

Nonruminant Nutrition: Health/Management

252 Population dynamics of leukocytes during immune activation of the chicken immune system by *E. coli*. V. Arias* and K. Klasing, *University of California, Davis*.

The innate and adaptive systems must have appropriate levels of nutrients to support changes in leukocyte numbers and function during an immune response. As a first step at understanding the dynamics of these changes, we examined a time course of peripheral leukocytes in blood of adult Hyline chickens injected IV with dead *E. coli* at 1×10^{10} cfu/ml. After primary injection, blood was collected and total white blood cells (WBC), T cell (CD4⁺ and CD8⁺), B cell (IgM⁺ and IgG⁺), macrophage/monocyte, and thrombocyte cell numbers were determined. Data were analyzed by one-way ANOVA, and differences among treatments were determined by means contrasts. An increase in total WBC numbers occurred at 5 d, 7 d, and 10 d post-injection compared with baseline ($P = 0.01$, $P < 0.01$, $P = 0.04$). CD4⁺ numbers increased compared with baseline at 7 d, 10 d, and 14 d post-injection ($P < 0.01$, $P < 0.01$, $P = 0.01$). However, CD8⁺ cell numbers showed no difference. IgM⁺ cell numbers increased compared with baseline at 5 d, 7 d, and 10 d post-injection ($P < 0.01$ for each day). IgG⁺ cell numbers increased at 5 d, 7 d, 10 d, and 14 d post-injection compared with baseline ($P < 0.01$ for each day). Macrophage/monocyte cell numbers increased 3 d, 5 d, 7 d, 10 d, and 14 d post-injection compared with baseline ($P = 0.02$, $P < 0.01$, $P < 0.01$, $P < 0.01$, $P < 0.01$). Thrombocyte cell numbers increased at 5 d and 7 d post-injection compared with baseline. ($P = 0.01$, $P < 0.01$). Maximal percent increase in cell numbers for WBC, CD4⁺, IgM⁺, IgG⁺, macrophage/monocyte, and thrombocyte were 83%, 66%, 117%, 336%, 214%, and 102%, respectively. These data indicate an increase in most cellular components of the avian immune system during systemic activation compared with naïve birds (maintenance). Supported by USDA Regional Research project 1013.

Key words: chicken, leukocytes, *E. coli*

253 Effects of dietary seaweed extract supplementation in sows and post-weaned pigs on performance, intestinal morphology, intestinal microflora and immune status. S. G. Leonard, T. Sweeney, B. Bahar, and J. V. O'Doherty*, *University College Dublin, Dublin, Ireland*.

The present experiment investigated the effects of dietary supplementation of a seaweed extract (SWE) to sows and weaned pigs on post-weaning growth performance, intestinal morphology, intestinal microflora, volatile fatty acid (VFA) concentrations, and immune status of pigs at d 11 and 117 post-weaning. Gestating sows ($n = 20$) were supplemented with SWE (0 vs. 10.0 g/d) from d 107 of gestation until weaning (d 26). At weaning, pigs (4 pigs/sow) were divided into 2 groups based on sow diet during lactation and supplemented with SWE (0 vs. 2.8 g/kg diet), giving 4 treatment groups; 1) BB (basal sows-basal pigs); 2) BS (basal sows-treated pigs); 3) SC (treated sows-basal pigs); and 4) SS (treated sows-treated pigs). Pigs weaned from SWE-supplemented sows had a higher ADG between d 0–21 ($P < 0.05$) post-weaning compared with pigs weaned from non SWE-supplemented sows. Pigs offered post-weaning diets containing SWE had decreased colonic *E. coli* populations on d 11 ($P < 0.01$) and decreased colonic *Enterobacteriaceae* numbers on d 117 ($P < 0.05$). Pigs offered post-weaning diets containing SWE had a greater mRNA abundance of MUC2 in the colon at d 11 post-weaning ($P < 0.05$) compared with pigs offered un-supplemented diets. In conclusion, these results dem-

onstrate that SWE supplementation post-weaning provides a dietary means to improve gut health and enhance growth performance in starter pigs. Dietary SWE supplementation increased ADG during the grower-finisher (GF) phases. However, there was no growth response to SWE inclusion in the GF diets when pigs were weaned from SWE-supplemented sows.

