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Galactomannan fenugreek extract as proposed alternative to antibiotics in young rabbits nutrition

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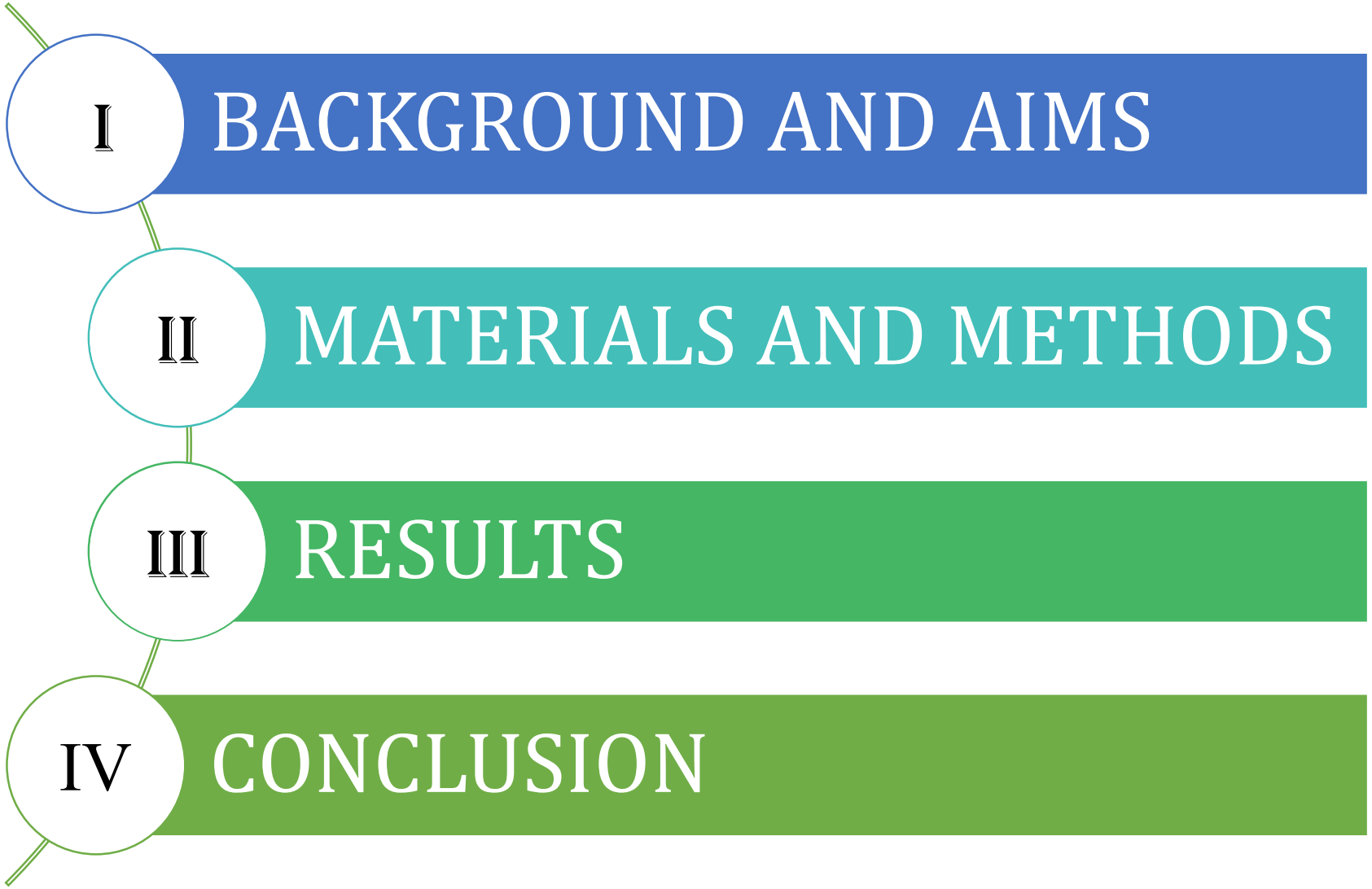
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CONCLUSION

