

were measured using fly speck notecards (n = 3 per period) and on-calf counts (n ≤ 10 per period). Data were analyzed as a randomized block design with main effects of random block, treatment, period, and treatment by period interaction in MIXED procedure of SAS. Period effects (P < 0.01) reflected normal seasonal changes in fly population. With treatment, fly speck counts decreased in the lactating herd housing when compared to control (58 vs. 132 per card, P < 0.02) but an interaction of treatment and period (P = 0.07) increased difference in summer and removed difference after hard frost. Also, total flies collected in lactating herd housing were decreased with treatment (P < 0.01). In calf housing, treatment did not decrease fly populations as measured by fly specks count (200 per card) or flies per side of calf (6.0 flies). The inclusion of Clarifly™ in purchased grains decreased fly populations evident in lactating herd housing but not in calf housing. The lack of effect of Clarifly™ in calf housing is likely related to limited intake of purchased grain during first weeks of life.

Key Words: fly control, dairy cattle

W219 Black soldier fly larvae grown on cow manure. M. Chahine*¹, M. E. de Haro Marti², S. St Hilaire³, O. Pozo¹, and R. E. Sheffield⁴, ¹University of Idaho, Twin Falls, ²University of Idaho, Gooding, ³Idaho State University, Pocatello, ⁴Louisiana State University, Baton Rouge.

The objective of the study was to examine the feasibility of growing black soldier fly larvae on a dairy farm to decrease the volume of manure generated. The study was conducted on a 3000 cows dairy in southern Idaho. Small scale containers using 640-gallon water tanks were

designed so that fresh manure and black soldier fly eggs could be layered. Small ramps that allowed the larvae to migrate when ready to pupate were built in the containers. At the top of each ramp a hole was designed through which prepupae fell into buckets. Other containers used in the study included containers purchased from ESRI International LLC (lab Container) as well as a recycle bin. Prior to initiation of the study, a former structure of manure separator was modified to give shadowed conditions and some wind protection to the larvae. Study was started on June 11 2008. Approximately 1,763,100 eggs were distributed into the three previously mentioned containers. On June 27, the larvae were fed fish offal to stimulate their growth. On July 4 2008, the harvest of the first prepupae started in small amounts. A week later, there was an intensive period of two weeks with 88% of the harvest migrating during this period. Afterward, the harvest decreased dramatically. The shape of the recycle bin container made the migration difficult to accomplish and it was removed from the study. The total harvested quantity from all containers and the floor was 13,238 g, equivalent to around 93,990 prepupae. This value represents only 5.3% of the original population. The large proportion of losses was distributed between immature and dead larvae within the containers. Black soldier larvae reduced manure by 40 percent on a dry matter basis even in less than ideal conditions. The best behavior and development of the larvae occurred when the maximum environmental temperature exceeded 30°C. For better results, it would be important to design a facility that provides stronger protection against rain, wind and low temperature. Even during summer, the wide differences in temperatures between day and night could present challenges for growing black soldier larvae outside without heating in high desert climates.

Key Words: manure, black soldier fly

Ruminant Nutrition: Dairy Calves

W220 The influence of parity, sex and twinning on birth weight of Holstein calves. M. H. Fathi Nasri* and H. Farhangfar, *Department of Animal Science, The University of Birjand, Iran.*

The birth weight of calves is one of the factors affect the calf growth especially before weaning. In this study the effects of dam parity, sex and twinning factors on calf birth weight were evaluated. The birth weight records of 1654 calves born in a large dairy herd during 6 years were analyzed using the SAS Proc GLM according to the following model: $Y_{ijk} = \mu + P_i + S_j + W_k + e_{ijk}$ where Y_{ijk} = the dependent variable, μ = overall mean, P_i = the fixed effect of parity (i = 1 to 9), S_j = the fixed effect of sex (j = 1, 2), W_k = the fixed effect of twinning (k = 1, 2), and e_{ijk} = random residual. Least square means (LSM) are reported and significance is declared at P < 0.05. The effect of parity (Table 1) on calves birth weight was significant. Also the calf sex and twinning effects on calves birth weight were significant, so that the male calves were 3.4 kg heavier than females (42.1 vs. 38.7 kg, respectively) and twins calves were 7.8 kg lighter than single birth calves (32.7 vs. 40.5 kg, respectively). As the birth weight is used as a criterion for genetic selection of candidate replacement calves, these environmental factors are needed to be taken into account in the statistical selection models.

