasses.** R. Remache<sup>1</sup>, V. Inca Guerrero<sup>1</sup>, I. Barba<sup>1</sup>, C. Hernández<sup>1</sup>, J. Palmay<sup>2</sup>, M. Tenelema<sup>3</sup>, J. Espinoza<sup>2</sup>, A. J. Morales-delaNuez<sup>4</sup>, and D. Sánchez Macías<sup>\*2</sup>, <sup>1</sup>*Agroindustrial Engineering, Universidad Nacional de Chimborazo, Riobamba, Ecuador*, <sup>2</sup>*Agroindustrial Engineering, Universidad Nacional de Chimborazo, Riobamba, Ecuador*, <sup>3</sup>*Facultad de Ciencias Pecuarias, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador*, <sup>4</sup>*Facultad de Ciencias Pecuarias, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador*

Logically, increasing LWS could increase a farmer's profit margin by maximizing meat production. Quantification of the growth of the carcass parts is essential prerequisites of Integrated Management Systems. Guinea pigs are used for meat production in South America, Africa, and Asia, but little information is available in the literature. The objective of this work was to determine the effect of guinea pig age on the regional composition of the carcasses. Fattening guinea pigs reared to different ages were used: 3 months (3M,  $n = 48$ ), 4 months (4M,  $n = 37$ ), and 6 months (6M,  $n = 41$ ). The animals were fasted for 14 h before slaughter. Live weight at slaughter and cold carcass weights (CCW) were recorded. Each carcass was divided into two half carcasses; the left half carcass was jointed in four cuts following anatomical points (neck, shoulder, hind leg, and ribs). Data were recorded in grams and in percent with respect to the left half carcass. ANOVA procedure was used with the statistical program SAS (v. 11). In terms of weights, neck cuts ranged from 18 to 31 g, shoulder cuts ranged from 35 to 49 g, long leg cuts ranged from 78 to 117 g, and ribs ranged from 82 to 117 g. In all cuts, the 3M animal group had the lowest weights and the 6M group the highest. When means are shown as percentages for neck and long leg cuts, the 3M guinea pig group had the lowest values (neck 8.4%), and the 4M and 6M groups the highest without significant differences (9.5–9.9%). For the shoulder, the 3M group had a higher percentage (16.3%) than the 4M and 6M groups (15.2% and 15.5%, respectively). For long leg cuts, the 3M and 4M animal groups did not differ (35.9% and 35.7%), but the results were significantly lower than obtained for the 6M guinea pig group (36.8%). And for ribs, in the 3M and 6M groups the percentages were 37.4% and 36.8%, respectively, without significant differences; these means were lower than the percentage for rib cuts in the 4M group. In conclusion, when animals are older, the cut weights are higher; however, when the results are presented as percentages, there is no linear allometric growth of

the different parts of the guinea pig in carcasses.

**Key Words:** guinea pig, carcass, regional composition

**0829 Inulin and flavomicine as growth promoters in rabbit diets: Effects on animal performance, cecum crypt depth, and serum-bone macrominerals (Ca, P, Mg).** M. E. Juárez Silva, M. Cuchillo Hilario\*, I. Torres Acosta, E. L. Villarreal Delgado, and R. M. Castillo Domínguez, *National Institute of Medical Science and Nutrition Salvador Zubiran, Mexico City, Mexico.*

