

The Effect of Added Lemongrass Leaf Powder (*Cymbopogon Citratus*) to the Diet and Drinking Water on Some Productive, Carcass and Microbial Traits of Japanese Quail

Mohammed Joodi Shaheed

Faculty of Agriculture and Marshlands, The University of Thi-Qar.

Email: muhamed-j@utq.edu.iq

Abstract

This study was conducted at a private field in Al-Radwanayah area, Baghdad province, from 2/10/2018 to 13/11/2018, for a period of 6 weeks. The study aims to determine the effect of adding different levels of lemongrass leaf powder (*Cymbopogon citratus*) to diet and drinking water on productive, carcass and microbial traits of Japanese quail (*Coturnix japonica*). A total of 180 quail birds, one day old, were used in the study. The birds were distributed randomly into our treatments, of 45 birds per treatment by three replicates (15 birds per replicate). They were reared in wooden cages (75 x 75 cm). The study treatments were as follows: **T1**: (comparative treatment) the birds were fed on the main feed without any addition. **T2**: the birds were fed on the basal diet, with 20 g/ kg diet of lemongrass leaf powder. **T3**: the birds were fed on basal diet, with 200 ml/ liter of drinking water of aqueous extract of lemongrass leaves. **T4**: the birds were fed on the basal diet with 10 g/ kg diet of lemongrass leaf powder + the addition of 100 ml/ liter of drinking water of aqueous extract of lemongrass.

The results showed that there were no significant differences among T2, T3 and T3 in total body weight, total weight increase, total feed consumption, total food conversion efficiency and total water consumption. However, significant differences ($P \leq 0.05$) between T1 and T4, which did not differ significantly with T2 and T3. Also, there were no significant differences in the dressing percentage among T2, T3 and T4, but it significantly exceeded ($P \leq 0.05$) compare with T1. As for the total live weight before slaughter, the total carcass weight, and the numbers of total bacteria in the small intestine, T2, T3 and T4 did not differ. T4 was significantly outperformed on T1. T4 was the best treatment with its mathematical superiority in most of the studied traits. No mortality in all the experimental treatments except for T3 which gave the death of one bird out of a total of (45) birds and T1 gave the death of two birds out of a total of 45 birds. This indicates that lemongrass leaves were better in all treatments compared to control.

Keywords: Lemongrass leaf powder (*Cymbopogon citratus*), diet, drinking water, productive, carcass, microbial, Japanese quail.

Introduction :

The Lemongrass plant (*Cymbopogon citratus*) has been used since the time of the Pharaohs and ancient Chinese to treat many diseases and this plant is still used to this day in treating many diseases (Melon et al., 2001). Where it was used as a pain reliever compared to commercial analgesics, and it was an appetite suppressant because it contained Myrcener (Pereira et al.,

2004). It is used to treat digestive and nervous disorders because it contains Citral and has a great role in expelling intestinal worms (Al-Dajwi, 1996). Plays an important role in regulating liver function, and this leads to an increase in digestive enzymes that increase the utilization of the food eaten to meet the body's need (Jamroz and Kamel, 2002). As a result of containing phenol compounds, they are considered antioxidants (Vazquez-Briones et al., 2015). Al-Obaidi and Radam (2004) found that the aqueous and alcoholic extract of lemongrass lowered the level of glucose, cholesterol and triglycerides in the blood sugar of animals with diabetes. And 1% of lemongrass oil is immunomodulated in eliminating the primary rays and not forming virgin cysts for parasites (Al-Qaissi, 2005). Issa et al (2010) confirmed that the aqueous extract of lemongrass is an antagonist in the treatment of the protozoa (protozoa) of the genus *Eimeria* that infect the gastrointestinal tract of poultry, which causes great economic loss. In recent times, we have witnessed the use of many medicinal plants in feeding poultry birds, such as metalus leaves, mornka leaves and lemongrass (Yasser, 2020). For its great role in improving growth rates and increasing the weight of birds as it contains the active compounds tannins, flavonoids, phenolic acid as they act as natural antioxidants and antimicrobial agents, which improves metabolism and thus weight gain (Dain et al., 2017). As a result of these benefits, and because the lemongrass plant contains of the important materials, we use it today as a dried and milled feed material in certain proportions in the diet, as well as its aqueous extract in drinking water for Japanese quail *Coturnix coturnix japonica* and its effect on some productive characteristics, intestinal bacteria and clearance percentage. The quail is considered a domesticated bird, so the quail raised for the production of meat is from America and France, and the white quail is from Japan and Korea (Kssab et al., 2019).

