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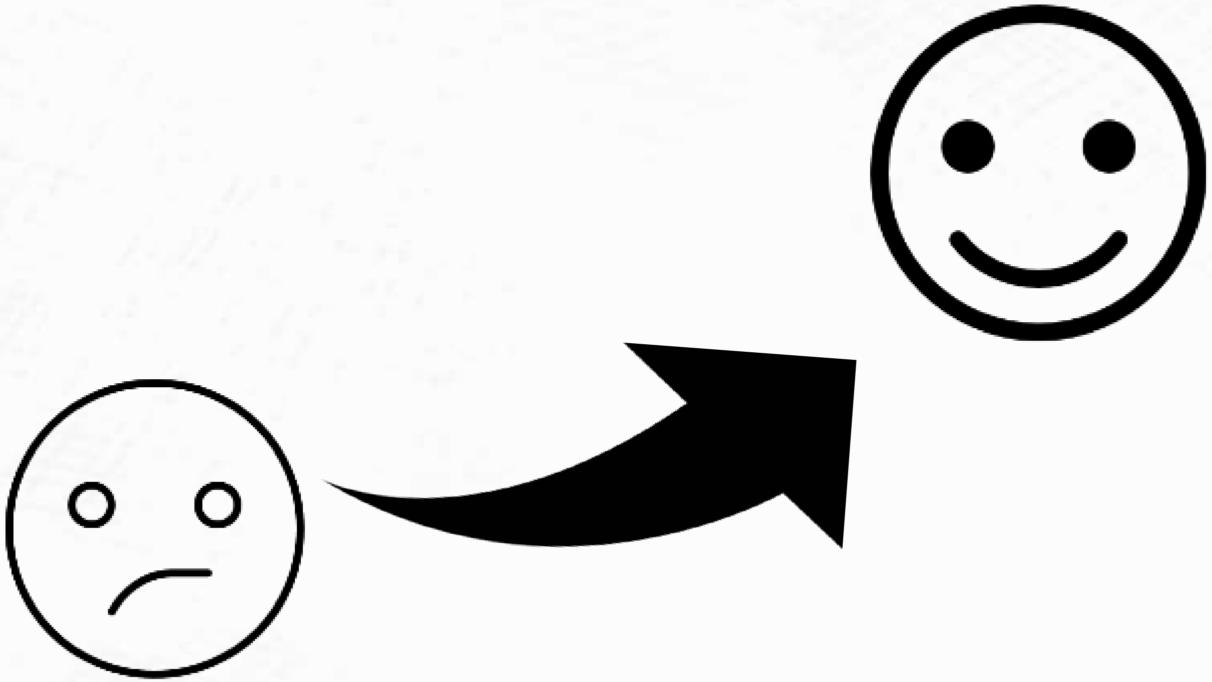
2022

Diego Braña

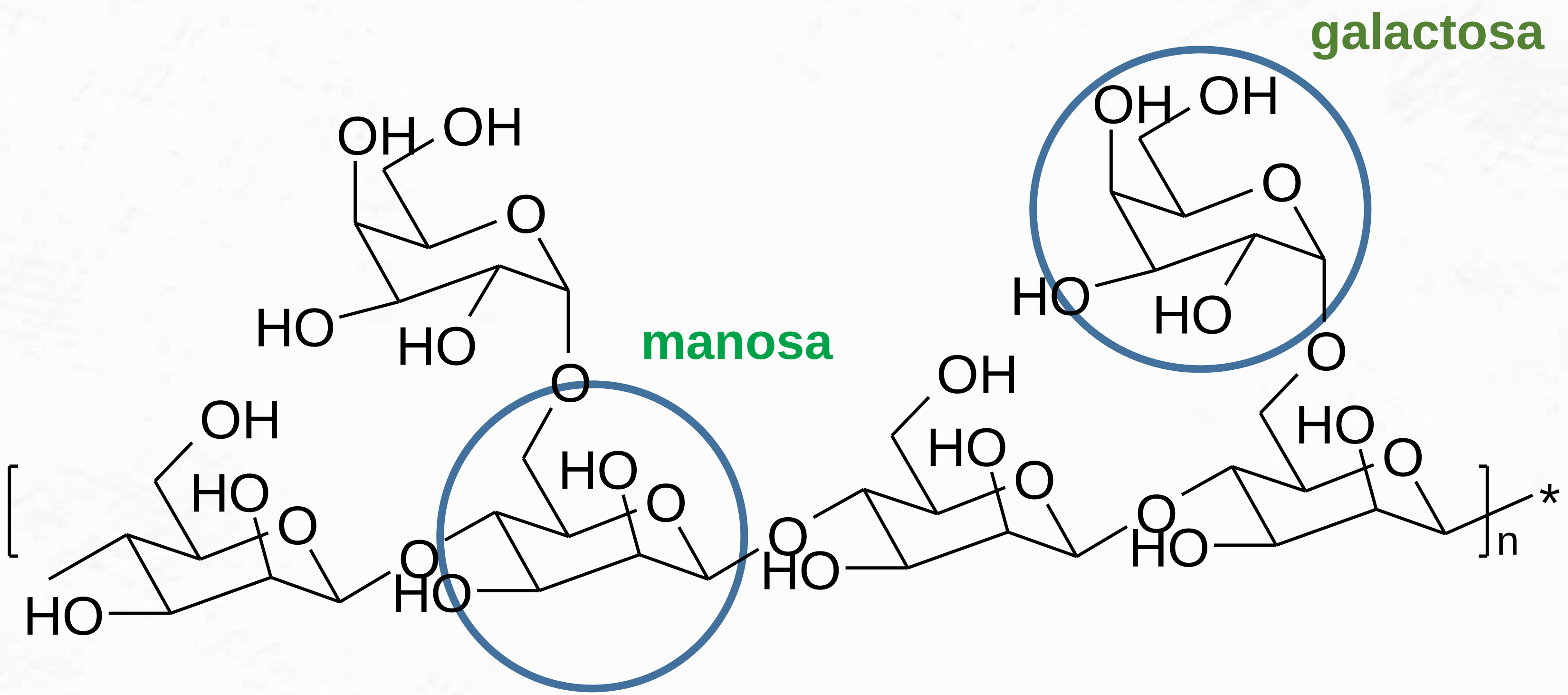
Optimización dietas reduciendo los efectos de los β-mananos.



