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Efficacy of Different Medicinal Herbs as Feed Additives on the Meat Composition and Economical Evaluation of Broiler Chicken

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Abstract
Seven blends of medicinal herbs were used in the broiler chicken diet to study their effects on meat compassion and economic evaluation in broiler chicken. Two hundred and ten (210, one-day-old) unsexed chicks were divided into Seven dietary treatments, including basal diet with no addition of medicinal herbs (T1), basal diet plus 0.5 g/kg of medical herbs including cinnamon (T2), turmeric (T3), Piper nigrum (T4) Plantago lanceolata (T5), basil (T6), Eruca sativa (T7). The results showed that chicks were fed on medicinal herbs as an additive, a noticeable improvement in the chemical composition of poultry meat in terms of an increase in total protein and minerals as represented by ash, as well as reducing the levels of fat, amino acid, especially Leucine, lycin, threonine, tryptophane, and valine for all treated groups.

Keywords: Medicinal Herbs, Feed Additives, Broiler Chicken

Introduction
The increasing demand for lean and protein-rich nutritious meat in livestock and poultry has become essential for several years [1]. Goose meat, known for its abundance of amino acids and minerals, is a healthy food option that benefits human health [2].

With the risks associated with synthetic food additives and the increasing demand for better net catering, people have chosen natural products, such as spices and medicinal plants. These choices lend the prospective buyers safety and stability similarly. Medicinal plants evolved a reputation as the ultimate therapeutic solution for diverse ailments in the past, and possessing the ability to influence farm animal health positively has been a growing field of interest lately [3]. In recent decades, there has been a growing activity in utilizing plant, herbal extracts, and phytochemicals in livestock feed formulation. On the other hand, research confirms that phenolic compounds within medicinal plants and herbs have been consistently reported for their antioxidant capacity, preventing lipids' oxidation, thus reducing the production of non-desirable off-odors in meat [4].

A novel approach proposed at the intersection of animal sciences and food sciences is enhancing the nutritional value of meat via dietary means [5, 6, 7] because it is more beneficial to implement nutrition-related strategies in the whole chain of meat production in order to increase the quality of meat rather than to add supplements into the meat; this is because the nutrients shade the areas where they are most needed for high absorption rates [8]. In the broiler chickens prospect, meat quality comes up instead of the physical ones, as it is mainly consumed as cuts or processed foods, not whole carcasses. The physical quality encompasses various meat properties, such as pH levels and color values.

Flowering plants and herbaceous plants have many compounds that have anti-cancer properties, which help prevent damaging changes in meat by radicals, thus reducing the production of unpleasant odors [4]. Currently, at the crossroads between animal technology study and nutrition science research, a unique way has been adopted. It is based on the idea that healthy means can ultimately improve meat [7]. This strategy intends to catch beneficial molecules at the points where the latter are most necessary for healthy pursuits [9], which turns out to be better than just incorporating extraneous supplements in the meat.

Current research indicates that Chinese medical herbs show anti-oxidative activity, which implies their effect on poultry meat's quality and immunity [10, 11]. One particular Herbin Gentian works similarly by making a bitter taste that increases appetite. Recently, digestion has been researched to increase appetite in rodents. It triggers bitter receptors in the gastrointestinal tract; somatostatin is released, and absorption of nutrients is increased along with water retention in muscles [12]. The licorice herb, also known as Glycyrrhiza glabra, is another notable one, and not only improves meat quality in broilers and finishing pigs but enhances their feed efficiency. The main active components of licorice, glycosides, and triterpenoids saponin contribute to these activities [13].

Licorice extract is also associated with the press production of these biomolecules, which defend against infections through increased interferon and globulin levels in the body of the animals [14]. Furthermore, studies have shown that Poria cocos polysaccharide exhibits various immune effects. It increases serum IgG levels, stimulates macrophage phagocytosis, and stimulates antibody production in B lymphocytes and the spleen [15, 16]. It has also been reported that polysaccharides derived from Codonopsis pilosula preserve intestinal homeostasis and safeguard the intestinal mucosal immune barrier. [17].