The study aims to determine the effect of adding different levels of lemongrass leaf powder (*Cymbopogon citratus*) to diet and drinking water on productive, carcass and microbial traits of Japanese quail (*Coturnix japonica*).

Materials and methods:

This experiment was conducted at a private field in Al-Radwanayah area, Baghdad province, from 2/10/2018 to 13/11/2018. A total of 180 quail birds, one day old, were used in the study. The birds were distributed randomly into our treatments, of 45 birds per treatment by three replicates (15 birds per replicate). They were reared in wooden cages (75 x 75 cm). The study treatments were as follows: **T1:** (comparative treatment) the birds were fed on the main feed without any addition. **T2:** the birds were fed on the basal diet, with 20 g/ kg diet of lemongrass leaf powder. **T3:** the birds were fed on basal diet, with 200 ml/ liter of drinking water of aqueous extract of lemongrass leaves. **T4:** the birds were fed on the basal diet with 10 g/ kg diet of lemongrass leaf powder + the addition of 100 ml/ liter of drinking water of aqueous extract of lemongrass.

Cymbopogon citratus was obtained from a private farm. A quantity of the plant was taken, and after removing the impurities and cleaning them well, they were dried at room temperature. Table (1) shows the chemical composition of lemongrass leaves. Figure (1) shows the shape of the lemongrass plant and its powder after drying, it was milled by an electric grinder in the form

of a fine powder (powder) as in Figure (2). The aqueous extract was prepared according to the method (Hernandez et al., 1994). The dried leaves of the lemongrass plant were heated with a liter of distilled water. Heat at 60 ° C for 10 minutes, then cool the solution and filter so that the filtered liquid is ready. The concentrate was used at a concentration of 10 g for a dose of 100 ml concentrated extract of lemongrass / liter of drinking water and a concentration of 20 g for a dose of 200 ml concentrated extract of lemongrass / liter of drinking water. Experiment materials were added from the first day. Table (2) shows the percentages of forage materials included in the composition of the experiment diet, and chemical analysis calculated for their components according to what was mentioned in NRC (1994).

Table (1) the chemical composition of lemongrassleaves.

content	(%)
Protein	13.3
Humidity	18.1
Ash	14.3
Fats	5.1
Carbohydrates	29.3
Fiber	19.7



Figure (1) Lemongrass plant used in the experiment and its powder after drying.

Table (2) the percentages of diet materials included in the composition of the experiment diet and the calculated chemical composition.

Diet	Percent %
yellow corn	64
soybean meal	32
Premex/kg *	3
CaCo ₃	0.7

Nacal salt	0.3
Total	100
The calculated chemical estimate	
protein %	19.64
metabolize energy (kilo calorie/ kg of diet)	2864.10
fat %	3.93
fibers %	3.49
Calcium %	2.31
Available phosphor %	0.46
Methionine%	038
Lycin %	1.06

* Bremix consists of -vitamins: 334,000 international units, E 57,000 mg, D3 500 mg, B1167 mg, B21000 mg, B60.66 mg, B1267 mg, Niacin 1000 mg . metal: Fe1.667 mg, Mn3.334 mg, choline 17000 mg, folic acid 17 mg, biotin 33.1 mg, Zinc 2.667 mg, copper 334 mg, Iodine 17 mg, methionine 27000 mg, zinc-basterracene 667 mg, antioxidants 3.33 ppm, phosphorous 10.6%, sodium 4-4.5%.

Traits studied

Productive traits: the rates of live body weight, weight gain, amount of feed consumed, efficiency of food conversion and water consumption were calculated every three weeks (from 0-3 weeks and from 4-6 weeks). The mortality was calculated daily.

