

## Effect of the Chinese Herbal Feed Additive on the Development of Yellow Broilers

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**Abstract :** The aim of this experiment was to study the effect of the Chinese herbal feed additive for the development of the organs and tissue of broilers (three yellow broilers) under the heat stress condition. Broilers of 1 day were divided into 3 groups by random sample, contrasted group, tested group 1 and tested group 2 with 20 cocks and 20 hens respectively. In this experiment, two additive levels (0.4% and 0.8%) were supplemented to the basal ration. The contrasted group was only supplied with basal ration, the test group 1 was supplied with the basal diet and 0.4% Chinese herbal feed additive, the test group 2 was supplied with the basal diet and 0.8% china herbal feed additive. The result showed that the basal ration supplementing 0.8% of the Chinese herbal feed additive could enhance the growing of the liver, the kidney and the stomach of broilers under the heat stress condition. the basal ration supplementing with 0.4% Chinese herbal feed additive could not promote the development of the organs and tissue of broilers under the heat stress condition. This suggest that the Chinese herbal feed additive can decrease the damage of heat stress to the liver and the lung to some extent.

**Key words :** Chinese herbal feed additive; Organs and tissue; Three broilers; Development

### Introduction

With the development of livestock husbandry on a large scale and intensive, the effect of the environment factor on animal production is more and more obvious. In every kind of environment factor, the heat environment played important role in the development and growth of animal and chicken markedly. In summer, all parts of our nation are in high temperature, which brings economical loss in chicken industry greatly<sup>[1]</sup>. For this purpose, On the one hand, people are trying to improvement ambient environment for reducing the negative effect of the environment; on the other hand, they are searching the anti-stress medicine or promoting growth medicine for improving heat tolerance in productions of animal and poultry<sup>[2]</sup>. But the animal feed containing a large of antibiotics and other chemical compound maybe produced drugs residue and bacterial resistance, which brought the damages to human beings<sup>[3]</sup>. So, It has been becoming the focus of nutrient ecology to Look for the Chinese herbal additives increasing the performance of chickens under heat stress and avoid drugs residue<sup>[4]</sup>. The effect of environment and feeds on animals

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inevitably presents in cell, tissue, organs that are the basic of life<sup>[5]</sup>. What effect of Chinese herbal additives on the growth of organs in broilers, is not only the basic establishment of mechanism of animal physiology, is but also one of problem that workers at animal science concerns. But the data of this research was few available. This experiment was conducted to define the effect of the Chinese herbal feed additives on the organs and tissue of three yellow broilers under heat stress conditions, to provide the evidence of mechanism to improved animal production by adding Chinese herbs in ration..

## Materials and Methods

### Materials

**Treatment and management:** 120 three yellow chicken in Zhanjiang were divided into randomly three groups (contrasted group, tested group 1 and tested group 2) including 20 cocks and 20 hens. The broilers in Tested group 1 and tested group 2 were feed by basic ration supplementing with 0.4% and 0.8% Chinese herbal medicine respectively, but the broilers of contrasted group was only feed by basic ration

**Basic Ration:** Feed Jiafeng 721 type in age from 1 to 30 day, 722 type in age from 30 to 50 day, 723 type after 50 day. The main nutrient of three types of Rations were showed in Table 1.

Table 1 Nutrient composition of three diets.

Type	Moisture (%)	CP (%)	CF (%)	Ash (%)	Ca (%)	P (%)	NaCl (%)	Lys (%)	ME (MJ · KG <sup>-1</sup> )
721	12.9	20.5	2.0	9.0	0.8~1.3	0.6	0.3~0.8	0.9	20.5
722	12.9	18.0	6.0	9.0	0.8~1.2	0.8	0.3~0.8	0.8	18.0
723	12.9	17.0	6.0	9.0	0.8~1.3	0.5	0.3~0.8	0.7	17.0

**The ingredients of Chinese herbal additives:** The Chinese herbal additives were composed of gypsum, yanhusuo, rhizome of Rehmannia, fruit of asiatic Cornelian cherry, rhizome of Common Yan, Indian Breed, all-gras of wild mint, rhizome of Oriental Waterplantain, root of Mongolian Milkvetch, et al, supplemented with NaHCO<sub>3</sub>, KCl, Vc et al.