Key words: sow, fucoidan, laminarin

254 Effect of maternal seaweed extract supplementation on suckling piglet growth, humoral immunity, selected microflora, and immune response after an ex vivo lipopolysaccharide challenge. S. G. Leonard, T. Sweeney, B. Bahar, and J. V. O'Doherty*, *University College Dublin, Dublin, Ireland*.

The present study was conducted to investigate the effect of maternal dietary supplementation ($n = 10$ sows/treatment) with seaweed extract (SWE: 0 vs. 10.0 g/d) from d 107 of gestation until weaning (d 26) on neonatal piglet growth, humoral immunity, intestinal morphology, and selected intestinal microflora. Furthermore, this study examined the effect of dietary treatment on the immune response following an ex vivo *Escherichia coli* lipopolysaccharide (LPS) tissue challenge at weaning in a 2×2 factorial arrangement. The main factors consisted of sow dietary treatment (SWE or control) and immunological challenge (yes or no). The SWE supplement (10.0 g/d) contained laminarin (1.0 g), fucoidan (0.8 g), and ash (8.2 g). The SWE-supplemented sows had greater colostrum IgA ($P < 0.01$) and had a trend for greater IgG ($P = 0.062$) concentrations compared with non SWE-supplemented sows. Piglets suckling SWE-supplemented sows had greater serum IgG ($P < 0.05$) concentrations on d 14 of lactation compared with those suckling non-SWE supplemented sows. Dietary SWE supplementation decreased fecal *Enterobacteriaceae* populations in sows at parturition ($P < 0.05$) and piglets suckling SWE-supplemented sows had a lower colonic *E. coli* population at weaning ($P < 0.01$) compared with non SWE-supplemented sows. Lipopolysaccharide challenge increased the mRNA abundances of the pro-inflammatory cytokines IL-1 α and IL-6 ($P < 0.01$) in ileal tissue and TNF- α in colonic ($P < 0.01$) tissue. Piglets suckling SWE-supplemented sows had greater TNF- α mRNA expression following ex vivo LPS challenge compared with non SWE-supplemented sows ($P < 0.05$). However, there was no effect of sow dietary treatment on TNF- α mRNA expression in the unchallenged ileum tissue. In summary, these results demonstrate an important immunomodulatory role of SWE supplementation characterized by enhanced colostrum IgA and IgG concentrations, greater piglet circulatory IgG concentrations and enhanced TNF- α mRNA expression in the ileum following an ex vivo LPS challenge.

Key words: sow, immunity, laminarin

255 Plant extracts for weaned pigs experimentally infected with porcine reproductive and respiratory syndrome virus. 1: Effect on growth performance and immune responses. Y. Liu^{*1}, J. J. Lee¹, M. Song¹, T. M. Che¹, J. A. Soares¹, D. Bravo², W. G. Van Alstine³, and J. E. Pettigrew¹, ¹*University of Illinois, Urbana*, ²*Pancosma SA, Geneva, Switzerland*, ³*Purdue University, West Lafayette, IN*.

A study evaluated the effects of 3 different plant extracts (PE) on growth performance and immune responses of weaned pigs experimentally infected with porcine reproductive and respiratory syndrome

virus (PRRSV). Weaned pigs (n = 64, 7.8 ± 0.3 kg BW, 21 d old) were used in a 2 × 4 factorial arrangement. The first factor was with or without PRRSV challenge (10⁵ intranasal dose; 50% tissue culture infective dose). The second factor was 4 diets: a nursery basal diet (CON), 10 ppm capsicum oleoresin (CAP), garlic (GAR), or turmeric oleoresin (TUR). Pigs were housed in disease containment chambers for 28 d: 14 d before and 14 d after the inoculation (d 0). Rectal temperatures (RT) were measured every 3 or 4 d post-inoculation (PI). The ADG, ADFI, and G:F were measured on d -14 to 0, 0 to 7, and 7 to 14. Blood was collected on d 0, 7, and 14 to detect serum viral load (SVL) by qPCR and PRRSV antibody titer (AT) by ELISA. The PRRSV infection decreased (*P* < 0.01) ADG and ADFI from d 0 to 7, d 7 to 14, and d 0 to 14, and G:F from d 7 to 14 and d 0 to 14, and increased (*P* < 0.05) RT on d 7, 9, 11, and 14 PI, SVL on d 7 and 14 PI, and AT on d 14 compared with the unchallenged group. In the PRRSV challenged group, CAP reduced (*P* < 0.05) RT (39.67 vs. 40.18°C) on d 4 and SVL (Ct, 18.94 vs. 16.15) on d 7; GAR increased (*P* < 0.05) ADG (328 vs. 236 g/d) from d 0 to 7 and reduced (*P* < 0.05) RT (39.67 vs. 40.18°C) on d 4; TUR increased (*P* < 0.05) ADG (469 vs. 333 g/d) from d 7 to 14, G:F from d 7 to 14 (0.70 vs. 0.42) and from d 0 to 14 (0.58 vs. 0.42), PRRSV AT (2.09 vs. 1.69 S/P ratio), and decreased SVL on d 7 (Ct, 18.97 vs. 16.15) and d 14 (Ct, 23.84 vs. 21.54). In the unchallenged group, all piglets were PRRSV negative during the overall period PI. The CAP increased (*P* < 0.05) ADFI from d 0 to 7 and overall period PI, and final weight of piglets compared with the CON. In conclusion, the 3 PE tested showed different effects on growth efficiency and humoral immune responses, and TUR might strengthen immune responses and efficiency of pigs infected with PRRSV.

