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Research Article

Investigating the Effect of Dietary Supplementation of *Rytigynia umbellulata* Leaf Essential oil on the Growth Performance, Carcass Characteristics, Nutrient retention, Intestinal Microbial Population and Sensory Evaluation of Japanese Quails

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Abstract:

This study was undertaken to investigate the effect of dietary supplementation of *Rytigynia umbellulata* leaf essential oil on the growth performance, carcass characteristics, nutrient retention, intestinal microbial population and sensory evaluation of Japanese quails. 500- two weeks old Japanese quails (mixed sex) were randomly distributed into five treatment groups and each treatment had five replicates (20 birds per replicate). The duration of the experiment was 35 days and a completely randomized design was adopted. Quails in group A received standard diet (corn-soybean based diet) with Oxytetracycline at 15 g per kg diet, treatment B (standard diet with 5 mL *Rytigynia umbellulata* essential oil), treatment C, D and E were fed standard diet supplemented with *Rytigynia umbellulata* essential oil at 10 mL, 15 mL and 20 mL respectively. Birds had unrestricted access to feed and fresh water. Final body weight, feed conversion ratio and feed consumption improved in birds fed *Rytigynia umbellulata* essential oil in group: B, C, D and E compared to group A ($p<0.05$). Dressing percentage (60.89 - 76.02 %) and carcass weight (109.0 - 199.6 g) were influenced ($p<0.05$) except for the weights of shank, neck, breast, back, head, drumstick, thigh, wing and abdominal fat ($p>0.05$). Crude protein, crude fibre, ash, ether extract and nitrogen free extract retention were higher among birds in group B, C, D and E compared to A ($p<0.05$). Microbial population of *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis* and *Enterococcus spp* were higher among birds in group A than other treatments whereas *Lactobacillus spp* were higher among birds in group B, C, D, E and lowest in group A ($p<0.05$). Juiciness, colour, tenderness, flavor and overall acceptability of meat samples were also affected. It was concluded that *Rytigynia umbellulata* leaf essential oil has abundant concentrations of phyto-components or bioactive compounds which are effective, chemical free and can be supplemented up to 20 mL per kg in the diet of quails without negatively affecting their general performance.

Key words: antimicrobials; growth; carcass; nutrient; retention; phytochemicals; quails

Introduction

Reducing the risk of antimicrobial resistance is an urgent priority as livestock producers around the globe strive to feed a growing population in a more sustainable way and safe guard the animal protein industry (Alagbe et al., 2025). The use of medicinal plant have been reported has been reported as one of the potential alternatives to antibiotics because they are non-toxic, eco-friendly and has no withdrawal period (Oluwafemi et al., 2022). Essential oils can be found on the leaves, seeds, roots, buds, flowers and have been reported to possess several therapeutic properties (Omokore and Alagbe, 2019) and can contribute to animals performance and maintaining their health status when supplemented in their feed (Shittu et al., 2023; Alagbe, 2025). Therefore, essential oils are excellent alternative to avoid the use of antibiotics (John, 2024a).

Rytigynia umbellulata are flowering plants that belongs to the family Rubiaceae. It consist of over 10,000 species widely distributed in Africa and most parts of Asia including India (Raaman, 2006). The plant is known to have a characteristic feature of whorled leaves with interpetiolar stipules while the flowers are sympetalous actinomorphic in nature (Ikechukwu et al., 2023). *Rytigynia umbellulata* is a potent medicinal plant and its ethno-medicinal usage includes the treatment of pyrexia (fever), malaria, diarrhea, sexually transmitted infections and dermatological infections and inflammatory reactions (Ojah et al., 2021; Kumar et al., 2018). The leaf extract has been known to have anti-fertility, anti-inflammatory, antioxidant, gastro-protective, immune-stimulatory, cytotoxic, anti-cancer, antibacterial, hepato-protective and antioxidant effect (Rahman et al., 2013; Basumatary et al., 2016). The extracts from the leaves can also be used to preserve the shelf life of food items while the flowers are used as dyes for fabrics (Silva et al., 2017; Singh et al., 2018)

Essential oils from *Rytigynia umbellulata* exhibited good activity against *Staphylococcus aureus, Bacillus subtilis, Proteus mirabilis, Streptococcus faecalis, Escherichia coli* and *Klebsiella pneumonia* bacteria (Bremei et al., 2009; Moronkola and Faruq, 2013). The major components of *Rytigynia umbellulata* oil are saturated hydrocarbons such as cyclohexane, phytol and monoterpenes: α-pinene, α-Copaene, Caryophyllene, α-Ionone, β-Ionone, Rulepidadiene B and α-Gurjenene (Saleh et al., 2010; Tiwari et al., 2011), which possess strong antimicrobial activity by the disruption of bacteria cell membrane (Alagbe et al., 2025; Gul et al., 2017). The plant also contains various secondary metabolites including, flavonoids, phenolic compounds, tannins, saponins, terpenoids and coumarins (Proestos et al., 2013; Galego et al., 2008).