### Methods

**Experiment environment:** The Ambient temperature of this experiment were 29°C~35°C and and relative humidity (RH) were 78%~88% respectively. The broilers were in heat stress(High temperature :29°C~35°C), Artificial light(16L:8D), natural ventilation during the experiment period.

**Experiment period:** The experiment was conducted from July 21 to October 16. The chickens were feed basal ration from age 1 to 15, but started to supplement Chinese herb in basic ration in tested groups after age 15.

**Observation of slaughter:** 4 broilers(2 cocks and 2 hens) were slaughtered from age 27 to experiment ending every other 10 days. The heart, liver, lung, pancreas, stomach, and other organs of each broiler were obtained by dissection, weighed by electron-balance and recorded.

**Observation of section:** The Paraffin-section was made by the methods showed as Reference 5 when the broiler were slaughtered on age 57 and observed under microcamera.

**Data annlysis:** All the data obtained from above were analyzed by one-way ANOVA, and the mens were compared by LSR and SSR.

## Results

### *Effect of Chinese herb on the growing of tissue and organs in digestion system*

The effect of Chinese herbal additives on the growing of tissue and organs of those broilers in digestion system exposed to high temperature were shown in table 2 and table 3.

Table 2 Effect of Chinese herbal additives on weight of tissue and organs in digestion system

Age	Group	Liver(g/pcs)	Stomach(g/pcs)	Pancreas(g/pcs)
	10	March	20% <sup>1</sup>	
Accepted	Tested group 1	11.6714±2.67 ab	12.7261±1.84	1.3848±0.22
	Tested group 2	15.1337±2.46 a	14.0759±1.27	1.5843±0.37
	Contrasted group	14.9777±0.85 b	15.6986±3.04	1.5771±0.16
37	Tested group 1	15.2644±2.35 ab	16.6371±3.58	1.5151±0.42
	Tested group 2	17.9946±1.91 a	19.7817±5.00	1.7191±0.14
	Contrasted group	21.1230±6.44	21.1788±4.72	2.3477±0.65
47	Tested group 1	22.7853±4.15	22.5848±4.80	1.5076±0.58
	Tested group 2	26.6337±6.03	28.7301±5.20	2.0884±0.46
	Contrasted group	26.2039±5.55 B	27.9515±5.25B	2.9701±0.75
57	Tested group 1	32.5491±4.24 AB	34.4764±4.73 AB	2.6631±0.23
	Tested group 2	37.2895±4.43 A	38.3635±0.96 A	2.3537±0.38

Notes:1. The description of data is means+Std error, those means from ten samples; 2. The superscript of lowercase and capital stand for significant mark( $P<0.05$ ) and higher significant mark( $P<0.01$ ) respectively; 3. No different mark exists if the superscript is the same letter or no letter in the same team data; 4.The following tables are the same.

Table 3 Effect of Chinese herb on the growth index in digestion system in broilers

Age	Group	Liver (%)	Stomach (%)	Pancreas (%)
27	Contrasted group	2.47 B	3.13	0.38
	Tested group 1	3.20 AB	3.49	0.37
	Tested group 2	3.35 A	3.12	0.35
37	Contrasted group	2.67	2.97	0.30
	Tested group 1	2.60	2.83	0.25
	Tested group 2	2.79	3.07	0.27
47	Contrasted group	2.50 b	2.51 b	0.27
	Tested group 1	3.26 ab	3.23 ab	0.22
	Tested group 2	3.53 a	3.81 a	0.27
57	Contrasted group	2.48 B	2.65 B	0.28
	Tested group 1	2.97 AB	3.14 AB	0.24
	Tested group 2	3.67 A	3.78 A	0.23

**Liver:** The order of the average weight of liver for those broiler from small to large was Contrasted group, Tested group 1 and Tested group 2. There were no significant difference on the weights of those liver between Contrasted group and Tested group 1 in whole experiment period. But the weight in Tested group 2 was 6 gram and 3 gram significantly higher ( $P<0.05$ ) than that in

Contrasted group in two spans(age from 18 to 27 and from 27 to 37); furthermore, the weight of liver in Tested group 2 was 11 gram higher very significantly( $P<0.01$ ) than that in Contrasted group in age from 48 to 57. These results showed that the effect of the ration supplementing with 0.8% Chinese herbal additives on accelerating growth of liver was obvious but this effect of the ration supplementing with 0.4% Chinese herbal additives were not obvious.