Key words: plant extracts, PRRSV, weaned pigs

256 Plant extracts for weaned pigs experimentally infected with porcine reproductive and respiratory syndrome virus. 2: Effect on peripheral blood immune cells and inflammatory mediators. Y. Liu^{*1}, J. J. Lee¹, M. Song¹, T. M. Che¹, J. A. Soares¹, D. Bravo², W. G. Van Alstine³, and J. E. Pettigrew¹, ¹University of Illinois, Urbana, ²Pancosma SA, Geneva, Switzerland, ³Purdue University, West Lafayette, IN.

A study evaluated the effects of 3 different plant extracts (PE) on peripheral blood immune cells and inflammatory mediators of weaned pigs experimentally infected with porcine reproductive and respiratory syndrome virus (PRRSV). Weaned pigs (n = 64, 7.8 ± 0.3 kg BW, 21 d old) were used in a 2 × 4 factorial arrangement. The first factor was with or without PRRSV challenge (10⁵ intranasal dose; 50% tissue culture infective dose). The second factor was 4 diets: a nursery basal diet (CON), 10 ppm capsicum oleoresin (CAP), garlic (GAR), or turmeric oleoresin (TUR). Pigs were housed in disease containment chambers for 28 d: 14 d before and 14 d after the inoculation (d 0). Blood was collected on d 0, 7, and 14 to measure the total and differential white blood cells (WBC), and serum tumor necrosis factor-α (TNF-α), C-reactive protein (CRP), and haptoglobin (HP). Compared with the unchallenged pigs, the PRRSV infection reduced (*P* < 0.01) WBC and lymphocytes (LYM) on d 7, monocytes (MONO) on d 7 and d 14, and the ratio of neutrophils to LYM (NEU/LYM) on d 14, but increased NEU/LYM on d 7, WBC and LYM on d 14, and the levels of serum TNF-α, CRP, and HP. In the PRRSV challenged group, CAP reduced (*P* < 0.05) TNF-α (146.2 vs. 179.5 pg/ml) and CRP (27.9 vs. 41.0 μg/ml) on d 7, and increased (*P* < 0.05) HP (1503 vs. 890 μg/ml) on d 14; GAR increased (*P* < 0.05) HP (1485 vs. 890 μg/ml) on d 14; TUR reduced (*P* < 0.05) TNF-α (139.4 vs. 179.5 pg/ml) on d 7 compared with the CON. The 3 PE tested did not influence the populations

of peripheral immune cells. In the unchallenged group, CAP increased (*P* < 0.05) LYM on d 7; GAR increased (*P* < 0.05) MONO and CRP (27.6 vs. 16.8 μg/ml) on d 7 and NEU/LYM (1.86 vs. 0.92) on d 14, but reduced (*P* < 0.05) MONO on d 14 (1.01 vs. 1.66 × 10³/μl), compared with the CON. In conclusion, the 3 PE tested showed different effects on immune responses of piglets with or without PRRSV infection, and CAP and TUR modulate the inflammatory mediators of pigs infected with PRRSV.

Key words: plant extracts, PRRSV, weaned pigs

257 Effects of spray-dried plasma on pregnancy rate and growth performance of mated female mice after transport as a model for stressed sows. M. Song^{*1}, T. M. Che¹, Y. Liu¹, J. A. Soares¹, J. J. Lee¹, J. M. Campbell², J. Polo², J. C. O'Connor³, and J. E. Pettigrew¹, ¹University of Illinois, Urbana, ²APC Inc., Ankeny, IA, ³University of Texas Health Science Center, San Antonio.

