



# Effects of *Enterococcus faecium* L3 on production performance, egg quality and intestinal microflora in Hyline-brown laying hens

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# Content

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□ Research background

□ Research contents

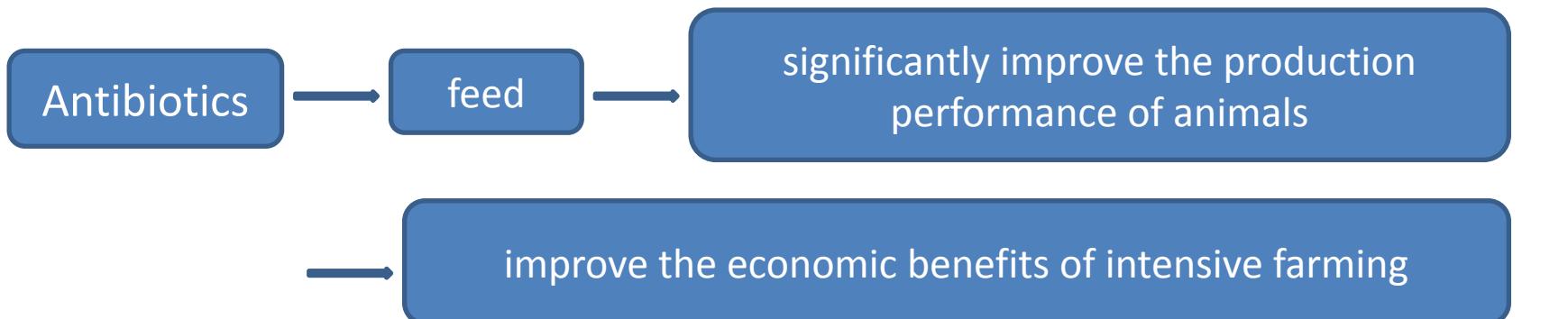
    1、Production performance

    2、Egg quality

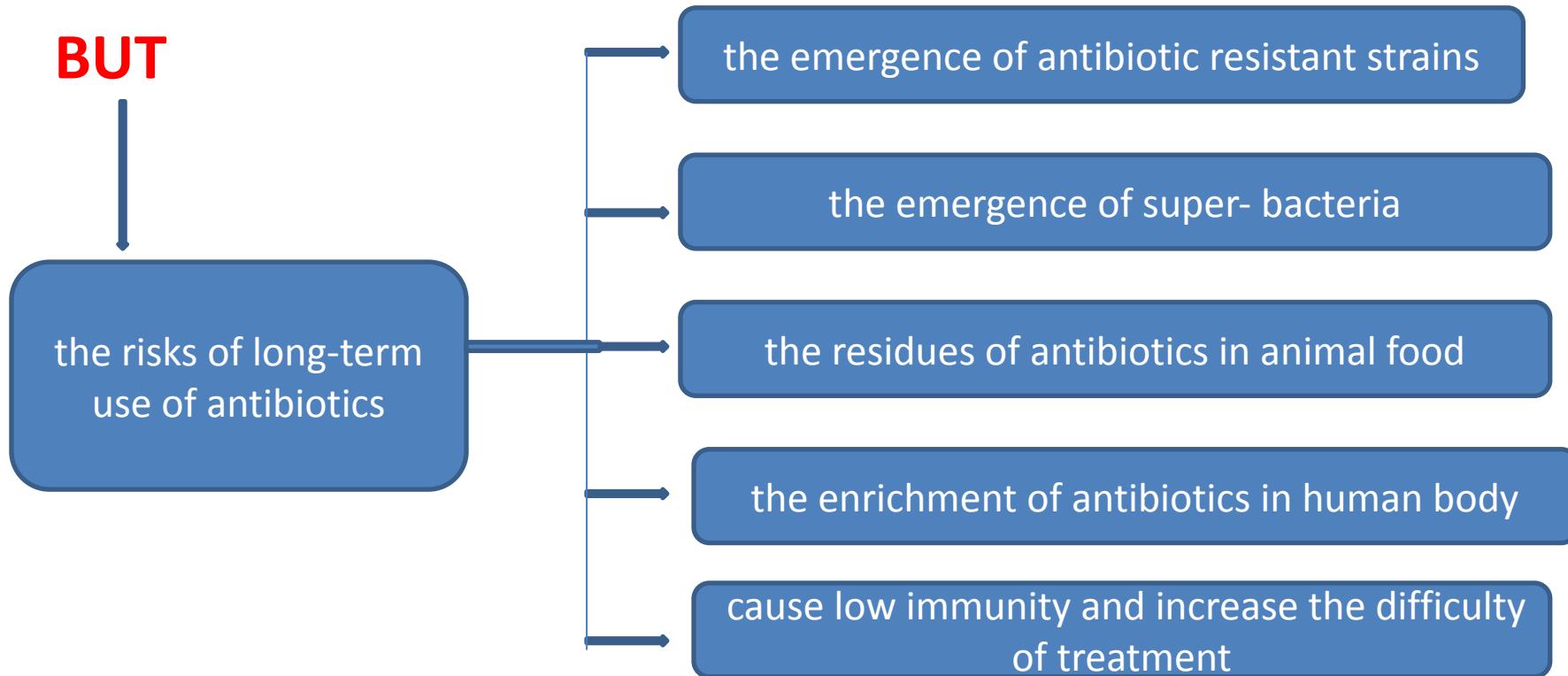
    3、Serum and blood biochemical indices