Concern about the utilization of antibiotics in animal feeding is rising because overuse may cause bacterial and microorganism resistance. Also, the use of probiotics and antibiotics to increase animal productivity and the effects on the cecum crypt depth, mucus layer thickness, and bone macromineral metabolism are still not clear. Therefore, sixty New Zealand rabbits (female = 30/male = 30) of 40 d age ( $790 \pm 150$  g) were randomly arranged into four treatments of 15 animals each. All groups were fed with the same protein, energy, crude fiber, and ether extract content (16.9%, 13.80 KJ/g, 12.5%, and 3.9%, respectively). The study lasted 57 d, the first 15 d of which were for adaptation. Weekly weights were registered during the experiment. Basal diet consisted of alfalfa hay (43.8%), wheat bran (25.1%), soybean meal (12.9%), corn (11.6%), soybean oil (3.1), carboxymethyl cellulose (2%), calcium phosphate (1.0), sodium chloride (0.5%), and vitamins and minerals (0.1%). The control group (CG) did not receive either antibiotic (Flaveco40 ECO-Animal Health) or inulin (IPS Raftifeed, Megafarma-Orafti) supplementation. The second group (I+) was supplemented with 2.5 g of inulin/kg of feed. The third group (F+) received 0.1 g of flavomicine/kg of feed. To evaluate possible interactions, the fourth group (IF) received both inulin and flavomicine doses as discussed previously. One-way analysis of variance (ANOVA) and the Tukey test ( $P < 0.05$ ) were employed using SPSS (15.0). Kruskal–Wallis and Mann–Whitney tests were used when the samples showed no normal distribution. Rabbit final weight was greater in CG ( $P < 0.05$ ) than I+, F+, and IF (2269 g, 1938 g, 2036 g, and 2170 g, respectively). The cecum crypt depth and mucus layer thickness were significantly larger in rabbits with I+ ( $P < 0.001$ ). Rabbits supplemented with inulin showed the least triglyceride level in comparison to CG and F+ ( $P < 0.05$ ). In the same line, blood glucose in I+ was less than F+ ( $P < 0.05$ ). In contrast, serum concentrations of calcium and magnesium were greater in I+ ( $P < 0.05$ ). Additionally, calcium, phosphorus, and magnesium values in femur bone from I+ were greater than CG ( $P < 0.05$ ), whereas only phosphorus and magnesium values from I+ were greater than F+ ( $P < 0.05$ ). Nevertheless, the magnesium concentration in bone from IF was greater than CG ( $P < 0.05$ ). Despite the slightly lesser final weight of rabbits with I+, the inclusion of inulin

has positive effects; e.g., cecum crypt depth and mucus layer thickness increased. Likewise, inulin supplementation augmented calcium, phosphorus, and magnesium in serum and in femur bone. Furthermore, inulin is capable of depressing serum triglycerides and glucose, while increasing bones mass.

**Key Words:** probiotics, crypt depth, bone mineralization

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**0830 Increased body condition during lactation increases milk production and pre-weaning growth of Bali cattle.**

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Bali cattle (*Bos javanicus*), the main cattle species in eastern Indonesia, have high rates of calf mortality (up to 48%, Talib et al., 2003) and low average daily gain (ADG) (< 0.2 kg, Dahlanuddin et al., 2012). The objective of this experiment was to determine the effect of body condition score (BCS) of heifers throughout pregnancy and lactation on milk production and ADG of calves up to 6 mo of age. Non-pregnant Bali heifers [ $n = 24$ ,  $3.2 \pm 0.1$  BCS (1 to 5 scale), mean  $\pm$  s.e.m.] were ranked on body weight (BW;  $217 \pm 6$  kg) and allocated to treatments that would result in high (4.0) and low (2.5) BCS at parturition and throughout lactation. Heifers were maintained in individual pens and fed a mixture of tree legumes (*Leucaena leucocephala* and *Sesbania grandiflora*) ad libitum and 10 g maize grain DM/kg LW.day (HighBCS, 164 g CP and 8.9 MJ ME/kg DM) or King grass (*Pennisetum purpureum*; LowBCS, 75 g CP and 7.8 MJ ME/kg DM) ad libitum throughout pregnancy and lactation. Heifers observed to be in oestrus were mated with a single bull. Heifer BW was measured every week, BCS was measured every month, milk production was estimated by the weigh-suckle-weigh technique, calf BW was measured at birth and every week until weaning at approximately 6 mo of age. At parturition HighBCS heifers were heavier ( $292 \pm 15$  vs.  $226 \pm 10$  kg) and in a higher BCS ( $4.2 \pm 0.1$  vs.  $2.8 \pm 0.1$ ) than LowBCS heifers ( $P < 0.01$ ). At weaning HighBCS heifers were heavier ( $276 \pm 3$  vs.  $181 \pm 12$  kg) and in a higher BCS ( $4.2 \pm 0.1$  vs.  $2.3 \pm 0.1$ ) than LowBCS heifers ( $P < 0.001$ ). Calf birth weight ( $13.5 \pm 0.2$  kg) was unaffected by maternal BCS ( $P > 0.1$ ). HighBCS heifers produced more milk than LowBCS heifers at each measurement during lactation and overall ( $2.1 \pm 0.1$  vs.  $1.0 \pm 0.1$  kg/day,  $P < 0.001$ ). ADG of calves between birth and 6 mo for age was higher for calves born to HighBCS heifers than those born to LowBCS heifers ( $0.37 \pm 0.02$  vs.  $0.16 \pm 0.02$  kg,  $P < 0.001$ ). In conclusion, milk production of Bali cows and pre-weaning ADG of Bali calves are influenced by BCS