I BACKGROUND

II MATERIALS AND METHODS

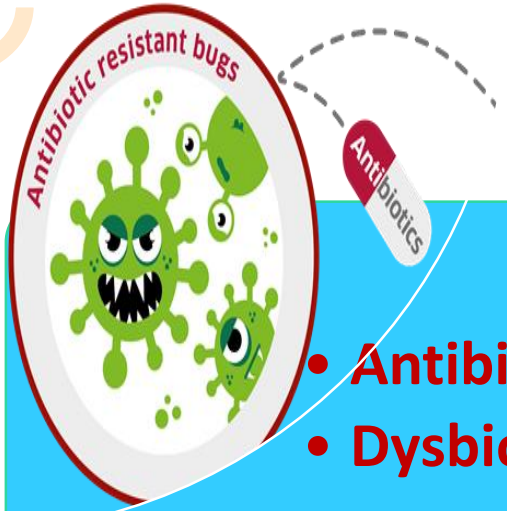
III RESULTS

IV CONCLUSION

- High incidence of digestive diseases

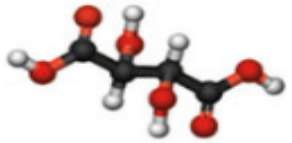
- High dependence on antimicrobials

- Natural alternatives



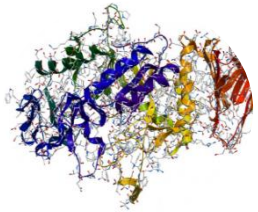
- Antibioresistance
- Dysbiose

Organic acids



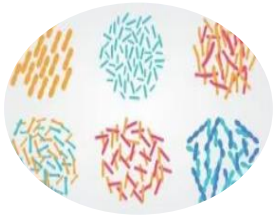
Prebiotics

Enzymes



Antibiotics alternatives

Probiotics

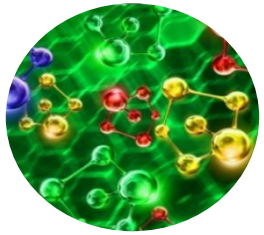


Herbs and spices

Soluble fiber

Insoluble fiber

Essential oils



(Gidenne, 2015)

Prebiotics

Fenugreek galactomannan

Antibiotics alternatives

Soluble fiber

Beet pulp

Insoluble fiber

Grape seeds

Prebiotics ???

Galactomannan

Antibiotics alternatives

Fenugreek Plant

(*Trigonella foenum graecum*)

Fenugreek Seeds

Aqueous Extraction

Has Fenugreek galactomannan really a prebiotic effect ?

- Not digestible by gastrointestinal enzymes
- Highly fermentable by intestinal bacteria
- Selectively stimulates the development and/or activity of intestinal bacteria

Characterization of fenugreek galactomannan (Chemical composition, purity)

In vitro **evaluation of the prebiotic effect of fenugreek galactomannan in diets rich in soluble fiber or insoluble fiber** (No digestibility and high fermentability)

The evaluation of the *in vivo* inclusion of 1% of Fenugreek galactomannan in young rabbit's diet with different levels of soluble fiber on health status, faecal digestibility and caecal activity

