THE EFFECT OF LOCAL SEAWEED ON GROWTH PERFORMANCE IN NEWLY WEANED PIGLETS

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WEANING IS A PIG CHALLENGE

WEANING

(removal from sow)

→

Leads to changes in:

ENVIRONMENT

Pathogen load
Pen mates

IMMUNOLOGICAL PROTECTION

No maternal antibodies
Developing immunity

FEED

No milk
Physical form
Nutrient composition

→

Ultimately leads to:

REDUCE IN FEED INTAKE
+
REDUCE IN GAIN
+
INCREASE DIARRHEA

BAN ON MEDICAL ZINC...

Rhouma et al., 2017; Jayaraman and Nyachoti, 2017

SEAWEED MEAL: NUTRITIONAL VALUE

Macronutrient composition of seaweeds used in this experiment

	Unit	Ulva lactuca	Ascophyllum nodosum	Saccharina latissima
Dry matter	g/100g	94.54	93.24	91.51
NDF	g/100g DM	29.62	20.98	5.56
ADF	g/100g DM	9.85	21.86	15.49
Ash	g/100g DM	57.58	31.69	37.29
Fat	g/100g DM	1.06	3.22	1.53
Nitrogen	g/100g DM	2.24	1.95	2.11
Crude protein	g/100g DM	14.02	12.20	13.22

ADF =Lignin, cellulose.
NDF = Lignin, cellulose, hemicellulose.

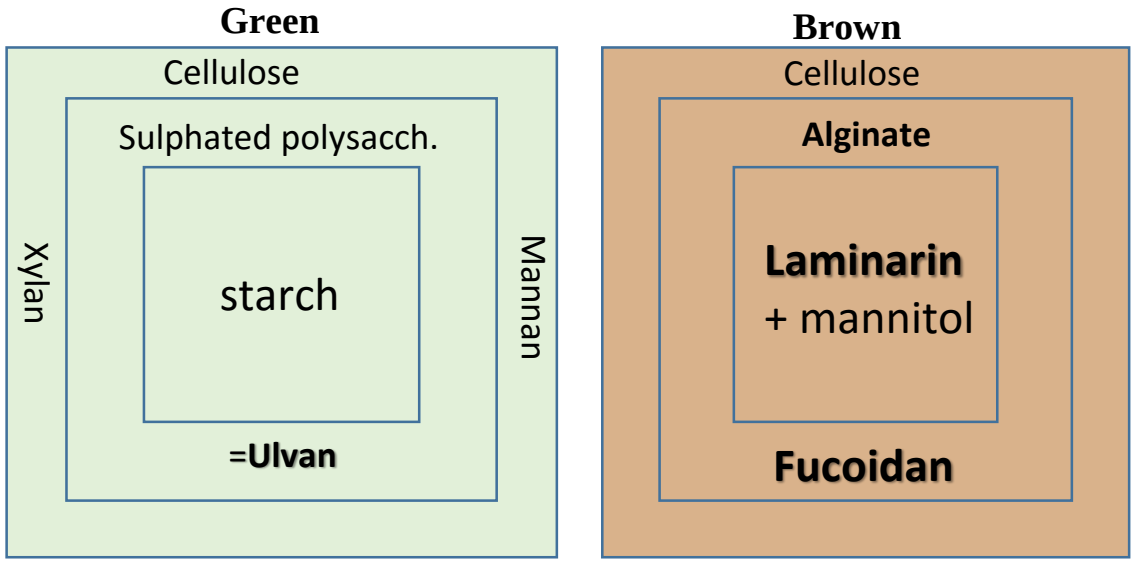
SEAWEED CONTAINS MAINLY:
1. Ash
2. Indigestible fibre

BUT IS LOW IN:
1. Protein
2. Fat

→ Easily digestible nutrients

SEAWEED. A SOLUTION?

Low nutritional value, but....



IMPROVED HEALTH LINKED TO BIOACTIVE POLYSACCHARIDES I.E.

Ímproved gut health.

OTHER BIOACTIVE COMPOUNDS

Polyphenols
Vitamin E
Polyunsaturated fatty acids

Reilly et al., 2008; Bouwhuis et al., 2016; Lynch et al., 2010; Holdt and Kraan, 2011; Stiger-Pouvreau et al., 2016; Chojnacka et al., 2012.