Previous studies have shown that essential oils has positive effect on the general performance of birds, for instance, Denli et al. (2004) reported that dietary supplementation essential oils from thyme (*Thymus vulgaris*), black seed (*Nigella sativa*) at 60 mg can improve the growth performance of quails. Gul et al. (2019); Alagbe (2023), also reported that oregano and *Prosopis africana* essential oil supplementation in the diet of quails at 600 mg can inhibit the activities of pathogenic organism in the gut and modulate the fatty acid composition in the meat of broiler chicken. However, there is scanty information on the dietary supplementation of *Rytigynia umbellulata* on the performance of Japanese quails. This experiment will help to establish a safe optimal level for birds and also access the possibility of using the oil as a potential alternative to antibiotics. The outcome can be used to promote livestock sustainability and safety of food.

Materials and methods

Description of experimental site

The Poultry section at Sumitra Research Institute, Gujarat India located at 7°25' N and 5°19' E with average annual temperature and annual rainfall of 25.3°C and 1455 mm, respectively was used for the study. The experiment was done following the research ethics and guidelines of Animal management department of the Institute with reference number (THU/08/2024) and the duration of the research was 35 days.

Management of experimental birds, diet and design

500- two weeks old Japanese quails (mixed sex) were used for the experiment. Before the arrival of birds, battery cages were properly disinfected, plastic feeders and drinkers were washed. Birds were transferred to the Poultry unit of Sumitra Research Institute, Gujarat very early in the morning. Upon arrival, quails were unboxed and the average initial body weight was recorded using a digital sensitive scale before it was randomly distributed into five treatment groups and each treatment had five replicates (20 birds per replicate). Strexia plus WSP (anti-stress) with vitamins (1:1) was added to water and served to birds. Standard diet (Corn-soya based) was formulated according to the requirement for bird's recommended by Nutritional Research Council (1994). Cages were properly labeled and illuminated with 100 W bulb at night to supply heat as well as continuous feed consumption. Birds were given 2 weeks acclimatization period before introducing the test ingredient. Birds in treatment A received standard diet with Oxytetracycline at 15 g per kg diet, treatment B (Standard diet with 5 mL *Rytigynia umbellulata* essential oil), treatment C, D and E were fed Standard diet supplemented with *Rytigynia umbellulata* essential oil at 10 mL, 15 mL and 20 mL respectively. A completely randomized design model was adopted cleaning of drinkers and feeders was done every morning and birds were fed thrice daily (7:00 H, 12:00 H and 17:00 H). Feed offered to birds in each replicate was weighed daily while the weight of the remnant was also recorded. Total feed consumed was estimated by subtracting the left over from the initial feed offered. Average body weight gain was calculated as the difference between final body weight and initial body weight of birds (g). Average daily weight gain was computed by dividing the average body weight gain by 35 days. Average daily feed intake or consumption = Total feed consumption divided by 35 days. Feed conversion ratio was calculated by dividing the average daily feed consumed divided by average daily weight gain.

Sourcing of *Rytigynia umbellulata* essential oil

Essential oil from *Rytigynia umbellulata* leaf which had previously been extracted through steam distillation (as stated on the label) was purchased from Singh Pharmaceutical Company in Gujarat, India. 25 mL of the purchased oil was sent to the laboratory for the analysis of bioactive compounds. Analysis was carried out using Gallium GC/MS (Model T8900C-09D, China) set at an oven temperature of 60 °C, with 2 minutes initial hold, and then to 300°C at 3 °C /min, with final hold time of 10 minutes; helium was used as carrier gas at a flow rate of 1 mL/min. The components of the essential oil were identified on the basis of their retention indices. Identification was carried out by comparison of their mass spectra with reference compounds from the Library of National Institute of Standard and Technology (NIST, 2011) database.