El paso de Bueno a Excelente…
No es función de las circunstancias,
Si no de elecciones conscientes y de disciplina

Jim Collins, Good to Great

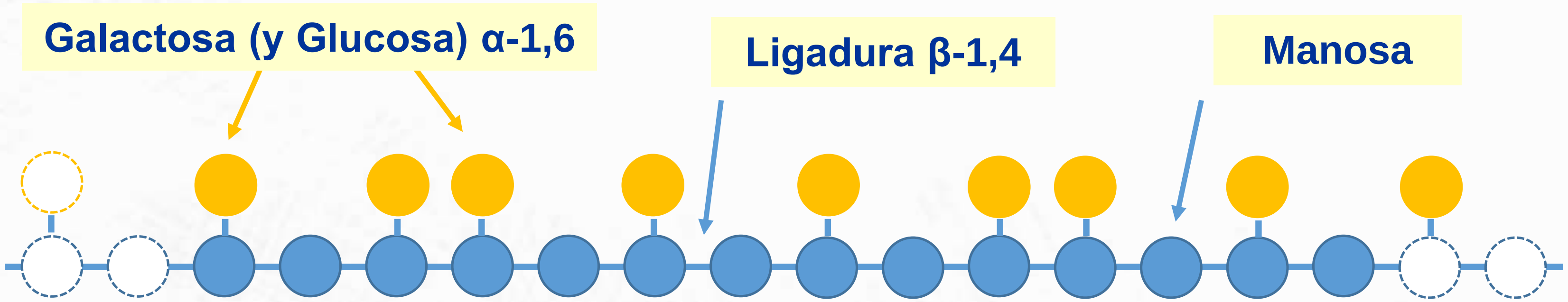
Estructura de un β-galacto-manano



Moléculas de D-manosa unidas con enlaces β-1-4, teniendo moléculas de D-galactosa unidas con enlaces α 1-6, como cadenas laterales.
Las cadenas lineales son de 200 a 500 manosas. Los enlaces β no se degradan por animales

Las β-mananos son fibras antinutritivas

- Fibras de polisacáridos presentes en la mayoría de los vegetales
    - Fibras indigestibles de hemicelulosa
    - Pueden ser solubles o insolubles
    - Cadena lineal de manosa y cadenas laterales de galactosa (la que aumenta solubilidad, viscosidad y antigenicidad a la cadena de manosa)
    - Conocidos como β-galactomanano, β-galactoglucomanano y β-glucomanano



β-galactomanano de la soya

β-Galacto-mananos en diversos organismos

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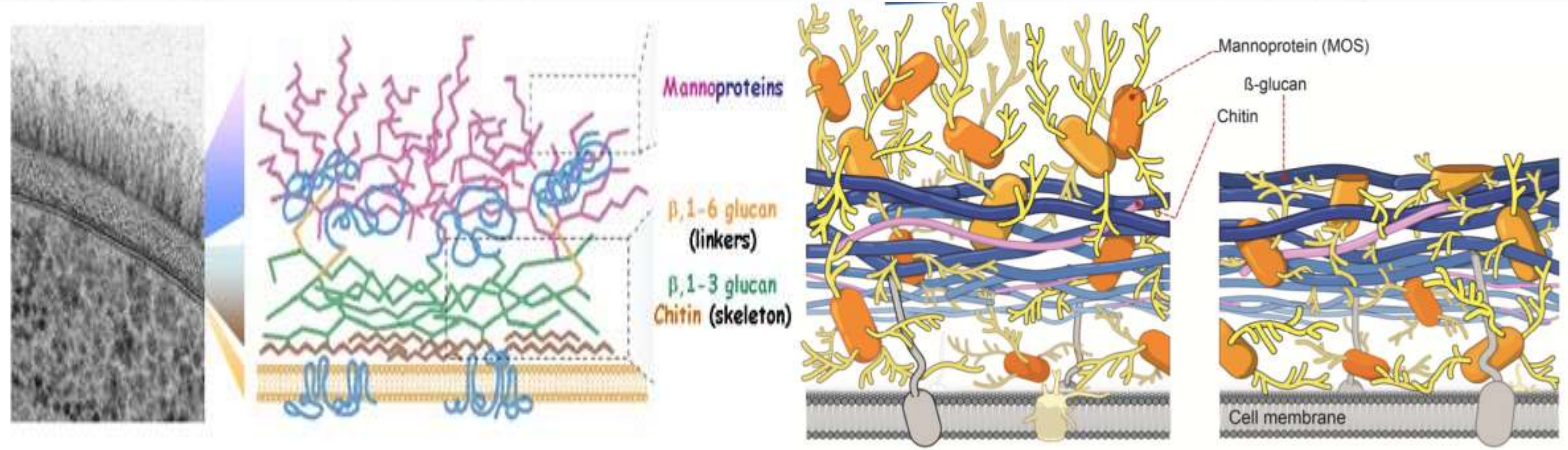
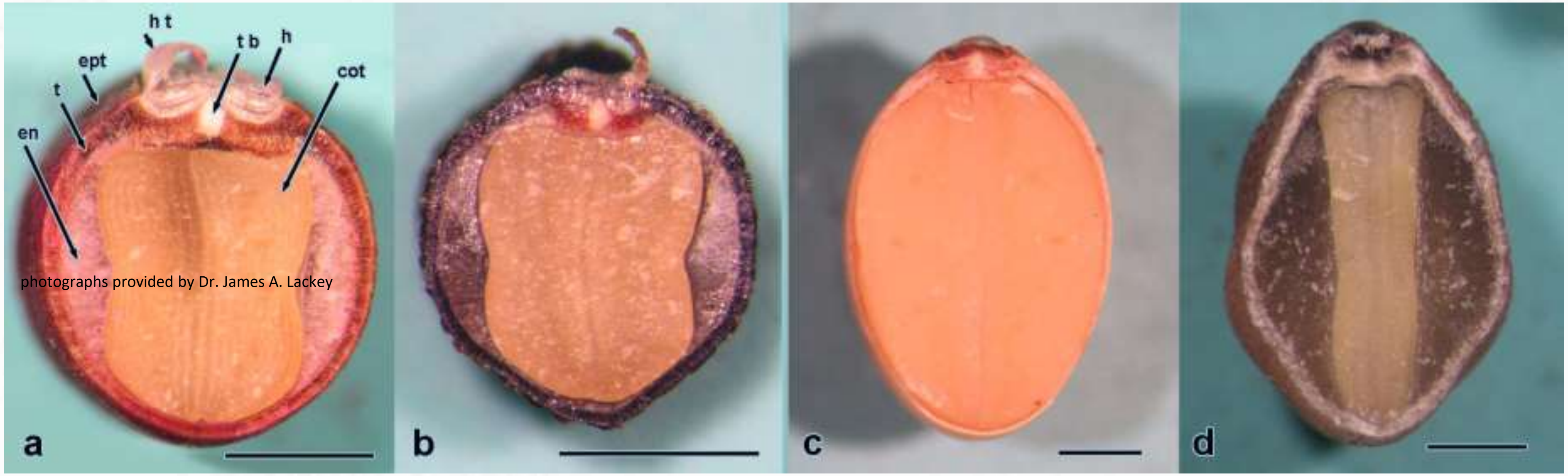
- Además de las plantas, otros microrganismos los producen, por ejemplo bacterias, hongos, levaduras y virus



Los carbohidratos presentes y su tipo de enlace varían entre reinos y especies
Por ejemplo en levaduras los MOS derivan de β-1,3-glucanos, y β-1,6-gluosa y manosa
Otros son poly-(1→6)(1→3)(1→4)-α-Dglucopyranosa

La cantidad y tipo de fibra (solubles e insolubles), varia entre especies, por región (latitud), genética, clima, etc.