Table 1. The birth weight of calves at different parities

Parity	1	2	3	4	5	6	7	8	≥9
Number	124	349	370	270	197	140	78	59	34
LSM	37.8 ^c	38.7 ^c	39.4 ^b	40.0 ^b	41.3 ^{ab}	41.9 ^a	41.4 ^a	41.4 ^a	41.5 ^{ab}
SD	0.60	0.44	0.40	0.43	0.49	0.54	0.69	0.80	0.98

Means in the same row of Tables with no common letters differ.

Key Words: calf, birth weight, parity

W221 Influence of altering conventional milk replacer feeding rate and protein source on pre- and post-weaning performance and health of dairy calves. D. Carlson*¹, S. Hayes¹, B. Ziegler², R. Larson², M. Raeth-Knight³, G. Golombeski³, J. Linn³, D. Ziegler⁴, and H. Chester-Jones⁴, ¹Milk Products, LLC, Chilton, WI, ²Hubbard Feeds Inc., Mankato, MN, ³University of Minnesota, St. Paul, ⁴University of Minnesota, Southern Research and Outreach Center, Waseca.

Holstein heifer calves (n = 125; 2 to 4 d of age) were assigned randomly to 1 of 4 medicated milk replacer (MR; 20% protein, 20% fat) programs to evaluate the effect of feeding rate and protein source on pre-weaning (d 1 to 42) and post-weaning (d 43 to 56) performance and health. Calves were housed in individual calf pens within a naturally-ventilated barn with curtain sidewalls. Treatments (Trt) were: 1) all-milk (AM) protein MR fed at 0.57 kg/d (powder weight) in 2 daily feedings for d 1 to 35 and 0.28 kg/d 1X daily from d 36 to 42 (AMCON); 2) AM protein MR fed as Trt 1 from d 1 to 14, stepped down (SD) to 0.45 kg/d fed in 2 daily feedings from d 15 to 35, then 0.23 kg/d fed 1X daily from d 36 to 42 (AMSD); 3) Animal plasma (APL) and milk protein MR with additives fed as in Trt 2 (APLSD); 4) Wheat (W), APL, and milk protein MR with additives fed as in Trt 2 (WAPLSD). All MR were reconstituted with water to achieve a 12.5% solids solution. Calves were fed an 18% CP (as-fed) texturized calf starter and had access to fresh water. Average daily gain (ADG) was not affected by MR protein source from d 1 to 14; likewise, neither MR protein source nor feeding rate affected ADG from d 15 to 42 or d 43 to 56. Calf starter dry matter intake (DMI) was similar from d 1 to 14, but greater (P < 0.05) from d 1 to 42 for AMSD (0.41 kg/d), APLSD (0.38 kg/d), and WAPLSD (0.36 kg/d) compared with AMCON (0.29 kg/d). Total MR DMI was greater (P < 0.05) for AMCON (21.1 kg) compared with AMSD (18.5 kg), APLSD (18.4

kg) and WAPLSD (18.3 kg). Total health costs did not differ among groups. Under the conditions of this study, decreasing feeding rate of a conventional milk replacer at d 14 resulted in similar performance due to greater calf starter intake.

Key Words: dairy calves, milk replacer, protein source

W222 Effect of milk replacer carbohydrate source on performance and health of dairy calves. J. K. Bernard*¹ and A. F. Kertz², ¹University of Georgia, Tifton, ²ANDHIL LLC, St. Louis, MO.

Fifty-one Holstein calves (23 male and 28 female) were used in an 8 wk randomized block design trial to determine the effect of milk replacer carbohydrate source on performance and health. After receiving colostrum for 2-d, calves were randomly assigned to one of four experimental milk replacers. Experimental milk replacers were formulated to contain 20% protein and 20% fat (as fed basis) using different sources of carbohydrate (MSC Speciality Nutrition, Carpentersville, IL). Carbohydrate sources in the milk replacers were: 33% lactose whey (A), 25% lactose whey + 20% corn syrup solids (B), 33% lactose whey + 10% corn syrup solids (C), or 25% lactose whey + 10% corn syrup solids + 10% dextrose (D). Experimental milk replacers were reconstituted to 12% solids and fed at a rate of 0.45 kg/d divided into two equal feedings during wk 1-5. During wk 6 the amount of milk replacer was reduced by 50% and fed once daily. Calves were weaned at the end of wk 6. Starter grain was offered for ad libitum consumption throughout the trial. Body weights and measurements were recorded every 2 wk. Intake of milk replacer was lower ($P = 0.03$) for D versus B or C: 3.55, 3.57, 3.56, and 3.52 kg/d for A, B, C, and D, respectively. Starter intake was similar among treatments; 0.26, 0.34, 0.36, and 0.29 kg/d for A, B, C, and D, respectively. Calves receiving experimental milk replacer C and D had numerically higher ($P = 0.18$) rate of BW gain during wk 0 through 6 than A: 307, 376, 443, and 481 g/d for A, B, C, and D, respectively. Calves fed C gained more ($P = 0.01$) wither height than those fed A or D: 6.0, 7.1, 8.4, and 5.8 cm for A, B, C, and D, respectively. No differences were observed in hearth girth or body length among treatments. Average scour score was higher ($P = 0.02$) for B and D compared with A: 1.65, 2.15, 1.75, and 2.01 for A, B, C, and D, respectively. The results of this trial indicate that corn syrup solids can be used to replace a portion of lactose whey in milk replacers, but the combination of lactose whey, corn syrup solids and dextrose is not advantageous.

