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EFFECT OF IMPLANT DIFFERENT LEVELS OF ZERANOL ON GROWTH PERFORMANCE, CARCASS TRAIT AND BODY COMPOSITION OF AWASSI LAMBS

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ABSTRACT

A total of 30 weaned Awassi lambs (3-4 months) with an average body weight of 28.10 ± o.64 kg were divided equally and randomly into 3 groups. The first was left intact, while the 2nd and 3rd groups were implanted with zeranol at the rate of 12 and 24 mg, respectively. Each group was kept in a separate pen and fed concentrate (15.067 % C.P. and 2950 kcal/kg) ad lib till they were slaughtered at 40 kg body weight. Results revealed that daily gain, dressing percentage based on body weight and rib eye area averaged 0.212 ± 0.007g, 50.17 ± 0.36 % and 12.88 ± 0.29 $cm^{2,}$ respectively, and the differences among treatments were not significant. Fat thickness over L.dorsi muscle was significantly (p<0.05) thinner in lambs received 24 mg zeranol as compared with other treatments. Also, it appears that implanting lambs with zeranol resulted in a significant (p<0.01) increase in the percentage of lean and a reduction in fat percentage of the carcass. Intact lambs had significantly (p<0.05) higher total body fat (6.94 ± 0.22 kg) as compared with lambs implanted with 12 mg (6.15 ± 0.21 kg) and lambs implanted with 24 mg zeranol (5.94 ± 0.29 kg). This reduction was associated mainly with a reduction in carcass fat only.

KEY WORDS: Growth, Carcass Traits, Zeranol, Awassi

INTRODUCTION

Sheep are considered the most farm animals in Iraq, and the greater portion of income come from the sale of lambs and mutton. However, their importance is further enhanced due to the fact that they are the most suitable farm animals to the extensive area of arid and semi-arid lands of Iraq, as well as, the major source of livelihood for the rural inhabitants of such areas (Alkass and Juma, 2005). An important issue of meat consumers not only considers the meat taste, but now seeks to consume low-fat meat. Therefore, beginning approximately two decade ago, the meat industry investigated new technologies derived from animal production that promote a decrease in the content of fat and cholesterol and an increase in the tramuscular deposition of poly unsaturated and mono fatty acids (Valenzulea-Grijalva *et al*., 2011). Therefore, researchers attempted to manipulate growth of farm animals through several means such as, breeding, nutrition, castration, growth promoters…etc. to increase meat production (Mahgoub and Lodge., 1998). Moreover, among anabolic agents, zeranol has been shown to have estrogen-like activity in livestock animals (Bouffault and Willermart., 1983) and is approved in 1969 by food and drug administration, U.S.A. for use in feedlot steers, and also has been cleared for use in suckling calves, feedlot heifers and weaned lambs (Martin., 1984). Furthermore, zeranol implant has been noticed to increase daily gain in weight in rams (Wilson *et al*., 1972) and lambs (Landau *et al*., 1987). Also an improvement in feed efficiency was noticed as a result of implanting lambs with zeranol (Wiggins *et al*., 1979, Hutcheson *et al*., 1992, Nold *et al*., 1992, Salisbury *et al*., 2007), and steers (Williams *et al*., 1987). Earlier work on the effect of zeranol implantation on growth performance and carcass traits of Awassi and Karadi lambs conducted during the hottest months (May-July) of the year revealed that a slight response of the two breeds to zeranol implantation in all studied traits was observed (Alkass and Kak, 2015) However, Calhoun *et al* (1972) concluded that the response of lambs to zeranol implantation was lower during summer in Texas as compared to response in winter. Therefore, the objective of this investigation is to study the effect implanting

Awassi lambs with either single or double dose of zeranol during winter and spring months on growth performance, carcass traits and carcass tissue distribution.

MATERIALS AND METHODS

Animals and experimental design

A total of thirty weaned (3-4 months old) intact Awassi lambs with an average live body weight of 28.10 ± 0.64 kg raised at the Animal farm, College of Agriculture, University of Duhok were used in the current work. Following an adaptation period for a week, the lambs were weighed and randomly divided equally into three subgroups, the first as a control, and the second and the third groups were implanted with 12 and 24 mg Zeranol (Ralgroo), respectively, fattened and slaughtered at 40 kg body weight. Each group of lambs was kept in a separate pen and fed on group basis.

