

## Ruminant Nutrition: Proteins and Amino Acids - Beef, Sheep and Misc Ruminants

**W234 Effect of dietary CP level on visceral organ mass and the protein expression of ATP synthase and Na<sup>+</sup>/K<sup>+</sup>-ATPase in steers.** Y. J. Wang\*, S. Holligan, H. Salim, M. Z. Fan, B. W. McBride, and K. C. Swanson, *University of Guelph, Guelph, ON, Canada.*

Twenty-four beef steers (510 ± 6.7 kg BW) predominately of Angus breeding were used to determine the effect of dietary CP levels on visceral organ mass and the protein expression of ATP Synthase and Na<sup>+</sup>/K<sup>+</sup>-ATPase. Steers were allotted to 6 pens (4 steers per pen, 1 from each treatment) in a randomized block (pen; week of slaughter) arrangement of treatments consisting of high-moisture corn based diets containing 8.8, 12.1, 13.2 or 15.4% of dietary CP (DM basis), respectively. The starting date of the experiment was staggered so that all steers were on treatment for 28 d, and 4 steers from the same pen were slaughtered per week for 6 weeks and visceral organs were removed. Liver, kidney, rumen and jejunum were sampled. Wet tissue weight and intestinal length were recorded. The protein expression of ATP synthase and Na<sup>+</sup>/K<sup>+</sup>-ATPase in liver, kidney, rumen and jejunum was analyzed by Western blotting. Final BW and ADG increased linearly (kg; P < 0.008) as CP increased. Kidney, liver, lung, and rumen weights (g) increased linearly (P < 0.05) with increasing CP. Lung weight on a BW basis (g/kg BW) was also linearly increased (P < 0.05) with increasing CP. The protein expression of ATP Synthase in liver increased as CP level increased from 8.8 to 12.1% and decreased as CP level increased from 12.1 to 15.4% (P < 0.05). Kidney ATP Synthase increased linearly (P < 0.05) as CP increased. There was also a linear increase (P ≤ 0.05) in jejunum Na<sup>+</sup>/K<sup>+</sup>-ATPase with increasing CP. These results indicate that increasing dietary CP level increases ADG and the mass of kidney, liver, lung and rumen, and alters expression of proteins involved with ATP production and utilization in liver, kidney, and small intestine.

**Key Words:** Dietary CP, Expression of ATP Synthase and Na<sup>+</sup>/K<sup>+</sup>-ATPase, Steer

**W235 Intake and total and partial digestibility of nutrients, ruminal pH and ammonia concentration in beef cattle fed diets containing soybean silage.** J. P. Rigueira, O. G. Pereira\*, M. I. Leão, S. C. Valadares Filho, and R. Garcia, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

The intake and total apparent and partial digestibility of nutrients, ruminal pH and ammonia concentration were evaluated in beef cattle fed diets containing soybean silage (SS), SS with microbial inoculant (SSI), SSI with molasses (SSIM) and SS with molasses (SSM). Diets consisted of 40% soybean silage, 30% corn silage and 30% concentrate, being formulated to be isonitrogenous (13% CP, DM basis). The inoculant used was Sil All C4 (Altech, Brasil). Powder molasses was used in the ratio of 2.5% in natural basis. Four crossbred Holstein × Zebu steers, fistulated in the rumen and abomasum with 230 kg initial body weight, were assigned to a 4×4 Latin square design. Chromic oxide was used as a marker to estimate fecal and abomasal dry matter flows. The intakes (kg/day) and total, ruminal and intestinal apparent digestibilities of all nutrients were not influenced (P > 0.05) by diets. However, the intake of DM and NDF, as % BW, were affected (P < 0.05) by diets, where the animals fed the SSIM diet had higher intake than those fed SS diet. Mean values of 73.5 and 75.0; 70.4 and 44.0; 78.8 and 28.3; 73.3 and 86.2%, were calculated for the apparent total tract and ruminal digestibilities of DM, CP, EE and neutral detergent fiber correct

for ash and protein (NDFap), respectively. The ammonia concentration and ruminal pH were not influenced (P > 0.05) by diets and the mean values were 11.91mg/100ml and 6.45, respectively. Molasses, with or without microbial inoculant, in soybean silage did not affect intake and digestibility of nutrients, nor pH and ruminal ammonia concentration in beef cattle.

