

INFLUENCE OF DIFFERENT LEVELS OF GROUND OAK (QUERCUS AEGILOPS) ACORNS ON GROWTH PERFORMANCE AND SOME CARCASS CHARACTERISTICS OF AWASSI LAMBS

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ABSTRACT:

This study was aimed to investigate the effect of feeding different levels of oak acorns on growth and some carcass characteristics of Awassi lambs. Twenty lambs were blocked into four groups (5 lambs/ group) according to live body weight and fed on one of the experimental diets (0, 5, 10 and 15% oak acorns). The results showed no effect of dietary treatments on live body weight throughout the period of study, also there were no effects of treatments on carcass traits except for rib-eye muscle area which was largest in the group fed on 5% acorns. It could be concluded that feeding Awassi lambs on ground oak acorns has no adverse effects on growth performance and health condition.

KEYWORDS: Oak Acorns, Sheep, Fattening, Performance, Carcass.

1. INTRODUCTION

One of the most important priorities in production is to reduce feeding cost and encourage sheep producers to practice feedlot fattening in order to exploit maximum growth potential of lambs within a limited period of production (Al Jassim et al., 1998). Among the natural resources, trees and shrubs have been used for centuries as important feed resources for livestock and play an important role in the nutrition of livestock in areas where few or no alternatives are available (Papachristou and Nassis, 1996). Oak acorn is a woody plant which is cheap and readily available in many countries (Mekki et al., 2019; Froutan et al., 2015). Oak leaves and twigs are often grazed by animals including sheep or harvested to be used as livestock fodder during shortage periods (Singh et al., 1996). The main carbohydrate in oak acorns is starch, amounting to over 55% of the kernel (Saffarzadeh et al., 2000) and may serve as a good and cheap source of energy and minerals (Rababah et al., 2008). Tannins are bioactive phenolic compounds distributed in various plants and act to interfere with protein and lipid metabolism in the rumen, by forming undegradable complexes with feed proteins and affecting the biohydrogenation (Minieri et al., 2014). Tannins are found throughout the oak plant, with higher levels found in the leaves, buds, twigs, while acorns are low in total tannin content (3.2 - 4.4% DM) and acorn intake by small ruminants could involve positive effects mainly in nitrogen metabolism (Bausch and Carson, 1981; Moujahed et al., 2005). In ruminants, moderate concentrations of tannins in the diet can have beneficial effects (Patra and Saxena, 2011). The low intake of tannins by small ruminants, may lead to positive effects mainly on nitrogen metabolism. Indeed, condensed tannins, at low levels, may complex proteins and protect them from microbial enzymes (Reed et al., 1990) and protect soluble proteins from microbial degradation (Wang et al., 1994; Teferedegne, 2000). Condensed tannins may improve the digestive utilization of feed by ruminants, mainly because of a reduction in protein degradation in rumen and an increase

in amino acid flow to the small intestine (McNabb et al., 1996). When ewes and cows were fed diets containing less than 4% tannins of diet dry matter, they exhibited higher retention of nitrogen and lower plasma urea concentrations, as a result of the ability of tannin to preserve feed protein from degradation by rumen microbes (Min et al., 2003; Frutos et al., 2004). Also, in goats Froutan et al. (2014) reported that replacement of ground acorn up to 25% in the diet did not affect average daily gain, feed conversion ratio and blood parameters of goat kids. Available data linking the effect of acorns on growth and carcass quality of sheep is very limited; therefore, the aim the present study was to evaluate the influence of different levels of oak acorns on performance and carcass traits of Awassi lambs.

2. MATERIALS AND METHODS

This experiment was conducted at the Animals project of the College of Agricultural Engineering Sciences, University of Duhok during the period of July first to October first of 2019.

