

REVIEW

of the Official Opponent **Li Bo** Doctor of food Sciences, professor at Henan Institute of Science and Technology, China for PhD Thesis **Yingying Qiao**
«Development of technological methods of growing and use the plant extracts to improve the meat quality of broiler chicken» Submitted for a Scientific Degree of a Doctor of Philosophy Field of Study: 20 - "Agrarian Sciences and Food" Specialty 204 - "Technology of production and processing of animal husbandry products"

1.Relevance of the dissertation topic

Poultry products are an indispensable food source in people's daily life, and ensuring their greenness, environmental protection and safety is an important part of food safety. However, in recent years, with the increasing intensification of the poultry farming industry, in order to improve economic benefits, farmers have used a large amount of antibiotics in feed, which has brought great harm to human health and environmental safety. Countries around the world, including China and Ukraine, currently ban the use of antibiotics in feed.

Astragalus is the dried root of *Astragalus mongolica* and *Astragalus membranaceus*, which is one of the traditional Chinese medicines in China. Astragalus polysaccharide is an immunoactive polysaccharide isolated from the rhizome of *Astragalus membranaceus*, which has the functions of regulating animal immune function, anti-oxidation, anti-tumor and anti-infection. As one of the traditional Chinese herbal medicines, Glycyrrhiza has attracted people's attention due to its biological activities such as anti-oxidation, antibacterial and anti-virus, anti-cancer, anti-inflammation, immune regulation, and hypoglycemia. In addition, Glycyrrhiza also has the effects of antitussive, expectorant, asthma, lung protection and resistance to respiratory pathogens.

Most meat needs to be processed before eating to obtain the expected taste and flavor, remove the peculiar smell and bloody smell of the meat itself, and be more conducive to human digestion and absorption of more nutrients. Common traditional processing methods include salting, steaming, boiling, frying, roasting, drying, etc. However, the quality of meat products will change after processing, and different processing methods have different effects on meat quality. Studies have shown that meat cooked in high-temperature water can not only kill harmful microorganisms in the meat, improve the taste, but also retain the nutrition of the meat more comprehensively.

At present, most of the studies on *Astragalus* extract and *Glycyrrhiza* extract focus on the effect on the performance of broiler chickens, but there is no report on the effect of feeding *Astragalus* extract and *Glycyrrhiza* extract on chicken quality by using high-temperature boiling technology. Therefore, to study the effect of *Astragalus* extract and *Glycyrrhiza* extract on the feeding effect of broiler chickens, and to study the effect of high-temperature boiling process on the quality of broiler chickens fed with *Astragalus* extract and *Glycyrrhiza* extract, the *Astragalus*

extract and Glycyrrhiza extract were used as The application of new antibiotic alternatives in poultry production is of great significance.

2. Scientific novelty of the obtained results

The experiment was the first to systematically study the effects of Astragalus extract, Glycyrrhiza extract and their combination on broiler performance, meat quality, antioxidant function, immune function and intestinal barrier function.

The experiment was the first to systematically study the effect of high-temperature boiling process on the quality of broilers fed with extracts of Astragalus membranaceus and Glycyrrhiza extracts.

Through the analysis of intestinal microflora, it was concluded that Astragalus extract and Glycyrrhiza extract could affect broiler performance, meat quality, antioxidant function and immune function by regulating intestinal microorganisms.

The optimal doses of Astragalus extract and Glycyrrhiza extract in broiler diets were determined through research.

3. Practical significance of the obtained results

Astragalus extract and Glycyrrhiza extract can affect production performance, serum antioxidant performance, immune function, inflammatory factors, intestinal mucosal morphology and intestinal permeability by improving the composition of intestinal flora.

Adding astragalus extract and Glycyrrhiza extract can achieve the feeding effect of adding oxytetracycline calcium, and adding 150mg/kg astragalus extract + 75mg/kg Glycyrrhiza extract has a better effect.

Adding Astragalus extract, Glycyrrhiza extract, high-dose Astragalus-Glycyrrhiza combination, and low-dose Astragalus- Glycyrrhiza combination to the diet increased the income per chicken by US\$0.078, US\$0.120, US\$0.044 and US\$0.113, respectively. Adding Glycyrrhiza extract alone has the best economic benefit.