Materials and Methods

Animal housing and nutrition

Each dietary treatment consisted of 210 chickens, divided into seven pens with 30 chickens per pen. The feeding program comprised three phases: starter, grower, and finisher diets. During the initial 14-day acclimation period, the chicks were fed a starter diet. Subsequently, they were given a grower diet for the following 21 days and a finisher diet for the last 7 days of the fattening period. Feed and water were provided ad libitum throughout the trial, ensuring unrestricted access. Microclimate conditions were regularly monitored to maintain optimal environmental conditions. Puvača et al. (2015) detailed the rearing and housing circumstances, whereas Puvača et al. (2016) provided an overview of the hens' nutritional requirements.

Table 1. Experimental design with chickens and dietary treatments, g/100g

Experimental treatments	Additives (Medical herbs)	Concentration of additives in chicken diets g/kg		
		Starter 1 – 14 days	Grower 15 – 35 days	Finisher 36 – 42 days
T1	basal diet	0.0	0.0	0.0
T2	cinnamon	0.5	0.5	0.5
T3	turmeric	0.5	0.5	0.5
T4	Piper nigrum	0.5	0.5	0.5
T5	Plantago lanceolata	0.5	0.5	0.5
T6	basil	0.5	0.5	0.5
T7	Eruca sativa	0.5	0.5	0.5

Sample collections.

On the 42nd day of the experiment, five broiler chicks from each treatment group were selected for meat quality evaluations. These chicks had an average body weight. Before slaughter, the broiler chickens were fasted for 12 hours. Subsequently, they were slaughtered and subjected to processes such as bloodletting, scalding, plucking, and evisceration, following standard procedures. The carcasses were then chilled. After slaughter, according to the designated procedure outlined in the Regulation on Poultry Meat Quality, cold carcasses were sliced into primal portions, such as the breast, thighs with drumsticks, wings, back, head, neck, and legs. Twenty-four hours after death, the muscle fibers of the chest (Musculus pectoralis) and the thigh muscles (Tibialis anterior and Biceps femoris) were examined.

Chemical analyses

Meat chemical composition (Moisture, Protein, Fat, Ash, Arginine, Cysteine, Isoleucine, Leucine, Lysine, Threonine, Tryptophan, and Valine.) The Diode Array 7200 NIR analysis system, known for its simplicity and accuracy, was used to estimate the meat quality. The analysis process involves four straightforward steps. First, the sample is poured into the dish. Next, the dish is placed under the light beam. Then, the desired product is selected from the list on the touch-screen interface. Finally, by pressing the "Analyze" button, the system provides the results within six seconds. This method minimizes errors and ensures efficient and rapid analysis.

A new dish is presented after the analysis of each sample, and cleaning is avoided as the vessel is ready for another sample. Firstly, this brand's NIR Dissolved Oxygen Analysis System is highly versatile when working with different sample types, most of which can be analyzed without any extra sample preparation steps. The fact that the diode array technology applied in these systems is from the breed that does not employ the moving parts in the optics is noteworthy. It is a distinctive detail of the instrument as the quality of operation is not affected by components wearing out or misalignment. Consequently, instead of the high maintenance needs of the systems that incorporate moving parts, such as scanning monochromators, this instrument requires much less service, and the maintenance cycle is usually longer than ever before (Figure 1). Let's say that the 7200 NIR Diode Array analysis system's operation is geometrically presented with a diode array. The 7200 NIR analysis system operates based on the following optical principle: The experiment can be done in the lab.

The sample is lit by a lamp that shines a white-colored light. The sample typically absorbs a specific part of this light while the remainder will be reflected; this reflected light will encounter a thin grating, which is stationary and in place to spread and split it into individual wavelengths, thus enabling the observer to visualize the rainbow-like spectrum. Each line of wavelength by a particular sensor is considered, resulting in the exact measuring and understanding. The absence of moving parts in the system's optics enhances stability and reduces maintenance requirements compared to systems that utilize scanning monochromators.

