

REVISTA DE
agricultura

v. 101 - n. 4 (2026): Edição Especial

ANAIIS DA 36^a REUNIÃO ANUAL DO CBNA

AVES, SUÍNOS E BOVINOS

NUTRIÇÃO ALÉM DA NUTRIÇÃO



Coordenadores

Godofredo Miltenburg, Marcio Ceccantini
Urbano dos Santos Ruiz, José Fernando Machado Menten
Felipe Dilelis de Resende Sousa, Marcos Livio Panhoza Tse
Otávio Rodrigues Machado Neto

ISSN: 2318-2407

REVISTA DE
agricultura

v. 101 - n. 4 (2026): Edição Especial

DOI: 10.37856/revistadea.v101i4.4436

ANAIIS DA 36ª REUNIÃO ANUAL DO CBNA AVES, SUÍNOS E BOVINOS

NUTRIÇÃO ALÉM DA NUTRIÇÃO

Resumos Trabalhos Científicos

Coordenadores

Godofredo Miltenburg, Marcio Ceccantini, Urbano dos Santos Ruiz,
José Fernando Machado Menten, Felipe Dilelis de Resende Sousa,
Marcos Livio Panhoza Tse, Otávio Rodrigues Machado Neto

Revista de Agricultura

Editor Editores-Chefes

Prof. Dr. Carlos Eduardo de Freitas Vian

Prof. Dr. Evoneo Berti Filho

Conselho Editorial (2025-2027)

Angélica Maria Penteado Martins Dias

Elmar Luiz Floss

Evoneo Berti Filho

José Djair Vendramin

Lúcia Massutti de Almeida

Ruy de Araújo Caldas

Wesley Augusto Conde Godoy

Editores Associados (2025-2027)

Catarina Barbosa Careta

Celso da Costa Carrer

Fábio Ricardo Marin

José Otávio Machado Menten

Mateus Mondin

Sônia Maria de Stefano Piedade

Vivian Lara dos Santos Silva

Secretaria

Humberto Luis Marques

Gabriela Palmira da Silva Lopes Scatamburlo

Fundação de Estudos Agrários

Luiz de Queiroz (Fealq)

Avenida Centenário, 1080 -

Bairro São Dimas

CEP: 13416-000 - Piracicaba-SP

Telefone: + 55 19 3417-6600

fealq@fealq.org.br

Diagramação e capa:

Victor Benatti (@vbenatti)

Editor:

Humberto Luis Marques

Coordenação de produção editorial:

Gabriela P. S. Lopes Scatamburlo

Gestão editorial:

Fabiana Cerri de Carvalho

Apoio editorial:

Sônia Piacentini

1ª edição: Setembro 2026

Dados Internacionais de Catalogação na Publicação (CIP)

DIVISÃO DE BIBLIOTECA - DIBD/ESALQ/USP

Reunião Anual do CBNA: Aves, Suínos e Bovinos; Nutrição além da Nutrição (36 : 2026 : São Paulo, SP)
Resumos, trabalhos científicos... [recurso eletrônico] / coordenadores Godofredo Miltenburg. - -
Piracicaba : FEALQ, 2026.

Realizado 12 a 14 de maio de 2026, São Paulo, SP

Publicado na Revista de Agricultura, edição especial

ISBN: 978-85-7133-105-1

DOI: 10.37856/revistadea.v101i4.4436

1. Aves 2. Bovinos 3. Suínos 4. Nutrição animal I. Miltenburg, G., coord. II. Ceccantini, M., coord.
III. Ruiz, U. dos S., coord. IV. Menten, J. F. M., coord. V. Sousa, F. D. de R., coord. VI. Tse, M. L. P.,
coord. VII. Machado Neto, O. R. VIII. Colégio Brasileiro de Nutrição Animal IX. Título

CDD 636.085

36ª REUNIÃO ANUAL DO CBNA

AVES, SUÍNOS E BOVINOS

NUTRIÇÃO ALÉM DA NUTRIÇÃO

12, 13 e 14 de maio de 2026
Centro de Convenções do Anhembi – Setor Expo 2
São Paulo-SP

Programação

12 de maio de 2026

13h30 – 14h00 Sessão de Abertura

Painel: Impacto da pesquisa brasileira na produção animal

Coordenador: Felipe Dilelis de Resende Sousa – Esalq/USP

14h00 – 14h05 Abertura e apresentação dos palestrantes pelo moderador

14h05 – 14h30 *A importância das Tabelas Brasileiras para a indústria*

Horácio Santiago Rostagno – UFV

14h30 – 14h55 *Histórico e perspectivas de pesquisa em aves de postura*

José Henrique Stringhini – UFG

14h55 – 15h20 *Histórico da evolução da pesquisa em aves*

Sergio Luiz Vieira – UFRGS

15h20 – 15h45 *Perspectivas para pesquisas sobre nutrição de aves*

Everton Luis Krabbe – Embrapa Suínos e Aves

15h45 – 16h10 *Perspectivas para pesquisas sobre nutrição de suínos*

Bruno A. N. Silva – IFMG/ICA

16h10 – 16h30 Sessão de Discussão

13 de maio de 2026

Painel: Retorno do Investimento na Nutrição

Coordenador: Urbano dos Santos Ruiz – Esalq/USP

- 09h00 – 09h05 Abertura e apresentação dos palestrantes pelo moderador
- 09h05 – 09h30 *A importância da nutrição/alimentação nos custos totais de produção*
Marcelo Miele – CIAS Embrapa Suínos e Aves
- 09h30 – 09h55 *Custo de produção de suínos com foco na diversidade de matérias-primas*
Cesar Augusto Pospissil Garbossa – FMVZ/USP
- 09h55 – 10h20 *Custo de Produção de aves com foco na diversidade de matérias-primas*
Keysuke Muramatsu – BRF
- 10h45 – 11h15 Sessão de Discussão
- 11h15 – 11h30 Intervalo – Visitação aos Pôsteres
- 11h20 – 12h30 Apresentação de 4 trabalhos científicos – “Aves”
Coordenador: José Fernando Machado Menten – Esalq/USP

Painel: Retorno do Investimento na Nutrição

Coordenador: Otavio Rodrigues Machado Neto – FMVZ/Unesp

- 14h00 – 14h05 Abertura e apresentação dos palestrantes pelo moderador
- 14h05 – 14h35 *Além da Nutrição: Tecnologias que transformam o resultado*
Laura Franco Prados – Cargill
- 14h35 – 15h05 *Nutrição de Precisão em Bovinos Confinados: Estratégias para otimizar a saúde intestinal e o desempenho*
Marco Aurélio de Felício Porcionato – Trouw Nutrition
- 15h05 – 15h35 *Sustentabilidade econômica de dietas com alta e baixa utilização de cereais commodities*
Thiago Henrique da Silva – Agropastoril Paschoal Campanelli
- 15h35 – 16h05 *Emissões e Soluções*
Diogo Fleury Azevedo Costa – Esalq/USP
- 16h05 – 16h30 Sessão de Discussão
- 16h30 – 16h45 Intervalo – Visitação aos Pôsteres
- 16h45 – 17h45 Apresentação de 4 Trabalhos Científicos – “Bovinos”
Coordenador: Otavio Rodrigues Machado Neto – FMVZ/Unesp

14 de maio de 2026

Painel: Soluções além da Nutrição

Coordenador: Fabio Catunda – ADM

09h00 – 09h05 Abertura e apresentação dos palestrantes pelo moderador

09h05 – 09h30 *Lei de Bioinsumos*

Luiz Carlos Demattè Filho – Korin

09h30 – 09h55 *Formulação de dietas para suínos em diferentes mercados*

Vitor Hugo Cardoso Moita – ADM Nutrição Animal

09h55 – 10h20 *Otimizando o retorno através da melhoria e processos de fabricação na avicultura*

Leopoldo Malcorra de Almeida – Seara

10h20 – 10h45 *Inovações na tecnologia de moagem fina e controle de qualidade em tempo real: Aliados na otimização de custos de produção*

Arturo E. Sánchez Carvajal – Tietjen

10h45 – 11h15 Sessão de Discussão

11h15 – 11h30 Intervalo – Visitação aos Pôsteres

11h30 – 12h30 Apresentação de 4 Trabalhos Científicos – “Suínos”

Coordenador: Urbano dos Santos Ruiz – Esalq/USP

Painel: Inteligência Artificial

Coordenador: Flavio Alves Longo – Btech

14h00 – 14h05 Abertura: *Introdução à IA na Nutrição Animal – Potencial e Possíveis Desafios*

14h05 – 14h30 *Inteligência artificial na nutrição animal: eficiência, ajuste e tomada de decisão*

Luiz Victor Ferrato Melo de Carvalho – Alltech

14h30 – 14h55 *IA na interpretação de resultados*

Aaron Cowieson – DSM

14h55 – 15h20 *Aplicação de IA na interpretação de análise de expressão gênica relacionado a desempenho de frangos de corte frente a diferentes desafios*

Luis Fernando Romero Millan – Biofractal (Portugal)

15h20 – 15h45 *Aplicação de IA para interpretação da microbioma relacionado a diferentes estratégias nutricionais e o desempenho animal*

Mariana Quintino do Nascimento – Sapiens AI in
Microbiome

15h45 – 16h15 Sessão de Discussão

16h15 Premiação aos melhores trabalhos científicos e
encerramento

Comissão Científica

Urbano dos Santos Ruiz
José Fernando Machado Menten
Felipe Dilelis de Resende Sousa
Marcos Livio Panhoza Tse
Otávio Rodrigues Machado Neto

Realização

Colégio Brasileiro de Nutrição Animal – CBNA

Parceiros

Quota Prata

ABVista

Adisseo

ADM

Alltech

APC

DSM-Firmenich

EsalqLAB – Zootecnia

Evonik

FASA

Novus

ORFFA

Sanfer Salud Animal

Sapiens

Sindirações

Apoio

FENAGRA 2026

Parceria Divulgação

Agronotícia

Feed & Food Xclusive

O Presente

Apresentação

A 36ª Reunião Anual do Colégio Brasileiro de Nutrição Animal (CBNA) reuniu pesquisadores, profissionais da indústria e especialistas da cadeia produtiva para discutir avanços técnicos, desafios e tendências da nutrição animal no Brasil e no mundo. Nesta edição, o tema central do evento foi *“Nutrição além da Nutrição”*, com conteúdo dedicado às áreas de Aves, Suínos e Bovinos, abordando diferentes tópicos: Impacto da Pesquisa Brasileira na Produção Animal; Retorno do Investimento da Nutrição; Soluções além da Nutrição; Inteligência Artificial. Um ponto importante desta edição é que a construção do programa contou com a participação de empresas do setor, buscando integrar a produção científica voltada à nutrição animal no Brasil com as demandas da indústria. Esse trabalho conjunto garantiu uma grade atual, estratégica e totalmente conectada às demandas do setor, e a apresentação de trabalhos científicos com temas inovadores e com grande aplicação na produção de aves, suínos e bovinos.

Coordenadores

Anais da 36ª Reunião Anual do CBNA

Sumário

Aves

Effects of condensed tannin from Acacia Mearnsii as a substitute for antibiotic growth promoters on productive performance and environmental quality in laying hens

Bruna Poletti, Daniela Oliveira, Carlos Bôa-Viagem Rabello, Lilian Francisco Arantes de Souza, Marcos José Batista dos Santos, Dayane Albuquerque da Silva, Apolônio Gomes Ribeiro

Dietary Carbohydrate sources in the pre-starter phase of broiler chickens: effects on performance, intestinal morphometry, and plasma glucose and lactate

Giulia C. Vieira, Ana B. S. Oliveira, Júlia C. C. Pereira, Amanda C. S. Segundo, Mateus T. Menegalle, Danila Z. Spalato, José F. M. Menten, Felipe Dilelis

Bone mineralization in broiler chickens fed raw sesame cake

Dayane A. Silva, Maria do Carmo M. M. Lucke, Lilian F. A. Souza, Jorge V. Ludke, Camila G. Valadares, Kananda R. Santos, Clener M. A. Fausto, Apolônio G. Ribeiro

Effects of inclusion levels of corn gluten meal in the pre-starter diet on performance, relative organ weight and blood parameters of broiler chicks

Mateus T. Menegalle, Ana Beatriz S. Oliveira, Amanda C. S. Segundo, Giulia C. Vieira, Júlia C. C. Pereira, Danila Z. Spalato, Victor H. Manacorda, José F. M. Menten, Felipe Delelis

Replacement of sulfates with copper, maganese, and zinc glyxinates improves incubation performance in japanese quail breeders (Coturnix coturnix japonica)

Marcos Adriano Pereira Barbosa, Armando de Amorim Oliveira, Pedro Afonso Ezidio, Caroline de Oliveira Marciano, Ulquer dos Santos, Angélica de Souza Khatlab, Eliane Gasparino, Patrícia Versuti Arantes Alvarenga, Silvia Letícia Fornel Ferreira, Murilo Mora de Assis, Simara Marcia Marcato

The trajectory to dysbiosis begins before challenge exposure in broilers

Mariana Q. Nascimento, Marcos A. Nascimento Filho, Adriana N. Figueiredo, Rosiane Camargo, Lorhaine L. Bernardes, Giuliano Campos, Daniel N. Morais

Effect of additives on the performance and intestinal morphometry of broilers challenged with non-starch polysaccharides

Amanda C. da S. Segundo, Tarciso Tizziani, Rosiane S. Camargo, Victor H. F. Manacorda, Danila Z. Spalato, José F. M. Menten, Felipe Dilelis

Influence of diet formulation technique on digestible threonine requirement estimates for growing japanese quails

Aliton N. da Silva, José A. L. Barbosa, Mateus T. Menegalle, Tamires M. S. Felix, Thalís J. Oliveira, Felipe Dilelis, Urbano S. Ruiz, Leonardo A. F. Pascoal, José J. Filho, José H. V. da Silva

Influence of diet formulation technique on estimates of digestible methionine and cystine requirements for growing japanese quail

Aliton N. da Silva, Mateus T. Menegalle, José A. L. Barbosa, Tamires M. S. Felix, Thalís J. Oliveira, Felipe Dilelis, Urbano S. Ruiz, Leonardo A. F. Pascoal, José J. Filho, José H. V. da Silva

Effects of the physical struture of feed on the performance of broiler chickens up to 15 days of age

Juliana K. Baron, Brenda C. P. dos Santos, Ana C. B. Doi, Maria L. B. Mariani, Guilherme F. Deda, Isabella de C. Dias, Anne C. Araújo, João P. F. Ribeiro de Oliveira, Simone G. de Oliveira, Alex Maiorka

Effect of different particle sizes of soybean meal on protein and amino acid digestibility in broilers

Juliane K. Baron, Antoniel P. G. Franco, Brenda C. P. dos Santos, Anne Caroline Araújo, Erick C. C. dos Santos, Simone G. de Oliveira, Alex Maiorka

Effect of particle size and feed processing on broiler chicken performance and yield

Erick Cordeiro Custódio dos Santos, Isabella de Camargo Dias, Maria Letícia Bonadiman Mariani, Guilherme Francisco Deda, Brenda Carolina Pereira dos Santos, Leopoldo Malcorra de Almeida, Alex Maiorka

Copper nanoparticles as a performance enhancer in broiler diets

Júlia de Castro Campos Pereira, José E. Gagliardi Butolo, Mateus Tinelli Menegalle, Mariana Feitosa Cavaleiro, José F. Machado Menten, Gerson Barreto Mourão, Felipe Dilelis de Resende Sousa

Determination of the energy value of wheat and triticale “in vivo” in broiler chickens compared to those estimated by prediction equations

Tatitane A. Barros, Maria do Carmo M. M. Ludke, Carlos B. V. Rabello, Lilian F. A. Souza, Jorge V. Ludke, Kleydson T. A. de Oliveira, Edson J. A. Carvalho, Clener M. A. Fausto

Determination of the energy value of corn ethanol production by products “in vivo” in broiler chickens compared to those estimated by prediction equations

Edson J. A. Carvalho, Maria do Carmo M. M. Ludke, Carlos B. V. Rabello, Lilian F. A. Souza, Jorge V. Ludke, Kleydson T. A. de Oliveira, Tatiane A. Barros, Kananda R. Santos

Suínos

Use of condensed Tannin and phytobiotic in growing-finishing pigs inoculated with Salmonella Typhimurium and challenged with high stocking density

Bruna Poletti, Roberta Pinheiro dos Santos, Stephane Alverina Briguento da Motta, Pedro Henrique Pereira, Sibely Aiva Flores, Luiz Otávio Ribeiro Meneses, Luis Eduardo Resende Paiva, Samilly Pedroni Altoé, Vinicius Cantarelli

Condensed Tannin as a modulator of sow physiology: stress, redox status and intestinal health

Bruna Poletti, Caio C. J. Pereira, Maria C. S. Silva, Stephane A. B. da Motta, Pedro H. Pereira, Sibely A. Flores, Roberta P. dos Santos. Luiz O. R. Menezes, Luis E. R. Paiva, Samilly P. Altoé, Ana M. de Oliveira, Vinicius Cantarelli, Izabel C. Tavares

Effects of β -Mannanase and postbiotic on nutrient digestibility of diets in growing and finishing pigs

Amanda Gorrosterazú, José A. L. Barbosa, Hélio Moreira Junior, Júlia D. Marcio, Dener O. Moreira, Carlos E. M. Bertanha, João L. de Brito, Samya S. S. de Souza, Urbano S. Ruiz

Effect of β -Mannanase and postbiotic on waste excretion and nutrient utilization efficiency in pigs

Amanda Gorrosterazú, José A. L. Barbosa, Hélio Moreira Junior, Júlia D. Marcio, Dener O. Moreira, Carlos E. M. Bertanha, João L. de Brito, Samya S. S. de Souza, Urbano S. Ruiz

Effects of β -Mannanase and postbiotic on growth performance and immune response of growing and finishing pigs

Amanda Gorrosterazú, José A. L. Barbosa, Hélio Moreira Junior, Júlia D. Marcio, Carlos E. M. Bertanha, João L. de Brito, Samya S. S. de Souza, Urbano S. Ruiz

Less Plasma but same performance: sugarcane yeast extract as functional ingredient to partially replace spray-dried plasma in weaned piglets

Graziela A. C. Valini, Melina Bonato, Caio A. Silva

Effects of lignocellulose fiber supplementation in sow diets during gestation and lactation on the structure and biomarkers of the gut microbiota in piglets

Rafaela Hilgemberg, Cátia L. A. Fernandes, Bruno A. N. Silva, Márvio L. T. Abreu, Silviano Bunzen, Lorraine B. Lima, Giuliano Campos, Daniel N. Morais, Mariana Nascimento

Exogenous protease influences nutrient digestibility in piglet diets containing high levels of Trypsin Inhibitors

Debora Reolon, Carlos Beretta Neto, Dejanir Pissinin, Leonardo Tombesi Rocha, Amanda de Moura Dani, Bruno Neutzling Fraga, Vladimir de Oliveira

Research trends and meta-analytical insights on endogenous losses and mineral digestibility in swine

José Andrew L. Barbosa, Hélio Moreira Junior, Amanda Gorroterrasu, Dener P. Moreira, Júlia D. Marcio, Marcos L. P. Tsé, Luan S. Santos, Felipe Dilelis, Urbano S. Ruiz

Body composition and serum urea concentration of growing pigs fed diets varying in soybean hulls and standardized ileal digestible Threonine levels

Mariana Garcia de Lacerda, Kallita Lourenço de Souza Cardoso, Saimon de Souza e Souza, Vanessa Pereira de Abreu, Gabriela Ribeiro da Silva, Amoracyr José Costa Nuñez, José Henrique Stringhini, Allan Paul Schinckel, Vivian Vezzoni de Almeida

Bovinos

Effect of increasing levels of Tannin extract from Eucalyptus on performance and methane emissions of feedlot-finished nellore cattle

Bruna Poletti, Guilherme P. Rissi, Janaina S. Silva, Ives C. S. Silva

Modulation of ruminal taxa by yeast culture supplementation in beef steers

Lorhaine B. Lima, Giuliano Campos, Rafaela Hilgemberg, Flávia S. N. P. Oliveira, Ellen Baldissera, Nicolli S. Mokochisnki, Lívia A. Ienke, Daniel N. Morais, Adriana N. Figueiredo, Ricardo P. Manzanos, Mariana Nascimento, Mikael Neumann

Use of natural compounds as an additive to improve intestinal health in calves

Roberto H. de F. Rodrigues, Luis F. de S. Caixeta, Elias Bungenstab, Reginaldo N. Ferreira

Family succession and financial dependence on beef cattle cow-calf farms

Vitória T. L. Rozin, Rafael M. Jensen, Lucas B. Maciel, Lázaro G. L. Lima, Matheus S. P. Carlis, Matheus C. Garcia, Oscar A. Ojeda-Rojas, Angela M. Gonella-Diazza, Guilherme Pugliesi, Julio C. C. Balieiro, Augusto H. Gameiro, Rodrigo S. Goulart

Overview of cow-calf production systems on beef cattle ranch in Brazil

Vitória T. L. Rozin, Lázaro G. L. Lima, Rafael M. Jensen, Lucas B. Macieli, Matheus S. P. Carlis, Matheus C. Garcia, Oscar A. Ojeda-Rojas, Angela M. Gonella-Diazza, Guilherme Pugliesi, Júlio C. C. Balieiro, Augusto H. Gameiro, Rodrigo D. Goulart

Levels of magnesium oxide on microbial protein synthesis in nellore cattle fed high-concentrate diet

Jordana L. A. Andrade, Lázaro G. L. Lima, Rafael M. Jensen, Lucas B. Maciel, Gabriel V. Manvailer, Vitória T. L. Rozin, João P. N. Minetto, Iago S. Lima, Pedro H. S. P. de Lima, Maria S. Garcia, Matheus S. P. Carlis, Rodrigo S. Goulart

Effect of different drying methods on protein fractions of corn silage predicted by NIRS

Larissa de S. Camargo, Roselena Sestari, Jonas G. Dantas, Thamarys V. B. Reis, Leticia C. B. Soares, Daniel M. Polizel, João Pedro A. Ventorin, João Pedro M. do Carmo

Prediction of the bromatological fraction of ethanol coproducts by NIRS method

Roselena Sestari, Jonas G. Dantas, Thamarys V. B. Reis, Cassiano Locatelli, Diogo P. Rodrigues, Felipe D. Resende Sousa, João P. Monteiro do Carmo, Carla M. M. Bittar

**36ª REUNIÃO
ANUAL DO CBNA**

RESUMOS TRABALHOS CIENTÍFICOS

AVES



Effects of condensed tannin from *Acacia Mearnsii* as a substitute for antibiotic growth promoters on productive performance and environmental quality in laying hens

Bruna Poletti¹, Daniela Oliveira², Carlos Bôa-Viagem Rabelli²,
Lilian Francisco Arantes de Souza², Marcos José Batista dos Santos³,
Dayane Albuquerque da Silva², Apolônio Gomes Ribeiro³

¹TANAC S.A.; ²Universidade Federal Rural de Pernambuco; ³Universidade Federal da Paraíba

Contact: bpoletti@tanac.com.br / **Presenter:** Bruna Poletti

Abstract: The objective of the present study is to evaluate condensed tannin from black wattle (*Acacia mearnsii*) as a dietary additive for laying hens, aiming at positive effects on productive performance and environmental quality, while providing an alternative to antibiotic growth promoters (AGPs). A total of 480 Hy-Line W80 laying hens, 20 weeks of age, were used. The experimental period lasted until 45 weeks of age, under an average temperature of 29°C, relative humidity of 64%, and a 16-hour light program. The birds were allocated in a completely randomized design with 45 treatments, eight replicates, and ten hens per replicate. The treatments consisted of: a negative control diet (NC); a positive control diet with antibiotic (BAC, 0.06% / 100 kg bacitracin methylene disalicylate); and four diets with condensed tannin at different inclusion levels or application phases: TAN75 (0.75 kg/t), TAN100P (1.00 kg/t starting at laying), and TAN100C (1.00 kg/t starting at rearing). The tannin source used was a condensed tannin extract from black wattle (*Acacia mearnsii*)**, containing 70% tannin. The performance data showed that the treatment with 1 kg/t of tannin during the laying phase (TAN100P) was superior to the antibiotic control (BAC) in terms of egg weight and egg mass. In addition, improvements were observed in intestinal integrity

and environmental parameters. The reduction in ammoniacal nitrogen indicated lower protein degradation in the hindgut, while the decrease in excreta pH contributed to reduced ammonia volatilization, better air quality, and fewer respiratory risks. A more acidic intestinal environment also favored beneficial bacteria and inhibited enteric pathogens. Overall, tannins acted as antioxidants and as agents of microbial and environmental balance, with positive impacts on bird welfare and production sustainability. The inclusion of 1 kg/t condensed tannin from black wattle (*Acacia mearnsii*) during the laying phase (TAN100P) proved more effective than the antibiotic control (BAC) in improving performance and excreta quality.

