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GROWTH PERFORMANCE AND MICROFLORA IN GROWING QUAIL FED DIETS SUPPLEMENTED WITH *Lactuca serriola* POWDER

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ABSTRACT

The aim of the current study was to assess the influence of *Lactuca serriola* supplemented diet on performance, carcass characteristics and intestinal microbiota count of Japanese quails. A total of eighty birds of quail (one week of age) were divided into 2 groups of 40 birds each (five replicates of eight birds each). In the first group, the birds were fed a basal diet without *Lactuca serriola*, while the birds in the second group were fed diets containing 20 g *Lactuca serriola* /kg feed. Birds in both groups were fed for five weeks. Quails were slaughtered in order to study intestinal microbiota count and carcass characteristics at six weeks age. The results showed that quails fed *Lactuca serriola* had higher growth performance including body weight in comparison with the control group. The inclusion of *Lactuca serriola* had significantly higher lactic acid bacteria count and lowest level of E. coli and Salmonella enterica count than the control group. However, *Lactuca serriola* did not affect carcass measurements. Thus, supplementation of *Lactuca serriola* can improve the performance of Japanese quail and used as a new feed additive to balance gut microbiota.

Key words: Lactuca serriola, Intestinal microbiota, Carcass measurements, Quail.

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INTRODUCTION

In recent years, products of different species of poultry are marketed including quail products. Japanese quail is the main species of poultry whose meat is commonly demanded every where in the world especially in America, Europe and Asia (Partovi and Seifi, 2018). Nowadays, a major concern of poultry producers is to optimize the produced meat both qualitatively and quantitatively. Consequently, a number of the recent studies have been used herbs and spices as efficient and safe feed additives to improve poultry health as well as the rate of growth, immunological, physiological and intestinal microbiota state (Vispo and Karasov, 1997; Rehman *et al*., 2007). Additionally, problems caused by bacteria are food poisoning and diarrhea. Salmonella and pathogenic E. coli bacteria consider as the main cause of food poisoning. Food-borne bacteria caused by salmonella, which is an important pathogen, is one of the most popular diseases that found in food produced by animals (Forsheel and wierup 2008). Recently, poultry industries use natural medicinal plants as feed additives used for promoting immune response and enhancing the performance of birds. *Lactuca serriola* has been used as antibacterial due to triterpenoid saponin present in its stem (Yadava and Jharbade,2008). *Lactuca serriola* (Compositae) is an herbaceous species widely grown in Europe, India, Pakistan and Middle Eastern countries. The plant is used in medicinal applications that is the old practice of human history (Janbaz et al., 2013). Research has demonstrated that *Lactuca serriola* contains lactic acids and β- carotene as well as it is also considered as rich source of almost all vitamins and minerals including calcium, zinc and iron (Noumedem and Kuete, 2017). Some earlier investigations studied the effects of *Lactuca serriola* as pharmacological properties such as an antipyretic, anti-cancer, antifungal,

antitumor, antiviral, antimicrobial, anti-inflammatory,spasmolytic, bronchodilator, relaxant agent, hypotensive and antioxidant(Yadava and Jharbade,2008, Janbaz *et al*.2013, Mohammad, 2013). However, there is very rare information regarding the effect of *Lactuca serriola* on Japanese quail growth performance and quality of carcass. It has been expected that the supplementation of *Lactuca serriola* may have beneficial impacts on the growth performance, quality of carcass and microflora level. Thus, the objective of the study was to evaluate the effects of *Lactuca serriola* inclusion in performances, carcass quality and microflora level of Japanese quail meat.

MATERIAIS AND METHODS

Plant material

In 2019, *Lactuca serriola* leaves were collected from a botanical garden of Erbil city (Kurdistan Region, Iraq). The identification of plants was done based on the taxonomical in the college of agriculture engineering sciences. The leaves of *Lactuca serriola* were cleaned using distilled water, subsequently dried for 48 h at 40 °C and crushed into powder form then stored in dark containers at 4 °C until using as a feed additive. The chemical compositions of leaves were as following: 93.7% moisture, 1.4% protein, 0.4% fat, 1.1% fiber, 2.2% carbohydrate and 1.2% ash.