Financial support by CNPq and FAPEMIG

**Key Words:** *Glycine max*, Rumen Fermentation, Silage Additive

**W236 Dry matter intake and performance of Nellore steers fed diets based on different proportions of soybean and corn silages.** W. F. Souza<sup>1</sup>, O. G. Pereira\*<sup>1</sup>, K. G. Ribeiro<sup>2</sup>, S. C. Valadares Filho<sup>1</sup>, A. S. Chaves<sup>1</sup>, F. Zamuner<sup>1</sup>, and G. A. Aguiar<sup>1</sup>, <sup>1</sup>*Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.* <sup>2</sup>*Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina, Minas Gerais, Brazil.*

A trial was conducted with 30 Nellore steers (372 kg), castrated, and distributed in 6 randomized blocks to evaluate the effects of different proportions of soybean (SS) and corn silages (CS) on dry matter intake, ADG, carcass gain, feed conversion and carcass yield. The diets consisted of 60% silage and 40% concentrate (DM basis), and were formulated to contain 12.5% CP (DM basis). Treatments consisted of different proportions of soybean and corn silage: 100:0; 75:25; 50:50; 25:75 and 0:100, respectively (DM basis). The experiment was conducted for 84 d (15 d for diet adaptation, and 3 periods of 28 d for data collection). Steers were individually fed for ad libitum intake twice daily at 0700 and 1500. There were no differences (P > 0.05) in the daily intake of DM (kg/d or % BW) among treatments (Table 1). Similarly, no treatments effects were observed on ADG, carcass gain, and feed conversion, which were, on average 0.683 kg/day, 1.16 kg/day, and 7.66, respectively. Although animal performance was similar among the diets, an economic evaluation is necessary.

Financial support by CNPq and FAPEMIG

**Table 1. Effect of different proportions of soybean and corn silages on dry matter intake (DMI), average daily gain (ADG), carcass gain (CG), and feed conversion (FC)**

SS:CS	DMI, kg/d	DMI, %BW	ADG, kg/g	CG, kg/d	FC
100:0	8.67	2.09	1.21	0.665	7.3
75:25	8.75	2.07	1.14	0.688	7.65
50:50	8.95	2.02	1.21	0.690	7.45
25:75	8.92	2.12	1.1	0.698	8.13
0:100	8.96	2.17	1.17	0.678	7.77

**Key Words:** Carcass Gain, Feed Conversion, *Glycine max*

**W237 Efficacy of condensed glutamic acid fermentation solubles as a nitrogen source in ruminant diets.** A. I. Soria-Flores\* and L. L. Berger, *University of Illinois, Urbana.*

The efficacy of feeding a new condensed extracted glutamic acid fermentation solubles (GAFS) with GAFS containing *Corynebacterium*

in feedlot cattle. Twenty-four dairy-beef steers ( $425.8 \pm 0.9$  kgs) were randomly assigned to 6 pens (4 steers/pen). Steers were fed one of three diets: The Control diet was 72.5% cracked corn, 20.0% chopped hay, 5.0% molasses, 1.3% urea. The Old GAFS and New GAFS replaced the molasses and urea. Diets were formulated to meet NRC nutrient requirements for growing steers. Blood samples were collected to determine differences in metabolic profile due to diet. Steer performance was similar across diets (table). Significant differences in kidney heart and pelvic fat (KHP) percentage, and USDA yield grade are not considered to be biologically important. Metabolic profile showed that most measurements were within the normal range for healthy animals. However, blood Na concentrations decreased ( $P < 0.01$ ) for GAFS diets ( $140.7$  mEq/L) vs. Control ( $142.0$  mEq/L) steers. GGT production was increased ( $P = 0.03$ ) in GAFS diets ( $24.3$  U/L) vs. Control ( $17.5$  U/L). In summary, based on animal performance, carcass traits and metabolic profile of steers, New GAFS is similar to Old GAFS, and supported feedlot performance similar to a typical control diet.

