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RESEARCH ARTICLE

The Impact of Dietary Thyme and Turmeric Essential Oils on Behavior, Performance, Carcass Traits and Meat Quality of Japanese quails

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ABSTRACT

This study investigated the impacts of supplementing the diet with thyme (Thymus vulgaris) and turmeric (curcuma longa) essential oils on behavior, performance, carcass traits and meat characteristics of Japanese quails. One hundred ninety-two quail chicks at one-day old were reared for one week for adaptation and then randomly divided into 4nutritional treatments, each with 3 replicates (16 birds per replicate). Quails in the untreated group (G1) fed a standard diet without essential oil supplementation, the second group (G2) fed a standard diet supplemented with 0.2% thyme essential oil, the third group (G3) fed a standard diet supplemented with 0.3% turmeric essential oil and the fourth group (G4) fed a standard diet supplemented with mixture of 0.075% thyme and 0.125% turmeric oils. The experiment lasted for 5 weeks. A focal sample technique was used to report the quail's behavior twice daily (once at the start of the day between 7 and 10 AM. and the other in the afternoon between 3 and 5 PM.) for 20 min per time for each replicate. Moreover, growth performance, meat quality and carcass traits were evaluated. The results revealed that Supplementing the diet with thyme and turmeric essential oils induced significant improvements in ingestive and comfort behaviors, a reduction in feed intake, improved body weight gain, feed efficiency and enhanced carcass traits and meat quality in Japanese quails. Throughout the experiment, Japanese quails of G4 had the best performance. In summary, dietary supplementation of 0.075% thyme and 0.125% turmeric essential oils, enhanced Japanese quail growth performance, carcass traits, meat quality, while also reducing feed consumption.

Introduction

Japanese quail (*Coturnix coturnix japonica*) is a member of the Kingdom Animalia, family Phasianidae, order Galliformes, genus Coturnix, and species japonica. Quail are known for their rapid growth, minimal feed consumption, early sexual maturation (42 days of age), high egg output, and tasty meat. Furthermore, it requires minimal room and equipment to raise. It is also extremely resistant to the most prevalent infections that affect other domestic species of birds. Furthermore, it can thrive in challenging environmental and climatic conditions [1]. These birds are raised for both meat and eggs, making them the smallest avian species employed in research [2]. Quail eggs are highly nutrient-dense, containing three to four times as many vitamins and minerals as chicken eggs, and their meat serves as a major dietary supply of protein and essential micronutrients including mineral and vitamin content and unsaturated fatty acids. So, they are a healthier choice for several health benefits [3] offer an affordable, high-quality protein satisfying the increasing need for animal-based protein, which could be crucial in combating malnutrition in developing nations [4]. Plant-derived substances called phytogenic feed additives (PFAs), which are widely utilized in chicken farming, include herbs, spices and oils. They serve as natural replacements for antibiotic-based growth enhancers, for enhancing avian health, growth efficiency and overall production [5]. The total cost of feed, which makes up 60–70% of the entire production costs, is one of the most important elements affecting poultry output [6]. Therefore, in order to lower feed costs, nutritionists in the poultry sector are looking into essential oils that are produced from plants as alternatives to conventional feed sources[7]. Essential oils are organic, non-toxic, and residue free alternatives gaining popularity in animal feed, offering a solution to antibiotic resistance and residue concerns[8]. Thyme essential oil, derived from *Thymus vulgaris* leaves and flowers, is one of these phytogenic oils gaining recognition for its potential benefits in poultry farming. It contains bioactive compounds (including thymol and carvacol) that give antibacterial, antioxidant, and anti-inflammatory effects, it is being explored as a natural replacement for artificial antibiotics. It enhances chicken health by boosting immunity, reducing infection risk, and promoting growth through increased appetite, feed intake, and the release of digestive enzymes. Additionally, it improves overall productivity and feed efficiency, making it a valuable addition to sustainable poultry management practices. [9]. Turmeric essential oil, known for its significant health and welfare benefits, is a valuable addition to chicken diets as it enhances protein synthesis in the enzymatic system, supporting overall growth and health. It contains bioactive compounds (including curcumin and turmerone) that give potent antioxidant, antibacterial, antifungal, anti-inflammatory, and immune-boosting effects [10]. The study explores the influence of various plant-derived oils on behavioral patterns, performance, carcass traits and meat characteristics of Japanese quails.