Carcasses traits: the average live weight at slaughter, the carcass weight and the dressing percentage were calculated at the end of the experiment by slaughtering four birds from each treatment.

Microbial traits: The numbers of coliform bacteria, aerobic bacteria and lactobacilli were estimated in the jejunum area of the small intestine as well.

Statistical analysis

It was analyzed by applying the Complete Random Design (CRD) to study the effect of the studied treatments on different traits using the ready-made statistical program SAS (2012). Significant differences between the means were tested using the Duncan (1955) multiple range multipleat 0.05 level.

Results and discussion

Feed consumption:

Table (3) indicates that the average total feed consumption in different treatments from the experiment, there were no significant differences ($P \leq 0.05$) among T2, T3 and T4, which the powder of lemongrass leaves was used in the diet or its aqueous extract in drinking water or in both (in drinking water and diet together) during the trial period of 6 weeks, but the difference was between T1 and T4, and that T4 was better mathematically than T2 and T3. These results did not agree with the findings Sariözkan et al. (2016), they found a decrease in the level of feed consumption for lemongrass treatments compared to the treatments that did not contain

lemongrass, but agreed with Dianet al. (2017), and the reason for the increase in feed consumption may be due to the some active ingredients Phenole and linalool, which improves digestion processes and increases the feed consumed, as there is a correlation coefficient between body weight and feed consumed (Lee et al., 2004). The reason may be due to Myrcener, which was considered an appetite suppressant and increases feed consumption (Al-Dajwi, 1996).

Body weight and gain:

Table (3) shows the effect of adding levels of lemongrass leaf powder or its aqueous extract to drinking water, or both, on the mean weight and weight gain during the trial period of 6 weeks, there was no significant difference among T2, T3 and T4. However, there was a significant increase in weight ($P \leq 0.05$) compare with T1. The preference for the T4 over the rest of the treatments is shown in the mean weight and weight gain, agreed with Dianet al. (2017) and Sariözkan et al. (2016) when adding lemongrass leaf powder at levels 0.5, 1 and 1.5 to the diet for a period of six weeks, led to a significant improvement in weight and overall weight gain compared to the standard diet. The reason may be due to the average weight gain and overall weight gain, due to the active compounds in the leaves and aqueous extract of Lemongrass Flavonoids and Linalool, improves digestion and increases the secretion of digestive enzymes in the experimental chicks. The process of benefiting from the food intake improves and is reflected in growth and weight gain (Cabuk et al., 2003). Where there is a positive correlation coefficient between the percentage of digestion and body weight on the rate of weight gain and the final weight of the birds (Lee et al., 2004).

Feed conversion factor:

The results indicate the effect of different levels of lemongrass leaf powder to diet and its aqueous extract to drinking water and their mixture to diet and water together on the food conversion factor of quail birds. There were no significant differences ($P \leq 0.05$) among T2, T3 and T4 of six weeks in the feed conversion factor, but T4 recorded the best feed conversion factor with a significant difference ($P \leq 0.05$) compare with T1. These results did not agree with Sariözkan et al. (2016) when adding lemongrass leaf powder to quail feed by 1.5 and 3%, no significant differences ($P \leq 0.05$) were observed in the nutritional conversion factor between the trial and comparison treatments. However, the results were in agreement with Lacy (2002). The reason for the improvement in the efficiency of nutritional conversion may be due to the presence of active compounds in lemongrass and aqueous extract, improve digestion and increase the absorption of the digested food and the process of analyzing food by the beneficial microorganisms by creating a microbial balance within the intestine, this increases the utilization of food and reduces undigested food (Mukhtar et al., 2012).

Water consumption:

Table (3) shows the effect of adding different levels of lemongrass leaf powder to the feed and its aqueous extract to drinking water and their mixture on the rate of total water consumption of quail birds for the six-week trial period. T4 recorded the highest rate of water consumption with

a significant difference ($P \leq 0.05$) compare with T1, T2 and T3, agreed with Kasseb et al. (2019). The reason for the increase in water consumption may be the increase in feed consumption, as it is estimated to double the feed consumption (Lacy, 2002). Lemongrass leaves and its aqueous extract may have a role in improving the flavor and taste of feed or drinking water, which increases palatability, thus increasing the consumption of water and feed in favor of treatments of lemongrass and its aqueous extract.

