Ruminant Nutrition: Fats, Fatty Acids, Oils, and Glycerin Supplementation II

TH37 Comparison of direct transesterification and extraction procedures to analysis the fatty acid composition in the rumen contents. S. P. Alves*[1,2], A. R. J. Cabrita[3], A. J. M. Fonseca[4], J. A. M. Prates[1], and R. J. B. Bessa[1], *[1]CIISA, Faculdade de Medicina Veterinária, Lisbon, Portugal, [2]UIPA, Instituto Nacional de Investigacao Agrária e Veterinária, Santarem, Portugal, [3]REQUIMTE, Faculdade de Ciências, Universidade do Porto, Porto, Portugal, [4]REQUIMTE, ICBAS, Universidade do Porto, Porto, Portugal.*

The information about rumen fatty acid (FA) composition is essential to understand the effects of ruminant diets on the composition of meat and milk. The aim of this work was to compare the FA composition in rumen content using a transesterification procedure, which directly produces FA methyl esters (FAME) from intact sample, and a 2-step extraction procedure followed by transesterification. Freeze-dried rumen samples from lambs were used. In the direct transesterification method (DT), the FAME were prepared by the addition of sodium methoxide in methanol followed by HCl in methanol. In the extraction methods, 2 subsequent extractions were carry out, first with 3× dichloromethane:methanol (2:1) (DMM) followed by a second extraction of the residue with methanol:water:HCl (5:4:1) (MWH). Both extracts were transesterified and the FAME were analyzed by GLC. The DT method produced 41 ± 1.1 mg/g DM of FAME in rumen samples, whereas the DMM plus MWH produced 32 ± 0.7 mg/g DM. These lost FAME were found in the aqueous phase of the DM extraction, which was then re-extracted (RE) 2× to recover more 9.9 ± 0.2 mg/g DM of FAME. Thus, the combined fractions accounted 42 ± 0.9 mg/g DM of FAME, which showed to be similar ($P = 0.708$) to the FAME produced by the DT method. Despite the saving of time and solvents compared with the extraction methods, the DT does not give information about the FAME composition of the different fractions (DMM, MWH and RE). Indeed, the FAME composition of the MWH and RE showed that the dimethylacetals and OBCFA are almost absent in these fractions suggesting that the microbial lipids are almost completed extracted with DMM. In contrast, the highest proportion of the total C18 FA was observed in the RE fraction, mainly because of the highest proportions of the C18:1trans, suggesting that *trans* FA are more retained in the aqueous phases and less extractable. As conclusion, both DT and combined extraction methods generate similar final results, given the extraction methods more information, although to produce reliable results the extractions should be checked to ensure complete lipid extraction.

Key Words: rumen, fatty acid, lipid

TH38 Delayed feeding of fat enriched protein supplement alleviates postprandial suppression of in vitro rumen metabolism. Q. Baptiste*, E. Nestor, S. Chavez, S. Rastle-Simpson, K. D'Souza, A. Redhead, M. Knights, and E. Felton, *West Virginia University, Morgantown.*

The effects of time of feeding a fat enriched protein supplement on postprandial rumen metabolism were investigated with in vitro rumen fermenters. All fermenters were fed a basal diet of orchard grass hay in unequal portions throughout the day, with the largest meals being fed at 0600 and 1800 h. The supplement of soybean oil mixed with soybean meal was fed to fermenters at 10% of total daily dry matter. Control (C) fermenters did not receive any supplement at any time. Three supplementation times were tested. Supplement was fed to fermenters at 0600 h (AM), 1800 h (PM), or in evenly divided doses at both times (AP). Fermenter effluent samples were collected at eight 3-h intervals over a 24-h period and were analyzed to determine concentrations of ammonia nitrogen [NH_3-N] and total volatile fatty acid [TVFA]. Fermenter pH was measured at each collection time. A quadratic treatment × postprandial time interaction ($P < 0.01$) was observed for pH, [NH_3-N] and [TVFA]. Postprandial [TVFA] of AP fermenters tended to increase ($P = 0.08$) at 6 h, was elevated ($P = 0.04$) by 9 h and had a peak value at 21 h which did not differ ($P = 0.10$) from that of C fermenters at 21 h. Contrastingly, AM fermenters [TVFA] were similar ($P = 0.11$) to PM and ($P = 0.48$) C fermenters but lower ($P = 0.02$) than that of AP fermenters at 21 h postprandial. Similarly, AP treatment elevated ($P \leq 0.05$) postprandial [NH_3-N] at 6, 18 and 21 h. There was also a tendency for PM treatment to elevate postprandial [NH_3-N] at 6 h ($P = 0.09$) and [NH_3-N] was higher in AP and PM ($P \leq 0.01$) than in AM at 21 h. Postprandial [NH_3-N] profiles were similar ($P \geq 0.05$) in AM and C fermenters. Postprandial pH was flatlined in C and AM but fluctuated greatest with AP and PM treatments. In AP treatment, postprandial pH peaked at 6 h ($P = 0.02$) and was numerically lower than other treatment pH values between 3 and 24 h. Fermenter pH increased ($P < 0.03$) between 15 and 21 h with PM treatment. Therefore, delayed feeding (AP, PM) of a fat enriched protein supplement alleviates postprandial suppression of in vitro rumen metabolism.

Key Words: in vitro, rumen, metabolism

TH39 Estimation of energy content and short-chain fatty acid for microwave irradiated sorghum grain by in vitro gas production technique. F. P. Khajehdizaj*, A. Taghizadeh, B. B. Nobari, and H.Paya, *Dept of Animal Science, Faculty of Agriculture, University of Tabriz, Tabriz, Eastern Azarbaijan, Iran.*

There is an interest in the industrial application of microwaves to improve conventional drying processes, with the intent of taking advantage of its lower startup time, faster heating, greater energy efficiency, space savings, precise process control, selective heating and yielding final products with improved nutritive quality. Objective of this study was to elucidate the effect of different irradiation times of microwave on estimated nutritive values of sorghum grain. The DM of sorghum grain was evaluated and water was added to increase the moisture content up to 30%. Three samples were subjected to microwave irradiation (Butane microwave BC380W) at a power of 900w for 3, 5 and 7 min. Gas production was measured by Fedorak and Hrudy method. Rumen liquor samples were obtained from the 2 wethers that were fed on a diet comprising (DM basis), 55% forage and 45% commercial concentrate. Rumen fluid was collected after the morning feeding. ME, NEl and SCFA values were calculated from the amount of gas produced at 24 h of incubation with chemical composition of sorghum grain using equations of Menke and Steingass and Getachew. The ME, NEl and SCFA were affected ($P < 0.05$) by microwave treatment (Table 1). As can be seen microwave treatments increased ($P < 0.05$) ME and NEl of sorghum grain. But there was no significant difference between time periods of treatment. The higher ME, NEl and SCFA predicted from gas production in microwave treated sorghum, due to a high absolute gas production at 24 h of incubation can be resulted from changes in chemical composition of treated sorghum. Gelatinization led to chemical and physical changes in the starch granules and facilitated starch availability for microorganisms to ferment them.

