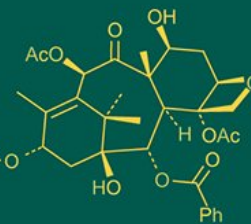
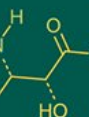
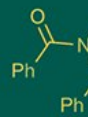


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Adding different levels of anise aqueous extract to drink water of broilers and its effect on the productive performance

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Abstract

This research occurred in the animal facility of the Animal Production Branch at the College of Agriculture, University of Karbala, from October 6, 2022, to November 9, 2022 (35 days), to examine the impact of incorporating varying concentrations of anise aqueous extract into drinking water on the productiveness of broiler chickens. The experiment utilized 180 unsexed Roos-308 strain chicks sourced from a local hatchery in the Karbala Governorate, each with an initiation weight of 40 g.

Each of the four groups was given a random number of chicks; there were fifteen chicks per group. Each group had three replicates. The following was the breakdown of the treatments: In the first trial, participants consumed a control diet. In the second trial, water with an anise extract concentration of 10 ml/liter was added. In the third trial, water with a concentration of 20 ml/liter was added. In the fourth trial, water with a concentration of 30 ml/liter of anise extract was added.

According to the results, compared to the control treatment, all treatments that included anise water in drinking water had significantly better average live body weight, weekly weight gain, feed consumption, and feed conversion ratios for all weeks ($p < 0.01$). In terms of the production index measure, the results demonstrated that the addition treatments (T₂, T₃, and T₄) were significantly better than the initial treatment (control) ($p < 0.01$). Results show that broiler chicken productivity is positively and significantly affected by adding anise aqueous extract to drinking water at concentrations of 10, 20, and 30 ml/L.

Keywords: Anise aqueous extract, productive performance, broiler chicken

Introduction

Feed additives of plant origin, such as essential oils or aromatic plant extracts, meet consumer preferences and are suitable for environmentally friendly agricultural practices [26]. These additives have received increasing attention as alternatives to conventional antibiotics, especially after the European Union agreed to ban the use of antibiotics as additives in poultry feeds [18, 11]. Some reports have shown that feeds containing herbal sources have improved growth performance [29]. Feed additives include a variety of herbs, spices and essential oils. In addition to improving taste and flavour, these additives have positive effects on digestion and gut health, and contribute to preventing digestive disorders and improving the productive performance of birds [8].

Herbs and aromatic plants constitute an important part of the medical uses in developing countries [15, 1, 33]. Many medicinal plants have been introduced into the feed of broilers and laying hens, including fenugreek seeds, black seed, and garlic powder, which have shown different effects on productive, physiological, and immune characteristics due to their natural chemical content [32, 31, 7]. Medicinal plants have been used since ancient times as food preservatives due to their anti-pollution properties and their disinfectant properties [6]. Accordingly, medicinal plants have been used in poultry feed in different forms, including oil or water extracts or food additives, with the aim of improving the productive and health status of animals [30, 23, 7].

One of these medicinal plants is anise, its seeds can be a growth stimulant for poultry due to its stimulating effect on gastric juice production and its effective effects on farm birds including Japanese quail [25]. Medicinal and aromatic plants contain many compounds such as phenols, coniodates, flavonoids, alkaloids,

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proteins and oxygen exchange derivatives [2, 35, 24], some of these substances can work synergistically to enhance their biological activity [13].

Scientific research has indicated that adding anise seeds to feed has a significant effect in increasing growth rate, in addition to a significant improvement in production characteristics when adding anise seeds to broiler and Japanese quail feeds [14]. Recently, the demand for anise seeds has increased due to its antibacterial and antioxidant activity, in addition to their use in the food, pharmaceutical, perfume and cosmetic industries [41, 22, 40].

Materials and methods

The purpose of the 35-day experiment, which took place in the animal field of the Animal Production Department / College of Agriculture - University of Karbala, was to determine the impact of various concentrations of anise aqueous extract on the productivity of broiler chickens given water to drink. The experiment utilized 180 male-and-female-sex-unmatched Ross-308 broiler chicks, each weighing 40 g at birth. Because each replicate had fifteen chicks, they were randomly assigned to one of four treatments. Each treatment had three repetitions. The drinking water began to have an anise aqueous extract added

to it on the first day of the trial. Each of the four treatments-T1, a control group that did not receive any anise extract-was followed by four treatments that did contain anise extract: T₂, which added 10 ml/liter of drinking water, T₃, which added 20 ml/liter of drinking water, and T₄, which added 30 ml/liter of drinking water.