Carcass evaluation

At the end of the trial (35 days), 3 quails (one male and one female) were randomly selected per replicate for carcass evaluation. Birds were feed starved for 12 hours prior to slaughter while water was provided. The birds were weighed and slaughtered by severing the jugular vein with a sharp knife. After evisceration, weights of carcass were recorded and expressed in gram. Dressing percentage was calculated as: Carcass weight /live weight × 100

Intestinal microbial population estimation

For intestinal microbial estimation, 3 birds were randomly selected per replicate (same used for carcass evaluation). 2g of intestinal content was collected into a sterile labeled sample bottle, 2 drops of 1% peptone reagent was added and samples were taken to the laboratory to enumerate the population of microbes. Analysis was carried out using Spon

automated microbial analyzer (Model VB008C, China). Kit was adjusted to according to the recommendation of the manufacturer to ensure accuracy in results.

Sensory evaluation

For sensory evaluation, 3 quails (one male and one female) were randomly selected per replicate (same used for carcass evaluation). Meat samples were collected from the breast region, labeled minced and cooked. Each meat samples were presented to a set of trained panelist to determine juiciness, colour, flavour, tenderness and overall acceptability. Each member rinsed his or her mouth with warm water after assessing each meat sample to avoid carry-over effect. Scores were awarded by the panelist using a nine point hedonic scale; (i) Dislike extremely (ii) Dislike very much (iii) Dislike moderately (iv) Dislike slightly (v) Intermediate (vi) Like slightly (vii) Like moderately (viii) Like very much (ix) and Like extremely

Nutrient retention trial

On the 35th day of the experiment, five birds were randomly selected per replicate for digestibility trial which was carried out for seven days, the first two days was used as an adjustment period, while the remaining five days was used to collect results. Selected quails were transferred to a labeled metabolic cage and each birds received a known quantity of feed. Droppings voided from each replicate was weighed and recorded. Wet droppings collected from each replicate was oven dried at 65 ℃ for 24 hours. Droppings from each replicate was bulked together and samples were sent to the laboratory for further analysis. Proximate components were determined according to AOAC (2000) procedure.

Nutrient retention of each parameters were computed using the formula:-

Nutrient retention = Nutrient intake – Nutrient output × 100

Nutrient intake

Data analysis

Data obtained were analyzed using General Linear Model procedures of Statistical Analysis System (SAS, version 9.1.3 of 2009). Differences in mean were computed using Duncan's Multiple Range Test for multiple comparisons. Significance was determined at $p < 0.05$.

Experimental Results

Ingredients	Content
Maize	57.01
Corn gluten meal	4.82
Soya bean meal	30.4
Fish meal	2.52
Di-calcium phosphate	3.00
Limestone	1.00
L-Lysine	0.28
DL-Methionine	0.29
Premix	0.25
Toxin binder	0.02
Sodium chloride	0.35
Total	100.00
Determined analysis (%)	
Crude protein	22.85
Crude fibre	3.50
Ether extract	4.28
Calcium	1.21
Phosphorus	0.58
Energy (MEkcal/kg)	2944.5

Table 1: Ingredient and chemical composition of experimental diet

Vitamin and Mineral premix Each 2.5 kg consists of: Vit A 18,000, 000 IU; Vit D3, 4000, 000 IU; Vit. E. 20g; Vit k3 6 g; Vit B1, 2500 mg ; Vit B2, 100g ; Vit B6, 300 g; Vit B12, 50 mg; Pantothenic acid, 100 g; Niacin, 85 g , Folic acid , 1900 mg ; Biotin, 100 g; Choline Chloride, 660 mg, Fe, 60 g; Mn, 120 g; Cu, 3.7 g; Co, 250 mg; Si, 180 mg and Zn , 96 g

Major bioactive components in *Rytigynia umbellulata* essential oil (Table 2). The major bioactive compound includes; α-Selinene (33.10 %), β-Caryophyllene (15.66 %), D-Limonene (9.70 %), Cubenol (7.20 %), 2,6, 11- Trimethyldodecane (6.09 %), α-Himachalene (5.50 %), 1,8- Cineole (4.12 %), γ-Elemene (3.91 %), α-Pinene (2.64 %), α-Farnesene (2.95 %), β-Selinene (2.61 %), Isomethyl-α-ionol (2.19 %), 5-Octadecene (2.06 %) and Ethylhexadecanoate (2.00 %) in that order.