Key Words: milk replacer, carbohydrate, dairy calve

W223 Impact of glycerol in milk replacer on dairy calf performance. M. Raeth-Knight*¹, J. Linn¹, R. Larson², and J. Salzer¹, ¹University of Minnesota, St. Paul, ²Hubbard Feeds, Mankato, MN.

The objective of our study was to evaluate the impact of adding glycerol to milk replacer (MR), as a partial replacement for lactose, on calf performance and health. Following birth, thirty-four Holstein or Holstein crossbred calves were blocked by sex and breed and randomly assigned to 1 of 2 MR treatments for 70 d. Treatments were MR without glycerol supplementation (CON) or MR with glycerol added at 35% of the total DM (G). Calves were born November to December of 2007 and were individually housed in outdoor hutches. Colostrum was fed twice daily the first 2 d following birth. Calves assigned to the CON treatment were offered a 20% protein: 20% fat MR (42.7% lactose) at 0.32 kg MR DM twice daily from 3 to 36 d of age and then once daily from d 37 to weaning at d 42. A 30% protein: 30% fat MR (23.2% lactose) was fed

to calves on the G treatment. Calves were offered 0.22 kg MR DM and 0.11 kg glycerol (DM basis) twice daily d 3 to 36 and then once daily d 37 until weaning at d 42. The CON and G MR were mixed with water to contain 15.2% solids and glycerol was added to the G MR after being reconstituted with water. Starter (18% CP) and water were offered ad libitum starting d 3. Feed intake was recorded daily. Body weight was recorded at birth and 14, 28, 42, 56 and 70 d of age. Hip height was measured at birth and d 70. Fecal scores were observed daily and blood samples were taken on d 21 and 56. There was no difference in MR, starter or total DM intake across treatments. Calves consumed 0.59 kg/d MR and 1.06 kg/d starter DM pre-weaning and 3.10 kg/d starter DM post-weaning. Average daily gain was also similar with calves gaining 0.59 and 1.01 kg/d pre- and post-weaning, respectively. There was no difference in stature growth with calves gaining 15.2 cm in hip height d 1 to 70. Blood glucose concentration was 10.4 mg/dl higher for CON compared to G calves on d 21 however not different at d 42. Fecal scores indicated no impact of MR treatments on fecal consistency with an average score of 1.1 pre-weaning across treatments. Under the conditions of this study, glycerol replaced approximately 46% of lactose in MR without negatively impacting calf growth or health.

Key Words: milk replacer, glycerol, dairy calves

W224 Effect of group penning on dairy calf performance. D. Carr* and A. Chestnut, *Vigortone Ag Products, Hiawatha, IA.*

