Congresso CBNA sobre Nutrição Pré-Natal e de Animais Jovens
Aves, Suínos e Bovinos

UTILIZAÇÃO FIBRA NA ALIMENTAÇÃO DE LEITÕES

ESTRATÉGIAS PARA REDUÇÃO DOS EFEITOS DA RETIRADA DE ANTIMICROBIANOS DAS DIETAS

Alexandre Barbosa de Brito, *PhD.*
LATAM Technical Manager
AB Vista

ABVista
The most important additive is intelligence

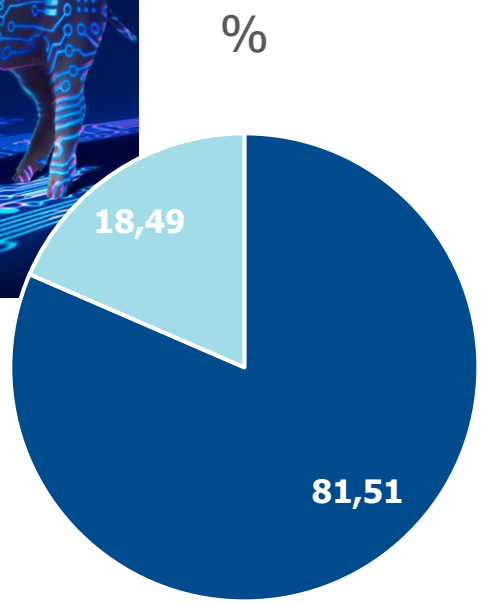
Introdução

ABVista

The most important additive is intelligence

INTRODUÇÃO

Nutrição e Nutrologia Animal



		Variação percentual dos itens de custo		
Composição	Item de custo	Mês anterior	No ano	12 meses
81,51%	Nutrição	↑ 0,27%	↑ 7,06%	↑ 31,48%
3,13%	Mão de obra	0,00%	↑ 0,48%	↑ 0,47%
3,05%	Custo de capital	↓ -0,31%	↑ 0,40%	↑ 1,19%
3,03%	Manutenção | Financeiro | Funrural	↑ 0,03%	↓ -0,25%	↑ 1,10%
2,91%	Transporte	↑ 0,14%	↑ 0,25%	↑ 0,34%
2,26%	Depreciação	0,00%	↑ 0,32%	↑ 0,57%
2,26%	Diversos | Outros	↑ 0,03%	↑ 0,18%	↑ 0,73%
1,36%	Sanidade	↑ 0,03%	↑ 0,14%	↑ 0,67%
0,48%	Energia elétrica | Cama | Calefação	0,00%	↑ 0,07%	↑ 0,11%

https://www.embrapa.br/suinos-e-aves/cias (2021)

INTRODUÇÃO

Nutrição e Nutrologia Animal

Nutrição tem Relação com Saúde Animal?

A Nutrologia é o ramo da medicina que se ocupa da nutrição em todos os seus aspectos, normais, patológicos, clínicos e terapêuticos. Por definição, a Nutrologia é uma especialidade médica de caráter clínico que tem como função fazer o diagnóstico, a prevenção e o tratamento das enfermidades nutroneurometabólicas.

https://abran.org.br/ (2021)

INTRODUÇÃO

Restrições na Produção Animal

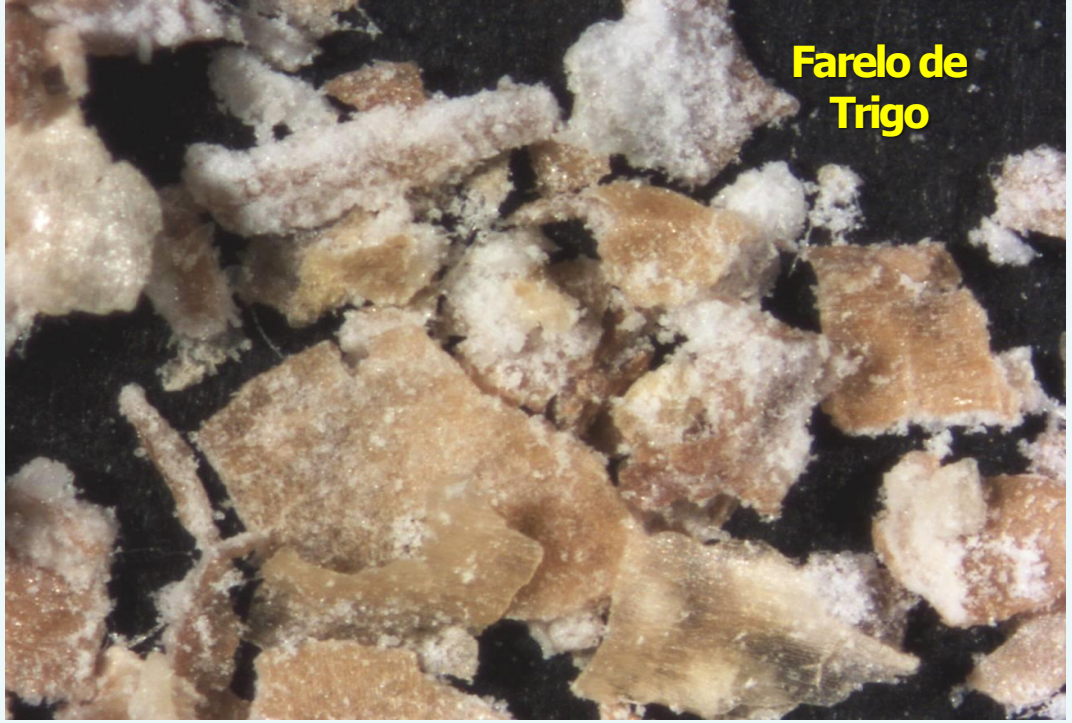
ARTICLE

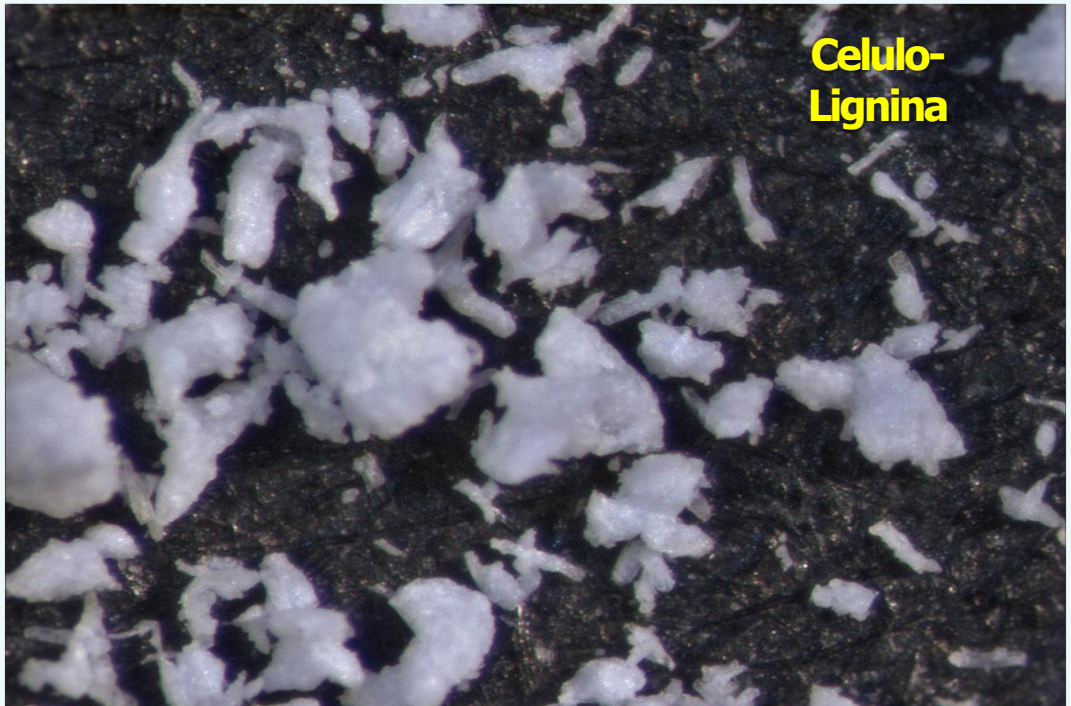
Check for updates

https://doi.org/10.1057/s41599-021-00852-4 OPEN

Antibiotics in pig meat production: restrictions as the odd case and overuse as normality? Experiences from Sweden and Italy

Alexandra Waluszewski[1✉], Alessandro Cinti[2] & Andrea Perna[3]





Cortesia,
G. Mateos (2021)

M. CHOCT

School of Environmental and Rural Science
University of New England, Armidale, NSW 2351, Australia
email: mchoct@une.edu.au

The word "fibre" used in the animal nutrition context is broad, confusing and chemically ill-defined. It is broad because fibre has traditionally been referred to as the organic residue remaining after a series of acid, alkaline and/or detergent extractions. It is confusing because various terms are used to describe fibre, such as Crude Fibre, Acid Detergent Fibre, Neutral Detergent Fibre and Dietary Fibre. These terms refer to a proportion of the same chemical entities or all of some entities but none of the other entities. They also do not correspond or relate to each other in a meaningful manner. It is chemically ill-defined because of the way in which all these fibres, except Dietary Fibre, are obtained, and relies on solvent extractions that do not distinguish specific chemical entities. As animal nutrition is becoming more about producing "more from less" sustainably, every nutrient that takes up the nutrient matrix in feed has to be scrutinised. In recent years, a great deal of interest has emerged in knowing what fibre does in poultry feed. To achieve this, the chemical entities that make up fibre need to be elucidated, and their physical and functional properties properly understood. This paper discusses the terms used to describe fibre, their chemical and physical characteristics, and their functions in relation to poultry nutrition.

Keywords: fibre; NSP; nutrition; feed formulation

Introduction

A typical feed for broiler chickens, for instance, contains 65% cereal grains, *i.e.*, corn or wheat, 25% soybean meal and some other minor ingredients which make up the rest. The crude fibre content of such a diet is around 2.5-3% but when all the nutrients listed in the matrix are added up, including the minor ingredients, they usually account for less than 90%. The missing 10% represent the rest of the total fibre that is not captured in the crude fibre determination. To account for the true fibre content of feed ingredients, a system for "detergent fibres" was instigated (van Soest 1963). This system includes two fractions, the neutral detergent fibre and the acid detergent fibre. This was devised in order to separate the more fermentable "hemicellulose" from the less digestible cellulose and lignin and was a much improved measurement of fibre compared with crude fibre. However, commercial feed formulators have largely ignored it, despite much research and refinement.

From the late 1970s onwards, fibre started to attract increased attention in human nutrition research due to the benefits of high dietary fibre food on bowel health with the added advantage of calorie reduction (Trowell *et al.* 1976; Stephens and Cummings 1980). This led to new definitions of fibre,

Choct (2015)

O QUE É FIBRA?

Uma Palavra Ampla, Confusa e Quimicamente Mal Definida!

Choct (2015)

The word "fibre" used in the animal nutrition context is broad, confusing and chemically ill-defined.

Amplo

- A fibra tem sido tradicionalmente referida como um resíduo orgânico que permanece após uma série de extrações por detergentes ácidos e/ou alcalinos.

O QUE É FIBRA?

Uma Palavra Ampla, Confusa e Quimicamente Mal Definida!

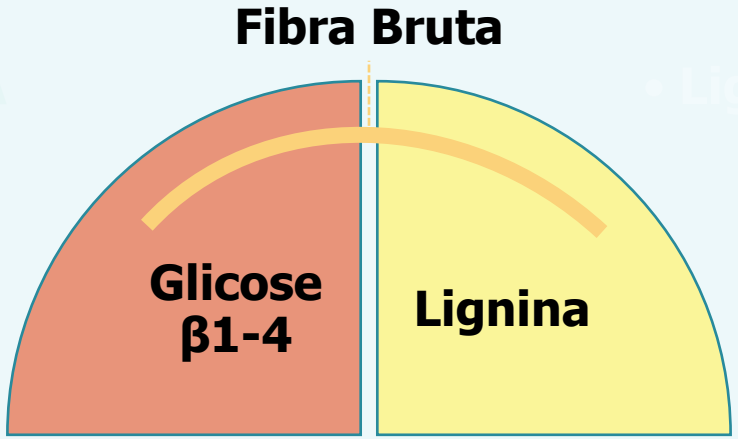
Choct (2015)

Fibra Bruta

O QUE É FIBRA?

