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Effect of Using Black Seed, Garlic and Licorice on Productivity Indicators of Japanese Quail

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THIS research study aimed to investigate the impact of dietary supplementation with black seed (*Nigella sativa*), garlic (*Allium sativum*), and licorice (Glabra) on the productive indicators of 600 white quail chicks in Egypt. The experiment was conducted on a private farm in Giza from February 1, 2023, for a period of 34 days. The quail chicks were divided into eight groups, with each group consisting of an average of 75 chicks. Within each group, three replicates were created, comprising 25 quail chicks each. All groups were subjected to identical housing and care conditions throughout the 34-day study period. The control group received the standard farm system diet without any supplements, serving as the baseline group. The remaining seven experimental groups received the basal diet supplemented with different combinations of black cumin, garlic, and licorice in powder form. The supplementation levels were 0.5% for each ingredient individually and in various combinations. The results showed that the groups supplemented with *Nigella sativa*, garlic, and licorice demonstrated superior performance in terms of live weight index, feed conversion coefficient, low mortality rate, and achieved profit percentage. Notably, the experimental groups that included two or three types of supplements exhibited the most favorable outcomes (which gave the best performance and the highest economic return).

Keywords: Glabra, *Allium sativum*, *Nigella sativa,* Japanese quail.

Introduction

Due to the rising need for high-quality animal protein, particularly chicken, quail breeding has become a popular way to produce poultry [1]. Numerous tactics have been used to increase the profitability of the chicken industry, and dietary manipulation has been found to have a considerable impact on animal performance [2]. Antibiotics were frequently used to poultry feed in the past to cure diseases and encourage development. However, many nations have put restrictions on their usage due to worries about the emergence of antibiotic resistance [3]. Researchers have worked hard to create organic alternatives to antibiotics used in poultry production. Utilising functional feed additives, such as medicinal herbs, probiotics, prebiotics, and synbiotics, is one promising strategy. These additions have the potential to improve animal performance, gastrointestinal health, and the immune systems of quails and other types of fowl [4].

Black seed *(Nigella sativa)*

The essential oil derived from black cumin (*Nigella sativa*) consists of 18 different types of chemicals. Among these, cumin aldehyde (23%), acetic acid (10.9%), 1,3,8-p-acetic acid (10.9%), and 1,3,8-p-menthatriene (7.9%) are the primary constituents, accounting for 99.15% of the oil [5]. Carvone and limonene are the two main components of black cumin essential oil, comprising approximately 66% and 50% of the oil, respectively [6].

It should be noted that depending on the source, the phytochemical makeup of BCS can differ greatly. The phytochemical makeup of 115

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BCS samples from various sources, including Ethiopia, India, Syria, Saudi Arabia, and Sudan, was examined in a research by AL-Saleh et al.[7]. They discovered significant differences in the amounts of thymoquinone and thymol, with the Ethiopian source having the greatest levels (3.1 and 0.23 g/kg BCS, respectively) and the Sudanese source having the lowest levels (1.3 and 0.11 g/kg BCS). This emphasises the difficulty in conducting published research on the use of BCS in diets because the phytochemical composition varies depending on the source.

Garlic

One of the first domesticated plants, garlic (*Allium sativum*), has been used in Greek and Egyptian folk medicine for thousands of years [8]. It is well known as a spice and natural remedy for the treatment and averting a number of illnesses [9,10]. Aged garlic extract has been shown in studies to have therapeutic effects, including lowering blood pressure, preventing the infiltration of fatty liver, and boosting immune system activity both in-vitro and in-vivo [11].