    4、Microflora of cecal contents

□ Conclusion



**BUT**





**January 1, 2006, the European Union has completely banned the use of antibiotics in animal feed**

**The United States planed to ban the use of prophylactic antibiotics in animal feed for three years from 2014**

**Since July 1, 2020, China has completely banned the use of antibiotics in feed production,**

**Research and development of safe, green and efficient antibiotic substitutes has become a hot spot .**

Probiotics

can improve the efficiency of aquaculture

safe and environmentally friendly

Enterococcus  
faecium

found in the intestines of healthy animals and humans

balance the intestinal flora

increase the number of beneficial bacteria

inhibit the reproduction of harmful microorganisms

enhance the resistance of animals to intestinal  
pathogens infection

promote the digestion and absorption of nutrients

improve the growth performance and promote the  
healthy growth of animals



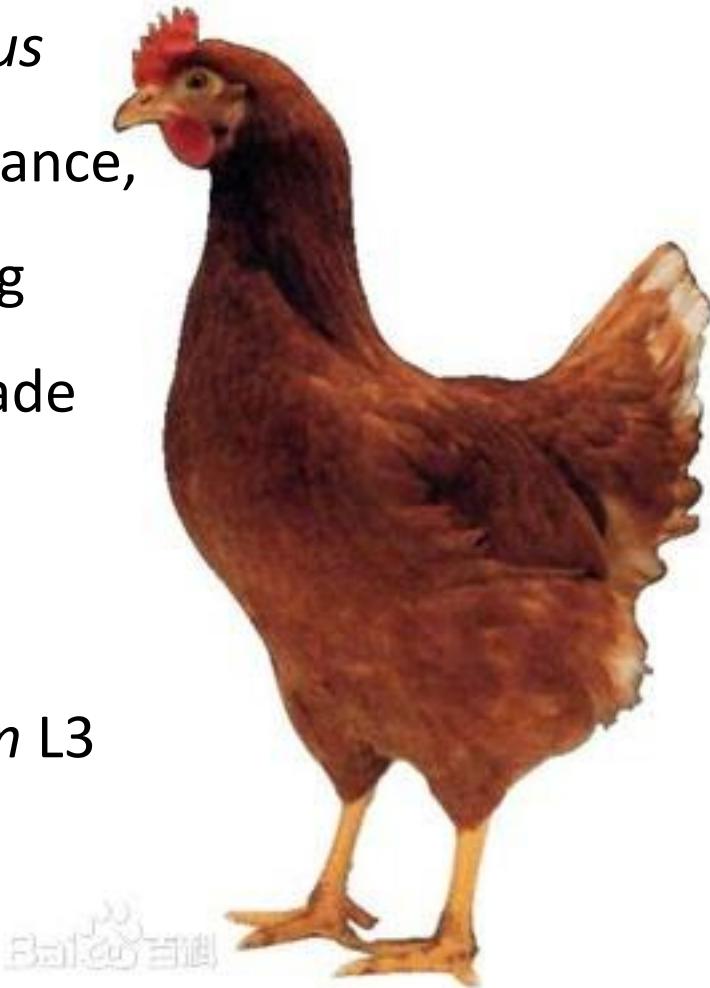
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# Research contents

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In this study, the effects of *Enterococcus faecium* L3 on the production performance, egg quality and intestinal flora of laying hens were studied by adding home made *Enterococcus faecium* L3 in feed.