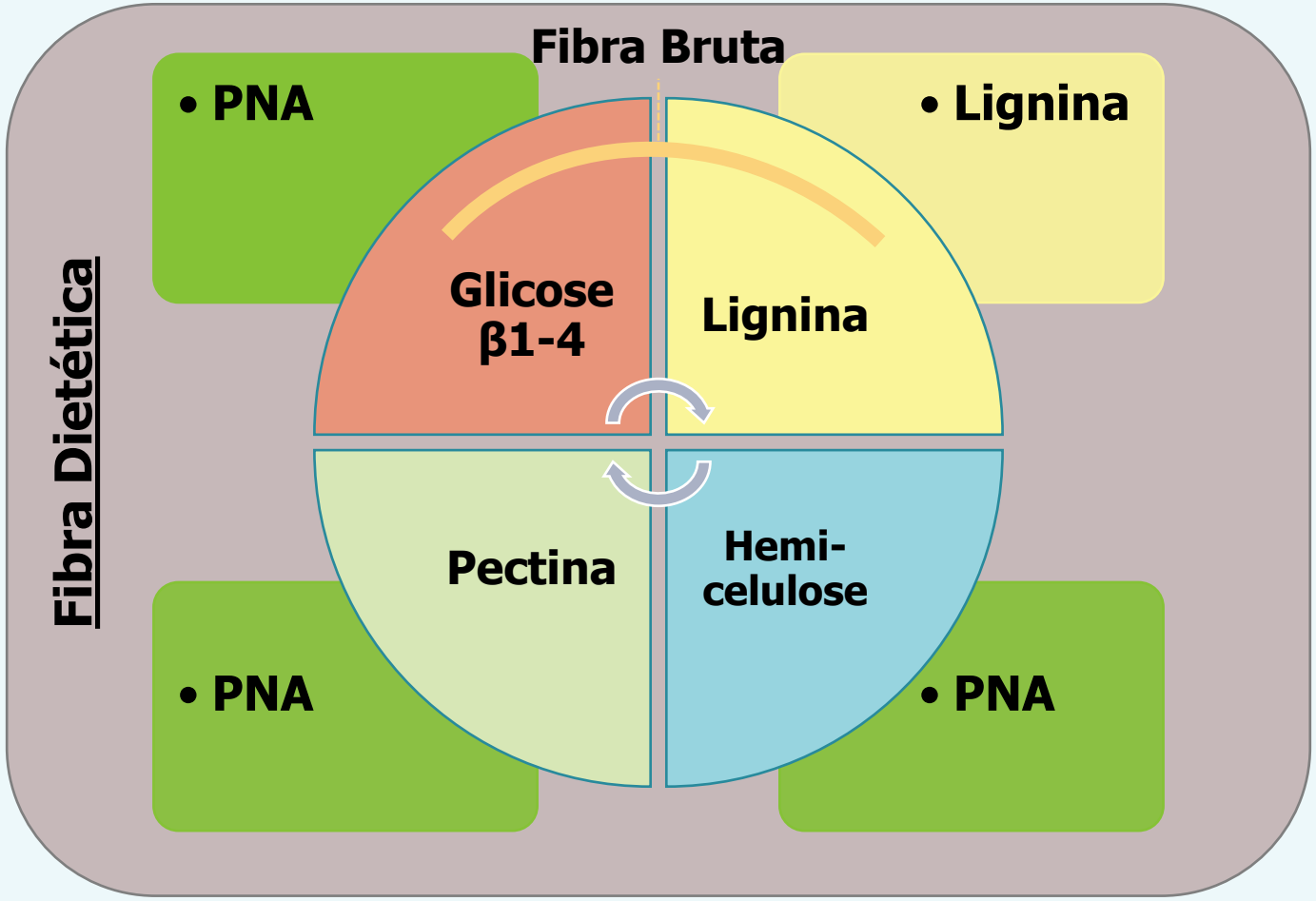
Uma Palavra Ampla, Confusa e Quimicamente Mal Definida!

Choct (2015)



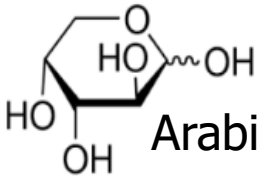
O QUE É FIBRA?

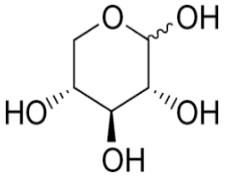
Uma Palavra Ampla, Confusa e Quimicamente Mal Definida!

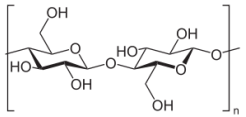


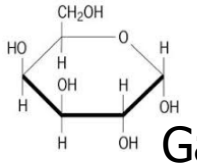
O QUE É FIBRA?

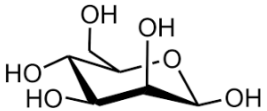
Uma Palavra Ampla, Confusa e Quimicamente Mal Definida!

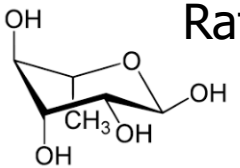

Arabinose

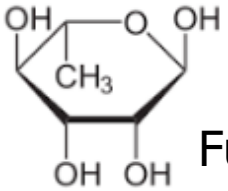

Xilose

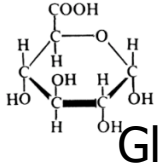

Glicose ß 1-4

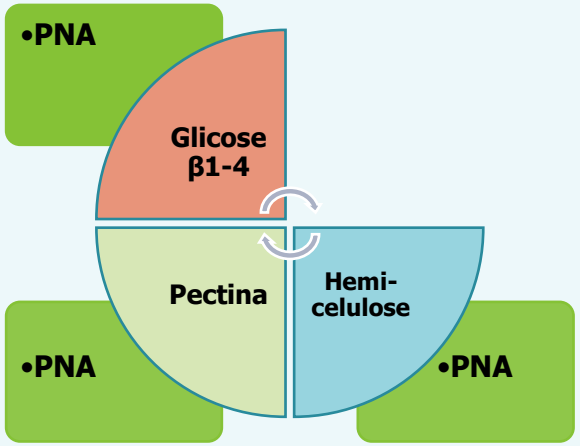

Galactose

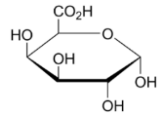

Manose


Rafinose


Fucosa


Ác. Glucurônico



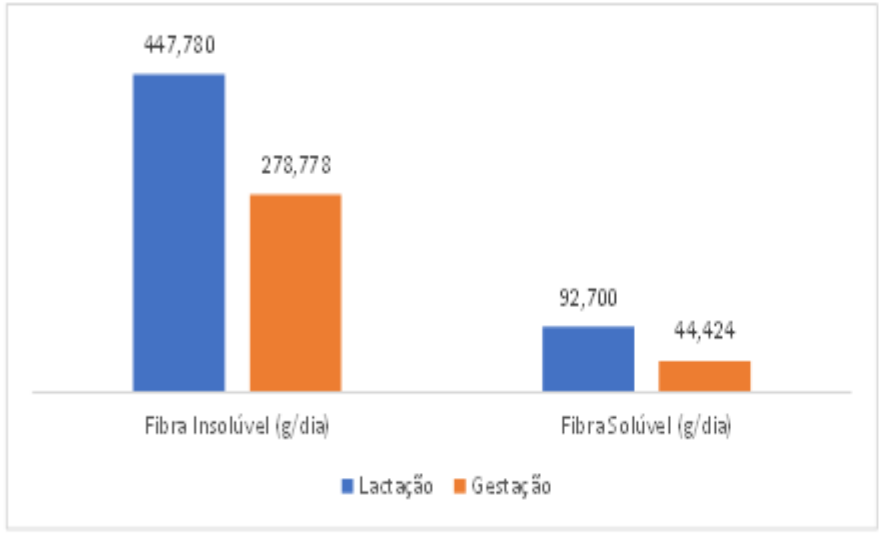

Ác. Galacturônico

QUANTA FIBRA COMO UM SUÍNOS POR DIA?

CONSUMO DE FIBRA, kg/dia/Matriz

	Lactação Patrón LAM (solo Maíz + Torta de So	Gestação Patrón BRASIL con 27% de Afrecho de Trigo
Consumo, kg/dia/Matriz	6,00	2,00
Lignina (AVD) (g/dia)	42,54	28,90

Total PNA (g/dia)	497,940	294,302
PNA Insolúvel (g/dia)	*405,24*	*249,88*
PNA Solúvel (g/dia)	*92,70*	*44,42*



	Lactação, Padrão LAM (apenas Milho + Farelo de Soja)	Gestação Padrão BRASIL com 27% de Farelo de Trigo
Total A+X (g/dia)	220,860	165,469
Insolúvel A+X (g/dia)	*199,50*	*146,94*
Solúvel A+X (g/dia)	*21,36*	*18,53*

Glicose total (g/dia)	155,280	89,778
Glicose Insolúvel (g/dia)	*122,76*	*77,93*
Glicose Solúvel (g/dia)	*32,52*	*11,85*

Total Outros (g/dia)	121,800	39,055
Outros Insolúvels (g/dia)	*82,98*	*25,01*
Otro Solúvel (g/dia)	*38,82*	*14,05*

Fibra Dietética Para Matrizes

ABVista

The most important additive is intelligence

Journal of Animal Science, 2019, 4922–4933

doi:10.1093/jas/skz278
Advance Access publication November 13, 2019
Received: 22 May 2019 and **Accepted:** 18 September 2019
Non Ruminant Nutrition

NON RUMINANT NUTRITION

Efeitos das fontes de fibra dietética durante o final da gestação e lactação no desempenho de matrizes suínas, qualidade e saúde intestinal de leitões

Qinghui Shang, Hansuo Liu, Sujie Liu, Tengfei He, and Xiangshu Piao[2]

State Key Laboratory of Animal Nutrition, College of Animal Science and Technology, China Agricultural University, Beijing 100193, China

[1]This study was financially supported by the National Natural Science Foundation of China (31772612) and CARS 35.

[2]Corresponding author: piaoxsh@cau.edu.cn

Abstract

This study was conducted to investigate the effects of dietary supplementation with 2 sources of fiber, sugar beet pulp (**SBP**), and wheat bran (**WB**), on sow performance, milk quality, and intestinal health in piglets. Forty-five multiparous sows at day 85 of gestation were allocated to the following 3 treatments: 1) a corn-soybean meal basal diet (**CON**); 2) the CON diet supplemented with 20% SBP in gestation and 10% SBP in lactation (SBP); and 3) the CON diet supplemented with 30% WB in gestation and 15% WB in lactation (WB). The SBP diets increased ($P < 0.05$) sow ADFI during lactation, litter and piglet weaning weight, piglet ADG, immunoglobulin A (IgA), and interleukin-10 (IL-10) levels in the colostrum and IgA levels in the milk, while the WB diets only increased ($P < 0.05$) IL-10 levels in the milk when compared with the CON diets. Piglets from SBP-fed sows had greater ($P < 0.05$) serum growth hormone and insulin-like growth factor-1 levels than those from WB-fed or CON-fed sows, whereas piglets from WB-fed sows had greater ($P < 0.05$) serum GH levels than those from CON-fed sows. Serum diamine oxidase activity, endotoxin, IL-6, and tumor necrosis factor-α (TNF-α) levels were reduced ($P < 0.05$) in piglets from SBP-fed or WB-fed sows. Piglets from SBP-fed sows also had greater ($P < 0.05$) serum IL-10 levels than those from CON-fed sows. The ileal mRNA expression of TNF-α was reduced ($P < 0.05$) in piglets from SBP-fed or WB-fed sows. Piglets from SBP-fed sows had lower ($P < 0.05$) IL-6 expression, and greater ($P < 0.05$) IL-10 expression and secretory immunoglobulin A (SIgA) levels in the ileum than those from WB- or CON-fed sows. Piglets from WB-fed sows had greater ($P < 0.05$) IL-10 expression and SIgA levels compared with those from CON-fed sows. The ileal mRNA expression of occludin in the ileum was greater ($P < 0.05$) in piglets from SBP-fed sows than those from CON-fed sows. The ileal mRNA expression of ZO-1 was greater ($P < 0.05$) in piglets from WB-fed sows than those from CON-fed sows, but lower ($P < 0.05$) than those from SBP-fed sows. Piglets from SBP-fed sows had greater ($P < 0.05$) abundance of *Christensenellaceae* and butyrate levels in the colon, while piglets from WB-fed sows had greater ($P < 0.05$) abundance of *Lactobacillaceae*. Collectively, maternal SBP supplementation was more effective than WB in improving milk quality, enhancing growth performance and intestinal barrier function, and ameliorating intestinal inflammation in piglets.

Key words: fiber source, intestinal health, milk quality, performance, piglet

Shang, *et al.*, (2019)

MATRIZ E LEITÕES

O que se Faz com a Matriz Sempre terá um Reflexo na Progênie!

