Wednesday, July 14, 2010

POSTER PRESENTATIONS

Animal Health: Probiotics and Diet

W1 Improved health status of newborn calves from dairy cows treated intravaginally with probiotic bacteria. Q. Zebeli*, S. Iqbal, S. M. Dunn, and B. N. Ametaj, *University of Alberta*, *Edmonton, AB, Canada*.

Improving cow's reproductive health during the transition period might be beneficial for the health status of newborn calves. We recently developed an intravaginal probiotic treatment to prevent uterine infections in dairy cows. This study sought to evaluate the effects of probiotic treatment of dairy cows on selected plasma variables and the incidence of diarrhea in newborn calves. Nineteen dairy calves coming from control (CTR; n = 10) or cows administered intravaginally with a probiotic culture (PRO; n = 9) at −2 and −1 wk prepartum as well as at +1, +2, +3, and +4 wk postpartum were used in this study. A total of 10^{10} to 10^{12} cfu of a probiotic culture consisting of *Lactobacillus sakei* FUA 3089, *Pediococcus acidilactici* FUA 3140, and *P. acidilactici* FUA 3138 was dissolved in 1 mL reconstituted skimm milk. Calves were supplied with 4 kg colostrum/d up to 3 d after birth, and blood samples were collected from the jugular vein on d 3 and 10. The incidence of diarrhea was monitored daily in all calves up to 2 wk. Blood data were submitted to repeated measures ANOVA, whereas the incidence of diarrhea was analyzed by chi-squared test with SAS. Significance and tendency levels were considered at $P < 0.10$ and $P < 0.15$, respectively. Data indicated that PRO calves showed greater concentration of glucose (89.4 vs. 101.5, ± 4.6 mg/dL), but lower lactate (5.7 vs. 4.3, ± 0.5 mmol/L) in the plasma ($P < 0.10$). Also, concentrations of haptoglobin (444 vs. 347, ± 60.1 μg/mL) and β-hydroxy-butyrate (125 vs. 107, ± 6.9 μmol/L) in the plasma tended to be lower in the PRO calves ($P = 0.11$). There was no effect of treatment on calf's body weight at birth, plasma non-esterified fatty acids, and cholesterol ($P > 0.15$). Frequency tables revealed that 6 out of 10 calves (60%) pertaining to the CTR group were affected by diarrhea, whereas the PRO calves showed lower ($P = 0.09$) incidence of diarrhea (2 from 9; 22.2%). In summary, results suggested that intravaginal treatment of the pregnant cows with probiotics during the transition period enhanced the metabolic health status of newborn dairy calves.

Key Words: probiotics, dairy calf, plasma metabolites

W2 Infusion of commensal bacteria intravaginally improved overall health status of transition dairy cows. Q. Zebeli*, S. Iqbal, S. M. Dunn, and B. N. Ametaj, *University of Alberta*, *Edmonton, AB, Canada*.

Transition period is associated with high incidence of metabolic and infectious diseases in dairy cows. Because commensal lactobacilli exert immune-stimulating properties, we hypothesized that intravaginal administration might promote health status of the transition dairy cows. This study sought to evaluate the effects of intravaginal administration of commensal lactobacilli on the incidence of metabolic diseases in transition dairy cows. Eighty Holstein cows were blocked by parity and incidence of disease in the previous lactation, and randomly allocated to 1 of the 2 different treatment groups. Forty cows (incl. 12 primiparous cows) were administered intravaginally with 10^{10} to 10^{12} cfu bacterial culture (*Lactobacillus sakei* FUA 3089, *Pediococcus acidilactici* FUA 3140, and *P. acidilactici* FUA 3138) dissolved in 1 mL reconstituted skim milk (TRT). The control cows (CON) received 1 mL of reconstituted skim milk only. Infusion was carried out by an insemination pipette at −2 and −1 wk prepartum and at +1, +2, +3, and +4 wk postpartum. Urine and vaginal pH were measured before the culture administration. Cows were monitored daily for incidence of disease, starting from −2 wk up to +8 wk postpartum. Data were analyzed statistically by chi-squared test with SAS. Results showed that TRT cows had lower incidence of lameness (56.1 vs. 34.2%; $P = 0.04$) and susceptibility from more than one disease such as metritis, pyometra, and mastitis (27.5 vs. 15.9%; $P < 0.01$). Treatment tended to lower the number of medications (7.3 vs. 4.5 medications/cow; $P = 0.09$) throughout the experiment in multiparous cows. Also, multiparous TRT cows showed greater urine pH (7.9 vs. 8.2; $P = 0.03$). Vaginal pH was affected only by day of sampling being the lowest at −3 d before parturition ($P = 0.02$). Data showed that 51.9% of multiparous CON cows had a strong (>25%) day-to-day variation of feed intake, whereas this variable was 21.4% in the TRT cows ($P = 0.02$). In conclusion, results indicated that intravaginal treatment of the pregnant cows with commensal lactobacilli improved health status of transition dairy cows.

Key Words: dairy cow, metabolic disorder, intravaginal lactobacilli

W3 Intravaginal administration of commensal lactobacilli modulated plasma metabolites and innate immunity in periparturient dairy cows. S. Iqbal, Q. Zebeli, S. M. Dunn, and B. N. Ametaj*, *University of Alberta*, *Edmonton, AB, Canada*.

Dairy cows experience a high incidence of uterine infections after parturition which initiates major changes in metabolism and activation of an acute phase response. The objective of this study was to test the effects of an intravaginal infusion of a mixture of lactobacilli around parturition on selected plasma metabolites and innate immunity in transition dairy cows. Eighty pregnant Holstein heifers and dairy cows were randomly assigned to one of the following treatments: 1) intravaginal administration of 1 mL of carrier alone (reconstituted skim milk) for the control cows, or 2) intravaginal administration of 10^{10}-10^{12} cfu of probiotic bacteria dissolved in 1 mL of reconstituted skim milk. The probiotic preparation contained a mixture of *Lactobacillus sakei* FUA 3089, *Pediococcus acidilactici* FUA 3140, and *P. acidilactici* FUA 3138 isolated from the vaginal tracts of healthy cows. Probiotics were applied intravaginally with a sterile syringe and insemination pipette once during wk −2, −1, +1, +2, +3, and +4 relative to parturition. Blood samples were collected from 15 cows per group (5 heifers and 10 cows) to be analyzed for β-hydroxybutyrate (BHBA), non-esterified fatty acids (NEFA), glucose, lactate, and haptoglobin (Hp). Results showed lower concentrations of BHBA (647 vs. 846 μmol/L; $P < 0.05$) and greater plasma NEFA (266 vs. 136 μEq/L; $P < 0.01$) in primiparous cows of treatment group. These cows also showed an interaction between treatment and wk of sampling for NEFA which were higher on wk +1, +2, and +4 ($P < 0.05$), and tended to be greater on wk +6 ($P = 0.11$). Also, an

interaction between treatment and time of measurement for cholesterol in multiparous cows ($P = 0.13$) was obtained. Interestingly, the overall analysis showed an interaction between treatment and wk of measurement for plasma Hp which was lower in the treatment group on wk −1 ($P = 0.05$) and tended to be lower on wk +2 ($P = 0.07$). In summary, intravaginal administration of lactobacilli modulated plasma metabolites and improved innate immunity in periparturient dairy cows.

