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Effect of Adding Biochar to Ration on Productive Performance and Some Carcass Characteristics of Iraqi Awassi Lambs

ABSTRACT

This study was conducted at Department of Animal production farm College of Agriculture University of Tikrit from 6/12/2017 until 21/2/2018 (77days) . Sixteen Awassi lambs were used, aged 4-5 months and average weight 23.38±0.14 Kg . Lambs were divided in to four groups (four lambs at each group) according to their weight, treatments distributed randomly into the groups.

Individual feeding was used which included four concentrate diet with different levels of biochar (0% ,1% , 2% and 3%).

Statistical analysis results showed that there was a significant increase ($P<0.05$) in the final weight for second group (1% biochar) compared with fourth group, also result showed a significant increase ($P<0.05$) for second group in the average daily gain and final body gain and feed conversion ratio compared with third and fourth groups. Also significant increase ($P> 0.05$) in the second group in hot and cold carcass weight and in the percentage Dressing based on hot and cold weight, relative to live weight as well as empty body weight and in Rib-eye muscle area compared with the other groups.

INTRODUCTION

Animals production is an important agricultural sector in Iraq and has its own place in the national economy. Sheep are one of the most important animals farm and the main sources of meat production in Iraq ,which is increasing the nutritional awareness of the consumer accompanied by the increase in population(Al-Saigh &Al-kass , 1992) ..Researchers since a long time study the problems affected animal performance and production,they found most important is nutrition, which requires a formula suited to the needs of the animal for rapid growth and increase production especially ruminants (ARC, 1984).The use of some nutritives additives and non-nutritives additive improves growth, increases the efficiency of feed utilization and improves the properties of carcasses (Hassan , 2009) .

Biochar is a non-feed additive in ruminant feed (Gerlach *et al*., 2013), it's refers to the carbon compounds prepared from the remains of some plants and some animal waste (Yalcin and Arol , 2002). The second step is to activate carbonated substances by exposing them to oxidizing agents such as carbon dioxide (CO2) or water vapor, which helps to burn the carbonate materials that block the pores. This helps to increase the surface area of this compound. The process of adsorption is one of the most important properties of biochar (Girgis *et al*., 2002).

Biochar are currently used to feed ruminants like additive because of their adsorption of gases and to provide a favorable environment for microorganisms in the rumen by increase growth of bacteria (Gerlach *et al*., 2013) .Biochar today are considered as non-food additives for animal

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nutrition to improve bowel function by eliminating toxins and impurities in the digestive system, increasing feed intake and improving animal growth (Strahsaker *et al*., 1997; Villalba *et al*., 2002). In view of the above, biochar was used in this study as non-feed additives for the Awassi lambs feed to study its effect on the productive performance and the characteristics of its carcasses.

MATERIALS AND METHODS

This study was conducted at the college of Agriculture-University of Tikrit from 6/12/2017 until 21/2/2018 (77days). Sixteen Awassi lambs were used, they were bought from local farms aged 4-5 months and average weight of 23.38± 0.14 Kg. Lambs divided in to four groups according to their weight, each group had four lambs , then distributed the treatments randomly on to the groups .

The Lambs feed individual with different levels of biochar (0 , 1 , 2 and 3) % respectively . The lambs were numbered with plastic figures then placed in cages of 1×2 m² in a semi - enclosed. Each cage was equipped with plastic containers for concentrate feed, roughage and water . Straw was used as a source of roughage, and soybean meal corn with barley used as sources of protein and energy, as well as a mixture of minerals, vitamins and salt .The lambs were fed on experimental diets for two weeks as adaptation period before starting the experiment and then weighed for two days at 8 am after fasting 12 hours for the purpose of fixing the primary weight. The weighting process continued on a weekly basis before feeding in the morning using an balance weight with Iron box . Until the end of the experiment to calculate the average daily gain and the amount of feed provided to animals was adjusted according to the new weight per week, diet was provided once a day at 8:00 am by 3% of the body weight throughout the trial . 350 g straw / animal / day as a dry matter were added . The animals were in good health, with no disease or digestive disorders observed until the end of the experiment.

