Effect of Different Levels of Rhus Coriaria L. powder in Awassi Lambs Diet on Some Carcass Characteristics

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Abstract

This research was conducted in (Good land farm and factory) for meat processing in Samarra in cooperation with Nature Resources Center in Tikrit University, to the period from 1/5/2019 to 1/8/2019. Sixteen Awassi lambs were used in this research average body weight (20±25) kg about (5.5-6) months. the lambs was divided into four treatments according to Sumac additives: Treatment one was control without Sumac, treatment two 1% Rhus powder, treatment three it was 3% Rhus powder and treatment four was 5% Rhus powder. Their results showed significant differences in live weight treatment four(42.38±1.73)kg was higher than the other treatments were (38.16±1.50)kg (36.64±1.04)kg (34.63±1.53)kg respectively. Significantly was noticed in treatment four than other three treatments in empty body weight, hot and cold carcass weight and dressing percentage. About the main cuts of right half of the carcass, leg cut in treatment four conducted significant differences (3.08±0.12) than other treatments were (2.47±0.22)kg (2.45±0.02)kg (2.52±0.10)kg respectively. Loin showed significant differences in treatment four(0.92±0.01)kg compared with control was (0.63±0.07)kg and treatment three (0.67±0.01)kg shoulders and ribs did not record significant differences between four treatments. For secondary cuts of right half cuts, fore shank of treatment two was the lowest (0.64±0.029) compared with other treatments were (0.75±0.002)kg (0.68±0.38)kg (0.76±0.023)kg respectively while breast, neck and flank did not record significant differences between treatments. Abdominal fat was the highest in treatment four (0.24±0.03)kg while the values in the res treatments were (0.08±0.02)(0.17±0.03)(0.07±0.07)kg respectively. kidney and pelvic fat also was high in treatment four (0.26±0.87)kg than other treatments. Finally, rib eye area was conducted high significant differences in treatment four was (10.404±0.302)mm compared with the other three treatments were(7.701±0.503)mm(6.650±0.155)mm(8.752±0.454)mm respectively.

1. Introduction

Sheep are the first in the production of red meat in Iraq, it is one of the most important farm animals for breeders. As selling lambs forms a large part of their annual income, however, its primary importance lies in the fact that it is the most suitable animal for the arid and semi-arid regions of Iraq, as well as being the main livelihood for the rural population they don’t require large amounts of investment and are distinguished by their short and rapid production cycles, in addition to their high growth rates compared to large ruminants [1]. And increase the demand for its meat [2]. This is due to its high palatability and acceptance by the consumer, which requires more attention to sheep, to better marketing weights and desirable meat recipes [3]. The high level of per capita income and the development of societies in all aspects, together with the change of the consumers, requirements and desire to consume more meat to meet the body needs of the increase meat consumption [4]. This is the reason for increasing demand for sheep meat, which is one of the main sources of meat production in many countries of the world as the slaughter age of males less than a year old, while older sheep are excluded because of their breeding becomes uneconomical [5].

In order to make the most efficient and healthy consumption of meat, it is necessary to search for a new technologies improve the qualitative characteristics of meat such as tenderness, juiciness, flavor and meat color which have an important role as for as lean meat consumption are concerned. Nutrition is one of the most important factors affecting performance and productivity of farms animals [6]. The low nutritional value of feed stuffs together with the low level of nutrients in animal feed have been found to have negative effects on the productivity of farm animals, so it seems cultivable to implement feed stuffs that have high nutritive value and to improve the level of daily feed intake of them. This could be achieved through introducing non-conventional feeding stuffs to attain an optimum production level [7].

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Therefore, the researchers tended to use natural additives that proved the ability and effectiveness to delay the development of unwanted flavours and improve the qualitative of meat. And they interested in studying the properties of these natural food additives increased greatly. Hence the idea of studying the addition of different levels from the Sumac plant to the diet used in feeding sheep. The original habitat of Sumac, North America, is a tree that is close to pomegranate long, but its leafy, soft and smooth. It blooms at the beginning of summer, its fruits ripen in August and September, and sumac contains many active substances that have an anti-oxidant effect in addition to its many medicinal benefits. It also takes advantage of its desired acidity in food [8].