Mortality:

Table (3) we did not notice the presence of mortality in the experiment treatments that contain powdered lemongrass leaves except for one bird in T2 out of a total of 45 birds. However, the first treatment was the comparison treatment and only two birds out of a total of 45 birds, so it was significantly different ($P \leq 0.05$) compare with the rest of the treatments, and these results were agreed with Dian et al. (2017). The reason may be due to the presence of active compounds that eliminate pathogens, inhibit oxidation and antimicrobial properties to discourage pathogenic bacteria and bacteria (Kasseb et al., 2019). All treatments that contain lemongrass powder in the diet or its aqueous extract in drinking water or in both, no artificial or natural antibiotics were given, reflects the important effect of lemongrass, with its active ingredients, which eliminated internal bacteria and revitalized the internal environment, increased its immune capacity to the point that the deaths that occurred are much less than the normal percentage in experimental birds, an indicator that opens the door wide for more studies on the quality and quantity of materials found in the leaves of the lemon grass and its aqueous and alcoholic extract and its oils. Those who have exhibited the behavior of natural antibiotics and the meat produced is more healthy for human consumption and the proportion of fat and cholesterol is very low (Mukhtar et al., 2012).

Table (3) The effect of adding lemongrass powder and its aqueous extract and their mixture on feed consumption (g), body weight (g), weight gain (g), feed conversion, water consumption (ml / bird) and the mortality (%).

Treatments	Traits					
	feed consumption (g)	body weight (g)	weight gain (g)	feed conversion (g diet/ g weigh gain)	water consumption (ml / bird)	the mortality (%)
T1	613,93±18,22 b	190,34±7,31 b	182,34±10,16 ab	3,36±0.03 a	1220,11±50,13 ab	4,44±0,45
T2	617,11±13,91 ab	193,16±6,99 ab	185,16±7,31 ab	3,33±0,02 ab	1235,31±43,99 ab	0,00±0,00
T3	623,01±17,71 ab	194,93±12,20 a	186,93±5,92 a	3,33±0,02 ab	1252,12±57,89 ab	2,22±0,16
T4	631,23±12,13 a	200,01±7,03 a	192,01±8,11 a	3,29±0.01 b	1265,13±61,00 a	0,00±0,00
Sig.	*	*	*	*	*	NS

T1: (comparative treatment) the birds were fed on the main feed without any addition. **T2:** the birds were fed on the basal diet, with 20 g/ kg diet of lemongrass leaf powder. **T3:** the birds were fed on basal diet, with 200 ml/ liter of drinking water of

aqueous extract of lemongrass leaves. **T4**: the birds were fed on the basal diet with 10 g/ kg diet of lemongrass leaf powder + the addition of 100 ml/ liter of drinking water of aqueous extract of lemongrass.

Live weight before slaughter, carcass weight and dressing percentage:

Table (4) show that non-significant differences of ($P \leq 0.05$) between the treatments T2, T3 and T4, which lemongrass and its aqueous extract were used in live weight at slaughter, carcass weight and dressing percentage, but these treatments were significantly high with the comparison treatment (T1). The reason is attributed to the increase in live weight, which was reflected in the body weight before slaughter, the carcass weight and the dressing percentage (Mukhtar et al., 2012).

Table (4) The effect of adding lemongrass powder and its aqueous extract and their mixture on live weight (g), carcass weight (g / bird) and dressing percentage (%).

Treatments	Traits		
	Live weight before slaughter(g/ bird)	Carcass weight (g)	Dressing percentage (%)
T1	188,98±11,43 B	131,77±03,89 b	69,73±1,06 b
T2	191,17±10,12 Ab	132,60±04,21 ab	69,09±0,91 a
T3	191,93±13,12 Ab	132,32±03,22 ab	68,94±0,11 ab
T4	196,01±06,23 A	136,39±02,33 a	69,58±1,11 a
Sig.	*	*	*

T1: (comparative treatment) the birds were fed on the main feed without any addition. **T2**: the birds were fed on the basal diet, with 20 g/ kg diet of lemongrass leaf powder. **T3**: the birds were fed on basal diet, with 200 ml/ liter of drinking water of aqueous extract of lemongrass leaves. **T4**: the birds were fed on the basal diet with 10 g/ kg diet of lemongrass leaf powder + the addition of 100 ml/ liter of drinking water of aqueous extract of lemongrass.