Key Words: dairy cow, intravaginal probiotics, plasma metabolites

W4 Intravaginal treatment with probiotics decreased the incidence of subclinical mastitis in dairy cows. S. Iqbal, Q. Zebeli, S. M. Dunn, and B. N. Ametaj*, *University of Alberta*, *Edmonton, AB, Canada*.

The decrease in milk production and high culling rate associated with mastitis are major concerns of the dairy industry. The aim of this study was to evaluate the effect of an intravaginal administration of a probiotic preparation around parturition to prevent development of subclinical mastitis in dairy cows. Eighty pregnant Holstein cows were randomly assigned to one of the 2 treatment groups: 1) intravaginal administration of 1 mL of carrier alone (reconstituted skim milk) for control cows, or 2) intravaginal administration of 1 mL of reconstituted skim milk containing 10^{10} to 10^{12} cfu of probiotic bacteria. The probiotic preparation contained a mixture of *Lactobacillus sakei* FUA 3089, *P. acidilactici* FUA 3140, and *Pediococcus acidilactici* FUA 3138 isolated from the vaginal tracts of healthy cows. Probiotic bacteria were applied intravaginally with a syringe and a sterile insemination pipette once during wk −2, −1 and +1, +2, +3, and +4 around calving. Milk samples were collected from 15 cows (5 heifers and 10 cows) per group to be analyzed for different milk variables. Results of the overall ANOVA showed that treatment lowered SCC (85,000 vs. 236,000 cells/mL; $P = 0.02$); whereas, there was a tendency for higher protein yield (1.06 vs. 0.91 kg; $P < 0.10$), as well as lactose content (4.37 vs. 4.30%; $P = 0.12$), and yield (1.59 vs. 1.35 kg; $P < 0.10$). Data also indicated higher milk lactose yield (1.74 vs. 1.39 kg; $P = 0.04$) in multiparous cows treated with probiotics. The latter cows showed tendencies for lower SCC (73,000 vs. 235,000 cells/mL; $P < 0.10$), fat content (4.24 vs. 4.82%; $P < 0.10$), fat to protein ratio (1.48 vs. 1.69; $P < 0.10$) and solid non fats (1.48 vs. 1.69 kg; $P < 0.10$), but higher for protein yield (1.14 vs. 0.93 kg; $P < 0.10$) and lactose content (4.37 vs. 4.26%; $P = 0.10$). Data also demonstrated that the total solids tended to be higher (13.4 vs. 12.6%; $P = 0.15$) in primiparous cows. In conclusion, intravaginal probiotic administration lowered the risk of sub-clinical mastitis and modulated several milk components in postpartal dairy cows.

Key Words: dairy cow, probiotics, somatic cell counts

W5 Improved feed intake and milk production in transition dairy cows treated intravaginally with probiotic bacteria. S. Iqbal, Q. Zebeli, S. M. Dunn, and B. N. Ametaj*, *University of Alberta*, *Edmonton, AB, Canada*.

The transition period is critical for the health and productivity of dairy cows due to major changes in the dietary composition and physiological state. The aim of this study was to investigate the effects of an intravaginal administration of a mixture of lactobacilli around parturition on health status and milk production of dairy cows. Eighty pregnant Holstein primiparous and multiparous dairy cows were assigned, 2 wk before the expected day of calving, to one of the following groups receiving either 1) intravaginal administration of 1 mL of carrier alone (controls), or 2) intravaginal administration of 1 mL of reconstituted skim milk containing 10^{10} to 10^{12} cfu of probiotic bacteria. The probiotic preparation was a mixture of *Lactobacillus sakei* FUA 3089, *Pediococcus acidilactici* FUA 3140, and *P. acidilactici* FUA 3138 prepared with commensal bacteria isolated from the vaginal tracts of healthy cows. Probiotic bacteria were applied intravaginally with a sterile syringe and insemination pipette once during wk −2, −1,+1, +2, +3, and +4 around calving. Rectal temperatures were taken during +2 wk before and +3 wk after calving, whereas milk production and feed intake were collected starting from +2 wk before until +8 wk after calving. Multiparous cows tended to have greater feed intake (32 vs. 28 kg/d; $P = 0.08$) associated with higher milk production (37 vs. 34 kg/d; $P < 0.01$). The cumulative analysis of milk data demonstrated a trend for higher milk production in the treatment group ($P = 0.14$). The overall analysis also showed a trend for feed intake to be greater (32 vs. 28 kg/d; $P = 0.10$) in treated cows. Interestingly, treatment did not influence feed intake or milk production in primiparous cows ($P > 0.05$). Treatment also had no effect on body condition score ($P > 0.05$). Results showed an interaction between treatment and day of measurement for rectal temperature in multiparous cows during wk +2 ($P = 0.02$). In summary, intravaginal administration of commensal Lactobacilli improved feed intake and milk production in postpartal multiparous dairy cows.

Key Words: dairy cow, intravaginal probiotics, milk production

W6 Effect of medicinal plants on immune system of broilers. A. Naghizadeh, S. Rahimi*, S. Askari Rankouhi, K. Gharib Naseri, M. Lotfi, and M. Rezaei, *Tarbiat Modares University*, *Tehran, Tehran, Iran*.