Table 1. Gas production estimated characteristics of untreated and microwave-treated sorghum grain

Parameter	Untreated	Microwave treated			SEM
		3 min	5 min	7 min	
ME (MJ/kg DM)	7.15[b]	8.06[a]	8.38[a]	7.93[a]	0.215
NEl (MJ/kg DM)	4.08[b]	4.75[a]	4.98[a]	4.66[a]	0.157
SCFA (mM)	0.84[b]	0.96[a]	1.01[a]	0.95[a]	0.030

[a–d]Means within a row with different subscripts differ ($P < 0.05$).

Key Words: in vitro gas production, microwave irradiation, sorghum grain

TH40 Effects of microwave irradiation on in vitro gas production characteristics of wheat grain. F. P. Khajehdizaj*, A. Taghizadeh, and B. B. Nobari, *Dept. of Animal Science, Faculty of Agriculture, University of Tabriz, Tabriz, Eastern Azarbaijan, Iran.*

Microwave energy penetrates a food or feed material and produces a volumetrically distributed heat source, due to molecular friction resulting from dipolar rotation of polar solvents and from the conductive migration of dissolved ions. The purpose of this study was to evaluate effects of microwave irradiation on gas production estimated kinetic parameters of wheat grain using gas production technique. The DM of 1 g sample in duplicate was determined and water was added to increase the moisture content of 1 kg wheat grain to 300 g/kg. Three samples (100 g each) were subjected to microwave irradiation (Butane microwave BC380W) at a power of 900w for 3, 5 and 7 min. Gas production was measured by Fedorak and Hrudy method. Rate and extent of gas production was determined for each feed by fitting gas production data with the one component model: $Y = A(1 - e^{-ct})$, where Y is the volume of gas produced at time t (h), A the potential gas production (mL g^{-1} DM), and *c* the fractional rate of gas production (h^{-1}). Parameters A and c were estimated by an iterative least square method using a non-linear regression procedure of SAS. Microwave treatments for 5 and 7 min increased ($P < 0.05$) the A fraction and decreased ($P < 0.05$) the rate of gas production (*c*) of wheat grain (Table 1). Irradiated for long times of wheat grain had a rise in parameters. It seems that microwave irradiation improved gelatinization of starch and led to chemical and physical changes in the starch granule. Disruption of linkages between protein matrix and starch granule, hydrogen bonds and water absorption facilitated microbial or enzyme degradation of the starch granule.

Table 1. In vitro gas production characteristics of untreated and microwave treated wheat grain

Parameter[1]	Untreated	Microwave treated			SEM
		3 min	5 min	7 min	
A	303.1[b]	294.2[b]	325.4[a]	336.6[a]	4.380
c	0.121[a]	0.120[a]	0.091[b]	0.083[b]	0.00278

[a–d]Means within a column with different subscripts differ ($P < 0.05$).
[1]A = potential gas production (mL/g DM); c = fractional rate of gas production (h^{-1}).

Key Words: microwave irradiation, gas production, rumen

TH41 Effect of alkaline pretreatment on in vitro volatile fatty acid production of sorghum grain. F. P. Khajehdizaj*, A. Taghizadeh, and B. B. Nobari, *Dept of Animal Science, Faculty of Agriculture, University of Tabriz, Tabriz, Eastern Azarbaijan, Iran.*

Sorghum grain (milo) is an excellent model for studying volatile fatty acid production during fermentation because sorghum has a resistant protein matrix and corneous endosperm in which starch (a major ingredient) has been embedded. Three types of chemical processing were used to monitor effects of alkaline pre-treatment on sorghum grain. Wood from an Elaeagnusan gastifolial tree was made and prepared by dissolving 500 of wood ash in 10 L of distilled water in plastic buckets. The mixture was stirred for 5 min and was allowed to settle for 15 h. The resulting supernatant was carefully removed and filtered through cotton cloth. A 500 g whole sorghum grain was soaked in 1 L of wood ash extract for 12 h. For NaOH and NaHCO3 processing, sorghum grain was mixed with 20 g/L of each of their solution in the proportion of 1 L of solution to 1 kg of grain and settled for 12 h. Untreated and alkaline pre-treated samples (300 mg) were weighed into 50 mL serum vial. Each feed sample was incubated in triplicate with 20 mL of rumen liquor and McDougall buffer solution (1:2) for each time of incubation. There were no differences for VFA production between Untreated and alkaline pre-treated sorghum at 12h ($P > 0.05$). This study revealed significant increase in VFA production of sorghum grain at time 4h of incubation by NaOH pre-treatment. It seems that the exact mechanism by which alkali improves digestibility of sorghum grain is not known, part of the improvement probably results from solubilization of hemicellulose in the seed coat, which renders the starch portion of the kernel more available for microbial attack

Table 1. The effect of alkaline pre-treatment of sorghum grain on in vitro total volatile fatty acids (mmol/L)

Time	Untreated	Alkaline pretreated			SEM
		Wood ash	NaOH	$NaHCO_3$	
4 h	5.3[b]	8.0[b]	14.7[a]	6.0[b]	1.34
12 h	23.3	22.0	25.7	19.0	3.06
24 h	58.0[a]	49.3[ab]	48.0[ab]	40.0[b]	5.49
48 h	82.0[a]	61.6[b]	57.6[b]	73.3[c]	2.16

[a–c]Means within a rows without common letter differ ($P < 0.05$).