SHOULD WE USE SEAWEED MEAL?

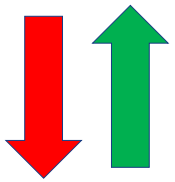
Opportunities

1. No high cost extraction method is needed
2. Less processing steps
3. A large array of bioactive compounds may have a positive effect on gut health

Threats

1. High indigestible fiber content might decrease total nutrient digestibility
2. High ash content might negatively affect growth performance
3. Access to bioactive compounds could be limited by undegradable cell wall components

Growth performance?



AIM

Taking into account these opportunities and threats:

"

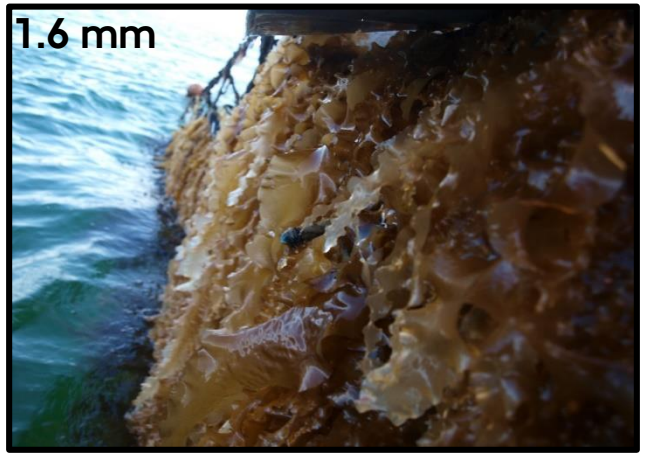
TO EVALUATE THE EFFECT OF FEEDING LOCALLY SOURCED SEAWEEDS ON GROWTH PERFORMANCE AND DIARRHEA LIKELIHOOD IN NEWLY WEANED PIGS

"

SEAWEEDS

Dried and milled into meal

Ulva lactuca – wild harvest DK



Saccharina latissima – cultivation DK

Ascophyllum nodosum - Iceland

DIET FORMULATION + EXPERIMENTAL TREATMENTS

3x!

Ingredients, g/100 g	NC	PC	Seaweed
Barley	14.69	13.78	9.39
Wheat	55.00	55.00	55.00
Soybean meal, toasted	10.00	10.00	10.00
Soy protein concentrate	13.06	13.20	13.21
Animal fat	3.09	3.30	4.00
Zink oxide	-	0.30	-
Seaweed	-	-	5.00
Calculated, g/100 g as fed			
Dry matter	87.8	87.9	88.1
Net energy, MJ/kg	10.6	10.6	10.6
Crude ash	5.70	62.4	59.0
Fiber	2.99	2.99	4.14
Crude protein	19.6	19.6	19.8

Including vitamin/mineral premix + synthethic amino acids

Diet conditions:

- Comparable levels of main ingredients
- 5% of each seaweed substitutes barley
- Diets are comparable in energy and protein levels
- Diets fulfill all other nutrient requirements

Five dietary treatments:

NC	=	negative control (standard diet)
PC	=	NC + zinc
UL	=	5% Ulva lactuca
SL	=	5% Saccharina latissima
AN	=	5% Ascophyllum nodosum

EXPERIMENTAL DESIGN

90 Male piglets weaned at 28 days

2 Periods:
N=45

16 days

3 Rooms:
N=15
5 treatments

Stressors: individual housing + low hygiene

RECORDINGS

Performance WEEKLY

- Average daily feed intake
- Average daily gain
- FCR (feed/gain)

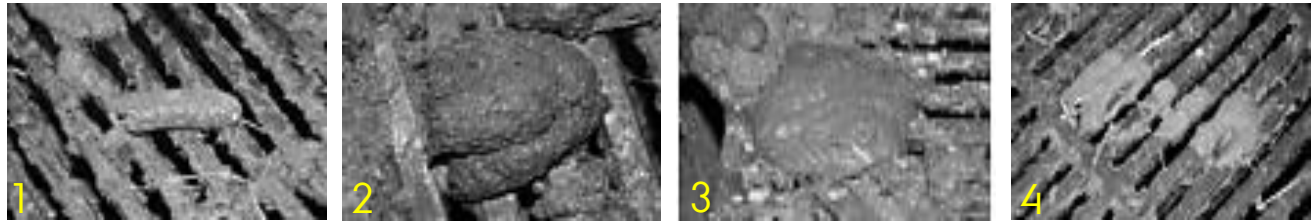
Diarrhea DAILY

- Faecal score

Gut health 1x

- Intestinal permeability
- Slaughter: SCFA, morphology, bacteria

Fecal score:



Visual assessment of fecal consistency
≥3 is considered diarrhea

NUTRITIONAL VALUE DIETS

Can we expect similar growth performance based on differences in nutrients?