The order of the growth index weight of liver for those broiler from small to large was Contrasted group, Tested group 1 and Tested group 2. No significant difference was found on the growth index of liver between Contrasted group and Tested group 1 in whole experiment period. But the growth index in Tested group 2 was significantly( $P<0.05$ ) or very significantly( $P<0.01$ ) about 1% higher than that in Contrasted group in three spans(age from 18 to 27, 38 to 47, 48 to 57). These results showed that the ration containing 0.8% Chinese herbal additives could increase the growth and development of liver for three yellow broiler.

On the observation of tissue structure, when those broilers were slaughtered in 37 day, hemorrhage point and white focus were found on liver in Contrasted group but not happened in other groups. The reason perhaps was the damage of heat stress to the liver.

On the observation of histology, structure integrity and distributing uniformity of the liver cell were found in three groups. Compared with each other, dilatation phenomena was found in lobule-vein and central vein of liver lobule in Contrasted group, accompanying with blood cell existing in central vein. Dilatation phenomena also was found in Contrasted group 1 and 2, but no blood cell existing. The results showed that heat stress made the blood vessel and tissue in liver harmful, but the Chinese herbal additives could alleviate this damages.

**Stomach:** On the weight of stomach, the order is Contrasted group< Tested group 1< Tested group 2. In the span(age from 8 to 48), no significant difference was found on the weight of broiler stomach among three groups, this showed that the function of Chinese herb increasing the growth of stomach was not obvious in this span. But the weight of stomach for the broiler in Tested 2 was 11 gram higher than that these in Contrasted group significantly( $P<0.05$ ) in the span of age from 48 to 57. That results showed that the ration supplementing with 0.8% Chinese herbal additives could promote the growth of stomach in broiler in this span, and the ration supplementing with 0.4% Chinese herbal additives could not.

On the growth index of stomach, the order is Contrasted group< Tested group 1< Tested group 2. Compared with the Contrasted group, no significant difference was found on the growth index in Tested group 1 in whole experiment period, but in Tested group 2, it was 1.3% higher significantly( $P<0.05$ ) or very significantly( $P<0.01$ ) in two spans(age from 38 to 47, 48 to 57). This result showed that the ration supplementing with 0.8% Chinese herbal additives could promote the growth of stomach in broiler in this span, and the ration supplementing with 0.4% Chinese herbal additives could not.

On observation of histology, structure integrity of the stomach and array regulation of muscle fibers were found among three groups. Compared with each other, broadening stroma on muscle fibers in stomach was found in Contrasted group, dilatation phenomena on small artery in stomach in Tested group 2, no difference in Tested group 1. Broadening stroma and blood vessel dilatation were perhaps caused by edema and active blood circulation respectively. The results indicated that

high temperature made harm to muscle fibers of stomach in broiler, but Chinese herb could decrease that harm.

**Pancreas:** On the weight of pancreas, no significant difference was found among three groups in the whole experiment period.

On the growth index of pancreas, no significant difference was found among three groups in the whole experiment period.

On the observation of tissue structure, the shape, structure and color of pancreas were normal, no different was found.

On the observation of histology, the structure of duct and pancreas islet et al are normal, no different was found.

#### *Effect of Chinese herb on the growing of heart, lung, kidney, testicle in broiler*

The effect of Chinese herbal additives on the growing of heart, lung, kidney, testicle in broilers exposed to high temperature are shown in table 4 and table 5.

Table 4 Effect of Chinese herbal additives on the weight of heart, lung, kidney, spermary in broilers