Animals, experimental design and diets

Eighty Japanese quails (a week of age with an average weight of 11.58 ± 0.21 g) were used to achieve the studied objective. The birds of quail were randomly divided into two different groups including 5 replicates of 8 birds each. Conventional type cages (90 × 40 × 40 cm) were used for housing the birds. Feed and fresh water were provided *ad libitum* for all birds until the 6th week of age. The two dietary treatments were basal diet without *Lactuca serriola* (treatment 1) and basal diet with *20* g *Lactuca serriola* /kg feed (treatment 2). To meet the quails' requirements, the basal diet composition (Table 1) was formulated based on the guidelines provided by the National Research Council (1994). Birds were subjected to 24 h of lighting and 35 °C of ambient temperature for the first seven days of rearing then reduced to 28 °C till the experiment end. Weekly, the amount of feed intake (FI) and body weight (BW) were documented in order to calculate the average daily gain (ADG) as well as feed conversion ratio (FCR).

Slaughtering procedures and carcass traits

Ten birds for each treatment group (6 weeks of age) were weighed and slaughtered following the halal slaughter procedure. The slaughtering procedure was performed by cutting the neck, severing both carotid arteries and jugular veins without decapitating the head till the death as blood loss. Upon slaughter, carcasses of birds were directly transferred to the laboratory for carcass examinations. The carcass dressing percentage was measured as the ratio of hot carcasses weight to the weight of slaughter multiplied by 100.

Faecal *LAB, E. coli* and *Salmonella enterica* count

Faecal lactic acid bacteria (LAB) were determined according to the method of Kareem et al. (2016) while the population of *E. coli* E-30 and *Salmonella enterica* was measured following the procedure described by Kareem (2020). The MRS-agar, LB and nutrient media were used to perform the enumerations of LAB, *E. coli* and *Salmonella enterica*, respectively. For LAB and *Salmonella enterica*, the plates were incubated in anaerobic jars for 48 h at 30 °C and 37 °C for *E. coli*. The results of bacteria count were expressed as CFU log10/g.

Table (1): Composition of the experimental diet

Ingredients	(%)
Wheat	17.50
Corn	20.00
Wheat flour	25.00
Protein concentrate (fish meal concentrate)	5.00
Soya bean meal	29.00
Methionine	0.09
Di - calcium phosphate	0.50
Choline chloride	0.05
Lysine	0.05
Soya bean oil	1.30
Salt	0.10
Antioxidant	0.01
Lime stone	1.00
Vitamins premix	0.05
Mineral Premix	0.10
Toxin binder	0.10
Feed sterilizes	0.10
Anticoccidial	0.05
Calculated Nutrients(%)[1]	
Crud protein	23.260
Energy metabolism (k cal/kg)	2930
Fat	3.322
Fiber	3.118
Calcium	0.963
Available P	0.492
Lysine	1.108
Methionine	0.379
Methionine+ Cystine	0.632

[1]The diets were formulated using feed live International software (Thailand).

Statistical analyses

The experimental design was based on a complete randomized design (CRD). All data obtained were statistically investigated using the generalized linear model of the Statistical Analysis System (SAS) package Version 9.1 software (SAS, 2007), except carcass quality. The carcass quality data were exposed to a generalized linear model with the factorial arrangement (levels of Lactuca serriola and sex). Differences between groups were tested with an independent sample T- test and the significance was established at a level of ≥ 0.05.

RESUITS AND DISCUSSION

Effects of Dietary Treatments on Quail Growth Performance

During the experiment period, the mortality was negligible because two birds died out of 80 quails which were not related to any treatment.

