



## EFFECT OF DIFFERENT LEVELS OF SOYBEAN MEAL IN FATTENING FARMER DIET ON AWASSI LAMBS PERFORMANCE AND CARCASS CHARACTERISTICS

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### ABSTRACT

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The study was carried out at the farm located at the Animal Production Farm, College of Agriculture, University of Tikrit for a period of 70 days excluding 14 days as an adaptation period (from 8<sup>th</sup> October to 16<sup>th</sup> of December 2020). The aim of this study find alternative diets for fattening Awassi lambs in the northern region and improved protein of barley. Sixteen Awassi lamb were used, aged 5-6 months, with an average starting body weight of  $26.2 \pm 0.3$  kg. Four formulation diets were randomly allocated to four groups of animals. Group one ( control) 98% barley, Group two (88% barley, 5% soybean meal, 5% vegetable fat), Group three (83% barley, 10% soybean meal, 5% vegetable fat), Group four ( 78% barley, 15% soybean meal, 5% vegetable fat). All the experiment diets were supplemented with 1% salts and 1% vitamins and minerals. The lambs were fed concentrate feed at 3% of live body weight on a dry matter basis with 100 grams of roughage (straw) day/lamb. The results showed that animals in group 2 (T<sup>2</sup>), group3 (T<sup>3</sup>) and group 4 (T<sup>4</sup>) significantly ( $P \leq 0.05$ ) higher final body weight, average daily body weight gain and feed conversion ratio, then those from (T<sup>1</sup>) . Moreover , animals from T<sup>3</sup> and T<sup>4</sup> had significant ( $P \leq 0.05$ ) higher production performance compared to those in T<sup>2</sup> . The weights of hot , cold carcass, and the three main carcass cuts (leg, shoulder, and rack) were ignorantly ( $P \leq 0.05$ ) heavier in T3 and T4 then other groups .The lambs in T3 andT4were also showed ( $P \leq 0.05$ ) larger eye muscle area then T1 and T2. There were no significant differences in dressing-out %,or fat thickness between the treatment groups .

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### INTRIDUCTION

Sheep are one of the main sources of meat production in Iraq, which numbered 6.6 million in 2018 and is a valuable source of meat and dairy production (FAO, 2018). Sheep meat is characterized by its high biological value proteins, minerals and vitamins for human nutrition (Corazzin *et al.*,2019). The quantity of its consumption comes second after poultry, which is an important source of domestic income for farmers, due to the low maintenance and feeding costs compared to livestock (Khoshnaw, 2009). The traditional production system for fattening lamb includes feeding barley grain that low in protein concentration, which probably led lower animal performance and it will take longer period to reach marketing body weight without supplementation (Santra and Karim, 2000 ; Bahtti, 2013). Studies have investigated increasing animals' performance by using different

formulation diets (Taher, *et al.*, 1987). Oliveira, *et al.*, (2009) and Ebrahimi, *et al.*, (2007) stated that increasing the level of protein and energy concentrations in ruminants' diet will improve the feed conversion ratio and reduce the period to reach a slaughter weight. In this respect, Qasim *et al.*, (1993) added non-protein nitrogen sources to barley to improve the efficiency of animal utilization. Soybean meal was used in a large scale in formulation for livestock (Rodrigues, *et al.*, 2013), due to its high protein content for growing lambs (Ružić-Muslić *et al.*, 2014). Adding fats source is important in the formulation diet of livestock, not only because it provides essential fatty acids and fat-soluble vitamins, but to increase the density of dietary energy in the diet by approximately 2.25% more than carbohydrates (NRC, 2007) and to increase the digestible energy used for growth (Renaudeau, *et al.*, 2012) also improved the level of fatty acids (FA) in meat (Francisco, *et al.*, 2015). This study was designed to study the effect of different levels (0, 5, 10 and 15%) of soybean meals as a source of protein to improve Awassi lamb's performance in the Northern region of Iraq.