The basal diet was supplemented with  $4 \times 10^9$  CFU / kg *Enterococcus faecium* L3 for 28 days .





## Composition and nutrient levels of the basal diet(air-dry basis)

Ingredients	Content(%)	Nutrient levels	Content(%)
Corn	62.00	ME (MJ/kg)	11.29
Soybean meal	24.00	Pro.	16.50
Soybean oil	1.00	Ca	3.50
Limestone	8.00	P	0.58
Premix	5.00	NaCl	0.30
Totle	100.00	Met	0.48
		Lys	1.02
		Met+Cys	0.70



# 1. Effect of *Enterococcus faecium* L3 production performance of laying hens

Items	A	B	P
Average daily feed intake (g)	125.7±0.79	122.3±1.90	0.100
Laying rate / %	0.93±0.01	0.93±0.004	0.956
Average egg weight (g)	63.7±0.80	63.04±0.60	0.506
Ratio of feed to egg(g/g)	2.16±0.02	2.14±0.03	0.575
Broken egg rate(%)	0.03±0.01	0.02±0.01	0.303
Soft egg rate(%)	0.02±0.001	0.004±0.002	0.412
malformed egg rate(%)	0.02±0.01	0.02±0.01	0.798



## 2. Effects of *Enterococcus faecium* L3 on egg quality of laying hens

Items	A	B	P
Egg weight(g)	62.7±0.86	61.3±0.88	0.252
Egg shape index	1.31±0.01	1.30±0.01	0.721
Eggshell thickness(mm)	0.36±0.03	0.38±0.02	0.726
Eggshell strength(N/cm <sup>2</sup> )	37.31±0.74	36.91±0.94	0.745
Albumen height(mm)	6.92±0.25	6.51±0.31	0.311
Yolk color	5.55±0.25	5.48±0.44	0.896
Haugh unit(HU)	81.75±1.88	80.96±1.79	0.764
Yolk weight(g)	18.10±0.35	17.64±0.27	0.303
Albumen weight(g)	37.48±0.66	36.76±0.82	0.507

### 3. Effect of *Enterococcus faecium* L3 on blood biochemical indexes of laying hens

Items	A	B	P
Leukocyte counts( $10^9/L$ )	91.65±2.60	92.46±2.27	0.815
Lymphocyte ratio (%)	75.68±0.90	76.83±0.89	0.373
Intermediate cell ratio (%)	8.92±0.21	9.04±0.23	0.690
Granulocyte ratio (%)	14.87±0.65	14.13±0.71	0.454
lymphocyte ( $10^9/L$ )	69.90±2.12	71.87±1.51	0.453
Intermediate cell ( $10^9/L$ )	8.18±0.28	8.55±0.36	0.434
granulocyte ( $10^9/L$ )	13.54±0.73	14.27±0.66	0.469
red blood cell counts ( $10^{12}/L$ )	2.23±0.16	2.33±0.06	0.540
Hematocrit (%)	29.95±0.91	29.27±0.77	0.571
mean red cell volume (fL)	126.67±0.99	125.70±1.17	0.535
Red blood cell distribution width SD (fL)	38.09±2.30	37.15±0.76	0.360
Red blood cell distribution width CV(%)	10.71±0.13	10.53±0.16	0.413
platelet count ( $10^9/L$ )	41.64±3.83	39.58±3.63	0.701
Mean platelet volume (fL)	10.35±0.18	10.00±0.10	0.103
platelet distribution width (%)	10.39±0.32	10.18±0.51	0.740
platelet crit (%)	0.04±0.005	0.03±0.004	0.211
Platelet large cell ratio (%)	1.78±0.13	1.86±0.26	0.801