Materials and methods

Birds and Management

The research was carried out following approval by the Institutional Animal Care and Use Committee of the Faculty of Veterinary Medicine, Zagazig University (ZU-IACUC/2/F/18/2025).

The research was performed in the experimental rooms belonging to the

faculty of Veterinary Medicine, Zagazig University to assess the impact of supplementing the diet with thyme (*Thymus vulgaris*) and turmeric (*Curcuma longa*) oil extracts on behavior, performance, carcass traits and meat characteristics of Japanese quails. One hundred ninety-two quail chicks at one day old were reared for one week for adaptation before being distributed into identical four chambers where each one represented experimental group. Each experimental room was divided into three pens ($1m^2$) for 3 replicates (16 birds per replicate).

Throughout the 5-week experimental period, the birds were housed in an artificially lit chamber under a continuous 24-hour lighting system [11]. Each pen was equipped with 10 cm-thick layer of sawdust, providing an available area of 0.038 m² per bird [12]. The room temp started at 35°C and was gradually lowered by 3°C weekly until the fifth week. After that, the temperature was between 18 and 20◦C throughout the remainder of the study [13]. Feed and water were always made available. The ingredients and chemical composition of the commercial diet during the growing and laying phases are detailed in Table 1.

Table 1: Formulation and Nutritional Content of the basal Diets

Components (g/kg as fed)	Growing phase	Laying phase
Yellow corn	51.84	64.50
Soybean meal (44%)	26.63	20.50
Concentrate (52%)	16.00	10.00
Vegetable fat	1.27	–
Di-calcium phosphate	1.50	2.31
Limestone	1.03	0.96
DL-methionine	0.09	0.09
Lysine	0.08	0.08
Vitamin and trace mineral	0.30	0.30
Premix	1.06	1.06
Coccidiostat	0.10	0.10
Antioxidant	0.10	0.10
Calculated analysis		
ME (Kcal/kg)	2900	2600
Crude protein (%)	24.00	20.00
Calcium (%)	0.80	2.50
Available phosphorus (%)	0.72	0.66
Lysine (%)	1.30	1.00
Methionine (%)	0.50	0.45

Experimental design

192 quail chicks at one day old were reared together for 7 days then randomly divided into 4 nutritional treatments, each with 3 replicates (16 birds per replicate). Quails in the untreated group (G1) fed a standard diet without supplementation, the second group (G2) fed a standard diet supplemented with 0.2% thyme essential oil, the third group (G3) fed a standard

diet supplemented with 0.3% turmeric essential oil and the fourth group (G4) fed a standard diet supplemented with a mixture of 0.075% thyme and 0.125% turmeric oils.[14]

Data Collection

Behavioral observation

The behavioral patterns of each group were recorded using the focal sample technique [15]. Observations were recorded two times daily (once at the start of the day between 7 and 10 AM. and the other in the afternoon between 3 and 5 PM.) for 20 min per time for each replicate. The duration and frequency of the following behaviors were recorded in Table (2) [16]

Table 2: Definition of recorded behavioral patterns of quails

Behavior	Explanation
Ingestive behavior	
Feeding	Head positioned in the direction of the feed containers
Drinking	The bird places its beak either inside or over the drinking equipment
Foraging	birds pecking food from the ground
Standing behavior	Standing Idle not engaged in any activity, locking about or with eye closed.
Kinetic behavior [17]	
Walking	Walking at least two successive steps.
Running	Moving rapidly not walking.
Flying	Via forcibly moving wings from one location to a new one.
Resting behavior [18]	
Crouching	Laying or sitting breast on the ground, locking around or keeping its eyes shut.
Sleeping	In a resting position, the bird exhibits completely extended or collapsed neck and its eyes remain shut.
Exploratory behavior	
Pecking	Birds show strong motivation to investigate environmental content.it includes (trough pecking, wall pecking and feather pecking).
Comfort behavior [19]	
Preening	Bird groom their feather using the beak while standing or in a crouched position.
Other comfort behavior	Include wings and legs stretching, wing ruffling, head and body shaking.