	Compounds	Reaction time (min)	Area (%)
1	Cubenol	3.37	7.20
2	γ-Elemene	4.56	3.91

3	β-Caryophyllene	4.85	15.66
4	α-Farnesene	4.90	2.95
5	β-Selinene	6.22	2.61
6	2,6, 11- Trimethyldodecane	9.09	6.09
7	1,8- Cineole	9.44	4.12
8	D-Limonene	10.35	9.70
9	α-Pinene	11.57	2.64
11	α-Selinene	13.09	33.10
12	α-Himachalene	14.55	5.50
13	5-Octadecene	14.86	2.06
14	Isomethyl-α-ionol	15.81	2.19
15	Ethylhexadecanoate	16.67	2.00

Table 2: Major bioactive components in Rytigynia umbellulata essential oil

Rytigynia umbellulata leaf essential oil effect on the growth parameters of Japanese quails is presented in Table 3. Body weight gain was lower in treatment A (15 g Oxytetracycline per kg diet) [127.92 g/bird], treatment B (5 mL *Rytigynia umbellulata* leaf essential oil per kg diet) [189.21 g/bird] than treatment C (10 mL *Rytigynia umbellulata* leaf essential oil per kg diet) [218.83 g/bird], treatment D (15 mL *Rytigynia umbellulata* leaf essential oil per kg diet) [221.9 g/bird] and treatment E (20 mL *Rytigynia umbellulata* leaf essential oil per kg diet) [226.69 g/bird] ($p<0.05$). Total feed consumption were higher in treatment E (980.7 g), treatment D (974.5 g), treatment C (970.2 g) and treatment B (938.1 g) than treatment A (890.0 g) ($p<0.05$). Increase in the dietary supplementation of *Rytigynia umbellulata* leaf essential oil lead to a significant decrease in feed conversion ($p<0.05$).

Variables	A	B	C	D	E	SEM
Experimental duration (days)	35	35	35	35	35	-
Initial body weight (g/b)	72.18	71.89	72.07	71.65	72.01	0.41
Final body weight (g/b)	200.1^{b}	261.1^{a}	290.9^{a}	293.6^{a}	298.7^{a}	1.73
Body weight gain (g/b)	127.92^{c}	189.21^{b}	218.83^{a}	221.95^{a}	226.69^{a}	1.60
Average daily weight gain (g/b)	3.65^{c}	5.40^{b}	6.25^{a}	6.34^{a}	6.47^{a}	0.06
Total feed consumption (g/b)	890.0^{b}	938.1^{a}	970.2^{a}	974.5^{a}	980.7^{a}	9.74
Average daily feed consumption (g/b)	25.43^{b}	26.80^{a}	27.72^{a}	27.84^{a}	28.02^{a}	0.18
Feed conversion ratio	6.95^{a}	4.95^{b}	4.43^{c}	4.39^{c}	4.38^{c}	0.01

Table 3: *Rytigynia umbellulata* leaf essential oil effect on the growth parameters of Japanese quails

Values followed by different letters were significantly different ($p<0.05$); Group A: Standard diet with antibiotics (Oxytetracycline at 15g/kg diet); Group B: Standard diet with 5 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group C: Standard diet with 10 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group D: Standard diet with 15 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group E: Standard diet with 20 mL *Rytigynia umbellulata* leaf essential oil per kg diet; SEM: standard error of mean

Rytigynia umbellulata leaf essential oil effect on the carcass parameters of Japanese quails is presented in Table 4. Data on carcass weight were higher among birds which received treatment E (199.6 g), treatment D (195.5 g), treatment C (192.3 g) than in treatment B (139.4 g) and treatment A (109.0 g). Dressing percentage were significantly influenced ($p<0.05$) except for weights of shank, neck, breast, back, head, drum stick, thigh and abdominal fat ($p>0.05$).

