Effects of restricted feeding with fermented whole crop barley and wheat in finishing pigs

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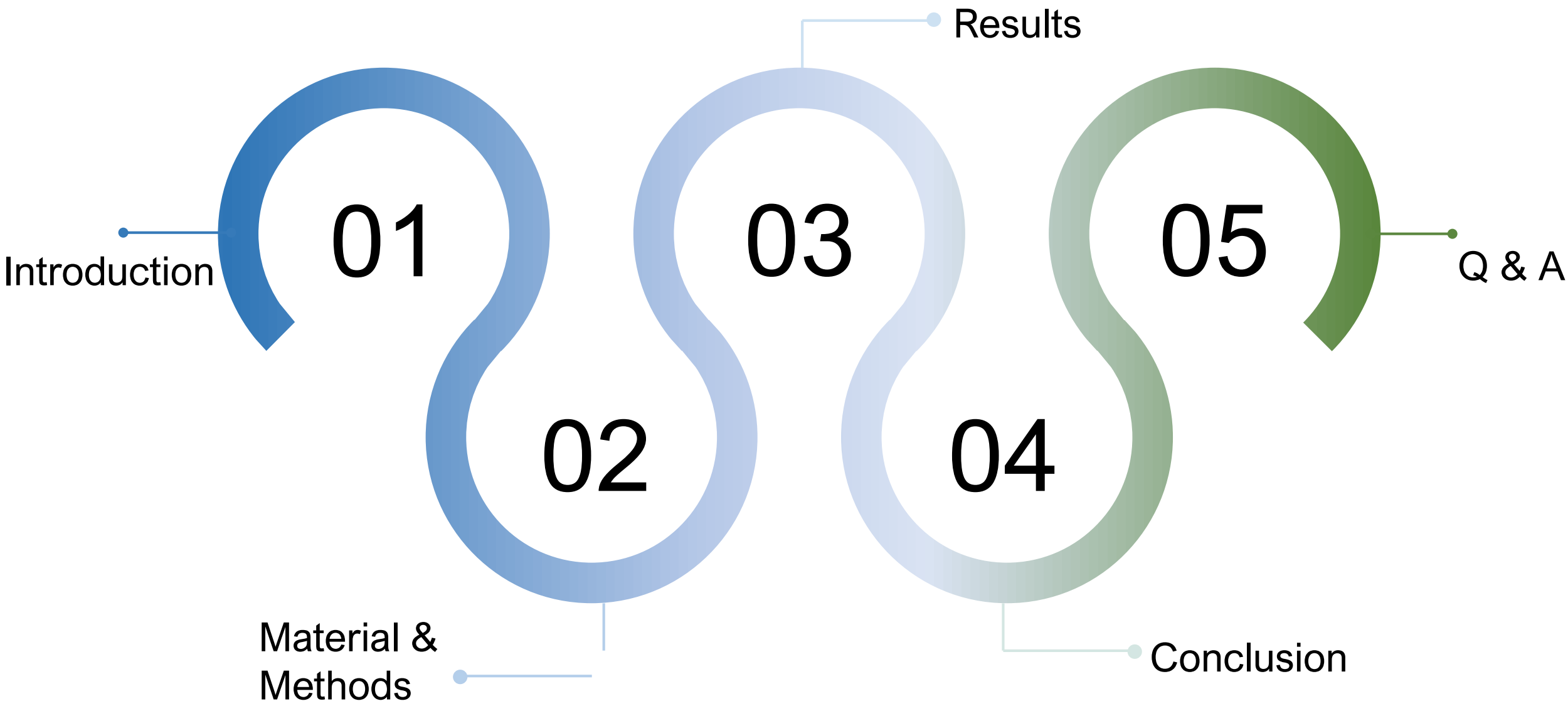
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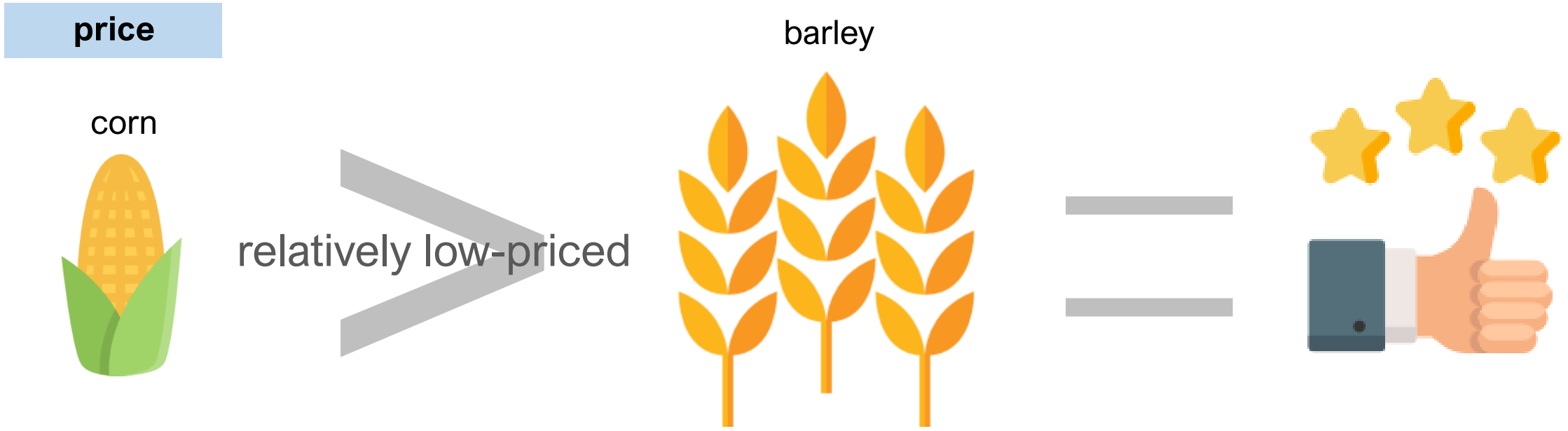
Introduction