BACKGROUND

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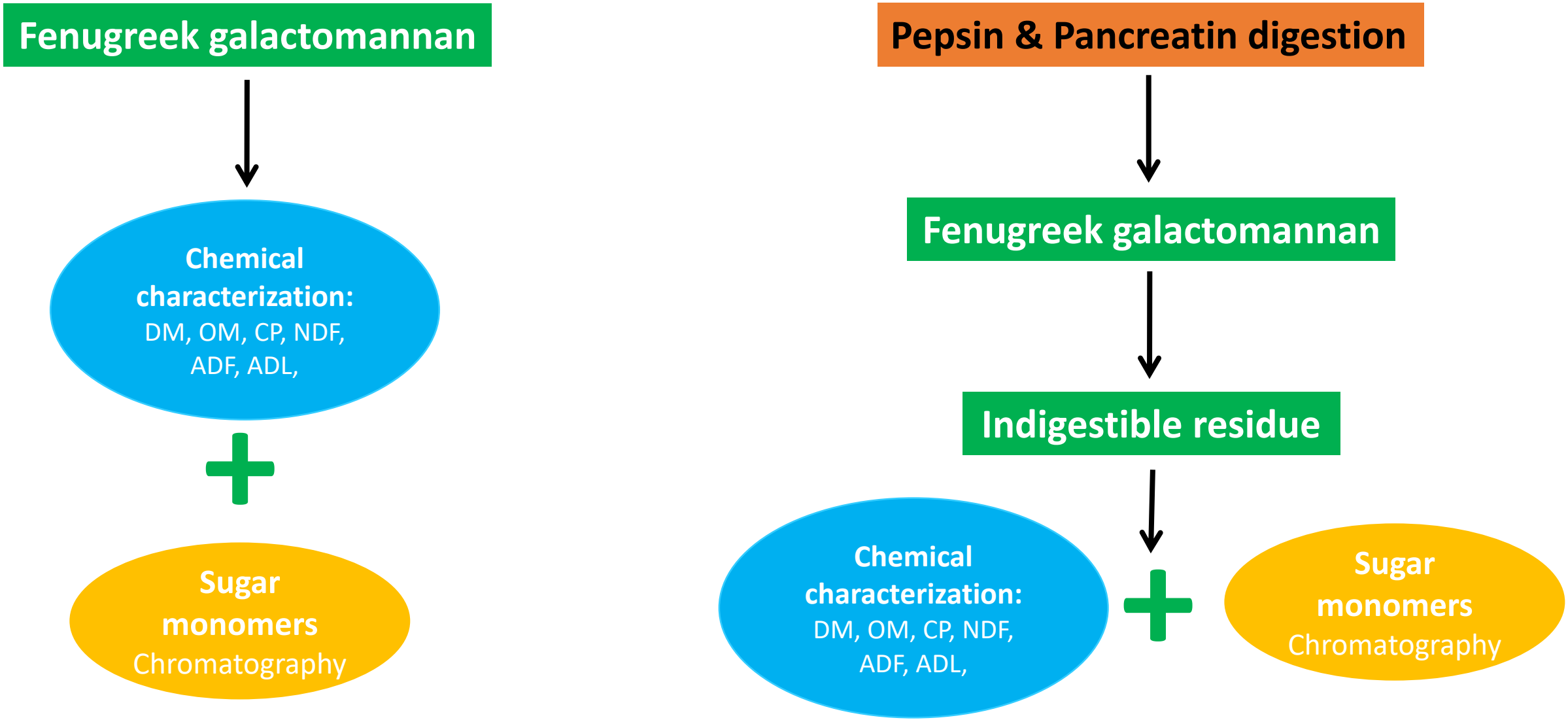
Characterization of fenugreek galactomannan



In vitro evaluation of the prebiotic effect of fenugreek galactomannan: NO-DIGESTIBILITY & FERMENTABILITY