Garlic (*Allium sativum*) contains a diverse array of beneficial substances, including at least 33 sulfur-containing chemicals, enzymes, amino acids, and minerals like selenium. The main active compounds responsible for garlic's medicinal properties include allicin, ajoene, dialkyl polysulfides, S-allylcysteine (SAC), diallylsulfide, S-methylcysteine sulfoxide, and S-allylcysteine sulfoxide. These substances are believed to have evolved as a protective mechanism against infections and other forms of harm. Notably, alliin, (S)-methyl-L-cysteine sulfoxide (methiin), and (S)-(trans-1-propenyl)-L-cysteine sulfoxide are frequently found in garlic, making up approximately 1% of its total content. Along with S-(2-carboxypropyl)-glutathione, garlic cloves also contain glutamyl-S-allyl-L-cysteine, glutamyl-S-(trans-1-propenyl)-L-cysteine, and glutamyl-S-allyl-mercapto-L-cysteine. Allicin naturally builds up in garlic when it is kept at cooler temperatures. A garlic bulb typically has 1.8% alliin and 0.9% γ-glutamylcysteine [8]. Garlic as a feed additive in poultry shows potential to enhance production and safeguard bird health through its bioactive compounds, offering physiological benefits like antioxidant, antibacterial, antiviral, immunostimulatory, intestinal homeostasis, and cholesterol-lowering activities [12].

Garlic (*Allium sativum*) shows promise as a natural feed additive for poultry, enhancing growth, feed efficiency, egg production, immune response, and reducing blood cholesterol levels. Variations in results may be due to differences in dosage, feeding duration, and processing techniques [13].

Garlic and its bioactive compounds offer a natural solution to prevent and control avian coccidiosis, improving weight gain, feed efficiency, and overall health in infected broilers. Further research is needed to understand garlic's mode of action and its impact on specific Eimeria species and immune-protective antigens for effective use in poultry production [14].

Glabra

Liquorice, a plant from the Fabaceae family, has a rich history in traditional medicine and exhibits various beneficial properties, including immunomodulatory, antimicrobial, antioxidative, and anti-inflammatory activities [15]. Phytochemical analysis reveals flavonoids, triterpene saponins, amino acids, and other compounds in liquorice extract [16]. Its active principles have shown pharmacological impacts in livestock [17, 18] making it a promising option for enhancing poultry production when included in the diet.

Therefore, there has been an increasing need to look at different options for preserving poultry health and productivity.

The objectives of this study is to assess the effects of feeding quail with black seed, garlic, and licorice, individually or in combination, on production and economic indicators.

Material and Methods

Study design

The study was carried out in Egypt on 600 white one day old quail chicks. The birds were divided into 8 groups, each containing three replicates an average of 25 chicks. All housing and care conditions were identical for all groups during the 34-day care period. The control group was fed basal diet without any supplements according to the standard farm system, While the other groups received the basal diet supplemented with of powder Black Seed (*Nigella sativa*), powder Garlic (*Allium sativum*)and Glabra and their combination in the groups (Dry and ground for all additives) According to the Table [1].

The feed composition materials used to feed the birds was set according to (system used on the

TABLE 1. Scheme of experimental groups. (It is added as a percentage of the feed mix).

Treatment	Groups							
	Control	1	2	3	4	5	6	7
Black seed (Seeds)	0	0.5%	0	0	0.5%	0.5%	0	0.5%
Garlic (Cloves)	0	0	0.5%	0	0.5%	0	0.5%	0.5%
Licorice (Roots)	0	0	0	0.5%	0	0.5%	0.5%	0.5%

TABLE 2. The contents of the Japanese quail diets.

Ingredients %	Starter diets	Grower diets	Finisher diets
Argentine yellow corn	48.4	56.2	64.2
High-fat Soybean meal (43%)	40	33	26
Limestone	0.41	0.49	0.68
Corn gluten meal (60%)	7	6.5	6
Oil	0.2	0.25	0.3
Dicalcium Phosphate	2	1.6	1.2
Vitamins premix	0.4	0.4	0.4
Minerals premix	0.3	0.3	0.3
Threonine	0.25	0.265	0.28
Sodium chloride	0.13	0.115	0.1
Methionine %	0.15	0.125	0.1
Sodium bicarbonate	0.1	0.125	0.15
Choline chloride	0.1	0.05	0
Antifungal and toxins	0.05	0.05	0.05
Manganese sulfate	0.02	0.01	0
LINCO MEX	0.01	0.01	0.01
Silica	0.1	0.025	0
Multivitamins AD3E	0.03	0.125	0
Yeast	0.1	0.125	0
Lysine	0.25	0.235	0.23
Total	100	100	100

TABLE 3. The calculated nutrient contents of the Japanese quail diets.