This study was carried out to investigate the effects of dietary administration of some medicinal plants to improve immune responses efficiency in broilers. Total of 180 d-old broilers (Arbor Acres Plus) were randomly distributed in 6 dietary treatments as follow: control; 4 groups of medicinal plants (dried powder of peppermint; thyme; basil and garlic at 1.5%); and one group fed diets containing antibiotic (15 ppm). Each treatment was replicated 3 times. Blood samples were collected from 3 birds at random from each group on d 25 and 46 of the experiment for evaluation of immune responses, including humoral immune response to sheep red blood cells (SRBC) and Newcastle disease vaccine (ND) and cellular immune response to phytohemagglutinin (PHA). Results showed that supplementation of broilers diets with garlic and peppermint increased humoral immune response significantly (4.33 ± 0.07 and 3.99 ± 0.03 for garlic and peppermint groups vs. 2.33 ± 0.11, 2.66 ± 0.08, 3.00 ± 0.13 and 3.33 ± 0.06 for control, antibiotic, basil and thyme treatments respectively) ($P < 0.05$). There were no significant differences among the treatments on cellular immune response. Also there were no significant differences in Newcastle disease antibody titer (HI) except garlic treatment ($P > 0.05$). Results indicated that use of medicinal plants as dry powder, had no significant effects on humoral immune responses, except for garlic and peppermint. However, garlic supplementation to broiler diets caused significantly higher HI titers against Newcastle disease at 46d compared with 25d.

Key Words: medicinal plants, immune system, broilers

W7 In vitro effects of plant and mushroom extracts on immunological function of chicken lymphocytes and macrophages. S.-H. Lee*[1], H. Lillehoj[1], Y.-H. Hong[1], S.-I. Jang[1], E. Lillehoj[2], and D. Bravo[3], [1]*Animal and Natural Resources Institute, Agricultural Research Service, USDA*, *Beltsville, MD,* [2]*Department of Pediatrics, School of Medicine, University of Maryland*, *Baltimore,* [3]*Pancosma S.A.*, *Grand Saconnex, Geneva, Switzerland*.

The present study was conducted to examine the effects of 4 different plant extracts from milk thistle (*Silybum marianum*), turmeric (*Curcuma*

longa), reishi (*Ganoderma lucidum*) and shiitake mushroom (*Lentinus edodes*) on innate immunity and tumor cells. The innate immunity was measured by splenocyte proliferation, NO production by an established avian macrophage cell line, HD11, and the inhibitory effect on a chicken B-cell tumor cell line, RP9. Cytokine transcript levels (IFN-α, IL-1β, IL-6, IL-12, IL-15, IL-18, TNFSF15) in the HD11 treated with turmeric or shiitake mushroom were also measured by real time RT-PCR. In vitro culture of splenocytes treated with milk thistle, turmeric, or combined extract of shiitake plus reishi induced significantly higher cell proliferation compared with the control ($P < 0.01$). Stimulation of macrophages with milk thistle or combined extract of shiitake plus reishi ($P < 0.001$), but not turmeric, resulted in robust NO production. All extracts inhibited the growth of RP9 cells at the dose ranges of 6 to 100 μg/mL ($P < 0.001$). Finally, the levels of IL-1β, IL-6, IL-12, IL-18, and TNFSF15 mRNAs were enhanced in HD11 that were treated with turmeric or shiitake mushroom compared with the untreated control ($P < 0.01$). These results show that plant extracts used in this study activate innate immune system and are cytotoxic against an avian tumor.

Key Words: innate immunity, phytonutrients

W8 Yeast autolysate combined with probiotic strains: Investigation of health effects in vitro and ex vivo. A. Ganner*[1], S. Masching[2], N. Reisinger[1], G. Schatzmayr[1], and T. Applegate[3], [1]*BIOMIN Research Center*, *Tulln, Austria*, [2]*BIOMIN Holding GmbH*, *Herzogenburg, Austria*, [3]*Purdue University*, *West Lafayette, IN*.

Yeast derivates have been proposed to improve animal health by preventing infectious diseases, by modulating the immune system and by controlling pathogenic bacteria. Probiotics have been described as being capable of protecting the intestinal mucosa by being antagonistic to undesirable microorganisms. The study was conducted to evaluate a product, consisting of yeast autolysate, lactobacilli, *Enterococcus* sp., *Pediococcus* sp. and bidifobacteria, on jejunal structure, apoptotic enterocytes, blood profile and health status of broilers. To exclude weakening effect of live probiotic components, the yeast autolysate was examined in vitro for its capacity to bind *Lactobacillus* sp., *Enterococcus* sp. and *Bifidobacterium* sp. with a microplate assay by measuring the OD as growth parameter of adhering bacteria. In a 35 d study, 300 broilers were distributed into 2 groups: control and trial group (0.1% autolysate + probiotic mix of 10^8 CFU/kg feed). On d 35, parts of distal jejunum were collected from 8 birds per group. Villi length and goblet cells were examined by Schiff and hematoxylin staining. Apoptotic enterocytes were examined with DeadEnd TUNEL. Blood samples were analyzed by flow cytometry. No binding was detected between autolysate and selected probiotics. A clear positive influence could be observed by the test product on weight d 14 and daily weight gain (DWG) 1–14 ($P = 0.0001$); slight improvement weight d 35 and DWG 1- 35 ($P = 0.08$). The goblet cell number was also increased by test diet with 126/villus (control 98/villus, $P = 0.1$). Villus height, crypt and apoptotic cells were not affected. Heterophils ($P = 0.08$) and lymphocytes ($P = 0.004$) were enhanced in the trial group. Our results indicate that the product consisting of yeast autolysate and probiotics is able to improve gut health, to modulate immune cells and to enhance bird performance.

Key Words: autolysate, probiotic, jejunum, performance

W9 Effects of a feed additive on neutrophil expression of immunomodulatory genes and production performance in periparturient dairy cows. R. D. Schramm, S. L. Shields*, D. L. Sevier, M. A. McGuire, and P. Rezamand, *University of Idaho*, *Moscow*.