Bacterial content:

Table (5) shows the effect of adding different levels of lemongrass leaf powder to the feed and its aqueous extract to drinking water or both on the numbers of aerobic bacteria, coliform and lactobacilli bacteria in the duodenum quail birds. An increase in favor of lemon grass leaf powder and aqueous extract treatments, it significantly exceeded ($P \leq 0.05$) in the number of lactobacilli bacteria in the duodenum when compared to T1 that did not contain the herb. T4 recorded the highest rate of bacterial infection with lactobacilli, compared to the rest of the treatments in the duodenum. The reason for this may be that the leaves of lemongrass and its aqueous extract contain compounds (Tannins; flavonoids; phenolic acid), which act as natural antioxidants and antimicrobials inhibit the action of many pathological germs, especially E.coli, Staphelococas and Klebsiella and have high effectiveness against bacteria (Kasseb et al., 2019).

Table (5) The effect of adding lemongrass powder and its aqueous extract and their mixture on total count bacteria, coliform and lactobacilli bacteria.

Treatments	Traits		
	Total count bacteria	Coliform	Lactobacilli
T1	4,33±0,06 a	10,33±0,05 a	4,55±0,08 b
T2	3,89±0,05 ab	9,65±0,05 ab	5,35±0,05 ab
T3	3,77±0,05 ab	9,64±0,06 ab	5,43±0,05 a
T4	3,31±0,06 b	9,46±0,08 b	5,62±0,10 a
Sig.	*	*	*

T1: (comparative treatment) the birds were fed on the main feed without any addition. **T2:** the birds were fed on the basal diet, with 20 g/ kg diet of lemongrass leaf powder. **T3:** the birds were fed on basal diet, with 200 ml/ liter of drinking water of aqueous extract of lemongrass leaves. **T4:** the birds were fed on the basal diet with 10 g/ kg diet of lemongrass leaf powder + the addition of 100 ml/ liter of drinking water of aqueous extract of lemongrass.

References

1. **Abdel Rahman HA, Shawky SM, Ouda H, Nafeaa AA and Orabi SH .2013.** Effect of Two Probiotics and Bioflavonoids Supplementation to the Broilers Diet and Drinking Water on the Growth Performance and Hepatic Antioxidant Parameters. *Global Veter.* 10 (6): 734-741.
2. **Al-Degwi A .1996.** Medicinal and Aromatic Plants, Madbouly Library- Egypt.
3. **Al-Obaidi SMR and Wadam, QN .2004.** The effect of aqueous and alcoholic extract of lemon grass on blood sugar level and a number of biochemical variables in healthy male rats with experimental diabetes. *College of Science / University of Tikrit.*
4. **Al-Qaisi AQI .2005.** Study of the effect of the volatile oil of lemon grass plant with or without the use of primary Royate antigen on the collagen cysts of granulomas. Master thesis; *College of Science / University of Baghdad,* page 90.
5. **Cabuk M, Alcicek A, Bozkurt M and Imre N .2003.** Antimicrobial properties of the essential oils isolated from aromatic plants and using possibility as alternative feed additives. *Nat. An. Nut. Congress.* 30: 357-359
6. **Dian MS, Trilianty L, Fransisca DA, Helena J and Iskandar T .2017.** Antioxidant and Anti-Glycation Activity of Ethanol Lemongrass (*Cymbopogon's cit rate*) Leaves Extract. *Inter. J. Pharm. and Phytochem. Res.*9 (5): 710-715
7. **Duncan DB .1955.** Multiple range multiple F-test-Biometeics. 11: 1-42.
8. **Harborn JB .1973.** *Phytochemical Mmethods.* Chapman and Hall Ltd., London. 49-188.
9. **Harrigan WF and McCance ME .1976.** *Labatory Methods in Food and Dairy Microbiology* Acaddemic Press. INC London.