2.1 Chemical Analysis

Chemical composition of the oak acorns and other feed ingredients was analysed according to the procedures described by AOAC, (2007). The samples were analysed for their dry matter (105°C in oven for 24 h), crude protein (Kjeldahl procedure), ash (550°C for 6 h), ether extract (Soxhlet extractor procedure) was determined by extracting the sample with ether for 6 hours and crude fiber (digesting the sample in diluted acid, diluted base, and then drying and burning at 550°C for 30 minutes. Nitrogen-free extract was calculated by difference. The condensed tannins (CT) content in the samples of oak acorns was determined according to Makkar et al., (1993). 10ml of 70% aqueous acetone was added to 0.2g of dried ground sample, and then centrifuged at 3000g for 10 minutes at 4°C. The supernatant was collected and kept on ice. 3ml of butanol-HCl reagent (butanol-HCl 95:5 v/v) and 0.1 ml of Ferric reagent (2% of ammonium iron sulfate in 2N HCl) were added to 0.5ml of supernatant, vortexed, covered

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with a glass marble and put in heating block at 97°C for one hour. After the tubes were cooled, the absorbance was read at 550 nm via spectrophotometer (Jenway, UK) and condensed tannins were calculated as following:

$(A_{550\text{ nm}} \times 78.26 \times \text{Dilution factor}) / (\% \text{ of DM})$

2.1.1. Diet Formulation and Treatments: Oak acorns were collected at Haden village at Duhok province, Kurdistan region, Iraq. The whole acorns were ground using a hammer mill and spread in shed at 25°C for 15 days. Depending on the laboratory analyses, the percentages of raw ingredients were chosen to formulate four experimental diets (Table1); T1 (0% oak acorns), T2 (5% oak acorns), T3 (10% oak acorns) and T4 (15% oak acorns). The ingredients were mixed on farm using a mixer machine. The proximate analysis of the experimental diets is shown in Table 1.

2.1.2. Animal Management: Twenty Awassi ewe lambs with an average initial live weight of 21±0.2Kg were purchased from a local farm. The ewe lambs were dewormed and vaccinated against enterotoxaemia. The lambs were blocked according to live weight, and then randomly allocated to one of the four treatments, with 5 lambs per treatment. Lambs were housed individually (4m²). Lambs were offered feed twice a day at 9 a.m. and 5p.m. with free access to fresh water. Feed refusals were recorded twice a week in order to estimate daily feed intake and feed conversion efficiency. Feed samples were collected weekly. To meet lamb growth requirement of feed, the quantity of experimental diets was adjusted weekly according to lamb's live weight to meet AFRC, (1993) requirement. Lambs were weighed weekly until the end of experiment using a portable electronic scale.

2.1.3. Carcass Characteristics: At the end of growth experiment, the animals were slaughtered; eviscerated and hot carcass weight was recorded. The hot carcasses were placed in a refrigerator at 4°C for 24 hours. The dressing percentage was calculated next day, and then it was split into two halves between the 12th and 13th rib. The fat thickness over eye-muscle area and muscle's depth were measured by using a Caliper device. The eye-muscle area was determined by tracing the muscle over a transparent paper and measured using a digital planimeter (Planix Tamaya, Japan). The right leg was cut off from the carcass weighed and then the fat, muscle and bone were separated. The percentage of fat, muscle and bone were measured as ratio to total leg weight.

2.2 Statistical Analysis:

All the parameters were statistically analyzed using Genstat (Genstat 18th edition, VSN, UK) as a complete randomized. At the last week of experiment, there was a numerical increase in mean live body weight (32.4Kg) of the lambs fed on T4, which was about 9% higher than that of lambs fed on control

block design with the main effect of diet and to eliminate the effect of block, the animals were chosen from same age and blocked via Genstat software according to their live body weights. The live body weight data were analysed via repeated measure analysis of variance using Genstat (Genstat 18th edition, VSN, UK) as a complete randomized block design with the effects of diet, period and interaction between period and treatment. Week 0 was set as covariate. The analyses were followed by Fisher's least significant difference test.

Table1. The composition experimental diets.

Feedstuffs %	T1	T2	T3	T4
Barley	50	45	40	40
Wheat bran	13	12	11	10
Soybean meal	15	16	17	18
Corn	10	10	10	5
Wheat straw	10	10	10	10
Oak acorns	0	5	10	15
Vitamins-minerals premix	1	1	1	1
Iodized Salt	1	1	1	1

T1: Control, T2: 5% oak acorns, T3:10% oak acorns, T4:15% oak acorns.

Table 2. The proximate analysis of acorn and experimental diets.