Ingredients %	Starter diets	Grower diets	Finisher diets
Calculated analysis:			
ME (kcal/kg)	3245	3269	3298
Crude Protein %	25.56	22.92	20.23
ME/P	126	142.63	163.03
Fat %	5.11	4.97	4.83
Crude fiber%	3.51	3.23	2.96
Ca%	0.72	0.64	0.42
P%	0.76	0.66	0.42
Lysine %	1.58	1.36	1.13
Methionine %	0.43	0.39	0.35
Cystine %	0.47	0.42	0.37
linoleic acid%	1.17	1.31	1.45
Cost (EGP)	21.3	20.85	20.76

farm) as shown in Table 2, and chemical analysis of the feed were calculated according to the Table 3.

Experimental measurements

Birds in individual pens were observed for mortality, three times daily throughout the experimental period. Birds were individually weighed on days 1, 14, 21, and 34 and their body weights were recorded. Feed intake was calculated by subtracting the amount of feed residues from the total amount of feed offered per replicate, and it was measured on days 14, 21 and 34 [19] Feed conversion ratio (FCR) was calculated as feed intake divided by body weight gain. The European Production Efficiency Factor (EPEF) was calculated according to the equation: body weight (kg) x livability (%) x 100/feed conversion ratio x age (d) [19].

The economic feasibility

The economic feasibility study evaluated the cost-effectiveness of Japanese quail fattening based on feed material prices, chick prices, and live weight during the research period [20], The study calculated various indicators, including the cost of chicks to produce 1 kg live weight, feed cost for 1 kg live weight, production cost for 1 kg live weight, realized profit, and profit index. These indicators provide valuable insights into the profitability of quail fattening operations.

Note

The price of a one-day-old chick is 5 Egyptian pounds
The selling price for 1 kg live weight is 90 Egyptian pounds
The price of 1 kg of black seed is 80 Egyptian pounds
The price of 1 kg of garlic powder is 60 Egyptian pounds
The price of 1 kg of liquorice is 60 Egyptian pounds

Statistical analysis

The data were analyzed using SAS software with a general linear model (Xlstat, 2014). LSM ± SE were used for reporting. Duncan's multiple range test was employed for mean separation when significance existed [21], with a significance level set at 5%. Percentage data underwent arc sine transformation before analysis. Differences between percentages of mortality were tested using Fisher's (F) test. Other indicators were subjected to analysis of variance with a simple random design, and significant differences between groups were assessed using the least significant difference (L.S.D) test at either the 5% or 1% level.

Results

It is noted by Table 4:The mortality rate index did not show any significant difference (P>0.05) between the control group and the experimental groups, except for the eighth group where no deaths were observed throughout the experimental period. A significant difference (P<0.05) was observed between the control group and the eighth group, with a difference of 5.33%. Despite the relatively high mortality rate in the control group compared to the other groups, it did not reach the predefined threshold for moral concern. This finding suggests that the feed additives used in the experiment may have had a positive impact on enhancing the birds' immunity and reducing mortality rates across all groups when compared to the control group.

Based on the findings presented in Table 5, there were no statistically significant differences (P>0.05) in the average live weight between the control group and the experimental groups at one day of age and at the end of the first stage. However, a significant difference (P<0.05) was observed between the control group and the eighth experimental group. It is important to note that the remaining experimental groups showed superiority in the live weight index, although it did not reach statistical significance at the end of the second and third stages.