The objectives of this study were to determine the effects of a feed additive, OmniGen-AF, on 1) neutrophil expression of immunomodulatory genes including interleukin-8 receptor (IL-8r), L-selectin (L-SEL), and interleukin converting enzyme (ICE), and 2) production performance and milk composition during the early postpartum period in dairy cows. Holstein cows were blocked by parity and randomly assigned to one of 2 treatments: OmniGen-fed (n = 11) and control-fed (n = 11). All cows received a standard dry ration before calving and were switched to a lactation ration after parturition either supplemented with OmniGen-AF (220 g/d of an inert additive containing 56 g OmniGen-AF) or received the same ration with inert additive but without OmniGen-AF. Cows were individually fed using Calan gates, and feed intake and milk yield were determined daily. Blood samples were obtained on d 28 and 7 before expected calving date and on d 9, 19, and 28 postpartum. Blood neutrophils were isolated and analyzed for mRNA expression of IL-8r, L-SEL, and ICE by rt-PCR. Populations of white blood cells were determined by flow cytometry in a subset of samples (n = 3/treatment), and milk composition was determined by a certified DHI laboratory. Data were analyzed by SAS in the mixed model procedure. No significant treatment effect was detected on feed intake, milk yield, or milk composition. Populations of leukocytes, granulocytes, T-cells and B-cells were also not different ($P > 0.05$) between treatments. Neither SCC nor neutrophil expression of immunoregulatory genes tested differed significantly between treatments. However, mRNA expression of IL-8r decreased as parturition approached, and increased beyond the initial level during the postpartum period ($P = 0.008$). Downregulation of IL-8r in the present study may explain, in part, the immunosuppression evidenced in periparturient dairy cows. Further studies are needed to clarify the specific roles of OmniGen-AF on mammary gland health in dairy cows.

Key Words: dairy cow, neutrophil, OmniGen-AF

W10 Potential of *Metharrizium anisopliae* as biological mean to control *Boophilus microplus* in tropical dairy farms. E. Maldonado-Siman*[1], P. Martinez-Hernandez[1], E. Galindo-Velasco[2], M. Alonso-Diaz[3], and R. Rodriguez-DeLara[1], [1]*Animal Science Department, University of Chapingo*, *Texcoco, Mexico, Mexico*, [2]*University of Colima*, *Tecoman, Colima, Mexico*, [3]*Autonomous National University of Mexico*, *Martinez de la Torre, Veracruz, Mexico*.

Biological control of tick (*Boophilus microplus*) infestations in tropical dairy farms can be a feasible alternative to chemical control. The aim of the study was to determine the tick load on dairy cows sprayed with *Metharrizium anisopliae* (entomopathogenic fungus) in the summer. Field work was carried out in a certified organic dairy farm in Veracruz, Mexico. Two treatments were evaluated: spraying cows with *M. anisopliae* strain Ma34 at a concentration of 1×10^8 conidia/ml every other week and no-spraying (control). Control cows were sprayed with water every time treated cows were sprayed. A completely random experimental design with 21 replicates was used. The experimental unit was a cow. Experiment lasted 16 weeks (May to August). All cows had the same management except at the spraying time. Ticks were counted every week; the first count was just before the first spraying. Treatments were compared every week. All cows showed a same initial tick load (50 ticks/cow). Afterward, in 10 out of the 15 weeks, cows sprayed with the fungus showed from 34 to 78% lower ($P < 0.05$) tick load than control cows, the largest difference in tick load was found in the last 2 weeks of the experiment. It was concluded that *M. anisopliae* represents a potential biological control of ticks.

Key Words: biological control, ticks, tropical dairy

W11 Effects of Globigen egg protein on calf health and performance. D. Wood*, R. Blome, and J. Sowinski, *Animix*, *Juneau, WI*.

Study objective was to evaluate effect on calf health and performance of supplementation of Globigen egg antibody preparation (AB). Auction sourced Holstein bull calves (n = 150; ~1 wk of age) were shipped to the facility and randomly placed in individual raised, slatted stalls. Calves were assigned to receive 1) calf milk replacer (CMR, 22% C.P. 20% fat) n = 75, or 2) same formula +AB at 1 g/calf/fdg wk 1, 2 g/calf/fdg wk 2 and 1 g/fdg wk 3, total AB 56 g/calf, n = 75. No differences were noted in individual serum total protein ($P \leq 0.22$). Total 21 kg CMR was fed over 42 d starting at 362 g/calf/day stepping up to 682 g/calf d 16. Calves in every-other-stall in the barn received AB. Manufacturer detected anticipated presence rotavirus and coronavirus titer in AB fed. Both formulas contained plasma (5%), mannanoligosaccharides and chlortetracycline. Neomycin was administered in both formulas d 1–14. Starter grain (18% CP) was introduced d 14 at 113 g/calf, increased to 227 g/d d 21 and to 454 g/day d 34. Orts were not measured. There was no effect on gain during any period of the study. Data was analyzed using F-test for variances and student *t*-test comparing 2 means. Five fecal samples from scouring calves in both groups were analyzed for presence of rotavirus and coronavirus using real-time PCR assays. Strong positive was detected in 5/5 and 4/5 fecal samples for coronavirus and rotavirus respectively in both groups. Number of calves treated during peak scours (wk 2) was 33% and 37% for control and AB respectively. Total number of calves treated was 56% and 59% for control and AB respectively ($P \leq 0.74$). Total number of treatments week one were reduced 33% in AB ($P \leq 0.62$). Avg med $/calf was $2.53 control and $2.01 AB and AB cost $9+/calf. Both mortalities were not disease related. In conclusion, under conditions of this study AB had no effect on gain or morbidity despite presence of target pathogens and incidence of FPT exceeding 50%. Calves receiving AB may have been continually re-infected from neighboring calf not receiving AB, due to every-other-calf study design.

Table 1. Calf Performance

	Control	AB	P-value
Initial Wt, kg	46.4	46.5	≤0.87
21 d ADG, g	244	231	≤0.43
21–42 d ADG, g	685	675	≤0.69
42 d ADG, g	465	453	≤0.50
Mortality	2	0	

Key Words: calf, egg, antibody

W12 The effect of three commercial herbal extracts on broilers performance. Z. Teymourizadeh, S. Rahimi*, and M. A. Karimi Torshizi, *Tarbiat Modares University*, *Tehran, Tehran, Iran*.