The body weight (BW), body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) of birds fed basal diet as a control (T1) and the diet supplemented with *Lactuca serriola* powder (T2) are shown in Table 2. In general, BW, BWG, FI and FCR at weeks two, three and four increased (P< 0.05) in birds fed diet supplemented with *Lactuca serriola* leaves powder compared with the control group. While there was no difference between the two treatments in growth performance indices at weeks five and six. Overall, the inclusion of *Lactuca serriola* in quail diet led to improve BW, BWG, FI and FCR compared to the control treatment. In agreement with the current findings, Yadav and Jha (2019) also found a significant effect of *Lactuca Scariola* feeding on the growth performance of poultry. The significant effect of *Lactuca serriola* in quail diet on growth performance could be due to reducing activity of intestinal microbiota which influences the health of birds and improved growth performance through enhancing feed utilization. According to Rinttilä and Apajalahti (2013), gut microbiota and their metabolic products could be improved the growth performance of poultry by increasing digestion, absorption and metabolism of nutrients.

Effects of Dietary Treatments and sex on Carcass Measurements

The effect of diet supplementation with *Lactuca serriola* on carcass traits of Japanese quail at 6 weeks of age are given in Table 3. The quail carcass traits including carcass weight and carcass dressing percentage are a vital sign for efficiency and ability of meat production (Sabow, 2019) which could be influenced by the inclusion of natural plants used in poultry nutrition (Vargas-Sánchez *et al.*, 2019). Some researchers showed a significant effects of adding natural herbs to the nutrition on poultry carcass measurements (Ghazaghi *et al.*, 2014), while others have not emphasized on such effects (Abd El Hack *et al.*, 2019). The results of the current study indicated that dietary supplementation of *Lactuca serriola* leaves did not affect (p>0.05) on the carcass weight and carcass yield (Table 3). In agreement with the current findings, Reda *et al.* (2019) also found no significant effect of plant-supplements feeding on the carcass traits of quails. In growing rabbits, Abd El Hack *et al.* (2019) also reported that there was no significant difference in carcass measurements between animals fed diets containing herbal natural feed additives and those in the control animals.

Nonetheless, carcass weight was higher (P< 0.05) and carcass yield was lower (P< 0.05) in female birds compared with male birds. The higher carcass weight in female birds could be due to higher live body weight. On the other hand, lower carcass yield could be attributed to the contribution of the reproductive system to the bodyweight before slaughter and female birds had a number of ova. These findings are in agreement with the results of Tarhyel *et al.* (2012) in which an increase of slaughter and hot carcass weight in Japanese quail were as a result of heavier reproductive organs of female birds.

Table (2): Growth performance in Japanese quail as affected by graded levels *Lactuca serriola*

Parameters	***Lactuca serriola* leaves level (g/kg diet)**		**P-value**
	0	**20**	
Body Weight (g/bird)			
Week 1	11.50±0.50	11.66±0.33	0.795
Week 2	32.26±0.81[b]	38.26±0.81[a]	0.006
Week 3	68.00±0.80[b]	74.00±1.89[a]	0.043
Week 4	105.60±1.28	111.60±2.66	0.112
Week 5	135.46±1.50[b]	143.20±2.49[a]	0.054
Week 6	152.66±3.34	165.46±9.62	0.277
Body weight gain(g/bird)			
Week 2	20.76±1.25[b]	26.60±1.10[a]	0.025
Week 3	35.73±1.53	35.73±1.09	1.000
Week 4	37.60±0.61	37.60±0.83	1.000
Week 5	29.86±1.16	31.60±0.46	0.238
Week 6	17.20±2.80	22.26±7.16	0.546
Overall	141.16±2.92	153.80±9.89	0.288
Feed intake (g/bird)			
Week 2	32.00±2.78[b]	56.08±0.44[a]	0.001
Week 3	76.40±2.60	84.40±3.25	0.127
Week 4	92.66±0.48[b]	99.60±2.43[a]	0.049
Week 5	110.60±2.20	106.93±2.19	0.303
Week 6	123.20±7.65	139.46±10.39	0.276
Overall	434.87±3.14	485.48±3.73	0.151
Feed conversion ratio (feed/gain)			
Week 2	1.55±0.14[b]	2.11±0.10[a]	0.034
Week 3	2.14±0.06[b]	2.36±0.02[a]	0.042
Week 4	2.46±0.49[b]	2.65±0.01[a]	0.021
Week 5	3.71±0.16	3.38±0.2	0.113
Week 6	7.44±0.95	7.78±2.46	0.904
Overall	3.46±0.14	3.65±0.50	0.732