2. Materials and methods:
This research was conducted in (Good land farm and factory) for meat processing in Samarra to the period from 1/5/2019 to 1/8/2019. Sixteen Awassi lambs were used in this research average body weight (20±25) kg about (5.5-6) months. The lambs was divided into four treatments according to Sumac additives: Treatment one was control without Sumac, treatment two 1% Sumac, treatment three it was 3% Sumac and treatment four was 5% Sumac. Each lamb in these four treatments was put in individual cages (1 x 1.5) m², the cage was supplemented with a special feeder and utensils for drinking water. Also the mineral salts block was placed in the cages in front of the lambs.

2.1. Treatment diet
In this research, a typical diet was given to the lambs consisting of Barley, the largest percentage, then the wheat bran, soybeans, yellow corn, salts and minerals. As for Sumac, its addition was different according to the treatments as we mentioned earlier.

| Treatments | T1 | T2 | T3 | T4 |
|------------|----|----|----|----|
| Ingredients (%) | Barley | 40 | 40 | 40 | 39 |
| | Wheat bran | 39 | 40 | 40 | 39 |
| | Soybean meal (SBM) | 10 | 10 | 11 | 11 |
| | Corn | 10 | 8 | 5 | 5 |
| | Sumac | 0 | 1 | 3 | 5 |
| | Min.& vit. Mixture | 1 | 1 | 1 | 1 |

2.2. Slaughter Lambs
At the end of the experiment of this research, the lambs were slaughtered before that were fasted from food for 12 hours water still available till the slaughter we took the final weight then we slaughter all lambs after that we took the weight of external offal parts ((head, limbs, skin)) and the weight of internal offal parts(( liver, spleen, lungs and trachea, heart, testes, gastrointestinal tract filled and empty, kidneys and pelvic fat, intestinal fat and heart fat))

Carcass measurements:

2.2.1. Hot carcass weight and cold carcass weight
After slaughtering about half hour we took hot carcass weight. And cold carcass weight was taken after chilled the carcasses along 24 hours in the cooling room at (4°m) . Shrinkage percentage was calculated after cooling according to the equation:

Shrinkage percentage%= hot carcass weight – cold carcass weight / hot carcass weight x 100

2.2.2. Empty Body Weight
Empty Body weight calculated by subtracting the weight of the digestive tract from the weight of the living animal.

Empty body weight = weight of living animal - weight of digestive system contents.

2.2.3. Fat tail, Kidney and pelvic fat
After carcass chilling, fat tail was separated from the carcass at the beginning of the Coccygeal (vertebra) and weighed. Kidney and pelvic fat were separated from pelvic area and weighed using electronic balance.
2.2.4. **Dressing Percentage**:

Was calculated in four methods:

- The percentage of cold carcass weight to live animal weight according to the equation: Dressing percentage = cold carcass weight/live body weight ×100
- The percentage of cold carcass weight to empty body weight according to the equation: Dressing percentage = cold carcass weight/empty body weight ×100

2.2.5. **Rib eye area**

The rib eye area was measured by drawing the outer boundary of longissimus dorsi between the 12 and 13 ribs using a trace paper and then calculated by a digital Planometer.

2.2.6. **Fat thickness**

Fat thickness was measured at the dorsal region of the spine between 12 and 13 ribs upon the rib eye area using a digital caliper (Vernia).

2.2.7. **Carcass cutting procedure**

The carcass was cut into two equal halves (left and right) using an electric saw. The right half was dissected into 8 cuts, four of them were the primary cuts (leg, shoulders, rack, loin); the other four cuts were the secondary cuts (flank, breast, fore shank, neck). The leg was selected from the right half of the carcass to the required tests.

2.2.8. **Samples Preparation**:

Meat and fat tissues were separated from the thigh cuts and mixed together using an electric grinder with a mesh of 8 mm holes, then re-processed with mesh 5 mm holes. Then it was mixed well and we took two samples from each thigh for the tests.