	As fed	NC	PC	UL	AN	SL	
DM	g/100g	87.51	87.7	87.65	87.5	87.71	
Nitrogen	g/100g	3.80	3.81	3.85	3.89	3.85	
Crude protein	g/100g	23.75	23.83	24.03	24.33	24.08	
Ash	g/100g	5.82	6.25	7.76	6.32	6.21	
Amino acids							Diff. %
Cysteine	g/100g	0.36	0.35	0.34	0.36	0.35	0.01
Histidine	g/100g	0.51	0.50	0.49	0.51	0.50	0.02
Isoleucine	g/100g	0.95	0.93	0.95	0.96	0.95	0.02
Leucine	g/100g	1.54	1.53	1.53	1.55	1.54	0.02
Lysine	g/100g	1.41	1.39	1.38	1.43	1.40	0.05
Methionine	g/100g	0.44	0.44	0.44	0.46	0.44	0.02
Phenylalanine	g/100g	1.01	0.99	1.01	1.01	1.00	0.02
Threonine	g/100g	0.92	0.92	0.93	0.94	0.92	0.02
Valine	g/100g	1.10	1.08	1.10	1.11	1.10	0.03

Growth (protein deposition) depends on:

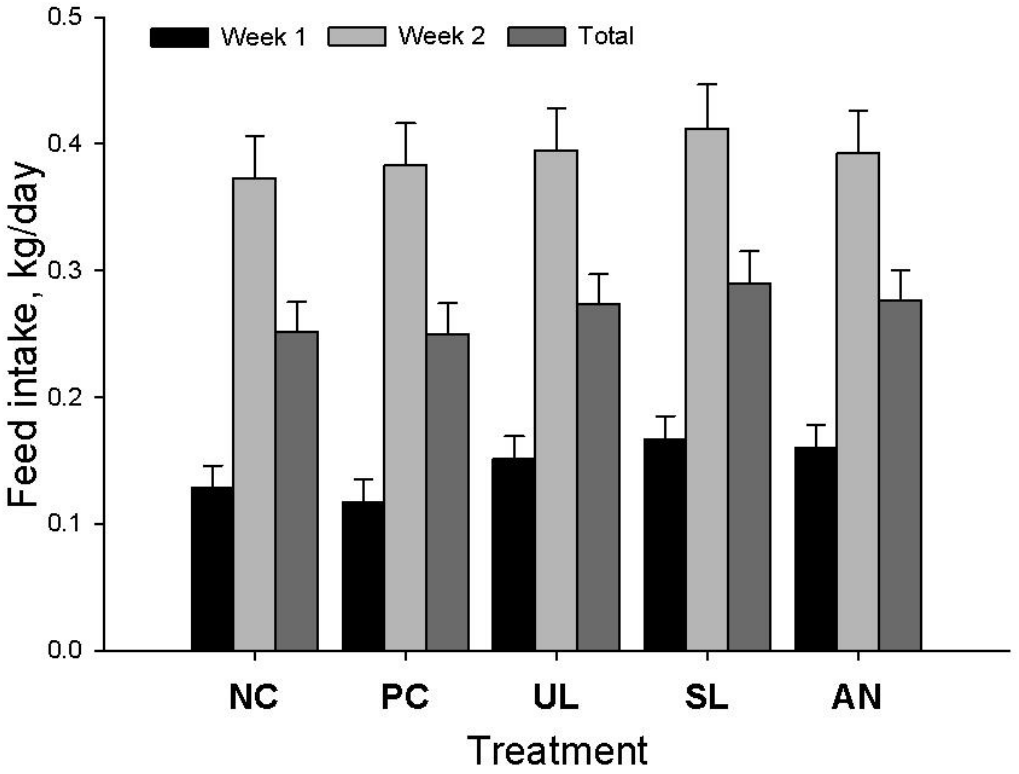
1. Amino acid content
2. Protein digestibility
3. Energy