### MATERIALS AND METHODS

The study was carried out at the farm located at the Animal Production Farm, College of Agriculture, University of Tikrit, for a period of (70) days, from 8<sup>th</sup> of October 2020 to 16<sup>th</sup> of December 2020 excluding 14 days as an adaptation period. Sixteen Awassi lambs aged 5-6 months with an average weight  $26.2 \pm 0.3$  kg. The lambs were randomly divided into four experimental diet groups (n=4). Group one (T1) control diet contained 98% barley (used by local farmer), Group2 (T2) diet contained 88% barley, 5% soybean meal, 5% vegetable fat, Group 3 (T3) diet contained 83% barley, 10% soybean meal, 5% vegetable fat, and Group (T4) diet contained 78% barley, 15% soybean meal, 5% vegetable fat. All the experimental diets were supplemented with 1% salts and 1% minerals and vitamins (Table 1). The experimental diet composition is shown in table (2) according to the A.O.A.C. (2002). The lambs were fed experimental diet at 3% of live body weight as a dry matter. The animals were received the experimental diet twice a day (8 am and 4 pm), water was available *ad libitum* and each animal also received 100 grams of straw per day. The refused feed was weighed daily to calculate the amount of feed consumed (offered - refused). Lambs were weighed weekly and periodically before feeding in morning, using electronic scale until the end of experiment to calculate weights of animals, and amount of feed provided was adjusted according new weight. The lambs were housed in semi-open pens divided into individual cages with 1x2m containing feeder and water trough. The lambs were examined by the qualified veterinarian to ensure that they were healthy during experimental period.

Table (1): The ingredients of experimental diets (%).

Treated	T1	T2	T3	T4
Meal material				
Black crushed barley	98	88	83	78
Soybean meal	0	5	10	15
Vegetable fat	0	5	5	5
Salts	1	1	1	1
Vitamins and minerals	1	1	1	1
Total	100	100	100	100

Table (2) The chemical composition of the concentrate experiment diets (g / kg).

Nutritional elements Diets	Dry matter	Organic matter (g / kg)	Crude protein (g / kg)	Crude fiber (g / kg)	Ether extract (g / kg)	Nitrogen-Free Extract* (g / kg)	Ash (g / kg)	Metabolizable energy ** MJ / Kg
Treatment 1	960.8	952.96	116.62	72.52	26.46	737.36	47.04	12.90
Treatment 2	960.5	953.46	127.22	68.67	76.71	680.86	46.54	13.57
Treatment 3	958.2	951.56	143.77	68.52	78.31	660.96	48.44	13.49
Treatment 4	955.9	949.66	160.32	68.37	79.91	641.06	50.34	13.41

\*Nitrogen-Free Extract (NFE )= OM –(CP+CF+EE) from AFRC(1987).

\*\*Metabolic energy was calculated according to MAFF ( 1975).

ME (MJ/Kg DM) = 0.012\*CP+ 0.031\*EE+0.005\*CF+0.014\*NFE.

### carcass characteristics:

At the end of the experimental period, the lambs were weighed in the morning and considered as final body weight, Then, three animals from each treatment were randomly selected (12 animals) were slaughtered according to Halal slaughter method at the Animal Experimental Station ,College of Agriculture, University of Tikrit. Twelve hours before the slaughter lambs feed was removed. Carcasses were weighed and considered as the hot carcass weight. The carcasses were kept in a chiller of (2-4°C) for 24 hrs, (Field, *et al.*, 1963), then the cold carcasses weight was recorded .The fat tail was removed and weighed Each carcass was cut longitudinal into right and left sides. The right side of each carcass was cut into two halves, front and back from the rib area 12-13, and then it was cut into three regions (shoulder, Rack, Loin, Leg) and the left side was cut into four pieces (neck, Shank, Breast, Flank) and each piece was weighed individually (bowman, *et al.*, 1968). The cutting process was carried out using an electric saw (H-Kitchen - Chinese origin), each piece was weighed using an electronic scale , and the eye muscle area was drawn between the rib twelfth and thirteenth using wax paper and measured by Planimeter Racom –Digital ( Japanese made), An average of three readings were taken for each sample in order to obtain the most accurate readings, and the thickness of the fat over the eye muscle was measured by digital Vernier (Delfa *et al.*, 1996).