# Effect of *Enterococcus faecium* L3 on serum biochemical indexes of laying hens



Items	A	B	P
triglycerides (TG,mmol/L)	20.33±0.90	22.93±0.81	0.039
total cholesterol (TC,mmol/L)	3.71±0.16	4.25±0.18	0.028
IL1 (pg/mL)	181.82±8.21	134.93±11.06	0.004
IL4 (pg/mL)	98.32±7.48	91.14±7.87	0.533
IL6 (pg/mL)	26.96±1.77	27.28±2.67	0.919
IgA (pg/mL)	16.94±0.85	15.27±1.13	0.252
C-reactive protein (CRP, ug/mL)	160.02±13.76	138.81±9.92	0.245



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#### 4. Effects of Enterococcus faecium on cecal content microflora of 60-week-old Hyline -brown laying hens

The data were analyzed on the free online platform of Majorbio Cloud Platform

# Effects of *Enterococcus faecium* L3 on alpha diversity indexes of cecal content microflora



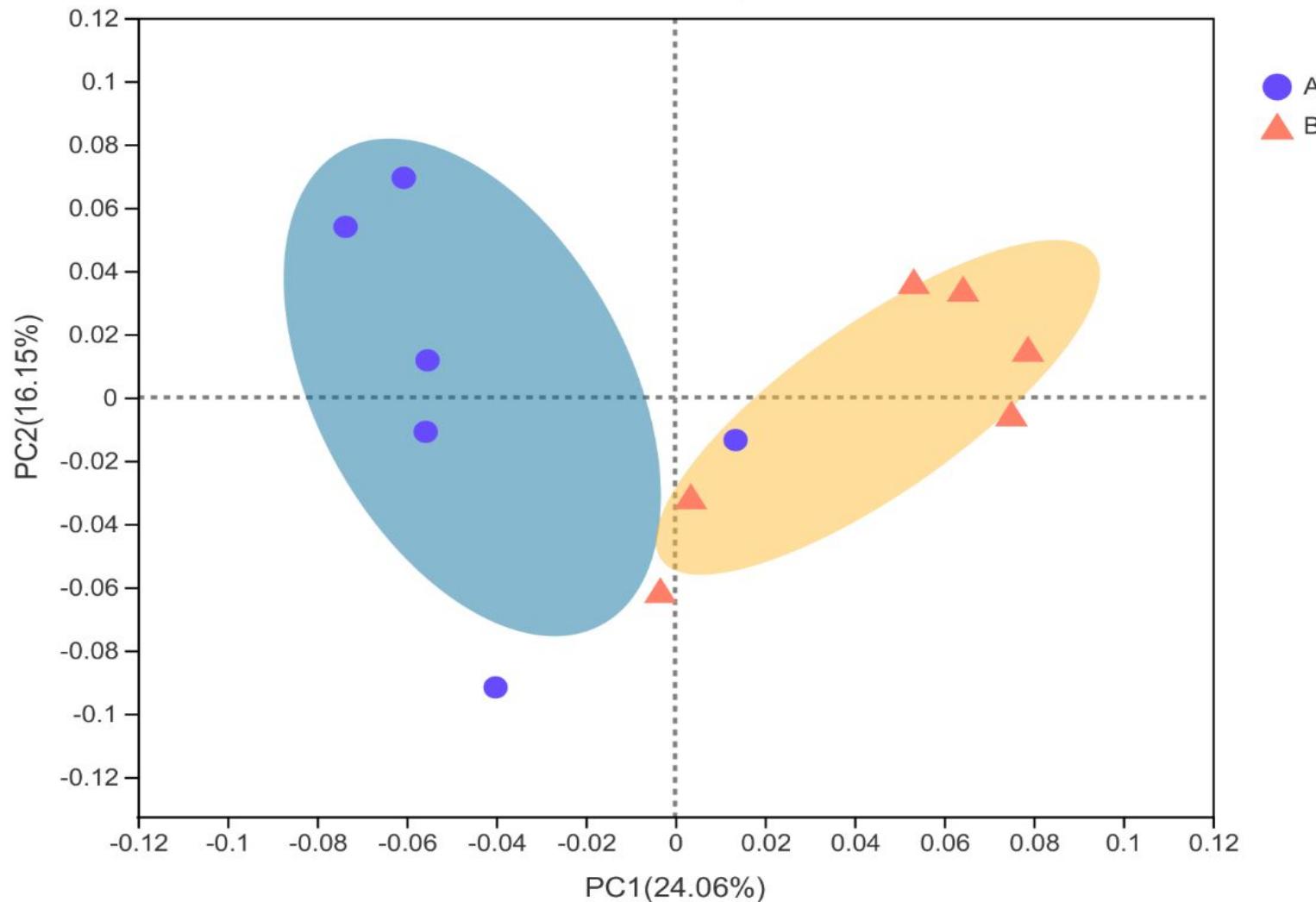
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Estimators	A group	B group	P -value
Sobs	441.17±8.35	454±10.66	0.04267
Ace	459.35±8.03	477.0±11.58	0.0119
Chao	464.44±11.74	485.13±16.94	0.03378
Shannon	4.62±0.22	4.65±0.22	0.7964
Simpson	0.02±0.01	0.03±0.01	0.7669