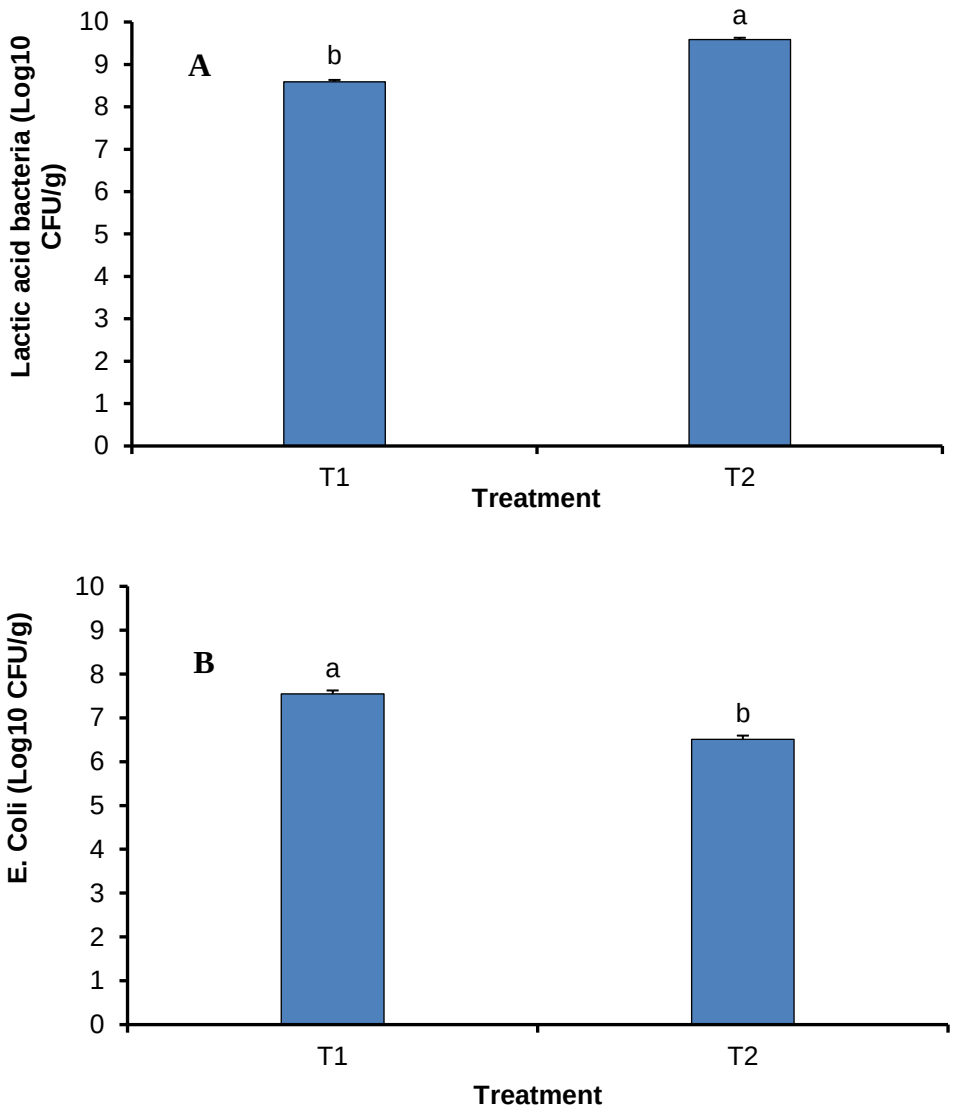
[a,b] means within the same row for each parameter with different superscripts are significantly different (P<0.05