Keywords: NUTRITION; hens; ammonia; polyphenols

Table 1. Body Weight Gain (BWG, kg), Egg Weight (EW, g), Egg Production (EP, %), Egg Mass (EM, g/hen/day), Feed Intake (FI, g/hen/day), Feed Conversion per Egg Mass (FCR/EM, g/g), and Feed Conversion per Dozen Eggs (FCR/DZ, kg/dz) of laying hens at peak production fed different experimental diets

Treatments	BWG	EW	EP	EM	FI	FCR/ EM	FCR/DZ
DC	1.107	56.228	92.736	55.429	105.745	1.865	1.310
BAC	1.108	55.776	92.091	54.992	105.618	1.856	1.303
TAN50	1.068	56.264	92.133	55.872	105.736	1.829	1.305
TAN75	1.053	56.399	93.101	56.204	105.840	1.825	1.294
TAN100P	1.107	56.797	92.860	56.535	105.730	1.830	1.300
TAN100C	1.115	56.288	93.158	55.788	105.840	1.837	1.298
Overall Mean	1.093	56.282	92.692	55.795	105.749	1.839	1.301
SEM	0.004	0.047	0.067	0.079	0.012	0.002	0.007

*Statistical difference ($P < 0.05$)

SEM: Standard Error of the Mean

Table 2. Ammoniacal nitrogen content released (N, mg/100 g) in excreta and excreta pH of laying hens during the peak production phase (20-45 weeks of age)

Treatments	N	pH
DC	1.020	6.038
BAC	1.292	6.013
TAN50	1.279	5.463
TAN75	0.928	5.713
TAN100P	0.812	5.850
TAN100C	0.744	5.763
Overall Mean	1.014	5.806
SEM	0.075	0.040

*Statistical difference ($P < 0.05$)

SEM: Standard Error of the Mean

Dietary carbohydrate sources in the pre-starter phases of broiler chickens: effects on performance, intestinal morphometry, and plasma glucose and lactate

Giulia C. Vieira¹, Ana B. S. Oliveira¹, Júlia C. C. Pereira¹,
Amanda C. S. Segundo¹, Mateus T. Menegalle¹, Danila Z. Spalato¹,
José F. M. Menten¹, Felipe Dilelis¹

¹"Luiz de Queiroz" College of Agriculture, São Paulo University, Piracicaba/SP
Contact: g.cancian@usp.br / **Presenter:** Giulia C. Vieira

Abstract: The early growth of broiler chickens is influenced by factors such as the development of the gastrointestinal tract and adaptation to post-hatch diet, which are characterized by a higher supply of carbohydrates compared to the embryonic phase. During this period, the digestive system is still immature, potentially limiting nutrient digestion and absorption. Thus, nutritional strategies such as the inclusion of rapidly absorbed carbohydrates may improve energy utilization and support early development. The objective of this study was to evaluate the effect of including different carbohydrates sources on performance, intestinal morphometry, and blood parameters of broiler chickens in the pre-starter phase. A total of 192 male chicks (Cobb 500) were used, distributed in a randomized block design with four treatments and six replicates of eight birds each. The treatments consisted of: Corn and soybean meal diet (RMS); RMS + 5% dextrose (DRO); RMS + 5% dextrin (DRI); RMS + 5% maltose (MTO) from 1 to 7 days of age. Average body weight, feed intake, weight gain, and feed conversion ratio were recorded to assess performance. At 7 days of age, one bird per replicate was euthanized for intestinal sample collection for morphometric analysis and blood sampling. Data were subjected to ANOVA using R Studio software (4.5.1),

and means were compared by Tukey's test ($p < 0.05$). Productive performance parameters at 7 days did not differ among treatments ($p > 0.05$). Lactate levels were not affected ($p = 0.696$), while glucose showed a tendency to increase in the DRO treatment ($p = 0.053$). Intestinal morphometric variables, crypt depth, villus:crypt ratio, and villus and crypt dimensions, were not affected in the evaluated intestinal segments (duodenum, jejunum, and ileum), although a trend was observed for crypt width in the jejunum ($p = 0.066$). In conclusion, the inclusion of rapidly absorbed carbohydrates at 5% level in the prestarter diets does not affect performance, blood parameters, or intestinal morphometry at 7 days of age. Further studies are needed to explore alternative strategies to enhance the effectiveness of these carbohydrates during early development. New carbohydrate inclusion strategies should be investigated to enhance their effects during the pre-starter phase.

Keywords: blood parameters; intestinal histomorphometry; performance; pre-starter phase; simple carbohydrates.

Table 1. Initial performance, blood parameters, and intestinal morphometry of broiler chickens according to treatments

Item	Treatments				SEM	<i>p-value</i>
	RMS	DRO	DRI	MTO		
Performance						
BW, g	172.3	172.7	176.5	176.8	4.43	0.830
WG, g	133.1	133.6	137.6	137.8	4.39	0.818
FI, g	132.2	131.6	135.0	129.0	3.72	0.733
FCR, g:g	0.993	0.991	0.98	0.939	0.029	0.560
Blood Parameters						
Glucose, mg/dL	253.6	340.8	256.4	235.0	26.02	0.053
Lactate, mmol/L	33.5	31.3	28.8	25.6	4.82	0.696
Intestinal Morphometry						
Duodenum						
Height of villi, μm	873.3	851.1	876.4	888.3	31.42	0.863
Width of villi, μm	149.8	153.9	151.8	145.5	7.23	0.866
Crypt depth, μm	93.1	102.7	99.2	96.9	3.11	0.212
Width of crypt, μm	68.1	68.2	66.6	64.4	1.91	0.476
Villus Crypt ratio	9.4	8.4	8.8	9.1	0.44	0.442
Jejunum						
Height of villi, m	490.7	572.6	532.6	505.0	41.69	0.582
Width of villi, μm	140.0	145.0	138.7	144.1	7.04	0.908
Crypt depth, μm	94.9	100.8	93.0	96.5	2.97	0.381
Width of crypt, μm	62.7	69.8	64.4	68.0	1.80	0.066
Villus Crypt ratio	5.1	5.6	5.7	5.2	0.38	0.626
Ileum						
Height of villi, μm	345.0	359.0	336.6	333.0	19.93	0.804
Width of villi, μm	133.0	127.1	126.7	126.3	6.89	0.889
Crypt depth, μm	87.0	86.7	83.9	84.7	2.93	0.864
Width of crypt, μm	70.8	66.5	65.8	65.4	2.17	0.317
Villus Crypt ratio	3.9	4.1	4.0	3.9	0.18	0.833

BW: Body Weight; WG: Weight Gain; FI: Feed Intake; FCR: Feed Conversion Ratio

Bone mineralization in broiler chickens fed RAW sesame cake

Dayane A. Silva¹, Maria do Carmo M. M. Ludke¹, Lilian F. A. Souza¹,
Jorge V. Ludke², Camila G. Valadares¹, Kananda R. Santos¹,
Clener M. A. Fausto¹, Apolônio G. Ribeiro³

¹Universidade Federal Rural de Pernambuco; ²Embrapa Aves e Suínos; ³Universidade Federal da Paraíba
Contact: dayane.albuquerque.ds@gmail.com / **Presenter:** Maria do Carmo M. M. Ludke

Abstract: Raw sesame cake is a coproduct obtained from pressing sesame seeds without prior roasting and presents a high content of crude protein (371.0 g/kg), gross energy (5796 kcal/kg), metabolizable energy for broilers (4342 kcal/kg), and ether extract (324.7 g/kg). However, it contains significant levels of antinutritional factors such as calcium oxalate (1.04 mg/100 g), tannins (1.36 mg/100 g), and hemolytic saponins (243.77 µg ES/mg), which may reduce nutrient absorption, particularly minerals such as calcium. Thus, the present study investigated the impact of using raw sesame cake in broiler diets on calcium and phosphorus deposition in the bone matrix. For the experiment, two hundred and forty one-day-old Ross 308 chicks, with an average body weight of 42 g ± 2 g, were randomly distributed into four treatments with five replicates of twelve birds each. The treatments consisted of a control diet composed of corn, soybean meal, and meat and bone meal, and three diets containing raw sesame cake at inclusion levels of 50, 100, and 150 g/kg. For bone densitometry, Seedor index, and tibial mineral composition analyses, one bird per experimental unit was euthanized after prior stunning by the electronarcosis method with 42 days from age. After euthanasia, the right tibia of each bird was collected, dissected, and subjected to computed tomography. This was followed by measurements and weighing for the calculation of the Seedor index, as well as determination of calcium and

phosphorus concentrations and the Ca:P ratio. Data were statistically analyzed using ANOVA, followed by Dunnett's test ($P < 0.05$) and linear and nonlinear regression analyses. The inclusion of raw sesame cake did not influence the relative tibia weight of the broilers (mean value: 0.73), nor the Seedor index (mean value: 36.32 mg/mm), which also showed no significant difference, as well as bone densitometry values (mean values for distal: 804.47; medial: 1170.03; proximal: 828.15). The results indicated that raw sesame cake inclusion had no effect on bone mineralization. Despite these findings, increasing inclusion of raw sesame cake reduced calcium concentration and the Ca:P ratio in the tibia (linear effect), while phosphorus showed a quadratic response (peak at 57.83 g/kg). However, these values did not negatively affect bone densitometry. Based on these results, it can be concluded that raw sesame cake can be included up to 150 g/kg in broiler diets without impairing bone density.

Keywords: Coproduct; Minerals; Poultry; *Sesamum indicum*; Tibia

Table 1. Average values of calcium and phosphorus, relative weight, Seedor index, and bone densitometry in different regions of the tibia of broilers fed increasing levels of sesame cake

Tibia	Inclusion Levels g/kg				Mean	SEM	p-value	Regression
	0	50	100	150				
Relativa weight of the tibia	0.731 ± 0.024	0.775 ± 0.014	0.697 ± 0.068	0.730 ± 0.027	0.733	0.0191	0.5857	NS
Seedor index (mg/mm)	37.15 ± 0.96	36.40 ± 1.11	38.04 ± 1.26	33.69 ± 1.25	36.32	0.6469	0.0836	NS
Calcium (g/100g)	34.22 ± 1.36	26.82 ± 1.28*	27.25 ± 1.55*	21.63 ± 0.89*	27.48	1.1857	<0.0001	Linear
Phosphorus (g/100g)	11.67 ± 0.55	11.56 ± 0.58	13.08 ± 0.73	10.32 ± 0.42	11.657	0.3482	0.0320	Quadratic
Ca:P ratio	2.567 ± 0.117	2.187 ± 0.085*	2.084 ± 0.015*	2.097 ± 0.011*	2.234	0.0562	0.0007	Linear
Bone Densitometry								
Distal	732.7 ± 39.8	834.6 ± 28.9	882.8 ± 58.0	767.8 ± 54.1	804.47	25.2211	0.1440	NS
Medial	1180 ± 21	1201 ± 35	1170 ± 44	1129 ± 44	1170.03	18.0388	0.5810	NS
Proximal	814.5 ± 30.3	842.2 ± 25.0	797.9 ± 27.5	858.0 ± 11.0	828.15	12.4975	0.3393	NS

*Statistical difference (Dunnett test)

Linear Effect: (Calcium: $y = -0.0747x + 33.081$; $R^2 = 0.8699$); (Ca:P Ratio: $y = -0.003x + 2.4607$; $R^2 = 0.7415$)

Quadratic Effect (Phosphorus: $y = -0.0003x^2 + 0.0347x + 11.375$; $R^2 = 0.5431$; Maximum Point: 57.83 g/kg)

SEM: Standard Error of the Mean. NS: Not Significant

Effects of inclusion levels of corn gluten meal in the pre-starter diet on performance, relative organ weight and blood parameters of broiler chicks

Mateus T. Menegelle¹, Ana Beatriz S. Oliviera¹,
Amanda C. S. Segundo¹, Giulia C. Vieira¹, Júlia C. C. Pereira¹,
Danila Z. Spalato¹, Victor H. F. Manacorda², José F. M. Menten¹,
Felipe Dilelis¹

¹"Luiz de Queiroz" College of Agriculture (ESALQ), São Paulo University, Piracicaba/SP;

²Federal University of Juiz de Fora, Juiz de Fora/MG

Contact: mateus.menegalle@usp.br / **Presenter:** Mateus Tinelli Menegale

Abstract: The pre-starter period (1 to 7 days of age) in broiler chickens is critical, as it directly affects performance throughout the production cycle and requires high levels of protein and energy. During this phase, the gastrointestinal tract is still immature, which limits nutrient digestion and absorption, particularly of lipids, and increases the sensitivity of chicks to antinutritional factors present in soybean meal (SBM). In this context, the use of alternative ingredients, such as corn gluten meal high-protein (CGM), which has high digestibility and crude protein and metabolizable energy content, may contribute to supporting the early development of chicks. Therefore, this study aimed to evaluate the effect of including corn gluten meal (CGM) at different inclusion levels in the pre-starter diets on performance, relative organ weight and blood parameters of broiler. A total of 1680 one-day-old male Cobb 500 chicks were used and distributed in a randomized block design, with four treatments: corn and soybean meal (CS); CS + 2.5% CGM; CS + 5.0% CGM, CS + 7.5% CGM, with 10 replicates of 42 birds each. The diets were formulated meeting the recommended nutritional requirements with equal levels of digestible lysine, methionine and threonine. At 7 days of age, performan-

ce parameters were measured, including average body weight (ABW), feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). Two birds per replicate were euthanized for blood collection from the jugular vein to define serum levels of glucose (GLU), lactate (LAC), LDL, VLDL, HDL, cholesterol (CHOL), triglycerides (TG), globulin (GLOB), albumin (ALB) and total protein (TP). Organs were also collected to determine the relative weight of the gizzard (GIZ), liver (LIV), small intestine (SI), large intestine (LI) and small intestine length (SIL). Data were subject to ANOVA using the PROC MIXED procedure (SAS, 9.4) at a significance level of 5% ($\alpha=0.05$) and orthogonal polynomials. Regarding productive performance, only FCR differed among treatments ($p=0.010$), showing a quadratic response ($y=-42.48x^2+446.84x+52.095$). No significant treatment effects were observed for serum blood parameters or relative organ weights ($p>0.05$). In conclusion, the inclusion of CGM in pre-starter diets did not affect physiological or health related parameters, but negatively impacted FCR. Further studies are needed to evaluate alternative ingredients and strategies to support early broiler development.

Keywords: alternative ingredients; biochemical indicators; digestive physiology; performance; serum

Table1. Performance parameters in the pre-starter phase (1 to 7 days)

Variable	Treatments				SEM	<i>p-value</i>	L	Q ²	C ²
	CS	CS+2,5% GCM	CS+5,0% GCM	CS+7,5% GCM					
ABW, g	173.4	172.6	170.4	172.8	1.17	0.323	0.472	0.193	0.258
WG, g	133.0	132.0	129.8	132.0	1.47	0.326	0.350	0.205	0.319
FI, g	132.4	139.4	141.7	140.4	2.64	0.079	0.033	0.127	0.930
FCR, g:g	0.995b	1.057a	1.071a	1.065a	0.02	0.010	0.005	0.049	0.738

BW: Body Weight; WG: Weight Gain; FI: Feed Intake; FCR: Feed Conversion Ratio; SEM: Standard Error of Mean; *p-value*: Mean values within a row with no common superscript letter (a, b) differ significantly at 0.05 level; L: Linear effect; Q²: Quadratic effect; C²: Cubic effect

Table 2. Blood parameters in the pre-starter phase (1 to 7 days)

Variable (mg/dL)	Treatments				SEM	<i>p-value</i>	L	Q ²	C ²
	CS	CS+2,5% GCM	CS+5,0% GCM	CS+7,5% GCM					
LAC	60.5	53.3	68.3	49.3	7.89	0.318	0.587	0.442	0.107
GLU	309.0	330.0	392.2	374.5	33.58	0.246	0.080	0.550	0.404
LDL	18.8	17.2	10.3	15.1	3.75	0.362	0.262	0.364	0.290
VLDL	22.3	16.1	29.0	18.0	3.92	0.078	0.998	0.513	0.012
HDL	87.8	82.3	96.6	80.9	7.65	0.468	0.853	0.509	0.155
CHOL	128.9	115.5	135.9	114.0	11.46	0.442	0.626	0.703	0.133
TG	111.5	80.4	145.0	89.9	19.61	0.078	0.998	0.513	0.012
GLOB	1.57	1.37	1.46	1.43	0.10	0.471	0.402	0.376	0.311
ALB	1.62	1.46	1.44	1.37	0.11	0.412	0.118	0.676	0.659
TP	3.19	2.83	2.91	2.79	0.21	0.464	0.207	0.522	0.465

LAC: Lactate; GLU: Glucose; LDL: LDL; VLDL: VLDL; HDL: HDL; CHOL: Cholesterol; TG: Triglycerides; GLOB: Globulin; ALB: Albumin; TP: Total Protein; SEM: Standard Error of Mean; *p-value*: Mean values within a row with no common superscript letter (a, b) differ significantly at 0.05 level; L: Linear effect; Q²: Quadratic effect; C²: Cubic effect

Table3. Relative organ weight parameters in the pre-starter phase (1 to 7 days)

Variable	Treatments				SEM	<i>p-value</i>	L	Q ²	C ³
	CS	CS+2,5% GCM	CS+5,0% GCM	CS+7,5% GCM					
GIZ, %	4.28	4.22	4.27	4.40	0.08	0.516	0.282	0.297	0.919
LIV, %	3.94	4.05	4.08	4.06	0.15	0.674	0.320	0.479	0.904
SI, %	11.84	11.21	11.65	11.42	0.29	0.381	0.502	0.457	0.153
LI, %	1.67	1.51	1.49	1.28	0.15	0.116	0.017	0.883	0.847
SIL, cm	105.3	107.7	104.1	108.7	2.53	0.524	0.503	0.678	0.208

GIZ: Gizzard; LIV: Liver; SI: Small Intestine; LI: Large Intestine; SIL: Small Intestine Length; SEM: Standard Error of Mean; *p-value*: Mean values within a row with no common superscript letter (a, b) differ significantly at 0.05 level; L: Linear effect; Q²: Quadratic effect; C³: Cubic effect

Replacement of sulfates with copper, manganese and zinc glycines improves incubation performance in japanese quail breeders (*Coturnix coturnix japonica*)

Marcos Adriano Pereira Barbosa, Armando de Amorim Oliveira,
Pedro Afonso Ezidio, Caroline de Oliveira Marciano,
Uilquer dos Santos, Angélica de Souza Khatalab, Eliane Gasparino,
Patrícia Versuti Arantes Alvarenga, Silvia Letícia Fornel Ferreira,
Murilo Mora de Assis, Simara Márcia Marcato

Universidade Estadual de Maringá, Maringá, Paraná-Brasil, Biochem do Brasil Nutrição Animal Ltda.