Two trials were conducted to evaluate the effect of group vs individually fed calves on pre-weaning growth and starter intake. In trial 1, Holstein bull calves from a single source were gathered weekly and assigned to either group or individual pens after being stratified by age and weight. A total of 25 calves were distributed among 5 pens (13.4m²) for the group penned treatment (GP) and 23 calves were allotted to individual pens (3.3m²) for the individual penned treatment (IP). A 22% protein 20% fat milk replacer was fed to all calves and an 18% protein calf starter feed was provided ad libitum to all calves. The GP calves received 1400 g milk replacer mixed in 9.5 l water twice daily from a teat bar with five teats connected to a shared compartment. The IP calves were bucket fed 280 g milk replacer in 1.9 l water twice daily. Milk replacer feedings were reduced from twice daily to once daily during wk 5 and calves were weaned at the end of wk 5. Data was analyzed using AOV with means separated by LS. In trial 2 the same protocol was followed with the following changes. Group pens (20.1m²) consisted of 6 calves in each of 6 pens and IP calves were divided between those that were bucket fed (n=12) or bottle fed (n=15) with teats similar to those used by GP calves. A 23% protein 15% fat milk replacer was fed to all calves. In trial 1, GP calves gained more weight than IP calves by 2 wks (4.4 vs 3.0 kg, $P < 0.10$) and by 5 wk (19.0 vs 14.4 kg, $P < 0.01$). Starter intake tended to be greater for GP than IP calves at 2 wk (0.7 vs 0.4 kg, $P < 0.10$) but not at 5 wk (12.5 vs 9.6 kg, $P > 0.10$). In trial 2, weight gains of IP calves fed by bucket vs bottle were similar ($P > 0.50$). At 2 wk GP calves gained more than IP calves (7.2 vs 5.7 kg, $P < 0.05$) but displayed similar gains by 5 wk (21.6 vs 22.7 kg, respectively). Starter intakes were similar ($P > 0.10$) for GP and IP calves at 2 wk (2.0 vs 1.7 kg, respectively) and at 5 wk (16.8 vs 15.5 kg, respectively). Group penning calves has the potential to reduce labor without reducing performance.

Key Words: calves, group, penning

W225 Relationship between immunoglobulin G intake and serum immunoglobulin G concentrations in calves fed titrated levels of immunoglobulin G in colostrum replacers. J. M. Campbell*¹, J. C. Gawthrop², A. W. Riad², L. E. Russell¹, S. K. Hayes¹, J. D. Quigley¹, and J. D. Crenshaw¹, ¹APC, Inc., Ankeny, IA, ²CalfCare, North Manchester, IN.

The impact of increasing the mass of immunoglobulin G (IgG) concentration in a single feeding of a colostrum replacer (CR) containing IgG derived from bovine serum fractions on serum IgG and the ability to achieve adequate passive transfer in calves was determined in two experiments. In experiment 1, forty-five heifer or bull calves were randomly assigned to receive a CR containing 130, 150, 170, or 190 g of IgG. In experiment 2, sixty heifer or bull calves were randomly assigned to receive a CR containing 125, 150, 175, 200, or 225 g of IgG. For both experiments, care was taken to equalize sex among treatments. All CR were blended, individually packaged, and irradiated prior to feeding calves. Colostrum replacers were reconstituted in warm water, mixed using a hand blender to a constant solids concentration of 20.9%, and fed with an esophageal feeder. Colostrum replacers were fed in one feeding at 1 h of age. Acquisition of passive immunity was assessed by measuring 24-h serum IgG levels, serum protein levels, determining apparent efficiency of absorption (AEA) of IgG, and assessing the ability to prevent failure of passive transfer (FPT). In experiment 1, increasing mass of IgG intake from 130 to 190 g of IgG resulted in a linear increase ($P < 0.05$) in 24-h serum IgG and a linear decrease in percent FPT. No differences were noted in serum total protein or AEA. In experiment 2, increasing IgG intake from 125 to 225 g of IgG resulted in a linear increase ($P < 0.05$) in 24-h serum IgG and serum total protein, and a linear decrease in AEA and percent FPT. Collectively, these studies indicate that increasing mass of IgG in CR derived from bovine serum fractions fed in the one feeding improves subsequent serum IgG and passive transfer in calves.

Key Words: calves, immunoglobulin, colostrum replacer

W226 Effects of protein sources in calf milk replacers on growth and fecal score of dairy calves. S. Y. Luan¹, J. Q. Wang*¹, D. P. Bu¹, H. T. Zhang¹, Z. F. Zhou¹, and A. F. Kertz², ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, P. R. China, ²ANDHIL LLC, St. Louis, MO.

The objective of this study was to evaluate soybean and milk protein sources in milk replacer on pre- and post-weaning growth of female Holstein dairy calves. Forty-eight calves (housing outdoors in individual hutches at Mengniu Australia International Dairy Farm) were blocked by BW and assigned randomly within block to one of two milk replacer treatments: milk replacer containing soy protein (MR-S, \$3.07/kg) or milk protein (MR-M, \$4.31/kg). Milk replacers contained soybean protein (soy protein concentrate to provide 50% of total protein) or milk protein (whey protein). Calves were fed 500g/d DM divided into two equal feedings mixed into 2 liters water per feeding, from d-4 to 10, and then reduced to 400 g/d from d-11 until weaning. Milk replacers contained 22% CP and 18% fat. Body weight, wither height, heart girth and blood samples were measured and collected at birth, and then on d 11, 18, 25, 32, 39, at weaning, 46, 53, and 60. Calf starter (CS, \$0.55/kg) and water were offered for ad libitum consumption from d-4, and CS feed refusals were measured daily. No hay was fed. Fecal scores were recorded daily. Weaning criterion was based on a minimum daily starter intake of ≥ 900 g for 2 consecutive days. Body weight, wither height, heart girth, dry matter intake from both milk replacer and calf starter, and gain to feed ratio were not different between treatments. And