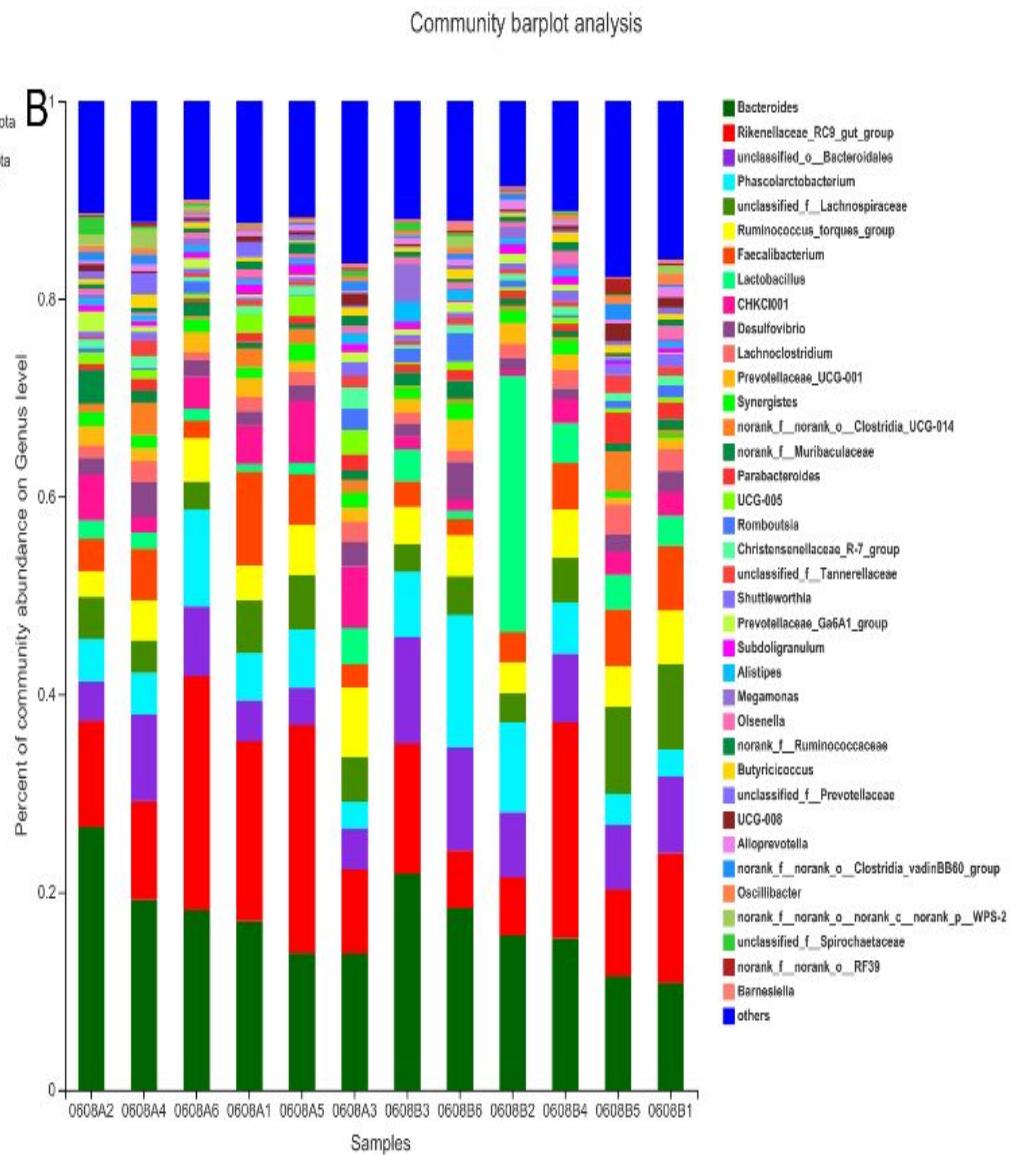
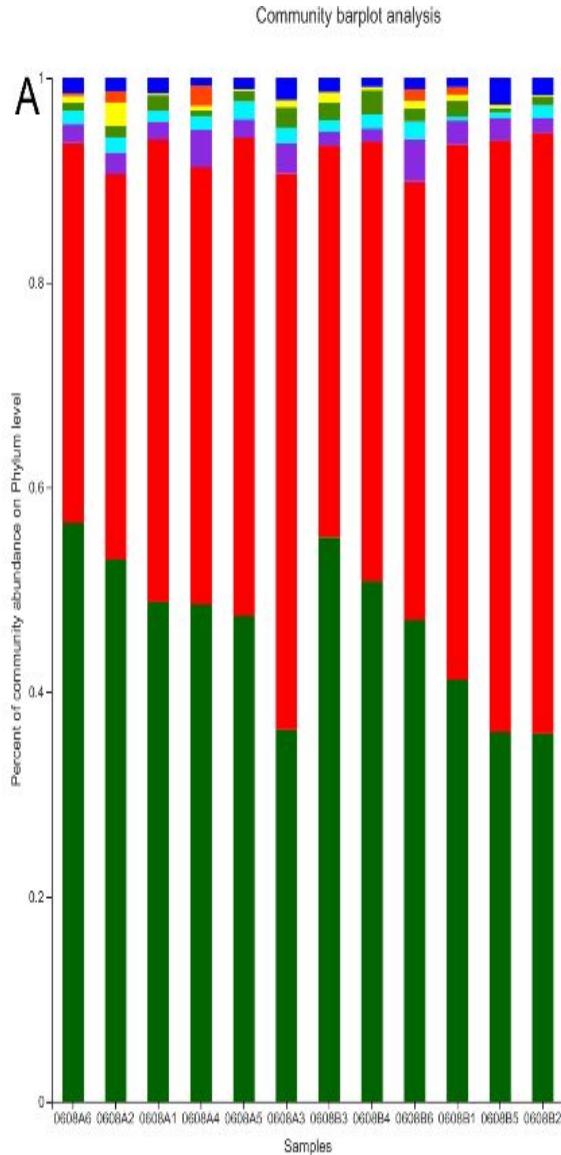
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### PCoA on OTU level