The high-temperature boiling technology can improve the meat quality of broiler chickens fed with Astragalus extract and Glycyrrhiza extract.

4. The level of substantiation of research results, conclusions and recommendations formulated in the dissertation

The experimental program of this dissertation was approved by the Academic Committee of Henan Agricultural University. Animal feeding experiments were carried out in strict accordance with the management procedures of large-scale farms. The experimental data were analyzed using SPSS 26.0 software for one-way ANOVA, and the Duncan method was used for multiple comparisons, and the data analysis results were reliable. References cited in the dissertation are well documented.

5. Evaluation of the completeness of the presentation of the main provisions of the dissertation in scientific publications

Published a total of 20 articles based on the research results of the dissertation, including 6 articles in scientific professional publications of Ukraine, 1 article in scientific journals of other countries, 4 articles published in journals indexed in Web of Science, and 9 theses of the reports. These serial publications ensure that the main terms of the dissertation are fully and accurately represented in scientific publications, revealing the subject of the dissertation. The research transparency of this experiment is high, the data support is sufficient, and the research process and results are presented in detail.

Articles in scientific professional publications of Ukraine

1. Qiao, Y., Kyselov, O., & Liu, C. (2019). EFFECTS OF AMBIENT TEMPERATURE ON BROILERS PHYSIOLOGY. PERFORMANCE AND MEAT QUALITY. Bulletin of Sumy National Agrarian University. The Series: Livestock, (1-2(36-37), 38-41. <https://doi.org/10.32845/bsnau.lvst.2019.1-2.5>
2. Qiao, Y., Kyselov, O., & Liu, C. (2020). Effects of ambient temperature on body size and organ development in broilers/ Bulletin of scientific works "Technology of production and processing of livestock products", Bila Tserkva. 2020. № 2. p. 29–36.<https://doi.org/10.33245/2310-9289-2020-158-2-28-35>
3. Qiao, Y., Kyselov, O., & Liu, C. (2020). EFFECTS OF LONG-TERM RELATIVELY HIGH AND LOW TEMPERATURE USE ON GROWTH PERFORMANCE AND MEAT QUALITY OF BROILERS. Bulletin of Sumy National Agrarian University. The Series: Livestock, (2 (41), 12-17. <https://doi.org/10.32845/bsnau.lvst.2020.2.2>
4. Qiao, Y., Kyselov, O., & Liu, C. (2021). THE EFFECT OF HERBAL FEED ADDITIVE ASTRAGALUS POLYSACCHARIDE ON IMMUNE REGULATION IN POULTRY. Bulletin of Sumy National Agrarian University. The Series: Livestock, (1(44), 110-114. <https://doi.org/10.32845/bsnau.lvst.2021.1.16>
5. Qiao, Y., Kyselov, O., & Liu, C. (2021). EFFECTS OF ASTRAGALUS EXTRACT AND GLYCYRRHIZA EXTRACT ON BROILER PERFORMANCE, APPARENT NUTRIENT METABOLISM RATE AND MEAT QUALITY. Bulletin of Sumy National Agrarian University. The Series: Livestock, (3 (46), 28-36. <https://doi.org/10.32845/bsnau.lvst.2021.3.5>
6. Yingying, Qiao, Liu Changzhong, and Oleksandr Kyselov. "THE EFFECT OF HIGH-TEMPERATURE MEAT PROCESSING TECHNOLOGY ON THE FLESH QUALITY OF BROILERS FED WITH ASTRAGALUS EXTRACT AND GLYCYRRHIZA EXTRACT." Bulletin of Sumy National Agrarian University. The series: Livestock 2 (2023): 3-8.