Fenugreek galactomannan: GM

Rabbit feed rich in **BEET PULP** (10 %): SF

Rabbit feed rich in **GRAPE SEEDS** (10 %): IF

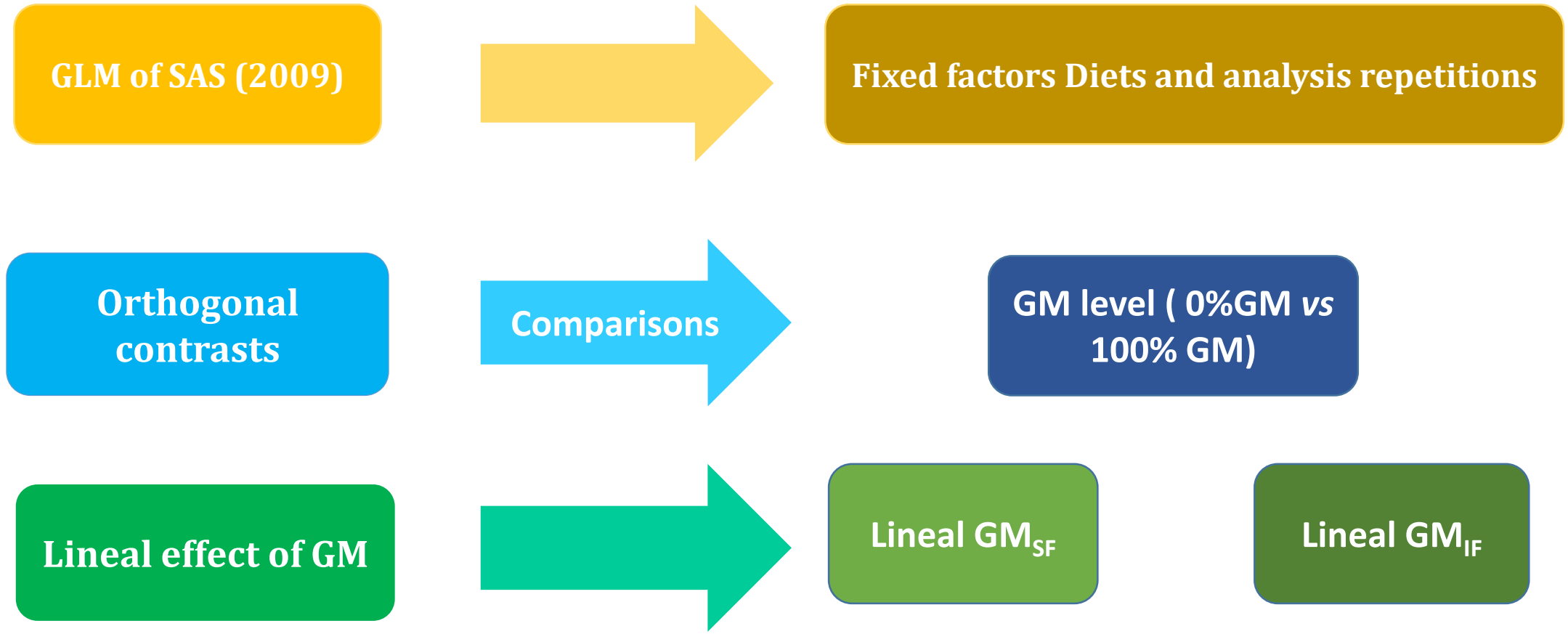
+ **0, 0.5, 1, 1.5 and 2% of GM**

I **Pepsin and pancreatin digestion**

Indigestibles residues

II **Fermentation in rabbit's caecal inoculum:** Pression, pH, VFA, N-NH_3

In vitro data analysis



SF: 10% Beet pulp diet IF: 10% Grape sedes diet GM: Fenugreek galactomannan

In vivo 1% fenugreek galactomannan inclusion: effects on health status, faecal digestibility and caecal activity

Animals	Group 1 (25 gazapos)	Group 2 (25 gazapos)	Group 3 (25 gazapos)	Group 4 (25 gazapos)
Diets without antibiotics	High soluble fiber diet **H**	High soluble fiber diet +1% GM **HGM**	Low soluble fiber diet **L**	Low soluble fiber diet + 1% GM **LGM**