Combinação

- Farelo de Trigo *(Fibra Insolúvel)*
- Polpa de Beterraba *(Soluble Fiber)*

85 d. de Gestação até Final da Lactação

⇑ Colostro e Composição do Leite

- **Hormônios de Crescimento ⇑**
- **Resposta Imunológica ⇑**
- **Morfologia Intestinal ⇑**
- **Função de Barreira Intestinal ⇑**
- **Microbioma Intestinal ⇑**

Crescimento ⇑

Shang *et al.*, (2021)

EFEITOS DA FIBRA DIETÉTICA

Composição do Alimento Completo de Matrizes Suínas

Shang, *et al.*, (2019)

	Gestation			Lactation		
Item	CON	SBP	WB	CON	SBP	WB
Corn	73.65	54.55	50.80	69.74	59.05	54.98
Soybean meal	22.00	21.50	15.00	26.00	26.00	23.00
Wheat bran[1]	0.00	0.00	30.00	0.00	0.00	15.00
Sugar beet pulp[2]	0.00	20.00	0.00	0.00	10.00	0.00
Soybean oil	0.85	0.85	0.85	0.65	1.53	3.50
Dicalcium phosphate	1.28	1.35	0.57	1.45	1.50	1.10
Limestone	1.07	0.60	1.48	0.78	0.54	0.97
Salt	0.40	0.40	0.40	0.40	0.40	0.40
L-Lysine HCl	-	-	0.15	-	-	0.06
Valine	-	-	-	0.23	0.23	0.24
Premix[3]	0.50	0.50	0.50	0.50	0.50	0.50
Chromium oxide	0.25	0.25	0.25	0.25	0.25	0.25
Calculated composition						
DE Kal/kg	3353	3259	3037	3388	3388	3388
Available P	0.31	0.31	0.31	0.34	0.34	0.34
SID lysine	0.69	0.69	0.70	0.78	0.79	0.78
SID methionine	0.22	0.19	0.20	0.23	0.22	0.22
SID threonine	0.49	0.46	0.45	0.53	0.52	0.51
SID tryptophan	0.14	0.14	0.13	0.16	0.16	0.16
SID valine	1.05	1.04	1.02	0.85	0.85	0.85
Analyzed composition						
Calcium	0.74	0.76	0.75	0.68	0.70	0.68
Phosphorus	0.56	0.55	0.58	0.60	0.59	0.62
Crude protein	15.29	15.41	15.48	17.21	17.25	17.21
Total dietary fiber	11.37	21.60	21.81	11.82	16.83	16.88
Soluble dietary fiber	1.39	4.06	1.86	1.43	2.72	1.70
Insoluble dietary fiber	9.98	17.54	19.95	10.39	14.11	15.18

EFEITOS DA FIBRA DIETÉTICA

Efeitos das Fontes de Fibra Dietética no Desempenho da Matriz Suína

Shang, *et al.*, (2019)

Item	Controle	SBP	WB	SEM	P-*value*
CRD/Fêmea, kg/d	4,80^{b}	5,48^{a}	5,16^{ab}	0,15	0,01

EFEITOS DA FIBRA DIETÉTICA

Efeitos das Fontes de Fibra Dietética no Desempenho da Matriz Suína

Shang, *et al.*, (2019)

Item	Controle	SBP	WB	SEM	P-*value*
CRD/Fêmea, kg/d	4,80^{b}	5,48^{a}	5,16^{ab}	0,15	0,01
Tamanho de Leitegada					
Nascidos Totais, #	12,27	12,07	12,20	0,42	0,94
Nascidos Vivos, #	11,33	11,40	11,67	0,19	0,79
Nascidos mortos, #	0,93	0,67	0,53	0,36	0,31
Desmamados, #	9,93	10,27	10,47	0,33	0,51
Mortes na Maternidade, %	12,09	9,64	10,12	1,83	0,61

EFEITOS DA FIBRA DIETÉTICA

Efeitos das Fontes de Fibra Dietética no Desempenho da Matriz Suína

Shang, *et al.*, (2019)

Item	Controle	SBP	WB	SEM	P-*value*
CRD/Fêmea, kg/d	4,80^{b}	5,48^{a}	5,16^{ab}	0,15	0,01
Tamanho de Leitegada					
Nascidos Totais, #	12,27	12,07	12,20	0,42	0,94
Nascidos Vivos, #	11,33	11,40	11,67	0,19	0,79
Nascidos mortos, #	0,93	0,67	0,53	0,36	0,31
Desmamados, #	9,93	10,27	10,47	0,33	0,51
Mortes na Maternidade, %	12,09	9,64	10,12	1,83	0,61
Peso Vivo da Leitegada					
Nascimento, kg	18,27	18,69	19,03	0,74	0,77
Desmame, kg	56,94^{b}	64,39^{a}	62,71^{ab}	2,12	0,04
Peso Vivo do Leitão					
Nascimento, kg	1,63	1,65	1,65	0,06	0,96
Desmame, kg	5,74^{b}	6,26^{a}	5,97^{ab}	0,13	0,02
GPD, g/d	196^{b}	221^{a}	206^{ab}	5,39	0,01

EFEITOS DA FIBRA DIETÉTICA

Efeito da Fibra Dietética na Produção de Imunoglobulinas e Citocinas no Colostro e no Leite

Imunidade Passiva Sistêmica			Citocinas		
			Característica Anti-Inflamatória		
			↓	↑	↓
IgA	IgG	IgM	IL-6	IL-10	TNF-α

EFEITOS DA FIBRA DIETÉTICA

Efeito da Fibra Dietética na Produção de Imunoglobulinas e Citocinas no Colostro e no Leite

Item	Controle	SBP	WB	SEM	P-*value*
Colostro					
IgA, g/L	7,94^{b}	9,17^{a}	8,69^{ab}	0,28	0,03
IgG, g/L	63,79	67,66	65,32	2,67	0,60
IgM, g/L	2,52	2,70	2,68	0,08	0,22
IL-6, pg/mL	18,48	17,48	17,14	1,19	0,72
IL-10, pg/mL	6,05^{b}	9,79^{a}	7,42^{ab}	0,77	0,02
TNF-α, pg/mL	7,66	6,58	6,85	0,65	0,49

EFEITOS DA FIBRA DIETÉTICA

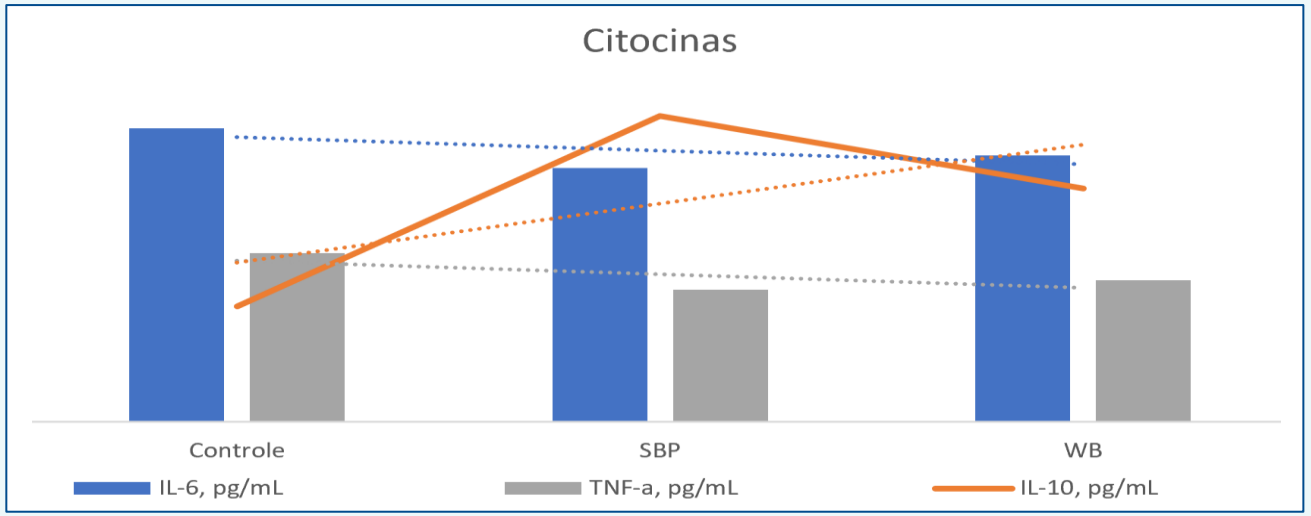
Efeito da Fibra Dietética na Produção de Imunoglobulinas e Citocinas no Colostro e no Leite

Item	Controle	SBP	WB	SEM	P-*value*
Colostro					
IgA, g/L	7,94^{b}	9,17^{a}	8,69^{ab}	0,28	0,03
IgG, g/L	63,79	67,66	65,32	2,67	0,60
IgM, g/L	2,52	2,70	2,68	0,08	0,22
IL-6, pg/mL	18,48	17,48	17,14	1,19	0,72
IL-10, pg/mL	6,05^{b}	9,79^{a}	7,42^{ab}	0,77	0,02
TNF-α, pg/mL	7,66	6,58	6,85	0,65	0,49
Leite					
IgA, g/L	3,26	3,39	3,21	0,10	0,48
IgG, g/L	24,75	24,98	24,78	0,30	0,84
IgM, g/L	1,15	1,18	1,15	0,02	0,38
IL-6, pg/mL	46,38	45,13	45,98	2,18	0,92
IL-10, pg/mL	2,62^{b}	3,57^{a}	3,42^{a}	0,19	0,02
TNF-α, pg/mL	20,47	19,68	19,11	1,01	0,65

EFEITOS DA FIBRA DIETÉTICA

Efeito da Fibra Dietética na Dieta Materna no Soro de Leitões ao 21º de Dia de Idade

Item	Controle	SBP	WB	SEM	P-*value*
Avaliação Sorológica em Leitões com 21 dias de idade					
IgA, g/L	1,15	1,10	1,12	0,04	0,56
IgG, g/L	20,47	20,49	19,28	0,42	0,11
IgM, g/L	2,27	2,30	2,38	0,03	0,08
IL-6, pg/mL	178,49^{a}	154,30^{b}	161,80^{b}	3,08	<0,01
IL-10, pg/mL	4,55^{b}	5,13^{a}	4,91^{ab}	0,11	0,01
TNF-α, pg/mL	102,45^{a}	80,28^{b}	85,92^{b}	1,80	<0,01



Jarrett and Ashworth *Journal of Animal Science and Biotechnology* (2018) 9:59
https://doi.org/10.1186/s40104-018-0270-0

Journal of Animal Science and Biotechnology

REVIEW Open Access

O Papel da Fibra Dietética na Produção de Suínos, com Ênfase Particular na Reprodução

Selene Jarrett and Cheryl J. Ashworth*

Abstract

Fibres from a variety of sources are a common constituent of pig feeds. They provide a means to utilise locally-produced plant materials which are often a by-product of the food or drink industry. The value of a high fibre diet in terms of producing satiety has long been recognised. However the addition of fibre can reduce feed intake, which is clearly detrimental during stages of the production cycle when nutrient needs are high, for example in growing piglets and during lactation. More recently, fibre has been found to promote novel benefits to pig production systems, particularly given the reduction in antimicrobial use world-wide, concern for the welfare of animals fed a restricted diet and the need to ensure that such systems are more environmentally friendly. For example, inclusion of dietary fibre can alter the gut microbiota in ways that could reduce the need for antibiotics, while controlled addition of certain fibre types may reduce nitrogen losses into the environment and so reduce the environmental cost of pig production. Of particular potential value is the opportunity to use crude fibre concentrates as 'functional' feed additives to improve young pig growth and welfare. Perhaps the greatest opportunity for the use of high fibre diets is to improve the reproductive efficiency of pigs. Increased dietary fibre before mating improves oocyte maturation, prenatal survival and litter size; providing a consumer-acceptable means of increasing the amount of saleable meat produced per sow. The mechanisms responsible for these beneficial effects remain to be elucidated. However, changes in plasma and follicular fluid concentrations of key hormones and metabolites, as well as effects of the hypothalamic satiety centre on gonadotrophin secretion and epigenetic effects are strong candidates.

Keywords: Fibre, Pig, Pregnancy, Production, Reproduction

Jarrett & Ashwoth, (2018)

EFEITOS DA FIBRA DIETÉTICA

Composição do Alimento Completo de Matrizes Suínas

Jarrett & Ashwoth, (2018)

Perhaps the greatest opportunity for the use of high fibre diets is to improve the reproductive efficiency of pigs. Increased dietary fibre before mating improves oocyte maturation, prenatal survival and litter size; providing a consumer-acceptable means of increasing the amount of saleable meat produced per sow.