Growth Performance

All the chicks were weighed at the end of first week of age to record their initial body weight. Then, the final body weight, amount of feed consumed per day, weight gain and feed conversion rate were estimated according to the following equations:

Weight gain= final body weight-initial body weight

Feed conversion ratio = feed intake /weight gain

Carcass traits

At the end of the study, 6 birds per treatment (2 birds /replicate) were randomly selected and weighed. The birds underwent slaughter, feather removal, and evisceration to evaluate carcass characteristics. The dressing % was calculated by dividing actual carcass

weight by the final body weight. The relative weight of liver, heart, gizzard and spleen were calculated [20].

Meat quality measurements

Six samples per treatment of breast and thigh muscle were dissected and used to assess meat quality (PH, WHC, cooking loss and drip loss).

The pH of the meat samples was estimated using a digital pH meter. 24 hours after chilling, 5g of the meat was ground and blended with 25 milliliters of distilled water [21]. The pH meter should be calibrated before use with standard buffers of pH 7.0 at 25ºC.

Water-holding capacity was assessed by centrifuging approximately 3–4 g of muscle tissue at 10,000 × g for half an hour in a stainless-steel tube. The separated fluid was immediately decanted to prevent reabsorption. The sample was then removed, dried with tissue paper, and reweighed to assess fluid loss[22].

For cooking loss assessment, a 1 cm^3 meat sample was taken from each muscle, weighed (initial weight), and stored at 4 °C for one day. It was then cooked in a water bath at 85 °C for ten minutes until reaching an internal temperature around 75 °C. After gently dabbing, the sample was reweighed (final weight). Cooking loss was estimated as a % of the initial weight.

Dripping loss%, meat samples were, meat samples were weighed and placed in cotton nets, then sealed in plastic bags and stored at 4 °C for 24 hours. Afterward, samples were lightly dried and reweighed using the same calibrated scale. Drip loss (%) was calculated as the % of the weight loss relative to the initial weight. [23].

Water absorptive power, three grams of the thigh muscle was excised from each replicate, weighed and placed in clean test tubes: About 10mL of distilled water was poured in the test tube and left for an hour. After one hour each sample was removed and re-weighed. The increase in weight of the sample indicates the volume of the water absorbed.

Data Analysis

Mean ± the standard error of means was applied to express the data of the results. All treatment groups' effects on the various behavioral patterns and performance metrics were evaluated using one-way analysis of variance (ANOVA) followed by Duncan multiple test as post hoc test. The value $p \leq 0.05$ was utilized as the threshold for statistical significance. The Statistical Package for Social Sciences version 24.0 (SPSS, IBM Corp., Armonk, NY) was used.

Results

The outcomes of supplementing diets with thyme and turmeric essential oils on ingestive behavior of quail is illustrated in Table 3. Feeding behavior duration Showed an increase in birds receiving supplementation relative to the control without significance difference, while feeding frequency was higher in control than other groups. Notably, the thyme group exhibited the highest drinking behavior (both in duration and frequency), with (43.86±10.14 sec and 12.26±2.95 bouts, respectively, followed by the turmeric group and the lowest values were noted for G1 and G4 (Table 3). Additionally, foraging behavior (duration and frequency) was significantly the highest in the thyme group and the lowest in the untreated group. Quail fed diet boosted by thyme showed the highest leg

and wing stretching (duration and frequency) followed by the turmeric group and the lowest values were noted for G1 and G4. No marked alteration in the other comfort behaviors between experimental groups was noticed.

As shown in Table 4, Standing behavior was markedly more prominent in quail fed un supplemented diet and turmeric groups. Whereas kinetic behaviors duration and frequency including (walking, running and flying) were notably higher in the thyme group over the remaining groups.

Resting behavior duration was considerably affected ($P \leq 0.05$)by dietary addition of essential oils (thyme and turmeric). Crouching and sleeping duration were highest in thyme and turmeric group (273.26±48.88sec and 56.00±18.90 sec, respectively) followed by turmeric group (203.50±31.88 sec and 25.83±8.30 sec, respectively) relative to the un-supplemented and thyme treatments. However, Quails supplied with thyme in their diet exhibited significantly higher pecking behavior (both duration and frequency) than the others.

Table 3. Impact of dietary Thyme and/or Turmeric essential oils on duration and frequency of ingestive and comfort behaviors of Japanese quail (Mean±SE).