Variables	A	B	C	D	E	SEM
Live weight (g)	179.5^{c}	200.7^{b}	256.9^{a}	260.6^{a}	266.5^{a}	2.08
Carcass weight (g)	109.0^{c}	139.4^{b}	192.3^{a}	195.5^{a}	199.6^{a}	1.91
Dressing percentage	60.89^{c}	69.22^{b}	75.00^{a}	75.01^{a}	76.02^{a}	0.57
Head weight (g)	5.01	5.21	5.28	5.33	5.36	0.01
Wing weight (g)	6.73	6.84	6.95	6.97	6.99	0.02
Shank weight (g)	1.91	1.93	1.95	1.97	1.99	0.02
Neck weight (g)	3.35	3.5	3.51	3.58	3.61	0.01
Breast weight (g)	30.1	30.38	30.41	30.53	30.56	0.21
Back weight (g)	20.83	22.84	22.89	22.96	22.98	0.16
Drum stick (g)	6.55	6.92	7.02	7.05	7.11	0.02
Thigh weight (g)	8.92	9.31	9.38	9.54	9.62	0.01

Abdominal Fat (g)	2.71	2.86	2.91	2.93	2.98	0.01

Table 4: *Rytigynia umbellulata* leaf essential oil effect on the carcass parameters of Japanese quails

Values followed by different letters were significantly different ($p<0.05$); Group A: Standard diet with antibiotics (Oxytetracycline at 15g/kg diet); Group B: Standard diet with 5 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group C: Standard diet with 10 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group D: Standard diet with 15 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group E: Standard diet with 20 mL *Rytigynia umbellulata* leaf essential oil per kg diet; SEM: standard error of mean

Rytigynia umbellulata leaf essential oil effect on the nutrient retention of Japanese quails (Table 5). Crude protein values which varied from 71.07 - 87.84 %, ether extract (54.51 - 70.86 %), crude fibre (39.22 - 50.18 %), ash (34.12 to 49.11 %) and nitrogen free extract (59.56 to 77.76 %) was higher among birds fed treatment C, D and E, intermediate in treatment B and lower in treatment A ($p<0.05$).

Variables	A	B	C	D	E	SEM
Crude protein	71.07^{c}	80.71^{b}	86.01^{a}	87.64^{a}	87.84^{a}	2.63
Ether extract	54.51^{c}	62.08^{b}	70.82^{a}	70.85^{a}	70.86^{a}	2.00
Crude fibre	39.22^{c}	44.17^{b}	50.10^{a}	50.12^{a}	50.18^{a}	1.81
Ash	34.12^{c}	41.83^{b}	48.84^{a}	49.05^{a}	49.11^{a}	1.07
Nitrogen free extract	59.56^{c}	69.94^{b}	77.23^{a}	77.62^{a}	77.76^{a}	2.11

Table 5: *Rytigynia umbellulata* leaf essential oil effect on the nutrient retention of Japanese quails

Values followed by different letters were significantly different ($p<0.05$); Group A: Standard diet with antibiotics (Oxytetracycline at 15g/kg diet); Group B: Standard diet with 5 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group C: Standard diet with 10 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group D: Standard diet with 15 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group E: Standard diet with 20 mL *Rytigynia umbellulata* leaf essential oil per kg diet; SEM: standard error of mean

Rytigynia umbellulata leaf essential oil effect on intestinal microflora of Japanese quails (Table 6). Microbial count of *Pseudomonas aeruginosa* which varied from 2.33 to 3.85 (Cfu/g), *Staphylococcus aureus* (1.41 - 2.77 Cfu/g), *Bacillus subtilis* (0.77 to 1.53 Cfu/g) and *Enterococcus spp* (0.51 - 2.95 Cfu/g) were higher among birds in treatment A than in treatment B, C, D and E ($p<0.05$) whereas *Lactobacillus spp* (2.72 - 4.68 Cfu/g) in treatment B, C, D and E were comparable ($p>0.05$) but significantly higher than treatment A ($p<0.05$).

Variables (Cfu/g)	A	B	C	D	E	SEM
Pseudomonas aeruginosa	3.85^{a}	2.73^{b}	2.51^{b}	2.42^{b}	2.33^{b}	0.04
Staphylococcus aureus	2.77^{a}	1.84^{b}	1.72^{b}	1.66^{b}	1.41^{b}	0.02
Bacillus subtilis	1.53^{a}	0.91^{b}	0.85^{b}	0.81^{b}	0.77^{b}	0.01
Enterococcus spp	2.95^{a}	1.01^{b}	0.61^{b}	0.52^{b}	0.51^{b}	0.01
Lactobacillus spp	2.72^{b}	4.33^{a}	4.42^{a}	4.51^{a}	4.68^{a}	0.02

Table 6: *Rytigynia umbellulata* leaf essential oil effect on intestinal microflora of Japanese quails