R=0.5093, P=0.009000

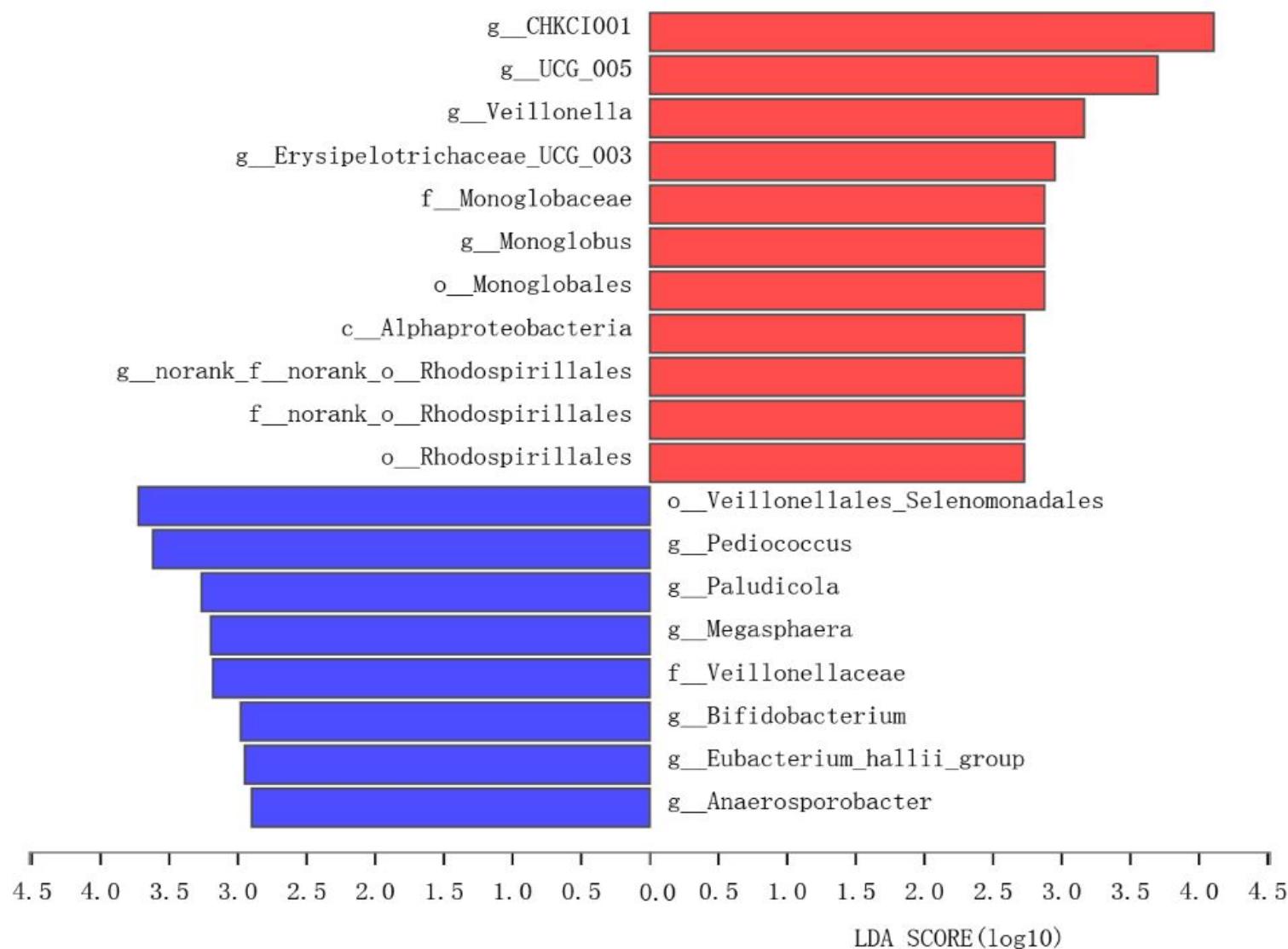


Effect of *Enterococcus faecium* L3 on the structure of cecal flora in laying hens

