ARTICLE / INVESTIGACIÓN

Characterization of the influence of diet on Japanese quail

Maysaloon W. Ibraheem[1], Akeel Abd AL Mjbel[1], Ammar S. Abdulwahid[1] and Th. T. Mohammed[2]*

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[1] Department of Animal Production, Agriculture College, Tikrit University, Iraq.
[2] Department of Animal Production, College of Agriculture, University of Anbar, Anbar, Iraq.
Corresponding author: ag.thafer.thabit@uoanbar.edu.iq

Abstract: The experiments were conducted in fields of the department of animal production- agriculture college – Tikrit University by adding different levels of onion and sumac to the quail dietary and know its effect on the chemical composition of the thigh and the percentage of some saturated and unsaturated fatty acids and measures the peroxide value. The quail was divided into five treatments: Treatment 1 was controlled without adding, treatment 2 (3.5)g/kg of onion added, Treatment 3 (7)g/kg of onion added, treatment 4 (5)g/kg of sumac added. Treatment 5 (10)g/kg of sumac added. The results showed a high percentage of moisture in treatment 3 (73.08) % compared with the others; also, treatment 4 showed significant differences in fat percentage (7.50)% to the others. No significant differences led to protein and ash percentages between the five treatments. Regarding saturated fatty acids, treatments 1 and 4 showed significant differences in palmitic acid (7.98, 7.01)%, respectively. Stearic acid was high in treatment one than the others (9.10)%. Regarding saturated fatty acids didn't notice significant differences between the five treatments, but about peroxide, the values in treatments 2, 3, 4 and 5 were lower than the control.

Key words: Natural anti-oxidants, medical plants, meat rancidity.

Introduction

Meat is a high nutritional value as it is a significant source of amino acids and a source of vitamins, and minerals[1]. Due to the chemical and biological nature of the meat, it is damaged by storage because of oxidation of fat, which causes deterioration of the strength, flavor and test meat of meat[2]. Several industrial anti-oxidants have been used, but recently the focus has been on utilizing some plant sources suitable for consumption as natural oxidants because they are cheap and available in the markets. These contain phenolic compounds, which are anti-oxidants available in most plants[3]. Onion has been used in different countries since ancient times for food and health purposes. It was mentioned by ancient physicians such as ibn al-Bitar and al-Razi, and recently onion has been used in dermatological diseases because it contains organic sulfur[4,5]. It was also used to treat hyperglycemia in humans and to treat flu, cough, stomach and regulate blood pressure[6]. In recent years, interest in onion and some medicinal plants has increased, and it has been introduced into poultry diets in place of antibiotics that have been widely used recently[7]. Onion was selected among all plants added to diets because it contains antimicrobial substances and antioxidants[8,9]. The same is valid for sumac, which includes many active substances with anti-oxidant and medicinal benefits[10]. Therefore, the present study aimed to determine the effect of onion and sumac in preserving quail meat.

Materials and methods

The experiment was conducted in the poultry halls in the fields of the faculty of agriculture, department of animal production, from 14-11-2017 to 17-1-2018. Twenty Quail used in this experiment were divided into five treatments, each one contain four quail:

Treatment1 was controlled without adding treatment 2 (3.5)g/kg of onion added.

Treatment 3 (7)g/kg of onion added, treatment 4 (5)g/kg of sumac added.

Treatment 5 (10)g/kg of sumac added.

Moisture content determination

Moisture content was determined in sheep meat samples according to (11) by drying about 15 gm of the model at 120°C until a constant weight was recorded. Then calculate, the weight difference and the moisture was determined by the difference in weight before and after drying.

Protein determination

Total nitrogen was measured according to (11) procedures using (micro-Kjeldahl) techniques, and a conversion factor of 6.25 extract protein percent in the meat sample was used.

The percentage of fat in meat was measured by using soxhlet extraction units according to (11) procedures.

Ash determination

According to *AOAC 1980*[11] procedures, Ash is determined: 2 gm. of meat was weighed, put in a silica platinum dish, and transferred to a muffle furnace maintained at (500-600°C)

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for 6 hours until grey ash was obtained. It was left to be cooled, then weighted, and the ash percent was calculated.