### statistical analysis

Data were analyzed by Statistical Analysis using the (CRD) design by Anonymous (SAS. 2003), according to the following model:

$$Y_{ijk} = \mu + t_i + e_{ijk}$$

Standard errors, differences within means were calculated by Duncan, 1955 test (Steel and Torrie., 1984).

## RESULTS AND DISCUSSION

### initial and final weights:

The findings related to growth performance (initial and final weights) are given in Table (3). Final weight of Awassi lambs improved significantly ( $P \leq 0.05$ ) were found in treatments T2 , T3 and T4 compered withT1, Although there were no significant differences in the amount of feed intake (dry matter). This indicates may be added an amount of SBM and fat stimulate growth of micro-organisms in the rumen led to Improve

production of microbial protein . Added fats helped to provide the necessary energy to diet this correspond to what Mahmoud, (2013) and Muruz, *et al.*, (2017) and Abbasi, *et al.*, (2014).

**Average daily gain(adg) and total weight(tw):**

The current results showed significant differences ( $P \leq 0.05$ ) between the treatments in the average daily gain (ADG) for Awassi lambs (Table 3). The lambs from treatments 2,3 and 4 had significantly ( $P \leq 0.05$ ) higher ADG with average 0.193, 0.240 and 0.245) kg/day/lamb respectively than treatment 1 (0.141 kg/day/lamb). The differences may be probably due to soybean supplementation completed the insufficient amount of the protein content in the barely portion of the diet. Similar conclusion was stated by Muruz, *et al.*, (2017).

Table (3): performance of Awassi lambs as affected by protein ratio (kg).

Variables	Mean $\pm$ standard error			
	T1	T2	T3	T4
Initial weight	26.45 1.06 $\pm$	26.00 1.22 $\pm$	26.35 1.02 $\pm$	26.22 1.04 $\pm$
Final	36.30 c 0.919 $\pm$	39.57 b 1.257 $\pm$	43.15 a 1.33 $\pm$	43.43 a 1.49 $\pm$
Total weight gain	9.85 c 1.31 $\pm$	13.57 b 0.865 $\pm$	16.80 a 0.94 $\pm$	17.21 a 1.151 $\pm$
Average daily gain	0.141 c 0.018 $\pm$	0.193 b 0.012 $\pm$	0.240 a 0.013 $\pm$	0.245 a 0.016 $\pm$
Dry matter intake Concentrate with 100g lambs day straw	0.993 0.057 $\pm$	1.043 0.30 $\pm$	1.097 0.042 $\pm$	1.071 0.086 $\pm$
Feed conversion ratio	7.78 c 0.35 $\pm$	5.43 b 0.037 $\pm$	4.66 a 0.026 $\pm$	4.53 a 0.04 $\pm$

\* The different letters within the column indicate the presence of significant differences at the level of ( $P \leq 0.05$ ).

The animals from treatments 3 and 4 had significantly higher ADG than those from treatment 2. This study indicated that 5% of the soybean meal in the second treatment was not sufficient to supply enough protein source for optimum of microbial growth compared to 10 or 15% soybean. This study also revealed that 15% of soybean meal in lamb diet did not significantly exceed the 10%, which indicated that increasing the soybean meal for more than 10% may be not necessarily improve animal performance. In contrast, Muruz, *et al.*, (2017) found significant improvement in weight gain of Barbary lambs that were fed diet with 17% of protein. The benefit of increasing level of soybean meal in the present study to improve the total weight gain as showed in table (3) (9.85, 13.57, 16.80 and 17.21) kg for the first, second, third and fourth treatments, respectively.

**Dry matter intake and feed gain ratio:**

The present results showed that there were no significant differences between the four treatments in feed intake .This may be due to the restricted percentage of feed (3% concentrate and 100 g / lamb/ day straw) offered to the experimental lambs The lambs from group 2 (4.87), 3 (4.16) and 4 (3.96) had significantly(  $P \leq 0.05$ ) better feed gain ratio than lambs from group 1 (6.22). Moreover, the animals from group 3 and 4 had significantly ( $P \leq 0.05$ ) better feed conversion efficiency than those from group 2, which indicated that 5% soybean meal is not sufficient with barley to enhance fattening of lambs. Similar results were reported by Abbasi, *et al.*, (2014); Muruz, *et al.*, (2017) and Mahmoud, (2013). In

contrast with the present conclusion, Lv *et al.*, (2020) stated that lambs that fed diets containing different levels of protein (11.8 and 15.7%) did not have any significant improved in the dry matter intake, weight gain and feed conversion efficiency.