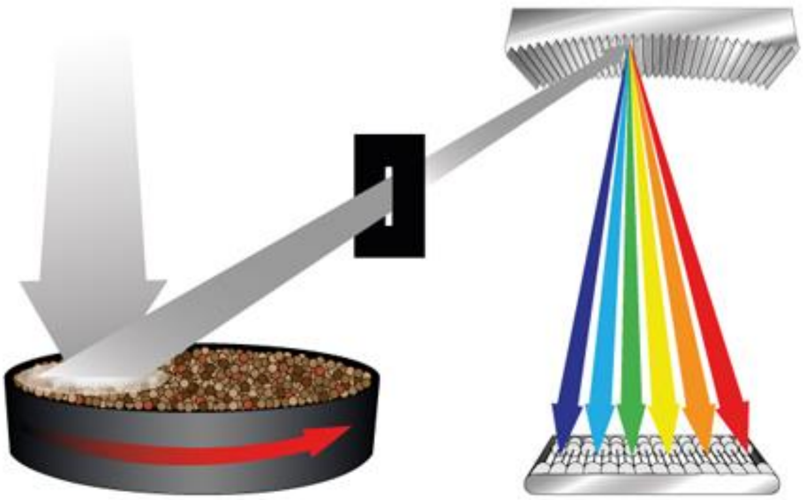

Fig (1) Scanning monochromators of Diode Array 7200 NIR Analysis System

Table 2 The effect of adding many medicinal herbs on the chemical composition of poultry meat.

Medical herbs	Basal diet	Cinnamon	Turmeric	Piper nigrum	Plantago lanceolata	Basil	Eruca sativa	P value
parameters	(T1)	(T2)	(T3)	(T4)	(T5)	(T6)	(T7)	
Moisture	18.77 ±0.5	19.5 ±0.79	20.43 ±0.3	21.87 ±0.13	23.3 ±0.38	20.63 ±0.95	24.33 ±0.55	0.002
	b	b	a	a	a	b	a	
protein	42.8 ±0.15	43.37 ±0.49	43.37 ±0.27	43.97 ±0.09	43.73 ±0.27	43.47 ±0.81	43.5 ±0.78	0.02
	ab	a	a	a	a	a	a	
fat	7.77 ±0.09	7.13 ±0.23	6.73 ±0.15	6.7 ±0.25	7.03 ±0.22	6.67 ±0.2	7.37 ±0.24	0.001
	a	ab	b	b	b	b	b	
Ash	21.49 ±0.31	21.72 ±0.29	23.63 ±0.2	23.44 ±0.41	24.54 ±0.28	23.88 ±0.48	25.51 ±0.43	0.0012
	c	c	b	b	a	a	a	
Arginine	6.3 ±0.04	6.03 ±0.04	6.11 ±0.07	6.37 ±0.02	6.48 ±0.1	6.35 ±0.05	6.71 ±0.03	0.0012
	b	b	b	ab	a	b	a	
Cystine	2.03 ±0.17	1.95 ±0.03	1.85 ±0.05	1.76 ±0.03	1.57 ±0.02	1.73 ±0.02	1.29 ±0.04	0.0011
	a	a	ab	b	bc	b	c	
isoleucin	3.78 ±0.09	3.77 ±0.27	4.06 ±0.19	4.43 ±0.12	4.79 ±0.05	4.04 ±0.03	5.42 ±0.11	0.0011
	c	c	b	b	a	b	a	
leucin	3.55 ±0.18	4.41 ±0.25	4.44 ±0.07	4.5 ±0.19	4.62 ±0.13	4.32 ±0.15	4.59 ±0.14	0.006
	c	b	a	a	a	b	a	
lycin	0.4 ±0.05	0.67 ±0.06	0.7 ±0.03	0.85 ±0.07	0.87 ±0.07	0.79 ±0.09	1.22 ±0.14	0.0013
	c	bc	bc	b	b	b	a	
therionine	2.23 ±0.16	2.72 ±0.08	2.62 ±0.12	2.74 ±0.13	2.91 ±0.1	2.66 ±0.06	2.74 ±0.09	0.022
	c	a	b	a	a	b	a	
tryptophane	0.55 ±0.02	0.68 ±0.11	0.65 ±0.03	0.69 ±0.07	0.68 ±0.1	0.72 ±0.14	0.63 ±0.11	0.439

	b	ab	a	a	ab	a	ab	
valine	3.37 ±0.06	3.53 ±0.03	3.68 ±0.09	3.52 ±0.14	3.66 ±0.02	3.57 ±0.02	3.75 ±0.07	0.0033
	b	ab	a	ab	a	ab	a	

Results and discussion

The effects of medicinal blends of herbs on the proximate chemical analysis of broiler chicken meat are illustrated in Table 2. No significant (P>0.05) effects due to medicinal herbs supplementation were observed on meat moisture content in T2 and T5 compared with the control group in contrast to other groups. At the same time, meat protein and ash% were significantly (P<0.05) affected by medicinal herbs addition. The highest fat content was recorded in control T1 (7.77 ±0.09) with significant (P > 0.05) differences compared to the other treatments.