all of the selected blood metabolites (BUN, GLU, NEFA and BHBA) were also not different from birth to 60d. Fecal scores between birth and 14 d were significantly higher ($P < 0.05$) for calves fed MR-S versus MR-M, but did not differ for d 15 to 28, 29 to weaning, and weaning to 60 d old. Feed cost (including milk replacer and starter) per calf was significantly greater ($P < 0.01$) for calves fed MR-M. Under conditions of this study, compared with the milk protein milk replacer, the calves fed MR-S achieved the same level of body growth and reduced feed cost by 26%.

Key Words: calves, soybean protein, milk protein

W227 Effects of combining hydrolyzed wheat gluten and spray dried plasma in calf milk replacer (CMR) on calf performance. D. Wood*, J. Sowinski, and R. Blome, Animix, Juneau, WI.

There are considerable published data and wide scale use of plasma in CMR. Hydrolyzed wheat gluten protein (WGP) is widely used as a milk protein replacement, particularly in the sizable EU. There are no data examining a combination of these two protein sources in CMR. The objective of this study was to evaluate if supplying functional proteins in spray dried bovine plasma (SDBP) can improve effectiveness of using WGP in CMR. Auction sourced Holstein bull calves ($n=120$; app. 1 wk of age) were shipped to the facility and randomly placed in individual raised, slatted stalls. Calves were randomly assigned to receive either a CMR (22% CP, 20% fat) containing 6% WGP and 5% SDBP providing 24.5% and 17.7% of total CP respectively (W/P; $n=60$), or 22:20 all-milk formula (Control; $n=60$). Both formulas contained oxytetracycline / neomycin and mannanoligosaccharides. Content of LYS was 2.19% and 1.93% in W/P and control, respectively. A starter grain (17% CP, 4% fat) was introduced day 14. Individual calf BW was determined at placement, on d 15, 29 and 43. Initial BW were 47.3 and 48.1 kg for W/P and control respectively ($P < 0.18$). Calves fed the all milk formula grew faster ($P < 0.05$) from d 0 - 15 than calves fed W/P (0.23 vs. 0.18 kg/d). This trend was reversed during the second period when W/P fed calves grew faster ($P < 0.059$) than control calves (0.86 vs. 0.90). Over the entire experimental period (0-43 d) there was no significant treatment effect on daily gain (0.64 and 0.65 kg/d for control and W/P fed calves, respectively). Twenty-five percent fewer calves fed the W/P diet required treatment for health problems week one ($P < 0.32$) while 35% more W/P calves were treated week five ($P < 0.12$). There was a trend for reduced incidence of grain refusal by 24% in W/P fed calves ($P < 0.16$). Mortality/cull was 6 and 4 for W/P and control, respectively. In conclusion, a combination of WGP and SDBP can effectively replace up to 42% of the milk protein in CMR fed to young calves.

Key Words: calf, plasma, wheat gluten protein

W228 Hydrolyzed proteins from animal origin can replace dried skim milk from milk replacer formula. M. Terré*¹, E. Borda², F. Boe¹, and A. Bach^{1,3}, ¹IRTA-Unitat de Remugants, Barcelona, Spain, ²Bioiberca, S.A., Barcelona, Spain, ³ICREA, Barcelona, Spain.