Fermentação da Fibra	Fibra Insolúvel	Porque?
		Desenvolvimento ovariano é muito sensível à taxa de ingestão materna.
		Maturação de oocistos é sensível à perturbações na saúde materna.

animals

MDPI

Article

Ingestão Ideal de Fibra Dietética em Dietas para Reter uma Maior Reserva de Folículos Ovarianos em Fêmeas Suínas

Meng Cao †, Yong Zhuo *,†, Lechan Gong, Lianchao Tang, Zipeng Li, Yang Li, Min Yang, Shengyu Xu, Jian Li, Lianqiang Che, Yan Lin, Bin Feng, Zhengfeng Fang and De Wu *

Key Laboratory for Animal Disease-Resistant Nutrition of the Ministry of Education of China, Animal Nutrition Institute, Sichuan Agricultural University, Chengdu 611130, China; caomeng1111@126.com (M.C.); Gongyuechanpenny@163.com (L.G.); steve5678t@163.com (L.T.); 15554422287@163.com (Z.L.); liyang_cc@yeah.net (Y.L.); yangmin040101@yeah.net (M.Y.); shengyu_x@hotmail.com (S.X.); lijian522@hotmail.com (J.L.); clianqiang@hotmail.com (L.C.); linyan936@163.com (Y.L.); fengbin@sicau.edu.cn (B.F.); fangzhengfeng@hotmail.com (Z.F.)

* Correspondence: zhuoyong@sicau.edu.cn (Y.Z.); wude@sicau.edu.cn (D.W.)

† These authors contributed equally to this work.

Received: 28 September 2019; Accepted: 25 October 2019; Published: 29 October 2019

check for updates

Simple Summary: Successful development of replacement gilts plays a critical role for sustainable swine production, whereas most gilts entering the breeding herd are culled at a young age. Recent advances in reproductive physiology revealed that the ovarian reserve could be considered as an important target of improving reproductive span. Therefore, in the present study, we hypothesized that ovarian follicle development and survival could be enhanced by dietary fiber. Currently there is no appropriate level of dietary fiber intake for growing replacement gilts despite the fact that dietary fiber, rather than starch, protein, or feeding allowance level, could improve the fertility of gilts. Results in the present study demonstrated that ovarian follicle development and survival were sensitive to dietary fiber levels. Our results shed light on the mechanisms underlying the beneficial effects of dietary fiber on the reproduction of sows and provided nutritional insights for enhancing the lifetime fertility of pigs by targeting the ovarian reserve.

Abstract: Ovarian follicle activation and survival were recently found to be controlled by nutrient sensors AMP-activated protein kinase (AMPK) and mammalian target of rapamycin (mTOR) and apoptosis related markers Caspase-3, Bax, and Bcl-2, yet their expression as regulated by dietary fiber remained uncertain for gilts. To investigate the effects of dietary fiber levels on ovarian follicle development, and the cellular molecular components related to follicle activation and survival of gilts, 76 gilts with similar bodyweight and age were fed four diets, including a corn-soybean meal based control diet, or other three diets to consume 50%, 75%, and 100% more dietary fiber than the control

Cao, *et al.*, (2019)

EFEITOS DA FIBRA DIETÉTICA

Composição do Alimento Completo de Matrizes Suínas

Cao, *et al.*, (2019)

Ingredients (g/kg)	1–60 Days				61 Days–Slaughter [4]			
	1.0 DF [5]	1.5 DF	1.75 DF	2.0 DF	1.0 DF	1.5 DF	1.75 DF	2.0 DF
Corn	720	720	720	720	780	780	780	780
Soybean (44%CP)	208	208	208	208	160	160	160	160
Fish meal (65%CP)	25	25	25	25	20	20	20	20
Soybean oil	20	20	20	20	17	17	17	17
L-Lys HCl (98%)	3	3	3	3	2	2	2	2
DL-Methionine (99%)	1	1	1	1	0.4	0.4	0.4	0.4
L-Threonine (98%)	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2
L-Trptophan (98%)	0.1	0.1	0.1	0.1	0	0	0	0
Choline chloride (50%)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Salt	4	4	4	4	4	4	4	4
Limestone	6.2	6.2	6.2	6.2	5.9	5.9	5.9	5.9
Monocalcium phosphate	8.6	8.6	8.6	8.6	7	7	7	7
Vitamin-mineral premix [1]	2	2	2	2	2	2	2	2
Dietary fiber mixture [2]	0	63	94	125	0	62	93	124
Total	1000	1063	1094	1125	1000	1062	1093	1124
Nutrient composition, g/kg [3]								
Digestible energy, Mcal/kg	3.40	3.20	3.11	3.02	3.40	3.20	3.11	3.02
Crude protein	169.0	159.0	154.5	150.2	147.0	138.4	134.5	130.8
Total Lysine	10.8	10.2	9.9	9.6	8.6	8.1	7.9	7.6
Standardized ileal digestible lysine	9.8	9.2	9.0	8.7	7.8	7.3	7.1	6.9
Calcium	6.9	6.5	6.3	6.1	5.9	5.6	5.4	5.2
Total phosphorus	5.9	5.6	5.4	5.2	5.3	5.0	4.8	4.7
Soluble fiber	10.2	21.4	26.5	31.3	10.3	21.4	26.4	31.2
Insoluble fiber	115.0	155.6	173.8	191.1	113.9	154.0	172.3	189.6
Total dietary fiber [3]	125.2	177.0	200.4	222.4	124.2	175.3	198.7	220.8

[3]Total dietary fiber = soluble fiber + insoluble fiber, analyzed value according to method AOAC.
[4]Gilts were slaughtered on the 19th day of the 3rd estrous cycle.

EFEITOS DA FIBRA DIETÉTICA

Desenvolvimento de Folículos Ovarianos

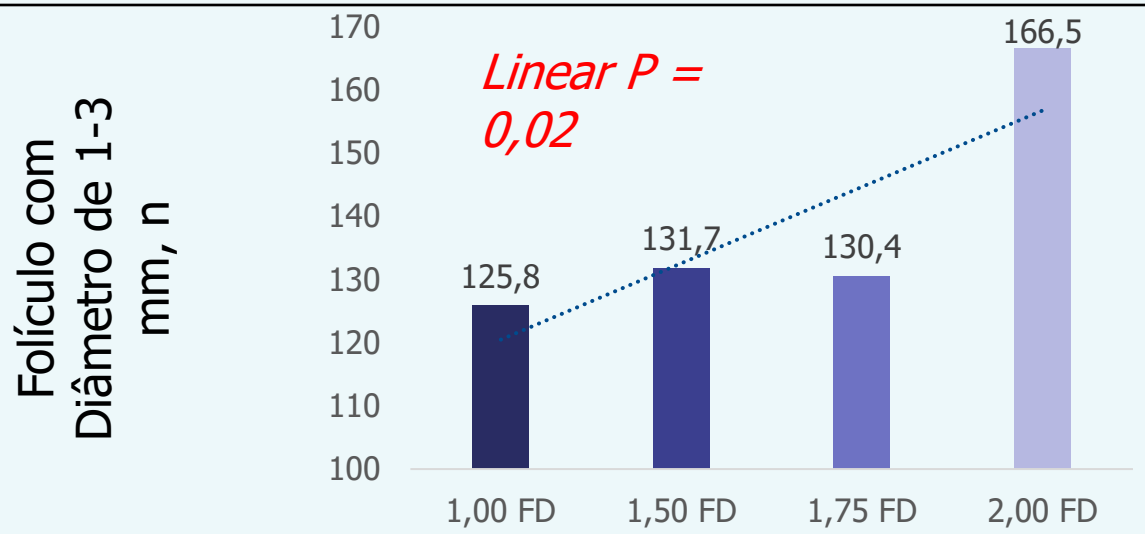


Table 3
Follicle development, and oestrus and ovulation characteristics of sows fed either commercial diet (CON), sugar beet pulp (SBP)-rich diet, or micro-fibrillated cellulose diet (MFC) during 1 week before weaning and the weaning-to-oestrus interval (WEI).

	Treatment				
	CON	SBP	MFC	RMSE	*P*-value
Number of sows, n	19	20	19		
Follicle diameter, mm					
At weaning[1]	4.11	3.97	4.03	0.06	0.21
At 3 days after weaning[1]	6.68	6.35	6.52	0.16	0.32
At ovulation[1]	7.34	7.22	7.26	0.12	0.75
Oestrus and ovulation					
Oestrus rate ≤ 7 days, %	79.4 (15/19)	85.2 (17/20)	84.6 (16/19)	9.3	0.87
WEI, h[12]	101.6	105.9	109.3	2.7	0.15
WOI, h[12]	128.4	128.8	129.8	2.9	0.92
EOI, h[12]	27.0	23.0	22.0	2.7	0.38
Pregnancy rate at 35 days, %[3]	100	100[4]	100		1.00

WOI = weaning-to-ovulation interval; EOI = oestrus-to-ovulation interval.
[1] Of sows showing oestrus ≤ 7 days.
[2] Data were presented as mean.
[3] Of all sows inseminated.
[4] One sow culled after pregnancy check (SBP).

Han, *et al.*, (2021)

Fibra Dietética para Leitões

ABVista

The most important additive is intelligence

FIBRA DIETÉTICA PARA LEITÕES

Como Impulsionar a Performance dos Leitões!

DOI: http://dx.doi.org/10.1590/1678-992X-2018-0199

SCIENTIA AGRICOLA

Research Article

Fibra Dietética e aditivos de zinco no desempenho e saúde intestinal de leitões desafiados com *Escherichia coli*

Carolina Dias Fernandes[1], Maira Resende[1], Letícia Mendonça Rodrigues[1], Cesar Augusto Prospisil Garbossa[2], Leandro Batista Costa[1], Rony Antônio Ferreira[1], Márvio Lobão Teixeira de Abreu[1], Vinicius Souza Cantarelli[3]*

[1]Universidade Federal de Lavras – Depto. de Zootecnia, C.P. 3037 – 37200-000 – Lavras, MG – Brasil.

[2]Universidade de São Paulo – Depto. de Nutrição e Produção Animal, Av. Duque de Caxias Norte, 225 – 13635-900 – Pirassununga, SP – Brasil.

[3]Pontifícia Universidade Católica do Paraná/Escola de Ciências da Vida, R. Imaculada Conceição, 1155 – 80215-901 – Curitiba, PR – Brasil.

*Corresponding author <vinicius@dzo.ufla.br>

Edited by: Antonio Faciola

Received June 15, 2018
Accepted September 04, 2018

ABSTRACT: This study aimed to evaluate the effects of zinc oxide and a low level of encapsulated zinc oxide, with or without dietary fiber, on the performance and intestinal health of weaned piglets. A total of 112 piglets were used, divided into four treatment groups: basal diet with zinc oxide (ZnO); basal diet with zinc oxide and dietary fiber (ZnO+DF); basal diet with encapsulated low zinc oxide (LZnOE); and basal diet with LZnOE and DF (LZnOE+DF). Piglets were challenged with *E. coli* K88*, weighed weekly and the fecal score was evaluated daily. One pig per pen was slaughtered to evaluate the production of volatile fatty acids, intestinal microbial populations, intestinal morphology, and digestibility. The encapsulated zinc resulted in lower body weight and average daily gain, but, when associated with dietary fiber, had similar results to zinc oxide. Until 49 days of age, zinc oxide reduced diarrhoea ($p < 0.05$). At 63 days of age the piglets subjected to LZnOE+DF treatment had lower diarrhoea than the pigs subjected to LZnOE treatment but higher than the ZnO and the ZnO+DF groups. Final weight and incidence of diarrhoea of pigs receiving LZnOE was worse than ZnO. LZnOE associated with DF provided the same final weight of piglets from the ZnO group.

Keywords: nutrition, diarrhoea, jejunum, swine, weaning

Introduction

Postweaning diarrhoea syndrome (PWDS) is a recurrent problem during the transition from the maternity to the nursery phase, with strains of enterotoxigenic *Escherichia coli* as its main causative agents. PWDS is aggravated in early weaning conditions, when there is a reduction in the height and width of the intestinal villi and the activity of digestive enzymes (Wang et al., 2008).

Zinc oxide (ZnO) and a portion of dietary fiber are potential additives with antimicrobial effects that can facilitate better adaptation to postweaning conditions (Pascoal et al., 2015). ZnO can be used in the diet of piglets to improve intestinal health and performance and may benefit intestinal morphology, resulting in increased villus density and height (Kwon et al., 2014). However, most of the ZnO delivered in high doses, from 1,500 to 3,000 ppm, is excreted in the feces, leading to environmental pollution (Hill et al., 2001). Thus, encapsulated zinc (EZ), which is released only after capsule digestion, can be used in lower doses, reducing the environmental impact (Shen et al., 2014).

Fibers are present in the postweaning diet when piglets start to be fed diets rich in plant products, and they play an important role in modulating the microbiota and intestinal morphology (Pascoal et al., 2015). According to Lindberg (2014), fiber, if it does not increase the viscosity, can be beneficial for piglets by increasing the lactobacilli:coliform ratio and decreasing the occurrence of weaning diarrhoea.

Considering all these beneficial effects and the possibility that fibers could also increase the activity of certain enzymes, such as lipase (Chen et al., 2015), their supply, along with EZ, may produce synergistic effects by speeding up lipid capsule degradation, releasing a greater amount of zinc at the beginning of the duodenum. Therefore, this study aimed to evaluate the effects of conventional ZnO and a low level of EZnO, with or without dietary fibers, on the performance and intestinal health of weanling piglets.