Transportation stress can reduce implantation, impair embryo development, and decrease pregnancy rate after breeding of animals. A study evaluated the effects of spray-dried plasma (SDP) on pregnancy rate and growth performance of mated female mice (C57BL/6 strain) after transport as a model for stressed sows. The mated female mice (n = 250; 16 ± 1.2 g BW; 4 replicated groups, 62 or 63 mice/group) were shipped from Bar Harbor, ME to Urbana, IL on the day the vaginal plug was found (gestation day (GD) 1), arriving at the laboratory on GD 3. They were housed in individual cages, randomly assigned to dietary treatments with or without 8% SDP (SDP or CON), and fed for 2 wk. The diets were formulated to similar ME, CP, and AA levels without antibiotics. Measurements were pregnancy rate and growth performance (GD 3 to 17). Pregnancy was determined on GD17 on the basis of BW and shape of abdomen, and was confirmed by inspection post-mortem. The SDP markedly improved (*P* < 0.05) pregnancy rate compared with the CON (Table). The SDP also improved (*P* < 0.05) ADG (non-pregnant mice: 0.142 vs. 0.106 ± 0.008 g/d; pregnant mice: 0.712 vs. 0.638 ± 0.018 g/d) and G:F (non-pregnant mice: no data; pregnant mice: 0.223 vs. 0.202 ± 0.006) compared with the CON, but did not affect ADFI. In conclusion, SDP improved pregnancy rate of the mated female mice after transportation stress and growth performance of pregnant mice.

Table 1. Effect of SDP on pregnancy rate of mated female mice after transportation stress*

Group	CON			SDP		
	Pregnant	Total	% Pregnancy	Pregnant	Total	% Pregnancy
1	8	31	26	15	32	47
2	2	31	7	19	31	61
3	5	50	10	5	13	39
4	2	48	4	5	14	36
Overall	17	160	11	44	90	49

*Data are number of mice and analyzed by chi-squared test.

Key words: mice, pregnancy rate, spray-dried plasma

258 Dietary phosphate supplementation to neonatal pigs affects satellite cell proliferation and progression through their myogenic lineage. L. S. Alexander^{*}, B. S. Seabolt, and C. H. Stahl, North Carolina State University, Raleigh.

Severe neonatal dietary phosphate (PO₄) deficiency reduces the proliferation of satellite cells (Alexander, 2010). The objective of this study was to examine the impact of dietary PO₄ on the growth, sera parameters, and tissue-specific stem cell proliferation in the neonatal pig. Seventy-five 1-d old pigs were pair-fed either a 25% PO₄ deficient (PD), a PO₄ adequate (PA), or a 25% PO₄ excessive (PE) liquid diet over an 18d period. Circulating PO₄ was lower ($P < 0.05$) in PD fed animals throughout the trial when compared with PA and PE fed animals. Sera Ca concentrations were higher ($P < 0.05$) in PD fed animals at all time points when compared with their PE fed counterparts. Increased ($P < 0.05$) sera PTH was observed among pigs fed the PE diet when compared with both the PD and PA fed groups. PD fed animals had lower ADG ($P < 0.05$) and G:F ($P < 0.05$) than PA and PE fed animals. Dietary PO₄ restriction reduced the in vivo proliferation of satellite cells, but no differences were seen between the PA and PE treatment groups. Satellite cells were additionally cultured to evaluate the effect of dietary PO₄ on their developmental programming. Altered gene and protein expression of muscle regulatory factors (Pax7, MyoD, and Myogenin) was observed among the satellite cells based on the PO₄ status of the pigs from which they were isolated. Our previous research demonstrated reduced satellite cell proliferation during severe PO₄ deficiency, and similar results were also seen in this study with a mild PO₄ deficiency. Although excess dietary PO₄ did not result in increased proliferation in vivo, differences in both proliferation and markers of the progression of these cells through their myogenic lineage was affected by excess dietary PO₄. Additional research is needed to further clarify how PO₄ status affects satellite cell activity and the subsequent impact on growth.

Key words: pig, phosphate, satellite cell

259 Flavour preferences conditioned by the effects of porcine digestible peptides (PDP) and soybean concentrate in post-weaned piglets. J. Figueroa*¹, D. Solà-Oriol¹, S. L. Vinokurovas¹, E. Borda², and J. F. Pérez¹, ¹Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain, ²Bioibérica, Barcelona, Spain.