Nowadays, the increasing price of protein from milk origin leads the industry to investigate new ingredients for milk replacers (MR). Palbio calves RD and Palbio calves SD (Bioiberca S.A., Spain) are two products obtained from the enzymatic hydrolysis of porcine intestinal mucosa, which comply with European legislation concerning animal by-products manufacturing and non-ruminant and ruminant feeding regulations. Forty-five Holstein male calves (13.8 ± 6.20 d old and

42.1 ± 5.34 kg of BW) were arranged in 3 groups to study the effect of replacing part of dried skim milk from MR by Palbio calves RD or Palbio calves SD. The three groups were: calves fed a MR based on dried skim milk (CT), calves fed a MR containing 5.5% of Palbio calves SD (PSD) and calves fed a MR containing 14.5% of Palbio calves RD (PRD). Calves were fed an isonitrogenous MR (23.4% CP) at 12.5% DM at the rates of 4 l/d from 1-7 d, 6 l/d from 8-28 d, 4 l/d from 29-35 d and 2 l/d from 36 to weaning day (42 d). Calf starter was offered ad libitum until the end of the study (42 d). Individual calf MR and starter consumption were recorded daily, and calves were weighed weekly. Fecal scores and medical treatments were recorded daily. Performance data were analyzed with an ANOVA with repeated measures, and medical treatments and liquid feces with a logistic regression. Comparisons with $P \leq 0.05$ were considered as significant. None of the performance parameters measured (BW, ADG, starter and milk replacer intake, gain to feed ratio) was affected by MR formula. There were no differences in the weekly number of days that calves were not medically treated (6.7, 6.6 and 6.4 d in CT, PSD and PRD calves, respectively) and the weekly number of days with no liquid feces (6.6, 6.5 and 6.1 d in CT, PSD and PRD calves, respectively). It is possible to replace part of dried skim milk from MR formula by hydrolyzed protein without impairing calf growth and calf starter intake, and without increasing the number of days with liquid feces.

Key Words: calves, milk replacer, Palbio

W229 The effect of feeding alfalfa hay at different ages on pre- and post-weaning performance of Holstein calves. A. Ahangarani*, M. H. Fathi Nasri, H. Farhangfar, and A. Omid, *Department of Animal Science, The University of Birjand, Iran.*

Thirty Holstein calves (15 males and 15 females) were used to evaluate the effects of feeding alfalfa hay at different ages on pre- and post-weaning performance and weaning age. Following 2 d of colostrum and transition milk feeding, calves were allocated in a completely randomized design to 3 treatments, including 1) feeding starter from beginning 2) feeding starter and alfalfa hay from beginning and 3) feeding starter from beginning and alfalfa hay from 21 d age. Calves were fed whole milk at 10% of the initial daily body weight and had free access to starter, alfalfa hay and water. The weaning criterion was defined as the calf's age at a daily intake of 0.80 kg of solid feed(s) for 2 days, consecutively. Increased solid feeds (starter and alfalfa hay) DMI was observed ($P < 0.05$) for calves fed treatment 2 during the pre-weaning (322.1, 606.3 and 393.0 g/d for treatments 1, 2 and 3, respectively), the post-weaning (1975.0, 2592.5 and 2176.0 g/d for treatments 1, 2 and 3, respectively) and over the entire experiment period (751.7, 1269.7 and 894.9 g/d for treatments 1, 2 and 3, respectively). Weaning age in treatment 2 was attained earlier ($P < 0.05$) than two other treatments (59.3, 47.7 and 54.9 d for treatments 1, 2 and 3, respectively). Average daily gain (ADG) of calves in treatment 2 was significantly ($P < 0.05$) higher than calves in two other treatments during the pre-weaning (432, 517 and 476 g/d for treatments 1, 2 and 3, respectively) but not carry over into the post-weaning phase or over the entire experiment period. Feed efficiency ratio (ratio of ADG to DMI) was not different between treatments during the pre-weaning, the post-weaning and over the entire experiment period. These findings revealed that adding the alfalfa hay to diet in lower ages, increased DMI and decreased the weaning age of calves.

Key Words: calf, weaning age, alfalfa hay

W230 Effects of supplementing a mix of nucleotides to dairy calves prior to weaning on respiratory afflictions and immune response during the postweaning period. A. Bach*^{1,2}, A. Ferrer², D. Martínez-Puig³, and J. Ahedo⁴, ¹ICREA, Barcelona, Spain, ²IRTA-Ruminant Production, Caldes de Montbui, Spain, ³Bioiberica, Barcelona, Spain, ⁴Rancho Las Nieves, Mallén, Spain.