La cantidad de endospermo varía entre leguminosas



a) Kudzu; b) Soya silvestre; c) Soya domesticada; d) Guar

Fruto de Palma Africana (oleaginosa), de donde se obtiene el Palmiste

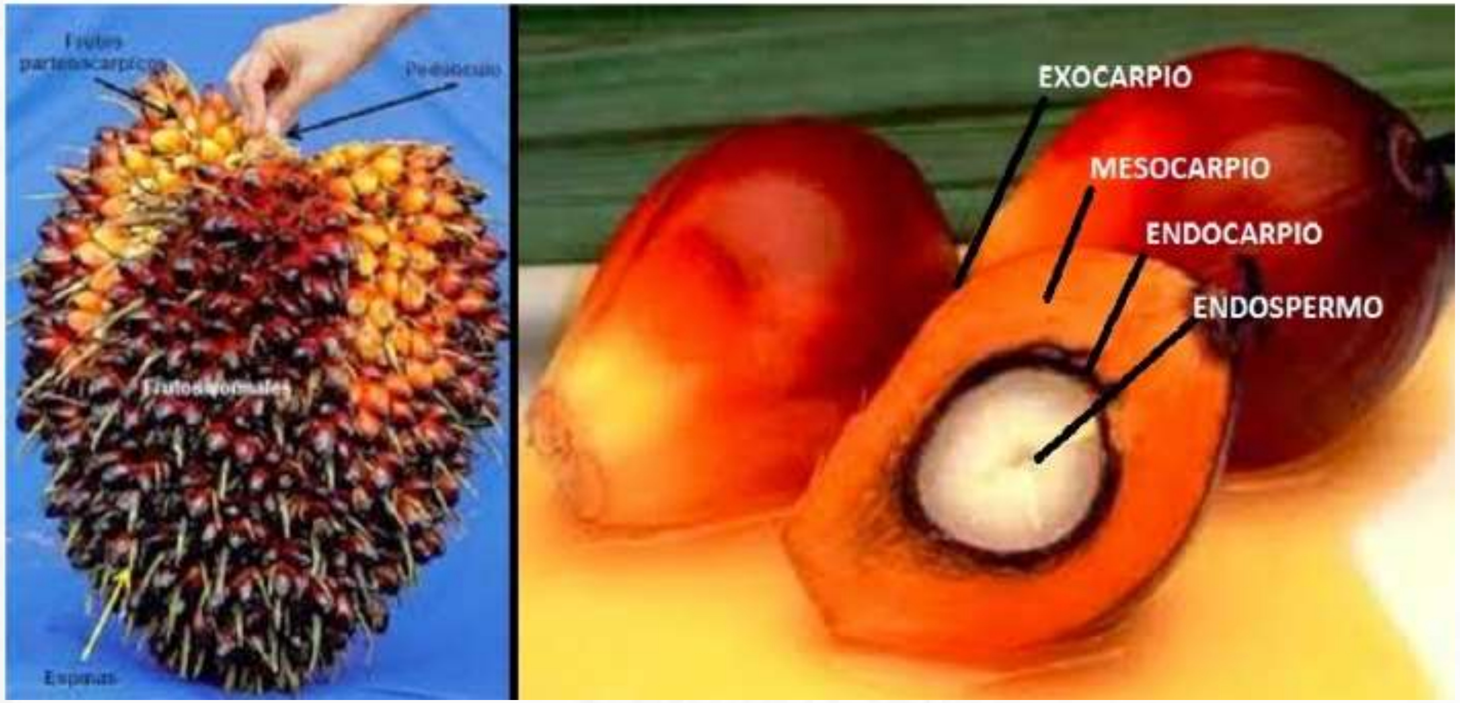


Foto de https://app.emaze.com/@AQTCQRZW#7

El endospermo es el tejido nutricional de la semilla.

Los β-galacto-mananos se usarán como fuente de energía y agua para la germinación

Contenido estimado de β-mananos solubles

Ingrediente	β-mananos, Pct.	Mínimo	Máximo
Cebada	0.42	0.37	0.46
Harina de remolacha	0.22	–	–
Maíz	**0.14**	0.09	0.22
Pasta de gluten maíz	0.17	0.10	0.24
DDGS	**0.57**	0.23	1.09
Avena	0.31	–	–
Palmiste	**7.24**	5.34	10.90
Expeler de Canola	0.13	–	–
Canola , entera	0.08	0.07	0.09
Cascarilla de Soya	**6.67**	6.43	6.91
Pasta de Soya 44% CP	**0.79**	0.38	1.30
Pasta de Soya 48% CP	**0.59**	0.28	1.00
Pasta de Soya, fermentada	0.59	0.58	0.59
Trigo	0.27	0.11	0.42
Salvado de Trigo	0.25	0.21	0.34

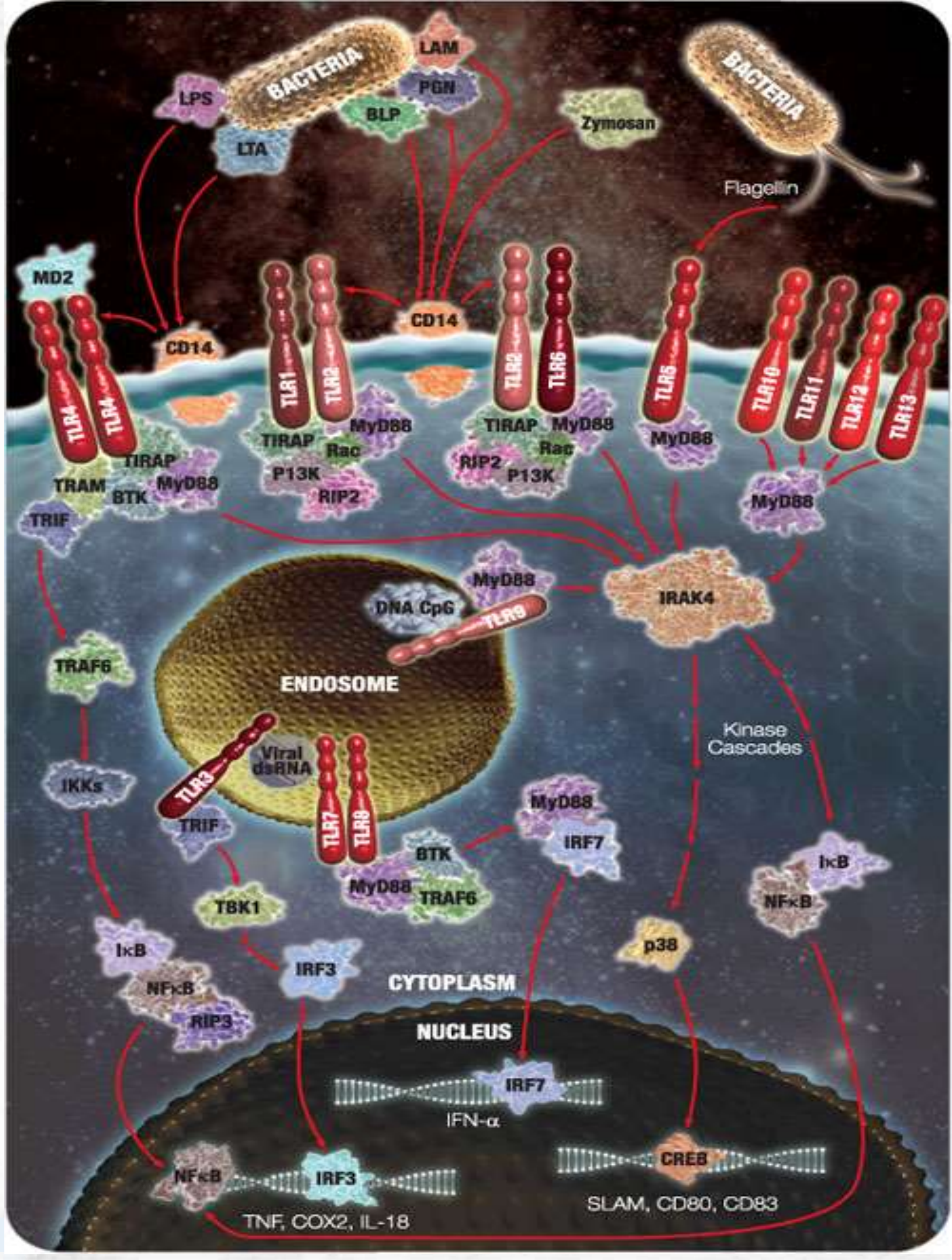
1) β-mananos solubles estimados, % = Manosa Soluble % x 1.5