Preparation of anise seed aqueous extract

After purchasing powdered anise seeds from the marketplaces of the Karbala Governorate, they were ground using a small electric grinder. Following technique [37], an electric mixer was used to combine 1 gram of dry powder with 2 milliliters of distilled water to create the extract. The mixture was then placed in a water bath set at 60°C for one hour and allowed to rest at room temperature for another 24 hours. The fluid underwent filtration via numerous layers of sterile medical gauze to get it ready for the experiment.

The birds were given starter feed from day one until they were three weeks old, and growth feed from the end of the fifth week until the end of the sixth week, as stated in Table (1). The manufacturing firm ordered the inoculation of the birds against diseases according to the vaccination schedule that was suitable for each ailment.

Table 1: Broiler chicken starter and growth feed composition

Feed materials	Starter feed 1-21% day	Grower feed 22-35% day
Yellow Corn	30	40
Wheat	28.25	24
Soybean Meal (48% Protein)	31.75	24.8
Protein extract	5	5
Sunflower Oil	2.9	4.4
Limestone	0.9	0.6
Dicalcium Phosphate DCP	0.7	0.9
Vitamin & Mineral Mix	0.2	0.2
Table Salt	0.3	0.1
Total	100	100
Chemical analysis of feed**		
Crude protein (%)	23.04	20.06
Calculated metabolizable energy (kcal/kg feed)	3021.45	3194.92
Lysine (%)	1.27	1.07
Methionine (%)	0.41	0.38
Cysteine (%)	0.35	0.30
Methionine + Cysteine (%)	0.82	0.78
Available phosphorus (%)	0.41	0.43
c/p Energy:protein ratio (%)	131.14	159.26

**The chemical analysis of the feed was calculated according to [28]

Studied Traits

The following traits were measured weekly
Production index scale, average alive body mass, average weight gain, feed consumption, and feed conversion ratio

Live body weight

The chicks were weighed at one day of age, and then the birds were weighed weekly for each replicate of the treatments during the experimental period by weighing the chicks of each replicate (5 birds/weight) using an electronic balance (Dahongying) with a capacity of 40 kg, made in China [5].

$$\text{Average bird weight (g)} = \frac{\text{Total weight of birds in the replicate}}{\text{Total number of birds in the replicate}}$$

Weekly weight gain

Weekly weight gain was calculated according to [5].

Weekly weight gain rate (g) = final weight of the live body at week's end (g) - beginning week's worth of live body weight (g).

Measurement of feed intake

A weekly feed consumption total was determined by weighing the leftover feed after the week and deducting it from the total feed given during the week. This calculation took into consideration the feed eaten by dead birds and was based on the average weekly feed consumption of birds, as stated by [3].

$$\text{Average weekly feed consumption (g/bird)} = \frac{F}{C*7+D}$$

Where:

F = the weekly amount of feed that is consumed.

C = how many birds are still alive by the weekend's conclusion.

D = the number of days that the dead birds were fed.

7 = the number of days in the week.

Conversion factor for food

It is the amount of feed that must be consumed in kilograms in order to generate one unit of output, be it eggs or meat. Based on the information provided by [3] and the equation provided, the food conversion factor is determined weekly:

$$\text{Feed conversion factor} = \frac{\text{Average weekly feed intake (g)}}{\text{Average weekly weight gain (g)}}$$

Evaluation of production performance

Broiler flocks can be evaluated according to the production index values. If the values of this scale are less than 210, the flocks are considered poor, while if the index values ranging between 210-219, the flocks are considered acceptable, they are considered good if the index between 220-229, and the flocks considered very good if the index value rise between 230-239, if the production index value ranges between 240-260 or more, the flocks considered excellent, according to what [27] indicated.

$$\text{Production index scale} = \frac{\text{Average body weight (g)} * \text{Vitality ratio}}{\text{Number of days of rearing} \times \text{Feed conversion factor} \times 10}$$

Note that the vitality rate = 100 - mortality rate (the mortality rate in the experiment was 0%).