Table (3): Carcass traits of growing Japanese quail as affected by graded levels *Lactuca serriola* (g/kg diet) and sex

Parameter	T1		T2		SEM	P-value		
	Female	Male	Female	Male		Treat	Sex	Treat*Sex
Live weight	161.60	138.00	183.20	146.80	5.19	0.010	0.001	0.237
Carcass weight	100.00	85.20	101.60	92.40	3.22	0.140	0.006	0.338
Dressing%	61.98	61.69	55.79	62.95	1.76	0.142	0.047	0.033

Treatments on Intestinal Microbiota Effects of Dietary

Figure 1 shows the results of effecting diet supplementation with *Lactuca serriola* on intestinal microbiota of Japanese quail at 6 weeks of age. The gastrointestinal tract of poultry containing a number of microorganism. The inoculum introduced at hatch, first diet and host intestinal epithelium are factors determining composition and density of microbiota (Apajalahti *et al*, 2004). The data obtained showed that the population of LAB significantly ($P< 0.05$) increased in birds fed a diet supplemented with Lactuca serriola compared to the control group. While, the population of E. coli and salmonella count decreased ($P< 0.05$) significantly in birds fed the diet supplemented with Lactuca serriola compared to the control group. Similarly, Al-Marzoqi *et al.* (2015) reported that the effect of active compounds in *Lactuca serriola* affected different pathogenic organisms. The enhancement of population of beneficial bacteria(LAB) by *Lactuca serriola* could be due to the inhibition of pathogenic bacteria colonization caused by natural antimicrobial compounds in the selected plants such as phenolic, terpenoid and alkaloid. Moreover, Jha and Berrocoso (2015) reported that some natural medicinal plants used as feed additives could reduce the pathogenic gut microbiota activity and enhancing the immune system of the host.



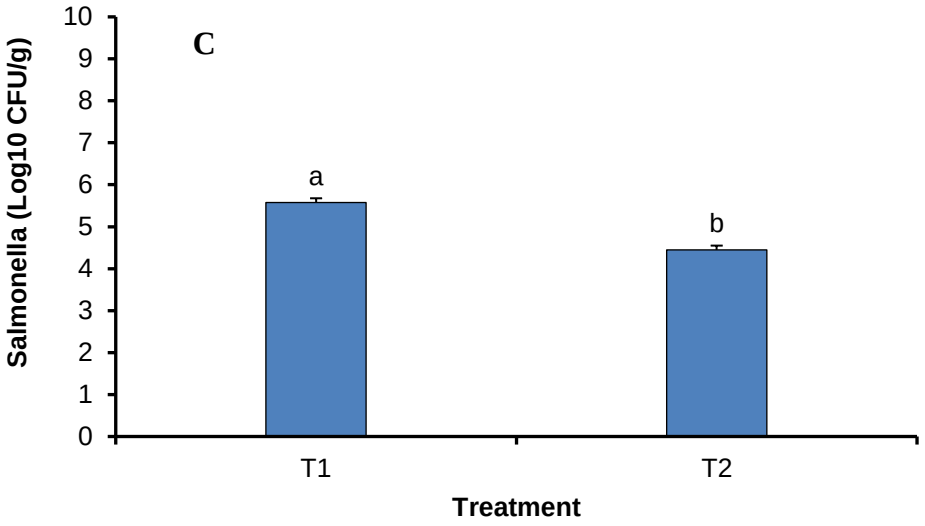


Figure (1): Bacteria counts of caecal sample obtained from growing Japanese quail fed dietary *Lactuca serriola* supplementation. Values with different letters are differ significantly at P<0.05.