**Table 1. Carcass Data and Animal Performance**

	Control	Old GAFS	New GAFS	SE	P
Initial Weight,kg	425.9	425.5	426.1	6.06	0.99
Final Weight,kg	560.7	547.0	551.6	12.45	0.73
DM Intake,kg/d	10.0	9.4	9.6	0.38	0.44
ADG,kg/d	1.36	1.23	1.27	0.10	0.66
Feed Efficiency,(G:F)	0.14	0.13	0.13	0.01	0.91
Hot Carcass Weight,kg	317.1	311.5	316.6	8.97	0.99
KHP fat,%	1.0 <sup>A</sup>	1.4 <sup>B</sup>	1.3 <sup>B</sup>	0.09	0.03
USDA Marbling <sup>C</sup>	412.5	450.0	487.5	14.94	0.01
USDA Yield Grade	2.0 <sup>A</sup>	2.0 <sup>A</sup>	1.5 <sup>B</sup>	0.11	0.01
Calc. Yield Grade	2.1	2.5	2.3	0.18	0.23

<sup>A,B</sup>P < 0.05; <sup>C</sup>300=Standard;400=Select;500=Choice;800=Prime

**Key Words:** GAFS, Feedlot Cattle, AA Supplementation

**W238 *In vitro* gas production kinetics of protein sources used in sheep nutrition.** A. S. Juarez-Reyes\*<sup>1</sup>, M. Murillo-Ortiz<sup>1</sup>, M. A. Cerrillo-Soto<sup>1</sup>, J. F. Obregon<sup>2</sup>, and F. G. Rios<sup>2</sup>, <sup>1</sup>FMVZ-Universidad Juarez del Estado de Durango, Durango, Durango Mexico, <sup>2</sup>FMVZ-Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico.

A study was conducted to evaluate the *in vitro* gas production characteristics of protein sources commonly used in sheep nutrition practices in the dry tropics of northwest Mexico. Samples (200 mg DM) of cotton seed meal (CSM), corn distiller dried with solubles (CDD), overheated sesame meal (OSM), safflower meal (SM), canola meal (CM), and soybean meal (SBM), were placed in 100 ml calibrated glass syringes by triplicate. Buffered and mineral solutions were mixed in a 2:1 proportion with rumen fluid collected from three rumen cannulated sheep fed alfalfa hay and a commercial concentrate (75:25). Thirty ml of buffered rumen fluid was dispensed to each syringe at the time incubation started. The gas volume was recorded at 0, 3, 6, 9, 12, 24, 48, 72 and 96 h. Data obtained were fitted to the equation:  $p = a + b(1 - e^{-ct})$  using PROC NLIN. Metabolizable energy content from *in vitro* gas production was determined by: ME (Mcal kg<sup>-1</sup> DM) = (2.20 + 0.136 Gas Prod<sub>24h</sub> + 0.057 Crude Protein + 0.0029 Crude Fat<sup>2</sup>)/4.184. Data were then analyzed using ANOVA for a completely randomized design. The gas produced

from the soluble (a) fraction in CM was significantly ( $P < 0.05$ ) higher than other feeds. Corn distillers dried, followed by SBM, registered the higher ( $P < 0.05$ ) gas produced from the slowly degraded b fraction. The constant rate of gas production (c) was higher ( $P < 0.05$ ) in CM. The potential gas production a + b was higher in CDD. The ME content was higher ( $P < 0.05$ ) in SBM followed by CM. Variables such as constant rate of gas production c might indicate a good availability of nitrogen in the rumen, whereas the ME content of analysed feeds shows a non negligible energy content.

**Table 1. *In vitro* gas production characteristics of sources of protein used in sheep nutrition practices in northwest of Mexico**

Feed	Parameters				ME
	a	b	c	a+b	
CSM	5.53 <sup>b</sup>	39.09 <sup>c</sup>	0.053 <sup>d</sup>	44.63 <sup>d</sup>	2.22 <sup>d</sup>
CDD	6.54 <sup>b</sup>	61.63 <sup>a</sup>	0.036 <sup>e</sup>	68.17 <sup>a</sup>	2.29 <sup>c</sup>
OSM	4.19 <sup>b</sup>	26.55 <sup>e</sup>	0.085 <sup>c</sup>	30.74 <sup>e</sup>	2.05 <sup>e</sup>
SM	7.27 <sup>b</sup>	33.86 <sup>d</sup>	0.097 <sup>b</sup>	41.13 <sup>d</sup>	2.19 <sup>d</sup>
CM	13.26 <sup>a</sup>	40.14 <sup>c</sup>	0.111 <sup>a</sup>	53.40 <sup>c</sup>	2.70 <sup>b</sup>
SBM	4.84 <sup>b</sup>	53.08 <sup>b</sup>	0.090 <sup>bc</sup>	57.92 <sup>b</sup>	2.88 <sup>a</sup>
Mean	6.94	42.39	0.079	49.33	2.386
SEM	0.77	2.85	0.006	2.95	0.072