2.3. **Statistical analysis**:

Statistical analysis of the results of the experiment was done using the complete random design (CRD) to study the effect of studied parameters on different characteristics (SAS, 2001). The significant differences between the average were compared using the Duncan test. Analyze the data using the following linear additive model:

\[ y_{ij} = \mu + T_j + e_{ij} \]

Where:

- \( Y_{ij} \): the observation of the additives
- \( \mu \): is the overall mean effect
- \( T_j \): effect of treatment
- \( e_{ijk} \): is independent normally distributed random error term with zero mean and variance \( \sigma^2 \)

3. **Results and discussion**

3.1. **Effect of using different levels of Sumac on some characteristics of the carcass**

The results in table (2) showed significant differences between treatments in live weight, treatment four Sumac 5% conducted high weight it was (42.38 ± 1.73) kg compared with the other three treatments the reason may be due to the different percentage of diet between four treatments given to the lambs. About empty body weight treatment four conducted high significant differences (36.58 ± 1.88) kg compared with other treatments and that is clear because of the high live weight of the same treatment. As for hot carcass weight, treatment one two three was low (17.97 ± 0.80) kg, (17.15 ± 0.20) kg, (17.00 ± 0.53) kg respectively compared with treatment four it was (20.99 ± 1.54) kg and that is may be due to the different live weight conducted and because of the weight of external offal parts. It is the same for cold carcass weight also treatment four was high significant differences (20.67 ± 1.55) kg than the other treatments. About dressing percentage 1, no significant differences appear between four treatments. About dressing percentage 2, we noticed a high significant differences between treatment four was (56.46 ± 1.35)% and the other three treatments (52.96 ± 0.24)% (54.59 ± 0.39)% (54.54 ± 0.50)% this difference between two dressing percentage due to the way we calculate it using empty body weight instead of live weight,
note that method 2 of calculate dressing percentage more accurate than method 1. In general, about the characteristics of carcass we noticed that treatment four was moral superiority than other treatments and that may be due to the high percentage of Sumac 5% in this treatment.

**Table 2.** Effect of using different levels of Sumac on some characteristics of the carcass.

| Treatments | Live weight (Kg) | Empty body weight (Kg) | Hot carcass weight (Kg) | Cold carcass weight (Kg) | Dressing percentage (%) | Dressing percentage (%) |
|------------|------------------|------------------------|-------------------------|--------------------------|-------------------------|-------------------------|
| Control    | 38.16±1.50ab     | 33.34±1.83ab           | 17.97±0.80ab            | 17.65±0.89ab             | 46.23±0.52a             | 52.96±0.24b             |
| T2         | 36.64±1.04ab     | 30.85±0.13b            | 17.15±0.20b             | 16.84±0.19b              | 46.02±1.82a             | 54.59±0.39ab            |
| 1% sumac   | 34.63±1.53b      | 30.57±0.56b            | 17.00±0.53b             | 16.68±0.46b              | 48.20±0.81a             | 54.54±0.50ab            |
| T3         | 42.38±1.73a      | 36.58±1.88a            | 20.99±1.54a             | 20.67±1.55a              | 48.71±1.67a             | 56.46±1.35a             |
| T4         | 52.96±0.24b      | 46.23±0.52a            | 17.97±0.80ab            | 17.65±0.89ab             | 46.23±0.52a             | 52.96±0.24b             |

1-Cold carcass weight (Kg)/ Live weight (Kg).
2-Cold carcass weight (Kg)/ Empty body weight (Kg).

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

3.2. Effect of using different levels of Sumac on primary cuts of carcass

Table (3) showed no significant differences between treatments in half carcass the values were converging although there were calculated differences for treatment four but it didn’t the level of significantly. About Leg cuts, treatment four showed high significant differences was (3.08 ± 0.12) kg than other treatments were (2.47 ± 0.22)kg (2.45 ± 0.02)kg (2.52 ± 0.10)kg respectively. Shoulders cut didn’t showed significant differences between four treatments. Loin in treatment four was high significant differences (0.92 ± 0.01) kg compared with the rest three treatments (0.63 ± 0.07)kg (0.68 ± 0.04)kg (0.67 ± 0.01)kg. the last primary cuts Ribs, didn’t showed significant differences between all treatments. The high significant differences of treatment four in leg and loin may be due to the deposition of large quantities of lean.

**Table 3.** Effect of using different levels of Sumac on primary cuts of carcass.

| Treatments | Right carcass half | Leg | Shoulder | Loin | Ribs |
|------------|--------------------|-----|----------|------|------|
| Control    | 6.85±0.68a         | 2.47±0.22b | 1.28±0.27a | 0.63±0.07b | 0.57±0.05a |
| T2         | 6.81±0.52a         | 2.45±0.02b | 1.11±0.05a | 0.68±0.04ab | 0.63±0.01a |
| 1% sumac   | 6.57±0.38a         | 2.52±0.10b | 1.16±0.13a | 0.67±0.01b | 0.59±0.01a |
| T3         | 8.15±0.40a         | 3.08±0.12a | 1.22±0.07a | 0.92±0.01a | 0.82±0.12a |

* based on right carcass half.