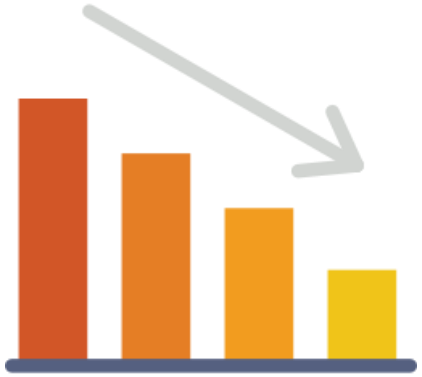
- ✓ The Korean market is interested in using relatively low-priced barley and wheat as alternative energy sources for conventional feeds that use corn as a raw material.



Introduction

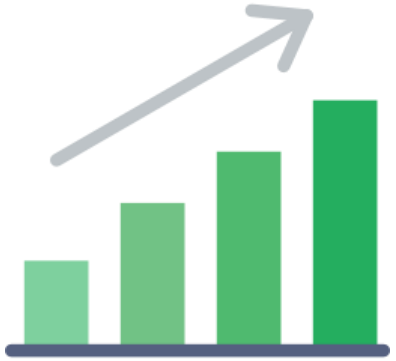
- ✓ Fermentation can be applied to pig feed as an alternative to antibiotic use as a growth promoter. (Skrede *et al*., 2001; Brooks, 2008; Jørgensen *et al*., 2010)

- ✓ Through fermentation, beneficial bacteria are increased, and harmful microorganisms are decreased in feeds.



Harmful bacteria

Fermentation



Beneficial bacteria

Introduction

- ✓ Inoculum in feeds (probiotics; *Bacillus subtilis, Lactobacillus fermentum and Enterococcus faecium*) could reduce the number of intestinal enterobacteria and prevent diarrhea caused by *E. coli* (Guo *et al*., 2006; Huang *et al*., 2004).

Introduction

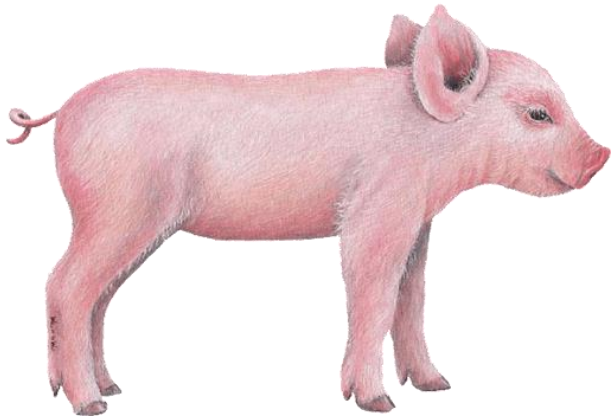
The objective of this experiment

- ✓ To determine the effects of restricted feeding and fermented whole barley and wheat on growth performance, nutrient digestibility, blood constituents, and fecal microbiota in finishing pigs.