GM: Fenugreek galactomannan

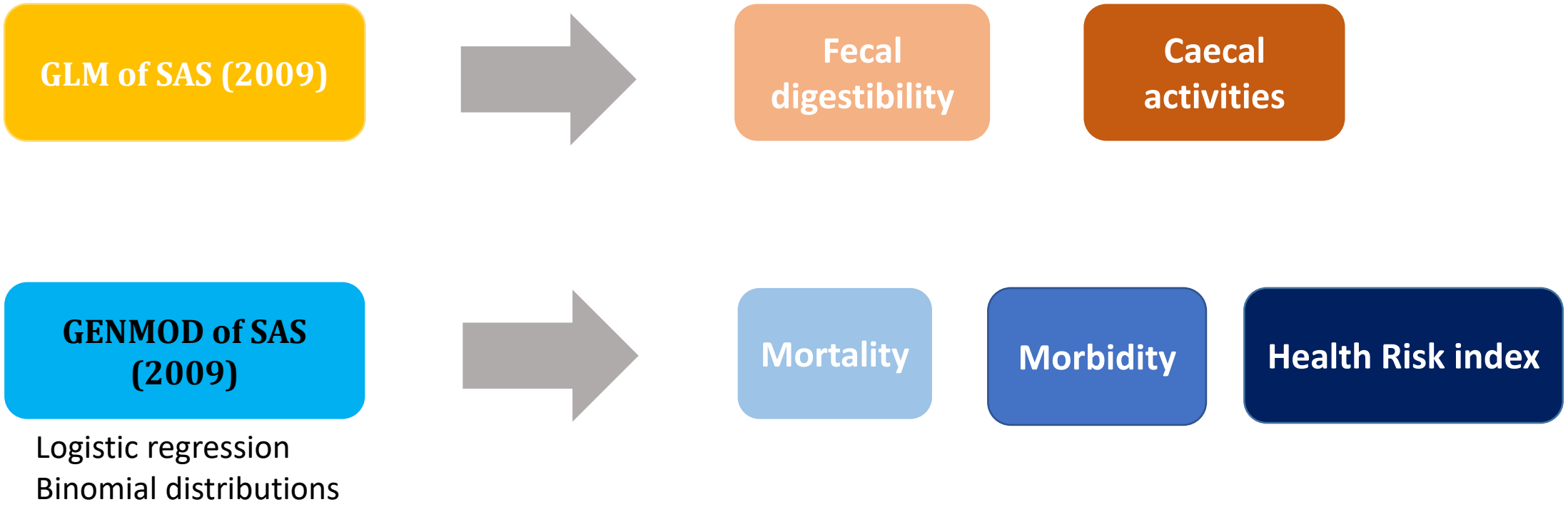
Duration of the trail: weaning, 28 days to 63 day of age

Mortality and morbidity: daily

Faecal digestibility: 49 to 53 days of age (Perez et al., 1995)

Caecal parameters: pH, VFA, N-NH_3 at 63 days of age

In vivo data analysis



Fixed effects: Fenugreek GM level, Fiber level and their interaction

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RESULTS
Characterization

Characterization and no-digestibility of fenugreek GM

	Fenugreek GM	Indigestible residue GM pepsine and pancreatin
Humidity (%)	8.7	7.8
Crude protein (%) DM	22.3	16.4
Mannose (%)	48.5	45.4
Fructose (%)	<0.1	<0.1
Glucose (%)	<0.1	<0.1
Lactose monohydrate(%)	<0.1	<0.1
Maltriose (%)	<0.1	<0.1
Galactose %	51.5	54.6
Galactose/Mannose Ratio	1.1	1.2
Purity (%)	68.8	52.5

84%of fenugreek galactomannan resist to digestion with pepsine pancreatin→ the first condition of the prebiotic effect is validated

RESULTS
IN VITRO

Fermentability of fenugreek galactomannan after digestion

	pH	Pression(mbar)	N-NH_3 mg/ml	tVFA mmol/ml	(%)No-fermentable residue
Indigestible residue of fenugreek GM	5.7^{a}	2.0^{c}	27.0^{a}	46.1^{c}	1.6^{a}
Indigestible residue of soluble fiber diet	6.2^{a}	1.5^{bt}	89.4^{b}	21.3^{b}	58.9^{b}
Indigestible residue of insoluble fiber diet	6.3^{c}	1.3^{a}	102.4^{c}	16.3^{a}	66.5^{c}
P-value indigestible residues	***	***	***	***	***
P-value Reptition	***	***	***	***	***

Level of signification:
* p<0.05
** p<0.01
*** p<0.001

Fenugreek GM is totaly fermentable by rabbit's caecal bacteria→ the second condition of the prebiotic effect is validated

RESULTS
IN VITRO

Effect of fenugreek GM on fermentation parameters

	0% fenugreek GM- 100% fenugreek GM	Lineal fenugreek GM Soluble Fiber	Lineal fenugreek GM Insoluble Fiber
tVFA	-27,32±3,31***	-0.72±2.44	1.79±2.44
Acetic acid	4.27±3.72	-1.84±2.74	0.12±2.74
Propionic acid	-3.08±0.87*	0.85±0.64	0.71±0.64
Butyric acid	-2.12±2.35	0.19±1.73	-0.92±1.73
Isobutyric acid	-0.15±0.06	0.06±0.04	0.01±0.04
Valeric acid	0.26±0.10*	0.20±0.07**	0.03±0.07
Isovaleric acid	-0.49±0.09***	0.08±0.06	0.04±0.06
Caproic acid	1.23±0.39**	0.42±0.28	-0.00±0.28
$N\text{-}NH_3$	69.58±6.29***	12.50±5.41*	2.20±5.41