The isoleucine amino acid shows significant (P<0.05) effects in all treatment groups except T1 and T2. From the results given in Table 2, no significant (P > 0.05) differences in Arginine content in T5 and T7 compared to the other treatments and control groups can be observed. No significant (P>0.05) effects due to supplementation of medicinal herbs were observed on the meat Cystine content in all treatment groups compared with the control group. Medicinal herbs have significantly increased (P<0.05) in amino acids Leucine, glycin, threonine, tryptophane, and valine for all treated groups.

The sequence of amino acids and their total abundance are essential for determining meat quality. Also, the amino acid composition and content are significant factors in judging nutritional value and flavor [18]. Through amino acids, a number of flavor amino acids are responsible for the taste and freshness of meat. According to research, these include Leucine, Lysine, Methionine, and Tryptophan [19]; this is so since the herpes plant herbs can bring more amino acids into the body, particularly Arginine; adding these to the diet through herbs, spices will result in augmenting the overall levels of Arginine. It follows from these revelations that meat quality improvement is achievable by including herbs in chicken diets through increased concentrations of flavor amino acids and amino acids (Table 2 has demonstrated this).

In addition, an appropriate moisture content is essential for enhancing the juiciness and tenderness of meat, thereby improving its overall quality. The study revealed that the treatment of herb additives impacted the protein and moisture levels in the meat. However, all remaining treatments appeared to possess higher muscle protein and moisture levels than T1. Another reason for this is the decrease in the fat content of the meat, which can cause the juiciness and tenderness of the meat and the quality in general [20]. Overall, data analysis showed that herbs somewhat decrease the meat's tenderness and taste. The polyphenols, which are found in herbs and spices (that is derived from various plant parts like branches, roots, stems, tree trunks, fruits, and seeds) have similar activity of secondary metabolites and are, thus, a good substitute for the synthetic growth stimulants commonly used in animal feeding stuff [21].

These ingredients prove essential by making a difference in an animal's health, the quality of animal products, and others. Phytocompounds that possess bioactive compounds in a high number, such as alkaloids, glycosides, tannins, saponins, essential oils, and flavonoids, are known as phytobiotics. It has antioxidant action, antibacterial properties, and protection [22]. These herbs, spices, or probiotics are particular flora remedies/plant parts with a rich individual compound content used for animal nutrition [23].

The fat of chicken meat is affected by the bird's diet [24] and genetic factors [25]. Compared to other meat, chicken meat is richer in polyunsaturated fatty acids because the diet of broilers is generally rich in PUFA [26]. Recently, nutritional procedures to alter the fatty acid profile of meat have been a popular research topic. They are also the most practical way of manipulating the fatty acid profile in meat. Works discussing the effect of herbs beneficially modifying the fatty acid profile of chicken meat and eliminating negative effects of lipid oxidation in meat have gained increasing popularity [27, 28]. It can be supposed that these are the antioxidant properties of flavonoids, carotenoids, essential oils, and other components of plants that may affect the fatty acid profile and amino acid in tissue and the oxidative stability of meat and limit the deterioration of meat quality in storage.

At present, the practices of enriching feed rations for birds with herb plants have enjoyed great interest due to the multiple beneficial uses of such extracts and, simultaneously, the possibility of increasing the production capacity and enhancing poultry health control [29, 30]

Conclusion

Based on the results, it is possible to conclude that adding medicinal herbs to broiler chicken diets significantly affected the development of the chemical properties of meat. Moreover, these herbs can improve chicken meat's nutritional, mechanical, and management qualities, as all additives positively affect the quality of the meat. This result is evidence that botanical supplements often have the same effect on meat quality as chemical compounds without any side effects. Medicinal herbs effectively regulate fat metabolism to prevent atherosclerosis or coronary heart disease in humans who consume this chicken product daily. As a result, the general conclusion is that adding these seasoning herbs has a positive effect on chicken production, and the plant supplements positively impact chicken meat quality.

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