Statistical examination

The effects of various treatments on the attributes under investigation were investigated using a Complete Random Design (C.R.D). In the statistical study, the ready-made SAS program (1996) [39] was utilized, and Duncan's (1955) [16] multinomial test was employed to compare the significant differences between the averages.

Results and Discussion

From one week to five weeks of age, the birds' average live body weight was affected by adding various quantities of anise aqueous extract to their drinking water, as shown in Table (2). The anise addition treatments were significantly better than the control treatment at all five weeks of the birds' age ($p < 0.01$). In comparison to the first treatment (control), which had the lowest average body weight of 1720.38 g, the birds in the fourth, third, and second treatments showed a highly significant advantage ($p < 0.01$) in terms of average live body weight at the fifth week, reaching 2105.00, 2014.03, and 1957.97 g, respectively.

Table 2: Impact of varying concentrations of anise aqueous extract in drinking water on live bodies of water (g)

Treatments	Age in weeks				
	1	2	3	4	5
T1	0.24 ± 127.54 ^c	1.82 ± 332.48 ^c	1.28 ± 708.08 ^c	13.04 ± 1145.03 ^c	16.02 ± 1720.38 ^c
T2	0.45 ± 129.45 ^b	2.41 ± 354.43 ^b	5.12 ± 767.66 ^b	14.52 ± 1270.04 ^b	36.62 ± 1957.97 ^b
T3	0.57 ± 130.32 ^b	2.96 ± 358.60 ^b	5.53 ± 778.43 ^b	12.37 ± 1298.12 ^{ab}	± 2014.03 ^{ab} 34.13
T4	0.31 ± 131.72 ^a	3.59 ± 368.20 ^a	4.98 ± 796.79 ^a	17.95 ± 1345.58 ^a	45.54 ± 2105.00 ^a
Significance level	**	**	**	**	**

(±standard error) for broiler chickens during the experimental weeks.

**indicates substantial differences between treatments at a probability threshold of 0.01. Innovative therapies T₁: Regulation, T₂: Incorporating anise extract at a dosage of 10 ml per liter of potable water, T₃: Incorporating anise extract at a concentration of 20 ml per liter of drinking water; T₄: Incorporating anise extract at a concentration of 30 ml per liter of drinking water.

Table (3) presents the weight gain rates of broilers from 1 to 5 weeks of age. The table indicates a statistically significant superiority ($p < 0.01$) over five weeks for the anise extract treatments compared to the control in the weekly weight increase rate of the birds. Regarding total weight increase (1-5 weeks), all treatments incorporating anise extract in drinking water (T₂, T₃, and T₄) exhibited a highly significant superiority ($p < 0.01$) over the control treatment (T₁), with recorded weights of 1917.97 g, 1974.03 g, and 2065.00 g, respectively, in comparison to T₁, which recorded the lowest rate for this trait, 1680.38 g weight gain. The reason for the improvement in body weight and weight gain may be attributed to the role played by anise extract, as anise seeds have a growth-enhancing role and a digestive stimulating effect due to the presence of the two active compounds anethole and eugenol, which are the two active elements in the digestive stimulating role [12].

[34] stated that anise contains protein, fatty acids, starch, choline, vitamin B, calcium, magnesium, plant gel, potassium, iron and plant estrogens. These are important nutritional elements and their presence in this extract explains the extent to which the body benefits from them, which affects the average live body weight as a final stage

and thus is reflected in improving the benefit from digestive products during the period of increasing the liver's effective function [36]. In addition, the active ingredients in anise are considered antiparasites and it also has an important effect in resisting pathogenic microorganisms in the digestive system that affect the level of benefit from the consumed feed materials, which is reflected in its effect on the live weight [34, 17].

Anise seeds include the active ingredient anethole, which aids digestion and growth, which in turn affects body weight and rates of weight increase favorably [10]. In addition to its antimicrobial and antifungal properties, anise powder enhances the digestive system's functional status by promoting the release of digestive enzymes and their quick attachment to the surface of the mucus layer spread over the cells in the intestines, thus increasing the production of digestive juices. In addition to the extracts' role in increasing the quantity of beneficial bacteria and their efficacy in digestion and absorption, this layer provides an ideal environment for the growth and reproduction of microbes, which is positively reflected in the balance regarding weight gain [4, 9].

