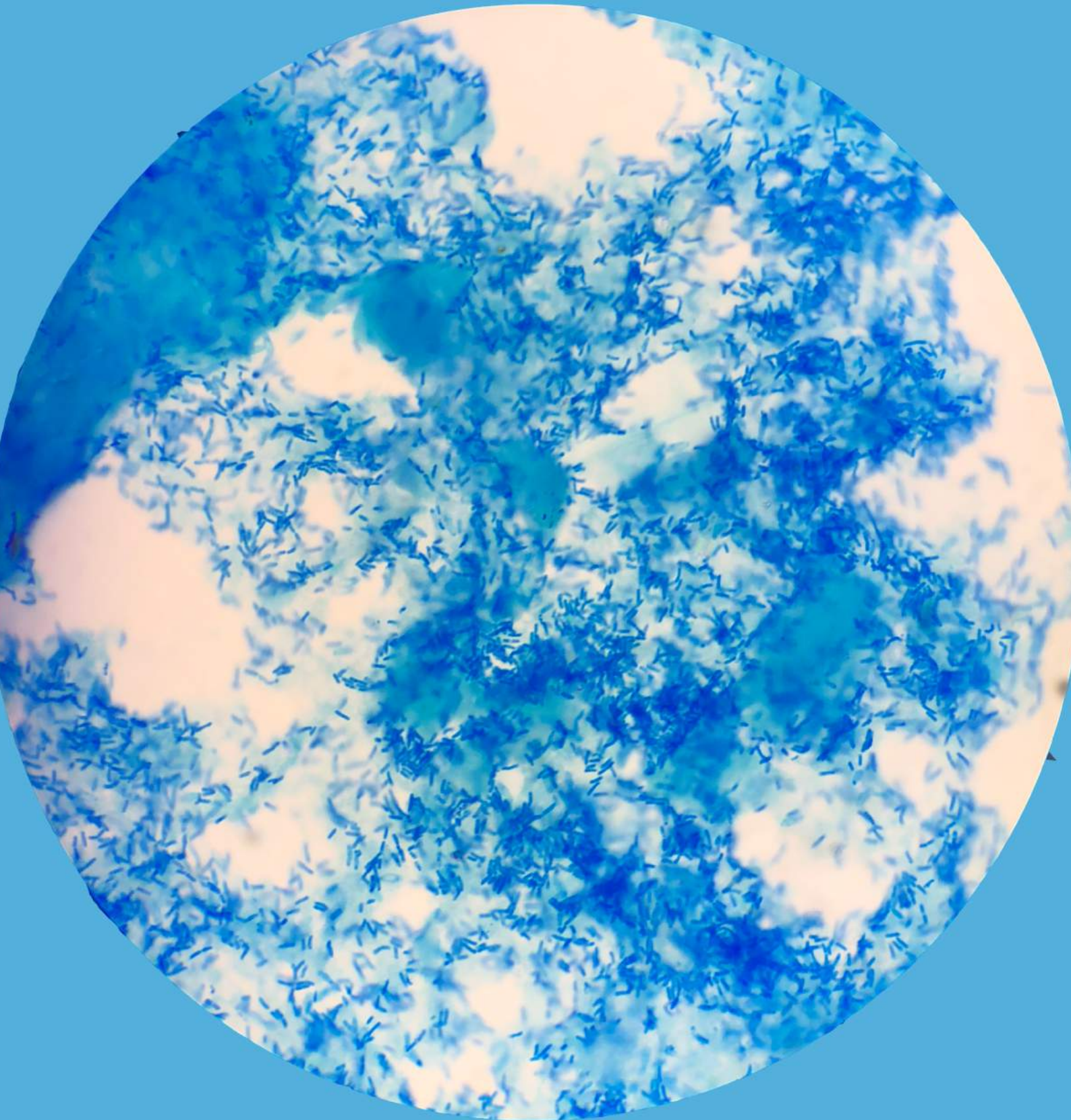


Substitute antibiotic---

Clostridium butyricum



Substitute antibiotic---*Clostridium butyricum*

Acidifiers, plant essential oils , probiotics and enzyme preparations are the four most recognized products in the current no-resistance scheme of animal husbandry diet. The sales of probiotics in 2019 reached 1.776 billion US dollars, and the use of probiotics additives will increase by about 60% in the future.

Vegamax studied the inhibitory effect of *Clostridium butyricum* on *Escherichia coli*, and verified the antibiotic substitution effect of probiotics with sulfate as control.