age	Group	Heart	Lung	Kidney	Testicle
27	Contrasted group	2.5257±0.75	2.1231±1.03	3.9488±0.93	0.0749±0.02
	Tested group 1	2.7342±0.09	2.1137±0.42	3.5113±1.08	0.0971±0.05
	Tested group 2	2.6229±0.27	2.7649±0.44	4.7838±0.43	0.1271±0.02
37	Contrasted group	2.6117±0.42	2.8368±0.51	4.2965±0.36 B	0.1979±0.06
	Tested group 1	2.6899±0.29	3.2135±0.41	5.1391±0.49AB	0.1866±0.001
	Tested group 2	2.9224±0.54	3.4899±0.93	5.9727±0.98 A	0.2058±0.01
47	Contrasted group	2.7827±0.45	4.0322±1.26	6.4759±1.08	0.3632±0.08
	Tested group 1	3.2569±0.70	3.7393±0.77	6.5259±0.54	0.1900±0.14
	Tested group 2	3.6208±0.71	3.9141±1.05	7.1531±1.43	0.2822±0.03
57	Contrasted group	4.0798±0.66	5.6540±1.63	7.4174±1.15 b	0.4119±0.08
	Tested group 1	4.0484±0.87	5.0712±0.92	8.9556±0.60ab	0.4419±0.10
	Tested group 2	4.0141±0.84	5.2782±2.16	10.0122±1.15 a	0.5840±0.35

**Heart:** On the weight of heart, no significant difference was found among three groups in the whole experiment period. This showed that the effect of Chinese herb on the growth of heart was not obvious.

On the growth index of heart, compared with the Contrasted group, no significant difference was found in Tested group 1 in whole experiment period, but in Tested group 2, it is significant ( $P<0.05$ ) in the span (age from 38 to 47). This result showed that the ration supplementing with 0.8% Chinese herbal additives could promote the growth of heart in broiler in this span, and the ration supplementing with 0.4% Chinese herbal additives could not.

On the observation of tissue structure, the shape, structure and color of heart were normal, no difference was found.

On the observation of histology, structure integrity of the mucous, intercalated disc and array regulation of muscle fibers were found among three groups. Compared with each other, congestion was found among muscle fibers of heart in Contrasted group, the dilatation phenomena caused by heat stress in small vein and artery of heart in Tested group 2, these dilatation phenomena was not

found the broiler in Tested group 1. This showed that Chinese herb could decrease the damage caused high temperature.

**Lung:** On the weight of lung, no significant difference was found among three groups in the whole experiment period. This showed that the effect of Chinese herb on the growth of lung was not obvious. The same result to the growth index of lung.

On the observation of lung structure, when the broilers were slaughtered in 37 day, white and hemorrhage caused by the heat stress were found on the lung in cock in Contrasted group. On the observation of histology, compared among three groups, lots of blood cells existed in the terminal bronchia, pulmonary emphysema was badly serious in Contrasted group; a few blood cells existed in bronchiole, pulmonary emphysema was not serious in Tested group 1; few blood cells existed in bronchiole, pulmonary emphysema was light in group 2. This results revealed that high temperature made the damages to alveoli and capillary in lung, and Chinese herb could alleviate those damages.

Table 5 Effect of Chinese herbal additives on the growth index of heart, lung, kidney, testicle in broilers

Age	Group	Heart (%)	Lung (%)	Kidney (%)	Spermary (%)
27	Contrasted group	0.66	0.55	1.03	0.02
	Tested group 1	0.75	0.58	0.96	0.03
	Tested group 2	0.58	0.61	1.06	0.03
37	Contrasted group	0.50	0.54	0.81 b	0.04
	Tested group 1	0.48	0.55	0.87 ab	0.03
	Tested group 2	0.45	0.54	0.92 a	0.03
47	Contrasted group	0.33 b	0.48	0.77 b	0.04
	Tested group 1	0.47 ab	0.54	0.93 ab	0.03
	Tested group 2	0.48 a	0.52	0.95 a	0.04
57	Contrasted group	0.39	0.54	0.70 B	0.04
	Tested group 1	0.37	0.46	0.82 AB	0.04
	Tested group 2	0.40	0.52	0.98 A	0.05

**Kidney:** On the weight of kidney the order is Contrasted group < Tested group 1 < Tested group 2. No significant difference was found on the weight of kidney among three groups in two spans (age from 18 to 27, 38 to 47). Compared with the Contrasted group, no difference existed in the Tested group 1 in age from 28 to 37, but it was 1.7 gram very significantly ( $P < 0.01$ ) higher in Tested group 2. So did in the age from 48 to 57, the number was 2.5 gram. This results indicated that the effect of the ration supplementing with 0.8% Chinese herbal additives on promoting growth of kidney was obvious, but the ration supplementing with 0.4% Chinese herbal additives was not.