Free fatty acids

Free fatty acids are estimated according to (12). Weigh 3g of meat and added 50ml of ethyl alcohol concentrate 98% and added to the sample drops of phenolphthalein after heating in a water path till boiling then squeeze the mixture with potassium hydroxide 0.1 standards till converted to pink then estimate the percentage by the equation:

Free fatty acids %= titration(A-B)×N×282/ 1000×W.t of sample(g) ×100

Peroxide value

Peroxide was estimated by (12). The weight of 3g of meat was increased by 30 ml of a mixture containing three parts of ice acetic acid, two pieces of chloroform,5ml of saturated potassium iodide and 20 ml of water dice and a few drops of starch, and then scraped the mixture with sodium thiosulfate solution standard 0.001. until the disappearance of the blue color and the amount of peroxide using the equation:

Peroxide(ml) = numbers of milliliters of sodium thiolate × 0.01 × 1000/weigh of sample (g).

Statistical analysis

The results were statistically analyzed using (SPSS) and full random design according to the mathematical model[13]:

Yij = μ + Ti + eij

Yij= the observation I to treatment j

μ = the overall mean effect

Ti = effect of treatment I

eij = : is an independent normally distributed random error term with zero mean and variance .σ^2

difference between averages was compared using Duncan,s Multiple Range Test[14].

Results

Chemical composition of the thigh

The results of the chemical analysis in the table (1) showed significant differences in moisture content in treatment 3 (onion 7g/kg) it was (73.08) compared with the rest treatments, the higher percentage of moisture in the third treatment (7% onion) compared with the rest treatments may be because of the high rate of moisture in onion which is positively affected the therapy. In general, water was high in all treatments. Protein didn't notice significant differences between the five treatments except for some account differences.

Fat content showed highly significant differences in treatment five, which was 7.50% compared with the other treatments, and that may be due to the reverse relationship between fat and moisture. Also, we noticed that the lowest percentage of fat in treatments 2 and 3 was (4.99, 5.01) % (the onion additives); the reason may be due to the low rate of fat in the onion—also, the difference in the chemical composition between onion and sumac.

No significant differences were noticed between the five treatments in ash percentage; it was low values in all treatments, which is a good indicator of the quality of meat because heavy metals are always found in Ash.

Saturated Fatty acids

In saturated fatty acids (palmitic), in table (2), the control treatment conducted a high level(7.98)%, it was higher than the rest treatments (6.99, 5.98,7.01, and 5.97)%, respectively. And that may be due to the effectiveness of the substance added to the other four treatments (onion and sumac). Also, we noticed the lower percentage of saturated free fatty acids in treatment 3(7g/kg onion and 5 g/kg sumac) was (5.98, 5.97)%, respectively; the high level of additives used in these treatments than the other treatments also the high percentage of palmitic cames from the other source of it is the amino acids grounded in diets and carbohydrates

About citric acid, the same has happened. Also, the control was higher than the others (9.10)% because management didn't have any anti-oxidant additives. Treatments 4 and 5 conducted the lowest percentage of citric (5.09, 5.12)%.

Unsaturated fatty acids

The results table (3) about palmitoleic acid showed no significant differences between 1,2,3and 5 treatments it was (25.45, 25.98, 25.98, 25.63)%, respectively and that is an accepted range not more than the limits, but treatment four has significantly differences lower than the rest treatments it was (24.98)%. About linoleic acid, we noticed treatment 1 (control) has significant differences (17.04) % from the other treatments it was (16.09, 14.87, 15.99, 15.87)%, respectively is may be due to the natural anti-oxidant substance added to the Quail diets with different percentage. Also, significant oleic differences noticed in treatment 4 was (43.08)%, but the other treatments were (42.01 42.68, 42.98, 42.01)% for treatment 1,2,3,5, respectively.

The three unsaturated fatty acids results did not differ highly from the control. That may be due to the anti-oxidant effectiveness of additives onion and sumac; everyone is different from the other in its contents and effects on diets.

Peroxide value

The results in a table (4) effecting adding different levels of onion and sumac on peroxide showed highly significant differences between treatment 1 (control) was (1.00) and treatments 2, 3, 4, and 5 were (0.8, 0.6, 0.7, 0.6) respectively this low in peroxide in treatments 2, 3, 4 and 5 then the treatment one may be due to the additives used in this research as we now onion and sumac have an anti-oxidant effect, so it is known the peroxide values will be decreased when we use these additives that is very important for us to know the effect of natural anti-oxidant on meat quality and if they affected by it or not. And that it will be clear in stored meat the fresh.