The results showed that the effect was no less than that of antibiotics.

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RESEARCH

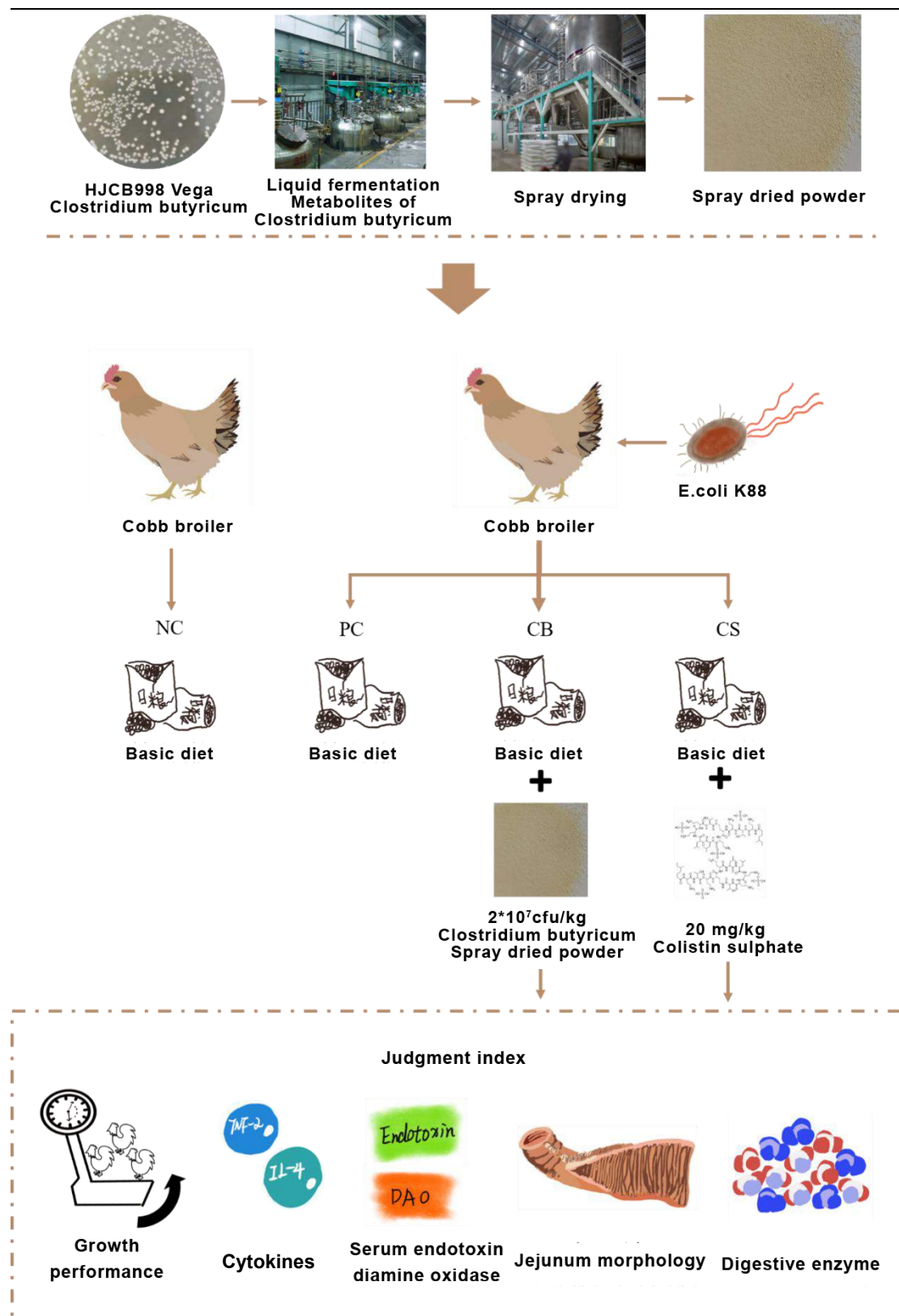
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Effects of dietary supplementation of probiotic, *Clostridium butyricum*, on growth performance, immune response, intestinal barrier function, and digestive enzyme activity in broiler chickens challenged with *Escherichia coli* K88