Behavior	G1 Control (basal diet)	G2 Thyme	G3 Turmeric	G4 Thyme&Turmeric
Ingestive behavior				
Feeding duration (sec)	128.60±13.34	131.23±15.93	141.43±22.63	137.16±24.68
Feeding frequency	8.43±1.05	7.46±0.697	8.36±1.48	6.63±1.04
Drinking duration (sec)	15.73±3.32^{b}	43.86±10.14^{a}	31.10±3.72^{ab}	21.63±2.43^{b}
Drinking frequency	5.73±1.10^{b}	12.26±2.95^{a}	10.13±1.11^{ab}	6.60±0.858^{b}
Foraging duration (sec)	41.46±7.79^{b}	66.16±8.16^{a}	44.03±7.04^{ab}	47.20±7.25^{ab}
Foraging frequency	4.13±0.520^{b}	6.30±0.678^{a}	5.43±0.800^{ab}	4.33±0.721^{ab}
Comfort behavior				
Preening duration (sec)	84.16±9.59	90.66±9.36	109.26±12.85	90.46±10.13
Preening frequency	15.06±1.55	12.80±1.30	13.53±1.30	15.50±1.56
Leg & wing stretching duration (sec)	2.40±0.463^{b}	6.13±1.43^{a}	4.46±0.763^{ab}	2.13±0.394^{b}
Leg & wing stretching frequency	1.36±0.260^{b}	2.36±0.305^{a}	2.40±0.388^{a}	1.16±0.203^{b}
Shaking &ruffling duration (sec)	9.60±1.27	9.10±0.872	8.40±0.867	8.36±1.19

Shaking &ruffling frequency	6.70±0.812	6.16±0.639	5.50±0.633	5.06±0.563

[ab] Means in the same row with different superscripts are differ significantly at $P \leq 0.05$ according to Duncan multiple Significant Difference test.

Table 4. Impact of dietary Thyme and/or Turmeric essential oils on duration and frequency of kinetic and inactive behaviors of Japanese quail (Mean±SE).

Behavior	G1 Control (basal diet)	G2 Thyme	G3 Turmeric	G4 Thyme&Turmeric
Kinetic behavior				
Walking duration (sec)	118.73±10.16	136.20±13.29	102.73±8.27	105.93±12.75
Walking frequency	40.16±2.58	41.06±2.78	38.86±3.26	36.20±3.56
Running duration (sec)	1.46±0.425[b]	9.93±3.586[a]	3.70±1.587[b]	1.96±0.787[b]
Running frequency	0.800±0.216[b]	2.20±0.653[a]	0.966±0.366[b]	0.600±0.212[b]
Flying duration (sec)	0.9000±0.181[ab]	1.033±0.340[a]	0.4000±0.163[ab]	0.3000±0.173[b]
Flying frequency	0.900±0.181[a]	0.833±0.275[a]	0.400±0.163[ab]	0.200±0.121[b]
Inactive behavior				
Standing duration (sec)	594.06±30.16[a]	529.10±27.32[ab]	551.90±30.09[a]	452.30±42.1[b]
Standing frequency	59.33±3.25[a]	53.16±2.81[ab]	59.90±2.94[a]	48.80±4.74[b]
Resting behavior				
Crouching duration (sec)	152.06±29.23[b]	152.43±21.629[b]	203.50±31.88[ab]	273.26±48.88[a]
Crouching frequency	7.63±1.16	6.76±1.18	7.13±0.936	7.73±0.986
Sleeping duration (sec)	19.63±8.05[b]	15.36±6.69[b]	25.83±8.30[ab]	56.00±18.90[a]
Sleeping frequency	0.500±0.218	0.500±0.171	0.733±.185	0.966±0.323
Exploratory behavior				
Pecking duration (sec)	0.733±0.348[b]	8.76±2.65[a]	4.00±1.41[b]	3.16±1.01[b]
Pecking frequency	0.300±0.145[b]	1.40±0.382[a]	0.793±0.250[ab]	0.500±0.157[b]

[ab] Means in the same row with different superscripts are differ significantly at $P \leq 0.05$ according to Duncan multiple Significant Difference test.