The observed increase in the live weight of the groups fed black seeds can be attributed to their potential effects on enhancing feed utilization. Black seeds stimulate bile production, enhance the digestion process, and increase nutrient absorption in the intestines, resulting in improved weight gain. Similarly, when garlic is used as an additive, the increase in live weight may be attributed to its antimicrobial properties, which contribute to eliminating harmful bacteria in the gastrointestinal tract and enhancing the birds' immune system. These benefits of garlic have been well-documented in previous research studies.

Regarding licorice, its primary mechanism of action in promoting increased live weight is its ability to stimulate the digestion process and act as an antiviral and antibacterial agent. By improving the efficiency of digestion and preventing viral and bacterial infections, licorice can positively impact weight gain in quails.

TABLE 4. Mortality rate in the experiment period.

Age(days)	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group7	Group 8
14	4.00[a]	1.33[a]	0.00[a]	1.33[a]	0.00[a]	1.33[a]	0.00[a]	0.00[a]
21	4.00[a]	2.67[a]	1.33[a]	1.33[a]	0.00[a]	2.67[a]	1.33[a]	0.00[a]
34	5.33[a]	2.67[ab]	1.33[ab]	2.67[ab]	1.33[ab]	2.67[ab]	1.33[ab]	0.00[b]

a…d. Means, within age and source of variation (S.O.V), with different superscripts, are significantly different [21]

TABLE 5. Live body weight (g) during the experiment period.

S.O.V	Age	1	2	3	4	5	6	7	8	SE	Pr
Live body weight (g)	1	11.9	11.9	12.1	11.9	12.1	11.6	12.2	12.1	0.286	0.618
	14	140.9	140.0	139.9	141.2	140.0	140.5	140.7	143.3	1.906	0.925
	21	230.3[b]	230.3[b]	230.9[b]	231.2[b]	235.7[ab]	235.2[ab]	237.0[ab]	247.1[a]	4.118	0.137
	34	347.6[b]	349.8[b]	350.8[b]	349.2[b]	353.7[ab]	355.1[ab]	354.4[ab]	366.7[a]	4.201	0.112

Moreover, the synergistic effect of using the additives together becomes evident when combining two types of additives, leading to an increase in live weight. Notably, when all three additives were used simultaneously, a significant increase in live weight was observed (P<0.05). This finding aligns with previous research studies that have also reported positive effects when combining different types of additives.

Average feed intake

It is noted by Table 6:There were no significant differences (P>0.05) in average feed intake between the control group and the experimental groups. However, some studies reported an increase in feed consumption when garlic or licorice were used, which could be attributed to the enhanced palatability of the feed. It is worth noting that this increase in feed intake was observed only when higher levels of garlic or licorice were used compared to the levels employed in the present study.

Feed conversion ratio

It is noted by Table 7: A significant difference (P<0.05) was observed in the feed conversion ratio between the control group and the eighth experimental group, while no significant differences (P>0.05) were found between the control group and the other experimental groups. It was observed that the feed conversion ratio improved in all experimental groups. This improvement can be attributed to the higher average live weight of the birds in the experimental groups.

Explanation

The average feed intake did not show significant variations between the control group and the experimental groups, indicating that the addition of garlic or licorice did not have a significant impact on the overall feed consumption. However, other studies have reported an increase in feed intake when garlic or licorice were used, which could be due to the improved taste and palatability of the feed. It is important to note that these studies used higher levels of garlic or licorice compared to the levels used in the present research.

Regarding the feed conversion ratio, a significant difference was observed between the control group and the eighth group. This indicates that the addition of certain additives, potentially including garlic or licorice, had a positive effect on the efficiency of converting feed into body weight in the eighth group. However, no significant differences were observed between the control group and the other experimental groups, suggesting that the overall impact on feed conversion ratio was not statistically significant.

TABLE 6. Feed intake (g) /day during the experiment period.