Item	T1	T2	T3	T4	Acorn
DM g/kg	903	909	906	901	593
OM g/kg DM	965.3	958.6	957.6	938.5	968.8
Ash g/kg DM	34.7	41.4	42.4	61.5	31.2
CP g/kg DM	131	137	137	147	42
EE g/kg DM	35.7	34.5	32	29.7	87.5
CF g/kg DM	109	104	107	97.8	73.2
NFE ¹ g/kg DM	592.6	592.1	587.6	565	359.1
ME ² MJ/kg DM	12.56	12.61	12.49	12.25	8.96
CT g/kg DM	-	-	-	-	3.76

T1: Control, T2: 5% oak acorns, T3: 10% oak acorns, T4: 15% oak acorns, DM: Dry matter, OM: Organic matter, CP: Crude Protein, EE: Ether extract, CF: Crude fiber, NFE: Nitrogen-free extract, ME: Metabolizable energy, CT: Condensed tannins.

¹NFE%= 1000- (Water + Ash + EE + CP + CF contents).

²ME was calculated according to (MAFF, 1975), ME= (CP*0.02+EE*0.031+Cf*0.005+NFE*0.014).

diet (29.65Kg), but this increase in live weight was statistically insignificant.

Table 3. Some Fattening Characteristics of Awassi Lambs Fed Different Levels of Oak Acorns

Treatment	T1	T2	T3	T4	SED	P value
No. of animals	5	5	5	5		
Initial body weight	21.15	21.02	20.95	21.2	0.79	0.98
*Final body weight	29.65	31.6	29.9	32.4	1.87	0.42
Total gain	8.50	10.58	8.95	11.2	1.75	0.39
Avg. daily gain	94.4	117.6	99.4	124.4	19.46	0.39
DM intake	120.7	124.3	122.3	122.8	1.64	0.22
DM intake (kg/d)	1.34	1.38	1.35	1.36	0.01	0.22
FCR %	11.44	11.59	12.26	8.24	1.42	0.07

T1: Control, T2: 5% oak acorns, T3: 10% oak acorns, T4: 15% oak acorns, DM: Dry matter, FCR: Feed conversion ratio, P value: For treatment.

Body weights change was analyzed by repeated measures of analysis where P values: treatment= 0.31, time= <0.001, time treatment= 0.37.

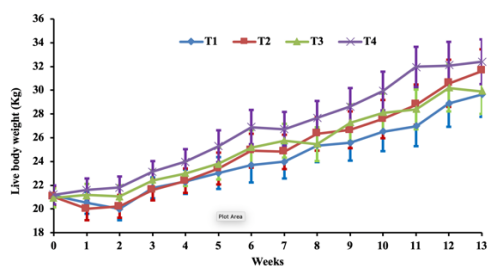


Figure 1. Effect of dietary levels of oak acorns on growth rate of lambs. SED values: Treatment= 1.22, time= 0.35, time*treatment= 1.40. P values: Treatment= 0.31, time= <0.001, time*treatment= 0.37

The results are in accordance with those reported by Mekki et al. (2019) that live weight gain was not affected in Barberine lambs fed pasture and oak acorns as compared to lambs fed on pasture and barley. The results are comparable to that of Al Jassim et al. (1998) as they demonstrated no effect of feeding Awassi lambs on diets containing 25% oak acorns on live weight gain. In the current study the absence of the effect of feeding oak acorns may be attributed to the non-significant effects of acorns on feed intake and/or due to the similar nutritive value of dietary treatments.

2.2.1 Dry Matter Intake: There was no effect of dietary levels of oak acorns on DM intake. Al Jassim et al. (1998) also found

that feeding Awassi lambs on a diet containing 25% oak acorns did not cause significant difference in feed conversion ratio. The use of conservative dose of tannins may explain the absence of an adverse effect of tannins on animal performance (Krueger et al., 2010). It has been shown that many mammals, especially browsers, have the ability to produce proline-rich salivary proteins, these proteins are able to bind to dietary tannins to inactivate them (Austin et al., 1989). The binding of proline-rich salivary proteins and tannins are responsible for astringent taste (Prinz and Lucas, 2008). Proline-rich proteins are not produced by the salivary glands of sheep (Makkar, 2003). Therefore, the absence of significant difference in DM intake due to astringent taste mechanism associated with tannins may not occur in sheep. In addition, the absence of dietary effects of oak acorns on DM intake may be justified also by the findings of Ben Salem et al. (2005) who demonstrated that in lambs, there is a clear adaptation period (from 24 to 72 days) to tanniniferous feeds.