Articles published in journals indexed in Scopus / Web of Science databases

7. Yingying Qiao; Changzhong Liu; Yongpeng Guo; Wei Zhang; Weibing Guo; Oleksandr Kyselov; Zhixiang Wang, Polysaccharides derived from Astragalus membranaceus and Glycyrrhiza uralensis improve growth performance of broilers by enhancing intestinal health and modulating gut microbiota. Poultry Science 2022, 101 (7), 101905. <https://doi.org/10.1016/j.psj.2022.101905>
8. Qiao, Y.; Guo, Y.; Zhang, W.; Guo, W.; Oleksandr, K.; Bozhko, N.; Wang, Z.; Liu, C. Effects of Compound Polysaccharides Derived from Astragalus and Glycyrrhiza on Growth Performance, Meat Quality and Antioxidant Function of Broilers Based on Serum Metabolomics and Cecal Microbiota. Antioxidants 2022, 11, 1872. <https://doi.org/10.3390/antiox11101872>
9. Xing Li, Zhenhui Cao, Yuting Yang, Liang Chen, Jianping Liu, Qiuye Lin, Yingying Qiao, Zhiyong Zhao, Qingcong An, Chunyong Zhang, Qihua Li, Qiaoping Ji, Hongfu Zhang, Hongbing Pan. Correlation between jejunal microbial diversity and muscle fatty acids deposition in broilers reared at different ambient temperatures[J]. Scientific reports, 2019, 9(1): 1-12. <https://doi.org/10.1038/s41598-019-47323-0>
10. Yuting Yang, Huan Gao, Xing Li, Zhenhui Cao, Meiquan Li, Jianping Liu, Yingying Qiao, Li Ma, Zhiyong Zhao, Hongbing Pan. Correlation analysis of muscle amino acid deposition and gut microbiota profile of broilers reared at different ambient temperatures[J]. Animal bioscience, 2021, 34(1): 93. DOI: 10.5713/ajas.20.0314

Theses of the reports

11. Qiao Yingying, (2020) Influence of vegetable essential oils on the quality of meat in poultry industry / Proceedings SPS of teachers, graduate students and students of Sumy NAU (April 13-17, 2020) - Sumy, 2020. - p.145
12. Qiao Yingying, (2020) The use of polysaccharide astragalus in the growing up of broiler chickens / Proceedings of the All-Ukrainian scientific conference of students and posgraduate students to the International student day - (November 16-20, 2020). - Sumy, 2020. - p.98
13. Qiao Yingying, (2020)The effect of astragalus polysaccharides on immune system of broiler chickens /Kharkiv State Zooveterinary Academy / All-Ukrainian scientific-practical internet conference dedicated to the 100th anniversary of the Faculty of Animal Products Technology and Management Kharkiv-2020 -p. 50-53
14. Qiao Yingying, (2020)The immune regulation mechanism of astragalus polysaccharide and its application in poultry industry/ CURRENT ISSUES OF TECHNOLOGIES OF LIVESTOCK PRODUCTS V All-Ukrainian scientific-practical Internet conference / Poltava-2020. -p.116-121
<https://www.pdaa.edu.ua/sites/default/files/node/1239/zbirnyk-internet-konferenciya-29-30-2020.pdf>

15. Qiao Yingying (2021). Features of the use of astragalus polysaccharides in the poultry production performance. /Proceedings of the 2nd International Scientific and Practical Conference AWCGCC, April 21-22, 2021. Dnipro, -p. 82–83.

<https://dspace.dsau.dp.ua/>

16. Qiao Yingying, (2021). The results of the use of astragalus polysaccharides in the growing up of broiler chickens. Proceedings of the scientific-practical conference of teachers, graduate students and students of Sumy NAU (April 19-23, 2021). - Sumy, 2021. p.- 108

17. Qiao Yingying, (2021) Useful value of plant extracts and their use in poultry industry / Proceedings of the scientific-practical conference of teachers, postgraduate students and students of Sumy NAU (15-19 November 2021). - Sumy, 2021. p.- 117.

18. Qiao Yingying, (2022) Study of the effect of phytogenic additive α -galactosidase on productivity and health of broilers / Proceedings of the scientific-practical conference of teachers, postgraduate students and students of Sumy NAU (26-29 April 2022). - Sumy, 2022. p.- 67.