S.O.V	Age	1	2	3	4	5	6	7	8	SE	Pr
Feed intake (g) /day	1-14	21.8	21.7	21.6	21.7	21.9	22.8	22.2	22.5	0.576	0.828
	15-21	30.4	30.6	29.8	29.5	29.7	30.2	26.4	26.5	1.371	0.224
	22-34	42.3	40.2	39.5	38.9	39.0	39.7	39.3	37.7	2.897	0.978
	1-34	30.7	30.0	29.5	29.3	29.5	30.2	29.0	28.6	1.101	0.895

TABLE 7. Feed conversion ratio during the experiment period.

S.O.V	Age	1	2	3	4	5	6	7	8	SE	Pr
Feed conversion ratio	1-14	2.37	2.38	2.37	2.35	2.40	2.47	2.41	2.40	0.055	0.845
	15-21	2.37^{a}	2.38^{a}	2.34^{ab}	2.33^{ab}	2.30^{ab}	2.37^{a}	2.20^{ab}	2.13^{b}	0.069	0.169
	22-34	3.95	3.75	3.64	3.64	3.72	3.68	3.71	3.54	0.245	0.969
	1-34	2.92^{a}	2.86^{ab}	2.80^{ab}	2.79^{ab}	2.79^{ab}	2.82^{ab}	2.72^{ab}	2.60^{b}	0.093	0.435

The improvement in the feed conversion ratio across all experimental groups can be attributed to the higher average live weight of the birds in these groups. It is likely that the enhanced growth and development of the birds, possibly influenced by the utilization of additives such as garlic or licorice, contributed to the improved efficiency of converting feed into body weight.

The productive number

Based on the findings presented in Table 8, the experimental groups showed significant improvements in the productive number compared to the control group. The use of feed additives individually or in combination resulted in a 5% increase in the productive number compared to the control group. Furthermore, the eighth group exhibited a remarkable increase of 11% in the productive number index compared to the control group. This significant improvement in the eighth group can be attributed to its superior performance in terms of safety ratio, average live weight, and feed conversion coefficient, which were found to be significantly better than those of the control group (P<0.05).

The European production efficiency factor

Based on the findings presented in Table 9, The experimental groups showed superiority over the control group in terms of the use of feed additives. When using one of the feed additives, the experimental groups exhibited a 5-10% increase compared to the control group. Moreover, when two types of additives were used together, the improvement ranged from 8-14% compared to the control group. The most significant increase of 25% was observed when black seed, garlic, and licorice were combined, which can be attributed to the low mortality rate and high weight index in this group. Additionally, the food conversion factor was found to be improved in the experimental groups compared to the control group.

The economic feasibility of fattening birds

Based on the data presented in Table 10, the eighth group (black seed, garlic, and licorice) demonstrated the highest profitability, with a profit share of 21.65%. This is significantly higher than the control group's profit share of 3.21%. It is important to highlight that all experimental groups showed superior economic performance compared to the control group. The respective profit percentages for each group were as follows: 3.21%, 8.86%, 11.47%, 10.49%, 12.36%, 11.22%, 15.41%, and 21.60%.

TABLE 8. The productive number of birds.

S.O.V	1	2	3	4	5	6	7	8
P N	97.3	103.2	104.8	102.8	105.6	104.6	105.7	110.8
%	100	103.4	105.0	103.1	105.8	104.9	105.9	111.0

TABLE 9. The European production efficiency factor of birds.

S.O.V	1	2	3	4	5	6	7	8
EPEF	33.1	35.1	35.5	36.0	36.7	36.0	37.8	41.4
%	100.0	105.8	110.2	108.6	110.9	108.6	114.0	125.0

TABLE 10. The economic feasibility of fattening birds up to 34 days of age .