during lactation. Strategies to increase BCS during lactation will increase calf growth and potentially reduce calf mortality.

**Key Words:** Bali cattle, calf growth, milk production

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**0831 Alpaca and llama fiber quality comparison**

**in Ecuadorian Andes.** L. Cordova, A. J. Morales-delaNuez, M. Vaca-Cardenas, and N. F. Rodriguez Gonzalez\*, *Facultad de Ciencias Pecuarias, Escuela Superior Politecnica de Chimborazo, Riobamba, Ecuador*.

The fiber quality from ten body regions (dorsal neck, RC1; wither, RC2; middle loin, RC3; rump, RC4; ventral neck, RC5; ribs, RC6; flank, RC7; caudal thigh, RC8; forearm, RC9; and dorsal to hock, RC10) of 35 alpacas (*Vicugna pacos*) and 45 llamas (*Lama glama*) were evaluated. Samples were collected from the left side of the animals before shearing. Animals belonged to the Tourism Project of Palacio Real Community (Chimborazo province, Ecuador). Length (L), number of crimps (NR), diameter (D), and medullation rate (M) were measured in ten randomly selected fibers from each body region. Repeated measures ANOVA was performed to evaluate the effects of body region, as repeat measure, and sex and species, as independent factor. Additionally, Pearson's coefficient was used to calculate correlations between parameters. No differences in NR, D, and M due to species or sex in any of the studied body regions were observed. Differences in LA from RC4 between females were observed, where alpacas had longer LA than llamas. In RC5 llama males showed longer LA than llama females, while both sexes of alpacas presented intermediate values. RC6 (ribs) was the body region with better fiber quality, while RC10 (dorsal to hock) showed the worse quality fiber. A significant high correlation (0.64) was found between M and D. In conclusion, the best quality fiber was found in RC6 for both species, whereas the worst was found in RC10. Finally, D and M were highly correlated.

**Key Words:** *Lama glama*, *Vicugna pacos*, Ecuador

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**0832 Alpaca fiber quality in Ecuadorian Andes.**

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Nowadays, the importance of fiber from alpaca is increasing worldwide. Therefore, studies about the fiber quality from those animals is requested. To analyze the alpaca fiber quality in Ecuador, 143 alpacas from 3 rural communities from Chimborazo province and 223 alpacas from 7 rural communities from Cañar province were sampling on the middle rib area. Samples were evaluated with a wool-meter and calibrated ruler. Fiber quality was established based on four variables: diameter (D), number of crimps (NR), length (L),

and medullation rate (M). These characteristics were analyzed according to sex and age. Multifactorial ANOVA method was applied with Tukey-Kramer adjustment. Values were considered significant when  $P < 0.05$ . Furthermore, to establish correlations between parameters, the Pearson correlation coefficient was utilized. In Chimborazo provinces, the following averages were obtained: D: 21.75  $\mu\text{m}$ , NR: 2.12 crimps/cm, L: 11.97 cm, and M of 35.3%. For D, young animals presented finer fiber than old animals. Similarly, males showed finer fiber than females. For NR, older females showed fewer crimps per cm than other groups. Older males presented the longest fiber (L). No effect of sex or age was found in M. In Cañar province, the following averages were obtained: D 21.72  $\mu\text{m}$ , NR: 2.78 crimps/cm, L: 15.16 cm, and M of 53.9%. For D, young animals presented finer fiber than old animals, and sex had no effect on this variable. For NR, older animals showed fewer crimps per cm than young animals, while males had fewer crimps than females. Older animals presented longer fiber than young animals, while males showed shorter fiber than females. No effect of sex or age was found in M. Furthermore, in both provinces the diameter and medullation were strongly correlated. In conclusion, the alpacas raised in the Ecuadorian Andes have a good fiber quality, but it is necessary to improve it to increase the fabric craft quality. Sex and age must be considered for fiber quality.