Values followed by different letters were significantly different ($p<0.05$); Group A: Standard diet with antibiotics (Oxytetracycline at 15g/kg diet); Group B: Standard diet with 5 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group C: Standard diet with 10 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group D: Standard diet with 15 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group E: Standard diet with 20 mL *Rytigynia umbellulata* leaf essential oil per kg diet; SEM: standard error of mean

Rytigynia umbellulata leaf essential oil effect on sensory evaluation of Japanese quails (Table 7). Juiceness, colour, tenderness, flavor and overall acceptability of meat from birds fed diet supplemented with *Rytigynia umbellulata* leaf essential oil were comparable ($p>0.05$) but significantly higher than those which received treatment A ($p<0.05$)

Variables	A	B	C	D	E	SEM
Juiciness	5.50^{b}	6.13^{a}	6.27^{a}	6.31^{a}	6.37^{a}	0.03
Colour	5.02^{b}	5.34^{a}	6.00^{a}	6.10^{a}	6.12^{a}	0.01
Tenderness	5.25^{b}	6.00^{a}	6.10^{a}	6.25^{a}	6.40^{a}	0.02
Flavor	4.70^{b}	5.89^{a}	5.90^{a}	5.97^{a}	6.00^{a}	0.02
Overall acceptability	5.80^{b}	6.30^{a}	6.33^{a}	6.40^{a}	6.50^{a}	0.01

Table 7: *Rytigynia umbellulata* leaf essential oil effect on sensory evaluation of Japanese quails

Values followed by different letters were significantly different ($p<0.05$); Group A: Standard diet with antibiotics (Oxytetracycline at 15g/kg diet); Group B: Standard diet with 5 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group C: Standard diet with 10 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group D: Standard diet with 15 mL *Rytigynia umbellulata* leaf essential oil per kg diet; Group E: Standard diet with 20 mL *Rytigynia umbellulata* leaf essential oil per kg diet; SEM: standard error of mean

Discussions

The presence of bioactive compounds suggests that *Rytigynia umbellulata* essential oil possess medicinal properties making them act as antioxidant, cytotoxic (Ojediran et al., 2024), antimicrobial (Zakariya et al., 2017), antifungal, anti-cancer, immune-modulatory (Adewale et al., 2021), hypoglycemia, anti-diabetic (Singh et al., 2022), antidiarrheal (Alagbe, 2022), hypocholesterolemia (Adeoye et al., 2018; Oluwafemi et al., 2021), hepatoprotective (Musa et al., 2020; Alagbe et al., 2022), hepato-stimulatory properties amongst others. Bioactive compounds or phyto-constituents are non-toxic, eco-friendly and has no withdrawal period (Alagbe, 2024). α-Pinene (2.64 %) result obtained in this study was lower than (3.88 %) reported by Ikechukwu et al. (2023); Maria et al. (2018). The disparity in this results can be attributed to geographical location, processing technique, age of plant as well as specie (John, 2024a). The high concentration of α-Selinene and β-Caryophyllene in *Rytigynia umbellulata* essential oil obtained in this study suggests that it is capable of scavenging free radicals, preventing cardio-vascular disease and inhibiting the activities of some pathogenic organism in the gastro-intestinal tract of birds (John, 2024b; Agubosi et al., 2022). D-Limonene and Cubenol is reported to have anti-inflammatory and antimicrobial properties (John, 2024c; Olajuyige et al., 2011). 2, 6, 11-trimethyldodecane, 5-Octadecene and ethylhexadecanoate have been suggested to possess cytotoxic, anti-mutagenic, antidiarrheal and anti-carcinogenic activities (Odozi et al., 2014; Aworinde et al., 2014).

The result observed in this study suggests that the increase in dietary supplementation of *Rytigynia umbellulata* leaf essential oil lead to a significant improvement in body weight gain compared to birds fed solely on antibiotics (treatment A), this improvement may be due to increased villi height absorptive surface area, activation of gastro intestinal enzymes and efficient transport of nutrients facilitated by the presence of bioactive substances in of *Rytigynia umbellulata* leaf essential oil (John, 2024c; Musa et al., 2020). *Rytigynia umbellulata* oil also possess a gastro-protective properties, protecting the intestinal mucosa from oxidative damage to give room for better absorption of nutrients which translates to a better body weight gain and improved feed conversion in birds (Adewale et al., 2021; Alagbe, 2024). The result obtained aligns with the report of Zacaria and Ampode (2021) when turmeric was supplemented in the diet of laying Japanese quails. *Rytigynia umbellulata* oil also have a good flavoring effect on the feed making it more palatable for birds, this explain the higher feed consumption recorded was recorded among birds which received treatment B, C, D and E. Outcome obtained is in consonance with the findings of Chongtham et al. (2015). The average