Key Words: chemical treatment, sorghum grain, volatile fatty acids

TH42 Effect of essential oils on rumen fermentation and methanogenesis by in vitro gas production technique. E. W. Jin[1,2], J. Q. Wang*[1], Y. H. Jiang[1], D. P. Bu[1], W. J. Shen[1], H. T. Shi[1], W. H. Bao[1], and F. D. Li[2], *[1]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, [2]Gansu Agricultural University, Lanzhou, China.*

The objective of this study was to evaluate the effect of essential oil on rumen fermentation and methanogenesis by in vitro gas production technique. Ruminal fluid was obtained approximately 2 h before feeding from 3 dairy cows in mid-lactation fed total mixed ration (C:F = 40:60). Diet substrates is consistent with the donor cow, and approximately 0.5 g substrates were incubated with 75 mL of a 1:2 McDougall's buffer-to-ruminal fluid mixture for 72 h at 39°C. A randomized factorial design was used and there were 5 replicates in each treatment. The treatments were: cinnamon oil at the dose level of 0, 100, 300, 500 and 1500 mg/L, tea tree oil and clove bud oil with concentrations of 0, 50, 100, 300 and 1000 mg/L, respectively. The experiment was repeated 3 times. In vitro rumen fermentation parameters and dynamic gas production parameters were evaluated. Dynamic gas production data were obtained using automatic recording system of the AGRS-III in vitro gas production (China Agricultural University, Beijing, China). Data were analyzed using the PROC MIXED Model of SAS. The concentrations of ammonia N were decreased ($P < 0.05$) with adding cinnamon oil at the dose level of 300 and 1500 mg/L. The addition of tea tree oil with a level of 1000 mg/L and cinnamon oil with a level of 1500 mg/L decreased ($P < 0.05$)

concentration of total volatile fatty acid and proportion of propionate. The addition of tea tree oil and clove bud oil at a level of 100 mg/L significantly ($P < 0.05$) increased in the theory maximum gas production. Compared with the control groups, the proportion of methane were decreased ($P < 0.05$) by 47.4, 40.2, 51.5, and 67.5% with adding tea tree oil and clove bud oil at the 1000 mg/L, and cinnamon oil at a level of 500 mg/L and 1500 mg/L individually. The extent of tea tree oil, cinnamon oil, and clove bud oil reducing methane and dose showed a positive linear correlation ($R^2 = 0.96$,0.77, and 0.99, respectively). It was concluded that the addition of tea tree oil at the level of 100 mg/L and cinnamon oil at the 100~300 mg/L may be beneficial to manipulate rumen microbial fermentation.

Key Words: essential oil, in vitro gas production

TH43 Effect of C18 unsaturated fatty acid and rumen temperature on rumen fermentation and methane emission. Y. H. Jiang[1,2], J. Q. Wang[1], D. P. Bu*[1], H. J. Yang[2], L. H. Baumgard[3], E. W. Jin[1], H. T. Shi[1], and W. H. Bao[1], *[1]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, [2]College of Animal Science and Technology, China Agricultural University, Beijing, China, [3]Department of Animal Science, Iowa State University, Ames.*

Study objective were to evaluate the effect of high ruminal temperature on biohydrogenation and methane production using a dual-flow continuous culture system. The design of the experiment was a 2 × 4 factorial arrangement with 3 replicated independent runs, and a fermenter in continuous culture was considered an experimental unit. Oleic acid (OL), linoleic acid (LA), and linolenic acid (LNA) were added to the diet (3% of DM basis) and incubated with a normal ruminal temperature (39°C, RT) or high ruminal temperature (41°C, HT). Each fermenter was incubated in 1000 ± 10 mL filter rumen fluid and artificial saliva was continuously delivered to yield a fractional dilution rate of 6.0%/h by injection pump. Each independent period consisted of 5 d of adaptation and 3 d of sample collections. The samples for VFA, NH_3-N, and methane were obtained from the fermenter during the last 3 d. Data were analyzed using the GLM procedure of SAS. Compared with RT incubation, propionate concentration was decreased under HT incubation under HT ($P < 0.01$), but increased HT tended to increase concentration of isobutyrate ($P < 0.01$), butyrate ($P < 0.01$). The rumen fermentation would be changed in high ruminal temperature according to the value of ratio of non-glucogenic to glucogenic acids (NGR) ($P < 0.01$). The concentration of acetate and propionate were also lower in the OL compared with LA, LNA, and control ($P < 0.01$), the OL under HT increased the acetate: propionate (HT vs. RT, 2.68 vs. 2.40; $P < 0.01$) and the NGR ($P < 0.01$). The production of methane was not affected by the unsaturated fatty acid, but high ruminal temperature tended to decrease the production of methane ($P > 0.05$). The data suggests that rumen fermentation changes during heat stress.

Key Words: biohydrogenation, high ruminal temperature, rumen simulation system

TH44 Screening and characterization of *trans*-11 18:1 hydrogenating bacteria from rumen of dairy cows. Y. F. Lu[1,2], D. P. Bu*[1], S. G. Zhao[1], D. Jin[1], G. Q. Zhao[2], X. L. Hu[1], and J. W. Zhao[1], *[1]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Sciences, Beijing, China, [2]College of Animal Science and Technology, Yangzhou University, Yangzhou, China.*

Trans-vaccenic acid (*trans*-11 C18:1, t-VA) serves as a precursor for the synthesis of unsaturated fatty acid and conjugated linoleic acid in the rumen. The purpose of this study was to isolate and identify t-VA hydrogenating bacteria in vitro and further to analyze their biochemical characteristics and phylogenetic position. The ruminal samples were collected from Holstein cows and inoculated into Hungate tubes in 3 triplicates with basal medium containing t-VA (50 μg mL^{-1}) under anaerobe chamber. 87 clones were picked by numerous transfers of spread plate cultivation ($n \geq 5$) at 39°C for 12h after enrichment incubation. Samples were collected at 0 and 12 h of clones' reenrichment. Fatty acids profiles were detected by gas chromatograph. The biochemical characterization of the isolated strain RV the highest t-VA hydrogenation bacteria was analyzed by VITEK 2 compact system. Data were analyzed using SAS. The 16S rDNA and functional genes, sodA, rpoB and recN, were sequenced and used for phylogenic tree building using neighbor joining method. The isolated bacterium was named RV. It was strictly anaerobic, gram-positive, globose or oval shaped, and had optimum growth at 39°Cand pH 6.0–7.8. The carbon or energy sources of RV can be from D-xylose, D-maltose, D-cellobiose, D-ribose, pullulan. It contained some enzyme activities (e.g., α-galactosidase, aginine dihydrolase1, α-glucosidase and arylamidase) and resistant phylotpye to bacitracin, novobiocin, polymixin B. RV significantly reduced T11C18:1 at 12 h of incubation ($P < 0.01$). The t-VA hydrogenating efficiency of RV is 82.1%. The 16S rDNA of RV had high identity to *Streptococcus equinus* and *Streptococcus bovis* (99–100%). However, observed from the phylogenetic tree of functional genes, the RV had the highest homology to *S. bovis*. One t-VA hydrogenating bacterium named RV which is a strain from *S. bovis* was isolated from bovine rumen. To our knowledge, this is the first study showing that *S. bovis* has t-VA hydrogenating activity and this study would provide a strain for the research of biohydrogenation mechanisms in the future.