Table 3. Impact of anise aqueous extract concentration on weekly weight gain (g) when added to drinking water

Treatments	Age in weeks					Total
	1	2	3	4	5	
T1	0.24 ± 87.54 ^c	1.57 ± 204.94 ^c	0.53 ± 375.59 ^d	11.75 ± 436.94 ^c	2.97 ± 575.35 ^c	1680.38 ± ^c 16.02
T2	0.45 ± 89.45 ^b	1.96 ± 224.98 ^b	2.71 ± 413.23 ^c	9.40 ± 502.37 ^b	22.09 ± 687.93 ^b	1917.97 ± ^b 36.62
T3	0.57 ± 90.32 ^b	2.39 ± 228.28 ^b	2.56 ± 419.83 ^b	6.84 ± 519.69 ^{ab}	21.75 ± 715.90 ^{ab}	1974.03 ± ^{ab} 34.13
T4	0.31 ± 91.72 ^a	3.28 ± 236.47 ^a	1.39 ± 428.59 ^a	12.96 ± 548.78 ^a	27.59 ± 759.42 ^a	2065.00 ± ^a 45.54
Significance level	**	**	**	**	**	**

(±standard error) of broiler chickens during the weeks of the experiment.

**indicates substantial differences between treatments at a probability threshold of 0.01. Innovative therapies T₁: Regulation, T₂: Incorporating anise extract at a dosage of 10 ml per liter of potable water, T₃: Incorporating anise extract at a concentration of 20 ml per liter of drinking water; T₄: Incorporating anise extract at a concentration of 30 ml per liter of drinking water.

Broiler hens' weekly feed intake rate was tested by adding varying concentrations of anise aqueous extract to their drinking water, as shown in Table (4). Adding anise aqueous extract to the experimental treatments led to higher average feed consumption across the five weeks of the trial compared to the control treatment, according to the results. Over the course of the five-week trial, the average feed consumption for the fourth, third, and second treatments was significantly higher than that of the first treatment (control) ($p < 0.01$). When it came to the overall rate of feed consumption, the treatments that included anise extract had a significantly higher rate ($p < 0.01$) than the first treatment, T₁, which had the lowest rate at 3080.29 g feed/bird. The highest rates of feed consumption were recorded by T₂, T₃,

and T₄, with respective amounts of 3393.13, 3451.90, and 3529.77 g feed/bird. Because anise powder improves the quality of the feed that birds consume and affects their average live body weight, it is possible that this is the reason why birds treated with anise extract consume so much feed. Anise seeds' excellence is based on the presence of compounds that stimulate the digestive process and enhance birds' appetites. One such ingredient is eugenol, which causes birds to consume more feed and ultimately gain weight [9]. In addition to a number of useful chemicals, the anise powder used in the feed includes benzaldehyde, anethol, total flavonoids, and total phenols, all of which work together to improve the digestive system's efficiency in absorbing nutrients and regulating body weight [38, 19].

Table 4: Impact of varying concentrations of anise aqueous extract in drinking water on feed intake (g/bird/week)

Treatments	Age in weeks					Total
	1	2	3	4	5	
T1	0.62 ± 141.47 ^c	2.02 ± 354.57 ^c	2.00 ± 659.55 ^b	18.87 ± 810.43 ^b	2.37 ± 1114.27 ^b	3080.29 ± ^b 21.88
T2	0.47 ± 142.89 ^{bc}	0.90 ± 375.00 ^b	4.50 ± 701.36 ^a	17.96 ± 897.12 ^a	38.07 ± 1276.75 ^a	3393.13 ± ^a 60.11
T3	0.66 ± 143.44 ^b	2.52 ± 382.89 ^b	4.21 ± 703.92 ^a	16.37 ± 917.24 ^a	43.29 ± 1304.40 ^a	3451.90 ± ^a 67.07
T4	0.008 ± 145.22 ^a	4.09 ± 391.75 ^a	3.81 ± 708.15 ^a	30.04 ± 946.41 ^a	61.16 ± 1338.24 ^a	3529.77 ± ^a 99.12
Significance level	**	**	**	**	**	**

(±standard error) of broilers during the weeks of the experiment.

**indicates significant variations between treatments at a probability threshold of 0.01. Innovative therapies T₁: Regulation, T₂: Incorporating anise extract at a dosage of 10 ml per liter of potable water, T₃: Incorporating anise extract at a concentration of 20 ml per liter of drinking water; T₄: Incorporating anise extract at a concentration of 30 ml per liter of drinking water.