In terms of AA's

- Diet are mostly comparable
- Most variation in lysine

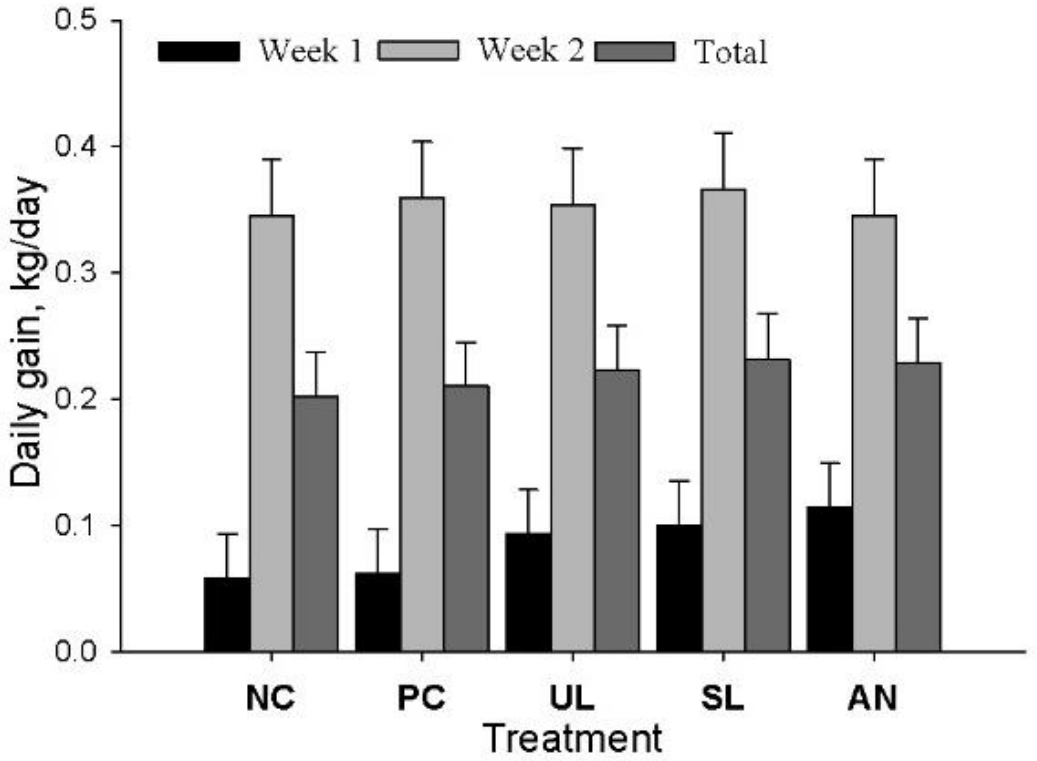
Even with 5% Seaweed, its protein contribution is low→ max. 0.047% of AA's came from seaweed!

RESULTS



No significant differences among treatments (P>0.05).