Key Words: biohydrogenating bacteria, *Streptococcus bovis*, *trans*-vaccenic acid

TH45 Effects of rumen-protected γ-aminobutyric acid on performance and health status in heat-stressed dairy cows. J. B. Cheng[1,2], D. P. Bu[1], J. Q. Wang*[1], X. Z. Sun[1,2], L. Pan[1], and W. Liu[1], *[1]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, [2]College of Animal Science and Technology, Anhui Agricultural University, Hefei, China.*

This experiment was conducted to investigate the effects of rumen-protected γ-aminobutyric acid (GABA) on lactational performance and health status in heat-stressed dairy cows. Sixty Holstein dairy cows (141 ± 15 DIM, 35.9 ± 4.3 kg of milk/d) were randomly assigned to 1 of 4 treatments in a completely randomized design (n = 15). Treatments consisted of 0 (control), 40, 80, or 120 mg GABA/kg DM from rumen protected GABA. The experimental period lasted 70 d. The average temperature-humidity index (THI) at 0700, 1400 and 2200h was 78.4, 80.2 and 78.7, respectively. Compared with control cows, cows fed 40 or 80 mg/kg GABA had decreased ($P < 0.05$) rectal temperatures at 0700, 1400 and 2200h, but 120 mg/kg GABA had no effect ($P > 0.05$) on rectal temperature. Cows supplemented with GABA had no effect ($P > 0.05$) on respiration rates at any time point. Cows fed 40 mg/kg GABA had increased dry matter intake (DMI) (22.71 vs. 21.13 kg/d; $P < 0.05$), milk yield (33.23 vs. 31.15 kg/d; $P < 0.05$), energy-corrected milk (ECM) (32.76 vs. 29.84 kg/d; $P < 0.01$) and 4% fat corrected milk (FCM) (30.38 vs. 27.89 kg/d; $P < 0.05$) compared with control cows. DMI (22.16 vs. 21.13 kg/d), Milk yield (31.97 vs. 31.15 kg/d), ECM (31.32 vs. 29.84 kg/d) and FCM (29.27 vs. 27.89 kg/d) tended ($P <$

0.10) to be higher for cows fed 80 mg/kg GABA compared with controls, but milk yield and ECM were not affected ($P > 0.05$) in cows fed 120 mg/kg GABA. Dietary treatment had no effect ($P > 0.05$) on milk fat content, milk SCC and feed efficiency, but milk fat yield (1.14 and 1.10 vs. 1.03 kg/d; $P < 0.01$) was increased in cows fed 40 or 80 mg/kg GABA than those in controls. Milk protein content (3.01%) and yield (0.99 kg/d) were increased ($P < 0.01$) for cows fed 40 mg/kg GABA than for other treatments. Milk lactose and total solid content, and milk urea nitrogen were increased ($P < 0.05$) by GABA supplementation. In conclusion, rumen-protected GABA supplementation could alleviate heat stress, increase feed intake, improve milk performance, and the optimal supplemental GABA level for heat-stressed dairy cows would be 40 mg/kg DM.

Key Words: γ-aminobutyric acid, milk performance, heat stress

TH46 Effects of rumen-protected γ-aminobutyric acid on rumen fermentation of dairy cows under heat stress. J. B. Cheng[1,2], J. Q. Wang*[1], D. P. Bu[1], X. Z. Sun[1,2], L. Pan[1], and W. Liu[1], *[1]State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, [2]College of Animal Science and Technology, Anhui Agricultural University, Hefei, China.*

γ-Aminobutyric acid (GABA) is an inhibitory neurotransmitter in the central nervous system, and has some physiological functions. The objective of this study was to determine the effects of rumen-protected GABA on rumen fermentation in heat-stressed dairy cows. Sixty Holstein dairy cows (141 ± 15 DIM, 35.9 ± 4.3 kg of milk/d) were randomly assigned to 1 of 4 treatments (n = 15 cows/group). Treatments were (1) control (no supplemental GABA), (2) 40mg GABA/kg DM from rumen protected GABA, (3) 80mg GABA/kg DM, and (4) 120mg GABA/kg DM. Cows were exposed to heat stress in the experimental period, during which time average temperature-humidity index (THI) at 0700, 1400 and 2200 h was 78.4, 80.2 and 78.7, respectively. The experimental period consisted of 2 wk for adaptation to the diet and 8 wk for sampling. Ruminal fluid samples were collected at 2 h after the morning feeding on d 70 of experimental period. Fecal samples were collected from the rectum or the ground, when fresh, at the end of experimental period: at 0900, 1500, and 2100 h (d 67), and at 0300, 0600, 1200, 1800 h (d 68), and at 0000 h (d 69). Compared with control, cows supplemented with GABA had higher concentrations of ammonia nitrogen (6.46, 7.13 and 7.64 vs. 4.94 mmol/L; $P < 0.01$), total volatile fatty acid (112.20, 112.61 and 115.25 vs. 100.96 mmol/L; $P < 0.05$), acetate (76.36, 74.67 and 78.41 vs. 68.45 mmol/L; $P < 0.01$), propionate (21.14, 21.80 and 21.73 vs. 18.83 mmol/L; $P < 0.01$), and microbial protein (0.49, 0.54 and 0.54 vs. 0.34 mg/mL; $P < 0.01$), but ruminal pH, concentrations of butyrate and valerate, ratio of acetate to propionate, enzyme activities of carboxymethylcellulase and xylanase were not different ($P > 0.05$) among treatments. Concentrations of iso-butyrate (0.99 and 0.91 vs. 0.76 mmol/L; $P < 0.01$) and iso-valerate (1.65 and 1.51 vs. 1.14 mmol/L; $P < 0.05$) in ruminal fluid were increased by 80 or 120 mg/kg GABA supplementation compared with control. These results indicate that rumen-protected GABA supplementation improved rumen fermentation in heat-stressed dairy cows.