Different letters within column refer to significant differences (P<0.05) between means.
3.3. Effect of using different levels of Sumac on secondary cuts

Table (4) showed the effect of using different levels of Sumac on secondary cuts, we noticed that the fore shank cuts conducted high significant differences in treatment one and four were \((0.75 \pm 0.002)\) kg respectively than treatment two and three were \((0.64 \pm 0.029)\) kg respectively. The rest secondary cuts of half right carcass Breast, Neck and Flank didn’t showed differences between four treatments

| Treatments | Secondary Cuts(Kg)* |
|------------|---------------------|
|            | Right carcass half  | Fore shank | Breast | Neck | Flank |
| Control    | 6.85±0.68a          | 0.75±0.002a | 0.85±0.101a | 0.42±0.004a | 0.30±0.037a |
| T1         | 6.81±0.52a          | 0.64±0.029b | 1.02±0.063a | 0.56±0.124a | 0.24±0.004a |
| 1% sumac   | 6.57±0.38a          | 0.68±0.038ab| 0.93±0.049a | 0.44±0.039a | 0.21±0.030a |
| T3         | 8.15±0.40a          | 0.76±0.023a | 1.08±0.021a | 0.75±0.220a | 0.30±0.015a |

* based on right carcass half.

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

3.4. Effect of using different levels of Sumac on carcass fat

Table (5) revealed that treatment four was high significant differences \((0.24 \pm 0.03)\) kg in abdominal fat compare with other treatments were \((0.08 \pm 0.02)\) kg respectively and that is may be due to the high live weigh of lambs treatment four and near arrival to body mature. Kidney and pelvic fat, treatment four conducted high significant differences \((0.26 \pm 0.087)\) kg and treatment one conducted the lowest value \((0.08 \pm 0.023)\) kg compared with treatments two and three were \((0.20 \pm 0.008)\) kg \((0.11 \pm 0.025)\) kg respectively. Heart fat and fat tail didn’t show significant differences between four treatments the values were converging.

| Treatments | Abdominal fat(kg) | Kidney & pelvic fat (kg) | Heart fat (kg) | Fat tail |
|------------|-------------------|--------------------------|----------------|---------|
| T1 Control | 0.08 ± 0.02b      | 0.08 ± 0.023b            | 0.20 ± 0.008a  | 2.56±0.287a |
| T2         | 0.17 ± 0.03ab     | 0.20 ± 0.008ab           | 0.16 ± 0.002a  | 2.05±0.147a |
| 1% sumac   | 0.07 ± 0.07b      | 0.11 ± 0.025ab           | 0.18 ± 0.038a  | 2.17±0.176a |
| T3         | 0.24 ± 0.03a      | 0.26 ± 0.087a            | 0.18 ± 0.010a  | 2.81±0.639a |

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

3.5. Effect of using different levels of Sumac on Rib eye area and Fat thickness

The results showed in table (6) revealed that the fourth treatment was significantly higher in rib eye area \((10.404 \pm 0.302)\) mm compared with the rest treatments were \((7.701 \pm 0.503)\) mm \((6.650 \pm 0.155)\) mm \((8.752 \pm 0.454)\) mm respectively that is may be due to the high weight of loin cuts of treatment four. Fat thickness didn’t conduct significant differences between four treatments and that is may be due to the non–product dietary also the decrease in fat thickness may be reflecting the decrease in fat percentage in the carcass.
Table 6. Effect of using different levels of Sumac on Rib eye area and Fat thickness.

| Treatments | Rib eye area* (cm²) | Fat thickness* (mm) |
|------------|---------------------|---------------------|
| Control    | 7.701 ± 0.503bc     | 2.10 ± 1.28a        |
| T1 - 1% sumac | 6.650 ± 0.155c     | 2.23 ± 0.11a        |
| T1 - 3% sumac | 8.752 ± 0.454b     | 2.27 ± 1.20a        |
| T4 - 5% sumac | 10.404 ± 0.302a    | 6.23 ± 2.35a        |

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

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