Material & Method

Experimental Animals



Total 80 finishing pigs
(LYD, average body weight of 72.9 ± 2.6 kg)

CON : nomal diet (Formulated to NRC, 1998)

TRT 1 - restricted to 10% in CON diet
(fermented whole crop barley with inoculums)

TRT 2 - restricted to 10% in CON diet
(fermented whole crop barley without inoculums)

TRT 3 - restricted to 10% in CON diet
(fermented whole crop wheat with inoculums)

TRT 4 – restricted to 10% in CON diet
(fermented whole crop wheat without inoculums)

Material & Method

Experimental period

Experimental period : **4 weeks**

Individual pigs body weights were measured at the **0, 14, and 28 days** of the experiment period

Experimental design

4 replications per treatment, with **4 pigs** per pen

All pigs were allowed *ad libitum* access to feed and water

Statistical analysis

All data were analyzed using the general linear model **(GLM)** procedure of SAS.

Material & Method

Experimental Analysis items

- **Growth performance :** average daily gain **(ADG)**, average daily feed intake **(ADFI)**, gain:feed ratio **(G:F)**

- Nutrient digestibility : the apparent total tract digestibility **(ATTD) -** dry matter **(DM)**, nitrogen **(N)**

neutral detergent fiber **(NDF)**, acid detergent fiber **(ADF)**

- Blood constituents : high density lipoprotein **(HDL)**, low density lipoprotein **(LDL)**-cholesterol,

blood urea nitrogen **(BUN),** glucose

- Fecal microbiota : *E. coli , Lactobacillus*

Results

Table 1. Growth performance

Items, mg/dl	CON	Barley		Wheat		SE[1]	P-value
		+ino	-ino	+ino	-ino		
Initial BW, kg	73.92	74.54	72.24	71.16	72.77	2.62	0.99
Final BW, kg	105.15	100.38	98.34	99.43	86.18	2.06	0.18
ADG	1.15	1.05	0.93	1.04	0.97	0.07	0.26
ADFI	3.70[a]	3.04[c,]	3.06[cb]	3.10[bc]	3.14[b]	0.03	<.0001
G:F	0.31	0.35	0.30	0.34	0.31	0.02	0.65

BW = body weight, ADG = average daily gain, ADFI = average daily feed intake
[1] Standard error
[a, b, c,] Means in the same row without a common superscript differ ($p < .05$)

- ADFI decreased in fermented whole crop barley and wheat diets compared to CON ($p < 0.05$).
- There were no significant difference in ADG and G: F between treatments.

Results

Table 2. Nutrient digestibility

Items, %	CON	Barley		Wheat		SE[1]	P-value
		+ino	-ino	+ino	-ino		
DM	82.63	83.27	79.94	83.62	80.83	1.00	0.68
N	71.75	75.55	69.00	71.83	69.64	1.75	0.10
NDF	63.08	59.93	63.80	61.77	62.79	1.59	0.49
ADF	63.61	64.47	65.15	59.5	63.89	1.44	0.1

DM = dry matter, N = nitrogen, NDF = neutral detergent fiber, ADF = acid detergent fiber
[1] Standard error

- DM and N digestibility were no significant differences.
- NDF and ADF digestibility were no significant differences.

Results

Table 3. Blood constituents

Items, mg/dl	CON	Barley		Wheat		SE[1]	P-value
		+ino	-ino	+ino	-ino		
BUN	19[a]	16[ab]	10[c]	14[bc]	19[a]	1.42	0.01
Cholesterol	110	115	97	106	91	8.24	0.15
HDL/C	60	62	63	61	60	2.31	0.21
LDL/C	51	57	54	51	56	4.19	0.12
Glucose	58	64	62	66	64	6.93	0.90

BUN = blood urea nitrogen
[1] Standard error
[a, b, c,] Means in the same row without a common superscript differ ($p < .05$)

- BUN in blood was significantly lower in pigs fed fermented whole crop barley without inoculums diets.
- Total cholesterol, HDL cholesterol, LDL cholesterol, and glucose were not significantly different.

Results

Table 4. Fecal microbiota

Items, log10/g	CON	Barley		Wheat		SE[1]	P-value
		+ino	-ino	+ino	-ino		
E.coli	5.44[b]	5.39[b]	6.3[a]	5.43[b]	4[c]	0.17	0.01
Lactobacillus	7.12[b]	7.27[b]	7.1[b]	7.89[a]	6.7[c]	0.17	0.01

[1] Standard error
[a, b, c,] Means in the same row without a common superscript differ ($p < .05$)

- The number of *E. coli* was lowest in fermented whole crop wheat without inoculums.
- The number of *lactobacillus* was significantly higher in pigs fed fermented whole crop wheat with inoculums.

Conclusion

- ✓ In the present study, restricted feeding with fermented whole crop barley and wheat regardless of supplementing inoculums showed no significant difference in growth performance compared to CON.

- ✓ Fermented whole crop wheat diets were beneficial effects fecal microbiota.

In conclusion, fermented whole crop cereals can be regarded as being able to effectively utilize feeds as alternative material.

Thank you for your time and attention.