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I .Experimental design



II. Result

1. Growth performance

Index	Days after E.coli K88 treatment	Processing Mode			
		NC	PC	CB	CS
Weight/g	3d	351.71a	319.83b	342.23a	339.95a
	7d	401.16a	354.00b	402.71a	398.81a
	14d	747.33ab	649.00c	774.83a	738.16b
	21d	1283.5a	1064.8b	1265.8a	1275.2a
Average Daily Gain/g	3-7d	12.36b	8.54c	15.12a	14.71a
	7-14d	49.45a	42.14b	53.16a	48.47a
	14-21d	76.60	59.40	70.13	76.72
	3-21d	51.76a	41.38b	51.30a	51.95a

Clostridium butyricum can significantly improve the body weight and average daily gain of broilers infected with Escherichia coli K88. **There is no significant difference between Clostridium butyricum and antibiotics in inhibiting Escherichia coli.**

2. Jejunal mucosal cytokines

Index	Days after E.coli K88 treatment	Processing Mode			
		NC	PC	CB	CS
TNF- α ng/L	3d	53.80b	48.88b	76.66a	65.09ab
	7d	65.29ab	53.88b	69.32a	61.51ab
	14d	63.39	50.22	62.92	61.23
	21d	50.56	35.28	54.46	56.92
IL-4 ng/L	3d	52.52	50.9	68.7	67.51
	7d	68.23a	52.16b	62.91ab	57.03ab
	14d	70.65a	50.46b	69.79a	59.78ab
	21d	52.64	42.59	56.38	57.09

Clostridium butyricum can increase the concentration of TNF- α and IL-4 in broilers. **It can be concluded that clostridium butyricum can stimulate the immune response. And the ability of Clostridium butyricum to regulate cytokines is not weaker than antibiotics**

3. Serum endotoxin and DAO concentrations

Index	Days after E.coli K88 treatment	Processing Mode			
		NC	PC	CB	CS
Endotoxin EU/mL	3d	0.460b	0.738a	0.704a	0.734a
	7d	0.455b	0.640a	0.586a	0.578a
	14d	0.327b	0.413a	0.335ab	0.347ab
	21d	0.252c	0.380a	0.304bc	0.332ab
Diamine oxidase U/mL	3d	2.559b	8.823a	7.493a	8.056a
	7d	8.649a	8.649a	7.121a	7.496a
	14d	1.250c	6.254a	4.194b	4.201b

	21d	0.819c	3.952a	2.419b	3.060ab
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Clostridium butyricum reduced serum endotoxin and DAO levels of broilers challenged by Escherichia coli K88. The results showed that **Clostridium butyricum could significantly inhibit endotoxin induced by Escherichia coli K88 and enhance the intestinal barrier function of broilers.**

4. Mucosal morphology of jejunum

Index	Days after E.coli K88 treatment	Processing Mode			
		NC	PC	CB	CS
Villus Height	3d	264.35	259.81	275.71	253.01
	7d	267.65bc	287.54b	346.75a	254.41c
	14d	397.49b	355.07c	448.51a	410.9b
	21d	429.41b	433.6b	531.09a	407.26b
Crypt depth	3d	50.22a	47.01ab	33.68c	42.9b
	7d	50.06b	60.3a	39.44c	38.2c
	14d	66.07b	73.96a	56.51c	59.95c
	21d	82.5b	115.46a	84.04b	76.03b

Clostridium butyricum can increase the height of jejunum villi and reduce the depth of crypt, which indicates that **Clostridium butyricum can promote the growth of broilers by improving the morphology of mucosa** after being infected with Escherichia coli K88.

5. Digestive enzyme activity

Index	Days after E.coli K88 treatment	Processing Mode			
		NC	PC	CB	CS
Diastase	3d	0.94a	0.33c	0.70b	0.74ab
	7d	0.96a	0.45b	0.88a	0.83
	14d	0.80a	0.60b	0.87a	0.78a
	21d	0.91a	0.75b	0.79ab	0.85ab
Proteinase	3d	106.86a	54.66c	76.92b	80.10b
	7d	103.76a	65.29b	93.32a	89.39a
	14d	98.17a	67.04b	93.60a	91.46a
	21d	130.76	109.06	133.03	125.01
Lipase	3d	190.87ab	105.14c	154.02b	205.53a
	7d	193.84a	105.66b	186.09a	155.90ab
	14d	183.76	167.93	205.40	195.76
	21d	194.07	177.85	197.87	203.41

Clostridium butyricum can alleviate the decrease of enzyme activity caused by Escherichia coli.

Clostridium butyricum mentioned in this paper is the patented strain of Vegamax. Vegamax is an exclusive enterprise with new product certificate of Clostridium butyricum in China, and has a lot of experience in the research of Clostridium butyricum.

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