Level of signification:
* p<0.05
** p<0.01
*** p<0.001

RESULTS
IN VITRO

Effect of fenugreek GM on in vitro fermentation parameters

	0% fenugreek GM - 100% fenugreek GM	Lineal fenugreek GM Soluble Fiber	Lineal fenugreek GM Insoluble Fiber
tVFA	-27,32±3,31***	-0.72±2.44	1.79±2.44
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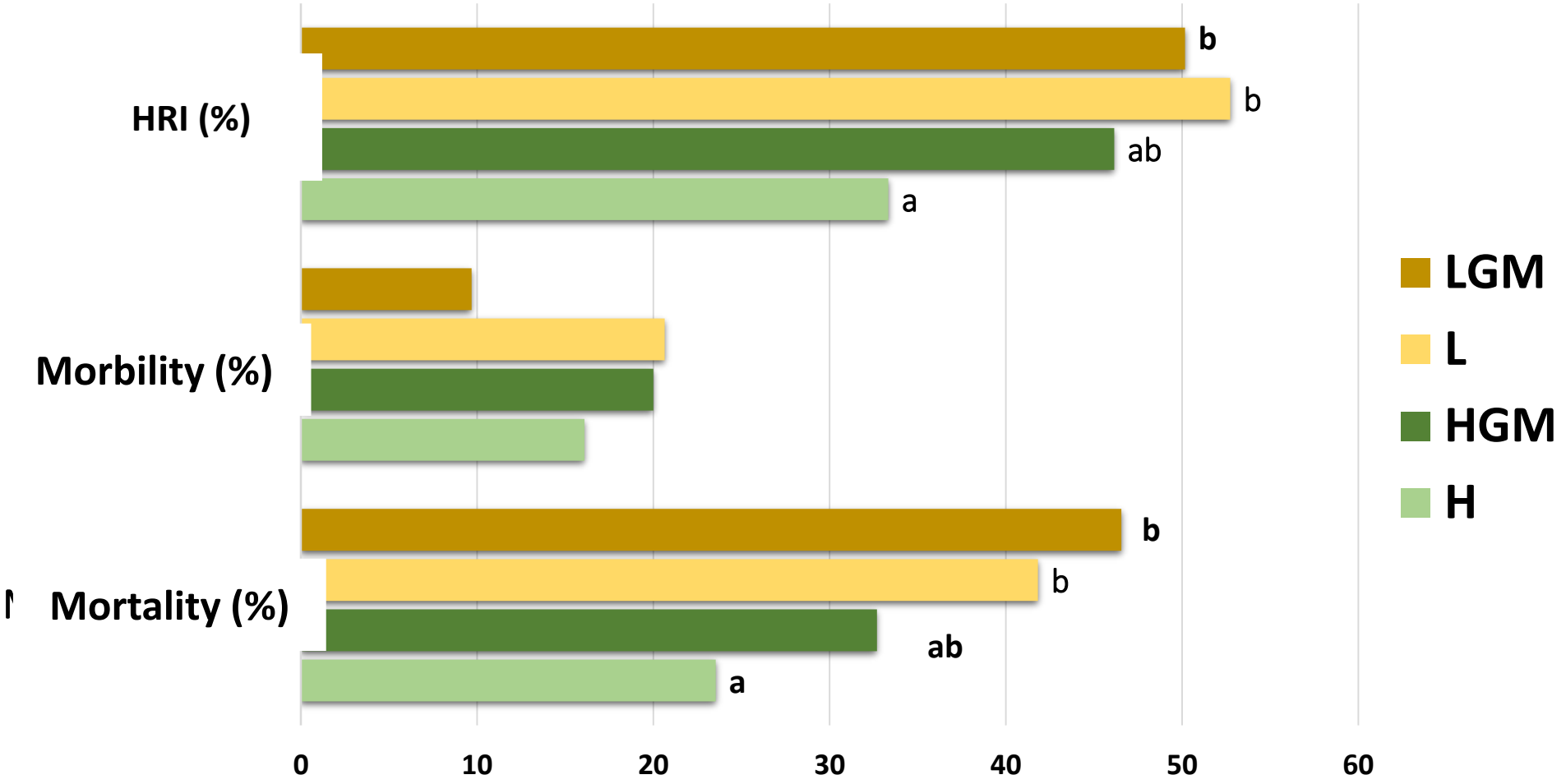
$N\text{-}NH_3$	69.58±6.29***	12.50±5.41	2.20±5.41