**Carcass characteristics:**

The present results showed (Table 4) that lambs from treatments 3 (23.145) and 4 (23.560kg) had significant ( $P \leq 0.05$ ) higher hot carcass weights than those from treatments 1 (19.713) and 2 (19.773 kg). The animals from treatments 3 and 4 had also significantly ( $P \leq 0.05$ ) higher cold carcass weights than those from treatments 1 and 2. The percentage of shrinkage in carcass after 24 hrs post with average 1.85, 2.05, 1.95 and 1.95 % for treatment 1,2,3 and 4, respectively. The improvement in hot and cold carcass weight of Awassi lambs from group 3 and 4 might be due to significantly high final live body weight than those from treatment 1 and 2. The current study also revealed that no significant differences between treatments 1 and 2 and between treatments 3 and 4. These results are consistent with that found by Shams El-Din, (1997); . Miltko, *et al.*, (2019) and Alves *et al.*, (2016). The latter authors reported that feeding Brazilian lambs on diets containing soybean meal showed significant differences ( $P \leq 0.01$ ) in hot carcass weight and cold carcass weight. In contrast with the present study, Rocha *et al.*, (2004) found that no differences in hot carcass weight and cold carcass weight between treatments of lambs fed with different levels of crude protein (14, 16, 18 and 20%).

**Dressing -out percentage**

There were no significant differences between four groups in the Dressing-out percentage calculated from hot or cold carcass weight (HCW or CCW) /empty body weight% ( Table 4). These results in agreement with the results of Sayed (2009) and Ekiz, *et al.*, (2019).

Table (4) Effect of different levels of soybean meal on Carcass characteristics of Awassi lambs.

Variables	Mean ± standard error			
	T1	T2	T3	T4
Hot carcass weight (HCW, kg)	19.713 b 0.813±	19.773 b 0.436±	23.145 a 0.933±	23.560 a 1.263±
Cold carcass weight (CCW, kg)	19.353 b 0.809±	19.340 b 0.431±	22.680 a 0.960±	23.085 a 1.238±
Dressing-out percentage on the basis of HCW /empty body weight%	58.44 0.008±	58.46 0.012±	58.82 0.007±	58.58 0.011±
Dressing-out percentage on the basis of CCW /empty body weight%	57.37 0.008±	57.19 0.013±	57.62 0.008±	57.40 0.011±
Weight loss percentage of carcasses%	1.85 0.0008±	2.05 0.0025±	1.95 0.0022±	1.95 0.0002±
Fat thickness (mm)	2.940 0.40±	3.142 0.70±	3.305 0.28±	2.940 0.27±
Ocular muscle area cm <sup>2</sup>	11.600 ab 0.67±	10.525 b 0.75±	12.950 a 0.61±	12.850 a 0.43±

\* The different letters within the column indicate the presence of significant differences at the level of ( $P \leq 0.05$ ).

**Eye muscle area and fat thickness :**

The results of the current study showed significant differences between four treatments in the measurements of the eye muscle area (EMA) (Table (4)). The EMA from animal carcasses from treatments 3 (12.950) and 4 (12.850 cm<sup>2</sup>) had significantly ( $P \leq 0.05$ ) than those from treatments 1 (11.600) and 2 (10.525 cm<sup>2</sup>). These results are in agreement with Al-Mallah (2007), who indicated a relationship between the EMA and the muscle content. Similarly, Shams al-Din (1997) and Zinn (1989) also found significant differences in the area of the eye muscle when using different levels of Fat and barley in fattening diets for growing calves. Table (4) also showed no significant differences between the four treatments in the thickness of the subcutaneous fat over the EMA. These results were also in agreement with Ebrahimi, *et al.*, (2007), who found that no effect of different levels of crude protein (10.5, 12.5, 14.5%) on subcutaneous fat thickness of Mehraban sheep. In contrast, Ruíz Nuño, *et al.*, (2009), who found a linear increase in the thickness of the fat layer (1.42, 2.10, 2.18 mm) in Billy Puyi lambs when fed on high-energy diets with levels of crude protein (14, 16, 18%).