Key Words: γ-aminobutyric acid, rumen fermentation, heat stress

TH47 Rumen biohydrogenation of polyunsaturated fatty acids differs between herb species. M. B. Petersen*[1] and S. K. Jensen[2], *[1]AgroTech, Institute for Agri Technology and Food innovation, Aarhus, Denmark, [2]Aarhus University, Department of Animal Science, Tjele, Denmark.*

Feeding species-rich herbage to dairy cows has been shown to alter ruminal biohydrogenation (BH) of polyunsaturated fatty acids (PUFA) and to lead to a higher content of beneficial PUFAs in milk, but little is known on how single plant species affect BH. In this study BH of PUFAs from 5 different plant species: chicory (*Cihorium intybus*), English plantain (*Plantago lanceolata*), salad burnet (*Poterium sangusisorba*), birds foot trefoil (*Lotus corniculatus*), alfalfa (*Meticago sativa*), and a clover grass mixture [on DM basis: 21% white clover (*Trifolium repens*) and 78% perennial ryegrass (*Lolium perenne*)] was investigated. The samples were incubated in 3 replicas in ruminal fluid from cows fed 3 different diets; a TMR based on corn- and grass silage, herbs silage composed of 10 herbs species and a ryegrass silage. Each feeding period lasted 21 d with collection of fluid at d 21. Twenty-two milliliters of strained rumen fluid, 22 mL buffer, and 1 g freeze-dried plant material were transferred to tubes, and incubated for 0, 2, 4, 6, 12, 24, and 30 h. Though BH occurred faster when samples were incubated in TMR rumen fluid, the overall BH pattern for PUFA was not dependent on the cows' diet. Differences in BH of the main PUFAs, C18:3n-3 (ALA) and C18:2n-6 (LA), was observed between single species. The lowest BH rate for both ALA and LA after 30 hours incubation was seen in salad burnet (51 and 37 percent ($P < 0.05$) for ALA and LA, respectively). Highest BH of ALA after 30 hours incubation was seen in birds foot trefoil (82 and 57%, $P < 0.05$) for ALA and LA, respectively). The highest content of c9,t11 C18:2 after 30 hours was observed for birds foot trefoil (0.007 g/ kg DM, $P < 0.05$) whereas no differences in content of C18:1t11 between species was seen. These results indicate that ALA and LA from salad burnet inhibit BH. The effect of herb silage on milk fat composition is currently studied in large scale on organic farms.

Key Words: biohydrogenation, fatty acid, herb

TH48 Microbiological and fermentative indicators in response to the inclusion of yeast *Candida norvegensis* on in vitro and in vivo experiments. O. Enriquez*[1], N. Madera[1], O. Ruiz[1], Y. Marrero[2,1], C. Arzola[1], C. Rodriguez[1], and A. Corral[1], *[1]Universidad Autonoma de Chihuahua, Chihuahua, Mexico, [2]Instituto de Ciencia Animal, La Habana, Cuba.*

Two experiments were made to compare the effect of yeast *Candida norvegensis* on utilization of fibrous feeds. The objective of these 2 studies were to evaluate, in vitro and in vivo, the response to the inclusion of doses of *Candida norvegensis* of corn stover. In the in vitro experiment 3 treatments were tested: 0 (0%), 30 (1.5%) and 60mL (3%) within 4 measuring times: 0, 24, 48 and 72h. On the other hand, the in vivo experiment was made with repeated measures over time evaluating the effect of 2 treatments of yeast: 0mL (0%) and 750 mL animal^{-1} day^{-1} (3.75%), at 0 4 8 and 12h; in both experiments a completely randomized design was used. Differences exist for measuring time, except pH showed no variation. A reduced production of ammonia nitrogen was presented at 0h ($P \leq 0.01$) with 0.42 mL mmol^{-1}; also showed a decrease in NDF on dry matter and ADF of dry matter while the time passed ($P \leq 0.01$). However, true digestibility of dry matter and NDF digestibility increased in the in vitro experiment ($P \leq 0.01$). In the in vivo experiment, a bigger population of total and cellulolytic bacteria were found with (6.22 and 8.10 cfu mL^{-1} log 10, respectively) in response to yeast doses, also higher pH and lower ammonia nitrogen values (6.95 and 0.51 mM ml^{-1} respectively). For measurement times, differences were found ($P \leq 0.05$) in total bacteria count, pH and ammonia nitrogen, showing the highest values of total bacteria at 0h, the highest pH value and the lowest of ammonia nitrogen at 12h. In conclusion there was no effect of yeast on the measuring parameters of the in vitro study, however the inclusion of 750 mL animal^{-1} day^{-1} of yeast in vivo, increases the

microorganisms population and reduces the ruminal concentration of ammonia nitrogen in sheep; so it can say that *Candida norvegensis* can be considered as an alternative additive for improving the use of fibrous feeds on ruminant feeding.

Key Words: additive, ruminant, yeast

TH49 Effects of purified n-6 and n-3 fatty acid on rumen fermentation indices and greenhouse gas emission in relation to bio-hydrogenation. S. M. Amanullah[1], S. C. Kim*[1], D. H. Kim[2], H. J. Lee[2], Y. J. Jae[2], Y. H. Joo[2], E. T. Kim[2], S. S. Lee[2], and I. H. Choi[3], *[1]Department of Animal Science (Inst. Agric. & Life Sci.), Gyeongsang National University, Jinju, South Korea, [2]Division of Applied Life Science, Gyeongsang National University, Jinju, South Korea, [3]Department of Companion Animal & Animal Resource Sciences, Joongbu University, Geumsan, South Korea.*

An in vitro experiment was conducted to estimate the effect of n-6 and n-3 fatty acid on rumen fermentation indices, fatty acid profile and greenhouse gas (GHG) emission. The treatments contained either pure C18:2n-6 (T1), C18:3n-3 (T2) or mixture of these fatty acids at 1:1 ratio (T3). Rumen fluid was collected from 2 cannulated Hanwoo steers fed rice straw and concentrate mixture in 2:8 ratio. Incubation was performed in 50 mL glass serum bottles containing 2 mg of fatty acid, 15 mL of incubation medium (rumen fluid + Van Soest medium = 1:2) and 150 mg of synthetic diet (411 g cellulose, 411 g starch, and 178 g casein/kg DM) at 37°C for 0, 1, 2, 4 and 8 h with 5 replications and 3 blanks. It was observed that the rate of bio-hydrogenation of n-6 and n-3 fatty acid (FA) is comparatively lower in T3 than others, characterized by higher C18:2n-6 and/or C18:3n-3 ($P < 0.0001$), PUFA ($P = 0.002$) and PUFA/SFA ratio ($P = 0.002$), but lower C18:0 ($P = 0.002$) and SFA contents ($P = 0.006$). The pH was not affected by the treatments in any incubation periods ($P > 0.05$). The concentrations of ammonia-N ($P = 0.002$), total VFA ($P = 0.039$) and iso-butyrate ($P < 0.001$) were higher in T1 than in the other treatments after 8 h of incubation. Methane production observed significantly lower ($P = 0.033$) in T2 than other treatments at 4 h of incubation. Concomitantly, propionate concentration also increased numerically in T2 at that period. Total gas volume and carbon dioxide content remained unaffected throughout the periods ($P > 0.05$). The results suggested that the mixture of pure n-6 and n-3 fatty acid is more effective to resist bio-hydrogenation partially to improve n-6 or n-3 fatty acid concentration in rumen rather than solely.