Level of signification: * p<0.05; ** p<0.01; *** p<0.001

The increasing levels of fenugreek GM affects significantly medium chain fatty acids and $N\text{-}NH_3$ → possible effect on caecal microbiota

RESULTS
IN VIVO

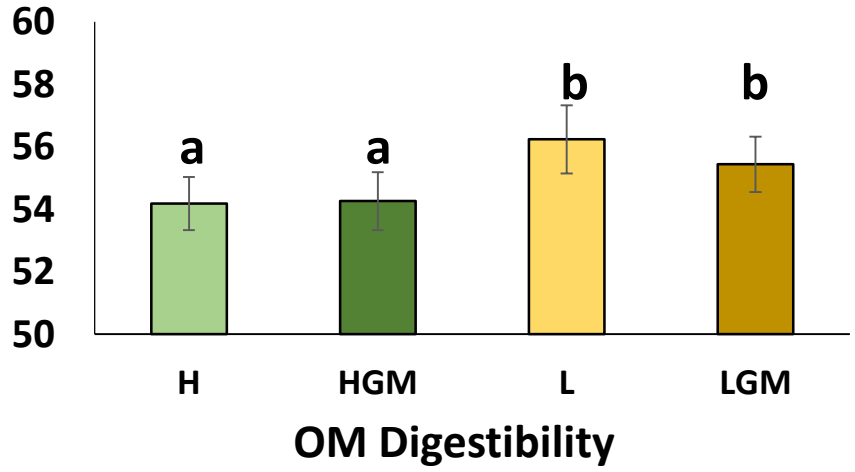
Mortality, morbility and health risk index (HRI)