An experiment was conducted to evaluate the effects of 3 herbal extracts and virginiamycin on performance, immune system, blood factors and intestinal selected bacterial populations in broiler chickens. A total of 4 hundred and 80 1-d old male broiler chicks were assigned to the basal diet (control); or basal diet supplemented with 15 ppm virginiamycin; 0.1% extracts of thyme (*Thymus vulgaris*), coneflower (*Echinacea purpurea*), garlic (*Allium sativum*); or a blend of extracts with the same dose(s). Broilers in the virginiamycin and coneflower treatment groups had the highest and lowest BW (2595g ± 56.20 vs. 2269g ± 48.2) and WG (2550.60g ± 45.7 vs. 2225g ± 36.4), respectively ($P < 0.05$). Lowest and highest FCR related to virginiamycin (1.71 ± 0.08, $P < 0.05$) and coneflower (1.86 ± 0.09, $P < 0.05$) respectively. There were no differences in carcass characteristics and fat pad, but small intestinal weight differed among treatments. Animals supplemented with virginiamycin had the lowest average small intestinal weight (2.29 ± 1.2), and control animals had the highest (2.84 ± 1.4) ($P < 0.05$). Relative weight of bursa Fabricius to body weight in the garlic group showed a significant increase compared with other groups, but relative weight of spleen to body weight was unaffected by treatments. Cutaneous basophil hypersensitivity response (to phytohemagglutinin injection) and antibody response to sheep red blood cells (SRBC) was higher in coneflower group ($P < 0.05$). Garlic (*Allium sativum*) significantly reduced the serum levels of cholesterol, LDL, and triglyceride and significantly increased the level of HDL. *E. coli* in ileo-cecal digesta of birds in the blend group was significantly lower compared with control group. However, there was no difference in *E. coli* counts between blend group and other treatment groups (this excludes the basal diet). Lactic acid bacterial counts were higher in the thyme group compared with the other groups except coneflower ($P < 0.05$).

Key Words: thyme, coneflower, garlic

W13 Omega-3 fatty acid enrichment of chicken meat by using fish oil. H. Saleh[1], S. Rahimi*[1], M. A. Karimi Torshizi[1], and A. Rahimi[2], [1]*Tarbiat Modares University*, *Tehran, Tehran, Iran*, [2]*Islamic Azad University*, *Tehran, Tehran, Iran*.

A 42-d study was conducted to evaluate the influence of fish oil inclusion on performance parameters, serum lipid content, antibody responses to sheep red blood cells (SRBC) antigen and meat fatty acid composition in broilers. Two hundred and sixteen 1-d-old broiler chicks from a commercial hybrid (Cobb 500) were randomly allocated to 4 groups comprising of 0.0, 1.5, 3.0 and 6% fish oil, according to a completely randomized design (CRD). The differences among the groups were significant regarding the performance, so that low level of fish oil (1.5%) were led to the higher feed intake and improvement of feed efficiency in comparison to control group ($P < 0.01$). The result of omega-3 fatty acid evaluation indicated significant differences among groups ($P < 0.01$) and the birds in 6% fish oil fed group had the highest level of n-3 fatty acid in meat. N-6/n-3 ratio of polyunsaturated fatty acids was lower in fish oil fed groups compared with the control group ($P < 0.01$). Broilers fed diets rich in omega-3 fatty acid had higher levels of anti-SRBC titer and lower levels of serum cholesterol and triglyceride than those fed control diet ($P < 0.05$). In conclusion, administration of 3% fish oil in broilers diet can improve the performance and immune response in these birds.

Key Words: performance, immune response, broiler meat

W14 Comparison the effect of commercial probiotics on performance and morphology of small intestine in broiler chicks. M. Soleimani[1], S. Rahimi*[1], M. A. Karimi Torshizi[1], and F. Niknafs[2], [1]*Tarbiat Modares University*, *Tehran, Tehran, Iran*, [2]*Zarbal Breeding Company*, *Amol, Mazandaran, Iran*.

Objective of this study was to compare the effects of different probiotics on performance and intestinal mucosa of broiler chickens. In this trial 480 d-old male broilers (Ross 308) were assigned as a completely randomized design to 6 experimental groups with 4 replicates with 20 birds per replicate as follows: control group (no feed additive in feed or water); 4 commercial probiotics and a lab-made probiotic. Body weight gain was significantly affected by monostrain, multispecies and yeast in finisher periods ($P < 0.05$). Multustrain, and lab-made probiotics significantly reduced FCR in starter period ($P < 0.05$). In all probiotic fed groups zigzag pattern of villi in ileum was more than control in d

21 of age ($P < 0.05$). In yeast, lab- made and monostrain groups ileum, villus length ($P < 0.01$) and apparent villus surface area were more than control and other probiotic groups ($P < 0.01$).The highest number of rows were observed in control group and the lowest number was in lab-made, and yeast group in duodenum in 35 d of age ($P < 0.05$). Crypt depth in jejunum was more in monostrain group in duodenum in 35 d of age. Tongue shaped villi in multispecies, lab-made, multistrain, yeast and monostrain groups were more than control group in 49 d of age. Leaf shaped villi in multispecies, multistrain, lab-made; yeast and monostrain groups were less than control group in d 49 ($P < 0.05$). Regardless of sampling age and site, lab-made group had the highest percent of tongue shaped villi and the lowest percent of leaf shaped villi ($P < 0.05$). Mortality rate, fecal moisture, blood hemoglobin concentration, serum cholesterol, relative weight of digestive organs, relative length of duodenum, jejunum, ileum, percent of convolute, bridge and finger shaped villi, villi length to crypt depth ratio, villi number per view field were not influenced by probiotics ($P > 0.05$).

Key Words: broiler, probiotic, performance

W15 Subjective assessment versus objective measurement of FAMACHA and hematocrits in sheep and goats fed herbs and ivermectin as dewormers under natural grazing conditions. H. A. Swartz*[1], C. Clifford-Rathert[1], A. N. Stewart[1], D. K. Sommerer[1], F. P. Wulff[1], K. Schmidt[1], and M. R. Ellersieck[2], [1]*Lincoln University*, *Jefferson City, MO*, [2]*University of Missouri*, *Columbia*.