Materials and Methods

Animals and diets

The experimental procedures were approved by the Ethics Committee on Animal Use of the University, protocol nº 004/16.

A total of 112 piglets of commercial lineage, weaned at 21 days of age and with initial weight of 5.32 ± 1.31 kg, were housed in a nursery unit with suspended pens in the experimental farm located at Lavras, Minas Gerais, Brazil, (21°13'52" S, 44°58'16" W, 918 m above sea level). The average temperature throughout the experiment was 26.34 ± 3.01 °C.

The diets were formulated to meet the minimum nutritional requirements, according to Rostagno et al. (2011), for three periods of the nursery phase: Pre-starter 1 (21 to 35 days of age), pre-starter 2 (36 to 49 days of age), and starter (50 to 63 days of age) (Table 1). To ensure isoenergetic and isoprotein diets, the inclusion of additives was offset by partial or total substitutions of the inert kaolin.

Experimental design

The experimental design was based on randomized blocks in a factorial scheme with four treatments, seven

Fernandes, *et al.*, (2020)

FIBRA DIETÉTICA PARA LEITÕES

Como Impulsionar a Performance dos Leitões!

Fernandes, *et al.*, (2020)

Table 1 – Centesimal composition and nutritional values of the diets used in the experiment.

Ingredients (%)	Pre-starter 1	Pre-starter 2	Starter
Corn	40.66	49.84	67.87
Micronized soybean	14.00	7.00	0.00
Soybean meal (CP† 46 %)	15.00	22.00	25.00
Plasma spray dried	5.00	2.50	0.00
Whey powder	19.31	11.04	0.00
Soybean oil	1.00	2.50	2.00
Dicalcium phosphate	1.15	1.35	1.45
Mineral and vitamin premix[1]	0.10	0.12	0.00
Mineral and vitamin premix[2]	0.00	0.00	0.15
Limestone	0.95	0.93	0.80
NaCl	0.05	0.20	0.45
L-Lysine	0.33	0.38	0.30
DL-Methionine	0.18	0.17	0.07
L-Threonine	0.14	0.15	0.06
L-Tryptophan	0.03	0.02	0.00
L-Valine	0.06	0.06	0.00
Kaolin	2.04	1.74	1.85

Table 2 – Experimental treatments.

Treatments[1]	21 to 35 days of age
ZnO	2500 ppm ZnO
ZnO + DF	2500 ppm ZnO 8000 ppm DF
LZnOE	800 ppm ZnO
LZnOE + DF	800 ppm ZnO 8000 ppm DF
Treatments[1]	**36 to 49 days of age**
ZnO	1500 ppm ZnO
ZnO + DF	1500 ppm ZnO 6000 ppm DF
LZnOE	500 ppm ZnO
LZnOE + DF	500 ppm ZnO 6000 ppm DF
Treatments[1]	**50 to 63 days of age**
ZnO	1500 ppm ZnO
ZnO + DF	1500 ppm ZnO
LZnOE	500 ppm ZnO
LZnOE + DF	500 ppm ZnO

FIBRA DIETÉTICA PARA LEITÕES

Efeitos das dietas no desempenho de leitões desmamados aos 21 dias de idade.

Item	Tratamentos (21 até 63 dias)				SEM	P-*value*		
	ZnO	ZnO + DF	LZnO	LZnO + DF		Fibra	Zinco	Fibra x Zinco
GP, kg	21,360[a]	20,070[ab]	19,310[b]	21,350[a]	0,833	0,455	0,449	0,004
GPD, kg/d	0,381[a]	0,352[ab]	0,343[b]	0,374[ab]	0,015	0,947	0,513	0,021
CRD, kg/d	0,664[a]	0,616[ab]	0,598[b]	0,662[ab]	0,028	0,762	0,693	0,011
CA, g/g	1,745	1,743	1,753	1,697	0,019	0,446	0,605	0,487

FIBRA DIETÉTICA PARA LEITÕES

Definição de Estimbiótico

Bedford (2018); Bedford & Apajalahti (2019)

PLOS ONE

RESEARCH ARTICLE

A suplementação com Aditivo Estimbiótico melhorou o desempenho e redução da resposta à inflamação via fermentação de fibra estimulante de um microbioma em leitões alojados em um ambiente sanitário ruim e alimentado com uma dieta pobre em óxido de zinco sem antibióticos.

Hyun Min Cho[1], Gemma González-Ortiz[2]*, Diego Melo-Durán[3], Jung Min Heo[1], Gustavo Cordero[2], Michael R. Bedford[2], Jae Cheol Kim[2]

1 Department of Animal Science and Biotechnology, Chungnam National University, Daejeon, South Korea, **2** AB Vista, Marlborough, Wiltshire, United Kingdom, **3** Departament de Ciència Animal i dels Aliments, Servei de Nutrició i Benestar Animal (SNiBA), Universitat Autonoma de Barcelona, Bellaterra, Spain

* Gemma.Gonzalez@abvista.com

Citation: Cho HM, González-Ortiz G, Melo-Durán D, Heo JM, Cordero G, Bedford MR, et al. (2020) Stimbiotic supplementation improved performance and reduced inflammatory response via stimulating fiber fermenting microbiome in weaner pigs housed in a poor sanitary environment and fed an antibiotic-free low zinc oxide diet. PLoS ONE 15 (11): e0240264. https://doi.org/10.1371/journal.pone.0240264

Editor: François Blachier, National Institute for Research on Agriculture, Alimentation and Environment (INRAE), FRANCE

Received: June 22, 2020

Accepted: September 22, 2020

Published: November 10, 2020

Data Availability Statement: All relevant data are within the manuscript and its Supporting information files.

Funding: This study was supported by AB Vista, who supplied the stimbiotic used in this trial. Additionally, AB Vista provided support in the form of salaries for GGO, GC, MB, and JK. The specific

Abstract

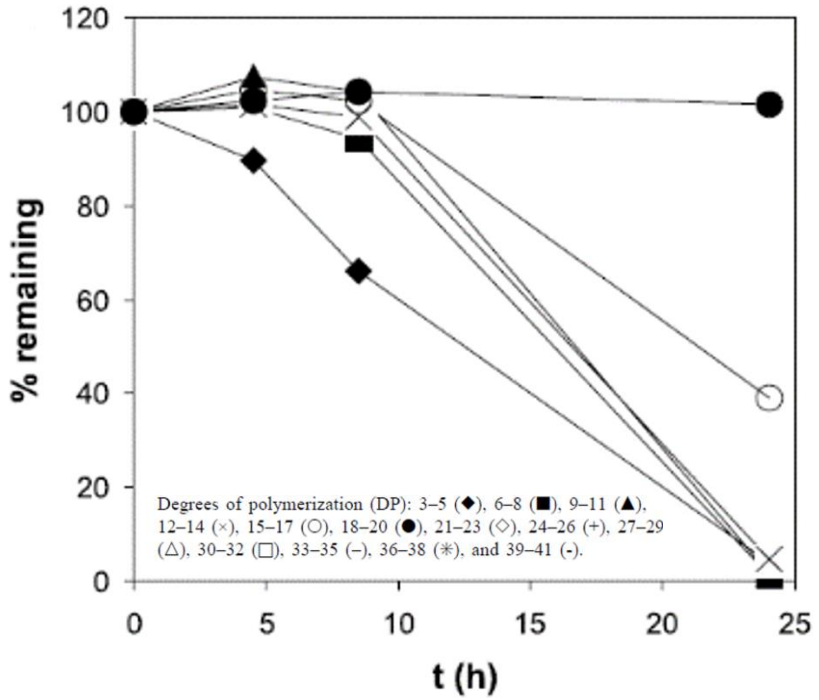
This study investigated whether the inclusion of a stimbiotic (STB) can improve performance, influence intestinal microbiota and fermentation activity, and reduce pro-inflammatory cytokines in piglets fed a low zinc oxide diet without antimicrobial growth promotors compared to fructo-oligosaccharide (FOS) and mannan-oligosaccharide (MOS) when housed either in good sanitary (GS) or poor sanitary (PS) environments. One hundred forty-four male pigs (28-day-old) were sorted by initial body weight (BW) and allocated to one of six experimental treatments: 1) GS environment without any additive (GS-CTR); 2) GS environment with 0.01% stimbiotic (GS-STB); 3) PS environment (without cleaning and disinfection of a previously populated room) without any additive (PS-CTR); 4) PS environment with 0.01% STB (PS-STB); 5) PS environment with 0.1% MOS (PS-MOS); and 6) PS environment with 0.2% FOS (PS-FOS). Each treatment had six replicates, with four animals each. Three feeding phases, based on corn, wheat, and soybean meal were available *ad libitum* for the 42-days of the study. Housing piglets under PS conditions negatively influenced performance, increased plasma tumor necrosis factor alpha (TNF-α), affected the fecal microbial populations and increased concentrations of branched-chain fatty acids (BCFA) compared to GS. Stimbiotic improved 42-d-BW under PS conditions ($P < 0.05$) whereas MOS or FOS had no effect. On d35, plasma TNF-α was reduced with STB in PS ($P < 0.05$). The ratio between VFA:BCFA increased ($P < 0.05$) with STB, MOS or FOS in PS, and under GS condition, STB also increased the ratio. Stimbiotic increased the proportion of Clostridiales Family XIII Incertae Sedis and *Clostridiaceae*, while MOS and FOS increased *Selenomonadaceae*, *Catabacteriaceae* and *Fibrobacteraceae*. These results indicate that STB shifted the intestinal microbiome to favor fiber fermentation which likely contributed to

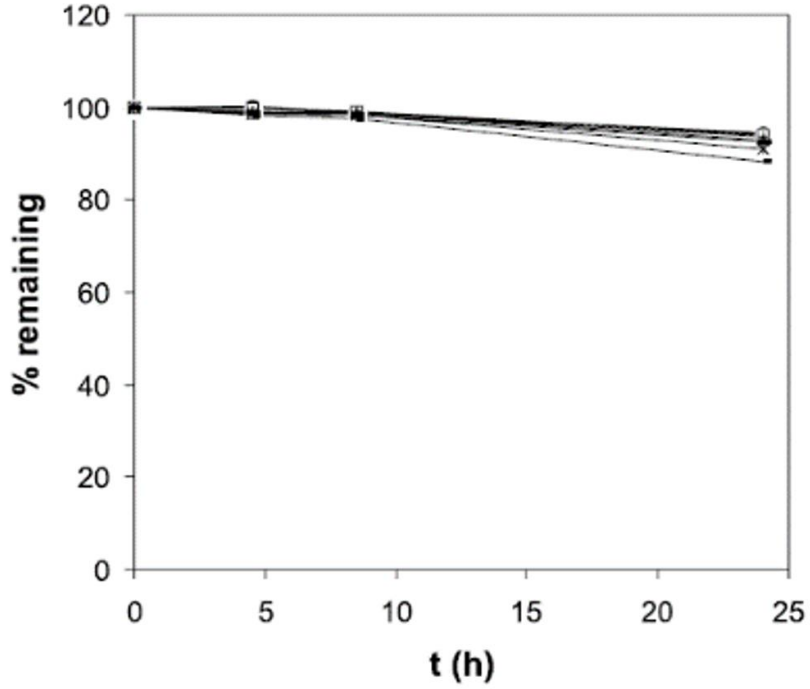
Cho, *et al.*, (2020)

FIBRA DIETÉTICA PARA LEITÕES

Definição de Estimbiótico

Cho, *et al.*, (2020)





Baixo GP	**Alto GP**
92% entre 2-20 e 5% >20	29% entre 2-20 e 70% >20

Cinética do consumo de frutooligossacarideos durante a fermentação de três substratos de B.infantis. (a) Fibrulose F97; (c) Fibrulina LC.

Perrin et al. (2002)

FIBRA DIETÉTICA PARA LEITÕES

Material e Métodos

Cho, *et al.*, (2020)

- **Boa Condição Sanitária**
  - Controle
  - Estimbiótico
- **Má Condição Sanitário**
  - Controle
  - Estimbiótico
  - MOS
  - FOS

Table 1. Ingredient composition and calculated and analyzed composition of the experimental diets.

Ingredient (%)	Phase 1 (d 0–14)	Phase 2 (d 14–28)	Phase 3 (d 28–42)
Calculated chemical composition			
Metabolizable energy, kcal/kg	3,314	3,290	3,366
Lysine, %	1.65	1.48	1.34
Zinc, (mg/kg)	150	150	150

FIBRA DIETÉTICA PARA LEITÕES

Material e Métodos

Cho, *et al.*, (2020)

Table 1. Ingredient composition and calculated and analyzed composition of the experimental diets.