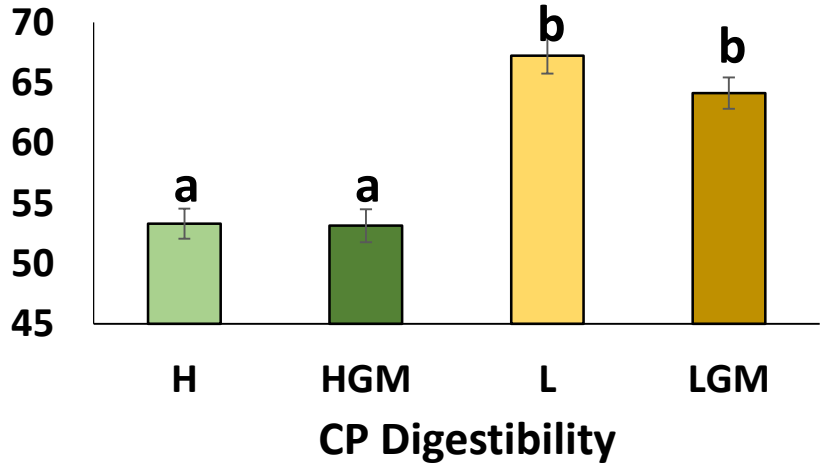


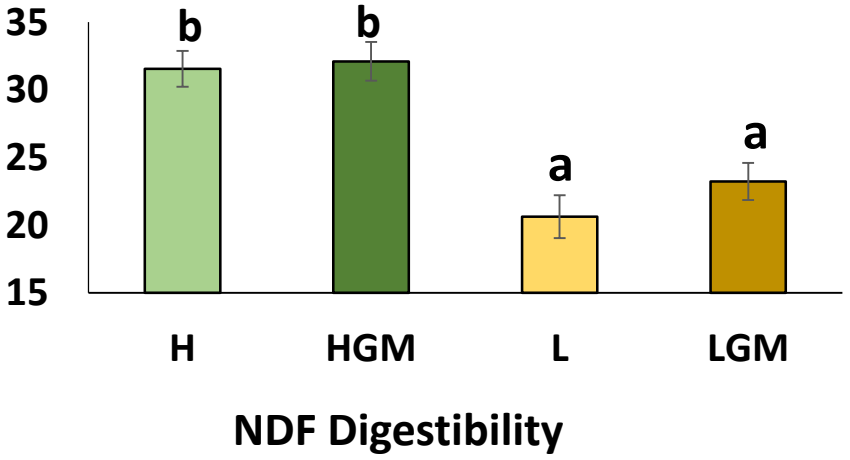
High soluble fiber diets decrease the risk of digestive disorders

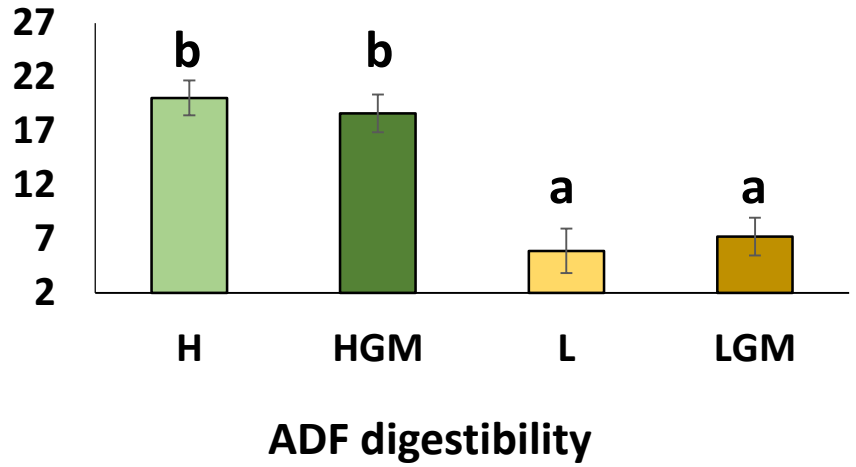
RESULTS
IN VIVO

Apparent faecal digestibility (%DM)









LGM increases (P>0.05) NDF digestibility with 2.6 and ADF digestibility with 1.3

RESULTS
IN VIVO

Rabbit's caecal activity parameters

	Pelleted Feed				P-value	
	H	HGM	L	LGM	Fibra	GM
pH	5.87±0.03	5.87±0.03	5.89±0.03	5.88±0.03	0.420	0.843
tVFA	53.78±1.68	53.86±1.74	44.64±1.81	44.02±1.81	<0.001	0.878
Acetic,%	81.22±0.01	81.7±0.01	77.59±0.01	76.19±0.01	<0.001	0.568
Propionic,%	4.14±0.00	4.17±0.00	3.86±0.00	3.87±0.00	0.061	0.896
Butiric,%	13.11±0.01	12.9±0.01	16.7±0.01	17.76±0.01	<0.001	0.526
Caproic, %	0.39±0.00	0.37±0.00	0.83±0.00	1.15±0.00	<0.001	0.010
N-NH_3,mg/L	35.18±8.47	35.75±8.83	92.45±8.64	105.21±8.83	<0.001	0.445

Caproic acid decreases coliform bacteria in the caecum and feces of animals infected with enteropathogenic strain of *E.Coli O103* **(Skrivanova et al., 2008)**

According to **Stewart et al. (1993) y Williams et al. (2000)**, short chain fatty acids are the main products of carobohydrates fermentation and for that they need a big amount of N-NH_3 as a source for microbial activity which could explain the low concentration of N-NH_3 in high soluble fibers diets **H** and **HGM**

→possible changes in caecal microbiota

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Conclusion

Our Fenugreek galactomannan:

- ❑ Not digestible by stomach and hindgut enzymes
- ❑ Fully fermented by caecal bacteria
- ❑ Enhances fiber fractions digestion
- ❑ Affects medium chain fatty acids concentration in the caecum which suggests a different microbial activity in the presence of GM

➔ **Future results of caecal microbiota composition**

Thanks For Your Attention!