Paramount in sheep and goats in hot summer months are internal parasite losses. The objective of this study was to determine the validity of applying a color chart, FAMACHA, (FAM) a subjective measurement (S) to hematocrits (HEM), an objective measurement (O) looking at the effects of *Haemonchus contortus*, that kills many sheep and goats from anemia. This trial compared ivermectin, a commercial dewormer, commercial herbs, herbal plants fed and a control groups receiving no treatment. Fecal egg counts (FEC) were measured in each collection period. The study was conducted in May, June, July, August, September and October 2009 with collection every 4 weeks. There were 4 treatment groups: 1) control, 2) ivermectin, 3) greenhouse *Artemisia absinthium* and (4) a commercial herbal dewormer. The control groups received no treatment, the ivermectin groups were treated monthly and the herbal groups were fed the herbs weekly. The McMaster FEC was used over the 6 mo period. The FAM subjective assessment ranged from 1 to 5 examining the ocular conjunctiva eyelid. The score of 1) bright red, 2) less red, 3) pink, 4) pale pink and 5) white indicating high to low HEM. Measurement of FAM, HEM and FEC were collected in Dorset (D) (n = 39), Katahdin (K) (n = 40) and Boer (B), (n = 41) divided into the 4 groups. Correlations coefficients over the 6 mo period used the Pearson correlation in statistics for S and O: 1) FAM-1 vs. HEM-1, r = −0.33 ($P \leq 0.01$), FAM-2 vs. HEM-2, r = −0.224 ($P \leq 0.01$), FAM-3 vs. HEM-3, R = .-.33 ($P \leq 0.0003$), FAM-4 vs. HEM-4, r = −0.36 ($P \leq 0.0001$), FAM −5 vs. HEM-5 r = . < 0.37 ($P \leq 0.0001$), FAM-6 vs. HEM-6, r = −0.53 ($P \leq 0.0001$). These results were analyzed using the Pearson correlation coefficient. The McMaster FEC showed differences within breeds and months using the SAS Proc MIXED statistical procedure on the FEM, HEM and FEC. All treatments differed within breeds and months from May to October and were highly significant at the $P \leq 0.000$l. In this study, herbs and ivermectin were effective in controlling internal parasites in K, D and B.

Key Words: FAMACHA, hematocrits, sheep and goats

W16 Effects of short-term tocopherol (T) feeding on nitric oxide production and protein nitration following endotoxin (LPS) challenge in beef calves. S. Kahl*[1], T. Elsasser[1], J. Shaffer[1], C. Li[1], K. Lebold[2], M. Traber[2], and S. Block[3], [1]*USDA, Agricultural Research Service*, *Beltsville, MD*, [2]*Oregon State University*, *Corvallis,* [3]*Archer Daniels Midland (ADM), Inc.*, *Decatur, IL*.

Posttranslational protein tyrosine nitration (pTN) contributes to functional tissue damage during pro-inflammatory stress. With regard to chemical reactivity, α-T has a greater antioxidant potential while γ-T has greater ability to inactivate reactive oxynitrogen species potentially involved in pTN formation. Our objective was to determine the effects of 5-d feeding of supplemental α-T (*A*, Novatol 1490, ADM; T content (%): α = 98.2, γ < 1) or γ-T (*G*, Decanox MTS-90 G, ADM; T content (%): α = 10, γ = 69) on the generation of key biomarkers of pTN during pro-inflammatory episodes initiated with LPS (0.25 μg/kg BW, i.v., *E. coli* 055:B5). Beef calves (n = 21; 211 ± 6 kg) were group penned in equal numbers across 3 test diet assignments: control (*C*, no supplement), *A*, or *G*. A growth diet was fed daily in all pens at 90% mean group ad libitum intake and top-dressed with a premix containing the treatments (daily intake/calf: Novatol = 1.25 g; Decanox = 3.85 g). Blood samples were obtained at 0, 7, and 24 h, and liver biopsy samples at −24 and 24 h relative to LPS injection. At LPS challenge, liver [γ-T] was: $G > C$ or A ($P < 0.01$) while [α-T] was: $A > G > C$ ($P < 0.01$). In all calves mean plasma concentrations of xanthine oxidase (XO, a superoxide anion producer, $P < 0.05$) and nitrate+nitrite (NO_x, an estimate of NO production, $P < 0.01$) increased after LPS. For XO no differences were observed between treatments but the increase in NO_x was attenuated in both *A* (45.7%) and *G* (46.3%) as compared with *C* ($P < 0.05$). The generation of pTN (measured by quantitative immunohistochemical localization of nitrotyrosine pixel density) 24 h after LPS was lower in *A* (24.4%) and *G* (27.4%) than in *C* ($P < 0.01$). Results indicate that a 5-d feeding of vitamin E isoforms differentially affects the generation of mediators of pTN but both significantly decrease overall pTN.

Key Words: cattle, endotoxin, vitamin E

W17 Interactive effects of active *Saccharomyces cerevisiae* and its cell wall material on intestinal microbial ecology during the receiving period of stressed beef cattle. C. T. Collier[1], J. A. Carroll*[1], J. R. Corley[2], A. G. Estefan[2], D. N. Finck[3], and B. J. Johnson[3], [1]*ARS-USDA*, *Lubbock, TX,* [2]*Lesaffre Feed Additives*, *Milwaukee, WI,* [3]*Texas Tech University*, *Lubbock*.

The effects of active *Saccharomyces cerevisiae* (SC) addition and/or its cell wall (CW) on hindgut microbial ecology were evaluated in receiving beef cattle (203+1.45 kg). Cattle were assigned to 1 of 4 treatment groups; with SC (n = 5); with CW (n = 4); with SC and CW (n = 6) and without (control; n = 5). The cattle were fitted with indwelling jugular catheters after 38d on feed. At 39d, *E. coli*-derived lipopolysaccharide (0.25 μg/kg BW) was administered via jugular catheter. After 24h, fecal samples were collected from the rectal probes inserted ~27 cm. Nucleic acids were isolated from the fecal samples then PCR amplified using 16S-V3-specific primers. Denaturant gradient gel electrophoresis was used to separate the resultant unique bacterial amplicons. Band numbers (bacterial species) were counted and banding patterns analyzed via Sorenson's pairwise similarity coefficients (C(S)); an index measuring common bacterial species between samples. Band numbers (23.5+1.3 vs. 29.6+0.8, respectively) and band intensity were greatest ($P < 0.05$) in SC-treated cattle when compared with CW-treated cattle suggesting a more species- and numerically-dense microbial profile. Intra-treatment band number variations were greatest ($P < 0.05$) in control (+3.6 bands) and SC/CW-treated (+5.5 bands) cattle when compared with

SC- (+1.6 bands) and CW-treated (+2.5 bands) cattle. Intra-treatment C(S) values were high, ranging between SC/CW (68.3+1.2) and SC (75.6+0.8). Inter-treatment C(S) comparison values were lower ($P < 0.05$) than intra-group values. Cumulatively, the C(S) values indicate homogenous microbial profiles within treatments that were unique from each other treatment. These results suggest that potential performance and immunological modulation of SC- and CW-treated cattle may partially be the result of modifying the intestinal microbial ecology. As the dynamic nature of the hindgut microbiota is typically resistant to protracted treatment-induced alterations, the sustained altered microbial profile observed here indicates that supplementation may select for a beneficial persistent microbiota.