<sup>a,b,c,d,e</sup> Means within columns with different superscript differ ( $P < 0.05$ ).

**Key Words:** Gas Production, Protein Sources, Sheep

**W239 Effects of dried distillers grains with solubles as a replacement for soybean meal and corn in diets fed to Boer-cross feeder kids.** R. Cox\*, T. Hutchens, G. Rentfrow, and G. Anderson, *University of Kentucky, Lexington.*

One hundred sixty crossbred feeder kids were used to characterize the effects of replacing soybean meal (SBM) and whole corn (WC) energy with dried distillers grains with solubles (DDGS) on growth and carcass characteristics. Crossbred feeder kids were randomly assigned to 4 dietary treatments. All kids were given ad libitum access to water and a control diet (0%) containing WC, SBM, soybean hulls (SBH) and Kentucky 31 tall fescue hay (KY-31), or energy replaced with DDGS at 10, 15 and 25% of total diet. All kids were fed concentrates at 3% of live body weight. Each treatment had 2 replications with 20 kids per replication. Kids were allowed 14 d to acclimate to the diets prior to beginning of the trial. Kids in each treatment group were weighed at 0, 14, 28, 42 and 56 d. Feed concentrates were increased accordingly following each weight measurement in order to maintain the 3% of body weight feeding rate. Additionally, both leg and hock circumference was measured at 56d. A stratified random sample of 3 was taken from each pen for carcass evaluation. Energy replaced at 15% DDGS showed the highest average live weight value at 56 d (31.05 kg) as compared to energy replaced at 0%, 10% and 25% DDGS (27.86, 29.50 and 30.87 kg respectively). Values were not different for both leg circumference ( $p = 0.35$ ) and hock circumference ( $p = 0.34$ ) across all treatments. Additionally, there was no difference ( $p = 0.41$ ) for hot carcass weight across all treatments in the harvest group. Average daily gain was highest for the 25% DDGS group (170g/d compared to 136, 159 and 163 g/d). Moreover, the 25% DDGS showed the highest percentage of gain on trial, gaining 7.56% more than the 0% DDGS treatment. These results

indicate that DDGS can be substituted for soybean meal and corn as an energy source with no detrimental effects on live animal weight gain or carcass weight.

**Key Words:** Distillers Grains, Boer-Cross

**W240 Effect of substitution of canola meal by cotton seed meal on apparent digestibility of diets for hair sheep.** J. F. Obregon\*, L. E. Antonio, E. Vazquez, F. G. Rios, A. Estrada, and J. J. Portillo, *UASCA-205 FMVZ-Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico.*

With the objective of determinate the effect of substitution of canola meal for cotton seed meal on the apparent digestibility of isoproteic diets, a total faecal collection experiment was conducted. Four hair sheep (males; BW = 21.25 ± 0.96 kg), were used in a crossover design experiment, the sheep were assigned to consume one of two diets in that consisted the treatments: 1) Diet with 17.2 % of CP and 3.38 Mcal of DE/kg, containing (DM basis): canola meal 22.3%, corn 53 %, Sudan grass hay 15%, sugar cane molasses 7% and mineral premix 2.7% (CM); and 2) Diet similar to CM but containing 19.5% of cotton seed meal and 55.8% of corn (CSM). Diets were offered twice a day (0800 and 1600 h). Sheep were placed individually in metabolic crates (0.6 × 1.2 m). Experimental periods consist in six days adaptation period and four days for samples collection. From each diet treatment and period one kg of diet was sampled and the total faecal production was collected. DM and CP were assayed. DM intake was similar ( $P = 0.69$ ) across the treatments (737.8 vs. 736.9 g/day) for CM and CSM. Cotton seed meal in diet increased ( $P = 0.06$ ) DM excreted in faeces (158.4 vs. 139.1 g/day), and increased ( $P = 0.02$ ) faecal excretion of crude protein (30.9 vs. 26 g/day). Apparent DM digestibility was reduced ( $P = 0.06$ ) by CSM treatment (78.5 vs. 81.1 %), and diminished ( $P = 0.02$ ) digestibility of dietary crude protein from 79.6 to 75.8 %. Digestible of the diets was decreased ( $P = 0.07$ ) by CSM treatment (3.36 vs. 3.47 Mcal/kg). This data suggest that substituting canola meal for cotton seed meal, decrease the digestibility of dry matter and crude protein, and reduce energy content of diet for sheep.