10. **Hasim SF, Ayunda RD and Faridah DN .2015.** Potential of lemongrass leaves extract (*Cymbopogon citratus*) as prevention or oil oxidation. *J. Chem Pharm. Res.* 7 (10): 55--60
11. **Hernandez PM, Lopez RE, Rabanal RM, Darias V and Arias A .1994.** Antimicrobial activity of *Visnea mocanera* leaf extracts. *Journal of Agric.Kafr El-Sheikh, Tanta University.*
12. **Issa WH, Khalaf DA and Al-Dabbagh ATM .2010.** The effect of aqueous extract on meat chicks experimentally infected with *Aimeria* species, *Cymbopogon citrates* of lemongrass herb, *Anbar Journal of Veterinary Sciences, the freezer* (3), Issue (1)
13. **Jamroz D and Kamel C .2002.** Plant extracts enhance broiler performance. *J. Anim. Sci.* 80 (Suppli): 41 (Abstract).
14. **Kassab YG, Al Falih RN and Al-Sharabi MM .2019.** The effect of using the remnants of dry bread on feeding two strains of Japanese quail in the stage of growth and egg production. *Minya Journal of Agricultural Research and Development.* 39 (2): 349_377.
15. **Lacy M .2002.** Broiler management. Pages 829 868-n: commercial ckicken meat and egg production (D. B. Bell and W. D. Weaver, Eds.) Kluwer Academic, pub. Norwell, MA.
16. **Lee KW, Everts H and Beynen AC .2004.** Essential oils in broiler nutrition. Department of nutrition, faculty of veterinary medicine, Utrecht university medicine, Utrecht university, 3508 TD Utrecht, the Netherlands
17. **Melon SF, Soares SF, Costa RF, Silva CR, Oliveria MBN, Bezerra RJAC, Caldeira-de-Araujo A and Bernardo-Filho M .2001.** Effect of the *cymbopogon citrates*, *Maytenus ilicifolia* and *Baccharis genistelloides* extracts against the stannous chloride oxidative damage in *Escherichia coli*. *Mutat. Res.*
18. **Mukhtar AM, Mohamed KA, Amal OA and Ahlam AH .2012.** Effect of different levels of lemon grass oil (lgo) as anatural growth promoter on the performance, carcass yields and serum chemistry of broiler chicks. *Egypt Poult. Sci.* 33 (1): 1-7.
19. **N.R.C. National Research Council. 1994.** Nutrient Requirement of Poultry. (9th rev. Ed.). National Research Council. Nat. Academy Press, Washington, D.S., USA
20. **Parade AK, Thombre BM, Patil RA, Padghan PV, Gaikwad BS and Meshram PB .2019.** Use of Lemongrass (*Cymbopogon citratus*) Leaf Meal as a Natural Feed Additive on Growth Performanceand Economics of Broilers *Inter. J. Current Micro. App. Sci.* 8 (10): 1842-1849
21. **Pereira RS, Sumita TC, Furlan MR, Jorge AOC and Ueno M. 2004.** Antibacterial activity of essential oils on microorganisms isolated from urinary tract infection. *Rev. Saudi Publica.,* 38 (2): 1-4.
22. **Sariözkan S, Konca Y, Kocaoğlu GB, Aktuğ E, Caliber M, Ozkan S and Ay ST .2016.** The effect of dietary supplementation of lemon grass (*cymbopogon citratus*) on performance, carcass quality, and marketing of quail (*coturnix coturnix japonica*). scientific works. series c. veterinary medicine.

23. **SAS .2012.** Statistical Analysis System, User's Guide. Statistical. Versio 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA
24. **Vazquez-Briones MD, Hernandez LR and Guerrero-Beltran JA .2015.** Physicochemical and antioxidant properties of *Cymbopogon citratus* essential oil Food Res. 4 (3): 36-45
25. **Yasir DH .2020.** The effect of adding different levels of lemon grass leaf powder to the bush and its extract to drinking water on the productive and physiological performance of broiler chickens. Master thesis - Faculty of Agriculture. Al-Qasim Green University. The Ministry of Higher Education and Scientific Research. Iraq.