On the growth index of kidney, the order from small to large was Contrasted group, Tested group 1 and Tested group 2. Compared with the Contrasted group, no significant difference was found on the growth index in Tested group 1 in whole experiment period. But it was 0.1%, 0.2%, 0.3% higher significantly ( $P < 0.05$ ) or very significantly ( $P < 0.01$ ) in three spans (age from 28 to 57). This results revealed that the effect of the ration supplementing with 0.8% Chinese herbal additives on promoting growth of kidney was obvious, but the ration supplementing with 0.4% Chinese herbal additives was not.

On the observation of tectology, the shape, structure and color of kidney were normal, no different was found among three group.

On the observation of histology, structure integrity of the proximal tubule, distal tubule and renal corpuscle were found in three groups. The size and distributing of kidney nucleolus were uniformity. Compared with each other, hypertrophy phenomena existed in kidney glomerulus and epithelium cell of renal tubules in Contrasted group. No difference existed in other groups. The results indicated that heat stress made the damage to kidney glomerulus and epithelium cell of renal tubules, and Chinese herb could alleviate those damages.

**Testicle:** On the weight of testicle, no significant difference was found among three groups in the whole experiment period. Which showed that the effect of Chinese herb on the growth of testicle was not obvious.

On the growth index of testicle, no significant difference was found among three groups in the whole experiment period.

On the observation of tectology, the shape, structure and color of testicle were normal, no difference was found in the broilers among this three group.

On the observation of histology, structure integrity of testicle stroma and seminiferous tubules were found in three groups, no difference existed.

## Discussion

Under the heat stress, the hypothalamus in the broiler may synthesize and release the corticotropin-releasing factor that may activate the pituitary synthesizing and releasing the ATCH, that hormone can activate the cell of cortex in the adrenal gland releasing the corticosterone. Quantities of corticosterone make broilers appear to be nervous, fast heartbeat and less appetite<sup>[6]</sup>. Under the heat stress, the chicken's body temperature will go up, the oxidation will be enhanced, this maybe lead to strong decomposition of protein and disordered central nervous system, weakening the peristalsis of gastro-intestinal tract and the secretion of the gastric juice and pancreatic juice, reducing the synthesis of the hepatin in liver, and breaking the composition of the protein in blood<sup>[5]</sup>. In this case, food intake and the digestion rate will be reduced, and also the body should enhance the oxidation to overcome the stress, this maybe led to the growing of the digestive system had been decreased. The all-grass of wild mint, gypsum and Tuckahoe et al in the Chinese herbal additives had the functions of clearing away heat to cool blood and relieving heavy thirst, which can alleviate the heat stress by inhibiting the thermoregulation center. Except for the function of clearing away heat and cool blood, the Moutan bark and rhizome of *Rehmannia* have the functions of nourishing yin and promoting fluid production, invigorating spleen and stomach, improving the digestion and absorption of food, and promoting the growth of the tissue<sup>[7]</sup>.

During the experiment period, when slaughter in age 37, hemorrhage point and white focus were found on liver in cock, which was perhaps caused by the obvious changes in blood circulation. The blood flow volume of liver of these birds was reduced, the blood circulation and fat metabolism of these birds was lowered in liver under the heat stress, leading to fatty liver or other diseases<sup>[8]</sup>. On the comparison of histology, dilatation phenomena was found in central vein of liver lobule, accompanying with many blood cells existing<sup>[9]</sup>. This was the reason that congestion caused by the

blood flow volume of liver was reduced and the microcirculation in liver was obstructed in the heat stress<sup>[10]</sup>. The result was accordance with pathological change in liver reported by Luo Jirong. However, Indian bread in Chinese herbal additives has the function of calming heart and soothe the nerves that can lower the blood pressure by accelerating dilatation of the capillary in epidermis, leading to alleviate the heat stress. Furthermore, Moutan bark and yanhusuo in the Chinese herbal additives have the functions of activating blood to resolve stagnation, promoting blood circulation and enhancing metabolism<sup>[11]</sup>.