As shown in Table 5, the supplementation of phytogenic essential oils of thyme and turmeric had a markedly effect on the feed intake of Japanese quails throughout the five-week study period. A marked reduction in feed intake was found in the treated groups compared to the un-supplemented group. The highest average feed consumption was recorded in the control group, while the significantly lower feed intake ($p < 0.05$) was found in the G4.

The final body weight and body weight gain data indicated that the supplementation of phytogenic essential oils of thyme and turmeric had a significant positive effect on the growth performance of Japanese quails. The highest final body weight and body weight gain were observed in G4 (241.02±3.62 g and 204.88±3.5g, respectively) followed by G2 (238.00±3.33g and 201.85±3.27g, respectively). In contrast, the untreated group showed the lowest final body weight and body weight gain. FCR was notably improved in treated groups relative to control.

Table 5. Impact of dietary Thyme and/or Turmeric essential oils on growth performance of Japanese quail.

Growth performance	G1 Control(basal diet)	G2 Thyme	G3 Turmeric	G4 Thyme&Turmeric
Initial body weight(g)	36.14±0.31155	36.14±0.23257	36.09±0.19221	36.14±0.30209
Final body weight (g)	225.83±4.50[b]	238.00±3.33[a]	233.40±4.15[ab]	241.02±3.62[a]
Body weight gain (g)	189.69±4.53[b]	201.85±3.27[a]	197.30±4.15[ab]	204.88±3.51[a]
Weekly feed intake(g)	168.73±11.27[a]	168.50 ±11.12[b]	167.00 ±12.42[c]	158.02 ±9.46[d]
Feed conversion rate(g)	4.53±0.094[a]	4.21±0.067[b]	4.33±0.124[ab]	3.90±0.069[c]

[abcd] Means in the same row with different superscripts are differ significantly at $P \leq 0.05$ according to Duncan multiple Significant Difference test.

Significant differences were observed in carcass traits (see Table 6). The Dressing weight and percentage were significantly higher in quail fed with a combination of 0.075% thyme and 0.125% turmeric essential oils compared to other treatments ($p < 0.05$). Nevertheless, the weights of the organs relative to body weight (liver, gizzard, heart and intestine) were not significantly influenced by dietary treatments.

Table 6. Impact of dietary Thyme and/or Turmeric essential oils supplementation on carcass traits of Japanese quail.

Carcass traits	G1 Control (basal diet)	G2 Thyme	G3 Turmeric	G4 Thyme&Turmeric
Live body weight (g)	218.16±2.83 ^{b}	223.16±7.01^{ab}	220.16±7.22 ^{b}	240.16±5.78^{a}
Dressing carcass weight (g)	154.75±7.50^{b}	165.36±5.07^{b}	168.97±2.82^{ab}	184.37±4.77^{a}
Carcass percent (%)	69.24±1.66^{c}	75.14±0.577^{ab}	70.66±2.69^{bc}	76.76±0.764^{a}
Liver (g)	4.23±0.564	3.72±0.391	3.55±0.345	3.64±0.309
Gizzard (g)	3.67±0.243	3.42±0.209	3.31±.124	3.84±0.310
Heart (g)	2.03±0.109	2.14±0.093	2.01±0.083	2.14±0.066
Intestine (g)	6.66±0.650	5.96±0.301	5.39±0.232	6.73±0.743

^{abc} Means in the same row with different superscripts are differ significantly at $P \leq 0.05$ according to Duncan multiple Significant Difference test.

As depicted in Table 7, phytogenic essential oils of thyme and /or turmeric had a prominent impact on the meat quality of Japanese quail. WHC percentage values were significantly higher in G2 (48.00±6.13%), G3 (61.55±2.18%) and G4 (40.55±6.68%) compared to those of quails in the control group (30.05±4.71%). Meanwhile, the cooking loss% values were the lowest in the group of thyme and turmeric combination (20.00±2.58%) compared to other groups. Additionally, PH values were significantly lower in treated groups than untreated. In contrast, dripping loss% and water absorptive power did not significantly differ among groups.

Table 7. Impact of dietary Thyme and/or Turmeric essential oils supplementation on meat quality of Japanese quail.