CONCLUSIONS

The outcomes of the present study indicated that *Lactuca serriola* supplementation can improve performance and promote quails health by modulating gut microbiota. The feeding of Lactuca serriola can be used as a fed additive to balance gut microorganism of growing Japanese quails.

DISCLOSURE STATEMENT

The authors have no conflicts of interest.

الأداء الإنتاجي والمستوى الميكروبي المعوي لطيور السمان المغذات على عليقة حاوية على مسحوق اوراق الخس البري *(Lactuca serriola)*

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الخلاصة

هدفت الدراسة علي تقيم تاثير اضافة مسحوق اوراق الخس البري (*Lactuca serriola*) على النمو و صفات الذبيحة والتعداد الميكروبي المعوي للسمان الياباني. تم توزيع ثمانين من السمان (بعمر اسبوع واحد) على مجموعتين متساويتين تتضمن كل منهما اربعين طير بخمس مكررات لكل مجموعة من التجربة. غذيت المجموعة الاولى على نظام غذائي اساسي بدون مسحوق اوراق الخس المنشاري بينما غذيت المجموعة الثانية على عليقة تحتوي ٢٠ غم / كغم مسحوق اوراق الخس البري (*Lactuca serriola*) لمدة خمس اسابيع. ذبحت الطيور عند الاسبوع السادس من العمر. اشارت النتائج الى ان اداء النمو وتعداد المايكروبي المعوي لجموعة الطيور التي غذيت على عليقة تحتوي على مسحوق اوراق الخس البري (*Lactuca serriola*) كانت افضل معنويا مقارنة بمجموعة المقارنة. لم تختلف قياسات الذبيحة معنويا بين المجموعتين. الاستنتاج، يمكن للعليقة حاوية على مسحوق اوراق الخس البري (*Lactuca serriola*) ان تحسن من اداء النمو لطيور السمان واستخدامها كاضافات علفية جديد لتوازن المكروب المعوي.

الكلمات المفتاحية: اوراق الخس البري ، تعداد المايكروبي المعوي ، صفات الذبيحة، السمان

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REFERENCES

Abd-El Hack, M. E., M. Alagawany and S. Abdelnour (2019). Responses of growing rabbits to supplementing diet with a mixture of black and red pepper oils as a natural growth promoter. *Journal of animal Physiology and Animal Nutrition, 103(2), 509-517.*

Al-Marzoqi, A. H., J. H. Hussein and M. S. Nebras (2015). Antibacterial Activity of the Crude Phenolic, Alkaloid and Terpenoid Compounds Extracts of Lactuca serriola L. on Human Pathogenic Bacteria. *Chemistry and Materials Research, 7(1), 8-10.*

Anonymous (2007). User's Guide. 9.2 ed. In SAS institute. Inc, Cary (NC).

Apajalahti, J., A. Kettunen and H. Graham (2004). Characteristics of the gastrointestinal microbial communities, with special reference to the chicken. *Worlds Poultry Science Journal*, 60(2), 223–32.

Forshell, L. and M. Wierup (2006). Salmonella contamination: a significant challenge to the global marketing of animal food products. *Revue scientifique et technique (International Office of Epizootics), 25(2), 541-554.*

Ghazaghi, M., M. Mehri and F. Bagherzadeh-Kasmani (2014). Effects of dietary Mentha spicata on performance, blood metabolites, meat quality and microbial ecosystem of small intestine in growing Japanese quail. *Animal Feed Science and Technology, 194, 89-98.*

Janbaz, K. H., M. F. Latif, F Saqib, I Imran, M. Zia-UI-Haq and V. De. Feo (2013) Pharmacological effects of Lactuca Serriola In: Experimantal model of gastrointestinal, respiratory and vascular ailment. *Evidence-Based Complementary and Alternative Medicine, 2013, 1-9.*