It has been shown in mammals that an initially arbitrary or aversive flavor can become strongly preferred after a learned association between the flavor and the positive consequences of its consumption (hedonic or post-ingestive). In this experiment, 480 non-deprived weaning piglets (10 piglets/pen) were trained during 6 d (alternate sessions) with one flavor in odd days as a positive conditioned stimulus (CS+) when mixed into a protein solution (2% Soybean Protein Concentrate (SPC) or 2% Porcine Digestible Peptides (PDP)) and another flavor on even days (CS-) mixed into a neutral solution (water). Flavor products used (anis or garlic, 0.075%) were paired with each solution and counterbalanced across subjects to act as the CS+ or CS- flavor. Double choice test between the CS+ and CS- flavors were performed at d15 and d22 after weaning (in water) and at d29 after weaning (in feed). Solution and feed intakes were measured after 30 min. Data were analyzed using the GLM procedure of SAS. Preference was calculated as the percentage contribution of the CS+ solution to the total solution intake. Piglets preferred protein-paired flavors at all 3 d; they showed higher preference for the CS+ flavor in the SPC group (55%, 57% and 57%) and PDP group (60%, 62% and 55%) on d 15, 22 and 29, respectively ($P < 0.05$). No differences were observed between the conditioning power of PDP and SPC. The present results indicate that weanling piglets can acquire strong flavor preferences resistant to extinction through conditioning strategies by using protein products. Establishing a preference for a flavored solution by conditioning may enhance intake due to hedonic or post-ingestive effects driven by this

association, and this could be a useful strategy to increase voluntary intake in critical periods, such as weaning.

Key words: flavors, conditioning, weaning

260 Influence of length of storage on parameters used to measure the quality of soybean meal. S. Sueiro¹, M. P. Serrano², M. González¹, M. Hermida¹, P. G. Rebollar², and G. G. Mateos*², ¹Laboratorio de Mouriscade, Pontevedra, Spain, ²Universidad Politécnica de Madrid, Madrid, Spain.

Methods used by the Industry to estimate protein quality of soybean meal (SBM) include KOH solubility (KOHsol), protein dispersibility index (PDI), urease activity (UA), and trypsin inhibitor activity (TIA). In general, meals with KOHsol values between 78 and 85%, PDI values between 15% and 35%, and UA values between 0.00 and 0.10 mg/g are considered of acceptable quality. Similarly, TIA values of less than 2.5–4.0 mg/g are considered best. However, there is no agreement among the different Institutions and publications with respect to the more suitable values for these variables in commercial SBM. The reasons for the wide range of values for these variables are not well understood. It is known that protein solubility and TIA changes with the methodology used and explain in part the high variability existing among laboratories. Also, length and environmental conditions during storage might influence protein solubility and thus, KOHsol and PDI values. In a previous study, we observed that protein solubility of SBM samples from the USA or Latin America stored for 24, 48, and 80 wk under room conditions (12–15°C) had significantly lower PDI values than the original SBM. An experiment was conducted to determine the influence of length of storage on different parameters that define the protein quality of SBM. Eight samples (500 g) of SBM (55–56% CP on DM basis) were collected weekly during June–July 2010 directly from the crusher (USA). Samples were analyzed at arrival to the Spanish port and then, every 30 d of storage at 12 ± 2°C and 70 ± 3% humidity. Length of storage did not affect KOHsol, UA, or TIA values. However, PDI values decreased with time (21.8, 21.4, 20.1, 18.7, and 17.7% for 0, 30, 60, 90, and 120 d, respectively; $P \leq 0.001$). Therefore, care should be taken when comparing PDI values to evaluate the protein quality of SBM samples that have been stored for different lengths of time.

Key words: length of storage, soybean meal, protein quality traits

261 Effects of an abrupt change from mash to pellets and vice-versa on growth performance in finishing pigs. C. B. Paulk*¹, J. D. Hancock¹, J. C. Ebert², and J. J. Ohlde², ¹Kansas State University, Manhattan, ²Key Feeds, Clay Center, KS.