**carcass Commercial of cuts :**

Carcasses from treatments 3 had significantly ( $P \leq 0.05$ ) heavier shoulder weight than the treatment 1 (Table (5)), while there were no significant differences between treatments 2 and 4. Carcasses from treatment 4 had significantly ( $P \leq 0.05$ ) heavier rack weight than the treatment 2. On the other hand, carcasses from treatment 4 contained significantly ( $P \leq 0.05$ ) heavier leg weight than those from treatments 1 and 2. While there were no significant differences between the four treatments in the weight of the loin piece.

Table (5) The effect of treatments on Carcasses pieces weight (kg).

Variables	Mean $\pm$ standard error			
	T1	T2	T3	T4
shoulder	1.461 b 0.13 $\pm$	1.665 ab 0.06 $\pm$	1.891 a 0.08 $\pm$	1.830 ab 0.18 $\pm$
Rack	0.806 b 0.05 $\pm$	0.791 b 0.01 $\pm$	0.876 ab 0.01 $\pm$	0.936 a 0.05 $\pm$
Loin	0.945 0.13 $\pm$	0.812 0.03 $\pm$	0.941 0.01 $\pm$	0.966 0.03 $\pm$
Leg	2.710 b 0.07 $\pm$	2.786 b 0.007 $\pm$	3.146 a 0.13 $\pm$	3.247 a 0.17 $\pm$

\* The different letters within the column indicate the presence of significant differences at the level of ( $P \leq 0.05$ ).

The effect of soybean meal levels on the neck, breast, flank and shank cuts of lam carcasses are shown in Table 6. The results indicated that lamb carcasses from treatment 3 had significantly ( $P \leq 0.05$ ) heavier neck cut than those from treatment 1. Table 6 is also revealed that lamb carcasses from treatment 4 contained significantly heavier flank cut than treatments 1 and 3. The current study showed no significant differences between the four treatments in the weight of the breast cuts.

Table (6) The effect of treatments on the commercial cuts.

Variables	Mean ± standard error			
	T1	T2	T3	T4
Neck / kg	0.676 c 0.02±	0.797 bc 0.04±	0.856 ab 0.02±	0.945 a 0.06±
Breast / kg	1.242 0.20±	1.052 0.10±	1.131 0.05±	1.160 0.10±
Flank / kg	0.282 b 0.03±	0.340 ab 0.02±	0.301 b 0.03±	0.412 a 0.01±
Shank / kg	0.716 b 0.03±	0.725 ab 0.01±	0.740 ab 0.03±	0.817 a 0.02±

\* The different letters within the column indicate the presence of significant differences at the level of ( $P \leq 0.05$ ).

**tissue in leg:**

Table (7) shows an improvement in muscle weight content with the leg from the treatment 3 had significantly ( $P \leq 0.05$ ) heavier muscle weight (1.968 kg) then those from treatments 1(1.618) and 2 (1.738 kg) and leg from treatment 4 contained significantly ( $P \leq 0.05$ ) more muscle weight (1.848 kg) than those from treatment 1(control). Table 6 also showed that leg from treatment 4 contain significantly ( $P \leq 0.05$ ) more fat (0.836 kg) than treatments 1 and 2 (0.623 and 0.534 kg, respectively). The leg from treatment 4 also contained significantly ( $P \leq 0.05$ ) more bone (0.536 kg) than from treatment 1 (0.447) kg.

The difference in leg tissue components may be due to the increase in the final body weight of the lambs from treatments 3 and 4, which were fed diets containing a higher energy and protein level than treatments 1 and 2. The high protein level might be contributed to increase the amount of muscle fat and bone components.