Key Words: fatty acid biohydrogenation, greenhouse gas, rumen fermentation

TH51 Effects of different forage profiles diets on key genes expression of fatty acid synthesis in the mammary gland of lactating dairy goats. H. Zhang, C. J. Ao*, L. W. Song, E. Khas, and X. F. Zhang, *Department of Animal Science of Inner Mongolia Agricultural University, Huhhot, Inner Mongolia, China.*

The objective was to investigate the effects of 2 forage profiles diets on the key gene expression of enzymes related to fatty acid synthesis in the mammary gland of goats. Analysis of mRNA expression for stearoyl coA desaturase (SCD), acetyl-coenzyme A carboxylase- α (ACACA), fatty acid synthesis (FASN) and lipoprotein lipase (LPL) were performed. Eight multiparous lactating goats (BW = 45.6 ± 2.5 kg, DIM = 90 ± 12 d) were assigned to 2 treatments in a crossover design. Animals were fed diets with different forage profiles, the concentrate-roughage ratio in the treatments were 40:60. Treatments were (1) hay (30%), corn straw (30%) with additional 40% of concentrate (HCS; CP: 14.2%, NDF: 39.7% and ME: 2.39Mcal/kg); (2) hay (30%), corn silage (20%) and alfalfa (10%) with additional 40% of concentrate (HCA; CP: 10.6%, NDF: 50.4% and ME: 2.24Mcal/kg), on DM base. Mammary gland biopsies were performed after milking on the last day of each period. The mammary tissue biopsy (50 mg/animal) was immediately frozen in liquid nitrogen and stored at −80°C until RNA isolation. Samples of total RNA were reverse transcribed to cDNA to determine the expression of key genes for fatty acid synthesis by the method of RT-PCR. Statistical analysis was performed using a paired *t*-test on the difference between treatments. Mammary mRNA abundance of SCD, which is involved in fatty acid desaturation, in animals fed HCA was increased by 50% ($P > 0.05$), ACACA and FASN, which are involved in de novo fatty acid synthesis were increased by 18 and 20%, respectively ($P > 0.05$) and LPL, which is involved in fatty acid uptake, was increased by 39% ($P > 0.05$) when compared with HCS. The data demonstrated that diet with high quality roughage (HCA) can increase the gene expression of enzymes that are related to milk fat synthesis in the mammary gland of dairy goats.

Key Words: dairy goat, fatty acid synthesis, mammary gland

TH52 Roughage quality affects mammary gland uptake of major milk fat precursors in lactating dairy cows. L. W. Song, C. J. Ao*, E. Khas, and H. Zhang, *Department of Animal Science, Inner Mongolia Agricultural University, Huhhot, Inner Mongolia, China.*

The objectives of this study were to determine the effects of roughage quality on fatty ACID metabolism in mammary gland and their transfer into milk fat in lactating dairy cows. Nine multiparous Holstein cows (BW = 617 ± 21; DIM = 120 ± 20) were used in a replicated 3 × 3 Latin square design with 21 d of diet adaptation and 7 d of data collection. Blood was collected from external pudendal artery and subskin abdominal vein. Treatments (DM basis) were (1) 40% corn straw plus 60% commercial concentrate supplement A (CSA; CP: 16.55%, NDF: 37.06%, NEL: 1.50 Mcal/kg); (2) 40% corn straw plus 60% commercial concentrate B (CSB; CP: 15.57%, NDF: 41.84%, NEL: 1.46 Mcal/kg); (3) 3.7% hay, 26.7% corn silage, 28.4% alfalfa plus 41.2% concentrate (Mixed Forage as MF; CP: 15.50%, NDF: 41.39%, NEL: 1.44 Mcal/kg). Fatty acids were analyzed by gas chromatography and data were analyzed by the PROC MIXED procedure of SAS 9.0. Results showed that DMI were lower for animals in MF group (13.69 kg/d) when compared with those in CSA and CSB groups (15.66 and 15.24 Kg/d, $P = 0.004$). No differences in milk yield and composition were observed among treatments, the MF group significantly increased the dairy efficiency (1.43) compared with the CSA (1.26) and CSB (1.26, $P = 0.05$) groups. The concentrations of most LCFAs (C16 to C18) and total FA in plasma of both artery and vein from animals in the MF group were higher than CSA and CSB groups. Particularly, plasma concentration of linolenic acid (C18:3n3) was significantly higher ($P < 0.0001$) in the MF group compared with CSA and CSB groups, and the plasma FA profiles were reflected in milk. Animals in the MF group had the highest milk concentration of linolenic acid (0.38g/100g vs. 0.26 and 0.20g/100g, $P = 0.04$). The MF group tended to increase the mammary extraction rate of total LCFAs than CSA and CSB ($P = 0.17$); however, no significant difference was found on the uptake ratio of mammary gland between treatments. We inferred that the different roughages sources could not change the FA extraction rate in mammary gland, and high quality roughages tended to adjust the milk fat composition to be better for human health.

Key Words: dairy cows, fatty acid, mammary uptake

TH53 Effect on fatty acids metabolism in mammary gland by two different diets of lactating dairy goats. L. W. Song, C. J. Ao*, E. Khas, H. Zhang, and S. W. Liu, *Department of Animal Science, Inner Mongolia Agricultural University, Huhhot, Inner Mongolia, China.*