Ingredient (%)	Phase 1 (d 0–14)	Phase 2 (d 14–28)	Phase 3 (d 28–42)
Wheat	27.38	20.80	25.00
Wheat bran	5.00	3.87	4.00
Maize (corn)	22.45	35.00	44.39
Soybean meal (crude protein 47%)	10.38	15.11	17.41
Blood plasma	5.00	3.00	-
Fishmeal	5.00	3.00	2.00
Lactose powder	6.00	5.00	-
Whey (sweet)	13.20	7.43	-
Soya oil	1.50	3.00	3.21
Limestone	0.98	0.91	0.69
Dicalcium phosphate (18% phosphorous)	0.77	1.01	1.25
Salt	0.50	0.20	0.20
Zinc Oxide	0.01	0.01	0.01
Choline chloride (50%)	0.05	0.07	0.07
Lysine HCl	0.58	0.56	0.66
DL-Methionine	0.21	0.19	0.19
L-Threonine	0.17	0.16	0.21
L-Tryptophan	0.02	0.01	0.03
L-Valine	0.11	0.09	0.12
L-Isoleucine	0.12	0.07	0.04
L-Leucine	0.08	0.00	0.01
Vitamin-Mineral Premix[1]	0.50	0.50	0.50

FIBRA DIETÉTICA PARA LEITÕES

Efeito dos tratamentos no desempenho de leitões de 42 dias após o desmame.

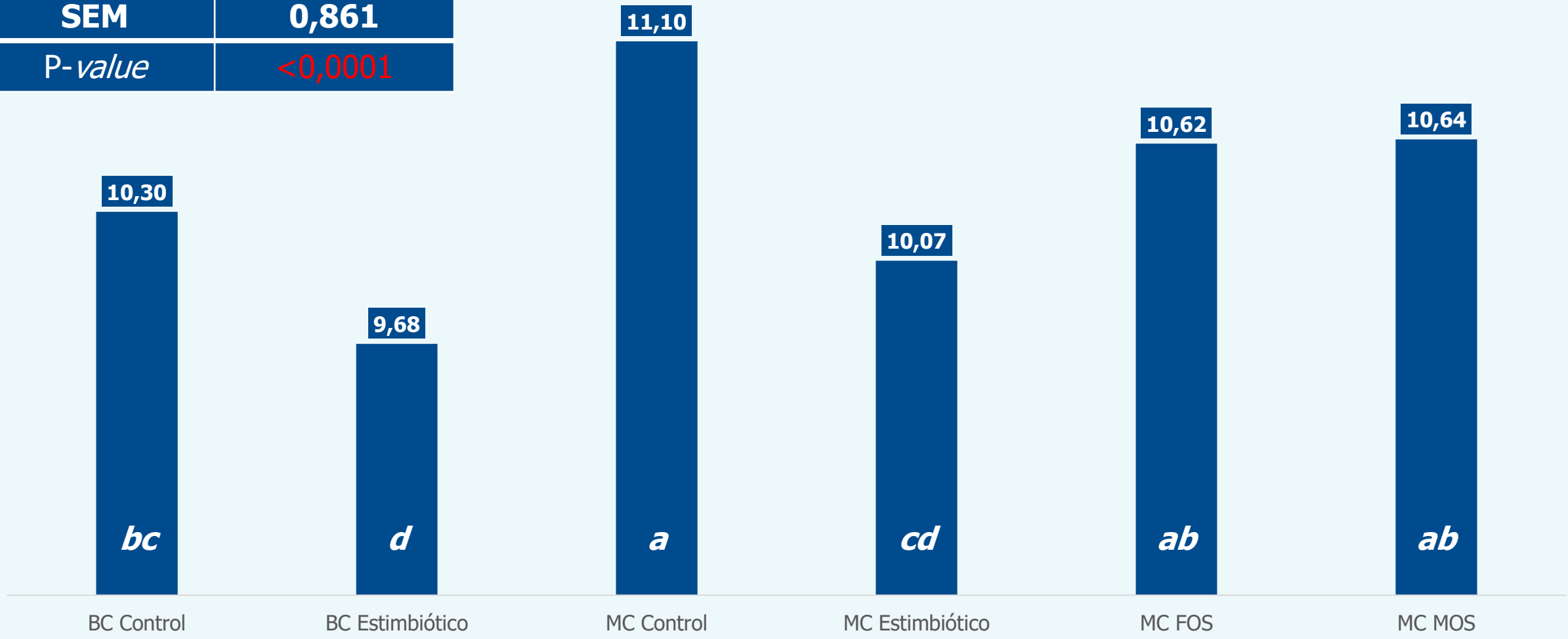
Cho, *et al.*, (2020)

Tratamentos	Ganho de Peso, kg	GPD, g/d	CR, g/d	CA, g/g
BC Control	21,9^{ab}	343^{ab}	541	1,57
BC Estimbiótico	23,0^{a}	370^{a}	551	1,48
MC Control	20,1^{c}	301^{c}	529	1,74
MC Estimbiótico	22,1^{ab}	348^{ab}	526	1,51
MC FOS	21,0^{bc}	322^{bc}	512	1,58
MC MOS	20,9^{bc}	319^{bc}	513	1,60
SEM	1,25	30	128	0,313
P-*value*	0,006	0,006	0,994	0,766

FIBRA DIETÉTICA PARA LEITÕES

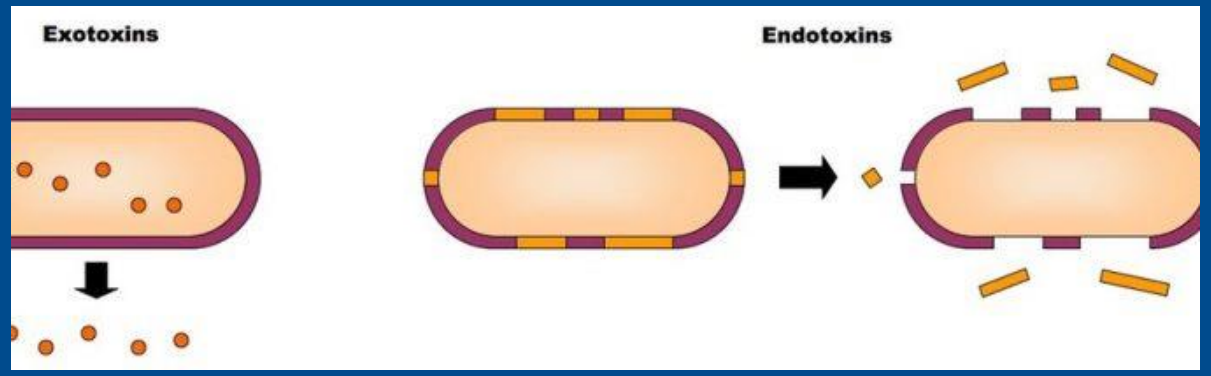
Coeficiente de Variação (%) do Ganho de Peso de Leitões aos 42 dias após o Desmame.

SEM	0,861
P-*value*	<0,0001



FIBRA DIETÉTICA PARA LEITÕES

Efeito da Fibra Dietética na Produção de Imunoglobulinas e Citocinas em Leitões



	Citocinas		
	Característica Anti-Inflamatória		
Endotoxinas	IL-1β	IL-6	TNF-α
	↓	↓	↓

FIBRA DIETÉTICA PARA LEITÕES

Efeito dos tratamentos nos níveis de citocinas pró-inflamatórias plasmáticas (pg/mL) e endotoxinas (EU/ng) em leitões aos 35 dias após o desmame.

Tratamentos	Endotoxinas	IL-1β	IL-6	TNF-α
BC Control	0,73	136	347	42,5^{c}
BC Estimbiótico	0,74	131	332	39,3^{c}
MC Control	2,42	242	387	73,9^{a}
MC Estimbiótico	1,72	157	355	55,9^{bc}
MC FOS	1,98	207	362	68,7^{ab}
MC MOS	2,02	203	368	69,3^{ab}
SEM	1,77	151	199	22,0
P-*value*	0,142	0,321	0,959	<0,001

FIBRA DIETÉTICA PARA LEITÕES

Efeito dos tratamentos nos teores de ácidos graxos voláteis e ácidos graxos de cadeia ramificada (mmol/kg) nas fezes de leitões aos 35 dias após o desmame.

Proteína Ácidos Graxos de Cadeia Ramificada - BCFA	Fibra Ácidos Graxos Voláteis ou de Cadeia Curta - VFA
Histamina	Acético
Espermidina	Propiônico
Putrescina	Butírico
Cadaverina	Valérico
Espermina	

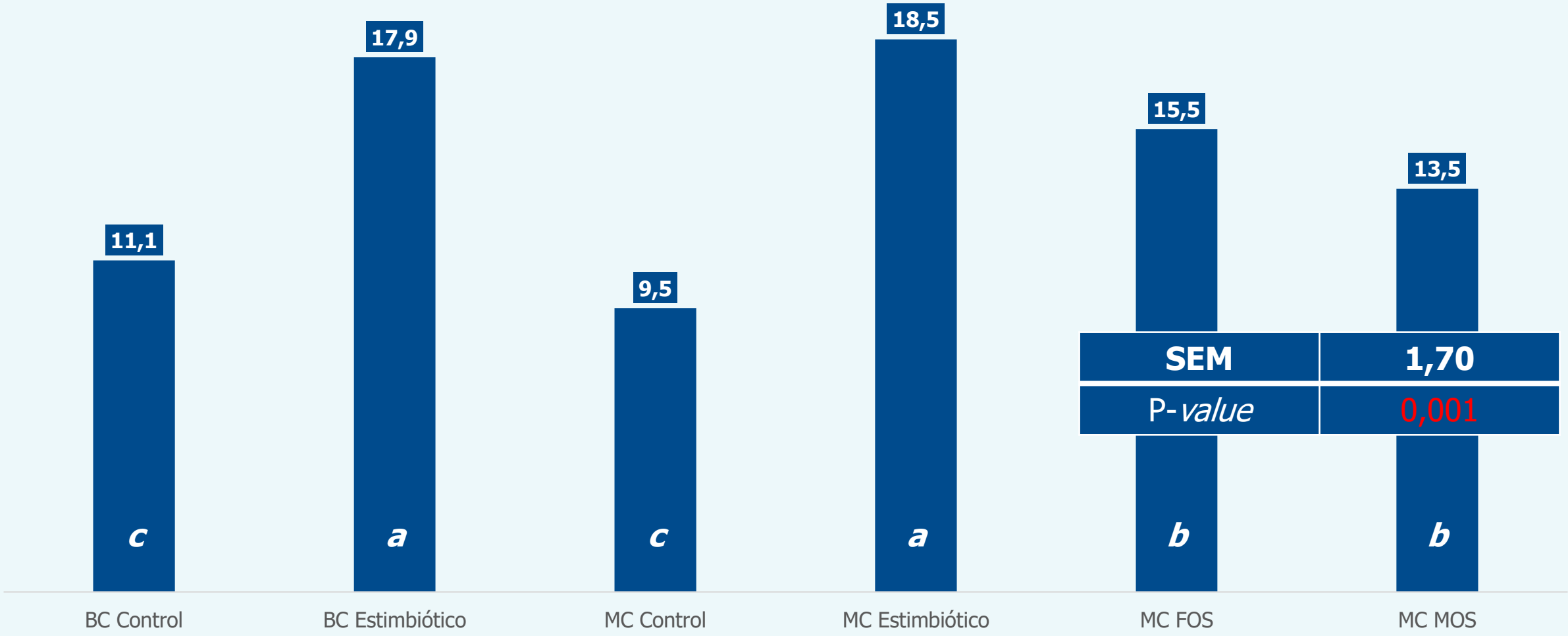
FIBRA DIETÉTICA PARA LEITÕES

Efeito dos tratamentos nos teores de ácidos graxos voláteis e ácidos graxos de cadeia ramificada (mmol/kg) nas fezes de leitões aos 35 dias após o desmame.