Meat quality	G1 Control (basal diet)	G2 Thyme	G3 Turmeric	G4 Thyme&Turmeric
PH	7.03±0.049[a]	6.85±0.042[b]	6.68±0.070[b]	6.85±0.067[b]
Water Holding Capacity(%)	30.05±4.71[c]	48.00±6.13 [ab]	61.55±2.18 [a]	40.55±6.68[bc]
Cooking loss (%)	28.33±1.42 [a]	22.83±1.01 [ab]	27.66±1.74 [a]	20.00±2.58 [b]
Dripping loss (%)	6.27±0.675	3.68±1.07	6.05±1.53	3.12±0.856
Water absorptive power	0.911±0.112	0.788±0.047	0.911±0.087	0.771±0.087

[abc] Means in the same row with different superscripts are differ significantly at P ≤ 0.05 according to Duncan multiple Significant Difference test.

Discussion

Behavior serves as a vital indicator for evaluating animal welfare, offering a firsthand insight from the animal's point of view [24]. Concerning the ingestive behavior, it was reported

that feeding duration was insignificantly longer in quails that were supplied with thyme and turmeric oils in their diets than the un-supplemented group; these results are supported by the results of [25-27]. This might be associated with the stimulation of both thyme and turmeric oils to the secretion of enzymes that aid in digestion leading to better digestion and nutritional absorption. On the other hand, [28-30] reported no major change in feeding behavior and food consumption in birds received turmeric in their diet. Quails fed with turmeric essential oils showed an increase in the frequency of foraging behavior. This could be due to curcumin's high polyphenol concentration that improves nutrient utilization, promotes gut health, and modifies gut flora. [31].

Preening duration, leg and wing stretching behavior were increased in turmeric-supplemented group than the un-supplemented group, these outcomes agreed with those of [27, 32]. This could be due to turmeric's analgesic and inflammation-suppressing effect result in reduced pain and inflammation and higher comfort.

Standing behavior was notably greater in the untreated group than in the thyme-supplemented treatment, as demonstrated by the studies referenced [25, 33]. Moreover, the frequency of walking behavior was not significantly affected by the addition of turmeric, consistent with the findings of [26].

The increase of duration of crouching and sleeping in thyme and turmeric and turmeric groups could be due to the analgesic, anti-inflammatory and sedative properties of turmeric and thyme. This

result agreed with [26], who found that turmeric shows a marked increase in crouching behavior. On the contrary, [25] found that broilers in treated groups displayed higher resting behavior than those in the control group.

Japanese quail groups receiving mixture of thyme and turmeric essential oils demonstrated significantly reduced feed consumption relative to the untreated group that recorded maximum feed intake. These findings are corroborated by [34, 35], who observed that broilers fed thyme essential oil exhibit marked lower feed consumption. Similarly, [36, 37] found that broilers chicks fed diets containing curcumin, exhibited a noticeable decrease in dietary consumption. Conversely, studies [38-40] observed that adding thyme essential oils to feed for broilers had no discernible effect on their feed consumption. According to [41], there was no obvious effect on feed consumption in broiler groups treated with turmeric oil.

Final body weight and weight gain were markedly increased in the treated groups relative to the untreated. This is possibly caused by the active components in phytogenic essential oils that enhance digestion through the regulation of the gastrointestinal microbial system and stimulation of the internal digestive enzymes, thereby improving poultry growth performance [42]. These findings align with previous studies [38, 43] which found that thyme essential oils significantly promote weight gain. Additionally, [41, 44, 45] found that providing birds with turmeric in their diet greatly increases their body weight gain. The best feed conversion ratio was recorded among birds that their diet supplied with thyme and turmeric oils and combination of them over quails that fed basal diet. These results supported by [38, 43].

Quails supplied with thyme oils or turmeric oils or combination of both had significantly better dressing weight and percentage. Our findings were supported by the previous results [40, 46, 47]. On the other hand, [48] found that broilers were supplied with thyme powder in their diets had no statistically significant differences in the carcass's weight and dressing output. [49] observed that mixing thyme to the feed of birds exhibited no influence on their carcass characteristics. Additionally, [50, 51] showed that providing turmeric to feed had no effect on the carcass characteristics of Japanese quails. Gastrointestinal organ weights were not influenced by administration of quail feed with thyme and turmeric oil extracts. Our results were confirmed with the previous results by [40, 48, 52, 53].