Our objective was to determine the effects of different diets on the changes of the milk fat percentage, milk fat yields and the fatty acids metabolism in mammary gland. Eight multiparous Lactating goats(BW = 45.56 ± 2.5 kg, DIM = 90 ± 12 d) fitted with blood vessel intubation in external pudendal artery (EPA) and subskin abdominal vein (SAV) were administered 2 treatments in a crossover design. The diets used same concentrate but different roughage, Concentrate-roughage ratio was 40:60. Treatments were (1) hay (30%), corn silage (20%) and alfalfa (10%) as roughage on dry matter basis (HCA; 10.57% CP, 50.37% NDF and ME 2.24 Mcal/kg); (2) hay (30%), corn straw (30%) (HCS; 14.25% CP, 39.69% NDF and ME 2.39 Mcal/kg). Each period lasted 3 wk. At the last 3 d of each period, we collected the blood of EPA and SAV via the blood vessel intubation for FA detection. All data were analyzed by the PROC MIXED procedure of SAS9.0. The milk fat percentage of HCA group (3.04%) was significantly higher ($P = 0.01$) than HCS group (2.84%). But the differences of milk fat yields between 2 treatments (15.28 vs. 14.51g/d) were not significant ($P = 0.22$). HCA treatment increased the percentage of long-chain FA (>16C) that can be absorbed by mammary gland compared with HCS (35.03 vs. 33.03%, $P = 0.16$), the concentration of FA composition in the blood of EPA and SAV and in the milk were not significantly different, but the total percentage of SFA by HCA was lower than HCS (71.71% vs. 73.41, $P = 0.15$), UFA by HCA was higher than HCS (28.29 vs. 26.59%, $P = 0.15$). HCA tended to increase the concentration of total FA of EPA plasma than HCS (0.73 vs. 0.57, $P = 0.32$), significantly different in SAV plasma (0.62 vs. 0.44, $P = 0.02$), especially the concentration of C18:0 and C18:2c6 (0.1 vs. 0.08, $P = 0.12$; 0.12 vs. 0.09, $P = 0.11$, respectively). HCA treatment contrast to HCS, the milk fat percentage increased probably because of the increase in total exogenetic FA in milk fat flow through EPA and SAV of mammary gland.

Key Words: dairy goat, fatty acid composition, milk fat percentage

TH54 Study of effects of conjugated linoleic acid (CLA) on feed intake, milk yield and composition, and milk fatty acid profile of Holstein dairy cows in early lactation. A. Mahdavi*, K. Rezayazdi, A. Z. Shahneh, and M. Dehghan-Banadaky, *Department of Animal Science, College of Agriculture and Natural Resources, University of Tehran, Karaj, Tehran, Iran.*

The aim of this experiment was to determine the effects of conjugated linoleic acid (CLA) supplement on feed intake, milk yield and composition, and milk fatty acid profile of Holstein cows in early lactation. Fifteen multiparous lactating Holstein cows (20 ± 3 DIM; mean ± SD) were blocked by milk production, and assigned in a completely randomized block design for 2 wk of adaptation followed by 5 wk of supplementation. Treatments were (1) control (115 g/d Ca salts of palm fatty acids), (2) rumen-protected CLA (120 g/d of lipid-encapsulated CLA), and (3) rumen-unprotected CLA (40g/d rumen unprotected CLA that replacing and balancing by Ca salts of palm fatty acids). Each dose provided 96 g/d fatty acids. Both of CLA supplements provided 12 g/d of *trans*-10, *cis*-12 CLA. Individual milk yield and DMI were recorded daily and milk composition was determined weekly. Data were analyzed by MIXED procedure of SAS. DMI was not affected by CLA supplements. There was a significant increase in milk yield in rumen-protected CLA compared with other treatments ($P < 0.01$), which were 44.6, 42.0, and 41.7 kg/d for rumen-protected CLA, rumen-unprotected CLA and control, respectively. The rumen protected CLA reduced milk fat content compared with other treatments ($P < 0.01$), which were 2.76, 3.29, and 3.36% for rumen-protected CLA, rumen-unprotected CLA and control, respectively. In contrast, there were no significant differences in content of milk protein and lactose between treatments. The proportion of short- and medium-chain fatty acids decreased in rumen-protected CLA compared with other treatments whereas the proportion of long-chain fatty acids increased in rumen-protected CLA. There was a significant increase in milk fat content of *trans*-10, *cis*-12 in rumen-protected CLA compared with control ($P < 0.01$). The Δ^9-desaturase index was not affected by CLA supplements. The results of this experiment indicated that rumen-protected CLA could increase milk yield, decrease milk fat content, and alter milk fatty acid profile of Holstein dairy cows in early lactation.

Key Words: conjugated linoleic acid, Holstein cow, milk fat

TH55 High levels of crude glycerin in the diets of lambs finished in feedlot: ruminal fermentation. V. B. Carvalho*, J. M. B. Ezequiel, V. R. Fávaro, R. F. Leite, E. M. de Oliveira, É. H. Fernandes, L. F. Cremasco, J. R. Paschoaloto, M. T. C. Almeida, and B. H. F. Araújo, *FCAV, São Paulo State University - UNESP, Jaboticabal, São Paulo, Brazil.*

In most studies crude glycerin (CG) has been evaluated as a partial replacement of corn in the diet. This trial aimed to evaluate the effects of inclusion of high levels of CG (83% glycerol) in diets of feedlot lambs, replacing the corn until the whole, in ruminal fermentation: rumen pH and rumen ammonia concentration. Five rumen-cannulated Santa Inês lambs were used in a 5 × 5 Latin square design and were housed in individual pens. Diets were isonitrogenous and concentrate:forage ratio of 82:18 and were fed to the animals twice per day amounting 0.880 kg of DM (restricted intake). Five experimental diets were consisted of Tifton hay, corn, crude glycerin, corn gluten meal, corn oil, urea, sunflower meal, soybean hulls and mineral salt. Treatments were used: Without inclusion of CG, including 7.5% of CG, 15% of inclusion CG, 22.5% of CG inclusion and 30% CG inclusion of dry matter. To determine pH and ammonia concentration, rumen fluid samples were taken through the rumen cannula at the time of feeding (0) and, 1, 2, 4, 6 and 8 h after feeding. Statistical analysis was performed using the MIXED procedure of SAS and data were compared using orthogonal contrasts (linear and quadratic). The time of harvest was included as a repeated measure. The rumen pH and ammonia concentrations were not influenced by treatments ($P = 0.6881$) and ($P = 0.2819$), respectively. The mean values of pH and ammonia concentration were respectively 6.21 and 28.38 mg/dL. These data suggest that the use of crude glycerin in high levels not affect the rumen pH and ammonia concentration.