Panel test

The sensory evaluation of the femur cut showed highly significant differences in flavor in treatment 4 (5g/ kg sumac) (4.4±0.82) compared with control and treatment 3 (10g/kg sumac). They were (1.87±0.32 and 3.3±0.21) respectively. Also, juiciness and acceptability were conducted high significant differences in the same treatments; they were (4.6±0.35 and 4.87±0.54) respectively, compared with control and treatment two, were (2.8±0.32 and 2.65±0.88) respectively, in juiciness and control in acceptability was (3.12±0.12). About the tenderness treatment, 2 (7g/kg onion) was the best it conducted (3.8±0.35) compared with control was (1.3±0.54); the tenderness affected by moisture and juiciness these three traits are incredibly related, and they influenced each other and also they affected on the acceptability.

Discussion

Chemical composition of the thigh

The higher percentage of moisture in the third treatment (7% onion) compared with the rest of the treatments may be because of the high rate of water in the onion, which positively affected the therapy. In general, moisture was increased in all treatments, which may be due to the age of the quail, so the meat of the younger quail has more water than the oldest quail. Protein didn't notice significant differences between the five treatments except for some account differences, which may be due to the early age of quail, so it converted the diet to protein rather than fat.

Regarding the fat content, the reason may be due to the reverse relationship between fat and moisture. Also, we noticed that the lowest percentage of fat was in treatments 2 and 3 (the onion additives); the reason may be due to the low rate of fat in the onion. Also, the difference in the chemical composition between onion and sumac may cause a difference in the chemical composition of Quail meat between treatments.

Low values in all treatments in ash content are an excellent indicater of the quality of meat because heavy metals are always found in Ash.

Saturated Fatty acids

In saturated fatty acids (palmitic), the control treatment conducted high level was higher than the rest treatments. That may be due to the effectiveness of the substance added to the other four treatments (onion and sumac). Also, we noticed the lower percentage of saturated free fatty acids was in treatment 3, which may be due to the high level of additives used in these treatments than the other treatments. Also, the high percentage of palmitic may be cames by the other source of it, the amino acids grounded in diets and carbohydrates

About citric acid, the same happened. Also, the control was higher than the others, and that is because the power didn't have any anti-oxidant additives. Treatment 4 and 5 conducted the lowest percentage of citric that is may be due to the high anti-oxidant effectiveness of sumac; the presence of citric acid is significant because it considers a natural anti-oxidant helps the substance from boiling and also protect the meat from a long time.

Unsaturated fatty acids

About palmitoleic acid showed no significant differences between 1,2,3and 5 treatments, which is an accepted range that exceeds the limits. Still, treatment four has significant differences lower than the rest treatments. About linoleic acid, we noticed treatment 1 (control) has significant differences that may be due to the natural anti-oxidant substance added to the Quail diets with different percentages. Also, significant oleic differences were noticed in treatment four, that is may be due to the additional effect of the chemical composition of Sumac and Onion on the Quail diets

In general, the results of the three unsaturated fatty acids did not highly differ from the control. They may be due to the anti-oxidant effectiveness of additives onion and sumac. Everyone is different than others in their contents and their effects on diets.

Peroxide value

Adding different levels of onion and sumac to peroxide showed highly significant differences between treatment 1 and treatments 2, and 3. This low peroxide in treatments 2, 3, 4 and 5 and then the treatment 1 may be due to the additives used in this research; as we know, onion and sumac have anti-oxidant effects, so it is known the peroxide values will decrease when we use these additives that is very important for us to know the effect of natural anti-oxidant on meat quality and if they affected by it or not. And that it will be transparent in stored fresh meat.

Panel test

The sensory evaluation of the femur cut showed highly significant differences in flavor in treatment 4 compared with control. Treatment 3 may be due to the fine addition of sumac to treatment 4 and the lovely taste of sumac compared with onion; many people reject the onion flavor. Also, juiciness and acceptability were conducted with highly significant differences in the same treatments compared with control and treatment 2 in juiciness and control in acceptability; that may be due to the moisture percentage because juiciness depends on the moisture in the meat cut. Regarding the tenderness treatment, 2 was the best compared with control of the tenderness affected by moisture and juiciness; these three traits are incredibly related, and they affected each other and acceptability.