Contact: marcosbarbosa0597@hotmail.com / **Presenter:** Marcos Adriano Pereira Barbosa

Abstract: This study aimed to evaluate the partial or total replacement of sulfate sources with copper, manganese, and zinc glycines in the diet of Japanese quail breeders, focusing on their effects on incubation parameters. A total of 360 breeder females were assigned to three treatments: a control with inorganic minerals (CON), partial replacement (Gly-50), and total replacement with glycines (Gly-100), the latter characterized not only by complete substitution of inorganic sources but also by a reduced total trace mineral supply. Glycine supplementation increased hatchability ($P < 0.05$), reaching 76.15% in Gly-50 and 74.23% in Gly-100, compared to 64.99% in the control. Similarly, embryonic mortality was reduced ($P < 0.05$), with lower values observed in Gly-50 (3.95%) and Gly-100 (5.20%) compared to CON (15.10%). Chick weight at hatch was also higher ($P < 0.05$) in Gly-100 (8.38 g) and Gly-50 (8.30 g) compared to the control (7.96 g). Fertility was not affected by treatments ($P > 0.05$). In conclusion, replacing sulfate minerals with Cu, Mn, and Zn glycines improves incubation performance, reduces embryonic mortality, and enhances early chick development, representing an effective nutritional strategy for Japanese quail breeders.

Keywords: Bioavailability; hatchability; embryonic mortality; organic trace minerals

Table 1. Hatchability fertility, mortality and average hatch weight of Japanese quail breeders supplemented with inorganic minerals and glycines

Variables	CON	Gly-50	Gly-100	SEM	<i>p-value</i>
Hatchability (%)	64.99b	76.15a	74.23a	0.0701	0.0001
Fertility (%)	80.09	80.10	79.43	0.6021	0.3651
Mortality (%)	15.10a	3.95b	5.20b	0.0653	0.0001
AHW (g)	7.96b	8.30a	8.38a	0.2720	0.0066

Means followed by different letters within a row are significantly different according to Tukey's test at the 5% probability level. CON: sulfates of Cu, Mn, and Zn; Gly-50: half of the sulfate levels from CON plus glycinate supplementation of Cu, Mn, and Zn *on top*; Gly-100: no sulfates and inclusion of glycines of Cu, Mn, and Zn *on top*; AHW (g): average hatch weight of the offspring in grams; SEM: standard error of the mean

The trajectory to dysbiosis begins before challenge exposure in broilers

Mariana Q. Nascimento¹, Marcos A. Nascimento²,
Adriana N. Figueiredo³, Rosiane Camargo³, Lorraine L. Bernardes¹,
Giuliano Campos¹, Daniel N. Morais¹

¹Sapiens Microbiome, Jundiaí/SP, Brasil; ²NutriFides Consultoria, Jacareí/SP Brasil;

³Aleris Animal Nutrition, Jundiaí/SP, Brasil

Contact: mariananascimento@sapiensmicrobiome.com / **Presenter:** Mariana Q. Nascimento

Abstract: Broilers exposed to the same enteric challenge may show distinct responses, indicating that early gut microbiota may contain predictive information on host susceptibility before overt intestinal dysfunction develops. This study aimed to determine whether pre-challenge gut microbiota could predict broiler susceptibility to enteric challenge and whether the resulting classification was biologically supported by dysbiosis progression after infection. A total of 1,890 birds were challenged at 4 days of age by oral gavage (0.6 mL/bird) with an attenuated multi-valent *Eimeria* vaccine containing *E. acervulina*, *E. maxima*, *E. praecox*, *E. tenella*, and *E. mitis* at 20 times the recommended dose. To intensify the challenge without high mortality, birds were also reared at high stocking density (15 birds/m²) and fed wheat bran. Intestinal microbiota was sampled from 30 birds at 3 days of age, before infection, and the same 30 birds were resampled at 12 days post-infection (dpi). Pre-challenge genus-level microbiota data, after rare taxa removal, zero replacement, and centered log-ratio transformation, were used as predictors in an Elastic Net model to estimate an integrated susceptibility score derived from body weight gain, feed conversion ratio, lesion score, FITC-d, and oocyst shedding. Predicted scores were stratified into low, medium, and high

susceptibility classes. sPLS-DA was used to identify microbial signatures associated with these classes. Microbial imbalance was assessed before and after infection through a dysbiosis index ranging from 0 to 1, where higher values indicate dysbiosis severity. The challenge reduced body weight by approximately 25% from 1 to 21 days relative to breed standards, confirming model robustness without severe mortality. Predicted susceptibility classes showed a biologically ordered pattern according to dysbiosis intensity and health-related outcomes. Highly susceptible birds showed higher dysbiosis index values before challenge than low-susceptibility birds (0.69 vs. 0.43), and this difference became more pronounced at 12 dpi (0.97 vs. 0.59), indicating severe and moderate dysbiosis, respectively. Both Elastic Net and sPLS-DA consistently associated higher susceptibility with *Escherichia-Shigella* and *Enterococcus*, and lower susceptibility with *Lactobacillus*, *Faecalibacterium*, and other short-chain fatty acid-producing taxa. These findings demonstrate that early intestinal microbiota can stratify broilers according to susceptibility to *Eimeria* challenge, while dysbiosis index values provide biological support for the model output.

Keywords: enteric health; risk stratification; microbial signatures; predictive modeling

Effect of additives on the performance and intestinal morphometry of broilers challenged with non-starch polysaccharides

Amanda C. da S. Segundo¹, Tarciso Tizziani², Rosiane S. Camargos³,
Victor H. F. Manacorda⁴, Danila Z. Spalato¹, José F. M. Menten¹,
Felipe Dilelis¹

¹"Luiz de Queiroz" College of Agriculture (ESALQ), São Paulo University, Piracicaba/SP,

²Additiva Nutrition, ³Aleris Nutrition, Jundiaí/SP, ⁴Federal University of de Juíz de Fora, Juíz de Fora/MG

Contact: amandasegundo@usp.br / **Presenter:** Amanda C. da S. Segundo

Abstract: Diets rich in non-starch polysaccharides (NSPs) increase viscosity, reduce nutrient digestibility, and increase intestinal inflammation. Additives such sodium butyrate and *Bacillus subtilis* can mitigate these effects, as they promote intestinal mucosal integrity, modulate the microbiota, and improve nutrient digestive efficiency. This study evaluated the effect of these additives in the diet of broiler from 1 to 21 days of age, as well as intestinal morphometry at 21 days, under NSP challenge. A randomized block design was used, with four treatments and seven replicates of 40 birds each. The treatments consisted of a reference diet based on corn and soybean meal (CSB), a diet high in NSPs with 30% rice bran (NSPs), NSPs + 250 ppm of butyrate (90% sodium butyrate - BUT), and NSPs + 300 ppm of *Bacillus subtilis* (1x10¹⁰ CFU/g - BS). The CSB and NSPs diets were isonutritional. The additives were added on top of the diets. Average body weight (BW), weight gain (WG), and feed conversion ratio (FCR) were calculated for the overall period. At 21 days, one broiler with average body weight per replicate was euthanized for the collection of duodenum, jejunum, and ileum segments for morphometric analyses. The analyses included measurements of villus height (VH) and

width (VW) crypt depth (CD), and the villus:crypt ratio (V:C). The data were subjected to analysis of variance (ANOVA) using the PROC GLM procedure of SAS 9.2, with means compared by Tukey's test ($p < 0.05$). There was no effect on BW ($p = 0.660$) or WG ($p = 0.496$). However, higher feed intake was observed in broiler ($p = 0.01$) receiving CSB, which resulted in poorer FCR ($p = 0.01$) for CSB (1.69) compared to the others (NSPs - 1.43; BUT - 1.38; e BS - 1.42). The duodenum and ileum showed no differences in the evaluated morphometric parameters ($p > 0.05$). In the jejunum, greater VH ($p = 0.002$) was observed for broiler in the CSB (712 μ m) and BUT (752 μ m) groups compared to those in the NSPs treatment (609 μ m), with intermediate values for BS (668 μ m), which was reflected in the V:C ratio ($p = 0.020$). The NSP challenge, contrary to expectations, improved feed conversion ration, regardless of additive supplementation. However, the reduction in villus size and the villus:crypt ratio indicates greater intestinal damage. Supplementation with sodium butyrate and *Bacillus subtilis* was able to mitigate the deleterious effects of the non-starch polysaccharide challenge on intestinal health. These effects are related to morphological changes and suggest greater sensitivity of the jejunum to nutritional interventions.

Keywords: bacillus; butirate; gut inflamattion; organic acids; probiotics

Table 1. Effect of treatments on the performance and intestinal morphometry of broiler

Item	Treatments				SEM	<i>p-value</i>
	CSB	NSPs	BUT	BS		
Performance						
BW, g	858.0	871.2	862.0	869.8	8.53	0.660
WG, g	816.5	831.4	819.9	830.2	8.19	0.496
FI, g	1385.3 ^a	1191.2 ^b	1137.7 ^b	1180.4 ^b	27.12	<0001
FCR, g:g	1.699 ^a	1.433 ^b	1.387 ^b	1.422 ^b	0.04	<0001
Intestinal morphometry						
Duodeno						
Villus heigth, μm	1322.2	1449.8	1387.1	1392.5	73.76	0.692
Width of villi, μm	149.5	160.3	155.8	152.2	7.65	0.729
Crypt depth, μm	96.7	115.7	125.1	125	9.51	0.170
Villus:Crypt ratio	11.8	11.6	11.67	9.8	0.75	0.274
Jejunum						
Villus heigth, μm	711.8 ^a	609.2 ^b	752.0 ^a	667.8 ^{ab}	22.29	0.002
Width of villi, μm	101.7	97.5	96.1	88.9	3.41	0.087
Crypt depth, μm	46.5	58.5	63.0	64.4	5.30	0.081
Villus:Crypt ratio	16.67 ^a	11.2 ^b	12.8 ^{ab}	10.8 ^b	1.35	0.02
Ileum						
Villus heigth, μm	611.4	605.6	584.5	605.2	14.27	0.617
Width of villi, μm	125.9	126.8	136.9	151.7	7.26	0.131
Crypt depth, μm	110.2	116.9	120.2	99.0	6.52	0.154
Villus:Crypt ratio	5.7	5.7	5.0	6.4	0.43	0.238

Mean values within a row with no common superscript letter (a, b) differ by Tykey test ($p < 0.05$); CSB: corn and soybean meal reference diet; NSPs: diet with added non-starch polysaccharides; BUT: NSPs + 250 ppm butyrate sodium; BS: NSPs + 300 ppm *Bacillus subtilis* 1×10^{10} CFU/g; SEM: Standard Error of the Mean; BW – body weight; WG – weight gain; FI – feed intake; FCR – feed conversion ratio

Influence of diet formulation technique on digestible threonine requirement estimates for growing japanese quails

Aliton N. da Silva¹, José A. Barbosa², Mateus T. Menegalle²,
Tamires M. S. Feliz¹, Thalís J. Oliveira¹, Felipe Dilelis², Urbano S. Ruiz²,
Leonardo A. F. Pascoal³, José J. Filho³, José H. V. da Silva³

¹Universidade Federal da Paraíba, Areia/PB; ²“Luiz de Queiroz” College of Agriculture, São Paulo University, Piracicaba/SP; ³Universidade Federal da Paraíba, Bananeiras/PB

Contact: andrew.lira980@gmail.com / **Presenter:** José A. L. Barbosa

Abstract: The objective was to estimate the requirements of digestible threonine (Thr) for Japanese quails from 10 to 36 days of age and to compare the effect of the diet formulation techniques of gradual supplementation and dilution. The experiment was conducted at the Poultry Laboratory of CCHSA, Campus III of UFPB. 588 Japanese quail females (*Coturnix coturnix japonica*) were used at 10 days of age, with an initial weight of 34.4 ± 2 g, distributed in a complete randomized design in a 7x2 factorial arrangement (7 levels of Threonine X 2 formulation techniques), totaling 14 treatments with 6 repetitions of 7 birds each. The diets were based on the gradual amino acid supplementation technique and on the diet dilution technique, to reach the following digestible Thr levels: 0.550%; 0.670%; 0.790%; 0.970%; 1.030%, 1.150%; 1.270%. The requirements of the other amino acids were met according to Silva and Costa (2009). The growth performance characteristics evaluated were: final weight (g), weight gain (g), feed intake (g) and feed conversion (g / g). The data were subjected to analysis of variance considering the level of 5% probability. The requirements for threonine were determined by the polynomial regression of the results of feed conversion: $Y_i = \beta_0 + \beta_1 * Trei + \beta_2 * Trei^2 + e_i$. There was an interaction ($P < 0.05$) between for-

mulation techniques and threonine levels. Feed consumption and final weight were higher ($P < 0.05$) for quails fed the diets formulated by the supplementation technique, compared to the dilution technique. These results reflected greater weight gain and better feed conversion of birds ($P < 0.05$). A quadratic effect ($P < 0.05$) was observed for the variables of final weight, weight gain, and feed conversion in both techniques, with an estimated level of 0.867%, with the supplementation technique and 0.938% with the technique dilution. There was an interaction effect for the absolute weight of the feathers, carcass, chest and protein depositions in the feathers and in the whole body of the birds. The lower Thr levels of the dilution technique impaired the warping of the birds, the weight of the breast and the depositions of protein in the feather and the whole body. The diets formulated based on the amino acid supplementation technique were better for estimating the digestible Thr requirement, for quails from 10 to 34 days.

Keywords: Amino acids, productive performance, body protein

Table 1. Performance of quails at 36 days of age, fed diets containing increasing levels of digestible *threonine*, formulated using two feed formulation techniques

Techniques	Levels	Quail performance 10 to 36 days					
		FI (g/b)	MI (g/b)	FW (g)	WG (g)	FCR (g/g)	FI (g/b)
Supplementation	0.55	354.062	1.947	34.402	135.638	101.237	3,500
	0.67	349.509	2.342	34.630	137.187	102.557	3,406
	0.79	355.984	2.812	34.372	143.297	108.925	3,269
	0.91	345.157	3.141	34.655	137.672	103.017	3,353
	1.03	336.101	3.462	34.758	134.207	99.448	3,382
	1.15	347.966	4.002	34.243	133.632	99.388	3,503
	1.27	344.949	4.381	34.153	132.783	98.630	3,499
		347.68^b	3.155^b		136.345^a	101.886^a	3,416^b
Dilution	0.55	324.920	1.787	34.270	109.272	75.002	4,334
	0.67	360.046	2.412	34.728	128.567	93.838	3,847
	0.79	370.384	2.926	34.252	132.633	98.382	3,769
	0.91	366.818	3.338	34.535	132.892	98.357	3,733
	1.03	375.950	3.872	34.268	130.79	96.522	3,897
	1.15	367.356	4.225	34.697	128.892	94.195	3,900
	1.27	383.865	4.875	34.437	127.74	93.303	4,117
		364.19^a	3.348^a		127.255^b	92.800^b	3,942^a
CV%		4.36	4.21	1.6	2.57	3.41	4.67
Regression Effect		NS	L	NS	Q	Q	Q
Techniques		0.0001	0.0001	0.975	0.0001	0.0001	0.0001
Levels		0.0064	0.0042	0.528	0.0001	0.0001	0.0001
Techniques* Levels		0.0001	0.0001	0.475	0.0001	0.0001	0.0265

FI: Feed Intake; MI: Methionine Intake; FW: Final Weight; WG: Weight Gain; FCR: Feed Conversion Ratio; ab: Means followed by different letters in the column differ by the F test; NS: Non significant effect; L: Linear effect; Q: Quadratic effect; CV%: Coefficient of variation

Influence of diet formulation technique on estimates of digestible methionine and cystine requirements for growing japanese quail

Aliton N. da Silva¹, Mateus T. Menegalle², José A. L. Barbosa²,
Tamires M. S. Felix¹, Thalís J. Oliveira¹, Felipe Dilelis², Urbano S. Ruiz²,
Leonardo A. F. Pascoal³, José J. Filho³, José H. V. da Silva³

¹Universidade Federal da Paraíba, Areia/PB; ²“Luiz de Queiroz” College of Agriculture, São Paulo University, Piracicaba/SP; ³Universidade Federal da Paraíba, Bananeiras/PB

Contact: andrew.lira980@gmail.com / **Presenter:** Mateus T. Menegalle

Abstract: Methionine is the first limiting amino acid (AA) in diets for Japanese quail, requiring precise nutritional balancing to avoid deficiency or excess. Different diet formulation techniques can be used to determine nutritional requirements. Therefore, the objective of this study was to estimate the digestible methionine + cystine (Met+Cys) requirements for Japanese quail from 10 to 36 days of age using the graded supplementation and dilution diet formulation techniques. A total of 588 Japanese quail (*Coturnix coturnix japonica*), 10 days of age, were housed in galvanized wire cages in climatecontrolled masonry rooms and distributed in a completely randomized design with a 7 × 2 factorial arrangement (Met+Cys levels × formulation techniques), totaling 14 treatments with six replicates of seven birds each. The diets were formulated using graded AA supplementation and diet dilution techniques. For each technique, the digestible Met+Cys levels studied were 0.460%, 0.580%, 0.700%, 0.820%, 0.940%, 1.060%, and 1.180%. The performance variables evaluated were: final body weight (FBW), weight gain (WG), feed intake (FI), and feed conversion ratio (FCR). At the end of the experiment, five fasted birds per treatment were euthanized to evaluate carcass weight, cuts, feathers,

and protein deposition in the carcass and feathers. The Met+Cys requirements were determined by polynomial regression of FCR: $Y_i = \beta_0 + \beta_1 \times \text{Met}_i + \beta_2 \times \text{Met}_i^2 + e_i$. The data were subjected to analysis of variance at a 5% probability level using SAS 9.1 software. There was an interaction ($p < 0.05$) between formulation techniques and Met+Cys levels for all variables studied. The FI and FBW were higher ($p < 0.001$) in quail fed diets formulated using the graded supplementation technique compared with the dilution technique, which was associated with greater WG and better FCR of the birds. The quadratic effect ($p < 0.001$) was observed for FBW, WG, and FCR in both techniques. For the absolute weights of feathers, carcass, and breast, as well as protein deposition in feathers and in the whole body of the birds, the lower Met+Cys levels in the dilution technique impaired feathering, breast weight, and protein deposition in feathers and in the whole body ($p < 0.05$). Digestible Met+Cys requirement levels were estimated at 0.86% using the graded supplementation technique and 0.95% using the dilution technique. Therefore, it can be concluded that diets formulated based on the AA graded supplementation technique are more suitable for estimating the digestible Met+Cys requirement for quail from 10 to 36 days of age.

Keywords: amino acids; performance, body protein

Table 1. Performance of quails at 36 days of age, fed diets containing increasing levels of digestible methionine + cystine, formulated using two feed formulation techniques

Techniques	Levels	FI (g/b)	MI (g/b)	FW (g)	WG (g)	FCR (g/g)
Supplementation	0.55	386.72	1.779	134.85	97.22	3.98
	0.67	376.04	2.181	136.65	99.06	3.8
	0.79	374.05	2.618	138.32	100.88	3.71
	0.91	381.07	3.125	140.89	103.49	3.68
	1.03	380.29	3.575	137.99	100.4	3.8
	1.15	394.47	4.181	137.06	99.31	3.97
	1.27	396.86	4.683	135.83	98.09	4.05
		384.21^a	3.163^a	137.37^a	99.78^a	3.856^b
Dilution	0.55	336.8	1.549	101.68	63.98	5.28
	0.67	358.27	2.078	129.51	91.9	3.9
	0.79	348.19	2.437	133.91	96.37	3.62
	0.91	353.44	2.898	138.76	101.21	3.49
	1.03	371.4	3.491	136.26	98.73	3.76
	1.15	379.43	4.022	123.74	86.11	4.41
	1.27	381.28	4.499	123.15	85.46	4.46
		361.26^b	2.996^b	126.72^b	89.11^b	4.131^a
CV%		2.95	2.03	2.3	3.33	4.93
Regression Effect		NS	L	NS	Q	Q
Techniques		0.0001	0.0001	0.0001	0.0001	0.0001
Levels		0.0001	0.0330	0.0001	0.0001	0.0001
Techniques* Levels		0.0006	0.0001	0.0001	0.0001	0.0001

FI: Feed Intake; MI: Methionine Intake; FW: Final Weight; WG: Weight Gain; FCR: Feed Conversion Ratio; ^{ab}: Means followed by different letters in the column differ by the F test; NS: Non significant effect; L: Linear effect; Q: Quadratic effect; CV%: Coefficient of variation

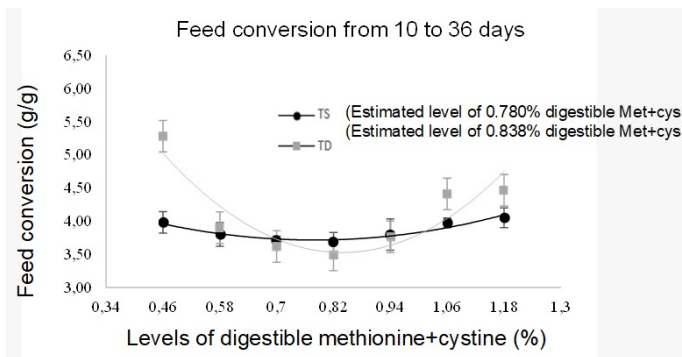


Figure 1. Graphical representation of the observed values and the fitted model for feed conversion of Japanese quails from 10 to 36 days of age, as a function of feed formulation techniques: TS = Supplementation technique; TD = Dilution technique

Effects of the physical structure of feed on the performance of broiler chickens up to 15 days of age

Juliane K. Baron¹, Brenda C. P. dos Santos¹, Ana C. B. DOI¹,
Maria L. B. Mariani¹, Guilherme F. Deda¹, Isabella de C. Dias¹,
Anne C. Araújo¹, João P. F. Ribeiro de Oliveira¹,
Simone G. de Oliveira¹, Alex Maiorka¹

¹Programa de Pós-Graduação em Zootecnia - Universidade Federal do Paraná, Curitiba, Paraná, Brasil

Contact: julianebaron@ufpr.br / **Presenter:** Juliane K. Baron

Abstract: The grinding of pelleted feed can influence the amount of fines present in the diet and compromise the performance of broiler chickens during the first days of life, a critical phase for the birds' initial development. Thus, this study aimed to evaluate the effect of different proportions of crushed pellets and fines, compared to a meal diet, and the increasing level of fines in the crushed pelleted feed, on the performance of broiler chickens aged 1 to 15 days. A total of 1,200 male Ross AP95 chicks were used, distributed in a completely randomized design with six treatments: five proportions of crushed and fine pellets (0%, 25%, 50%, 75%, and 100%) and a meal diet (control). Feed intake, average weight gain, and feed conversion were evaluated during the periods from 1 to 5, 6 to 10, and 11 to 15 days. From 11 to 15 days, a linear increase in average weight gain and a linear improvement in feed conversion were observed with a reduction in the proportion of fines ($P < 0.05$). In addition, birds fed thermally processed diets performed better than the control group during this period ($P < 0.05$). It is concluded that reducing fines and increasing the proportion of pellets favor the productive performance of broiler chickens in the early phase, especially from 10 days of age onward.