Key Words: ammonia, glycerol, pH

TH56 Lactation performance of dairy cows grazing a tropical pasture supplemented with sources of rumen protected fat. J. De Souza*[1], F. Batistel[1], K. C. Welter[2], M. M. V. Silva[1], C. Sitta[1], M. G. M. F. Santos[1], L. J. Chagas[1], D. F. A. Costa[1], and F. A. P. Santos[1], *[1]University of Sao Paulo, Piracicaba, SP, Brazil, [2]University of Sao Paulo, Pirassununga, SP, Brazil.*

The objective of this experiment was to investigate the effects of supplementation of early lactation dairy cows grazing a tropical pasture with diets containing calcium salts of palm oil (CSPO) or calcium salts of soybean oil (CSSO) on milk production and composition. Twenty-seven cows (15 ± 3 DIM) were used in a randomized block design and subjected to the following treatments: (a) control (no fat); (b) 400 g

CSSO cow^{-1} d^{-1}; (c) 400 g CSPO cow^{-1} d^{-1}. Treatment periods were 90 d in length followed by cows staying in the same diet to evaluated residual effect until the end of lactation period (280 DIM). Cows grazed paddocks of *Pennisetum purpureum* and received 8 kg cow^{-1} d^{-1} (DM) of concentrate twice daily. Milk yield was measured every 2 d and milk composition was analyzed every 6 d. Data were analyzed as repeated measures using a mixed model with block as random effect. The means were compared by Tukey test at 5%. Both sources of fat increased milk yield during the supplementation period (24.2; 26.8 and 29.0 kg d^{-1} for control, CSSO and CSPO, respectively). Milk yield was higher for CSPO than for CSSO. CSPO did not affect milk fat content in comparison with control (3.3 vs. 3.5% for CSPO and control, respectively), while CSSO reduced milk fat content (2.8%). Both fat sources decreased milk protein content (3.3; 3.1 and 3.1% for control, CSSO and CSPO, respectively), but did not affect lactose content (4.6; 4.5 and 4.6% for control CSSO and CSPO, respectively). Cows receiving CSSO lost less body weight (−5.4 vs. −18.3 kg $^{-1}$) and BCS (2.85 vs. 2.65) than cows receiving CSPO. After the supplementation period milk yield remained higher for CSPO in comparison to control and CSSO (21.0 vs. 18.4 and 19.3 kg d^{-1}, respectively). Milk composition was not affected after the supplementation period. CSPO increased total milk yield during lactation compared with control (7300 vs. 6100 kg $^{-1}$) and CSSO (7300 vs. 6600 kg $^{-1}$) treatments. Grazing dairy cows in early lactation supplemented with fat had a pronounced positive effect on performance throughout the whole lactation.

Key Words: palm oil, soybean oil, tropical pasture

TH57 Concentrate levels and supplemental fat for grazing mid-lactating dairy cows on milk fatty acids profile. F. L. Macedo, J. De Souza*, F. Batistel, W. F. Angolini, S. F. Angolini, and F. A. P. Santos, *University of Sao Paulo, Piracicaba, SP, Brazil.*

The objective of this experiment was to evaluate the interactions between the association of concentrate levels and fat supplementation on fatty acid profile in milk of dairy cows grazing a tropical pasture. Twenty-four Holstein × Jersey crossbred cows were assigned to randomized blocks according to number of lactation (primiparous or multiparous), DIM (132d ± 60) and milk yield (20.9 kg d^{-1} ± 2.22) in a 2 × 2 factorial arrangement. Treatments were (1) HS: High supplementation (1 kg of concentrate for every 2.5 kg of milk); (2) LS: Low supplementation (1 kg for every 5 kg of milk); (3) HSCS: HS with 2.78% of calcium salt of soybean oil (CS, Megalac-E); (4) LSCS:LS with 5.76% CS. Cows grazed fertilized Elephant grass pastures during 90 d. Milk samples were collected at 30, 60 and 90 d. Data were analyzed using MIXED procedure with statistical significance at $P < 0.05$ using Tukey test. The main saturated fatty acids (SFA) present in pasture and CS was C16:0 (18.4 and 17.6%), while unsaturated FA (UFA) were C18:2 c-9, c-12 (12.29 and 40.33%) and 18:3 n-3 (51.9 and 3%). The association of a possibly high dissociation of CS of soybean oil, rich in UFA, in the rumen along with a higher pasture DMI of treatments with low supplementation compared with the high supplementation (9.3 vs. 12.2 kg d^{-1}) most likely increased intake of C18:2 and C18:3. This may explain the increase in UFA, mono unsaturated FA (MUFA) and PUFA in milk of cows from CS treatment. Increasing UFA, particularly some PUFA (C18:2 isomers and CLA), may cause depression in milk fat, but they are also known for their human health related benefits.

Table 1. Fatty acids profile in milk of dairy cows supplemented or not with fat and different concentrate levels (CL)

	Treatment				*P*-value		
Fatty acids, %	HS	LS	HSCS	LSCS	CL	Fat	CL × Fat
SFA	64.7	61.3	59.9	58.0	0.008	0.001	0.43
UFA	33.0	36.1	37.8	39.4	0.01	0.001	0.46
MUFA	30.2	33.1	34.3	35.6	0.02	0.002	0.35
PUFA	2.79	2.98	3.45	3.83	0.02	0.001	0.44
18:2 c9,c12	0.28	0.15	0.65	0.56	0.01	0.001	0.10
18:2 c9,t11	0.19	0.42	0.09	0.051	0.001	0.001	0.18
18:2 t10, c12	0.003	0.002	0.003	0.01	0.09	0.04	0.04

Key Words: milk fatty acid, soybean oil, tropical pasture

TH58 Mathematical model for cheese yield prediction using nutritional composition of diets for dairy cows. E. Chávez-Delgadillo, D. Hernández-Sánchez, L. M. Vargas-Villamil, M. M. Crosby-Galván, O. Hernández-Mendo, S. S. González-Muñoz*, and R. Pinto-Ruiz, *Colegio de Postgraduados, Montecillo, Estado de México, México.*

The objective of this study was to develop a mathematical model to predict cheese yield using dairy cow live weight and composition of the diet as inputs. First, a systematic analysis of data from papers published by the *Journal of Dairy Science* (between 1980 and 2011) was carried out. Selection of papers and variables for the model was aimed to obtain 6 least squares linear regressions for predicting dry matter intake ($R^2 = 0.625$), milk production ($R^2 = 0.906$), milk protein yield ($R^2 = 0.904$), milk fat yield ($R^2 = 0.835$), lactose yield ($R^2 = 0.948$) and casein yield ($R^2 = 0.999$). Normal distribution of residuals for each linear regression was verified using Anderson-Darling test (P-value ≥ 0.05), with mean equal to zero and constant variance. Besides, each equation was validated using the new data for calculating the average predicted squared errors and the percentage of variability, to explain the model with the new data (R^2 prediction). The Van Slyke and Publow equation was used to predict cheese yield, which was also validated using the variability for the mathematical model here developed. According to this model, cheese yield and feed efficiency are sensible to changes in diet composition. Thus, both variables will be improved by increasing non-fiber carbohydrates and hemicellulose concentration in the diet but they will be reduced by increasing rumen degradable protein, whereas increasing ether extract in the diet will decrease cheese yield and improve feed efficiency.

Key Words: mathematical model, cheese yield, diet composition