**Key Words:** Apparent Digestibility, Protein Sources, Sheep

**W241 Apparent digestibility of diets for hair sheep elaborated with cull chickpeas, cotton seed meal and overcooked sesame meal.** J. F. Obregon\*, S. Fernandez, E. Vazquez, F. G. Rios, J. M. Uriarte, and G. Contreras, *UASCA-205 FMVZ-Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico.*

To compare the apparent digestibility of isoproteic diets elaborated with cull chickpeas, cotton seed meal and overcooked sesame meal, were utilized four Katahdin-Pelibuey sheep, males (BW = 19.85 ± 0.208 kg), individually placed in metabolic crates (0.6 × 1.2 m), Agreement with a square of Jouden design experiment were assigned to consume one of three diets in that consist the treatments 1) Diet with 17% of CP and 3.5 Mcal of DE/kg, containing (DM basis): cull chickpeas 53.5%, corn 20%, Sudan grass hay 15%, sugar cane molasses 9% and mineral premix 2.5% (CHP), 2) Diet similar to CHP but containing 19.5% of cotton seed meal and 54% of corn (CSM), 3) Diet similar a CHP but with 17.7% of overcooked sesame meal and 55.8% of corn (OSM). Diets were offered twice a day (0800 and 1600 h), after six days of adapta-

tion period, samples of diets (1 kg) and the total faeces produced were collected during four continues days. Samples were dried and weighed. DM and CP were performed and apparent digestibility of DM and CP, as well DE content of diets was calculated. Apparent DM digestibility was higher ( $P < 0.01$ ) for CHP vs. CSM and OSM with values of 83.96, 78.23 and 75.98% respectively. Similar situation was observed for apparent digestibility of CP ( $P < 0.01$ ) with values of 75.1 vs. 64.73 and 64.67 % for CHP, CSM and OSM respectively. The content of DE of the diets was affected ( $P < 0.01$ ) for treatments with values of 3.6 vs. 3.35 and 3.25 Mcal/kg for CHP vs. CSM and OSM respectively. It is concluded, that cull chickpeas can be included in isoproteic diets for sheep substituting sources of protein as cotton seed meal and overcooked sesame meal.

**Key Words:** Isoproteic Diets, Apparent Digestibility, Hair Sheep

**W242 Oscillating dietary protein in finishing cattle rations to reduce nitrogen inputs, with or without subcutaneous implants does not affect performance or final carcass composition.** C. R. Nightingale\*, K. L. Swyers, H. Han, T. E. Engle, and S. L. Archibeque, *Colorado State University, Fort Collins.*