Keywords: Crushed pelleted feed; Fine particles; Regression

Tabela 1. Efeito de diferentes proporções de peletes triturados e finos em relação a ração farelada no Consumo de Ração Médio (CRM), Ganho de Peso Médio (GPM) e na Conversão Alimentar (CA) de frangos de corte de 1 a 5 dias, 6 a 10 dias e 11 a 15 dias de idade

	Tratamentos						EPM	P-valor	P-valor Linear1	P-valor Quadrático
	Farelada (Controle)	0% Triturado	25% Triturado	50% Triturado	75% Triturado	100% Triturado				
1 a 5 dias										
CRM (g)	91	99	95	94	95	94	0,88	0,11	0,141	0,362
GPM (g)	98	109*	112*	108	111*	110*	1,35	<0,05	0,950	0,910
CA (g/g)	0,927	0,881	0,856*	0,877*	0,864*	0,861*	0,006	<0,05	0,442	0,837
6 a 10 dias										
CRM (g)	235	254	244	267*	251	246	2,63	<0,05	0,676	0,238
GPM (g)	149	155	154	159	157	158	1,27	0,298	0,409	0,809
CA (g/g)	1,575	1,643	1,591	1,681	1,596	1,569	0,017	0,364	0,313	0,456
11 a 15 dias										
CRM (g)	356	365*	369*	370*	366*	378*	2,01	<0,05	0,134	0,456
GPM (g)	285	313	323	327	328	341*	3,31	<0,001	<0,05	0,914
CA (g/g)	1,238	1,168*	1,142*	1,130*	1,115*	1,111*	0,008	<0,001	<0,01	0,331

*Indica diferença em relação ao controle (P<0,05) pelo teste de Dunnett

¹Equação linear GPM: $Y = 314,3 + 0,2433 X$

¹Equação linear CA: $Y = 1,162 - 0,000572 X$

Effect of diferente particle sizes of soybean meal on protein and amino acid digestibility in broilers

Juliane K. Baron¹, Antoniel P. G. Franco¹,
Brenda C. P. dos Santos¹, Anne Caroline Araújo¹,
Erick C. C. dos Santos¹, Simone G. de Oliveira¹, Alex Maiorka¹

¹Programa de Pós-Graduação em Zootecnia - Universidade Federal do Paraná, Curitiba, Paraná, Brasil

Contact: julianebaron@ufpr.br / **Presenter:** Juliane K. Baron

Abstract: Soybean meal (SBM) is a widely used ingredient in poultry feed formulations due to its protein content and amino acid profile. However, the nutritional value of this ingredient is influenced by factors such as the processing conditions to which it has been subjected. Milling is one of the most important stages in feed manufacturing, as the particle size produced by this process can affect the digestibility and utilization of nutrients in the ingredient, directly impacting animal performance. Thus, the present study aimed to evaluate the effect of different particle sizes of soybean meal on protein and amino acid digestibility in broiler chickens aged 18 to 21 days. A total of 140 male broiler chickens of the Cobb® line were used, housed in metabolic cages and distributed in a completely randomized design, totaling 5 treatments (a protein-free diet and the remaining diets formulated with soybean meal at different particle sizes (649 µm; 824 µm; 937 µm, and 1234 µm)) with 7 replicates of 4 birds each. An indigestible tracer was added to all diets to estimate ileal digestibility. Until 17 days of age, all birds received the same diet, and starting on the 18th day, they began receiving the experimental diets. On the 21st day, the birds were euthanized by cervical dislocation, eviscerated, and their intestines were separated to collect ileal contents, which were analyzed to determine ileal digestible energy (IDE), crude protein

(CP) digestibility, and amino acid digestibility. The obtained and calculated data were tested for normality using the Shapiro-Wilk test, and when normal and homogeneous, they were subjected to regression analysis, considering $P < 0.05$. The results indicated that different particle sizes of soybean meal did not affect IDE, but particle size linearly affected CP digestibility, and there was a quadratic effect of particle size on amino acid digestibility. These findings suggest that particle size impacts the digestibility of soybean meal and amino acids, and in the present study, the best digestibility results were obtained when soybean meal had a particle size of 824 μm .

Keywords: Milling; Nutritional utilization; Particle size

Tabela 1. Energia Digestível Ileal (kcal) e digestibilidade ileal da proteína bruta e dos aminoácidos (%) em diferentes granulometrias do farelo de soja

	Farelo de Soja				Regressão			
	649 μm	824 μm	937 μm	1234 μm	Linear	Quadrático	R ²	EPM
EDI (kcal)	3298,8	3354,75	3290,71	3398,74	0,054	0,333	-	-
Proteína Bruta ¹ (%)	91,53	93,15	90,27	90,8	0,028	0,281	0,069	0,295
Metionina ² (%)	92,95	94,8	93,72	90,98	0,012	0,001	0,358	0,36
Lisina ³ (%)	92,91	93,8	92,05	90,36	<0,001	0,003	0,38	0,282
Treonina ⁴ (%)	88,45	91,79	87,82	86,6	0,02	0,013	0,174	0,519
Valina ⁵ (%)	89,8	92,52	90,39	87,27	0,004	0,001	0,378	0,452
Isoleucina ⁶ (%)	91,08	93,61	91,71	89,32	0,01	<0,001	0,346	0,375
Arginina ⁷ (%)	96,2	97,34	96,99	94,53	0,002	<0,001	0,77	0,248

Fonte: Elaborado pelo autor (2026)

EDI = Energia Digestível Ileal

EPM = Erro Padrão da Média

1_y = $-0,0023X + 93,58$

2_y = $-3E-05X^2 + 0,0434X + 75,503$

3_y = $-0,0052X + 97,044$

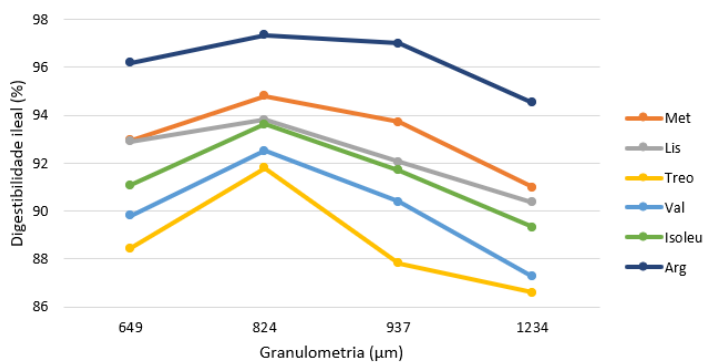
4_y = $-2E-05X^2 + 0,0347X + 75,353$

5_y = $-3E-05X^2 + 0,053X + 68,723$

6_y = $-3E-05X^2 + 0,0454X + 72,897$

7_y = $-2E-05X^2 + 0,0408X + 79,999$

ANAIS DA 36ª REUNIÃO ANUAL DO CBNA - AVES



Fonte: Elaborado pelo autor (2026)

Gráfico 1. Valores médios de digestibilidade ileal dos aminoácidos (%) em diferentes granulometrias do farelo de soja

Effect of particle size and feed processing on broiler chicken performance and yield

Erick Cordeiro Custódio dos Santos¹, Isabella de Camargo Dias¹,
Maria Letícia Bonadiman Mariani¹, Guilherme Francisco Deda¹,
Brenda Carolina Pereira dos Santos¹, Leopoldo Malcorra de Almeida²,
Alex Maiorka¹

¹Departamento de Zootecnia, Universidade Federal do Paraná, Curitiba, PR, Brasil

Contact: erick.cordeirozoo@gmail.com / **Presenter:** Erick Cordeiro Custódio dos Santos

Abstract: ABSTRACT Pelleted diets are widely used in the poultry industry due to their known benefits on animal performance. However while fine grinding improves pellet durability, coarser particles are necessary to stimulate gizzard function and maximize nutrient digestibility. Understanding the interaction between feed particle size and processing is fundamental to optimizing broiler performance. Therefore, the objective of this study was to evaluate the effect of geometric mean diameter (GMD) and feed processing on the live performance and carcass yield of broilers from 18 to 42 days of age. A total of 1,200 male Ross AP95 broilers were assigned to a completely randomized design in a 3 × 2 factorial arrangement, comprising three GMDs (800, 1,000, and 1,200 µm) and two feed processing methods (pelleted and post-pellet liquid application of fat [PPLA]). In total, six treatments were evaluated, with eight replicates of 25 birds each. Body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), and carcass and cuts yield were measured at 42 days of age. There was no interaction or main effect of GMD and feed processing ($P > 0.05$) on FI, BWG, or carcass and cuts yield. However, a significant interaction ($P < 0.05$) between factors was observed for FCR. Birds fed the pelleted diet with a GMD of 800 µm exhibited a poorer FCR

compared to those fed pelleted diets with larger GMDs (1,000 and 1,200 μm). Birds consuming PPLA diets showed a similar FCR regardless of particle size. In conclusion, feed processing and GMD influence live performance, where smaller GMDs in conventionally pelleted diets lead to a poorer FCR. Carcass and cuts yield were not affected by particle size or feed processing method.

Keywords: Feed conversion ratio; Geometric mean diameter; Pelleting; PPLA; Carcass yield

Tabela 1. Efeito do DGM (800, 1.000 e 1.200 μm) e do processamento da ração (peletizada e aplicação de óleo pós-peletização) sobre o desempenho de frango de corte

DGM, μm	Processamento da ração	CR, g	GP, g	CA, g/g
Interação				
800	Pelete	3862	2635	1.46b
1,000		3780	2644	1.430 ^a
1,200		3812	2669	1.429a
800	PPLA	3804	2660	1.430a
1,000		3833	2668	1.43ab
1,200		3756	2656	1.415a
EPM		11.7	8.4	0.004
800		3833	2647	1.448
1,000		3806	2656	1.433
1,200		3784	2662	1.422
	Pellet	3818	2649	1.441
	PPLA	3798	2661	1.427
p-Valor				
DGM		0.215	0.784	0.003
Processamento da ração		0.372	0.480	0.019
DGM *Processamento da ração		0.079	0.592	0.016

EPM: Erro Padrão da Média; DGM: Diâmetro Geométrico Médio; PPLA: Aplicação de óleo pós-peletização; a-b: Média seguida de letras distintas na mesma coluna diferem significativamente a $P < 0,05$ (teste de Tukey)

Tabela 2. Efeito do DGM (800, 1.000 e 1.200 μm) e do processamento da ração (peletizada e PPLA) sobre o rendimento de carcaça e cortes de frango de corte

DGM, μm	Processamento da ração	Rendimento, %			
		Carcaça	Peito	Coxa/ Sobrecoxa	Asa
Interaction					
800		77	31	22	7.5
1,000	Pellet	78	32	23	7.4
1,200		77	32	22	7.3
800		78	32	22	7.4
1,000	PPLA	78	32	22	7.4
1,200		78	32	23	7.3
EPM		0.19	0.22	0.14	0.05
800		77	31	22	7.4
1,000		78	32	22	7.4
1,200		78	32	22	7.3
	Pellet	77	31	22	7.4
	PPLA	78	32	22	7.3
p-Value					
DGM		0.260	0.318	0.825	0.453
Processamento da ração		0.120	0.293	0.954	0.493
DGM *Processamento da ração		0.683	0.375	0.547	0.793

EPM: Erro Padrão da Média; DGM: Diâmetro Geométrico Médio; PPLA: Aplicação de óleo pós-peletização

Copper nanoparticles as a performance enhancer in broiler diets

Júlia de Castro Campos Pereira¹, José E. Gagliardi Butolo¹,
Mateus Tinelli Menegalle¹, Mariana Feitosa Cavaleiro¹,
José F. Machado Menten¹, Gerson Barreto Mourão¹,
Felipe Dilelis de Resende Sousa¹

¹Departamento de Zootecnia, Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ/USP),
Piracicaba, SP, Brasil

Contact: juliaccp@usp.br / **Presenter:** Júlia de Castro Campos Pereira

Abstract: The global restriction on antibiotic growth promoters has prompted the search for alternative additives in poultry production. While copper (Cu) effectively modulates the microbiota due to its antimicrobial action, conventional inorganic sources require supra-nutritional doses (150–250 mg/kg) to be effective, raising environmental concerns regarding soil accumulation and nutrient antagonism. In this scenario, copper nanoparticles (CuNP) emerge as a promising strategy. This study aimed to evaluate the effects of dietary copper (copper oxide nanoparticles, CuONP) on the cecal microbiota of broilers challenged with *Eimeria* spp. The trial (CEUA nº 9365230524) used 336 Cobb 500 broilers (1–21 days old) in a randomized block design with 6 treatments: NC (no challenge/additive); CC (challenged/no additive); PC (challenged + 200 mg/kg of CuSO₄); and NP25, NP50, and NP100 (challenged + 25, 50, or 100 mg/kg of CuONP), with 8 replicates of 7 birds each. Diets met nutritional requirements, with additives included on top. The challenge was induced on day 1 via the oral route (10x commercial dose of coccidiosis vaccine). At 21 days of age, 8 birds/treatment were euthanized for cecal content collection. Microbiota characterization (CC, CuS200, and CuNP50) was performed via DNA extraction and sequencing of the V3-V4 16S rRNA

region (NGS), with taxonomy assigned via DADA2 and SILVA database. Alpha and beta diversity and differential abundance were analyzed using Type III ANOVA, Tukey's test, PERMANOVA (adonis2), BETA-DISPER, and MaAsLin3. Supplementation with CuNP50 and CuS200 did not affect alpha diversity, maintaining species richness (ASVs; $p=0.69$) and the Shannon index ($p=0.35$), similar to the CC group. Beta diversity revealed no significant distinctions between treatments in Bray-Curtis and Weighted UniFrac metrics ($p>0.05$). Additionally, MaAsLin3 detected no ASVs with significant variations between the CC and supplemented groups regardless of the copper source (FDR-BH $q > 0.10$). Results indicate that copper inclusion, regardless of the source, neither modulated the cecal community structure nor reversed the profile established by the challenge. In conclusion, the pressure exerted by *Eimeria* spp. infection on the intestinal ecosystem overshadowed the effect of the mineral additives at the evaluated dosages, dictating the microbial dynamics at 21 days of age.

Keywords: Poultry; Microbiota; Coccidiosis; Gut health; Alternative additives

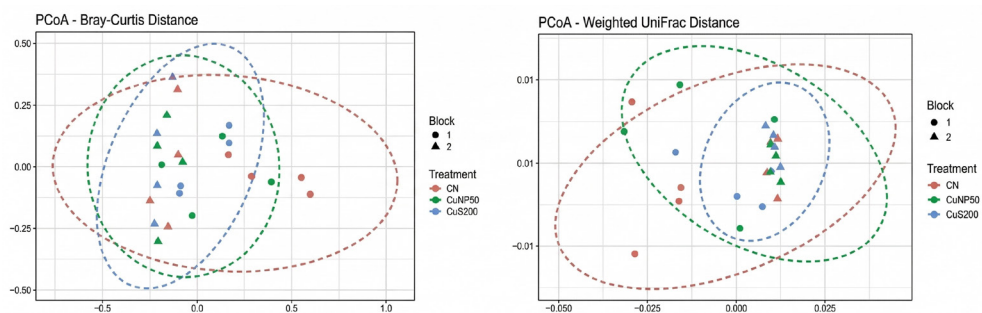


Figure 1 and Figure 2. Principal Coordinates Analysis (PCoA) of cecal microbiota based on Bray-Curtis and Weighted UniFrac distances in broiler chickens at 21 days old. Each point represents a single sample, colored by treatment group. 95% confidence ellipses are shown for each group

Determination of the energy value of wheat and triticale “in vivo” in broiler chickens compared to those estimated by prediction equations

Tatiane A. Barros¹, Maria do Carmo M. M. Ludke¹,
Carlos B. V. Rabello¹, Lilian F. A. Souza¹, Jorge V. Ludke²,
Kleydson T. A. de Oliveira¹, Edson J. A. Carvalho¹, Clener M. A. Fausto¹

¹Universidade Federal Rural de Pernambuco, Recife, Pernambuco;

²Embrapa Suínos e Aves, Concórdia, Santa Catarina.

Contact: tatiane.amaraldebarros@gmail.com / **Presenter:** Maria do Carmo M. M. Ludke

Abstract: The objective was to determine the energy values and nutrient utilization of wheat and triticale in Ross® 308 AP male broiler chickens, comparing in vivo obtained values with estimates from prediction equations in the literature. Physical analyses (granulometry and density) and analyses of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), mineral matter (MM), nitrogen-free extract (NFE), and gross energy (GE) of wheat and triticale were carried out. The evaluated prediction equations were: equation 1 = $(34.92 \times \text{CP}) + (63.1 \times \text{EE}) + (36.42 \times \text{NFE})$, and equation 2 = $(4.31 \times \text{digestible CP}) + (9.29 \times \text{digestible EE}) + (4.14 \times \text{digestible NFE})$. The comparison of the AMEn values determined by the estimates was performed using ANOVA ($P < 0.05$). Metabolism was studied in a completely randomized design and the treatments consisted of a reference diet (RD) and two test diets (30% replacement of the RD with wheat and triticale). The metabolization coefficients of dry matter (MCDM), crude protein (MCCP), ether extract (MCEE), nitrogen-free extract (MCNFE), and gross energy (MCGE), as well as the apparent metabolizable energy (AME) and nitrogen-corrected metabolizable energy (AMEn) values for broiler chickens, were determined using the

partial excreta collection method (Celite™ indicator) at 1%. The chemical composition of wheat and triticale was respectively: DM 88.20% and 88.11%, CP 14.80% and 15.89%, EE 1.42% and 1.53%, CF 2.82% and 2.23%, MM 3.19% and 3.97%, NFE 77.77% and 76.38%, GE 3973 kcal/kg and 3997 kcal/kg. The particle size and density analysis of the co-products were 451.65 μm and 797.8 kg/m³ (Wheat) and 468.69 μm and 853.3 kg/m³ (Triticale). The MCDM, MCCP, MCEE, MCNFE, and MCGE, as well as AME and AMEn values, were respectively for Wheat: 91.02%, 86.60%, 77.09%, 65.58%, 70.81%, 3615 kcal/kg, and 3377 kcal/kg; for Triticale: 81.85%, 88.60%, 77.70%, 56.82%, 76.17%, 3525 kcal/kg, and 3336 kcal/kg. In evaluating the prediction equations, it was found that the determined AMEn value for Wheat (3615 kcal/kg) was significantly higher than the estimate of 2905 kcal/kg (Equation 2) and not statistically different from Equation 1 which was 3480 kcal/kg. It can be concluded that for Triticale, the AMEn value determined in the present experiment (3336 kcal/kg) was close to the estimate from Equation 1 (3426 kcal/kg); however, for both, Equation 2 was not suitable for estimating the AMEn of these feedstuffs under the experimental conditions.

Keywords: Metabolizability; Nutritional composition; Poultry; Winter cereals

Table 1. Metabolization coefficients of DM, CP, EE, NNE, GE and the digestibles nutrients and determined values of AME and AMEn of Wheat and Triticale

Variable	Ingredients	
	Wheat	Triticale
MCDM	91.02 $\pm$ 0.46	81.85 $\pm$ 1.28
MCCP	89.60 $\pm$ 0.44	88.60 $\pm$ 9.87
DP	13.26 $\pm$ 1.27	14.08 $\pm$ 1.59
MCEE	77.09 $\pm$ 3.72	77.70 $\pm$ 4.98
DEE	1.09 $\pm$ 0.08	1.19 $\pm$ 0.06
MCNNE	68.58 $\pm$ 5.70	56.82 $\pm$ 7.56
DNNE	53.33 $\pm$ 4.49	43.40 $\pm$ 5.92
MCGE	70.81 $\pm$ 1.22	76.17 $\pm$ 2.25
AME	3615 $\pm$ 20.06	3525 $\pm$ 37.33
AMEn	3377 $\pm$ 20.80	3336 $\pm$ 32.91

Determination of the energy value of corn ethanol production by products “in vivo” in broiler chickens compared to those estimated by prediction equations

Edson J. A. Carvalho¹, Maria do Carmo M. M. Ludke¹,
Carlos B. V. Rabello¹, Lilian F. A. Souza¹, Jorge V. Ludke²,
Kleydson T. A. de Oliveira¹, Tatiane A. Barros¹, Kananda R. Santos¹

¹Universidade Federal Rural de Pernambuco, Recife, Pernambuco;

²Embrapa Suínos e Aves, Concórdia, Santa Catarina.