The feed conversion factor is one of the important economic indicators to indicate the efficiency of broilers in converting feed into weight gain. Table (5) shows the effect of adding different levels of anise aqueous extract to drinking water on the weekly and total feed conversion factor rates of broilers, as the experimental treatments varied in the occurrence of a highly significant improvement ($p < 0.01$) throughout the feed recycling process. Consider all treatments involving the addition of anise aqueous extract in comparison to the control treatment during the five-week duration of the trial. The total feed conversion ratio (1-5 weeks) was significantly enhanced ($p < 0.01$) in the fourth, third, and second treatments, yielding ratios of 1.70, 1.74, and 1.76 g feed/g weight gain, respectively, in contrast to the first treatment (control), which recorded 1.83 g feed/g weight gain. The significant improvement in the feed conversion ratio of the

supplementation treatments is due to the fact that the water containing anise extract and consumed by the birds led to positive stimulation of the digestive tract to increase the digestibility of protein and cellulose [21], which is reflected in their conversion into growth and meat (improved feed conversion efficiency).

[20] Proved that the aqueous extract of aromatic plants has an effective effect in improving the apparent digestibility of the ileum and digestive tract, and effectively in increasing the enzymes lipase, amylase and pancreas, and thus increasing the digestion of starch and fats. Anise seeds are also an effective substance in increasing the digestive enzymes and their rates in the small intestine [10], and this has an effective effect in stimulating the digestive tract to increase the benefit from the feed consumed and increase weight, thus improving the feed conversion factor.

Table 5: Impact of varying amounts of anise aqueous extract in water for drinking on the ratio of feed conversion (g feed/g weight gain)

Treatments	Age in weeks					Total
	1	2	3	4	5	
T1	0.002 ± 1.61 ^a	0.003 ± 1.73 ^a	0.002 ± 1.75 ^a	0.006 ± 1.85 ^a	0.005 ± 1.93 ^a	1.83 ± ^a 0.004
T2	0.003 ± 1.59 ^b	0.018 ± 1.66 ^b	0.000 ± 1.69 ^b	0.002 ± 1.78 ^b	0.004 ± 1.85 ^b	1.76 ± ^b 0.002
T3	0.002 ± 1.58 ^{bc}	0.006 ± 1.67 ^b	0.000 ± 1.67 ^c	0.008 ± 1.76 ^b	0.005 ± 1.82 ^c	1.74 ± ^c 0.003
T4	0.005 ± 1.58 ^c	0.005 ± 1.65 ^b	0.003 ± 1.65 ^d	0.01 ± 1.72 ^c	0.01 ± 1.76 ^d	1.70 ± ^d 0.01
Significance level	**	**	**	**	**	**

(±standard error) of broilers during the weeks of the experiment.

**indicates substantial differences between treatments at a probability threshold of 0.01. Innovative therapies T₁: Regulation, T₂: Incorporating anise extract at a dosage of 10 ml per liter of potable water, T₃: Incorporating anise extract at a concentration of 20 ml per liter of drinking water; T₄: Incorporating anise extract at a concentration of 30 ml per liter of drinking water.

At 35 days of age, the production index scale of broiler chicks was measured using Table (6), which indicates the effect of adding various doses of anise aqueous extract to drinking water. The production index scale showed a highly significant ($p < 0.01$) rise from 268.14 in the first treatment (control) to 316.21, 329.07, and 351.87 in the second, third, and fourth treatments, respectively. It is possible that the feed conversion ratio, mortality rates, and average live body weight increased in the second, third, and fourth treatments compared to the first treatment (control) are the reasons for the significant superiority in the production index scale values in the treatments to which anise aqueous extract was added compared to the control group [27].

Table 6: The impact on the productive index scale of varying amounts of anise aqueous extract added to potable water.

Treatments	Production index
T1	268.14 ± ^c 3.14
T2	316.21 ± ^b 6.34
T3	329.07 ± ^b 4.87
T4	351.87 ± ^a 5.49
Significance level	**

**indicates substantial differences between treatments at a probability threshold of 0.01. Innovative therapies T₁: Regulation, T₂: Incorporating anise extract at a dosage of 10 ml per liter of potable water, T₃: Incorporating anise extract at a concentration of 20 ml per liter of drinking water; T₄: Incorporating anise extract at a concentration of 30 ml per liter of drinking water.

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