We hypothesized that oscillating dietary CP concentration would reduce total N inputs while yielding comparable performance in finishing beef steers, regardless of implant status. Angus steers ( $n = 118$ ; 358 SEM 9 kg initial BW) were used in a completely randomized block design with a 2x2 factorial arrangement of treatments, and fed in 12 pens. The steers were fed either a 1) Control diet (11.7% CP;  $n = 6$  pens), or 2) Control diet and a diet with no added urea (9.6% CP) oscillated on a 48-h interval for each feed (OSC,  $n = 6$  pens). Additionally, steers received no implant (6 pens), or were implanted with Revalor S ( $n = 6$  pens). Dry matter intake did not differ among dietary treatments ( $P = 0.13$ ), but increased ( $P = 0.003$ ) from 10.86 to 11.56 kg/d when cattle were implanted. By design, N intake was decreased ( $P < 0.001$ ) from 0.276 to 0.249 kg/d when steers were fed the OSC diet instead of the Control diet. This equated to a total reduction ( $P = 0.009$ ) in N intake from 32.01 to 28.86 kg/hd during the 116 d finishing period. There was no difference in final live weight due to diet ( $P = 0.82$ ) or implant ( $P = 0.16$ ). Implanted cattle had a greater ( $P < 0.001$ ) ADG than non-implanted cattle, yet there was no diet x implant interaction ( $P = 0.80$ ) or dietary ( $P = 0.78$ ) effect on ADG. There was no diet x implant interaction ( $P \geq 0.36$ ) on any measured carcass characteristics. There was no difference in corrected yield grade ( $P = 0.44$ ), marbling ( $P = 0.47$ ), fat thickness ( $P = 0.10$ ), or rib eye area ( $P = 0.43$ ), due to diet. Steers fed the OSC diet had no difference in premium value above base carcass value ( $P = 0.17$ ), or total carcass value ( $P = 0.93$ ) compared to steers fed the Control diet. Cattle that were implanted had a numerical increase ( $P = 0.19$ ) in total carcass value from \$1099 to \$1157, even though there was a decrease ( $P = 0.008$ ) in marbling score compared to non-implanted cattle. These data suggest that oscillating dietary protein will decrease N inputs without compromising productivity or quality of feedlot steers regardless of implant status.

**Key Words:** Beef Steer, Protein Oscillation, Feedlot

**W243 Fractional protein synthesis rate (FSR) in intestinal mucosa of kids: Effect of a diet containing casein or soy protein.** U. Schoenhusen<sup>1</sup>, A. Floeter<sup>1</sup>, S. Kuhla<sup>1</sup>, P. Junghans<sup>1</sup>, C. C. Metzges<sup>1</sup>, K.

Huber<sup>2</sup>, R. Zitnan<sup>3</sup>, and H. M. Hammon\*<sup>1</sup>, <sup>1</sup>*Research Institute for the Biology of Farm Animals (FBN), Dummerstorf, Germany*, <sup>2</sup>*School of Veterinary Medicine Hanover, Hanover, Germany*, <sup>3</sup>*Institute of Animal Production, Nitra, Slovakia*.

In pre-ruminants, feeding soy protein instead of milk protein leads to alteration in intestinal mucosal structure and absorption of digested nutrients, which is partially caused by a deficit of indispensable amino acids (AA). Supplementation of those AA to soy protein may stimulate epithelial growth and probably affect mucosal protein synthesis in the gut. The present study has investigated effects of feeding soy protein with or without AA supplementation on jejunal mucosa development and FSR in kids. Kids (14 d of age) were fed comparable milk protein-based diets, in which 50% of the crude protein was either casein (CA), soy protein isolate (SP) or soy protein isolate with supplementation of those AA known to be lower concentrated in soy protein than in casein (SPA) for 43 d (n=8/group). An oral dose of [1-<sup>13</sup>C]leucine (180 mg/kg BW, 99

atom% <sup>13</sup>C) was administered 4 h after feeding the milk drink. Timed blood samples were collected between -15 and +45 min relative to the <sup>13</sup>C-leucine administration for determination of plasma free AA and <sup>13</sup>C ketoisocaproic acid. Kids were killed 5 h after feeding and mucosa was collected to measure protein-bound <sup>13</sup>C-leucine and to calculate FSR. Data were analyzed by GLM of SAS with diet as fixed effect. In medial jejunum (MJ), villus height/crypt depth ratio was higher (P < 0.05) in CA than SP, and mucosal protein content and protein/RNA ratio were higher (P < 0.05) in CA than SP and SPA. The <sup>13</sup>C-recovery in blood CO<sub>2</sub> tended to be lower (P < 0.1) in CA than SP. FSR of mucosal protein in MJ tended to be lower (P < 0.1) in CA than SP. Plasma concentrations of Met were lower in SP (P < 0.05) and of Thr were lower (P < 0.01) in SP and SPA than in CA. Feeding SPA does not ameliorate soy protein effects on intestinal mucosa in a significant manner. Supported by German Research Foundation (DFG: SCH 627/1-1).

**Key Words:** Kids, Soya Feeding, Protein Synthesis