Contact: edsonjacarvalho1966@gmail.com / **Presenter:** Maria do Carmo M. M. Ludke

Abstract: The objective was to determine the energy values and nutrient utilisation of the high-protein dried distillers grains (HP-DDG) and dried distillers grains with solubles (DDGS) Ross® 308 AP male broiler chickens, comparing in vivo obtained values with estimates from prediction equations for literature. Physical analyses (granulometry and density) and analyses of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), mineral matter (MM), nitrogen-free extract (NFE), and gross energy (GE) of HP-DDG and DDGS were carried out. The estimates prediction equations were: equation 1 = $(39.15 \times \text{DM}) - (39.15 \times \text{MM}) - (9.72 \times \text{CP}) - (63.81 \times \text{EE})$, and equation 2 = $(4.31 \times \text{Digestible Protein}) + (9.29 \times \text{digestible EE}) + (4.14 \times \text{digestible NFE})$. The comparison of the AMEn values determined by the estimates were performed using were statistically analyzed using ANOVA ($P < 0.05$). Metabolism was studied in a completely randomized design and the treatments consisted of a reference diet (RD) and two test diets (30% replacement of the RD with HP-DDG and DDGS). The metabolization coefficients of dry matter (MCDM), nitrogen (MCN), crude protein (MCCP), ether extract (MCEE), non-

nitrogenated extractive (MCNNE) and gross energy (MCGE), as well as the apparent metabolizable energy (AME) and nitrogen-corrected metabolizable energy (AMEn) values for broiler chickens were determined using the partial excreta collection method (Celite™ indicator) at 1%. The chemical composition of HP-DDG and DDGS was respectively: DM 92.02% and 88.07%, CP 47.89% and 36.51%, EE 8.20% and 6.80%, FB 9.50% and 10.07%, MM 2.71% and 5.62%, NNE 31.7% and 41.00%, EB 5209 kcal/kg and 4524 kcal/kg. The particle size and density analysis of the co-products were 437.3 µm and 0.67 g/L (HP-DDG) and 471.9 µm and 0.62 g/L (DDGS). The DMMC, MCN, MCCP, MCEE, MCNNE and MCGE, as well as AME and AMEn values, were respectively for DDG-HP, 83.68%, 78.40%, 66.92%, 47.32%, 85.36%, 82.40%, 3392kcal/kg, 3329kcal/kg; for DDGS, 76.22%, 73.90%, 51.44%, 34.71%, 65.80%, 71.23%, 3241 kcal/kg, and 2507 kcal/kg. In evaluating the prediction equations, it was found that the determined AMEn value for DDG-HP (3329 kcal/kg) was significantly higher than the estimates of 2425 kcal/kg (Equation 1) and 2862 kcal/kg (Equation 2). It can be concluded for DDGS, the value AMEn determined in the present experiment (2507 kcal/kg) was close to the estimate from the equation 1 (2230 kcal/kg), except for the HP-DDG, the equations are not appropriate for estimating the AMEn of this food under the experimental conditions.

Keywords: DDGS; HP-DDG; Metabolizable energy; Nutritional value; Poultry

Table 1. Metabolization coefficients of DM, N, CP, EE, NNE, GE and the digestibles nutrients and determined values of AME and AMEn of HP-DDG and DDGS

Variable	Ingredients	
	HP-DDG	DDGS
MCDM	83,68 ± 2,58	76,22 ± 4,27
MCN	78,40 ± 17,65	73,9 ± 2,91
MCCP	66,92 ± 0,52	51,44 ± 10,56
DP	32,05 ± 0,17	18,78 ± 1,26
MCEE	47,32 ± 21,80	34,71 ± 21,73
DEE	3,88 ± 0,72	2,36 ± 0,60
MCNNE	85, 36 ± 6,20	65,80 ± 5,87
DNNE	27,06 ± 1,34	26,98 ± 1,84
MCGE	82,40 ± 14,52	71,23 ± 8,57
AME	3392 ± 71,81	3241 ± 63,76
AMEn	3329 ± 44,48	2507 ± 38,45

**36ª REUNIÃO
ANUAL DO CBNA**

RESUMOS TRABALHOS CIENTÍFICOS

SUÍNOS



Use of condensed tannin and phytobiotic in growing-finishing pigs inoculated with *Salmonella Typhimurium* and challenged with high stocking density

Bruna Poletti¹, Roberta Pinheiro dos Santos², Victor H. Souza²,
Stephane Alverina Briguenta da Motta², Pedro Henrique Pereira²,
Sibely Aiva Flores², Luiz Otávio Ribeiro Meneses²,
Luis Eduardo Resende Paiva², Samilly Pedroni Altoé²,
Vinicius Cantarelli²

¹TANAC S.A.; ²Faculdade de Zootecnia e Medicina Veterinária da
Universidade Federal de Lavras - FZMV/UFLA

Contact: bpoletti@tanac.com.br / **Presenter:** Victor H. Souza

Abstract: Restrictions on antibiotic growth promoters in swine production have encouraged the search for nutritional alternatives. Phytogenic additives, especially condensed tannins, have gained attention due to their antimicrobial, antioxidant, and gut health-modulating properties, helping control enteric pathogens while maintaining animal performance. This study aimed to compare the effects of supplementation with condensed tannin from black wattle and a commercial phytogenic additive (thyme extract, copper and zinc amino acid complexes, carob meal, and dried chicory) on growth performance, productive parameters, and carcass characteristics of pigs during the growing and finishing phases, under sanitary challenge and high stocking density. A total of 96 pigs (average initial weight ~25 kg) were used in a randomized block design, with initial weight as the blocking factor. Treatments included: basal diet without additives (negative control), basal diet with phytogenic additive (2 kg/t), and basal diet with condensed tannin (2 kg/t). Animals were housed in pens of four pigs, with feed and water ad libitum. The trial included growing phase 1, growing phase 2, and finishing. To simulate

sanitary challenge, pigs were orally inoculated with *Salmonella typhimurium* on day 12. Performance variables and carcass traits were evaluated. No significant differences were observed among treatments during the growing phases or overall period. In the finishing phase, pigs receiving condensed tannin showed higher feed intake, while feed conversion and efficiency were similar between additive treatments. Final body weight was slightly higher in pigs supplemented with tannin. Carcass characteristics were not affected. In conclusion, phytogetic additives are an effective strategy to support pig performance under challenging conditions. Both additives can be used without impairing performance or carcass traits, and their selection should consider cost. These results reinforce tannins as a viable alternative in reduced-antibiotic production systems.

Palavra-chave: Phytogetic, natural additives, challenge

Table 1. Performance of pigs during the growing and finishing phases (0-64 days)

Variables ¹	T1*	T2*	T3*	CV % ³	<i>p-value</i>
Final Weight (kg)	110.33	109.20	110.08	2.98	0.77
ADFI (kg)	2.58	2.56	2.63	3.26	0.28
ADG (kg)	1.19	1.17	1.18	4.29	0.76
FCR (kg/kg)	2.17	2.19	2.23	2.63	0.23
FE (kg/kg)	0.46	0.46	0.45	2.52	0.20

¹ADFI: Average Daily Feed Intake; ADG: Average Daily Gain; FCR: Feed Conversion Ratio; FE: Feed Efficiency

²T1: positive control diet; T2: positive control diet + therapeutic additive at 2 kg/ton; T3: positive control diet + condensed tannin at 2kg/ton

³CV: Coefficient of Variation. Differences were considered significant when $p < 0.05$; different letters within the same row indicate statistically significant differences

Condensed tannin as a modulator of sow physiology: stress, redox status and intestinal health

Bruna Poletti¹, Caio C. J. Pereira², Maria C. S. Silva²,
Stephane A. B. da Motta², Pedro H. Pereira², Sibely A. Flores²,
Roberta P. dos Santos², Luiz O. R. Menezes², Luis E. R. Paiva²,
Samilly P. Altoé², Ana M. de Oliveira², Vinicius Cantarelli², Izabel C. Tavares³

¹Tanac S.A.; ²Faculdade de Zootecnia e Medicina Veterinária da
Universidade Federal de Lavras – FZMV/UFLA; ³Médica veterinária – Kobelgaard ApS
Contact: bpoletti@tanac.com.br / **Presenter:** Maria C. S. Silva

Abstract: Genetic improvement of hyperprolific sows has significantly increased swine production in recent decades, but this progress has also led to higher oxidative stress and inflammatory processes, compromising reproductive efficiency. Condensed tannins have emerged as a promising nutritional strategy to counteract these negative effects. This study aimed to evaluate the inclusion of Black wattle condensed tannins in sow diets and their impact on stress, productive performance, intestinal health, and the performance of litters. A total of 180 sows were allocated in a randomized block design with three treatments during gestation and lactation: CON (control), TanA (2.0 kg/ton) and TanB (1.5 kg/ton). Measurements included backfat thickness, body weight, and feed intake from early gestation to late lactation. Physiological parameters were assessed through fecal microbiome analysis, colostrum composition and IgG concentration, salivary cortisol and serotonin, cytokines (IL-10, IL-6), and blood redox status. Piglet performance was evaluated by birth and weaning weights, diarrhea incidence, mortality, and culling. Results indicated a tendency for increased feed intake in tannin-supplemented groups. Stress markers improved: cortisol was significantly reduced on the first day of lactation, and IL-10 tended to be higher in TanA on day

10. Antioxidant activity was enhanced, with higher catalase activity in TanA at day 85 of gestation, increased SOD activity in TanB at day 1 of lactation, and reduced TBARS in TanA at day 18 of lactation. Microbiome analysis revealed differences in beta diversity, with higher abundance of *Peptococcaceae* and *Lactobacillus reuteri*, and lower abundance of *Spirochaetaceae*, *Enterobacteriaceae*, and *E. coli* in tannin groups. In conclusion, condensed tannin supplementation reduced stress in sows during farrowing. At 2.0 kg/ton, black wattle tannins improved intestinal health and decreased lipid oxidation near weaning. These findings suggest black wattle tannins are a valuable dietary tool to enhance welfare, oxidative balance, and productivity in hyperprolific sows, with positive effects extending to their litters.

Keywords: additive; *Acacia mearnsii*; pig farming; immune response; microbiota

Table 1. Performance of sows during gestation and lactation

Variables ²	Treatments ¹			SEM	CV (%)	<i>p-value</i>
	CON	TanB	TanA			
<i>- Gestation -</i>						
BW (initial)	233,89	233,86	234,54	3,769	18,67	0,988
BT (initial)	23,55	22,44	22,70	0,641	20,34	0,411
BW (final)	263,00	266,00	266,00	2,989	13,98	0,788
BT (final)	31,93	29,65	30,21	0,554	21,38	0,156
DFI	2,11	2,12	2,11	0,008	5,37	0,89
<i>- Lactation -</i>						
BW (final)	257,32	259,33	256,77	3,517	16,25	0,778
BT (final)	31,19	31,41	29,82	0,570	20,81	0,461
DFI	5,70b	6,34a	6,01a	0,116	22,04	0,063
BML	-12,83	-10,18	-14,58	1,700	-157,1	0,511
Piglet Birth weight	1,41	1,39	1,43	0,021	16,70	0,658
Stillborn (%)	3,35	2,89	2,22	0,681	174,58	0,548
Mummified (%)	1,30	1,24	1,17	0,405	239,18	0,977

1. CON: Control; TanB: Control + 1,5 kg/t condensed tannin; TanA: Control + 2 kg/t the condensed tannin

2. BW: Body Weight; BT: Backfat Thickness; DFI: Daily Feed Intake; BML: Body Mass Weight

Table 2. Nutritional composition and IgG levels of sow colostrum six hours post-farrowing

Variables ²	Treatments ¹			SEM	CV (%)	<i>p-value</i>
	CON	TanB	TanA			
Dry matter (%)	22,29	22,07	22,69	0,474	9,48	0,872
Ether extract (%)	6,45ab	6,27b	7,32a	0,229	15,49	0,083
Crude Protein (%)	13,12	14,30	12,51	0,302	10,16	0,104
IgG (pg/ml)	637,07	721,73	700,16	50,319	28,28	0,749

1. CON: Control; TanB: Control + 1,5 kg/t condensed tannin; TanA: Control + 2 kg/t the condensed tannin

2. IgG: Immunoglobulin G

Table 3. Salivary cortisol and serotonin concentrations (ng/ml) of sows on the day of farrowing and on the 6th day of lactation

Variables	Treatments ¹			SEM	CV (%)	<i>p-value</i>
	CON	TanB	TanA			
<i>- Day of farrowing -</i>						
Cortisol	7,06a	4,11b	3,20b	1,710	70,27	0,020
Serotonin	15,53	13,83	12,13	1,953	27,20	0,373
<i>- 6th day of lactation -</i>						
Cortisol	1,73	1,54	1,38	0,398	57,84	0,778
Serotonin	27,60	35,30	29,70	4,937	72,17	0,821

Effects of β -Mannanase and postbiotic on nutrient digestibility of diets in growing and finishing pigs

Amanda Gorrosterrazú¹, José A. L. Barbosa¹, Hélio M. Junior¹,
Júlia D. Marcio¹, Dener O. Moreira¹, Carlos E. M. Bertanha¹,
João L. de Brito¹, Samya S. S. de Souza¹, Urbano S. Ruiz¹

¹University of São Paulo (USP), "Luiz de Queiroz" College of Agriculture, Piracicaba, SP, Brazil

Contact: a.gorrosterrazu@usp.br / **Presenter:** Dener O. Moreira

Abstract: The aim of this study was to evaluate the effects of β -mannanase associated or not with a postbiotic on the apparent total tract digestibility (ATTD) of dry matter (DM), mineral matter (MM), organic matter (OM), crude protein (CP), gross energy (GE), and neutral detergent fiber (NDF) of corn and soybean meal based diets in growing and finishing pigs. Eightyfour crossbred pigs (40.90 ± 3.95 kg of BW) were housed in groups of two or three animals per pen and assigned to six dietary treatments in a 2×3 factorial arrangement, with two levels of postbiotic (0 or 500 g/ton) and three levels of β mannanase (0, 50 and 100 g/ton). The animals were submitted to a four feeding phases program: growth I (7 days), growth II (21 days), finishing I (28 days) and finishing II (21 days). In each phase, the diets had exactly the same inclusion levels of corn and soybean meal (72.8 to 85.6% corn and 11.8 to 23.5% soybean meal), with similar calculated contents of NE (2.5–2.6 Mcal/kg), CP (12.6–17.25%) and SID Lys (0.67–1.06%), and contained titanium dioxide as an indigestible marker (0.5%). The ATTD was determined by the index method during the growth II, finishing I and II phases. A complete randomized block design based on initial body weight and sex of the pigs was used, with the pen as the experimental unit and five replicates per treatment. Data were submitted to ANOVA and means were compared by Tukey's test

($P < 0.05$) using the SAS MIXED procedure. In the growth II phase, in which the ratios had 78.6% corn and 18.2% soybean meal, the pigs receiving diets containing β -mannanase had greater ($P < 0.05$) ATTD of DM, OM, CP, GE, and NDF compared to pigs fed diets without the enzyme. The highest digestibility coefficients were observed at 100 g/ton, followed by 50 g/ton, indicating a dosedependent response using the enzyme. No significant effects were observed for the ATTD of MM. In the finishing phases, with greater corn (83.1 to 85.6%) and lower soybean meal dietary contents (11.8 to 14.0%), the inclusion of β -mannanase or postbiotic in the diets did not affected the ATTD of nutrients and energy. The addition of β -mannanase was effective in improving the ATTD of nutrients and energy in the growth II diets, but not in finishing I and II diets, which is probably related with the greater soybean meal and lower corn contents in growth II diets compared with finishing diets.

Keywords: Total apparent digestibility; feed additives; digestive efficiency

Table 1. Apparent Total Tract Digestibility (ATTD) of Dry Matter (DM), Mineral Matter (MM), Organic Matter (OM), Crude Protein (CP), Gross Energy (GE), and Neutral Detergent Fiber (NDF) of corn and soybean meal diets containing β -mannanase (Enz) at 0, 50, and 100 g/ton and postbiotic (Pos) at 0 and 500 g/ton, in growing and finishing pigs

Item	Postbiotic - Enzyme							<i>P-value</i>		
	0-0	500-0	0-50	500-50	0-100	500-100	SEM	E	P	E x P
Growing II										
ATTD DM, %	77.85	78.26	80.85	79.89	82.38	83.41	1.310	0.0001	0.8271	0.5531
ATTD MM, %	46.41	32.95	35.34	29.71	44.91	32.51	4.660	0.0865	0.0009	0.4497
ATTD OM, %	80.02	80.66	83.18	82.28	84.28	85.57	1.210	<0.0001	0.6295	0.4355
ATTD CP, %	63.87	65.71	70.70	67.17	72.69	74.36	2.090	<0.0001	0.9939	0.1410
ATTD GE, %	75.84	77.05	79.50	78.47	81.55	83.10	1.457	<0.0001	0.4995	0.4109
ATTD NDF, %	42.70	38.65	42.98	49.02	51.85	55.12	3.966	0.0008	0.4525	0.2032
Finishing I										
ATTD DM, %	82.56	82.79	82.72	81.32	82.44	83.93	0.938	0.2352	0.8402	0.1175
ATTD MM, %	28.41	32.96	35.80	34.80	41.00	34.79	4.418	0.0892	0.7326	0.2505
ATTD OM, %	84.94	85.16	85.10	83.66	84.49	86.22	0.923	0.3309	0.7465	0.0753
ATTD CP, %	72.46	70.52	73.10	69.79	73.39	74.43	1.857	0.1398	0.2192	0.2801
ATTD GE, %	82.25	82.56	82.40	80.95	82.41	83.66	1.097	0.2384	0.9544	0.2330
ATTD NDF, %	42.40	45.29	42.87	41.19	44.99	48.20	3.608	0.2222	0.4882	0.5723
Finishing II										
ATTD DM, %	80.98	79.31	78.96	81.91	81.49	81.15	2.437	0.7328	0.8123	0.3545
ATTD MM, %	17.88	21.48	18.05	32.60	29.19	22.16	7.334	0.4271	0.3741	0.1148
ATTD OM, %	83.75	82.35	82.18	84.21	83.90	83.65	1.967	0.8478	0.9111	0.4657
ATTD CP, %	71.91	73.39	69.62	72.27	71.03	73.35	3.760	0.7851	0.2957	0.9739
ATTD GE, %	80.80	79.18	78.74	81.38	80.81	80.26	2.370	0.9336	0.9078	0.4290
ATTD NDF, %	27.22	22.10	21.87	26.17	20.01	20.69	7.742	0.6029	0.9909	0.6618

0-0 = Postbiotic 0 + β -mannanase 0; 500-0 = Postbiotic 5000 + β -mannanase 0; 0-50 = Postbiotic 0 + β -mannanase 50; 500-50 = Postbiotic 500 + β -mannanase 500; 0-100 = Postbiotic 0 + β -mannanase 100; 500-100 = Postbiotic 500 + β -mannanase 100. SEM = Standard Error of the Mean

Effects of β -Mannanase and postbiotic on waste excretion and nutrient utilization efficiency in pigs

Amanda Gorrosterrazú¹, José A. L. Barbosa¹, Hélio M. Junior¹,
Júlia D. Marcio¹, Dener O. Moreira¹, Carlos E. M. Bertanha¹,
João L. de Brito¹, Samya S. S. de Souza¹, Urbano S. Ruiz¹

¹University of São Paulo (USP), "Luiz de Queiroz" College of Agriculture, Piracicaba, SP, Brazil

Contact: a.gorrosterrazu@usp.br / Presenter: Dener O. Moreira

Abstract: The objectives of this study were to evaluate the supplementation of β -mannanase and a postbiotic on growing and finishing pigs feeding over the potential environmental impact of pigs through the evaluation of dry matter DM, organic matter OM, ash and nitrogen N fecal excretion, and the excretion of DM, OM, ash and N per unit of weight gain. Eighty-four pigs 40 ± 3.95 kg were distributed in a randomized block design, in a 2×3 factorial arrangement, with two levels of postbiotic 0 or 500 g/ton and three levels of β -mannanase 0, 50, and 100 g/ton, totaling six treatments with five replicates. The experiment was conducted during the growing phases I 7 days and II 21 days, finishing phases I 28 days and II 21 days. The pigs were fed corn and soybean meal-based diets containing the same calculated NE (2.5–2.6 Mcal/kg), CP (12.6–17.25%), and SID Lys (0.67–1.06%) contents within phase, and titanium dioxide (TiO₂) as an indigestible marker. The indigestibility factor of the diets ($IF = [TiO_2] \text{ diet} / [TiO_2] \text{ feces}$) were calculated, and combined with feed intake, allowed for the calculation of total DM fecal excretions ($TFE = \text{feed intake} \times IF$), and the excretions E of OM, ash, and N in feces (EOM or $Eash$ or $EN = TFE \times [OM]$ or $[ash]$, or $[N]$ in feces), on a dry matter basis. Additionally, by associating the TFE of DM, EOM, Eash and EN with the weight gain of the pigs, the residue coefficients were calculated ($RC = TFE$

of DM or EOM or Eash or EN excreted in feces / total amount of live weight produced). In the growth phase II, pigs supplemented with β -mannanase showed lower $P<0.05$ excretions and RC of DM, OM, ash, and N, indicating greater nutrient utilization efficiency, with a more pronounced effect for the pigs fed diets with 100 g β -mannanase /ton, followed by the animals submitted to diets containing 50 g β -mannanase /ton, compared to non-supplemented pigs. In the finishing phase I, interactions were observed between β -mannanase and postbiotic $P<0.05$ for DM, OM, and N excretion. Additionally, the inclusion of 100 g β -mannanase/ton reduced $P<0.05$ the RC of DM and ash and showed a tendency $P<0.1$ to reduce the RC of OM. In the finishing phase II, no differences were observed in total excretions of DM, OM, ash and N. However, supplementation with β -mannanase reduced $P<0.05$ the RC of ash and tended $P<0.1$ to reduce ash excretion and the RC of DM and OM. Diets containing the enzyme β -mannanase promoted lower excretions of DM, OM, ash and N, as well as lower RC, indicating greater efficiency in nutrient utilization and lower potential environmental impact of production.