Tratamentos	Acético	Propiônico	Butírico	Valérico	BCFA
BC Control	82^{c}	29	3,5	$5,9^{a}$	$11,7^{b}$
BC Estimbiótico	105^{ab}	28	3,6	$3,8^{b}$	$8,4^{d}$
MC Control	90^{bc}	24	3,5	$6,4^{a}$	$13,3^{a}$
MC Estimbiótico	110^{a}	30	3,9	$4,8^{ab}$	$8,5^{d}$
MC FOS	102^{ab}	27	4,1	$5,8^{a}$	$9,6^{cd}$
MC MOS	98^{abc}	25	3,4	$5,3^{ab}$	$10,5^{bc}$
SEM	14,62	6,47	0,56	1,38	1,06
P-*value*	0,028	0,579	0,253	0,042	0,001

FIBRA DIETÉTICA PARA LEITÕES

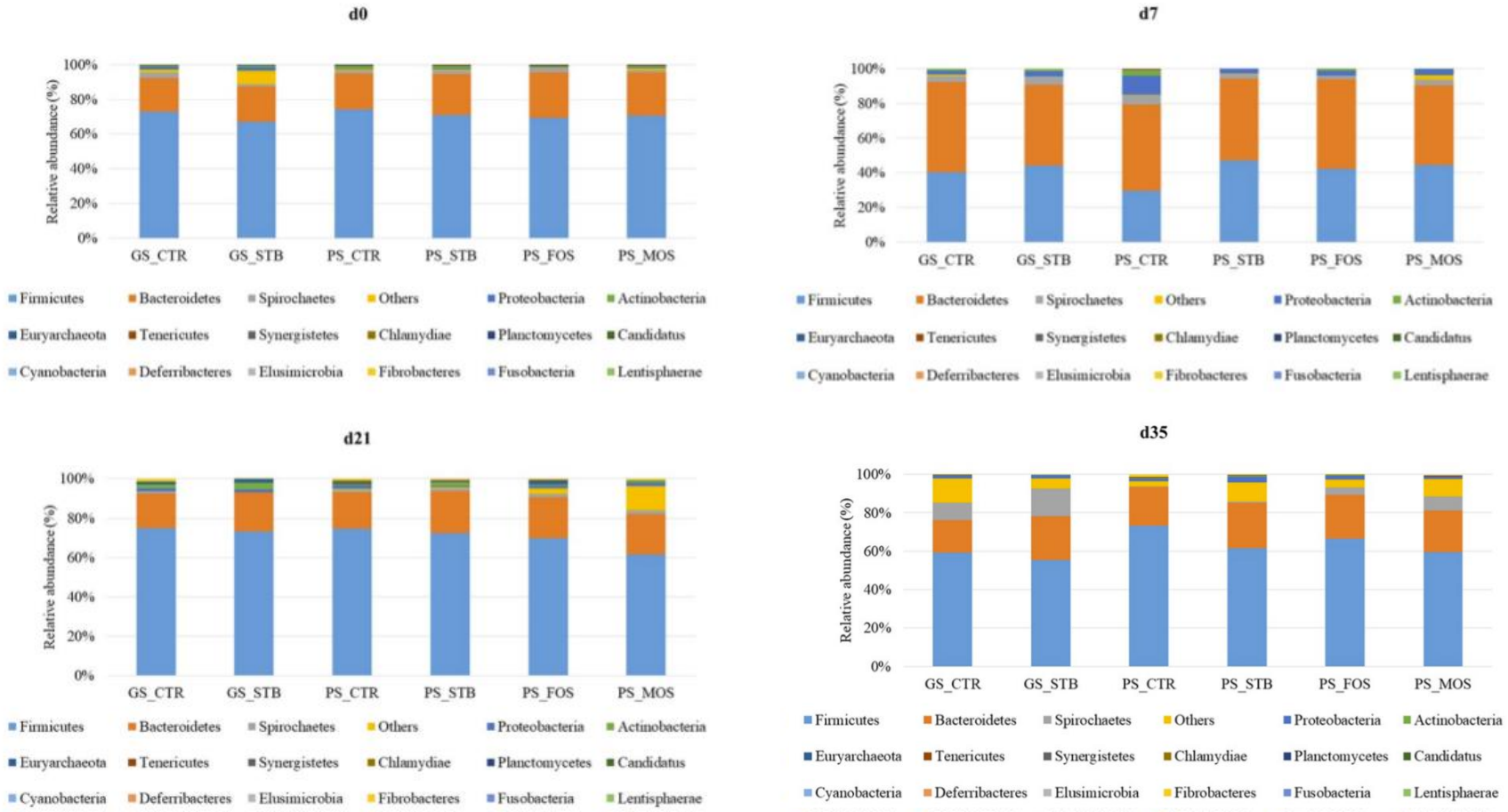
Efeito dos tratamentos na relação de ácidos graxos voláteis:ácidos graxos de cadeia ramificada nas fezes de leitões aos 35 dias após o desmame.



FIBRA DIETÉTICA PARA LEITÕES

Efeito sobre o Microbioma de Leitões

Cho, *et al.*, (2020)



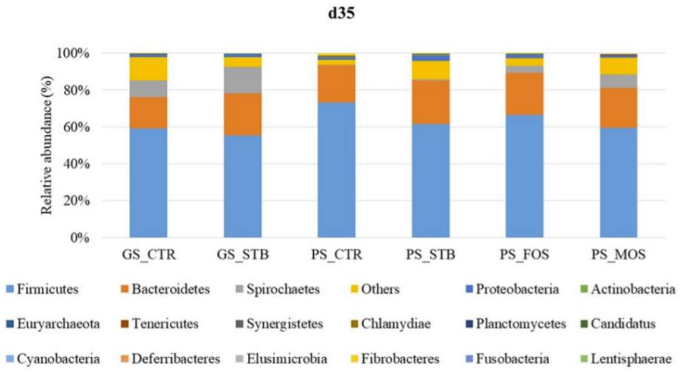
FIBRA DIETÉTICA PARA LEITÕES

Efeito sobre o Microbioma de Leitões

Cho, *et al.*, (2020)

Table 8. Most relevant fibrolytic species promoted or depressed (adjusted $P < 0.05$) based on the Ln changes compared to control treatments[1] in the fecal samples of piglets on d35 of the study[2,3].

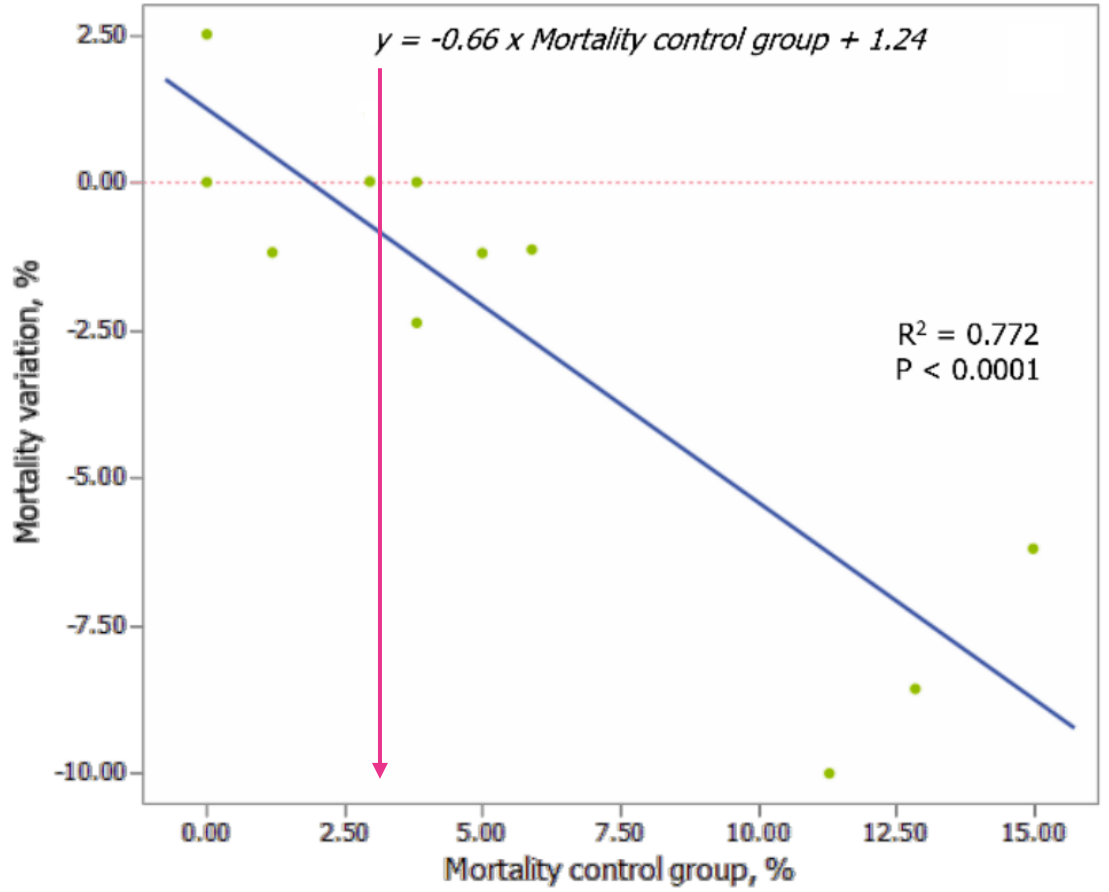
Additives[2]	STB		MOS	FOS
Sanitary condition[2]	GS	PS	PS	PS
Species promoted	*Clostridium cellobioparum*	*Cellulosilyticum ruminicola*	*Fibrobacter intestinalis*	*Fibrobacter succinogenes*
	Butyrivibrio crossotus	*Fibrobacter intestinalis*	*Pseudobutyrivibrio ruminis*	*Eubacterium rectale*
	Intestinimonas butyriciproducens	*Pseudobutyrivibrio ruminis*	*Clostridium cellulolyticum*	*Faecalicoccus acidiformans*
		Faecalibacterium prausnitzii	*Coprococcus eutactus*	
Species depressed		*Fibrobacter succinogenes*	*Eubacterium eligens*	*Faecalibacterium prausnitzii*
			Roseburia hominis	*Butyricicoccus pullicaecorum*
				Roseburia inulinivorans



FIBRA DIETÉTICA PARA LEITÕES

Efeito do incremento da fermentação de fibra sobre a mortalidade de suínos.

	Suínos
N° de ensaios	10
Mortalidade nas observações	13
Anos	2017-2021
Frequência do cereal principal (%)	
Milho	83%
Trigo	-
Outros	17%
Forma de dieta	
Ração peletizada	27%
Ração farelada	73%
Mín.-Máx. de fitase (FTU/kg)	0-2.000
Frequência de antibióticos (%)†	
Não	†
Sim	†
Mín.-Máx. da duração do ensaio (dias)	42 a 158
Mortalidade média do grupo de controle (%)	4,98%
Efeito do Signis na mortalidade (%)*	-2,07%



AB Vista Internal data (2021)

PLOS ONE

RESEARCH ARTICLE

A xilanase como um modulador da microbiota da mucosa e digesta do íleo de suínos alimentados com arabinoxilanos à base de milho. Este efeito é provavelmente através de uma estimulação (Estimbiótico) e mecanismo prebiótico.

Amy L. Petry[1], John F. Patience[1,2], Lucas R. Koester[3], Nichole F. Huntley[1], Michael R. Bedford[4], Stephan Schmitz-Esser[1]*

1 Department of Animal Science, Iowa State University, Ames, Iowa, United States of America, **2** Iowa Pork Industry Center, Iowa State University, Ames, Iowa, United States of America, **3** Department of Veterinary Microbiology and Preventive Medicine, Iowa State University, Ames, Iowa, United States of America, **4** AB Vista Feed Ingredients, Marlborough, Wiltshire, United Kingdom

* sse@iastate.edu

OPEN ACCESS

Citation: Petry AL, Patience JF, Koester LR, Huntley NF, Bedford MR, Schmitz-Esser S (2021) Xylanase modulates the microbiota of ileal mucosa and digesta of pigs fed corn-based arabinoxylans likely through both a stimbiotic and prebiotic mechanism. PLoS ONE 16(1): e0246144. https://doi.org/10.1371/journal.pone.0246144

Editor: Francois Blachier, INRAE, FRANCE

Received: September 28, 2020

Accepted: January 14, 2021

Published: January 27, 2021

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pone.0246144

Data Availability Statement: All relevant data and 16S rRNA gene sequences are available at the National Center for Biotechnology Information Sequence Read Archive under the BioProject ID:

Abstract

The experimental objective was to characterize the impact of insoluble corn-based fiber, xylanase, and an arabinoxylan-oligosaccharide on ileal digesta and mucosa microbiome of pigs. Three replicates of 20 gilts were blocked by initial body weight, individually-housed, and assigned to 1 of 4 dietary treatments: a low-fiber control (LF), a 30% corn bran high-fiber control (HF), HF+100 mg/kg xylanase (HF+XY), and HF+50 mg/kg arabinoxylan oligosaccharide (HF+AX). Gilts were fed their respective treatments for 46 days. On day 46, pigs were euthanized and ileal digesta and mucosa were collected. The V4 region of the 16S rRNA was amplified and sequenced, generating a total of 2,413,572 and 1,739,013 high-quality sequences from the digesta and mucosa, respectively. Sequences were classified into 1,538 mucosa and 2,495 digesta operational taxonomic units (OTU). Hidden-state predictions of 25 enzymes were made using Phylogenetic Investigation of Communities by Reconstruction of Unobserved States 2 (PICRUST2). Compared to LF, HF increased *Erysipelotrichaceae_UCG-002*, and *Turicibacter* in the digesta, *Lachnospiraceae_unclassified* in the mucosa, and decreased *Actinobacillus* in both (Q<0.05). Relative to HF, HF+XY increased 19 and 14 of the 100 most abundant OTUs characterized from digesta and mucosa, respectively (Q<0.05). Notably, HF+XY increased the OTU_23_*Faecalibacterium* by nearly 6 $\log_2$-fold change, compared to HF. Relative to HF, HF+XY increased genera *Bifidobacterium*, and *Lactobacillus*, and decreased *Streptococcus* and *Turicibacter* in digesta (Q<0.05), and increased *Bifidobacterium* and decreased *Escherichia-Shigella* in the mucosa (Q<0.05). Compared to HF, HF+AX increased 5 and 6 of the 100 most abundant OTUs characterized from digesta and mucosa, respectively, (Q<0.05), but HF+AX did not modulate similar taxa as HF+XY. The PICRUST2 predictions revealed HF+XY increased gene-predictions for enzymes associated with arabinoxylan degradation and xylose metabolism in the digesta, and increased enzymes related to short-chain fatty acid production in the mucosa. Collectively, these data suggest xylanase elicits a stimbiotic and prebiotic mechanism.