Slaughtering lamb

The lambs were weighed at the end of the experiment, which they were fasted for 12 hours before slaughter, while the water was left. Twelve lambs were slaughtered (three lambs from each treatment) and emptying the contents of the gut and then weighing the head, skin, gastrointestinal tract, empty gut, heart, liver, lungs, spleen, testicles, and the abdominal fat. Then recorded hot carcass weight . The carcasses were remained in the refrigerator for 24 hours at 4 ° C, then recorded the cold carcass weight (Field *et al.*,1963) .

Dressing percentage

Dressing percentage(1)= weight of hot carcass to live body weight x 100

Dressing percentage (2)= weight of hot carcass to the weight of the empty animal × 100

After cooling for 24 hours at a temperature of 4 ° C to extract the percentage of recovery based on the weight of the cold carcass as follows:

Dressing percentage (3)=weight of cold carcass to live body weight x 100

Dressing percentage (4)= weight of cold carcass to empty animal weight × 100

As reorted by (Bowman *et al.*,1968)

Longissimus dorsi Area

A long cross-section of the long dorsi (Longissimus dorsi) was drawn between the twelve and thirteenth ribs on Trace paper based on the way (Riley et al., 1966) measured by a Placom-digital Planimeter, three readings for each sample were taken to get the most accurate reading. . As mentioned by (Riley *et al*., 1966)

Thickness Fat on rib eye muscles

The thickness of the fat layer on the 12th rib of the left part of each carcass was measured by Digital Vernier and two readings were taken to obtain the most accurate reading for each sample. As mentioned by (Riley *et al*., 1966)

Table (1): The proportions and components of the feed used in the experiment (%) and the chemical composition of the feed based on g / kg dry matter

Feed materials	Feed Groups			
	First 0 biochar%	Second 1 biochar%	Third 2biochar %	Fourthbiocha 3%
Barly	30			
Soybean meal	10			
yellow corn	30			
Wheat bran	28			
Vitamins and salts	2			
	Gram\kg			
Crud protein (CP)	140.0			
Organic matter (OM)	964.40			
Ether Extract (EE)	30.10			
Crud Fibers (CF)	63.90			
Ash	35.60			
NFE Extract *	730.40			
Energy metabolism **	13.15			
NFE=Nitrogen Free Extract *NFE=OM-(CP+CF+EE) Maaf 1977 **Calculated metabolic energy by ME(MJ\KgDM)=0.012*CP+0.031*EE+0.005*CF+0.014*NFE				

The data were analyzed using complete random design (CRD) to study the effect of the coefficients in the studied traits. Significant differences were compared between the averages using the Duncan Multidisciplinary Test (Duncan, 1955). By using statistical program SAS (2001) according to statistical equation to the model.

$Yij= \mu+Ti+eij$

Yij = the transaction value of j for transaction i

μ = The general mean of the studied character

Ti = the effect of transaction i since i = 4,3,2,1

eij = random error distributed by natural and independent distribution with an average of zero and an equal variation of δe^2.

RESULTS AND DISCUSSION

Effect of adding biochar on performance of awassi lambs :

The second treatment with (1% biochar) showed significant effect ($P < 0.05$) in the final weight compared with the forth treatment (3 % biochar) , also showed significant ($P < 0.05$) effect in the total weight and average daily gain (16.68 kg and 216 g/day) compared with Third and forth treatment(14.35 , 13.92 kg,185.75 and 180.50 g / day) respectively (Table, 2) . The reason for the positive performance of The second treatment (1% biochar) was an increased on bacterial population , led to formation of several colonies called biofilm (Leng *et al*, 2012) which supported increased digestion of dry matter and organic matter cause the benefit of the diet. the significant lowered performance on the 2% and 3% of biochar treatment may be lower efficient of microorganisms and increased adsorption urea or nitrogen in the pores of the biochar make these substances unavailable for the microorganism this effected microble protein production.