Jha, R. and J. D. Berrocoso (2015). Dietary fiber utilization and its effects on physiological functions and gut health of swine. *Animal, 9(9), 1441–52.*

Kareem, K. Y. (2020). Effect of different levels of postbiotic on growth performance, intestinal microbiota count and volatile fatty acids on quail. *Plant Archives, 20(2), 2885-2887.*

Kareem, K. Y., T.C. Loh, H. L. Foo, H. Akit and A. A. Samsudin (2016). Effects of dietary postbiotic and inulin on growth performance, IGF1 and GHR mRNA expression, faecal microbiota and volatile fatty acids in broilers. *BMC Veterinary Research, 12(1), 163-173.*

Mohammad, A. (2013). Traditional use of kahu (Lactuca Scariola): a review. *Global Journal of Research on Medicinal Plants & Indigenous Medicine, 2, 465-474.*

Noumedem, J. A. K., D. E. Djeussi, L. Hritcu, M. Mihasan and V. Kuete (2017). Chapter 20 - Lactuca sativa. In: Kuete V (Ed). *Medicinal spices and vegetables from Africa. Academic Press, London, 437-449.*

NRC, (1994). Nutrient requirements of poultry. National Research Council. National Academy Press Washington, DC, USA.

Partovi, R. and S. Seifi (2018). Breast meat quality characteristics and its oxidative status during storage at refrigerator temperature and growth capabilities of Japanese quail fed by Echinacea purpurea extract. *International Food Research Journal, 25(5), 2018-2023.*

Reda, F. M., M. Alagawany, H. K. Mahmoud, S. A. Mahgoub and S.S. Elnesr (2019). Use of red pepper oil in quail diets and its effect on performance, carcass

measurements, intestinal microbiota, antioxidant indices, immunity and blood constituents. *Animal*, *14(5), 1025-1033*

Rehman, H. U., W. Vahjen, W. A. Awad and J. Zentek (2007). Indigenous bacteria and bacteria metabolic products in the gastrointestinal tract of broiler chickens. *Archives of Animal Nutrition, 61(5), 319-35.*

Rinttilä, T and L. Apajalahti (2013). Intestinal microbiota and metabolites—Implications for broiler chicken health and performance1. *Journal Applied Poultry Research*, *22(3), 647–58.*

Sabow, A.B. (2019). Carcass characteristics, physicochemical attributes, and fatty acid and amino acid compositions of meat obtained from different Japanese quail strains. *Tropical Animal Health and Production*, *52(1), 131-140.*

Tarhyela, R, B. M. Tanimomob and S. A. Hena (2012). Organ weight: As Influenced by color, sex and weight group in Japanese quail. *Scientific Journal of Animal Science, 1(2), 46-49.*

Vargas-Sánchez, R. D., F. J. Ibarra-Arias, B. del Mar Torres-Martínez, A. Sánchez-Escalante and G. R. Torrescano-Urrutia (2019). Use of natural ingredients in Japanese quail diet and their effect on carcass and meat quality—A review. *Asian-Australasian Journal of Animal Sciences, 32(11), 1641-1656.*

Vispo, C. and W. H. Karasov (1997). The interaction of avian gut microbes and their host: an elusive symbiosis. In: Mackie RI, White BA, editors. Gastrointestinal microbiology. *New York: Chapman and Hall*, *P. 116-55.*

Yadav, S and R. Jha (2019). Strategies to modulate the intestinal microbiota and their effects on nutrient utilization, performance, and health of poultry. *Journal of Animal Science and Biotechnology*, *10, 2-11*.

Yadava, R.N. and J. Jharbade (2008). New antibacterial triterpenoid saponin form Lactuca Scariola. *Fitoterapia, 79, 245-249.*