Petry, *et al.*, (2021)

EFEITOS DA FIBRA DIETÉTICA

Material e Métodos

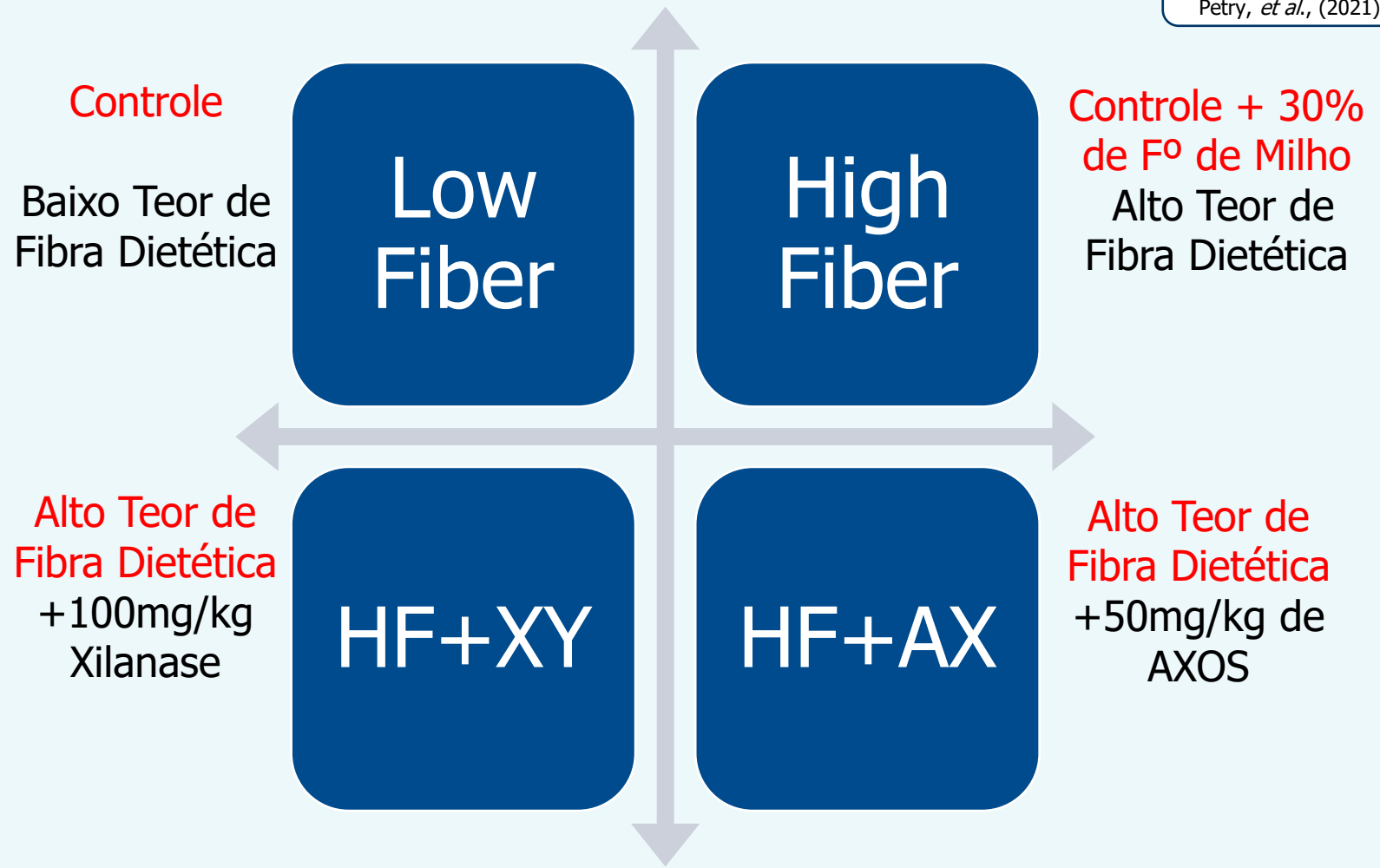
Petry, *et al.*, (2021)

20 Fêmeas

25.4 ±0.9 kg

46 dias

digesta ileal e a mucosa Ileas



Farelo de Milho de Alto Conteúdo de Ingredientes Insolúveis (NDF = 21,9%)

EFEITOS DA FIBRA DIETÉTICA

Efeito de Modulação do Microbioma

Petry, *et al.*, (2021)

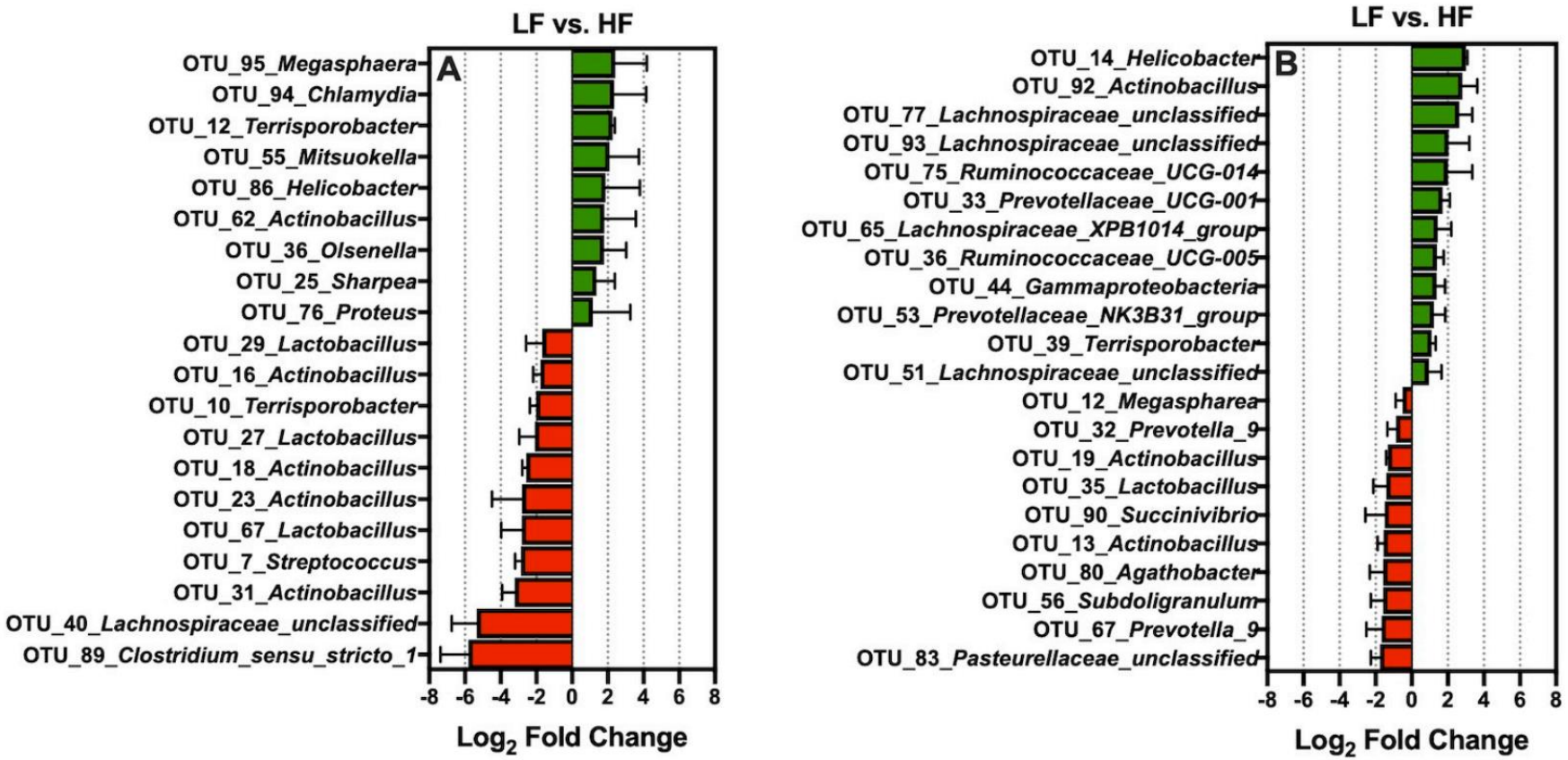


Fig 5. The $\log_2$-fold change difference between LF vs. HF for the significant OTUs from the 100 most abundant OTUs among treatments present in the ileal digesta (A) and mucosa (B).

EFEITOS DA FIBRA DIETÉTICA

Efeito de Modulação do Microbioma

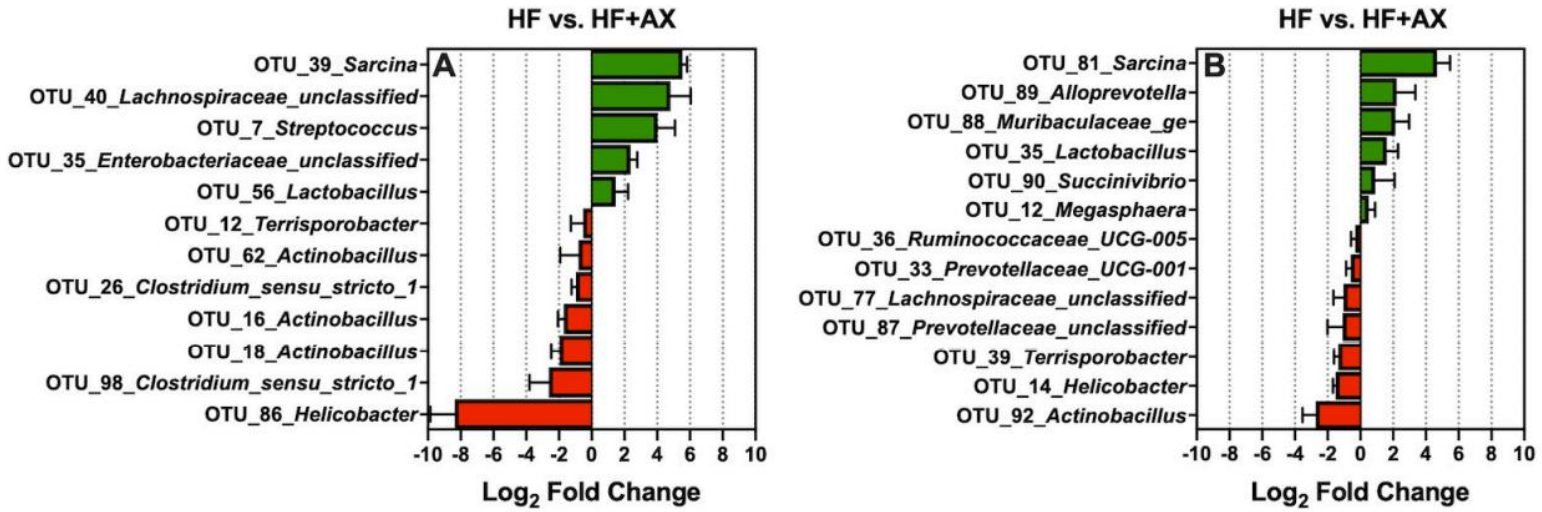
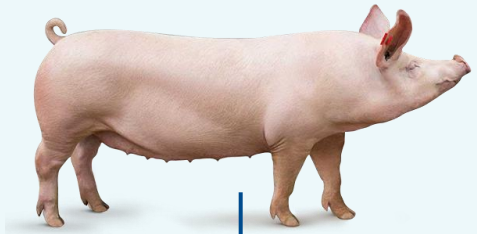


Fig 7. The $\log_2$-fold change differences between HF vs. HF+AX for the significant OTUs from the 100 most abundant OTUs among treatments present in the ileal digesta (A) and mucosa (B).

Conclusão

The most important additive is intelligence

TAKE HOME MESSAGE



Aditivos
Estimbióticos

- Novos *Desafios* *Uni. Monômeras*
- Estratégias de *Nutrição*
- Interação Matriz e Progênie
- Microbioma Intestinal ⇑
- Uso de Novos Aditivos

Crescimento ⇑

Muito Obrigado!

Alexandre Barbosa de Brito
LATAM Technical Manager
alexandre.barbosa@abvista.com

ABVista

The most important additive is intelligence