34 days	1	2	3	4	5	6	7	8
The cost of the chick to produce 1 kg live weight (Egyptian pounds)	25.01	23.82	23.75	23.86	23.56	22.53	22.57	21.81
Feed cost to produce 1 kg live weight (Egyptian pounds)	62.19	58.86	56.99	57.59	56.54	58.40	55.42	52.20
The cost of chick and feed to produce 1 kg live weight (Egyptian pounds)	87.20	82.68	80.74	81.45	80.10	80.92	77.99	74.01
%	100.00	94.81	92.59	93.41	91.86	92.80	89.43	84.88
The production cost of 1 kg live weight (Egyptian pounds)	116.27	110.24	107.66	108.60	106.80	107.90	103.98	98.69
The profit achieved from the production of 1 kg live weight (Egyptian pounds)	3.73	9.76	12.34	11.40	13.20	12.10	16.02	21.31
Profit index %	3.21	8.86	11.47	10.49	12.36	11.22	15.41	21.60

Discussion

The mortality rate was significantly reduced when the amount of garlic meal was increased [22]. While feed additives containing these components were reported to lower broiler mortality, supplementing with garlic and turmeric did not appear to have any appreciable benefits on survivability [23]. Garlic, ginger, turmeric, and other medicinal plants may contain organic substances that help with both health promotion and illness therapy [24]. These phytogenics have a long history in conventional medicine and are well-known for their pharmacological actions [25,26], antibacterial qualities [27-29], and the reduction of symptoms associated with gastrointestinal disorders.

In conclusion, the average live weight index improves when *Nigella sativa* (black seeds), garlic, and licorice are combined at simple quantities. It is crucial to acknowledge the pertinent studies that contributed to these conclusions. In the Osman [30] study, when BCS oil was added to grilled chicken meals, significant increases in ADWG were seen. Guler et al.[31] showed that as compared to the control group, birds fed meals containing 10 g/kg BCS and an antibiotic had the highest ADWG. Feeding meals containing 10 and 15 g/kg BCS significantly raised ADWG, according to a four-week research by Abu-Dieyeh [32]. Erener et al.[33] noted that after 42 days of age, BCS (10 g/kg) increased ADWG in comparison to the control group. Khan et al.[10] observed that at 28 and 42 days old, the ADWG was considerably greater in the BCS-fed groups (25 and 50 g/kg) compared to the group fed 12.5 g/kg BCS and antibiotic diets. According to Yatoo et al.[34], the 0.5% BCS group showed the biggest increase among all treatment groups, with greater ADWG than the control group. Durrani et al.[35] noted that adding BCS (20, 30, and 40 g/kg diet) led to a rise in body weight.

Better nutrient absorption from the stomach may be the cause for the increased ADWG attributed to BCS [36]. BCS addition to feeds may boost bile flow rate, increasing emulsification and activating pancreatic lipases, which will help with fat digestion and vitamin absorption that is dependent on fat [37]. Thymoquinone, carvone, anethole, carvacrol, and 4-terpineol are some of the active components in BCS, and they exhibit antioxidant, antibacterial, and digestive enzyme-stimulating effects in the pancreas and intestinal mucosa [36,22]. Low dosages of BCS have been demonstrated to elevate metabolic via elevating thyroxin concentration [23]. Additionally, the antimicrobial qualities of BCS may help broiler hens' ADWG and feed conversion ratio (FCR) [36,24]. According to the research by Premavalli et al.[38], compared to the control group, Japanese quails fed diets supplemented with garlic powder had considerably greater mean live body weight and better feed conversion ratio. The degree of viability did not differ much. The researchers came to the conclusion that adding garlic powder to the meal at a 1.5% level enhanced Japanese quail growth. Japanese quails were fed diets with varying amounts of garlic meal in the study by Olayinka et al. [25]. In terms of performance and nutrient digestibility, the results showed that quails fed a diet level of 750g garlic meal had the greatest outcomes, with the exception of crude protein, which also had positive results at inclusion levels of 500g and 750g. The study suggested 750g of garlic meal as the ideal inclusion amount for productivity. The results of both trials indicate that adding garlic meal or powder to quail diets has a good impact on growth performance. The hypothesis that quails' weight gain improves as the level of garlic meal increases is supported by the increase in final weight, weight gain, and total feed consumption with greater degrees of supplementation. The higher feed intake brought on by the eating of garlic meal may be responsible for the enhanced performance. The studies also show that natural feed additives, such as garlic, can improve feed palatability, stimulate the digestive tract, boost hunger, and lead to higher feed consumption Olayinka. Studies have shown that include licorice and garlic in chicken diets may have some advantages. In grill chicken feed, licorice supplementation at a dose of 2 g/kg significantly reduced belly fat [27]. Additionally, adding 1 g of licorice extract (LE) per kilogramme of food for six weeks to the feed for grill chicken improved body weight gain noticeably [28]. It should be mentioned, nonetheless, that in comparison to the control group, higher inclusion levels of licorice demonstrated a reduction in the growth of body weight. According to research by Alagawany et al.[29], adding G. gabra to poultry feeds greatly enhanced grill chicken development results. The addition of licorice root to the feed of grill chickens at a level of 2.5 g/kg led to the best performance outcomes [26]. Additionally, the administration of LE at doses of 100 mg and 450 mg/L in the drinking water of quails improved final body weight and body weight growth, but these effects were only seen in male birds [39]. It has been claimed that adding garlic and licorice to grill chicken diets improves performance during development [40]. Similar results were observed when aqueous licorice extract was added to broiler chickens' drinking water. Despite this, the hens' water and feed intake and feed conversion efficiency did not improve [41]. In contrast, a study by Rezaei et al.[42] discovered that adding glycyrrhiza to grill chicken meals reduced the amount of feed consumed and the amount of weight growth experienced by the birds compared to the control group. The possible fat-burning properties of liquorice flavonoids have been suggested as the cause of this drop in body weight [43].