Keywords: fecal excretion; enzyme supplementation; swine nutrition

Table 1. Total Fecal Excretion of Dry Matter (TFEDM), Excretion of Ash (EASH), Organic Matter (EOM), and Nitrogen (EN), and Reside Coefficients of Dry Matter (RCDM), Ash (RCash), Organic Matter (RCOM), and Nitrogen (RCN) of pigs fed diets containing β -mannanase (BM) at 0, 50, and 100 g/ton and postbiotic (P) at 0 and 500 g/ton, during the growing II and finishing I and II phases

Item	Postbiotic – β -mannanase							<i>P-value</i>		
	0-0	500-0	0-50	500-50	0-100	500-100	SEM	BM	P	BM x P
Growing II										
TFEDM, g	9303	8873	7521	8230	7074	6831	565.5	0.0001	0.9703	0.3317
EASH, g	1460	1387	1233	1303	1073	1123	103.2	0.0010	0.7976	0.5765
EOM, g	7843	7486	6287	6927	6001	5708	495.5	0.0002	0.9913	0.3033
EN, g	415.2	392.7	312.7	366.3	293.3	300.4	30.66	0.0003	0.4798	0.2331
RCDM, g/kg BW	490.1	464.1	412.3	439.3	374.2	359.7	27.74	<0.0001	0.7821	0.3820
RCMM, g/kg BW	76.74	72.79	67.56	69.93	56.64	59.41	5.550	0.0014	0.9031	0.6371
RCOM, g/kg BW	413.4	391.3	344.7	369.4	317.6	300.3	24.06	0.0001	0.7288	0.3397
RCN, g/kg BW	21.87	20.55	17.11	19.58	15.47	15.76	1.430	<.0001	0.5682	0.1957
Finishing I										
TFEDM, g	12662 ^{ab}	11816 ^{bc}	11484 ^{bc}	13429 ^a	11277 ^c	10918 ^c	820.1	0.0150	0.5117	0.0130
EASH, g	2187	2099	2056	2268	1794	1952	163.7	0.0374	0.3312	0.4034
EOM, g	10476 ^{ab}	9717 ^{bc}	9428 ^{bc}	11161 ^a	9482 ^{bc}	8966 ^c	547.8	0.0363	0.6506	0.0109
EN, g	498.8 ^{ab}	455.1 ^{abc}	432.5 ^{bc}	513.7 ^a	450.2 ^{abc}	424.8 ^c	33.22	0.2231	0.8396	0.0374
RCDM, g/kg BW	403.9	384.0	379.4	433.7	362.3	359.2	30.22	0.0298	0.4429	0.0815
RCMM, g/kg BW	69.77	68.22	67.89	73.35	57.72	58.71	5.550	0.0367	0.2731	0.5201
RCOM, g/kg BW	334.1	315.8	311.5	360.3	304.6	295.1	25.73	0.0643	0.5669	0.0684
RCN, g/kg BW	15.91	14.79	14.30	16.62	14.45	13.99	1.371	0.2980	0.7339	0.1318
Finishing II										
TFEDM, g	10966	10967	11119	10178	9569	10746	1083	0.5527	0.8988	0.3766
EASH, g	1999	2010	2095	1704	1611	1783	213.20	0.0965	0.5443	0.1374
EOM, g	8976	8957	9024	8475	7957	8963	932.47	0.7297	0.7850	0.4741
EN, g	367	389	405	293	356	327	57.94	0.6044	0.2136	0.2339
RCDM, g/kg BW	539	701	569	485	461	472	91.18	0.0728	0.5701	0.1827
RCMM, g/kg BW	99.15	110.4	87.30	82.34	77.74	79.15	13.66	0.0171	0.7248	0.6778
RCOM, g/kg BW	440.7	572.8	461.6	403.8	383.5	932.5	75.46	0.0965	0.5224	0.2208
RCN, g/kg BW	18.52	21.96	20.73	16.30	17.14	14.99	3.175	0.1260	0.5256	0.1983

0-0 = Postbiotic 0 + β -mannanase 0; 500-0 = Postbiotic 5000 + β -mannanase 0; 0-50 = Postbiotic 0 + β -mannanase 50; 500-50 = Postbiotic 500 + β -mannanase 500; 0-100 = Postbiotic 0 + β -mannanase 100; 500-100 = Postbiotic 500 + β -mannanase 100. SEM = Standard Error of the Mean

^{a-b}Values within a row with different superscripts differ at P < 0.05

Effects of β -Mannanase postbiotic on growth performance and immune response of growing and finishing pigs

Amanda Gorrosterrazú¹, José A. L. Barbosa¹, Hélio M. Junior¹,
Dener de Oliveira Moreira¹, Júlia D. Marcio¹, Carlos E. M. Bertanha¹,
João L. de Brito¹, Samya S. S. de Souza¹, Urbano S. Ruiz¹

¹University of São Paulo (USP), "Luiz de Queiroz" College of Agriculture, Piracicaba, SP, Brazil

Contact: a.gorrosterrazu@usp.br / **Presenter:** Dener de Oliveira Moreira

Abstract: The objective of this study was to investigate the use of a postbiotic and the enzyme β -mannanase in growing and finishing pigs feeding on growth performance and immune response. Eighty-four cross-bred pigs (40.90 ± 3.95 kg of BW) were housed in groups of three or two barrows and gilts per pen and assigned to six dietary treatments, in a 2×3 factorial scheme, with two postbiotic contents (0 or 500 g/ton) and three β -mannanase concentrations (0, 50 and 100 g/ton). The trial was divided into four phases, growth I (7 days), growth II (21 days), finishing I (28 days) and finishing II (21 days). The diets were corn and soybean meal based and presented the same calculated NE (2.5 – 2.6 Mcal/kg), CP (12.6 – 17.25%) and SID Lys (0.67 – 1.06%) contents within phase. The body weight (BW), average daily gain (ADG), average daily feed intake (ADFI) and feed conversion ratio (FCR) were evaluated in each phase and in the total period, and serum anti-PCV-2 IgG and IgA were measured at days 0, 22, 43 and 74 of the trial, after a challenge with a circovirus vaccine at day 21 of the experiment. A randomized block design was used, the experimental unit was the pen for growth performance and the pig for immune system activation, with five repetitions per treatment. The data was submitted to ANOVA and means were compared using Tukey's test ($P < 0.05$), utilizing the SAS MIXED procedure. The BW, ADG, ADFI and

FCR were similar among animals subjected to the different diets in growth I, II and in finishing I and II phases. However, over the entire study period, animals fed the diet with the β -mannanase at 50 g/ton and without the postbiotic had lower ($P<0.05$) ADG and ADFI than pigs fed diets without any feed additive or that received the diet with 50 g/ton β -mannanase and the postbiotic. Additionally, pigs fed β -mannanase at 50 g/ton presented a 4% better FCR ($P<0.05$) compared to pigs that received diets without the enzyme. There was a tendency for a 31% ($P=0.0773$) increase in serum immunoglobulins content in pigs fed postbiotics in the blood collection on day 21. These results indicate that the association between β -mannanase and postbiotic improve FCR and immune response in growing and finishing pigs.

Keywords: Enzyme supplementation; swine intestinal health; zootechnical performance; humoral immunity

Table 1. Average Daily Gain (ADG), Average Daily Feed Intake (ADFI), Feed Conversion Ratio (FCR), and Body Weight (BW) of pigs feed diets containing β -mannanase (BM) at 0, 50 and 100 g/ton and postbiotic (P) at 0 or 500 g/ton during the growing I and II and finishing I and II phases, as well as over the total period

Item	Postbiotic – β-mannanase						SEM	P-value		
	0-0	500-0	0-50	500-50	0-100	500-100		BM	P	BM × P
Growing I										
ADG, kg	1286	1.340	1.237	1.346	1.281	1.251	0.069	0.7714	0.4155	0.7886
ADFI, kg	2.198	2.240	2.027	2.218	2.175	2.218	0.125	0.2630	0.0739	0.1823
FCR	1.722	1.674	1.636	1.657	1.699	1.769	0.0481	0.1721	0.6995	0.3685
BW, kg	49.91	50.71	49.79	50.19	50.35	50.84	2.525	0.6541	0.3085	0.8280
Growing II										
ADG, kg	1.056	1.064	1.018	1.045	1.057	1.080	0.034	0.3299	0.3299	0.3299
ADFI, kg	2.792	2.775	2.648	2.787	2.952	2.781	0.1340	0.3528	0.3528	0.3528
FCR	2.641	2.603	2.598	2.659	2.808	2.574	0.1014	0.6422	0.6422	0.6422
BW, kg	68.93	69.87	68.11	69.00	69.10	69.82	2.973	0.1770	0.1770	0.1770
Finishing I										
ADG, kg	1.121	1.102	1.077	1.116	1.123	1.094	0.0344	0.8316	0.9095	0.7937
ADFI, kg	3.178	3.020	2.872	3.156	3.039	2.950	0.1422	0.4775	0.8693	0.1809
FCR	2.834	2.739	2.669	2.824	2.711	2.694	0.0785	0.5547	0.8152	0.5533
BW, kg	100.3	100.7	98.26	100.3	100.53	100.46	3.626	0.7210	0.5953	0.9252
Finishing II										
ADG, kg	0.971	0.877	0.916	1.022	0.942	1.020	0.0522	0.4597	0.4442	0.2298
ADFI, kg	3.256	3.103	3.023	3.258	3.182	3.274	0.1508	0.7010	0.4969	0.4635
FCR	3.356	3.593	3.301	3.203	3.401	3.223	0.1307	0.2256	0.9042	0.3324
BW, kg	120.72	119.13	117.49	121.72	120.30	121.88	3.554	0.7255	0.3834	0.6011
Total Period										
ADG, kg	1.079 ^a	1.071 ^{ab}	1.032 ^b	1.094 ^a	1.069 ^{ab}	1.073 ^a	0.0242	0.6707	0.0848	0.0339
ADFI, kg	3.041 ^a	2.935 ^{ab}	2.815 ^b	3.022 ^a	2.997 ^a	2.954 ^{ab}	0.1151	0.4687	0.6935	0.0366
FCR	2.858	2.789	2.726	2.711	2.805	2.747	0.0509	0.0378	0.1294	0.7523

0-0 = Postbiotic 0 + β -mannanase 0; 500-0 = Postbiotic 5000 + β -mannanase 0; 0-50 = Postbiotic 0 + β -mannanase 50; 500-50 = Postbiotic 500 + β -mannanase 500; 0-100 = Postbiotic 0 + β -mannanase 100; 500-100 = Postbiotic 500 + β -mannanase 100. SEM = Standard Error of the Mean

^{a-b}Values within a row with different superscripts differ at $P < 0.05$

Table 2. Serum anti-PCV-2 IgG + IgA concentrations of pigs fed diets containing β -mannanase (BM) at 0, 50, and 100 g/ton and postbiotic (P) at 0 or 500 g/ton, evaluated at different sampling days during the experimental period

Item	Postbiotic – β -mannanase							<i>P-value</i>		
	0-0	500-0	0-50	500-50	0-100	500-100	SEM	BM	P	BM x P
Day										
0	8442	6743	6113	6880	9257	6761	1745	0,4602	0,2681	0,4008
21	9128	12002	8950	9962	8799	13283	2595	0,6803	0,0773	0,6452
49	4938	5064	5017	4793	5070	5131	251,6	0,5385	0,9310	0,5511
73	3700	4531	4100	3892	3755	4204	383,0	0,8620	0,1219	0,1787
73	3700	4531	4100	3892	3755	4204	383,0	0,8620	0,1219	0,1787

0-0 = Postbiotic 0 + β -mannanase 0; **500-0** = Postbiotic 5000 + β -mannanase 0; **0-50** = Postbiotic 0 + β -mannanase 50; **500-50** = Postbiotic 500 + β -mannanase 500; **0-100** = Postbiotic 0 + β -mannanase 100; **500-100** = Postbiotic 500 + β -mannanase 100. **SEM** = Standard Error of the Mean

Less plasma but same performance: sugarcane yeast extract as functional ingredient to partially replace spray-dried plasma in weaned piglets

Graziela A. C. Valini¹, Melina Bonato¹, Caio A. Silva²

¹ICC Animal Nutrition, SP, BR; ²Universidade Estadual de Londrina, PR, BR

Contact: graziela.alves@iccbrazil.com.br / **Presenter:** Graziela A. C. Valini

Abstract: Minimizing post-weaning stress and preserving gut health are key priorities during the nursery phase. In this context, spray-dried plasma (SDP) is widely used in pre-starter diets due to its high palatability, stimulation of feed intake, and positive effects on digestibility and immune function. However, its high cost may limit its use. As an alternative, yeast extract (YE) contains high levels of bioactive peptides, amino acids, particularly glutamic acid, and nucleotides, which are essential for energy supply and tissue repair during early development. Therefore, this study evaluated the effects of partially replacing SDP with YE on performance, gut health, and inflammatory response in weaned piglets. A total of 350 piglets (n=14; 5 piglets/pen) were allocated by body weight and sex into five treatments: control (CN), including 3% SDP in pre-starter I and 1.5% in pre-starter II; CN+1% YE on top; and diets with 16.7% (0.5% YE), 33.3% (1% YE), and 50% (1.5% YE) replacement of SDP by YE. Feed intake (FI) per pen and fecal score per piglet were recorded daily, while individual body weight (BW) was measured weekly. Intestinal tissue, feces, and serum samples (n=10) were collected for histomorphometric analysis (day 12), fecal microbiota, and cytokine profile (day 21), respectively. Performance and intestinal morphology were analyzed by ANOVA followed by Tukey's test. Fecal score was analyzed using a generalized linear model (binomial distribution), and microbiota relative

abundance was assessed by Kruskal–Wallis followed by Dunn’s test. The Mann-Whitney test was performed to assess the alpha diversity between groups, while beta diversity analysis was conducted by perMANOVA within the QIIME2 pipeline. For all variables, significance was declared at $P < 0.05$. During pre-starter I, FI was higher in the CN group than in the 1.5% YE group ($P < 0.05$, Table 1). However, BW gain, BW, and feed conversion ratio were not affected by treatments ($P > 0.05$). During pre-starter II and starters I and II phases, as well as for diarrhea incidence (Table 2), no differences were observed among treatments ($P > 0.05$). In addition, intestinal morphology, fecal microbiota diversity and composition, including the Firmicutes/Bacteroidota ratio, and pro- and anti-inflammatory cytokine profiles remained unchanged across treatments ($P > 0.05$, Figures 1, 2, 3, and 4). These results indicate that partial replacement of SDP with up to 1.5% YE maintains performance, gut integrity, and immune homeostasis in weaned piglets, supporting its potential as a nutritional alternative to SPD.

Keywords: Gut health, *Saccharomyces cerevisiae*, Growth, Swine

Table 1. Effect of spray-dried plasma (Control diet, CN) or yeast extract (YE) as SDP partial replacement on the growth performance of weaned piglets during 42 days

Pre-starter I, d 1 to 7	Treatments					P-value
	CN	CN + 1% YE on top	0,5% YE	1% YE	1,5% YE	
Initial BW (kg)	6,052	6,052	6,050	6,052	6,054	1,00
Feed Intake, kg	0,246a	0,238ab	0,236ab	0,232ab	0,216b	0,03
Average daily gain, kg	0,157	0,168	0,151	0,142	0,133	0,22
Feed conversion ratio	1,654	1,474	1,593	1,763	1,937	0,28
BW, kg	7,156	7,233	7,120	7,051	6,989	0,24
Pre-starter II, d 8 to 14						
Feed Intake, kg	0,359	0,351	0,356	0,355	0,334	0,47
Average daily gain, kg	0,207	0,221	0,209	0,233	0,208	0,58
Feed conversion ratio	1,783	1,677	1,737	1,587	1,660	0,67
BW, kg	8,608	8,787	8,585	8,684	8,486	0,31
Starter I, d 15 to 22						
Feed Intake, kg	0,492	0,491	0,478	0,505	0,486	0,64
Average daily gain, kg	0,348	0,327	0,319	0,328	0,329	0,58
Feed conversion ratio	1,421	1,519	1,512	1,561	1,485	0,21
BW, kg	11,050	11,081	10,821	10,981	10,795	0,50
Starter II, d 22 to 42						
Feed Intake, kg	0,848	0,868	0,822	0,871	0,840	0,20
Average daily gain, kg	0,541	0,566	0,532	0,547	0,538	0,57
Feed conversion ratio	1,572	1,539	1,554	1,598	1,567	0,47
Final BW, kg	22,445	22,952	22,006	22,581	22,114	0,47
Total period, d 1 to 42						
Feed Intake, kg	0,605	0,611	0,587	0,614	0,590	0,32
Average daily gain, kg	0,388	0,401	0,377	0,389	0,379	0,46
Feed conversion ratio	1,563	1,531	1,561	1,585	1,561	0,46

a,b Means in the same row with different letters indicate a significant difference ($P < 0.05$) according to Tukey's test

Table 2. Effect of spray-dried plasma (Control diet, CN) or yeast extract (YE) as SDP partial replacement on Diarrhea Incidence (DI) during 42 days

	Treatments					<i>P-value</i>
	CN	CN + 1% YE on top	0,5% YE	1,0% YE	1,5% EL	
Score 2 (n)	12	8	16	7	12	0,31
Score 3 (n)	80	72	72	85	86	0,64
Total (n)	92	80	88	92	98	0,71
DI	0,031	0,027	0,030	0,031	0,034	-

S2: events with score 2 (pasty feces); S3: events with score 3 (watery feces). Total diarrheal events (S2 + S3); DI: events $\geq$ score 2 / total number of observations per treatment

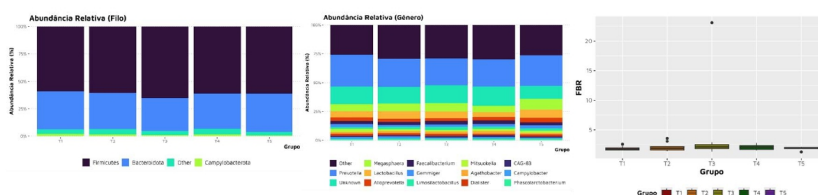


Figure 1. Fecal microbial community at phylum and genus levels, and Firmicutes-to-Bacteroidota ratio in weaned piglets fed diets with CN + YE on top (T1), 0.5% YE (T2), 1% YE (T3), 1.5% YE (T4), or control diet (T5) during pre-starter I and II phases. No statistical differences were observed ($P>0,05$)

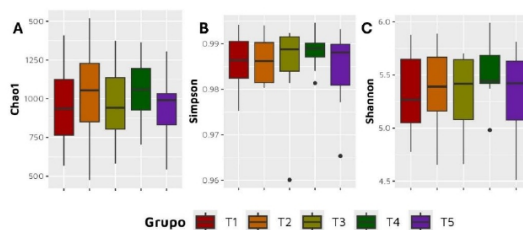


Figure 2. Alpha diversity of weaned piglets fed with CN + 1.0% on top diet (T1), 16.7% YE in SDP replacement (T3), 50% YE in SDP replacement (T4) or a CN diet (T5) in pre-starter I and II phases. The alpha diversity was estimated by the parameters Chao I (A), Simpson's Index (B), and Shannon's Index (C). Statistical comparison between groups was performed using the non-parametric Mann-Whitney test. No statistical differences were observed ($P>0,05$)

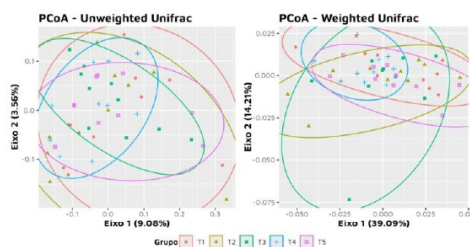


Figure 3. Beta diversity of weaned piglets fed with CN and 1.0% YE on top diet (T1), 16.7% YE in SDP replacement (T2), 33.3% YE in SDP replacement (T3), 50% YE in SDP replacement (T4) or a CN diet (T5) in pre-starter I and II phases. The Unweighted UniFrac estimated the beta diversity. No statistical differences were observed ($P>0,05$)

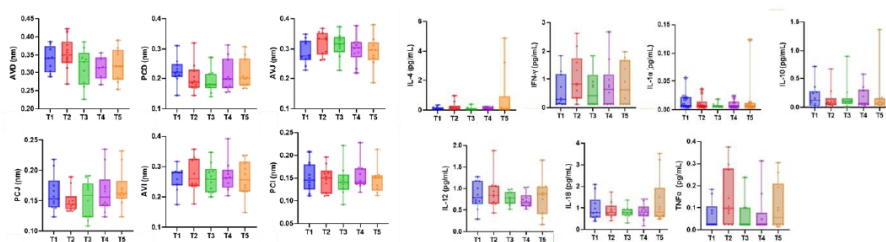


Figure 4. Villus height (AV) and crypt depth (PC) in small intestinal segments – duodenum (D), jejunum (J), and ileum (I), and plasma concentrations of cytokines (IL-4, IFN- γ , IL-1 α , IL-10, IL-12, IL-18, and TNF- α) in weaned piglets fed diets with CN + YE on top (T1), 0.5% YE (T2), 1% YE (T3), 1.5% YE (T4), or control diet (T5) during pre-starter I and II phases. No statistical differences were observed ($P>0,05$)

Effects of lignocellulose fiber supplementation in sow diets during gestation and lactation on the structure and biomarkers of the gut microbiota in piglets

Rafaela Hilgemberg¹, Cátia L. A. Fernandes^{2,3}, Bruno A. N. Silva^{2,3},
Márvio L. T. Abreu³, Silviano Bunzen⁴, Lorraine B. Lima¹,
Giuliano Campos¹, Daniel N. Morais¹, Mariana Nascimento¹

¹Sapiens Microbiome, Jundiaí, SP, Brasil; ²Universidade Federal de Minas Gerais (UFMG), Montes Claros, MG, Brasil; ³Universidade Federal de Lavras (UFLA), Lavras, MG; ⁴Feedis, Indaiatuba, SP, Brasil

Contact: rafaelahilgemberg@sapiensmicrobiome.com / **Presenter:** Cátia L. A. Fernandes

Abstract: Maternal nutrition plays a key role in shaping the early life gut microbiota of piglets, which may influence health, immune development, and performance. This study evaluated the effects of lignocellulose fiber supplementation in sow diets during gestation and lactation on the gut microbiota of piglets at weaning. A total of 36 high producing sows were assigned to a completely randomized design with two treatments: control diet (C) and diet supplemented with lignocellulose fiber (F). Diets were provided from day 75 of gestation through lactation. At weaning, fecal samples from piglets were collected for microbial DNA extraction and 16S rRNA gene sequencing. Shannon index (diversity) and richness (observed genera) were compared using non-parametric tests ($p < 0.05$), and differentially abundant taxa were identified by LEfSe (LDA > 2.0). Piglets from fiber supplemented sows showed higher microbial diversity (4.88 vs. 4.38; $p = 0.016$) and richness (360 vs. 292; $p = 0.0249$), indicating a more complex microbial community. Additionally, fiber supplementation reduced the abundance of negative biomarkers (0.72 vs. 2.89) and increased positive biomarkers (6.11 vs. 1.67), with higher representativeness of beneficial taxa (76.09% vs. 30.23%). Among the positive bio-

markers, genera such as *Anaerotignum*, *Faecalibacterium*, *Oscillospira*, and *Ruminococcus* were highlighted, known for their role in short-chain fatty acid (SCFA) production. These metabolites are commonly associated with improved intestinal integrity, immune modulation, and energy supply to enterocytes. Overall, maternal fiber supplementation promoted a shift toward a more favorable and fermentative microbiota profile in piglets, suggesting enhanced intestinal functionality. These findings support maternal nutrition as a strategy to modulate early life gut microbiota in piglets.