Key Words: cattle, 16S-V3, ecology

W18 Effects of ochratoxin A on performance of broilers and the efficacy of a mycotoxin detoxifying product. U. Hofstetter*[1], R. Borutova[1], V. Starkl[1], I. Rodrigues[1], and C. W. Kang[2], [1]*Biomin Holding GmbH*, *Herzogenburg, Austria*, [2]*Animal Resources Research Center, College of Animal Bioscience and Technology, Konkuk University*, *Seoul, Korea*.

Aim of the study was to investigate the effects of various levels of ochratoxin A (OTA) on broilers and to evaluate the effect of a mycotoxin deactivator. 200 d-old male broiler chicken were divided into 20 groups and fed 5 different diets for 5 weeks. Group 1: control (OTA free); group 2: 1mg/kg OTA; group 3: 1mg/kg OTA with 0.2% mycotoxin deactivator ; group 4: 2mg/kg OTA; group 5: 2mg/kg OTA with 0.2% mycotoxin deactivator. The statistic method used was General Linear Model (SAS, 2002) for dispersion analysis and when there were statistically significant differences Duncan's multiple range test was used. As dietary OTA increased, feed intake and weight gain significantly ($P < 0.05$) decreased. The relative weights of liver and kidneys and the activities of glutamic-oxaloacetic transaminase and glutamic-pyruvic transaminase in the groups fed diets containing OTA alone were significantly higher ($P < 0.05$) compared with the control group. The level of total serum cholesterol was significantly reduced ($P < 0.05$) by feeding OTA contaminated diets. As dietary OTA increased, the levels of OTA in liver and kidney tissue were significantly increased ($P < 0.05$). The presence of a mycotoxin deactivating product in contaminated diets significantly decreased ($P < 0.05$) the OTA accumulation in organs. Moreover the fecal excretion of OTA and the metabolite OTα were significantly increased ($P < 0.05$) by feeding the mycotoxin deactivator. This increase of fecal excretion of OTA was attributed to the bentonite which is one component of the feed additive whereas the increase of fecal excretion of OTα was attributed to the yeast strain *T. mycotoxinivorans*, which is able to biotransform OTA into this non-toxic metabolite. In conclusion, these results indicated the harmful effects of dietary OTA on broiler performance. Adversary changes of physiological responses were observed in broilers. Feeding a mycotoxin deactivating feed additive ameliorated the OTA organ accumulation and OTA-induced performance reduction. Moreover levels of OTA in liver and kidney were found to be a better biomarker of intoxication than OTA in blood.

Key Words: ochratoxin A, broilers

W19 Effects of short-term tocopherol (T) feeding on structure-localized protein tyrosine nitration (pTN) patterns of mitochondrial ATPase following endotoxin (LPS) challenge in beef calves. T. Elsasser*[1], S. Kahl[1], J. Shaffer[1], R. Castellano-Perez[1], C. Li[1], and S. Block[2], [1]*USDA, Agricultural Research Service*, *Beltsville, MD*, [2]*Archer Daniels Midland (ADM), Inc.*, *Decatur, IL*.

Mitochondrial ATPase/Complex-V (MCV) is an electron transport chain (ETC) component needed for ATP synthesis. The ETC, exquisitely sensitive to proinflammatory mediators (PIM), generates oxynitrogen reactants leading to pTN formation as mitochondrial membrane leakage occurs. Immunohistochemical localization (IHC-L) of pTN (a biomarker of pTN damage to proteins) in liver following LPS suggests that pTN responses to PIM are not uniform across liver structures. Furthermore, because of their respective oxynitrogen reactivities, α-T and γ-T may differentially affect pTN formation in cells. Our objective was to determine the effects of 5-d feeding of supplemental α-T (*A*, Novatol 1490, ADM; T content (%): α = 98.2, γ < 1) or γ-T (*G*, Decanox MTS-90 G, ADM; T content (%): α = 10, γ = 69) on the nitration of MCV in central venous (CV), portal triad (PT), and hepatocyte/paranchymal (HP) areas of the liver after LPS challenge (0.25 μg/kg BW, i.v.). Beef calves (n = 21; 211 ± 6 kg) were penned and fed in equal numbers one of 3 test diets: control (*C*, no supplement), *A* (Novatol = 1.25 g/calf/d), or *G* (Decanox = 3.85 g/calf/d). Liver biopsy samples were obtained at −24 and +24 h relative to LPS injection. The MCV was measured by quantitative IHC-L and MCV nitration analyzed by proximity ligation assay (PLA, Olink Biosciences, Sweden). After LPS, MCV staining increased 4-, 3.4-, and 2-fold (vs. pre-LPS) in *C*, *A*, and *G*, respectively ($P < 0.05$, effect of T). By structure, MCV intensities (pixels/cell) were: HP < PT < CV ($P < 0.05$). With CV as the target structure, PLA demonstrated a 5-fold increase ($P < 0.05$) in colocalized pTN signals associated with MCV after LPS with decreasing ($P < 0.05$) nitration of MCV in samples where $G < A < C$. The data are consistent with MCV as a target for nitration after LPS and a protective effect of T against this nitration.

Key Words: endotoxin, mitochondria, vitamin E

W20 Reserpine-induced changes of the small intestinal histology and the expression of genes relative to mucosal immunity in rat. X. Zhu*[1], K. Guo[2], F. Liu[2,3], J. Yu[2], A. Lu[2], N. Zhang[1], G. Cheng[2,3], P. Yin[1], N. Wang[2], and J. Xu[1], [1]*TCVM Laboratory, CAU-BUA TCVM Teaching & Research Team, College of Veterinary Medicine, China Agricultural University*, *Beijing, China*, [2]*Department of Animal Science and Technology, Beijing University of Agriculture*, *Beijing, China*, [3]*Beijing Key Laboratory of TCVM, CAU-BUA TCVM Teaching & Research Team*, *Beijing, China*.