“Engaño intestinal”

✓Los receptores de Macrófagos, y las células dendríticas **reconocen a los β-galactomananos como un patógeno.**

✓Se genera una respuesta inflamatoria. (Kogut y Klasing, 2009).

✓**Se trata de una “falsa alarma” ya que no hay un desafío real.**



Al activar la Inmunidad Innata

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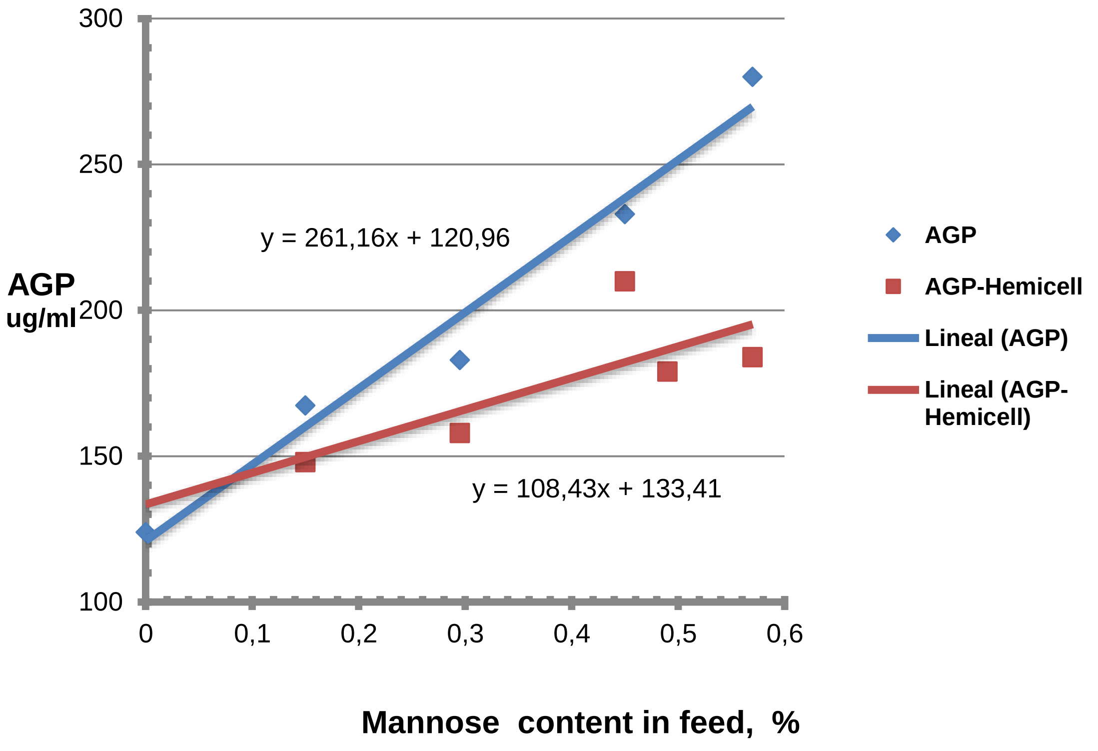
- Se suprime el crecimiento, dando prioridad a funciones de protección
- Los nutrientes se usan para apoyar la respuesta inmune innata
- Esto es regulado por una cascada de eventos:
  - Respuesta Inflamatoria (Fase Aguda)
  - ↓La secreción de IGF-1 e insulina
  - ↓ Digestión y absorción de nutrientes
  - ↓ Crecimiento
  - ↓ retención de nitrógeno



- **Pasta de Soya**
- **Impactos en formulación**

BY IOANNIS MAVROMICHALIS ON SEPTEMBER 27, 2012

Six points for optimal use of soybeans in piglet feed

ıs are an obvious feed choice for pig diets.
r, formulating for piglets can be tricky.

LITERATURE REVIEW

The role of soybean meal hypersensitivity in postweaning lag and diarrhea in piglets

Mark J. Engle, DVM
Audubon-Manning Veterinary Clinic, 1786 190th St., Audubon, Iowa 50025.

Swine Health and Production — Volume 2, Number 4

Immunomodulatory potential of dietary soybean-derived isoflavones and saponins in pigs[1]

Brooke Nicole Smith and Ryan Neil Dilger[2]

Department of Animal Sciences, University of Illinois, Urbana, IL 61801

Soy-derived isoflavones and saponins hold great potential as immunomodulatory compounds that may serve to benefit the efficiency and sustainability of pork production when used as health-promoting feed additives. Although there remain many limitations and unanswered questions, soy isoflavones and saponins could prove to be a valuable health management tool for future swine producers

Dietas altas en soya aportan Isoflavonas similares al 17β-estradiol.