This study indicated that diet with 10% soybean meal led to a significant increase in muscle tissue in lamb's leg It was also present study indicated that barley is low in protein content, which it I insufficient to provide adequate amount of protein for micro flora in the rumen. Moreover, supplementation of 5% soybeans meal does not met the nutritional needs of Awassi lambs.

Table (7): separable tissue in cuts components (meat, fat, and bone) for treatments (kg).

Variables	Mean ± standard error			
	T1	T2	T3	T4
Leg weight	2.710 b 0.080±	2.786 b 0.010±	3.176 a 0.132±	3.247 a 0.160±
Muscle weight	1.618 c 0.076±	1.738 bc 0.022±	1.968 a 0.053±	1.848 ab 0.094±
Fat weight	0.635 b 0.027±	0.552 b 0.021±	0.709 ab 0.070±	0.853 a 0.081±
Bone weight	0.457 b 0.013±	0.496 ab 0.017±	0.499 ab 0.021±	0.546 a 0.025±

\* The different letters within the column indicate the presence of significant differences at the level of ( $P \leq 0.05$ ).

## CONCLUSION

It was concluded that fattening lamb given barely with 10%soybean meal improved performance of Awassi lamb (live body weight, feed efficiency and improve some Carcass characteristics). Although barely with 15% soybean improved performance of Awassi lamb but increased fat content .

### تأثير مستويات مختلفة لفول الصويا في علائق تسمين الحملان العواسية على الاداء الانتاجي وبعض صفات الذبيحة

فارس صباح عواد مخلف الدليمي طاهر عبد اللطيف شجاع ميسلون وائل إبراهيم  
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### الخلاصة

أجريت هذه الدراسة في الحقل الحيواني, قسم الإنتاج الحيواني, كلية الزراعة, جامعة تكريت, لمدة 70 يوماً سبقتها 14 يوم فترة تمهيديه اعتباراً من تاريخ 2020/10/8 ولغاية 2020/12/16. إن هدف هذه الدراسة هو لإيجاد علائق بديلة لتسمين الحملان العواسية في المنطقة الشمالية وكذلك تحسين البروتين الخام في الشعير. استعمل ستة عشر حمل عواسي بعمر (5-6 اشهر) وبمعدل وزن (26.2 ± 1.2 كغم) الى اربع مجموعات (n=4). أعطيت المجموعة الاولى T1 98% شعير(عليقة المربي) والثانية T2 88% شعير +5% فول الصويا +5% دهن نباتي والثالثة 83% شعير +10% فول الص+5% دهن نباتي والرابعة 78% شعير +15% فول الصويا+5% دهن نباتي وتم اضافة 2% املاح ومعادن وفيتامينات لكل المجموعات. غذيت الحملان اعلاف مركزة على اساس المادة الجافة بنسبة 3% من الوزن الحي اضافة الى 100 غرام/حمل/يوم تبن الشعير. وزنت الحيوانات اسبوعياً وتم تعديل كمية العلف المقدمة حسب الوزن الجديد. أظهرت نتائج التحليل الاحصائي عدم وجود فروقات في معدل الوزن الابتدائي ولكن تفوقت المعاملات الثانية والثالثة والرابعة معنوياً (P≤0.05) على المعاملة الاولى في الوزن النهائي. معدل الزيادة اليومية بالوزن وكفاءة التحويل الغذائي, كما تفوقت المعاملات الثالثة والرابعة (P≤0.05) على المعاملة الثانية في معدل الزيادة اليومية بالوزن, الوزن النهائي وكفاءة التحويل الغذائي, لم يكن هنالك فروقات معنوية في كمية العلف المستهلك. كما وجدت فروقات معنوية (P≤0.05) في وزن الذبيحة الحار والبارد واوزان القطعيات الرئيسية (الفخذ , الكنتف , الاضلاع) ومساحة العضلة العينية لصالح المعاملتين الثالثة والرابعة, بينما لم تكن هناك فروق معنوية بين المعاملات الاربعة في نسبة التصافي واوزان القطعيات الثانوية وسمك طبقة الدهن.  
**الكلمات المفتاحية:** نسبة البروتين, تسمين الحملان, صفات الذبيحة, الحملان العواسي.

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