Further explanation was that no significant differences between adding 1 % biochar and 0% (control), although 9 % improvement in average daily gain with adding biochar 1%, it may be due to diets contain energy and protein suitable for lambs .It may be conclude that biochar more effected with poor diets (Erickson *et al*., 2011) and level of biochar added to the feed (Chu *et al*., 2013) .The results

of this study were consistent with studies by Van *et al*. (2006) ; leng *et al*. (2012) ; Silivong and Preston ,(2015) ; Vongkhamch *et al.* (2018) ; Khoa and Thang. (2018) and Saroen and Preston, (2018) indicating improvement in growth rate and feed conversion by adding biochar for cattle and goats feed . There was little defferences with feed intake and feed conversion ratio between treatments.

Table (2) Effect of the use of different percentages of biochar on performance of awassi lambs (mean ± standard error).

Traits / Treatment	initial weight (kg)	Final weight gain (kg)	Total weight (kg)	Average daily gain (gm)	Total feed intake)Straw + center) Gm	Total Feed conversion ratio dry matter / gm increase in weight
T1	0.19 ±23.8	0.54±39.0 ab	0.51±15.20 ab	6.69±197.0 ab	14.73±1454.7 a	0.18±7.39 ab
T2	0.29±23.02	0.90±39.70 a	0.67±16.68 a	8.67±217.0 a	20.17±1436.37 ab	0.18±6.66 b
T3	0.16±23.72	0.63±38.07 ab	0.61±14.35 b	7.92±185.75 b	11.05±1440.95 a	0.40±7.53 ab
T4	0.29±23.0	0.41±36.92 b	0.65±13.92 b	8.50±180.50 b	10.93±1392.92 b	0.36±7.76 a
General average ± standard error	0.14±23.38	0.39±38.42	0.38±15.04	5.01±194.81	8.88±1431.23	0.17±7.34
Significant level	N.S	*	*	*	*	*

*The vertically different numbers within the one character indicate that there is a significant difference below the probability level (P <0.05).
T1 = ingredients of the diet + Zero biochar, T2 = ingredients of the diet + 1% biochar, = T3 ingredients of the diet +2% biochar T4 = ingredients of the diet + 3% biochar.

The Effect of Adding Biochar on carcass Characteristics of Awassi lambs:

The results of the statistical analysis in table (3) showed that the second treatment was significantly higher (P <0.05) in the weight of the hot and cold carcass (20,306 and 19,793) kg respectively compared the first treatment (18.426 and 17.713 kg) respectively and the third treatment (18.280 and 17.890) Kg respectively and the fourth (18.133 and 17.756 kg), respectively. Also the results founded significant (P <0.05) differences in each of the percentage of reflux on the basis of the weight of warm relative to the live weight and the percentage of reflux on the basis of cold weight in relation to the live weight and the percentage of reflux on the basis of the weight of warm to weight empty body and the percentage of recovery on the basis of cold weight compared to the weight of the empty body (52.16, 50.85, 59.68 and 58.18) % respectively compared to the first treatment (47.67, 45.81, 55.05 and 52.92) % respectively and the third treatment (48.27, 47.24, 55.61 and 54.42) % Respectively and the fourth (48.78, 47.77, 55.28 and 54.14) % respectively. Table (3) shows a significant increase (P <0.05) in the area of the ocular muscle in favor of the second treatment 10.80 cm^2 compared to the first treatment 9.63 cm^2.

The results of the statistical analysis in Table (3) indicate that there were no significant differences between the different treatments in subcutaneous fat thickness (2.43, 2.03, 2.53 and 2.43) Mm for the first to fourth treatments respectively. The increase in the weight of the carcasses for the 1% biochar may be due to the higher final weights of the lambs compared to the other treatment . These results were consistent with Al-Mahdawi (2002) which observed that the increase in the weight of the live animal caused an increase in the weight of the carcass. The reason for the increase in the

percentage of reflux for the second treatment was probably due to the increase in the final weight of the second treatment.

The superiority of the second treatment in the area of the ocular muscle was somewhat consistent with the observed increase in the weight of the warm and cold carcass (Table 3). This is an inevitable result of the high and negative correlation between 0.95 and the cold carcass weight (Al-Mahdawi, 2002). The increase in the amount of microbial protein, the increase in animal protein availability due to biofuels, and the increase in microorganisms, improve fermentation and increase the efficiency of feed intake, which is reflected in production (LongThuy *et al*., 2018).