Seventy-eight dairy replacement calves (initial age = 18 ± 6.3 d and BW = 43 ± 6.1 kg) were fed a 2 L of milk replacer (MR) twice daily via a bottle at 0730 and 1630 until 45 d of life, and then a daily dose of 2 L of MR at 0730 for an additional week. At 37 d of age half of the calves received a daily dose of 3 g of a mix of nucleotides (Nucleoforce, Bioiberica, Spain) supplemented through the morning feeding of MR until weaning time (52 d). After weaning, calves were moved from individual hutches into pens holding 8 animals until reaching 111 ± 2.1 d (when the study was completed). Animal performance was monitored from 52 until 111 d of life. Respiratory afflictions were monitored daily from 37 to 111 d of life. Blood samples from half of the animals randomly chosen from each treatment group were obtained by venipuncture of the jugular vein at the age of 37 and 52 d. Incidence of respiratory afflictions was analyzed using mixed-effects logistic regression analysis, and the number of respiratory cases using a mixed-effects Poisson regression analysis. Body weight gain and blood determinations were analyzed using a mixed-effects ANOVA. The incidence of animals affected by respiratory problems tended ($P = 0.06$) to be lower in calves that received Nucleoforce ($27 \pm 0.45\%$) than in the unsupplemented animals ($48.7 \pm 0.51\%$). Also, the total number of respiratory cases was a numerically ($P = 0.13$) 55% lower in the supplemented than in the unsupplemented calves. Average daily gain was not affected by Nucleoforce supplementation, with supplemented calves gaining 1,169 g/d and the unsupplemented ones 1,152 g/d. Blood plateletcrit was lower ($P < 0.05$) in supplemented than in control calves (22.9 vs $21.5 \pm 0.45\%$, respectively). Similarly, mean platelet volume was also lower ($P < 0.05$) in supplemented than in control calves (7.9 vs 10.3 ± 0.01 fL, respectively). It could be concluded that 3 g/d of Nucleoforce tended to be effective in providing animals with an adequate immune response to reduce the incidence of respiratory upsets during transition from liquid to solid feeds.

Key Words: nucleotides, immune, pneumonia

W231 The effect of vanilla flavoured calf starter on performance of Holstein calves. M. H. Fathi Nasri*, A. Riasi, A. Arab, M. Kamalalavi, V. Vosoughi, and H. Farhangfar, *Department of Animal Science, The University of Birjand, Iran.*

Twenty one male Holstein calves were used to evaluate the effects of vanilla flavour added to starter on preweaning and postweaning calf performance. Following 2 d of colostrum and transition milk feeding, calves were assigned in a completely randomized design to 2 treatments including 1) unflavoured starter and 2) flavoured starter (containing 0.2% vanilla, DM basis). Calves were fed whole milk at 10% of the initial body weight daily and had free access to starter and water. The weaning criterion was defined as the calf age at a daily intake of 0.80 kg of starter for 2 days, consecutively. Increased starter DMI was observed for calves fed flavoured starter during the preweaning period. This effect did not carry over into the postweaning phase, but this increase was observed over the entire experiment for calves fed flavoured starter from 3 d age to weaning (Table 1). Weaning age was attained 2 to 3 d earlier ($P < 0.03$) when flavoured starter was fed (60.3 and 57.7 d for calves fed unflavoured and flavoured starter, respectively). Average daily gain (ADG) over the preweaning phase was significantly ($P < 0.01$) higher for calves fed flavoured starter. No differences in ADG were observed

postweaning or over the entire experiment due to treatment. Calves fed flavoured starter were more efficient in converting diet DM to gain than calves fed unflavoured starter during the preweaning phase. These findings demonstrate that supplementing starter with vanilla as a flavour agent is advantageous to calf performance.

Table 1

Item	Diet ¹		SEM ²	P
	UF starter	F starter		
Starter DMI (kg)				
Preweaning	0.40	0.44	0.010	0.03
Postweaning	2.12	2.25	0.121	NS ³
Overall	1.05	1.25	0.082	0.02
ADG (kg)				
Preweaning	0.33	0.40	0.02	0.01
Postweaning	0.86	0.92	0.03	NS
Overall	0.44	0.47	0.02	NS
Feed efficiency ⁴				
Preweaning	0.38	0.43	0.02	0.04
Postweaning	0.40	0.41	0.02	NS
Overall	0.34	0.31	0.02	NS

¹UF, unflavoured and F, flavoured starter, ²SEM – standard error of the means, ³NS- non significant, ⁴Ratio of ADG (kg) to DMI (starter and milk) (kg)

Key Words: calf, vanilla, weaning age

W232 Flavor effects on feed intake and performance of calves. C. Montoro^{*1}, I. Ipharraguerre², and A. Bach^{1,3}, ¹IRTA-Ruminant Production, Caldes de Montbui, Spain, ²LUCTA S.A., Barcelona, Spain, ³ICREA, Barcelona, Spain.