In this experiment, broadening stroma on muscle fiber in stomach was found, which might be attributable to the edema. The edema<sup>[11]</sup> was caused by the following reasons: the enhancement of the oxidation and the decomposition of protein; the decrease of concentration of the albumin and globulin in plasma. And those reasons led to the reduction of colloid osmotic pressure of plasma, in the end to the edema. No edema existed in tested groups because that Chinese herb could reduce those damages. The dilatation phenomena on small artery in stomach in Tested group 2 was found, which was caused by the enhancement of blood circulation and metabolism with Chinese herb<sup>[12]</sup>.

In this experiment, the weight of kidney in the tested group 2 was significantly or very significantly higher than that in contrasted group 1 in two spans(age from 28 to 37, 48 to 57). And as to the comparison of growth index, that of heart and kidney was significant or very significant in some spans. On the observation of histology, congestion was found among muscle fibers of heart in Contrasted group 1, which was caused by the reduction of blood flow volume in organs. Dilatation phenomena was found in small vein and artery of heart in Tested group 2. Under high temperature conditions, the growth and development of corresponding organs of these broiler was affected by obvious change in blood circulation: high heart rate, increase of blood flow volume in the skin, respiratory tract, abdominal muscles and relative decrease of blood flow volume in the kidney and other organs. The concentration function of these were raised the damage of the heat stress for the broiler, leading to diminution of blood flow volume in the organs, so the cycle of blood circulation was longer and the renewal of blood was slower, the growth of organs was affected<sup>[13]</sup>. The rhizome of Rehmannia in the Chinese herb has the function of nourishing negative and promoting fluid production; the yanhusuo has promoting to flow of air and stop pain, invigorating spleen and stomach; the fruit of malaytea scurfpea and all-grass of Longspur Epicedium have invigorating kidney strengthening positive, the combination of these Chinese herb medicine not only could relieve the heat stress, but also could improve the broilers immunity and accelerate the growth of organs of urinary circulatory system<sup>[14]</sup>.

When slaughter in age 37, hyperemia was found in lung in the Contrasted group, the phenomenon was the same with the results of research by Hu that Chinese herbal additives had the effect on the growth of organ in broilers under the heat stress. On the comparison of histology, finding that terminal bronchioles is existed lots of blood cells and the alveoli had serious pulmonary emphysema. This reason was that the birds have no sweat gland, the only effective way of loss of heat was depending on the panting under the high temperature, releasing heat by evaporating the water from respiratory tract. Long time hard respiration made the lung harm, it appeared to be hyperemia in lung on the macroscopical observation and hyperemia in bronchioles, pulmonary edema on the microcosmic observation<sup>[15]</sup>. The hypereamia of the whole lung was caused by bronchiole



hyperaemia, pulmonary emphysema was caused by rapid and deep respiration that generated the rupture of the wall of the alveoli, amalgamation among small alveolars, forming the big alveolar<sup>[10]</sup>. No hyperemia phenomenon or light pulmonary emphysema was found in Tested groups, which was produced by the reasons: the inorganic salt in the Chinese herbal additives could enhance the water drinking; all-gras of wild mint and Gypsum had the function of cooling blood, which could diminish the production of heat; Indian Breed had function of quieting heart and tranquilizing spirit, which could control the excitement of central nerve<sup>[16]</sup>. The combination of those functions could regulate the respiration frequency and respiration depth, diminishing the damages in lung in heat stress, avoiding pulmonary hyperaemia and pulmonary emphysema.

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## 中草药饲料添加剂对三黄鸡发育的影响

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**摘 要:** 本实验的目的是探讨中草药饲料添加剂对热应激状态三黄肉鸡细胞组织器官发育的影响。将体重相似的 1 日龄小鸡随机分成三组, 对照组、试验 1 组和试验 2 组, 每组公母各 20 只。对照组只喂基础日粮, 试验 1 组除供给基础日粮外, 添加 0.4% 的中草药饲料添加剂; 试验 2 组除供给同样的基础日粮外, 添加 0.8% 的中草药饲料添加剂。试验结果表明: 添加 0.8% 水平的中草药饲料添加剂能明显促进热应激状态下肉鸡肝脏、肾脏和胃的生长发育。添加 0.4% 水平的中草药饲料添加剂对热应激状态下肉组织器官的生长发育的促进作用效果不明显。这表明, 中草药饲料添加剂可在一定程度上减缓热应激对肉鸡肺和肝造成的损伤。

**关键词:** 中草药饲料添加剂; 组织; 器官; 三黄肉鸡; 发育