Las principales son Genistein y Daidzein

- **Actividad contra inflamación y oxidación**
- **Actividad antiviral (reducen la infectividad por Reo y Herpes virus)**
- **Evitan la fosforilación de Ocludina y Claudina (integridad intestinal)**

Soy bioactive	Interact with estrogen receptors	Anti-inflammatory properties	Anti-oxidative properties	Anti-viral properties	Anti-protozoal properties	Interact with intestinal epithelial junctions
Isoflavones	Yes; primarily estrogen receptor β[a]	Yes; inhibit tyrosin-specific protein kinase pathways[b]	Yes; inhibit NFκB activation, decrease lipid oxidation, and increase anti-oxidative enzyme activity[c]	Yes; reduce infectivity of rotavirus and herpes simplex virus *in vitro*[d]	No results found for soy isoflavones	Yes; decrease intestinal epithelial permeability[e]

Smith y Dilger, 2018

Soya y la edad del cerdo

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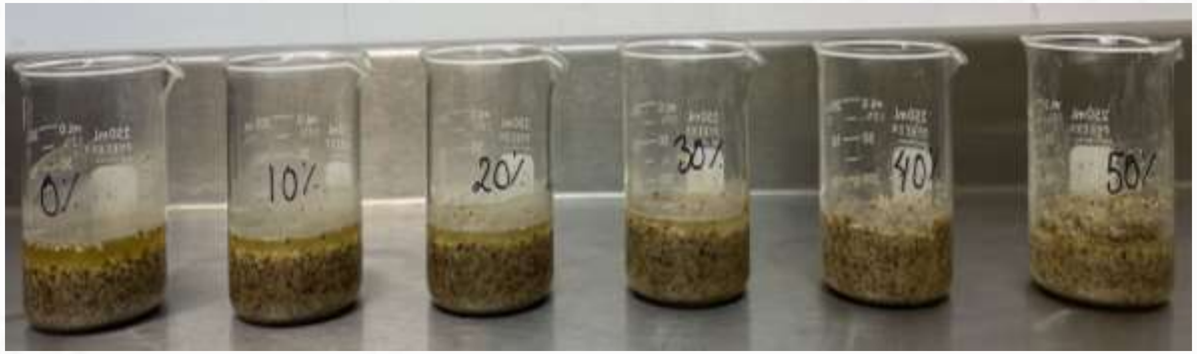
Cambios en el Sistema inmunológico del cerdo “ADAPTACIÓN”. Se caracteriza por una fina especificidad, que se adapta al reconocimiento del patógeno que aparece como un desafío para la homeostasis del individuo.

- Desarrollo del sistema digestivo. Cambios de diámetro y por ende del impacto de la viscosidad de la digesta.
- Microbioma. Aumenta la biodiversidad de la microbiota intestinal y su capacidad de lidiar con diferentes sustratos.
- Entre 30 y 40 kg de peso ya no hay efecto…

Viscosidad

¿Mito o realidad?

- Práctica de laboratorio:
- Comprobación del efecto de la viscosidad de la dieta en laboratorio
- Tome una muestra de alimento y agregue diferentes cantidades de Pasta de Soya (A falta de soya, puede usar cualquier leguminosa, o cascarilla de soya, o canola, etc.)
- Prepare una solución de agua bufferada a pH 4.5
- Disuelva el alimento en agua en una proporción 1:2
- Repose 90 minutos a 39°C, mezclando cada 20 minutos
- Filtre y mida la cantidad de agua recuperada



Harina de Soya, %	0	10	20	30	40	50
Capacidad de retención de agua, Relación	1.30	1.39	1.44	1.58	1.74	1.84

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Harina de Soya, %	0	10	20	30	40	50
Capacidad de retención de agua, Relación	1.30	1.39	1.44	1.58	1.74	1.84

Viscosidad

Característica de los fluidos, que indica su resistencia a deformarse. Resulta de los choques entre partículas que se mueven a diferente velocidad, provocando que se resista al movimiento. La fibra soluble altera la viscosidad de la digesta.

Mercado global de galactamananos

- **Se usan por sus características reológicas en la industria de alimentos y procesos químicos. Globalmente se producen al año más de 1 millón de tons de Guar. Para alimentos, farmacia, papeles, explosivos, etc.   Principalmente por sus efectos ESPESANTES.**
    - Ejemplos: jarabes, gelatinas, embutidos, helados, etc.

Efectos de la viscosidad de la dieta

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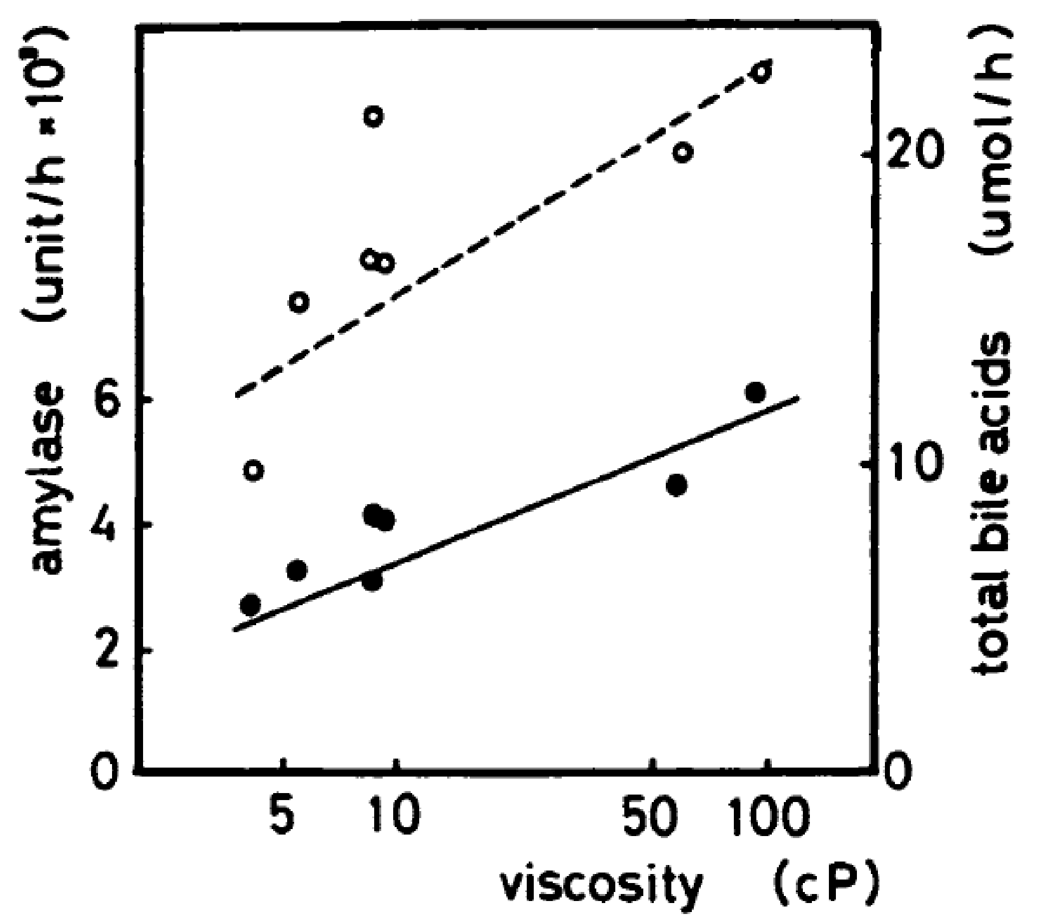
Viscosity of indigestible polysaccharides, experimental diets containing indigestible polysaccharides and gastric and intestinal contents of rats fed the experimental diets[1]