Keywords: Maternal nutrition; Modulation; Swine; Complex carbohydrates

Table 1. Effects of maternal dietary lignocellulose fiber supplementation on gut microbiota diversity and biomarkers in piglets

Variables	C	F	<i>P-value</i>
Shannon's diversity	4.38	4.88	0.016
Richness of genus	292	360	0.0249
Abundance of negative biomarkers	2.89	0.72	-
Abundance of positive biomarkers	1.67	6.11	-
Relative abundance of negative biomarkers	52.26	8.96	-
Relative abundance of positive biomarkers	30.23	76.09	-

C: Control diet without fiber supplementation; F: diet supplemented with fiber

Exogenous protease influences nutrient digestibility in piglet diets containing high levels of trypsin inhibitors

Debora Reolon¹, Carlos Beretta Neto², Dejanir Pissinin²,
Leonardo Tombesi Rocha², Amanda de Moura Dani²,
Bruno Neutzling Fraga², Vladimir de Oliveira²

¹Novus Internacional, Indaiatuba, SP; ²Universidade Federal de Santa Maria, Santa Maria, RS

Contact: debora.reolon@novusint.com / **Presenter:** Debora Reolon

Abstract: Soybean meal (SBM) is a widely used protein source in pig diets. However, contains antinutritional factors such as trypsin inhibitors (TI), which limit its inclusion in diets for pigs. The primary effect of TI is the inactivation of proteases, directly compromising protein digestibility. Consequently, protease supplementation has been proposed as a strategy to reduce the direct and indirect impacts of TI in soybeans and their by-products. This study aimed to evaluate the effects of different levels of SBM-derived TI and exogenous protease supplementation on nutrient digestibility in weaned piglets. Ninety-six 21-day-old piglets were assigned to a randomized complete block design with 32 pens and eight replicates per treatment. A 2 × 2 factorial design combined two TI concentrations with the presence or absence of protease (500 g/ton). To achieve the desired TI concentrations, 3% and 5% crude soybean were added to the pre-starter and starter diets, respectively. TI concentrations were 0.82 and 1.71 mg/g for the pre-starter phase and 0.96 and 1.83 mg/g for the starter phase, representing moderate and high levels, respectively. Apparent total tract digestibility (ATTD) of nutrients was determined using partial fecal collection. Piglets were allowed 4 days of adaptation to the diet containing the marker before fecal collection. Samples were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), and gross energy (GE). In the pre-starter phase, ATTD of DM was higher in the moderate

TI treatments compared with the high TI treatments ($p = 0.014$). ATTD of CP decreased under high TI ($p = 0.004$), with a trend toward a protease effect ($p = 0.073$). A significant TI $\times$ protease interaction was observed for ATTD of CP ($p = 0.035$), with reduced CP digestibility in the absence of protease under high TI conditions. ATTD of GE was also lower in the high TI groups ($p = 0.034$), with no effect of protease. In the starter phase, ATTD of DM was similar across treatments ($p > 0.05$). ATTD of OM showed a tendency to decrease under high TI ($p = 0.064$), with no protease effect. For ATTD of CP, a tendency toward lower values was observed under high TI ($p = 0.079$), along with a trend for a TI $\times$ protease interaction ($p = 0.065$). Lastly, ATTD of GE also tended to be lower under high TI ($p = 0.068$), with no protease effect. In conclusion, diets containing high TI levels impaired macronutrient digestibility in piglets. Although protease supplementation showed no main effect, it interacted with TI at higher levels, partially mitigating its negative impact.

Keywords: Antinutritional factor, protein digestibility, soybean meal

Table 1. Apparent total tract digestibility coefficients of diets for piglets fed different levels of trypsin inhibitors with or without protease inclusion

Trypsin Inhibitor	Moderate		High				<i>P-value</i>	
Protease	Without	With	Without	With	SEM	TI	P	TI $\times$ P
Pre-start diet								
Replications	8	8	8	8				
ATTD DM, %	85.46	85.80	83.81	84.80	0.82	0.014	0.494	0.386
ATTD OM, %	88.14	88.07	86.89	87.76	0.90	0.229	0.535	0.471
ATTD CP, %	82.29	82.08	79.07	81.44	0.83	0.004	0.073	0.035
ATTD GE, %	85.46	85.80	83.81	84.88	1.05	0.034	0.232	0.528
Starter diet								
Replications	8	8	8	8				
ATTD DM, %	85.31	85.33	83.27	85.25	0.98	0.140	0.170	0.167
ATTD OM, %	87.60	87.51	85.81	87.07	1.31	0.241	0.535	0.477
ATTD CP, %	83.17	82.90	80.68	82.97	0.92	0.079	0.139	0.065
ATTD GE, %	85.01	84.87	83.15	84.31	0.88	0.068	0.420	0.320

ATTD: Apparent Total Tract Digestibility; SEM: Standard Error of the Mean; P: Protease; DM: Dry Matter; OM: Organic Matter; CP: Crude Protein; GE: Gross Energy; Trypsin Inhibitor: pre-starter (0.82 and 1.71 mg/g) and starter (0.96 and 1.83 mg/g) for the moderate and high treatments, respectively. Protease: 0 and 500 g/ton for diets without and with protease inclusion, respectively

Research trends and meta-analytical insights on endogenous losses and mineral digestibility in swine

José Andrew L. Barbosa¹, Hélio M. Junior¹, Amanda Gorrosterrazu¹,
Dener O. Moreira¹, Júlia D. Marcio¹, Marcos L. P. Tsé², Luan S. Santos³,
Felipe Dilelis¹, Urbano S. Ruiz¹

¹"Luiz de Queiroz" College of Agriculture - USP; ²School of Veterinary Medicine and Animal Science - UNESP; ³Federal University of Mato Grosso do Sul

Contact: andrew.lira@usp.br / **Presenter:** José Andrew L. Barbosa

Abstract: The formulation of diets aimed at meeting pigs requirements for digestible nutrients is important for the efficiency and sustainability of their production. In the case of the mineral phosphorus (P), the concept of standardized total digestible P is currently used, which involves determining the apparent total digestibility of P corrected for basal endogenous losses of this mineral. This approach contributes to greater additivity of P content in ingredients and diets, promoting better production efficiency and minimizing P excretion. For calcium (Ca), total content is still used, but research on standardized Ca digestibility has been increasing, suggesting that in the near future standardized digestible Ca will become a reality in pig nutrition. Thus, the study of endogenous losses has emerged as an important tool for improving standardized mineral digestibility. Therefore, the objective was to evaluate the evolution of research and to quantify the basal endogenous losses of P and Ca through bibliometric analysis and meta-analysis. Data collection was carried out using the Scopus database, considering publications from 2003 to 2025. The initial search resulted in 1,142 records, and inclusion criteria related to the determination of true or standardized digestibility and the measurement of endogenous losses were subsequently applied, resulting in

107 eligible studies. The bibliometric analysis was conducted based on the temporal evolution of publications. For the meta-analysis, data on endogenous losses, body weight, and experimental design were extracted, with 81 trials included for P and 28 for Ca. Linear regression models were fitted, with observations weighted according to the number of animals or experimental replicates. The results showed a consistent increase in publications over the period analyzed, with greater intensification after 2010, indicating an expansion of scientific interest in the area. The meta-analysis revealed high variability in endogenous losses, ranging from 38 to 964 mg/kg of dry matter intake for P and from 123 to 1,580 mg/kg for Ca. A positive relationship was observed between body weight and endogenous losses, described by the equations: BEL of P = $174.953 + 1.784 \times BW$ and BEL of Ca = $212.896 + 4.095 \times BW$, with model fit values of $R^2 = 0.104$ for P and $R^2 = 0.619$ for calcium. It was concluded that endogenous losses are mainly influenced by physiological factors, especially body weight, and that the growth of research reinforces the relevance of this topic for precision nutrition and sustainability in pig production.

Keywords: bibliometrics; endogenous losses; mineral nutrition; meta-analysis; pigs

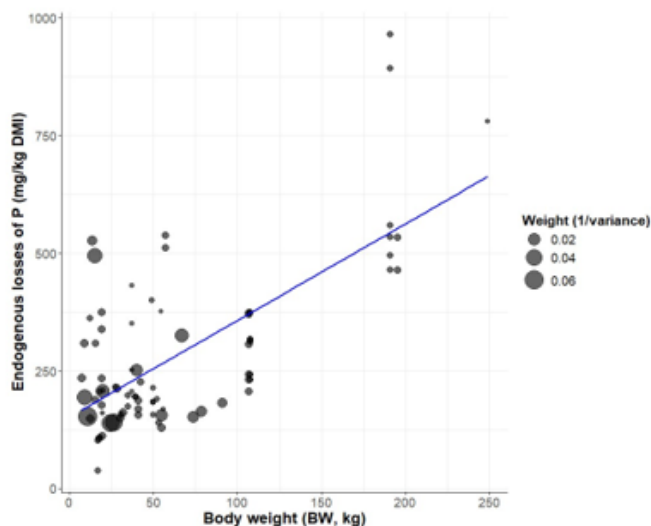
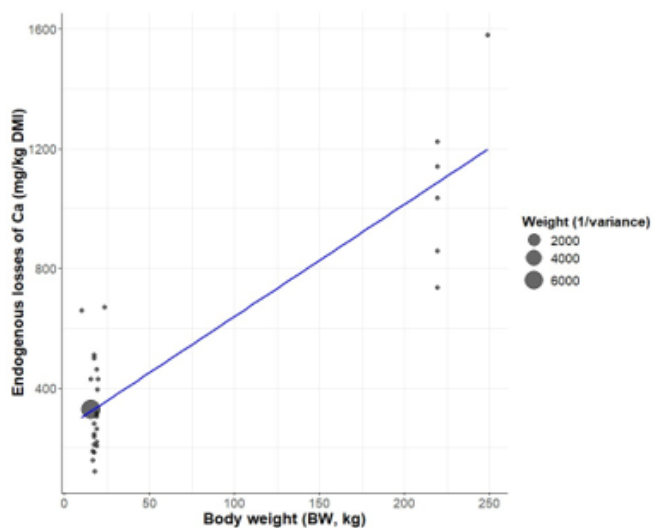


Figure 1. Meta-regression of the relationship between average body weight and basal endogenous phosphorus losses in pigs



re 2. Meta-regression of the relationship between average body weight and endogenous calcium losses in pigs

Figure 2. Meta-regression of the relationship between average body weight and basal endogenous calcium losses in pigs

Body composition and serum urea concentration of growing pigs fed diets varying in soybean hulls and standardized ileal digestible threonine levels

Mariana Garcia de Lacerda¹, Kallita Lourenço de Souza Cardoso¹,
Saimon de Souza e Souza¹, Vanessa Pereira de Abreu¹,
Gabriela Ribeiro da Silva¹, Amoracyr José Costa Nuñez¹,
José Henrique Stringhini¹, Allan Paul Schinckel², Vivian Vezzoni de Almeida¹

¹Universidade Federal de Goiás; ²Purdue University

Contact: marianagarcia@discente.ufg.br / **Presenter:** Mariana Garcia de Lacerda

Abstract: High-fiber ingredients, including soybean hulls (SBH), can increase endogenous threonine (Thr) losses, resulting in a greater Thr requirement for protein deposition. A total of 64 barrows (Large White x Landrace x Duroc; 28.3 ± 3.19 kg initial body weight) were used in a 28-d study to evaluate the effects of diets at 100 or 119% of the National Research Council (NRC, 2012) SID Thr recommended levels with or without SBH on body composition and serum urea concentration. Pigs were blocked by initial body weight and randomly assigned to one of four treatments with eight replicate pens per treatment and two pigs per pen. Dietary treatments were arranged in a 2 × 2 factorial design with two levels of SBH (0 or 15%) and two levels of SID Thr (0.59 and 0.70%; 100 and 119% of NRC requirements, respectively) in corn-soybean mealbased diets. Pigs were allowed ad libitum access to feed and water throughout the study. Real-time ultrasonic (RTU) measurements of the 10th-rib longissimus dorsi muscle area (LMA) and off-midline backfat thickness (BF) were taken for all pigs at the start (day 1) and the end (day 28) of the study. Prediction equations were used to estimate carcass fat-free total lean tissue (FFTOLN) and empty body protein (MTPRO) from the RTU mea-

surements. Fat-free lean gain was estimated as the difference between predicted lean mass at the end (day 28) and at the onset of the study (day 1) divided by the number of days on trial. At the end of the study, blood samples were collected from all pigs by jugular vein puncture and centrifuged at $2,500 \times g$ for 15 min at 4 °C to determine the serum urea concentration. All data were analyzed using the MIXED procedure of SAS software. There were no SBH $\times$ SID Thr interactions for any studied variable. Body composition and serum urea concentration were not affected by SID Thr levels. However, including 15% SBH to the diet increased FFTOLN ($P < 0.01$), MTPRO ($P = 0.03$) and fat-free lean gain ($P < 0.01$), as well as tended to increase ($P = 0.09$) LMA and decreased ($P = 0.09$) BF. In addition, pigs fed 15% SBH had lower ($P < 0.01$) serum urea concentration than pigs fed diets without SBH. In conclusion, adding supplemental SID Thr to diets with SBH did not alter body composition and serum urea concentration in growing pigs and further indicated that feeding 15% SBH increased dietary nitrogen utilization for muscle protein accretion.

Keywords: amino acid; dietary fiber; nutrition; swine

Table 1. Body composition and serum urea concentration of growing pigs fed diets containing Soybean Hulls (SBH) and 0.59 or 0.70% Standardized Ileal Digestible (SID) threonine (Thr)

Item ^a	0% SBH		15% SBH		Polled SEM	<i>P-value</i>		
	SID Thr level, %		SID Thr level, %			SBH	SID Thr	SBH x SID Thr
	0.59	0.70	0.59	0.70				
LMA, cm ²	18.76	18.72	19.35	19.79	0.51	0.09	0.66	0.61
BF, cm	1.30	1.19	1.12	1.18	0.03	0.09	0.65	0.13
FFTOLN, kg	18.79	18.67	19.29	19.62	0.35	<0.01	0.66	0.33
MTPRO, kg	7.70	7.64	7.91	7.92	0.12	0.03	0.80	0.77
Fat-free lean gain, g/day	361.86	359.82	386.01	392.47	9.71	<0.01	0.81	0.64
Urea, mg/dL	31.97	33.77	28.83	27.71	0.80	<0.01	0.81	0.31

^aLMA = Longissimus dorsi muscle area; BF = Backfat Thickness; FFTLON = carcass fat-free total lean tissue; MTPRO = empty body protein mass

**36ª REUNIÃO
ANUAL DO CBNA**

RESUMOS TRABALHOS CIENTÍFICOS

BOVINOS



Effect of increasing levels of tannin extract from Eucalyptus on performance and methane emissions of feedlot-finished Nellore cattle

Bruna Poletti¹, Guilherme P. Rissi², Janaina S. Silva², Ives C. S. Silva²

¹TANAC S.A.; ²Faculdade de Zootecnia e Engenharia de Alimentos da Universidade de São Paulo

Contact: bpoletti@tanac.com.br / **Presenter:** Bruna Poletti

Abstract: The growing global population has intensified the demand for animal protein, driving the adoption of sustainable nutritional strategies in livestock production. In this context, tannins, secondary plant metabolites, have gained prominence due to their potential to modulate ruminal fermentation, improve energy utilization efficiency, and mitigate methane (CH₄) emissions. These advances are fundamental to maintaining the competitiveness of Brazilian beef cattle production while balancing productivity and environmental responsibility. The objective of this study was to evaluate the effects of including increasing levels of Eucalyptus cloeziana tannins extract in the diet of feedlot-finished Nellore cattle on productive performance, carcass traits, meat quality, blood metabolites, fecal characteristics, ingestive behavior (feeding, rumination, and idle time), and enteric methane emissions. The experiment was conducted with 52 Nellore bulls (20 months; 387 ± 2 kg), housed in individual pens and fed a diet with a forage-to-concentrate ratio of 30:70. Treatments consisted of a control (CTL, without tannins), TAN16 (0.16% DM), TAN32 (0.32% DM), and TAN64 (0.64% DM). Average daily gain (ADG), dry matter intake (DMI), feed conversion ratio (FCR), carcass yield (CY), and meat physicochemical traits were evaluated. Methane (CH₄) emissions were estimated in 16 animals equipped with halters and collection canisters using the sulfur hexafluoride (SF₆) tracer gas technique. Tannin

inclusion did not significantly affect animal performance, carcass yield, or most meat quality parameters, although collagen content was reduced in TAN64 ($P < 0.01$). A nonlinear response was observed for CH₄ emissions, with TAN16 presenting the lowest emission values, whereas TAN32 resulted in the highest Ym values, representing the proportion of gross dietary energy converted into CH₄. Although no significant effects on productive performance were detected, TAN16 demonstrated potential to reduce methane emissions without compromising performance indicators.

Keywords: Cattle farming, Greenhouse gases, Natural extract, Ruminants

Table 1. Intake, performance, and methane emission intensities of Nellore cattle fed diets containing increasing levels of tannins

Variables	CTL	TAN16	TAN32	TAN64	SEM	<i>p-value</i>
DMI (kg)	9.96	12.50	11.10	11.94	0.90	0.01
BW (kg)	475.35	478.20	461.60	471.60	14.08	0.05
ADG (kg)	1.70	1.80	1.60	1.78	0.15	0.23
BW ^{0.75}	101.61	102.04	99.41	101.01	2.26	0.04
CH ₄ (g/day)	171.93	171.24	204.03	185.16	10.08	0.66
CH ₄ g/kg DMI	17.71 ^{ab}	14.03 ^b	19.37 ^a	15.89 ^{ab}	1.17	0.02
CH ₄ g/kg ADG	104.78	99.43	133.27	106.28	11.31	0.87
CH ₄ g/kg BW	0.36 ^b	0.36 ^b	0.45 ^a	0.39 ^{ab}	0.01	0.17
CH ₄ g/kg BW ^{0.75}	1.69 ^b	1.68 ^b	2.06 ^a	1.83 ^{ab}	0.08	0.70
CH ₄ g/kg carcass	0.62 ^{ab}	0.64 ^a	0.75 ^b	0.69 ^{ab}	0.05	0.73
Ym (%)	4.21 ^{ab}	2.98 ^b	5.01 ^a	3.70 ^{ab}	0.24	0.04

a,b Means followed by different lowercase letters within the same row differ ($P < 0.05$) according the Tukey test

CH₄: methane; DMI: dry matter intake; BW: body weight; ADG: average daily gain; BW^{0.75}: metabolic body weight; Ym (%): percentage of gross dietary energy converted to CH₄; SEM: standard error of the mean

Modulation of ruminal taxa by yeast culture supplementation in beef steers

Lorhaine B. Lima¹, Giuliano Campos^{1,4}, Rafaela Hilgemberg¹, Flávia S. N. P. Oliveira², Ellen Baldissera³, Nicolli S. Mokochisnki³, Livia A. Ienke³, Daniel N. Morais^{1,4}, Adriana N. Figueiredo⁴, Ricardo P. Manzano⁵, Mariana Nascimento¹, Mikael Neumann²

¹Sapiens Microbiome; ²Universidade Estadual do Centro-Oeste; ³Colaboradores do Nucleo de Produção Animal; ⁴Aleris Nutrition; ⁵Médico veterinário, consultor NUTRIPEC
Contact: lorhainelima@sapiensmicrobiome.com / **Presenter:** Lorhaine B. Lima

Abstract: Yeast cultures are used in beef cattle nutrition due to their potential to modulate the rumen environment. This study evaluated the effect of yeast culture supplementation on the rumen microbiota of steers, focusing on alpha diversity indices and differentially abundant taxa with potential functional relevance. Twenty-four male steers were assigned to two treatments, control and yeast culture supplementation (7 g/animal/day), with rumen microbiota evaluated in one animal per pen (n = 12). Rumen fluid samples were collected by esophageal probe 140 days after the adaptation period. The V3-V4 region of the 16S rRNA gene was sequenced from rumen fluid samples. Richness and differential taxon abundance were compared between groups using the Kruskal-Wallis test, while microbial diversity, estimated by the Shannon index, was evaluated using the Wilcoxon rank-sum test. Yeast culture supplementation did not alter alpha diversity indices of the rumen microbiota, with similar values for richness (control = 267.5; supplemented group = 307.0; p = 0.7488) and Shannon diversity (control = 4.04; supplemented group = 4.17; p = 0.749). In contrast, differential abundance analysis identified differences in specific taxa, with higher abundances of *Succinivibrio_uc* (0.0040 vs. 0.0160, p = 0.0459), *Treponema bryantii* (0.0631 vs. 0.1679, p =

0.0374), *Eubacterium* (0.0040 vs. 0.0170, $p = 0.0289$), and *Atopobiaceae_uc* (0.0151 vs. 0.2133, $p = 0.0239$, $p = 0.0370$). Functionally, taxa enriched in the supplemented group were mainly associated with carbohydrate fermentation and organic acid metabolism, whereas *Desulfovibrio*, which was reduced in the supplemented group, is linked to sulfate reduction and hydrogen sulfide formation in the rumen. In conclusion, yeast culture supplementation did not alter alpha diversity indices of the rumen microbiota, but it was associated with modulation of specific taxa with potential functional relevance to rumen fermentation.