Clinical and experimental evidence indicates that damage to the intestinal surface structure can significantly impair intestinal epithelial integrity, as well as the stability of the mucosal immune system. The aim of this study was to investigate the changes of the small intestinal surface structure and the gene expression profile caused by reserpine treatment. Rats were randomly divided into two groups: the control groups (C) and the reserpine treated group (Res), 6 rats each group. The control rats and the Res rats were administered with Salt solution 0.9% and reserpine subcutaneously 0.5 mg/kg respectively for 7 days. At the end of the experimental period, the duodenum, jejunum and ileum were sampled for morphology structure examination and microarray analyses. Structural changes of the mucosa in Res included atrophy of villi and reduction in crypt size, indicating significant injury to the small intestinal mucosa. DNA microarrays were employed to examine the gene expression profile in the jejunum of Res versus C. According to the GeneSpring GX 10.0 analysis, twelve genes (Log2Ratio < −1.0) related to mucosal immunity were down-regulated and confirmed by real-time PCR. Genetic network of toll-like receptor 2 (Tlr2), toll-like receptor 4 (Tlr4), complement component 3 (C3), myxovirus (influenza virus) resistance 1 (Mx1) and myxovirus (influenza virus) resistance 2 (Mx2) was performed by GeneSpring GX 10.0 software. Results showed that genes associated with TLR2, TLR4 by a variety of mechanisms. The

lower levels of TLR2 protein in the jejunum of Res were in concert with previous findings that the mRNA levels of TLR2 were significantly lower in the Res. Immunohistochemistry results suggested that most TLR2 deposited from the epithelial cells of the rats jejunum brush border and submucosa. Rats treated with reserpine can induce down-regulation in gene expression relative to the innate mucosal immunity of the small intestine, as well as the TLR2 protein expression.

Key Words: reserpine, gene expression, small intestinal mucosa

W21 Gastrointestinal motility and gastrointestinal hormones VIP and GAS expression in reserpine-induced FGID rats. G. Jingyi[1], Z. Xiaoyu[1], C. Fei[1], C. Guilin[2,3], L. Fenghua[2,3], and X. Jianqin*[1], [1]*China Agricultural University China Agricultural University*, *Beijing, China*, [2]*Beijing University of Agriculture*, *Beijing, China*, [3]*CAU-BUA TCVM Teaching & Research Team*, *Beijing, China*.

The purpose of this study was to investigate effects of reserpine-induced rat functional gastrointestinal disorders (FGID) on the gastrointestinal motility, gastrointestinal hormones VIP and GAS expression. The rats were randomly assigned to 2 groups: Reserpine-treated group (RG) and Control group (CG), 12 rats each group. RG was intraperitoneally injected with reserpine 0.5 mL/kg; and CG with normal saline 0.5 mL/kg, once daily for 7 consecutive days separately. Six rats were chosen randomly from each group. Gastric emptying rate and intestinal propulsive ratio were detected by administration trophism semisolid. Collect serum and detect for the Amylase (AMS) and Lipase (LPS) activities were determined by kit manuals. Total RNA was isolated from stomach and small intestine using Trizol reagent. RT-PCR detected VIP and GAS mRNA expression. VIP and GAS protein contents were assayed by ELISA with according to the kit instructions. The surplus 6 rats of each group were determined gastric myoelectrical activity with Pclab-UE Systems. The statistic analysis were performed using ANOVA of SPSS 12.0. The results showed: compared with the control groups, serum amylase activity had significantly decreased ($P < 0.05$), while the lipase activity obviously increased ($P < 0.05$); gastric emptying rate was highly significantly lower ($P < 0.01$), and the intestinal propulsion ratio had improvement significantly ($P < 0.01$); both of the frequencies and amplitudes of gastric electrical ware had decreased obviously ($P < 0.05$). VIP mRNA expression in the reserpine-treated groups was significantly lower in the duodenum and jejunum ($P < 0.05$). GAS mRNA expression had improvement significantly in the stomach and ileum, and obviously decreased in the duodenum and jejunum ($P < 0.01$). VIP sharply decreased and GAS increased significant degree in the stomach ($P < 0.05$). The conclusion is, enzyme activities of serum and gastrointestinal motility were disordered as reserpine induced rat FGID. The stomach is a sensitive part of GI hormones VIP and GAS. The abnormal expression of GAS is one of the important factors.

Key Words: reserpine, gastrointestinal motility, GI hormones

W22 Effects of medicinal plants on broilers performance, organs weight, small intestine morphology and GIT microflora. A. Niknam, S. Rahimi*, J. Azimi, M. Hoseinzadeh, M. Moradi Nejad, and K. Seifi, *Tarbiat Modares University*, *Tehran, Iran*.

The objective of this study was to compare the effects of medicinal plants on some broilers characteristics. A total of 420, d-old male broilers (Arbor Acres) were randomly allocated into 7 groups with 5 replicates in a completely randomized design. The treatments were control, dry peppermint (*Mentha piperita*) (15kg/ton), thyme (*Thymus vulgaris*) (15kg/ton), basil (*Ocimum basilicum*) (15kg/ton) or garlic (*Allium sativum*) (15kg/ton), Virginiamycin (150g/ton) and Primalac (1kg/ton). On 42 d of experiment 15 birds from each group were sacrificed. The garlic increased ($P < 0.05$) body weight (BW) and feed conversion ratio (FCR) during d 0 to 28. There were no significant differences between groups in BW and FCR from d 28 to 42, total FCR and relative weights of gizzard, liver, neck and back muscle. However, the relative weight of the breast muscle and thigh were increased for peppermint and garlic-fed broilers, respectively ($P < 0.05$). Birds in the thyme and basil groups had highest villus height (VH) in duodenum and ileum, respectively ($P < 0.05$). Also, peppermint diet significantly increased duodenal absolute and relative length, and ileal villus width (VW), crypt depth and relative weight ($P < 0.05$). The only change found in the jejunum was an increase in the VW in birds given Primalac. Villus height to crypt depth ratio only increased at the ileum for virginiamycin-fed broilers ($P < 0.05$). Crop contents of garlic and peppermint treatments had highest and lowest number of lactobacillus (5.88 vs. 3.68 Log10 cfu/g), respectively ($P < 0.05$). There was no significant difference in coliforms number in crop, while highest number of total aerobic bacteria observed for control treatment (5.69 Log10 cfu/g), respectively ($P < 0.05$). Supplementation of diet with garlic increased number of lactobacillus in ileum (8.76 Log10 cfu/g) compare with other groups ($P < 0.05$), and Primalac increased both coliforms and total aerobic bacteria in ileum higher than other treatments ($P < 0.05$). In present study, effectiveness of medicinal plants in broiler performance demonstrates their use a potential alternative for antibiotic as growth promoters.

Key Words: medicinal plants, broiler performance, GIT microflora