Polysaccharide and diet	Viscosity: Polysaccharides 1% solution	Diets 10% suspension	Gastric contents (50 mL)	Intestinal contents (50 mL)
	cp			
Control (nonfiber)	—	3.75	3.8[a]	4.2[a]
Apple pectin	53.2	16.3	6.6[a]	5.5[a]
λ-Carrageenan	290	58.5	30.2[a]	8.9[a]
Sodium alginate	416	83.6	120.5[b]	8.7[a]
Locust bean gum	1172	30.0	15.1[a]	9.4[a]
Gum xanthan	1900	610	220.3[c]	59.4[b]
Guar gum	932	648	186.3[c]	96.4[c]
Pooled SEM			5.4	7.6

[1]Viscosity of samples (cP = centipoise) was measured by the BL Type Viscometer (Tokyo Keiki, Tokyo, Japan) at 20°C at 30 rpm. Values of polysaccharides and diets are means for triplicate analysis. Values of gastric and intestinal contents are mean of 5–7 rats per group and



Ikegami *et al.*, 1990

Ikegami *et al.*, 1990

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Efectos de la viscosidad de la dieta

Effect of dietary indigestible polysaccharides on final body weight and weight and length of the digestive organs[1]

Diet	Body wt	Organ wt: Stomach	Organ wt: Pancreas	Organ wt: Small intestine	Organ wt: Cecum	Organ wt: Large intestine	Organ length: Small intestine	Organ length: Large intestine
	g	*g/100 g body wt*					*cm/100 g body wt*	
Control (nonfiber)	275.1	0.44^{a}	0.31^{a}	2.44^{a}	0.30^{a}	0.29^{a}	43.9^{a}	4.31^{a}
Apple pectin	260.7	0.42^{a}	0.33^{a}	3.50^{bc}	0.47^{c}	0.33^{ab}	49.1^{bc}	4.85^{ab}
λ-Carrageenan	278.0	0.38^{a}	0.34^{ab}	3.36^{b}	0.38^{ab}	0.38^{bc}	47.1^{ab}	4.93^{ab}
Sodium alginate	260.2	0.62^{b}	0.43^{c}	4.00^{c}	0.41^{bc}	0.35^{bc}	51.3^{cd}	5.10^{abc}
Locust bean gum	264.9	0.44^{a}	0.40^{c}	3.79^{bc}	0.35^{ab}	0.36^{bc}	51.1^{cd}	5.35^{bc}
Gum xanthan	276.1	0.40^{a}	0.39^{bc}	4.55^{d}	0.39^{bc}	0.38^{bc}	53.9^{d}	5.87^{c}
Guar gum	277.6	0.41^{a}	0.40^{c}	5.06^{d}	0.45^{c}	0.40^{c}	53.3^{cd}	5.26^{bc}
Pooled SEM	7.2	0.02	0.02	0.18	0.03	0.02	1.29	0.26

Effect of dietary indigestible polysaccharides on activities of pancreatic digestive enzymes and contents of nucleic acids and protein in the pancreas[1]

Diet	Protein	Enzymes: Amylase	Enzymes: Protease	Enzymes: Lipase	Nucleic acids: DNA	Nucleic acids: RNA	Nucleic acids: RNA/DNA
	mg	*units × 10³*			*mg*		
Control (nonfiber)	191^{a}	28.8^{a}	5.57^{a}	0.284^{ab}	7.56^{ab}	17.2^{a}	2.39
Apple pectin	217^{ab}	32.7^{a}	6.94^{ab}	0.247^{ab}	6.39^{b}	17.8^{ab}	2.66
λ-Carrageenan	261^{b}	30.8^{a}	6.87^{ab}	0.247^{ab}	7.67^{ab}	17.7^{ab}	2.27
Sodium alginate	272^{b}	39.4^{a}	8.68^{bc}	0.336^{ac}	7.47^{ab}	19.5^{abc}	2.65
Locust bean gum	251^{b}	35.6^{a}	7.71^{ab}	0.246^{ab}	7.52^{ab}	19.6^{abc}	2.70
Gum xanthan	259^{b}	45.7^{b}	8.58^{bc}	0.233^{ab}	8.75^{ac}	20.5^{b}	2.41
Guar gum	281^{b}	45.7^{b}	9.73^{c}	0.385^{c}	8.80^{ac}	21.4^{c}	2.51
Pooled SEM	18	4.6	0.70	0.036	0.61	0.9	0.17

Actividad Funcional de Oligosacaridos derivados de β-galactomanos

Journal List > Gut Microbes > v.4(1); 2013 Jan 1 > PMC3555890

gut microbes

Gut Microbes. 2013 Jan 1; 4(1): 72–75.
doi: 10.4161/gmic.22728
PMCID: PMC3555890
PMID: 23137964

Oligosaccharide structure determines prebiotic role of β-galactomannan against Salmonella enterica ser. Typhimurium in vitro

Roger Badia,[1,2] Rosil Lizardo,[1] Paz Martínez,[2] and Joaquim Brufau[1,*]

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See "β-Galactomannan and *Saccharomyces cerevisiae* var. *boulardii* Modulate the Immune Response against *Salmonella enterica* Serovar Typhimurium in Porcine Intestinal Epithelial and Dendritic Cells" in *Clin Vaccine Immunol*, volume 19 on page 368.

This article has been cited by other articles in PMC.

Gut Microbes

- Cepas intestinales patogénicas de *Salmonella* y *E. coli* comparten Fimbrias tipo 1, con alta afinidad por los residuos de Manosa… El reconocimiento de estos residuos permite la adherencia bacteriana a la superficie del enterocito y a su colonización.

- Galacto Mananos de soya para controlar *Salmonella typhimurium*

Contents lists available at ScienceDirect

International Journal of Biological Macromolecules

journal homepage: http://www.elsevier.com/locate/ijbiomac

Modified soybean meal polysaccharide with high adhesion capacity to *Salmonella*

Jenifer Mota Rodrigues [a,b], Maria Eugênia Rabello Duarte [b,*], Miguel Daniel Noseda [b,*]