There was a trend ($P=0.07$) in feed conversion ratio of lambs fed on T4 (8.24Kg DM/Kg LBW) which was lower than the means of other groups. Although the lambs fed T4 exhibited the highest daily weight gain that was 24% higher than that of control, but this increase was numerical.

2.2.2. Carcass Traits: The effect of dietary treatments on carcass traits is shown in table 4.

Table 4 Some Carcass Traits of Awassi Lambs Fed Different Levels of Oak Acorns.

Treatment	T1	T2	T3	T4	SED	P value
No. of animals	5	5	5	5		
Slaughter weight kg	29.65	31.6	29.9	32.4	1.87	0.42
Carcass weight kg	14.06	14.81	14.89	14.85	0.92	0.62
Chilled carcass weight kg	13.75	14.46	14.46	14.46	0.85	0.57
Shrinkage %	2.25	2.37	3.01	2.60	0.85	0.82
Dressing %	47.35	46.96	46.4	45.99	1.56	0.83
Rib-eye area mm ²	10.2 ^a	12.75 ^b	9.75 ^a	8.99 ^a	0.81	0.004
Rib-eye depth mm	26.5	28.07	27.26	24.32	2.12	0.36
Back fat thickness mm	1.89	1.91	2.44	2.18	0.41	0.52
Leg weight kg	2.3	2.14	2.08	2.13	0.12	0.36
Lean %	59.29	66.87	57.44	60.3	3.25	0.06
Fat %	19.45	14.93	15.25	16.39	1.71	0.08
Bone %	18.52 ^a	17.53 ^a	22.73 ^b	21.01 ^{ab}	1.55	0.02

Different letters within the same row refers to significant difference, T1: Control, T2: 5% oak acorns, T3: 10% oak acorns, T4: 15% oak acorns, P value: For treatment.

The largest rib eye muscle area (12.75 Cm²) was found in the carcasses of lambs fed on T2 which was significantly ($P=0.004$) higher than that of the other groups. The acorns used in this experiment contained 3.76g condensed tannins/ kg feed DM, thus the lambs fed on T2 received 0.188g condensed tannin/ kg feed DM. The largest rib eye muscle area from lambs fed this treatment might be due to the fact that low levels of tannins in the diet affect the rumen fermentation through decreasing feed protein degradability by making complexes with feed proteins leading to higher non ammonia nitrogen supply to the intestine (Makkar, 2003) and increasing the absorption of amino acids in the intestine (Waghorn and Shelton, 1997). In addition to this, it is evident that low levels of tannins cause to increase the efficiency of microbial protein synthesis in the rumen (Makkar et al., 1998). These two mechanisms are beneficial toward better production in ruminants including meat. Furthermore, high concentration of tannins in the diet cause to decrease nutrient digestibility (Makkar et al., 1995). More studies are needed to determine the optimum level of tannins in the diet as related to positive effects.

The lambs fed on T3 and T4 showed a numerically higher back fat thickness as compared to that of control. This increase in back fat thickness may be explained by the suggestion of Barry et al. (1986) that there is a positive correlation between dietary condensed tannins level and growth hormone which may increase the lipid turnover.

2.2.3. Physical Dissection: The highest mean of muscle percentage in the right leg was found in the carcasses of lambs fed on T2 which was 66.87% of the leg and this tended to be higher ($P=0.06$) than that of lambs the other groups. The mean percentage of fat in right leg of the carcasses of lambs fed on control diet was 19.45% and this tended to be the highest ($P=0.08$) as compared to that of other groups. Lambs Fed on T3 showed a significant ($P=0.02$) increase in right leg bone percentage (22.73%) as compared to that of control (18.52%) and that of lambs fed on T2 (17.53%).

3. CONCLUSIONS

It could be concluded that inclusion of oak acorns up to 15% in the diets of Awassi lambs has no adverse effects on animal performance and carcass characteristics, also no health problems were reported. Further research is needed to study the effect of oaks on meat quality parameters.

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