A total of 200 finishing pigs (avg initial BW of 60 kg) were used in a 58-d growth assay to determine the effects of an abrupt change from mash to pellets and pellets to mash on growth performance and carcass measurements. The experiment was designed as a randomized complete block with 5 pigs/pen and 10 pens/treatment. Treatments were mash to mash, mash to pellets, pellets to mash, and pellets to pellets for phases 1 and 2 of the experiment. For phase 1 (d 0 to 36), pigs fed the pelleted diet had 4% greater ADG and 8% greater G:F ($P < 0.02$) compared with pigs fed mash. For phase 2 (d 36 to 58) and overall (d 0 to 58), pigs fed the mash diet had lower ($P < 0.02$) G:F than pigs fed the pelleted treatments. Indeed, pigs fed pellets the entire experiment had ADG and G:F that were 5 and 8% better, respectively, than that of pigs fed mash the entire experiment. Pigs fed mash during phase 1 then pellets during phase 2 had greater ($P < 0.01$) ADG and G:F for phase 2

compared with pigs fed pellets then mash. However, the overall effect was for pigs fed pellets for either phase 1 or 2, but not both, tended to have growth performance intermediate to those fed mash and pellets for the entire experiment. With hot carcass weight used as a covariate, no differences ($P > 0.15$) were observed in dressing percentage, fat thickness, or percentage fat free lean index (FFLI). In conclusion, pigs fed pellets tended to have the greatest growth performance, pigs fed mash the worst, and pigs fed pellets for only part of the grow-finish phase fell in between.

Table 1.

Item	Mash to mash	Mash to pellet	Pellet to mash	Pellet to pellet	SE
Phase 1 (d 0 to 36)					
ADG, g	1,124	N/A	N/A	1,167	23
G:F, g/kg	393	N/A	N/A	423	4
Phase 2 (d 36 to 58)					
ADG, g	1,163	1,230	1,117	1,240	25
G:F, g/kg	403	441	404	431	9
Overall (d 0 to 58)					
ADG, g	1,134	1,168	1,148	1,195	22
G:F, g/kg	393	414	416	426	6
Dress, %	74.6	74.3	74.2	74.4	0.3
Fat thickness, mm	18.9	19.7	19.6	19.7	0.9
FFLI, %	52.0	51.6	51.7	51.7	0.5

Key words: mash, pellets, pigs

262 The effect of weaning group-housed calves over a different length of time fed by automatic feeding machine. K. Shore* and A. Roy, *Grober Nutrition, Cambridge, Ontario, Canada.*

Pre-weaned dairy replacement calves were evaluated for growth and health differences when weaned off of milk replacer from an automatic calf feeding machine over a different number of days. Thirty 6 calves (BW 45.8 ± 3.1 kg; height 82.7 ± 5.3 cm) were used in a 1-way ANOVA model and randomly assigned at arrival to one of 2 treatments: 5 d short weaning (SW) ($n = 18$), and 10 d long weaning (LW) ($n = 18$). Calves were housed in 4 groups of 9; 2 groups had access to 1 feeding machine. All calves were offered 9 L of milk replacer (1.35 kg of dry matter) on a daily basis. Milk intakes were recorded; body weights and heights were measured weekly. Health was evaluated daily using an adapted version of the University of Wisconsin calf scoring sheet. Calves were on trial for 10 wk, 8 wk on milk replacer, grain and hay and 2 wk on grain and hay only. Water was offered free choice. Milk intake was not different between treatments before weaning (SW = 7.40 ± 0.71 L; LW = 7.43 ± 0.79 L). Body weight gain was not different between the groups over the entire 10 wk (SW = 51.5 ± 9.9 kg; LW = 55.1 ± 7.8 kg). However, BW gain was greater in the LW group ($P = 0.006$) over the weaning period (SW = 9.7 ± 5.6 kg; LW = 14.2 ± 3.0 kg). The LW group gained more while consuming less milk (SW = 4.45 ± 0.34 L/d; LW = 3.46 ± 0.17 L/d) and more grain (SW = 0.799 ± 0.484 kg/d; LW = 1.38 ± 0.313 kg/d). ADG was not different between treatments during weaning; it was higher in the LW group ($P = 0.04$) post weaning (SW = 0.747 ± 0.456 kg/d; LW = 1.01 ± 0.256 kg/d). There was no difference in height gain. Health was measured by the number of events, there was no difference between treatments during the weaning period; however, the LG group had fewer health events post weaning ($P = 0.04$). In summary, weaning calves over a longer period when fed by automatic feeding machine seemed to encourage higher body weight gains during weaning, improved average daily gains and less health events post weaning.

Key words: calf, group housing, weaning