6. Evaluation of the main content and design of the work

The experiment was divided into 6 treatment groups, including control group (feeding basal diet), Antibiotic group (adding 500 mg/kg Terramycin calcium), Astragalus extract group (adding Astragalus extract 300 mg/kg), Glycyrrhiza polysaccharide group (Add Glycyrrhiza extract 150mg/kg), low-dose Astragalus-Glycyrrhiza polysaccharide group (add Astragalus extract 150 mg/kg+ Glycyrrhiza extract 75mg/kg), high-dose Astragalus-Glycyrrhiza polysaccharide group (add Astragalus extract 300 mg/kg+ Glycyrrhiza extract 150mg/kg). The effects of Astragalus, Glycyrrhiza extracts and their combined use on broiler performance, meat quality, antioxidant function, immune function and intestinal barrier function were mainly studied. Through the analysis of the intestinal microbial diversity of broiler chickens, the possible mechanism of the effect of extracts of Astragalus and Glycyrrhiza on broiler chickens by regulating intestinal microorganisms was discussed. The effect of high temperature cooking process on the quality traits of broilers fed extracts of Astragalus membranaceus and Glycyrrhiza membranaceus was studied. The experimental design is reasonable and the research content is sufficient.

7. General methodology and basic methods of research

The data analysis in the dissertation used SPSS 26.0 software for one-way ANOVA, and Duncan method was used for multiple comparisons, and GraphPad was used to draw pictures. The data analysis results are reliable.

8. Correspondence of the dissertation to the specialty and field of knowledge for which it is submitted for defense

The research content of the dissertation is in line with the research field "20 - agricultural sciences and food" and the major "204 Technology of production and processing of animal products".

9. Absence (presence) of violation of academic integrity

The content of the dissertation has passed the plagiarism test and meets the requirements of the dissertation

10. Compliance with the rules of handling animals and bioethics.

Experimental animals followed all procedures of the Animal Ethics Committee of Henan Agricultural University (HNND2022041602) to reduce stress and suffering.

11. Discussion clauses and comments

The latest research reports are cited in the discussion, and the evidence is solid. The following points should be noted in reviewing the full text:

1. When Inner Mongolia Hengguang Pharmaceutical Co., Ltd is mentioned in P63, where does the company originate from?
2. In the experimental design section, please confirm which word "Terramycin calcium" or "oxytetracycline" is used for the antibiotic?
3. Why did you use precisely Astragalus and Glycyrrhiza extract?
4. What is the cost price of Astragalus extract, Glycyrrhiza extract?
5. Why is the experiment time of broiler 42 days?
6. What method was used to determine the Metabolic Rate of Nutrients in Broilers?
7. What are the effects of Astragalus extract and Glycyrrhiza extract on the intestinal barrier of broilers?
8. What is the potential mechanism of Astragalus extract and Glycyrrhiza extract on the intestinal barrier of broilers?
9. In the dissertation, "*Occludin, Claudins*" and other words need to be written in italics, please modify.
10. The active components of Astragalus polysaccharides and glycyrrhiza polysaccharides are 70.23% and 61.36%, respectively. Do you know their active components?
11. Which plant extracts provide the most economic benefits?

12. General conclusion

Dissertation work of Qiao Yingyin on the topic "Development of technological methods of growing and use the plant extracts to improve the meat quality of broiler chicken", which was submitted for defense to the specialized academic council for obtaining the degree of Doctor of Philosophy in the field of knowledge

20 - "Agrarian sciences and food" Specialty 204 - "Technology of production and processing of animal husbandry products" according to its relevance, scientific and theoretical level, main results of validity, main provisions and the results published in professional publications, the novelty of the formulation and the practical significance meet the requirements of the order of the Ministry of Education and Culture of Ukraine No. 40 of January 12, 2017 «On approval of requirements for the preparation of a dissertation» and Resolution of the Cabinet of Ministers of Ukraine of January 12, 2022 No. 44 «On approval of the Procedure for awarding a degree doctor of philosophy and cancellation of the decision of the one-time specialized academic council of the institution of higher education, scientific institution on awarding the degree of doctor of philosophy» with changes introduced in accordance with Resolution of the Cabinet of Ministers No. 341 dated 03.21.2022.

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