An experiment was conducted to determine whether calves can be encouraged to increase consumption of dry feed by association of oronasal cues (flavor) elicited by the milk replacer (MR) with those produced by the starter. Forty-three calves (initial BW=51.3±0.63 kg, age=23±1.2 d) participated in this study. All calves were weaned 6 wk after the beginning of the study, which was continued until 2 wk after weaning. Twenty-two calves received a MR treated with a novel flavor and the other 21 calves consumed the same MR but unflavored. Until the preweaning week (wk 4) all calves were fed the same unflavored starter. During the preweaning week (wk 5), within each MR group, half of the calves were fed a pelleted starter treated with the same flavor used in the MR, whereas the remaining calves were offered the same starter but unflavored following a 2x2 factorial design. Starter and MR consumption was registered daily, and BW was determined weekly. Overall, starter intake (as a percentage of BW) was not affected by flavor addition. However, the increase of starter consumption expressed

as the percentage of starter intake with respect to average consumption the week before preweaning, was numerically greater when the flavored starter was offered (regardless of the MR treatment). Furthermore, when calves were classified in 4 groups according to the preweaning level of starter consumption, calves in the lowest consumption category consumed (as a % of BW) more ($P < 0.05$) dry feed when fed the flavored starter compared with the unflavored control. As a result, feeding the flavored starter numerically reduced the coefficient of variation of BW gain from 34.4 to 13.7% from preweaning to the end of the study. Results suggest that flavoring calf starters may improve feed intake of calves with a poor drive to consume dry feed, potentially reducing thereby variability in BW gain.

Key Words: aroma, palatability, choice

W233 Development of an animal model to evaluate oro-sensorial preferences in weaned calves. C. Montoro^{*1}, F. Boe¹, I. Ipharraguerre², and A. Bach^{1,3}, ¹IRTA-Ruminant Production, Caldes de Montbui, Spain, ²LUCTA S.A., Barcelona, Spain, ³ICREA, Barcelona, Spain.

A series of experiments were conducted to develop an animal model to evaluate oro-sensorial preferences in weaned calves. First, the feeding pattern of 35 calves (65±0.7 d of age) was monitored over 24 h every 60 min to define the optimum moment to conduct the assays. Results indicated that the best time to initiate a preference test would be around 0800. This is because at that time calves showed moderate hunger, allowing thereby detecting differences in oro-sensorial preferences that otherwise would be blunted by excessive or deficient feed consumption. Subsequently, a double-choice model involving 30 naive calves (65±0.7 d of age) was used to assess the capacity of animals to discern between a control diet and the same diet sweetened with 10% sucrose. Feed intake was monitored every 30 min during 6 h. The diet supplemented with 10% sugar was preferred when compared with the unsweetened control ($P < 0.001$). The model was able to detect differences in oro-sensorial preferences when 10 calves were randomly removed from the dataset, and even when only the first 30 min of feed consumption were considered in the analysis. In a subsequent experiment, the model was evaluated using 30 calves (65±0.9 d of age) and novel feeds. All calves were simultaneously offered a choice of ground corn or barley, and feed consumption was registered over 6 h every 30 min. Using this model allowed to find significant differences when intake data from only the first 3 h were considered. Randomly removing 10 animals from the dataset did not change the statistical power of the model, but in this case using data from the first 5 h was required because of the low feed consumption during the initial hours of the study. It is concluded that a double-choice model consisting on offering 2 options of feed ad libitum to a minimum of 20 naive weaned calves while measuring feed consumption every 30 min for 6 h represents an effective approach to evaluate oro-sensorial preferences in calves.

Key Words: palatability, taste, model

Ruminant Nutrition: Dairy Heifers

W234 Pre- and post weaning performance and health of heifer calves fed different levels of bovine spray dried animal plasma in a traditional milk replacer program. S. Hayes^{*1}, D. Carlson², D. Ziegler³, M. Raeth-Knight⁴, G. Golombeski⁴, B. Ziegler⁵, R. Larson⁵, J. Linn⁴, and H. Chester-Jones³, ¹APC, Inc., Ankeny, IA, ²Milk Products, Chilton, WI, ³University of Minnesota Southern Research and Outreach

Center, Waseca, ⁴University of Minnesota, St. Paul, ⁵Hubbard Feeds, Inc., Mankato, MN.

Holstein heifer calves (n = 120; 2 to 4 d of age; 40.4 kg ± 0.68 kg) were randomly assigned to 1 of 4 different milk replacers (MR; 20% protein, 20% fat) in November 2007 to develop feeding programs that targeted the use of spray-dried animal plasma (SDP) in MR. Calves were