daily feed consumption range observed in this experiment 25.43 - 28.02 g/b was similar to the outcome of a study by Alagbe (2025) who discovered that average feed consumption of Japanese quails fed diet supplemented with *Canarium parvum* leaf essential oil varied from 24.12 - 29.00 g/b. This result was lower than those reported by John (2024d) when *Megaphrynium macrostachyum* leaves was supplemented in the diet of quails. The variation in results could be attributed to nature and concentration of phyto-constituents as well as level of supplementation (John, 2024e; Omokore and Alagbe, 2019).

In this experiment, carcass and dressing percentage were affected ($p<0.05$) by the treatment. Quails fed diet supplemented with *Rytigynia umbellulata* oil (treatment B, C, D and E) were higher compared to those in treatment A. This result suggests that the presence of bioactive substance in *Rytigynia umbellulata* oil can positively influence the carcass yield of birds. However, weights of head, back, breast, shank, drumstick, wing and abdominal fat were not influenced ($p>0.05$) suggesting that *Rytigynia umbellulata* oil had no adverse or toxic effect on these parts. This further proves that the birds were healthy. Dressing percentage range (60.89 - 76.02 %) recorded in this experiment was similar to the result of a study by Behnamifar et al. (2018) who recorded a dressing percentage (65.00 - 78.00 %) when chamomile, wild mint and oregano herbal extracts were fed to quails. Oloruntola et al. (2024) also recorded a non-significant difference in the relative weights of heart, lung, liver and spleen of broilers fed diet supplemented with mango leaf powder. Dietary supplementation of *Rytigynia umbellulata* oil also help to improve feed efficiency and nutrient digestibility by increasing the absorptive surface in the gastrointestinal tract. This result further shows that *Rytigynia umbellulata* oil is more efficient compared to antibiotics. The result obtain is in agreement with the findings of Kichloo et al. (2023).

Microbial population of *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis* and *Enterococcus spp* decreased as the level of *Rytigynia umbellulata* oil increased across the group whereas there is rapid proliferation of *Lactobacillus sp* as the level of *Rytigynia umbellulata* oil increases compared to those in treatment A. The result obtained in this study suggests that *Rytigynia umbellulata* oil possess strong antimicrobial property of improving the birds gut integrity and inhibiting the colonization by pathogenic organisms such as; *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis* and *Enterococcus spp* which are capable of reducing digestion, feed efficiency and causing mortality among birds. The presence of bioactive compounds in *Rytigynia umbellulata* oil helps in lowering the pH in the gut making it easy to eliminate potential pathogenic organisms (Alagbe et al., 2022). Result obtained is in consonance with the reports of Burt and Reniders (2003); Daniel et al. (2023) when papaya oil was supplemented in the diet of broiler chickens.

Sensory parameters (Juiciness, color, tenderness, flavor and overall acceptability) were higher in meat of quails fed treatment B, C, D and E compared to treatment A. This shows that aside the medicinal component in *Rytigynia umbellulata* oil, it also has some nutritional value (minerals, vitamins, amino acids, protein amongst others) capable of positively influencing meat qualities (Proestos et al., 2013; Gao et al., 2010). For instance, carotene or vitamin A can influence the myoglobin content of the meat (Maria, 2015; Fratianni et al., 2010). Texture of a meat depends on the maturity of the connective tissues and contractile state of the myofibrillar proteins (Gao et al., 2010; Henchion et al., 2014). The outcome in this experiment revealed that the dietary supplementation of *Rytigynia umbellulata* oil could also improve the shelf life of animal product. Result obtained is in agreement with the report of Alagbe (2023) when *Prosopis africana* was supplemented in the diet of broiler chickens.

Conclusion

The dietary supplementation of *Rytigynia umbellulata* oil up to 20 mL per kg diet in this experiment showed positive results particularly in improving nutrient retention, exhibiting antimicrobial activity, enhancing feed intake, growth and rapid secretion of digestive enzymes in the gut. Sensory qualities were also enhanced compared to birds fed antibiotics. This results can be attributed to the presence of bioactive compounds in the oil.

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