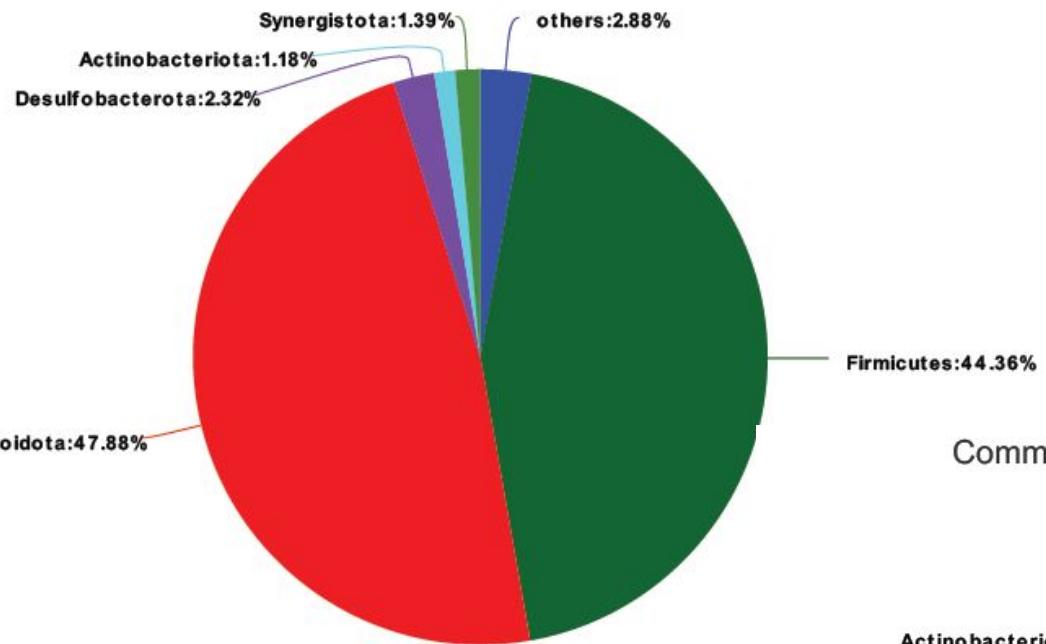


### LEfSe Bar

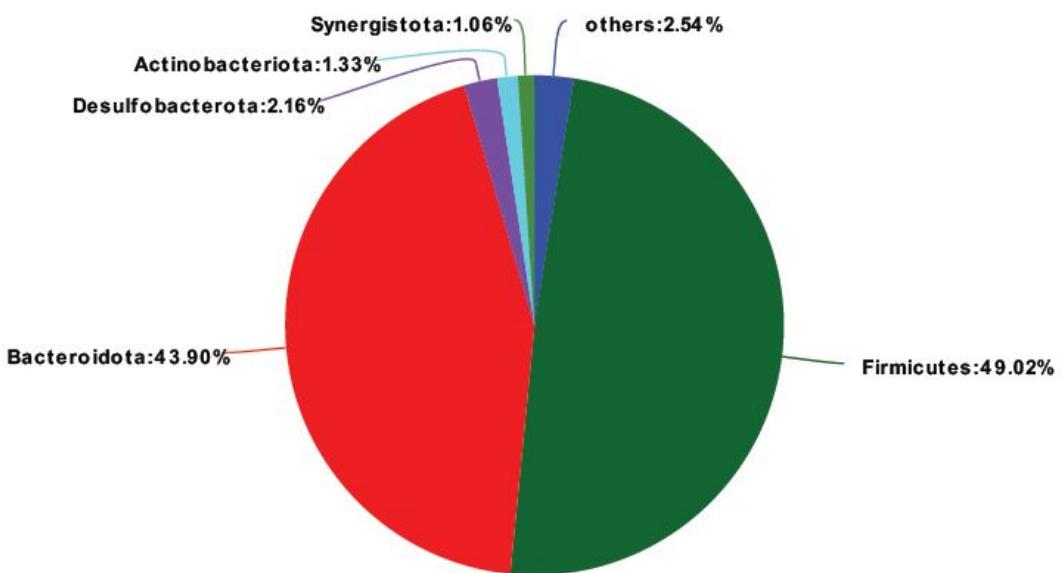
A  
B



Community analysis pieplot on Phylum level :a



Community analysis pieplot on Phylum level :b





# Effects of *Enterococcus faecium*L3 on relative abundance of cecal content microflora in phylum level of laying hens (relative abundance>1%)

Species name	A group	B group	P -value
Bacteroidota	48.10±7.00	45.97±7.59	0.5228
Firmicutes	44.13±6.40	46.66±7.79	0.7842
Desulfobacterota	2.32±0.74	2.24±1.13	0.9273
Actinobacteriota	1.15±0.51	1.45±0.76	0.4113
Synergistota	1.40±0.23	1.03±0.56	0.4113



# Conclusion

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- *Enterococcus faecium* L3 has obvious effect on improving the digestion and metabolism of nutrients, improving feed utilization and reducing feed consumption.
- *Enterococcus faecium* L3 can improve the intestinal flora structure and prolong the laying period of laying hens.



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Thank you for your  
attention!