Keywords: 16S rRNA; alpha diversity; differential abundance; microbiota; rumen fluid

Use of natural compounds as an additive to improve intestinal health in calves

Roberto H. de F. Rodrigues¹, Luis F. de S. Caixeta²,
Elias Bungenstab³, Reginaldo N. Ferreira⁴

¹Discente de Zootecnia, Escola de Veterinária e Zootecnia EVZ/UFG; ²Zootecnista, Dr. em Ciências Fisiológicas, Instituto ICB II/UFG, P&D Biofórmula; ³AB Vista; ⁴Docente, Universidade Federal de Goiás

Contact: roberto_henrique@discente.ufg.br / **Presenter:** Roberto H. de F. Rodrigues

Abstract: The efficiency of ruminant production systems remains a challenge, driving the search for strategies to improve feed efficiency using feed additives and alternative ingredients. Among these, natural resin acids have shown potential to promote intestinal integrity across multiple species. Therefore, this study aimed to evaluate the inclusion of natural resin acids in the diet of crossbred calves during the milk-feeding phase and to assess their effects on biochemical, histological, and immunological parameters. Twenty calves were used in this study. Their initial body weight was recorded, and animals were assigned to two treatments for 61 days: Control (6 L of milk) and PROGRES® (6 L of milk supplemented with 2 mL of natural resin acids). Concentrate, water, and hay were provided ad libitum. Blood samples (serum) for laboratory analyses were collected from all calves, via jugular venipuncture, on day 50 after the morning feeding. Serum IgA concentrations were determined using a commercial Bovine IgA ELISA kit (FineTest®, EB0035), based on the competitive ELISA method. Animals were slaughtered according to Municipal Inspection Service guidelines, including pre-slaughter stunning. After necropsy, Jejunum samples were collected for IL-10 (interleukin-10) quantification by immunohistochemistry. The immune response was influenced by treatment. Chi-square analysis revealed that the frequency

of detection of IGA was greater ($P = 0.05$) for PROGRES® calves (80%) compared with Control (20%; Figure 1). IgA plays a key role in mucosal defense by binding to intestinal epithelium and preventing pathogen adhesion. The effects of natural resin acids on the immune response may be associated with their role in protein synthesis via mRNA formation, supporting the development of immune cells and antibody production. The immune system is regulated by a complex biochemical network involving antigens, immunoglobulins, and cytokines, particularly interleukin-10 (Figure 2). Both innate and adaptive immune responses depend on the adequate availability of interleukins and other biologically active molecules. Natural resin acids appear to modulate immune responses via both direct and indirect pathways, potentially mediated by the intestinal microbiota. This modulation may help prevent dysbiosis and alterations in intestinal permeability, thereby enhancing mucosal immunity and overall intestinal health.

Keywords: Interleukin; IgA; Nutrition; Ruminants

IgA Results - Statistics

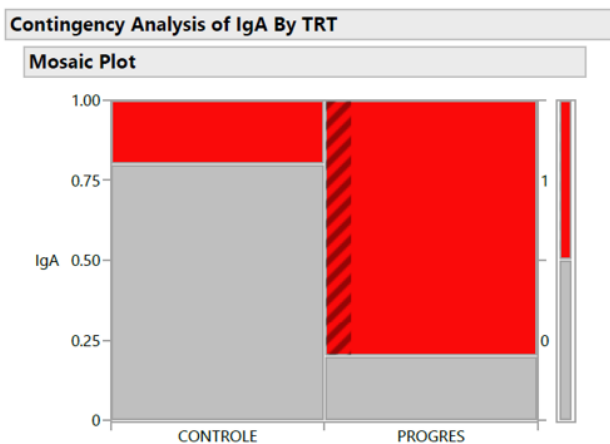


Figure 1. IGA Levels

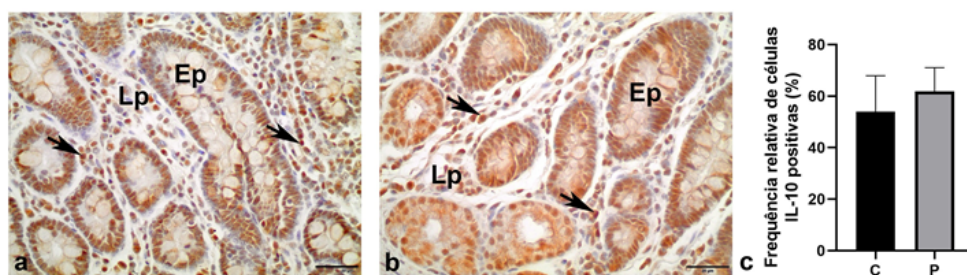


Figure 2. Immunohistochemistry for IL-10 in bovine jejunum. No significant difference in the relative frequency of IL-10-positive cells between groups C and P in the lamina propria. Arrows indicate IL-10-positive cells; Ep, epithelium; Lp, lamina propria; scale bar = 20 μ m

Family succession and financial dependence on beef cattle cow-calf farms

Vitória T. L. Rozin¹, Rafael M. Jensen¹, Lucas B. Maciel¹,
Lázaro G. L. Lima¹, Matheus S. P. Carlis¹, Matheus C. Garcia¹,
Oscar A. Ojeda-Rojas², Angela M. Gonella-Díaza³, Guilherme Pugliesi⁴,
Júlio C. C. Balieiro⁴, Augusto H. Gameiro⁴, Rodrigo S. Goulart¹

¹Dept. Animal Science, Univ. São Paulo, Brazil; ²Univ. Florida, USA;

³NFREC, Univ. Florida, USA; ⁴Vet. School, Univ. São Paulo, Brazil

Contact: vitoriatoffololuiz@usp.br / **Presenter:** Rafael M. Jensen

Abstract: Understanding family succession practices in cow-calf operations is a challenge, as these production systems rely heavily on large, fixed assets, such as land, and on the continuity of labor transferred across generations within the same family. This study aimed to characterize the presence of a successor within the family unit and the level of exclusive financial dependence on cow-calf operations, based on the 2021 production year. Data were collected from 280 farms an online questionnaire (SurveyMonkey®) between August 2022 and August 2023. Respondents selected one of the following options regarding succession: “have a successor,” “do not have any successor,” or “do not know.” For exclusive financial dependence on cow-calf operations, responses were: “Yes, exclusively dependent” or “No, also dependent on other activities.” Farms were distributed as follows: Midwest (95), Northeast (36), North (36), Southeast (72), and South (41). Data were processed using Excel® and expressed as percentages of total responses. Regarding family succession, 64.30% of respondents (n = 180) reported having a successor, 20.40% (n = 57) reported not having one, and 15.40% (n = 43) were doesn’t know. When evaluating exclusive financial dependence on cow-calf operations, only 22.14% of respondents (n = 62) reported relying solely on this acti-

vity. These results indicate that, although many farms have a potential successor, suggesting a positive outlook for generational continuity most families still depend on additional income sources beyond cow-calf production to ensure economic viability. Beyond income diversification, it is essential to make cow-calf systems economically attractive and profitable, ensuring not only the permanence of families in rural areas but also the sustainability of succession and the strengthening of the beef production chain.

Keywords: calves; beef cattle production; questionnaire; family income

Overview of cow-calf production systems on beef cattle ranch in Brazil

Vitória T. L. Rozin¹, Lázaro G. L. Lima¹, Rafael M. Jensen¹,
Lucas B. Maciel¹, Matheus S. P. Carlis¹, Matheus C. Garcia¹,
Oscar A. Ojeda-Rojas², Angela M. Gonella-Díaza³, Guilherme Pugliesi⁴,
Júlio C. C. Balieiro⁴, Augusto H. Gameiro⁴, Rodrigo S. Goulart¹

¹Dept. Animal Science, Univ. São Paulo, Brazil; ²Univ. Florida, USA;

³NFREC, Univ. Florida, USA; ⁴Vet. School, Univ. São Paulo, Brazil

Contact: vitoriatoffololuiz@usp.br / **Presenter:** Lázaro G. L. Lima

Abstract: With the continuous growth in global demand for beef, evaluating reproductive and productive indicators on Brazilian farms is essential to support strategies that strengthen the sector. As production relies on cow-calf systems, accurate farm mapping and diagnosis are key priorities. This study aimed to characterize the frequency of production systems adopted for beef calf production in the 2021 production year. Data were collected from 280 farms through an online questionnaire (SurveyMonkey®) applied between August 2022 and August 2023. Respondents selected one of the following systems: Conventional (beef cattle only), Crop-Livestock Integration (CLI), Livestock-Forest Integration (LFI), Crop-Livestock-Forest Integration (CLFI), or Organic (beef cattle only). Farms were distributed as follows: Midwest (95), Northeast (36), North (36), Southeast (72), and South (41). Data were processed in Excel® spreadsheets, and results were expressed as percentages of total responses. Among the evaluated cow-calf operations, the conventional system predominated, being adopted by 77.50% of producers (n = 217). Crop-Livestock Integration (CLI) was the second most frequent system, present in 22.14% of farms (n = 62), indicating a trend toward production diversification, albeit at a smaller scale. Complex systems, such as Livestock-

-Forest Integration (LFI) and Crop-Livestock-Forest Integration (CLFI), were reported by only 3.21% of producers each ($n = 9$). Organic systems, characterized by sustainable practices and restricted use of conventional inputs, showed the lowest adoption (1.78%; $n = 5$). These findings indicate that, despite initiatives aimed at sustainable intensification and diversification, most producers still operate under conventional systems, likely due to technical, economic, or structural barriers to adopting integrated or alternative systems. Overall, Brazilian beef production remains predominantly conventional, with low adoption of integrated and alternative systems. Policies, incentives, training, and extension services are essential to promote the transition toward integrated systems, optimizing land use, sustainability, and competitiveness. The small adoption of organic systems may also reflect economic challenges associated with this production model.

Keywords: beef; herd; cows; calves

Levels of magnesium oxide on microbial protein synthesis in Nellore cattle fed high concentrate diet

Jordana L. A. Andrade¹, Lázaro G. L. Lima¹, Rafael M. Jensen¹,
Lucas B. Maciel¹, Gabriel V. Manvailer¹, Vitória T. L. Rozin¹,
João P. N. Minetto¹, Iago S. Lima¹, Pedro H. S. P. de Lima¹,
Maria S. Garcia¹, Matheus S. P. Carlis¹, Rodrigo D. Goulart¹

¹School of Animal Science and Food Engineering (FZEA),

University of São Paulo, Pirassununga, SP, Brazil

Contact: jordanaandrade.vet@usp.br / **Presenter:** Lázaro G. L. de Lima

Abstract: High-concentrate diets, typically characterized by a high starch content, are widely used in feedlot systems to maximize beef cattle performance. In this context, the use of feed additives such as sodium monensin and alkalinizing agents (magnesium oxide) has been adopted to modulate ruminal fermentation. Therefore, this study aimed to evaluate the effects of sodium monensin combined with increased levels of magnesium oxide (MgO) on microbial protein synthesis in Nellore cattle fed high-concentrate diets. Five castrated Nellore steers with rumen cannulas, were assigned to a 5 × 5 Latin square design. The treatments were as follows: diet with no feed additive inclusion (NFA), diet containing 25 ppm of sodium monensin (MON) and three diets with increasing MgO inclusion (0.25%, 0.50%, and 0.75% on dry matter basis of total mixed ratio; MON+0,25MgO, MON+0,50MgO e MON+0,75MgO, respectively). Microbial protein synthesis was estimated based on urinary excretion of purine derivatives. Increasing MgO inclusion resulted in a linear decrease in allantoin excretion ($P = 0.038$), total purine derivatives ($P = 0.031$), absorbed purines ($P = 0.028$), and microbial nitrogen ($P = 0.026$). Conversely, creatinine excretion increased linearly ($P = 0.030$). The reduction in dry matter intake observed at higher MgO levels likely limited ruminal

microbial activity and microbial protein synthesis, while also increasing body protein turnover, particularly at the highest inclusion level (0.75%). In conclusion, the combination of monensin and MgO did not improve microbial protein synthesis or enhance ruminal environment stability.

Keywords: feedlot; microbial protein; purine derivatives

Table 4. Effect of magnesium oxide supplementation on microbial protein synthesis in castrated Nellore cattle fed a high-starch diet

Variable	Treatments					<i>p-value</i>				Q
	NFA	MON	MON+ 0,25MgO	MON+ 0,50MgO	MON+ 0,75MgO	MSE	NFA vs MON	MON vs MgO	L	
CMS, kg	8,36	8,40	8,43	8,44	6,38	0,643	0,942	0,149	0,003	0,016
Urine volume, L	5,39	6,20	6,16	7,02	7,00	0,032	0,089	0,351	0,175	0,964
Creatinine excretion, mg/kg BW per day	26,42	26,26	26,26	26,33	26,56	0,276	0,232	0,241	0,030	0,219
Uric acid, mmol/day	20,11	17,13	17,07	17,36	15,14	2,530	0,240	0,766	0,473	0,540
Allantoin, mmol/day	350,43	278,04	239,39	232,03	192,51	26,863	0,067	0,078	0,038	0,987
Purine derivatives, mmol/day	370,76	295,05	256,73	249,33	207,37	0,043	0,105	0,056	0,026	0,867
AL/PD, %	94,17	94,28	93,39	93,16	92,64	0,860	0,903	0,107	0,081	0,763
Absorbed purines, mmol/day	385,60	295,90	250,45	242,37	194,83	0,052	0,112	0,057	0,026	0,856
Microbial nitrogen, mg N/kg BW per day	526,01	405,10	338,04	325,61	279,57	54,513	0,074	0,097	0,069	0,813

Effect of different drying methods on protein fractions of corn silage predicted by NIRS

Larissa de S. Camargo¹, Roselena Sestari², Jonas G. Dantas²,
Thamarys V. B. Reis², Letícia C. B. Soares¹, Daniel M. Polizel³,
João Pedro A. Ventorin², João Pedro M. do Carmo²

¹School of Animal Science and Food Engineering – FZEA, USP; ²“Luiz de Queiroz” College of Agriculture, USP; ³Department of Biology and Animal Science – DBZ, UNESP
Contact: lakamargo@gmail.com / **Presenter:** Roselena Sestari

Abstract: The accuracy of predictive analyses using near-infrared spectroscopy (NIRS) can be affected by sample preparation procedures, including the drying method applied before analysis. This study aimed to evaluate the effect of four drying methods on protein fractions of corn silage as predicted by NIRS. Four pre-drying treatments were assessed: forced-air oven (OV) at 55°C for 72 hours; air fryer (AF) at 120°C in 15-minute cycles followed by 5-minute intervals until weight stability; microwave oven (MW) with an initial 5-minute cycle followed by 2-minute intervals until weight stability; and Koster tester (KO) with an initial 40-minute cycle followed by 5-minute intervals until weight stability. A randomized complete block design was used, with four treatments and ten replications. The variables analyzed were crude protein (CP), rumendegradable protein (RDP), acid detergent insoluble protein (ADIP), neutral detergent insoluble protein (NDIP), and soluble protein (SP). Data were submitted to ANOVA, and when significant ($P < 0.05$), Tukey's test was applied. Significant effects of the pre-drying method were observed for CP. The MW method yielded the highest mean from AF, while KO was intermediate (MW: 9.19%DM^a; OV: 9.05%DM^{ab}; KO: 8.47%DM^{bc}; AF: 8.28%DM^c; $P = 0.0031$; SEM = 0.11). For RDP, OV, KO,

and MW produced the highest values, whereas AF showed lower results (OV: 76.50%CP^a; KO: 75.70%CP^a; MW: 73.50%CP^a; AF: 65.50%CP^b; $P < 0.0001$; SEM = 0.80). Regarding ADIP, AF presented higher values than the other methods (AF: 11.84%CP^a; OV: 8.61%CP^b; MW: 8.61%CP^b; KO: 9.53%CP^b; $P < 0.0001$; SEM = 0.30). No significant differences were found among treatments for NDIP (OV: 21.63%CP; KO: 20.58%CP; 20.38%CP; 22.80%CP; $P = 0.0814$; SEM = 0.38). For SP, OV showed the highest value, followed by KO and MW, with AF presenting the lowest mean and differing significantly from all others (OV: 59.60%CP^a; KO: 58.80%CP^a; MW: 57.90%CP^a; AF: 46.42%CP^b; $P < 0.0001$; SEM = 1.08). The air fryer method deviated significantly from the laboratory reference (OV) across all variables, suggesting thermal degradation of protein fractions. In contrast, the microwave and Koster methods produced results statistically similar to the reference standard. It is concluded that the drying method influences NIRS-predicted values and may compromise analytical accuracy. Microwave and Koster methods have potential for the pre-analytics processing of protein fraction, whereas the air fryer should be avoided for this purpose.

Keywords: Chemical composition; Protein fractions; Spectroscopy

Table 1. Crude protein and protein fractions of corn silage as influenced by drying methods (NIRS)

Items	OV	KO	AF	MW	SEM	<i>p-value</i>
CP, %DM	9.05 ^{ab}	8.47 ^{bc}	8.28 ^c	9.19 ^a	0.11	0.0031
RDP, %CP	76.50 ^a	75.70 ^a	65.50 ^b	73.50 ^a	0.80	<0.0001
ADIP, %CP	8.61 ^b	9.53 ^b	11.84 ^a	8.61 ^b	0.30	<0.0001
NDIP, %CP	21.63	20.58	20.38	22.80	0.38	0.0814
SP, %CP	59.60 ^a	58.80 ^a	46.42 ^b	57.90 ^a	1.08	<0.0001

DM: Dry Matter; CP: Crude Protein; RDP: Rumen Degradable Protein; ADIP: Acid Detergent Insoluble Protein; NDIP: Neutral Detergent Insoluble Protein; SP: Soluble Protein; OV: Forced-air oven; KO: Koster test; AF: Air Fryer; MW: Microwave; SEM: Standard Error of the Mean; *P-value*: Means followed by different letters differ ($P < 0.05$)

Prediction of the bromatological fraction of ethanol coproducts by NIRS Method

Roselena Sestari¹, Jonas G. Dantas¹, Thamirys V. B. Reis¹,
Cassiano Locatelli¹, Diogo P. Rodrigues¹, Felipe D. Resende Sousa¹,
João P. Monteiro do Carmo¹, Carla M. M. Bittar¹

¹"Luiz de Queiroz" College of Agriculture, University of São Paulo; Piracicaba-SP, Brazil

Contact: roselena.sestari@usp.br / Presenter: Roselena Sestari

Abstract: Corn ethanol production results in several coproducts, including Dried Distillers Grains (DDG), Dried Distillers Grains with Solubles (DDGS), Wet Distillers Grains (WDG), and Wet Distillers Grains with Solubles (WDGS), which have high nutritional potential for ruminants. With an estimated production of 4.9 million tons for the 25/26 harvest, these materials consolidate their strategic relevance in the Brazilian livestock sector. The objective of this study was to evaluate the viability of Near-Infrared Spectroscopy (NIRS) technology in predicting the fractions of crude protein (CP), ash, and ether extract (EE) in ethanol coproduct samples. For this purpose, 124 samples from different regions of the country were used. The wet coproducts underwent preliminary drying in a forced-air oven (55°C for 48 hours). All samples were ground in a Wiley mill with a 1 mm screen and analyzed in a NIRS spectrophotometer (1100–2500 nm). The data were divided into calibration (80%) and validation (20%) sets using the Kennard–Stone algorithm. Statistical processing and visualization of data distribution were performed using Python (v.3.13) via the Google Colab platform, and calibration and validation models were developed via Partial Least Squares (PLS) regression. Calibration results for CP ($n_{cal} = 96$; $LV = 7$; $R^2c = 0.99$; $RMSEC = 0.88\%$) and ash ($n_{cal} = 92$; $LV = 11$; $R^2c = 0.93$; $RMSEC = 0.67\%$) proved to be robust. In the va-

lidation, CP ($n_{\text{val}} = 25$; $R^2_{\text{v}} = 0.98$; RPD = 7.43; RER = 29.33) confirmed excellent results and ash ($n_{\text{val}} = 25$; $R^2_{\text{v}} = 0.86$; RPD = 2.69; RER = 10.41) showed good predictive capacity. However, for EE, the indices obtained in calibration were acceptable ($n_{\text{cal}} = 89$; LV = 4; $R^2_{\text{c}} = 0.78$; RMSEC = 1.10%), although validation performance was unsatisfactory ($n_{\text{val}} = 25$; $R^2_{\text{v}} = 0.00$; RPD = 1.01; RER = 4.28), indicating that the variability or chemical nature of this fraction challenges the accuracy of the current model. It is concluded that NIRS is an accurate and reliable tool for the quality control of CP and ash in corn ethanol coproducts, although the model for EE requires an expanded database to become applicable.

Keywords: Animal nutrition; Accuracy; Calibration; Quality control; Spectroscopy

Table 1. Calibration and validation of chemometric models for characterizing ethanol coproduct variables

Items	Calibration					Validation		
	LV	nc	R^2_{c}	RMSEC	nv	R^2_{v}	RPD	RER
CP, %DM	7	96	0.99	0.88	25	0.98	7.43	29.33
Ash, %DM	11	92	0.93	0.67	25	0.86	2.69	10.41
EE, %DM	4	89	0.78	1.10	25	0.00	1.01	4.28

DM: Dry Matter; CP: Crude Protein; Ash; EE: Ether Extract; LV: Latent Variables; nc: number of samples in the calibration set; R^2_{c} : coefficient of determination; RMSEC: Root Mean Square Error of Calibration; nv: number of samples in the validation set; R^2_{v} : coefficient of determination of validation; RPD: Ratio of Performance to Deviation; and RER: Range Error Ratio