In various trials, adding BCS to poultry diets had varying impacts on average daily feed intake (ADFI). While other studies observed a decrease in ADFI [30], some have seen a rise in ADFI with BCS supplementation [33, 44,34]]. However, several researchers [31,9,45] have found no appreciable impact of BCS supplementation on ADFI. Osman et al.[46] discovered that adding powdered BCS to the meal at different amounts (2, 4, 5, 8, and 10 g/kg) enhanced ADFI in the case of grill chickens. BCS (10 g/kg) and BCS extract (1 g/kg) both increased ADFI in grill chickens when compared to the control diet, with no discernible difference between BCS and BCS extract. Yatoo et al.[34] found that during the starter phase, finisher phase, and during the whole study period, quails fed a meal supplemented with 1% BCS had increased ADFI. There were no discernible variations in ADFI across the groups when Japanese quail chicks were fed diets supplemented with various types of BCS, according to Abou-El-Soud [47]. The enhanced palatability of the meal and the stimulation of the appetite and digestive system may be responsible for the rise in ADFI seen with BCS supplementation [22]. There are studies that suggest that adding BCS causes a drop in ADFI, though. For instance, [30] discovered that adding BCS oil to the meals of grilled chicken dramatically decreased ADFI.

Similar to this, several studies have found different effects of BCS supplementation on feed conversion ratio (FCR). While some studies [9,34,35,45] have found no appreciable effects, some have demonstrated enhanced FCR with BCS supplementation [31,33]. The many traits and chemical components of BCS may be to blame for the variations in the outcomes.

Compared to the control group, weight gain in grill chickens increased considerably when garlic and kalongi were added to their diets [48]. Broilers fed a diet enriched with 0.5% garlic had the best feed conversion ratio and the highest live weight among the treatment groups. Feed consumption wasn't considerably impacted. Dressing percentages and relative organ weights did not differ significantly. These results highlight the potential economic contribution of garlic to the poultry industry by indicating that garlic, or kalongi, may be consumed in a way that promotes the inexpensive and effective production of grill chickens.