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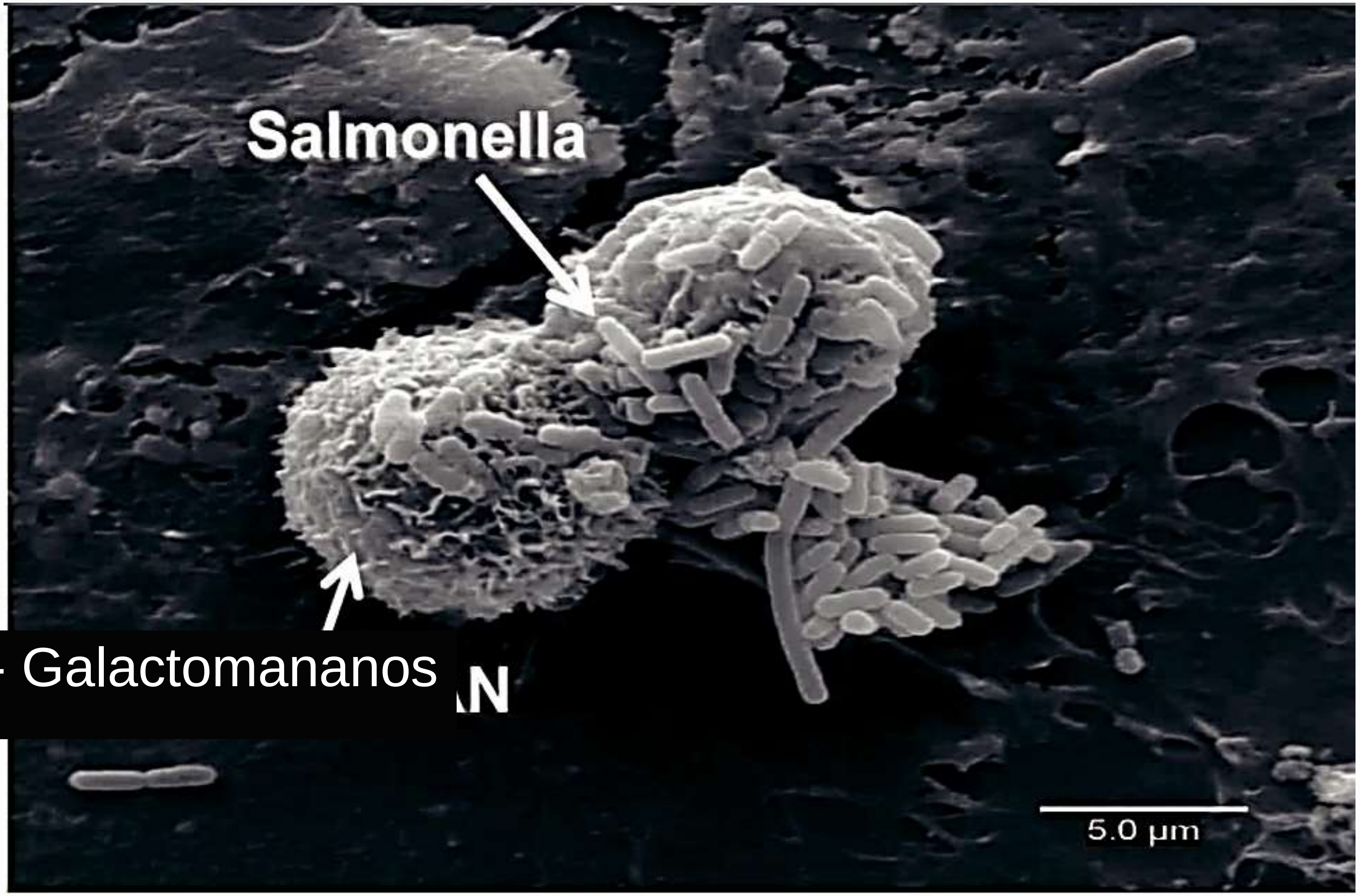
Thermochemical extraction process
Bacterial adhesion capacity

ABSTRACT

Carbohydrates are known to act as analog receptors for bacteria and therefore are promising alternatives for the control and prevention of bacterial infections. The present study evaluated the chemical structure of modified soybean meal polysaccharides and their capacity to adhere enterobacteria (*Salmonella* Typhimurium) and to interfere with the bacteria adhesion to the known analogue receptors, using in vitro assays. For this, soybean meal suspensions were subjected to a thermochemical extraction process and structural analyses showed that the fraction with higher adhesion and adhesion-inhibition potential, SAP, was constituted by two types of polysaccharides: a partially depolymerized pectin, of high molar mass, composed of xylogalacturonan and rhamnogalacturonan regions (SAP1, 545.5 kDa), and a (1 → 4)-linked-β-D-galactan of low molar mass (SAP2, 8.7 kDa). The results showed a high affinity of *Salmonella* for galactans, while high molar mass pectins showed no adhesion capacity. The chemical compositions of the fractions suggested that galactose could be responsible for the recognition process in the adhesion process. Other factors, such as structure and degree of polymerization of the polymers, may also be influencing the adhesion process. Modified soybean meal polysaccharides appear to be a promising alternative agent to antibiotics for the control and prevention of foodborne diseases.

Los Galactomananos libres, se fijan en las fimbrias de bacterias intestinales



- β- Galactomananos

Modificado a partir de “Hydrolyzed vegetal βGALACTOMANNANS to prevent intestinal invasion by Salmonella in poultry.
SERGI CARNÉ, ANNA ZARAGOZA . ITPSA https://itpsa.com/wp-content/uploads/2014/10/B-galactomananos-vegetales-ITPSA-Carne-SA201409webEng.pdf

Dietary β-galactomannans have beneficial effects on the intestinal morphology of chickens challenged with *Salmonella enterica* serovar Enteritidis. Brufau *et al*., 2015 JAS

S-bGM mezcla de B(1-4)-mannosa con galactosa (galactosa : manosa relación 1:4) más una b-mananasa.

The Journal of Nutrition
Nutrient Physiology, Metabolism, and Nutrient-Nutrient Interactions

Salmosan, a β-Galactomannan-Rich Product, Protects Epithelial Barrier Function in Caco-2 Cells Infected by *Salmonella enterica* Serovar Enteritidis[1–3]

M Teresa Brufau,[4] Joan Campo-Sabariz,[4] Ricard Bou,[5] Sergi Carné,[7] Joaquim Brufau,[8] Borja Vilà,[8] Ana M Marqués,[6] Francesc Guardiola,[5] Ruth Ferrer,[4] and Raquel Martín-Venegas[4]*

Efecto benéfico de Mananasa (Hemicell™ HT) para modificar la microbiota de los lechones consumiendo soya

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Table 5. Effects of dietary supplementation of β-mannanase on the count of *E. coil* in ileum and cecum of weaning pigs [1].

Items	Treatment [2]		SEM [3]	*p*-Value
	CON	β-Mannanase		
E. coil counts (log_{10} CFU/g fresh digesta)				
Ileum	7.40	6.68	0.509	0.33
Cecum	8.78	7.32	0.508	0.08

[1] Values represent means of five pigs per treatment (average anatomized BW: 17.17 ± 0.47 kg) slaughtered at d 35 post-weaning. [2] Dietary treatments: CON = basal diet, β-mannanase = basal diet +0.06% β-mannanase. [3] Standard error of the means.