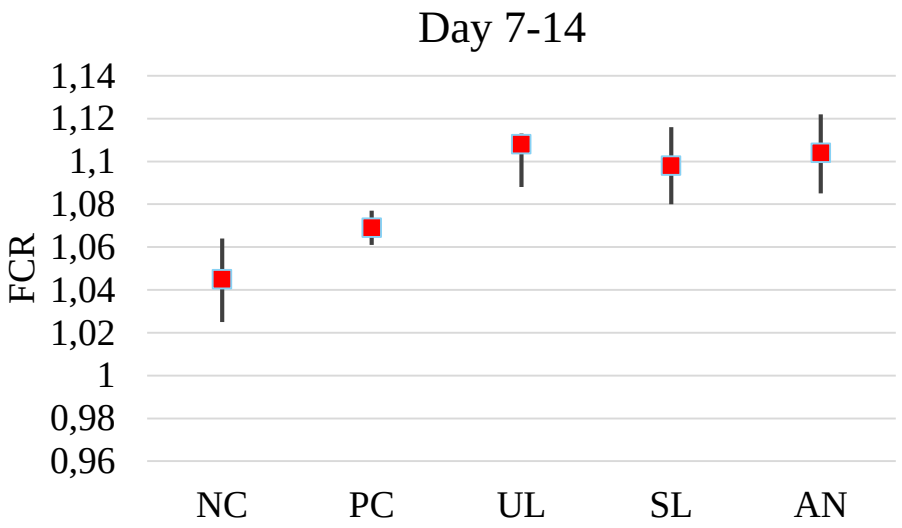
RESULTS

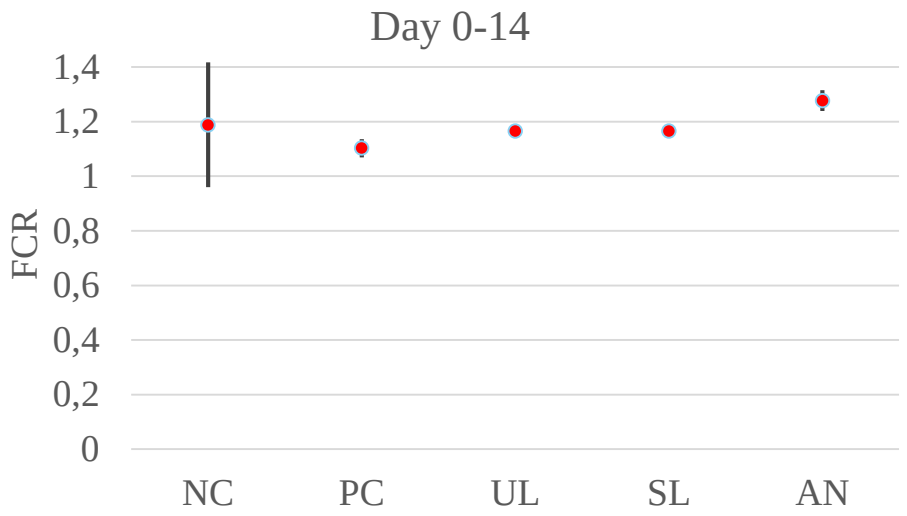


No significant differences among treatments P>0.05.

FEED CONVERSION RATIO

FEED INTAKE/GAIN – How efficiently is the ingested feed used for growth?





Data has been transformed:
95% CI (line) + lsmeans (red)

Data week 1 not shown as it was not biologically interpretable.

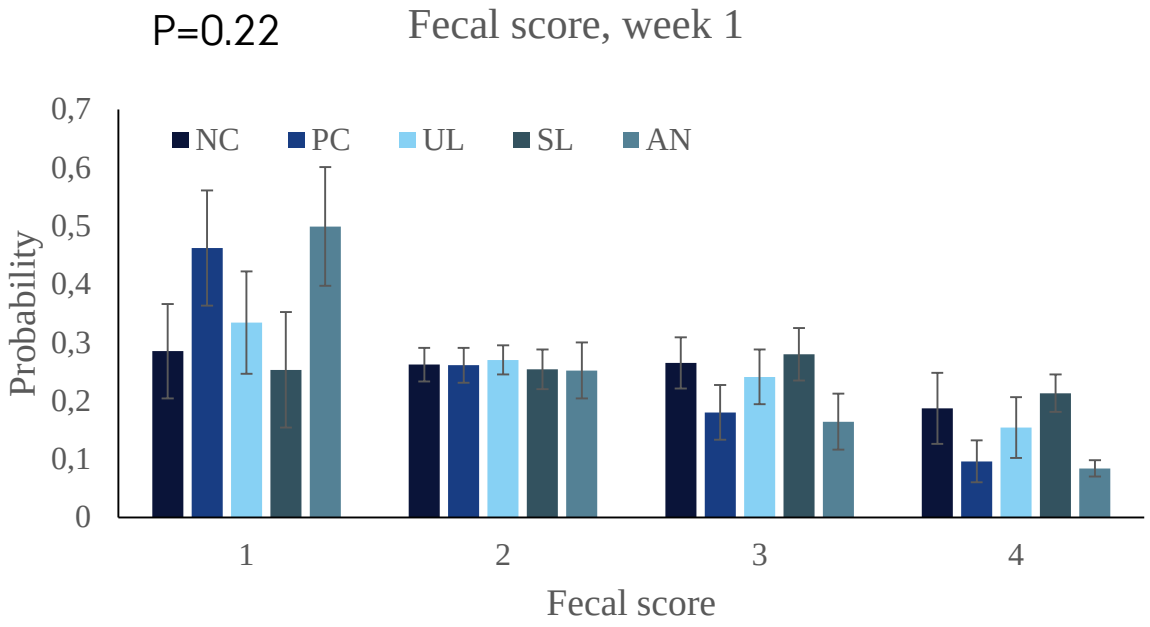
No significant differences among treatments P>0.05.