**Key Words:** *Vicugna pacos*, South American camelids, Ecuador

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**0833 Guinea pig carcass quality: Traditional diet vs. high quality diet.** M. C. Tenelema<sup>1</sup>, D. Sánchez-Macias<sup>2</sup>, D. D. Yumisaca-Guevara<sup>1</sup>, R. Remache<sup>2</sup>, V. Inca Guerrero<sup>2</sup>, I. Barba<sup>2</sup>, C. Hernández<sup>2</sup>, J. Palmay<sup>2</sup>, and A. J. Morales-delaNuez<sup>\*1</sup>, <sup>1</sup>*Facultad de Ciencias Pecuarias, Escuela Superior Politecnica de Chimborazo, Riobamba, Ecuador*, <sup>2</sup>*Agroindustrial Engineering, Universidad Nacional de Chimborazo, Riobamba, Ecuador*.

Guinea pig meat production provides a good and low-cost source of proteins. In Africa, Asia, and South America meat production from this species is common and ensure the food security in many rural communities. Traditionally, in Andean areas, guinea pigs are raised with low quality grass and kitchen waste. Few data is available about the carcass quality in guinea pigs fed in this way. The aim of this study was to evaluate the carcass quality of guinea pigs fed with high quality and low quality feed. In this study, 60 improved guinea pigs (30 males and 30 females) were divided into 3 groups (10 males and 10 females per group). One group was fed with fresh lucerne and concentrate (ASI). Another group of animals was fed with agriculture waste and concentrate (DSI). Finally, the last group was only fed with agriculture waste (DNO). All animals were slaughtered with 120 d, after a fast of 12 h. Weight before slaughter, different carcass weights,

non-carcass components, and carcass measurements were recorded and different carcass yields were calculated. Results showed that guinea pigs fed with agriculture waste (DNO) had decreased carcass quality compared to animals fed with concentrate feed. Few differences were found when animals fed with Lucerne (ASI) were compared to those fed with agriculture waste and concentrate (DSI). In conclusion, guinea pigs fed with agriculture waste and concentrate had similar carcass quality as those fed with high quality forage, so guinea pigs are able to use a low quality forage.

**Key Words:** *Cavia porcellus*, meat quality, nutrition

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**0834 Do buffaloes have better milk fat profile than cows? Where does the evidence stand in 2016?**

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The objective of the present study was to document a comprehensive comparison between the milk fat profiles of buffalo and cattle. Data on milk fat profiles of buffalo were retrieved from nine published studies on different breeds of buffalo (Nili-Ravi, Kundi, Murrah, Egyptian, Italian, Romanian), and values/proportions of individual/groups of fatty acids (FA) were averaged across breeds. Data on milk fat composition of cow milk was obtained from a recent study on Canadian Holstein cows using large gas chromatography data. Milk fat profiles (means of 29 variables each) of the buffalo and the cow were compared using Student's *t*-test. Overall, Holstein cows had approximately 3–4 times higher daily milk yield than buffalo. Buffalo milk had greater total solids (17.76% vs. 13.94%) and a higher fat percentage (7.02% vs. 3.86%) than cow milk, indicating more value for buffalo milk. Buffalo milk fat had slightly higher proportions of total saturated, total trans, and total mono-unsaturated FA but similar proportions of total polyunsaturated FA than that of cow; although differences in these groups of FA were statistically nonsignificant. Buffalo milk fat had higher proportions of human-health-related beneficial fatty acids (comparing one fatty acid at a time) such as oleic acid, CLA, cis-9 trans-11, and two omega-3 FA (C18:3 cis-9, 12, 15 and C20:5n3). Additionally, buffalo milk had relatively lower proportions of potentially undesirable (from human health standpoint) saturated FA (C12:0, C14:0, and C16:0) than cow's milk. Although the present study did not correct the data for various background effects involved in each of the reported studies, it provides a comprehensive comparison between buffalo and cow milk fat and is likely to have useful implications for the promotion of buffalo as a dairy animal from the human health point of view.

**Key Words:** buffalo, cattle, milk fat profiles