Jang *et al*., 2020

Livestock Science 228 (2019) 187–194

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Effects of β-mannanase supplementation on the intestinal microbiota composition of broiler chickens challenged with a coccidiosis vaccine

C. Bortoluzzi[a], L.B. Scapini[b], M.V. Ribeiro[b], M.R. Pivetta[b], R. Buzim[b], J.I.M. Fernandes[b,*]

[a] Department of Poultry Science, University of Georgia, Athens, GA, United States
[b] Department of Animal Production, Federal University of Parana, Palotina, PR, Brazil

β-mannanase supplementation promotes degradation of feed materials that can be used as prebiotic by beneficial groups of bacteria.

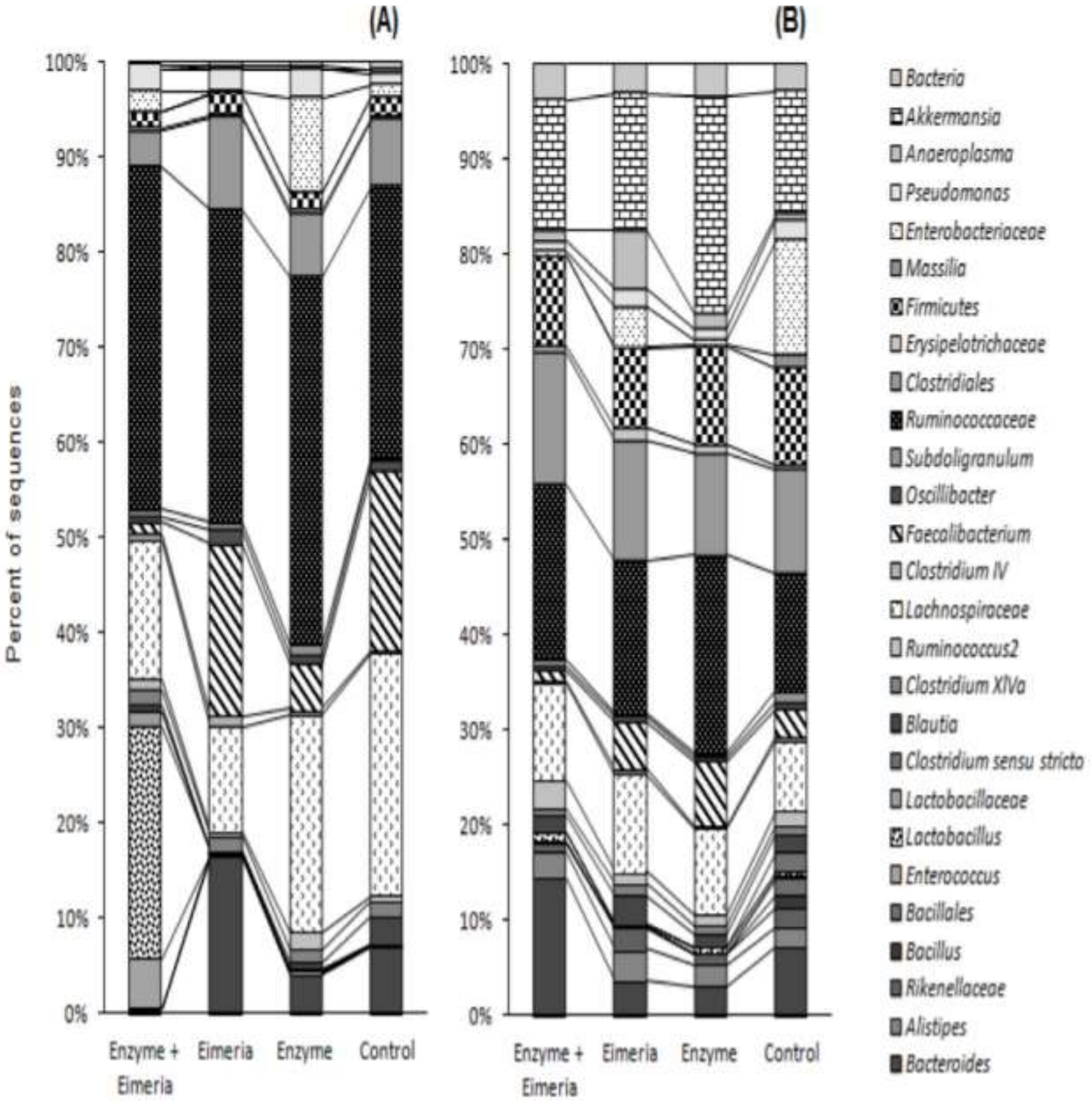

Fig. 3. Distribution of bacteria genera observed in a 16S rDNA large scale library from cecal samples collected from broiler chickens at 21 (A) and 42d (B) old fed diets containing enzyme and challenged or not with *Eimeria*. (4 replicates/treatment and 3 broiler chickens/replicate).

animals

MDPI

Article

Effects of Dietary β-Mannanase Supplementation on Growth Performance, Apparent Total Tract Digestibility, Intestinal Integrity, and Immune Responses in Weaning Pigs

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Received: 31 March 2020; Accepted: 14 April 2020; Published: 17 April 2020

check for updates

Table 3. Effects of dietary supplementation of β-mannanase on apparent total tract digestibility and nitrogen retention in weaning pigs [1].

Items	Treatment [2]		SEM [3]	*p*-Value
	CON	β-Mannanase		
Apparent total tract digestibility (%)				
Dry matter	87.92	87.78	1.148	0.93
Crude protein	86.63	86.56	1.591	0.98
Crude ash	56.14	58.30	4.371	0.74
Crude fat	70.13	76.51	4.783	0.01
Nitrogen (N) retention (g)				
N intake	6.79	7.05	0.058	0.65
Fecal N	0.91	0.95	0.109	0.81
Urinary N	1.77	1.86	0.263	0.81
N retention [4]	4.11	4.24	0.293	0.77

[1] Values represent means of five pigs per treatment (average BW 10.17 ± 1.35 kg). [2] Dietary treatments: CON = basal diet, β-mannanase = basal diet + 0.06% β-mannanase. [3] Standard error of the means. [4] N retention = N intake (g) − Fecal N (g) − Urinary N (g).

Jang *et al*., 2020

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Table 5. Effects of dietary supplementation of β-mannanase on the count of *E. coil* in ileum and cecum of weaning pigs [1].

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Table 4. Effects of dietary supplementation of β-mannanase on intestinal morphology of weaning pigs [1].

Items	Treatment [2]		SEM [3]	*p*-Value
	CON	β-Mannanase		
Jejunum				
Villus height (μm)	369.92	428.75	15.707	0.01
Crypt depth (μm)	244.67	212.50	11.182	0.05
Villus:Crypt ratio	1.58	2.03	0.104	0.01
Ileum				
Villus height (μm)	340.42	378.08	17.499	0.14
Crypt depth (μm)	188.83	191.58	10.862	0.86
Villus:Crypt ratio	1.83	2.08	0.141	0.23

[1] Values represent means of five pigs per treatment (average anatomized BW: 17.17 ± 0.47 kg) slaughtered at d 35 post-weaning. [2] Dietary treatments: CON = basal diet, β-mannanase = basal diet + 0.06% β-mannanase. [3] Standard error of the means.

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