The physicochemical properties of meat including pH, water holding capacity, cooking loss, dripping loss are very important and strongly affect the consumer acceptance. Poultry meat pH is particularly valuable for assessing quality, as it directly impacts how tender it is, WHC, cooking loss, visual appearance and storage stability [54, 55]. Quails that were supplied with turmeric and thyme oil extracts in their feed showed markedly lower PH in comparison with the untreated group. This reduction in PH can be ascribed to the antibacterial components found in thyme and turmeric oils, which limit the growth of spoilage bacteria that are responsible for creating alkaline metabolites such as ammonia and amines during protein degradation in meat. [56-58]. Oppositely, [59] observed that addition of thyme essential oil to the diet exhibited no impact on meat pH.

WHC serves as one of the most essential characteristics of meat, which is closely linked to its appearance and how tender it is. [60]. In our study, supplementing phytogenic essential oil from thyme and turmeric in the feed of quails noticeably improved water holding capacity percentage and decreased cooking loss percentage. It can be thought that the supplementary oils enhanced the antioxidant mechanism in poultry meat, leading to improved water-holding capacity. The same results were reported by [61-63] who demonstrated that feeding quails on thyme led to an increase in the WHC %., specifically [62] found that whether thyme oil was provided freely or via nano-encapsulation, it significantly decreased cooking loss. These findings are supported by the work of [63], who demonstrated that the meat samples of quails supplied with thyme in their diet exhibited a cooking loss less than that of the control.

Conclusions

Ultimately, using phytogenic essential oil from thyme and turmeric oils in a combination at dose of 0.075% thyme and 0.125% turmeric increased feeding and comfort behaviors, improved growth performance (final body weight, body weight gain and feed conversion ratio), decreased feed consumption, enhanced carcass traits and overall meat quality.

Conflict of interest

The authors declare they have no conflict of interest.

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الملخص العربي

تأثير إضافة الزيوت العطرية من الزعتر والكركم على سلوك وأداء وسمات الذبيحة وجودة لحوم طيور السمان الياباني

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تهدف هذه الدراسة إلى تقييم تأثير إضافة الزيوت العطرية من الزعتر والكركم على سلوك وأداء وسمات الذبيحة وجودة لحوم طيور السمان الياباني. قُسِّم 192 فرخ سمان ياباني عمر أسبوع عشوائيًا إلى أربع مجموعات ، كل مجموعة بثلاث متكررات (16 طائرًا في كل منها). تغذى السمان في المجموعة الاولى (المجموعةالحاكمة) على نظام غذائي أساسي بدون مكملات الزيوت العطرية، وتغذى المجموعة الثانية على نظام غذائي أساسي مضاف إليه 0.2% من زيت الزعتر العطري، وتغذى المجموعة الثالثة على نظام غذائي أساسي مضاف إليه 0.3% من زيت الكركم العطري، وتغذى المجموعة الرابعة على نظام غذائي أساسي مضاف إليه مزيج من 0.075% من زيت الزعتر و0.125% من زيت الكركم العطري. استمرت التجربة لمدة 5 أسابيع تم تسجيل سلوكيات السمان مرتين يوميًا (مرة في الصباح بين الساعة 7 و10 صباحًا، والأخرى في فترة ما بعد الظهر بين الساعة 3 و5 مساءً) لمدة 20 دقيقة لكل تكرار. علاوة على ذلك، تم تقييم أداء النمو وجودة اللحوم وسمات الذبيحة. كشفت النتائج أن المكملات الغذائية من الزيوت العطرية للزعتر والكركم قد حسنت بشكل كبير من السلوك الغذائي وسلوك الراحة، وخفضت استهلاك العلف، وحسنت زيادة وزن الجسم، ونسبة تحويل العلف، وعززت سمات الذبيحة وجودة اللحوم في السمان الياباني. طوال التجربة، حقق السمان الياباني من المجموعة الرابعة أفضل أداء. وقد خلصت نتائج البحث الي ان إضافة الزيوت العطرية للزعتر والكركم إلى العلف بنسبة 0.075% و0.125% على التوالي ادت إلى تحسين أداء نمو السمان الياباني، وخصائص الذبيحة، وجودة اللحوم، وتقليل استهلاك العلف.