Table (3) Effect of adding different level of biochar on some characteristics carcass of Awassi lambs (values represent averages ± standard error)

Traits / Treatment	Final weight (kg)	Hot carcass weight (kg)	Cold carcass weight (kg)	Dressing percentage (1)	Dressing percentage (2)	Dressing percentage (3)	Dressing percentage (4)	area Longissimu Dorsi Cm^2	Fat thicknes Mm
T1	0.54±39.0 ab	0.08±18.42 b	0.28±17.71 b	0.54±47.67 b	0.41±45.81 c	0.60±55.05 b	0.96±52.92 b	0.38±9.63 b	0.20±2.43
T2	0.90±39.70 a	0.49±20.30 a	0.47±19.79 a	0.66±52.16 a	0.75±50.85 a	0.40±59.68 a	0.59±58.18 a	0.20±10.80 a	0.08±2.03
T3	0.63±38.07 ab	0.37±18.28 b	0.39±17.89 b	0.30±48.27 b	0.27±47.24 bc	0.55±55.61 b	0.44±54.42 b	0.15±9.90 ab	0.08±2.53
T4	0.41±36.92 b	0.29±18.13 b	0.24±17.75 b	0.13±48.78 b	0.09±47.77 b	0.22±55.28 b	0.39±54.14 b	0.37±9.80 ab	0.21±2.43
General average ± standard error	0.39±38.42	0.30±18.78	0.30±18.28	0.56±49.22	0.58±47.91	0.60±56.41	0.65±54.91	0.18±10.03	0.08±2.35
Significant level	*	*	*	*	*	*	*	*	NS

*The vertically different numbers within the one character indicate that there is a significant difference below the probability level (P <0.05). T1 = ingredients of the diet + Zero biochar, T2 = ingredients of the bush + 1% biochar, = T3 ingredients of the diet + biochar (2%, T4 = ingredients of the diet + 3% biochar.

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تأثير اضافة الفحم الحيوي الى العلائق في الاداء الانتاجي للحملان العواسية وبعض صفات ذبائحها

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المستخلص

أجريت هذه الدراسة في حقول الأنتاج الحيواني في كلية الزراعة – جامعة تكريت للمدة من 2017/12/6 ولغاية2018/2/21 (77يوم) . واستعمل في هذه التجربة 16 حملاً عواسياً تراوحت أعمارها ما بين 4–5 أشهر وبمعدل وزن 23.38± 0.14كغم. وزعت الحملان إلى أربعة مجاميع تغذوية حسب الوزن وضمت كل مجموعة 4 حملان ثم وزعت المعاملات عشوائياً على المجاميع. واتبع في هذه التجربة نظام التغذية الفردية لعليقة واحدة مع مستويات مختلفة من الفحم الحيوي (0% , 1% , 2% , 3%) . أشارت نتائج التحليل الإحصائي إلى ظهور زيادة معنوية في معدل الوزن النهائي لصالح المعاملة الثانية (39.07) كغم مقارنة بالمعاملة الرابعة (36.95) كغم ، كما أظهرت تحسناً معنوياً($P> 0.05$) في كل من معدل الزيادة الوزنية الكلية والزيادة الوزنية اليومية وكفاءة التحويل الغذائي لصالح المعاملة الثانية مقارنة بالمعاملات الثالثة والرابعة .كما أشارت النتائج الى تفوق المعاملة الثانية معنوياً ($P>0.05$)في كل من وزن الذبيحة الحار والبارد وفي نسبة التصافي على أساس الوزن الحار الى الحي والبارد الى الحي كذلك نسبة التصافي على أساس اوزن الذبيحة الحار الى الفارغ والبارد الى الفارغ وفي مساحة العضلة العينية مقارنة ببقية المعاملات .

الكلمات المفتاحية : الحملان العواسية ,الفحم الحيوي , الأداء الإنتاجي , صفات الذبيحة