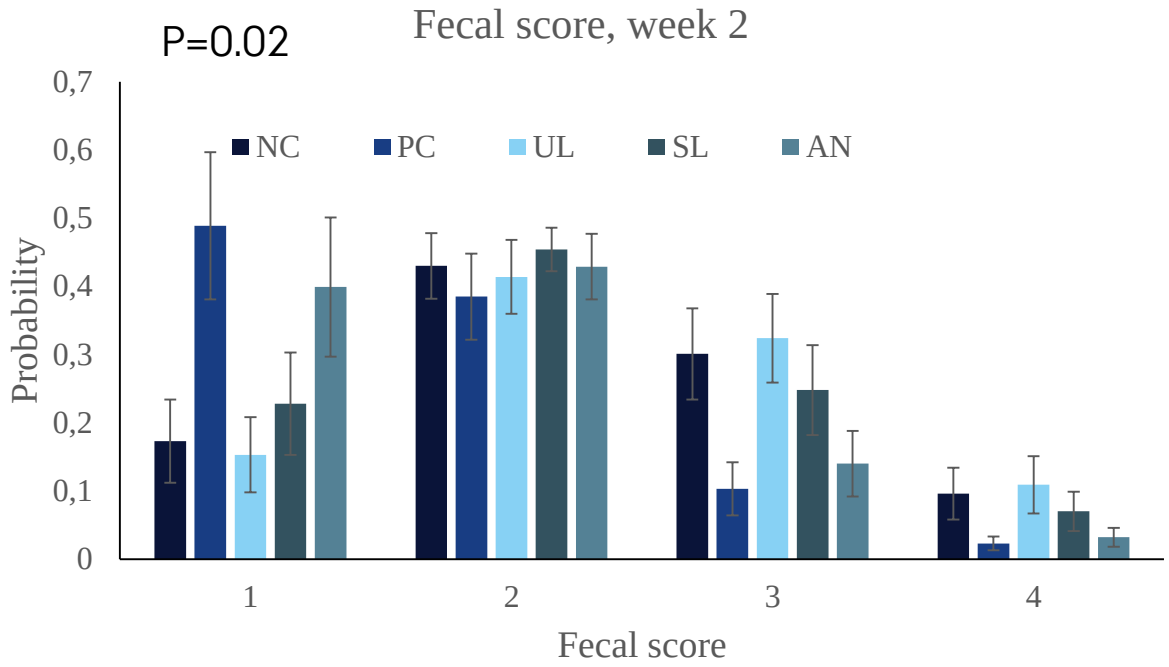
GROWTH PERFORMANCE

No significant differences in growth performance were observed

However… variation between pigs was high – limiting potential to show differences

FECAL SCORE





The probability of having diarrhea (score 3 and 4) is lowest for PC and AN.
In week 2, PC and UL were significantly different
UL and SL are most comparable to NC.

FECAL SCORE CONTINUED

Only Ascophyllum nodosum seemed to reduce likelihood of having diarrhea – why?

→ Seaweeds differed in particle size – AN was smallest

→ Could this have affected availability of bioactive compounds?

→ Differences in type and structure of polysaccharides can affect their function

Caution! high fecal score ≠ clinical diarrhea (i.e. caused by pathogen)

Data on gut health is needed

PRELIMINARY PERSPECTIVES

In short:

In this experiment we observed:

1. Including 5% Ascophyllum nodosum, Saccharina latissima or Ulva lactuca did not alter growth performance
2. Diarrhea likelihood was reduced and comparable between AN and zinc supplementation.

More data is needed...

Data on gut health will create a full picture - can we use intact seaweed to improve health at weaning?

→ Only then will it be worthwile to use seaweed meal.

In the future:

A similar experiment using the same seaweeds in calves is upcoming.

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