Adding kalongi (black seed), garlic, and turmeric to chicks' meal had a big impact on a lot of different metrics [49]. The most significant overall weight growth and the best feed conversion ratio were seen in the chicks supplemented with kalongi. The group supplemented with turmeric consumed the most feed. In the group receiving kalongi supplements, antibody titers against infectious bursal disease and Newcastle disease were greatest. The control group had the highest serum cholesterol levels. The most profitable treatment was treatment C (supplementation with kalongi), followed by treatments D (garlic), B (turmeric), and A (control). According to these results, adding garlic and kalonji to poultry feed may increase weight gain, feed conversion, disease resistance, and profitability.

According to studies, adding licorice to chicken diets can enhance digestion, appetite, growth, and organ development [50]. In broiler chickens, dietary licorice supplementation at a level of 2.5 g/kg and up to 0.5% inclusion prior to sexual maturity were found to produce the best results. Additionally, broilers exposed to heat stress who were given drinking water containing 450 mg/l of liquorice displayed enhanced feed conversion and financial efficiency. These results indicate that liquorice supplementation in chicken diets may have economic benefits in terms of growth, organ development, hunger stimulation, and enhanced feed conversion, particularly under difficult circumstances like heat stress.

Conclusions

The results of the study showed that the groups supplemented with Nigella sativa, garlic, and licorice demonstrated superiority in terms of live weight index, feed conversion coefficient, low mortality rate, and high percentage of achieved profit. Particularly noteworthy were the experimental groups that included two or three types of the studied subjects, indicating the potential synergistic effects of these supplements.

High light

These findings highlight the positive impact of black seed, garlic, and licorice supplementation on the productivity and profitability of quail farming. The study provides valuable insights for farmers and researchers in the poultry industry seeking to optimize the growth performance and economic outcomes of quail production. Further research and exploration of the specific mechanisms underlying these effects could contribute to the development of effective and sustainable strategies in poultry nutrition and management.

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Statements & Declarations

Ethical Consideration

The procedures of this study were approved by the Institutional Animal Care and Use Committee (CU-IACUC) of Cairo University (Approval number: CU-II-F-35-23).

Availability of Data and Material:

The data is available within the article.

Preprint Submission

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"تأثير استخدام الحبة السوداء والثوم وعرق السوس على المؤشرات الإنتاجية للسمان الياباني"

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هدفت هذه الدراسة البحثية إلى معرفة تأثير مكملات الحبة السوداء (حبة البركة) والثوم (Allium sativum) وعرق السوس (Glabra) على المؤشرات الإنتاجية لـ 600 كتكوت السمان الأبيض في مصر. أجريت التجربة في مزرعة خاصة بالجيزة اعتبارًا من 1 فبراير 2023 ولمدة 34 يومًا.

تم تقسيم صيصان السمان إلى ثماني مجموعات ، كل مجموعة تتكون من 75 كتكوت في المتوسط. داخل كل مجموعة ، تم إنشاء ثلاث مكررات ، تضم كل منها 25 كتكوت سمان. تعرضت جميع المجموعات لظروف إسكان ورعاية متطابقة طوال فترة الدراسة التي استمرت 34 يومًا.

تلقت المجموعة الضابطة النظام الغذائي القياسي لنظام المزرعة دون أي مكملات ، لتكون بمثابة المجموعة الأساسية. تلقت المجموعات التجريبية السبع المتبقية النظام الغذائي الأساسي المضاف إليه تركيبات مختلفة من الكمون الأسود والثوم وعرق السوس في شكل مسحوق. كانت مستويات المكملات 0.5٪ لكل مكون على حدة وفي تركيبات مختلفة.

أظهرت النتائج أن المجموعات المكملة بالحبة السوداء والثوم وعرق السوس أظهرت أداءً فائقًا من حيث مؤشر الوزن الحي ، ومعامل التحويل الغذائي ، وانخفاض معدل النفوق ، ونسبة الربح المحققة. والجدير بالذكر أن المجموعات التجريبية التي تضمنت نوعين أو ثلاثة أنواع من المكملات أظهرت أفضل النتائج (والتي أعطت أفضل أداء وأعلى عائد اقتصادي).

الكلمات الدالة: الاقتصادية ، العرقسوس ، الثوم ، حبة البركة .