Conclusions

The addition of these natural anti-oxidant (Onion, Sumac) to Quail diets improved the chemical and sensory qualities of Quail meat; this is a good indication of the trend towards using natural additives in Quail and Avian diets to help improve the quality of meat consumed by human and in addition to the health benefit, it also benefits the consumer and the producer because of the lower cost compared to the other synthetic anti-oxidant used.

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Treatments	Percentage	Moisture%	Protein%	Fat%	Ash%
Control	0	71.98± 2.0ab	22.07± 3.20 a	5.600± 0.7 b	0.3± 0.002 a
T2 Onion	3.5 g/kg	72.06± 1.2ab	22.32± 0.01 a	4.99± 0.8bc	0.4± 0.001 a
	7g/kg	73.08± 1.1 a	21.65± 0.01 a	5.01± 0.9 b	0.5± 0.003 a
T3 sumac	5g/kg	70.08± 1.3b	21.09± 0.06 a	7.50± 0.8 a	0.3± 0.001 a
	10g/kg	69.49± 1.0c	22.32± 0.08 a	6.99± 0.4 ab	0.4± 0.001 a

Different letters within the column refer to significant differences ($p \leq 0.05$) between means.

Table 1. Adding a Combination of Onion and Sumac Powder to the Japanese quail Diet on chemical composition (mean ± SE).

Treatments	Percentage	Palmatic	Citiaric
Control	0	7.98± 0.06 a	9.10± 0.04 a
T2 onion	3.5 g/kg	6.99± 0.02 ab	8.94± 0.05 b
	7g/kg	5.98± 0.09 b	8.12± 0.07 b
T3 sumac	5g/kg	7.01± 0.09 a	5.09± 0.01 c
	3.5 g/kg	5.97± 0.05 b	5.12± 0.02 c

Different letters within the column refer to significant differences (p ≤0.05) between means.

Table 2. Adding a Combination of Onion and Sumac Powder to the Japanese quail Diet on some saturated fatty acid (mean ±).

Treatments	percentage	Palmitoleic C16:1	Linoleic C18:2	Oleic C18:1
Control	0	25.45± 0.05 a	17.04± 0.12 a	42.01± 0.2 ab
T2 onion	3.5 g/kg	25.98± 0.01 a	16.09± 0.05 b	42.68± 0.1 ab
	7g/kg	25.98± 0.90 a	14.87± 0.02 c	42.98± 0.6 ab
T3 sumac	5g/kg	24.98± 0.03 ab	15.99± 0.06 bc	43.08± 0.7 a
	3.5 g/kg	25.63± +0.06 a	15.87± 0.80 bc	42.01± 0.4 ab

Different letters within the column refer to significant differences (p ≤0.05) between means.

Table 3. Adding a Combination of Onion and Sumac Powder to the Japanese quail Diet on some unsaturated fatty acid (mean ± SE).

Treatments	percentage	Peroxide
Control	0	1.00± 0.008 a
T2 onion	3.5 g/kg	0.8± 0.003 b
	7g/kg	0.6± 0.002 c
T3 sumac	5g/kg	0.7± 0.003 b
	3.5 g/kg	0.6± 0.003 c

Different letters within the column refer to significant differences (p ≤0.05) between means.

Table 4. Adding a Combination of Onion and Sumac Powder to the Japanese quail Diet on peroxide value (mean ± SE).

Treatments	Percentage	Flavor	Tenderness	Juiciness	Acceptability
Control	0	1.87±0.32 c	1.3±0.54 c	2.8±0.32 c	2.7±0.54 bc
T2 onion	3.5 g/kg	3.7±0.65 ab	3.01±0.62 ab	3.53±0.93 bc	4.6±0.95 ab
	7g/kg	3.4±0.58 ab	3.8±0.35 a	2.65±0.88 c	3.12±0.12 b
T3 sumac	5g/kg	4.4±0.82 a	3.1±0.22 ab	4.6±0.35 a	4.87±0.54 a
	3.5 g/kg	3.3±0.21 b	3.36±0.76 ab	4.1±0.88 ab	4.6±0.65 ab

Different letters within the column refer to significant differences (p ≤0.05) between means

Table 5. Adding a Combination of Onion and Sumac Powder to the Japanese quail Diet on panel test (mean ± SE).

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