The concentrate (15.067 % crude protein and 2950 kcal/kg ME) was divided into halves and fed at 8:30 a.m and 15:30 p.m. The refusal was collected and weighed on the next day before the morning feeding. Clean fresh water and mineral blocks was available constantly. All lambs were weighed at weekly intervals before feed is offered. One lamb from each treatment was excluded from the experiment due to their abnormal growth for unknown reasons.

Slaughtering of the animals

Lambs were weighed after fasting for 24h, with free acces to water, slaughtered and dressed. Hot carcass weight and the weight of the head, skin, feet and some visceral organs (heart, liver, lungs plus trachea, spleen and testes) were recorded. The gastro-intestinal tract then was weighed, emptied of their content, washed and weighed to facilitate calculation of empty body weight. Omental, mesenteric and cardiac fat was separated after the slaughter and weighed.

Carcass characteristics

Following chilling the carcass for 24h, cold carcass was weighed, then kidney and pelvic fat were removed and weighed. The carcass was split along the vertebral column into two halves using electric saw. The left side of the carcass was cut into eight whole sale cuts. The area of L. dorssi muscle at the 12th rib was determined by tracing the muscle on semi-transparent waxed paper, and measured by a placom digital Planometer. Also, fat thickness over the mid point of L. dorsi muscle was measured using Caliper device.

Physical dissection

The left carcass of all lambs was dissected completely into lean, fat and bone and the three components were weighed separately to calculate their percentages.

Non- carcass fat

Non-carcass fat is the some of the omental, mesenteric, pelvic and kidney and cardiac fat. Carcass fat including subcutaneous and intremuscular fat was separated from left side.

Statistical analysis

The analysis of data was carried out using the GLM (General Linear Model) within SAS (2001) program to study the effect of treatment on studied traits.

RESULTS AND DISCUSSION

Growth Performance

Results related to growth performance of control Awassi lambs and implanted with zeranol are given in Table (1). It seems from Table (1) that neither initial weight nor final weight of Awassi lambs is significantly different among experimental groups because all animals were slaughtered almost at the same weight (40 kg) according to the design of the experiment.

In the current work, it appears from Table (1) that the average daily gain was almost the same for control (0.212 kg), treated lambs with 12 mg zeranol (0.212 kg) and lambs treated with 24 mg zeranol (0.214 kg). Thus it seems from the present work as well as our previous work (Alkass and Kak 2015), that Awassi lambs do not respond to zeranol implantation in terms of growth rate. Similarly, agreed with other results in lambs (Otchere et al., 1986; Landau et al., 1987; Field et al., 1993; Eckerman et al., 2011; Alkass and kak., 2015).

Although lambs implanted with 12 mg zeranol are more efficient in converting feed (4.62 kg/kg gain) as compared with the control (5.77 kg/kg gain) and lambs implanted with 24 mg zeranol (5.66 kg/kg gain) however, it was impossible to analyze the date of feed efficiency statistically due to that lambs are fed as a group bases. Also, it have been reported by Landau et al., (1987), Castillo et al., (2014) and Alkass and Kak (2015), that implantation of lambs with zeranol had no effect on feed efficiency. The fattening period

required by lambs to attain their prescribed slaughter weight (40kg) are not significantly different and averaged 61.62, 58.00 and 66.22 days for intact lambs, treated with 12mg ,24 mg zeranol, respectively.

Table (1): Influence of zeranol implantation on growth rate and feed conversion ratio of Awassi lambs (mean ±s.e).

Traits	Overall mean	Experimental groups		
		Control	12 mg Zeranol	24 mg zeranol
No.	27	9	9	9
initial weight (kg)	28.10 ± 0.64	28.78 ± 1.11 a	27.07 ± 1.07 a	28.46 ± 1.97 a
Final weight (kg)	40.68 ± 0.19	40.90 ± 0.48 a	40.73 ± 0.29 a	40.42 ± 0.18 a
Total gain (kg)	12.57 ± 0.60	12.13 ± 1.14 a	13.64 ± 0.92 a	11.95 ± 1.07 a
No. of days	61.62 ± 4.37	58.00 ± 6.47 a	66.22 ± 6.34 a	60.66 ± 10.00 a
Average daily gain (kg)	0.212 ± 0.01	0.212 ± 0.01 a	0.212 ± 0.02 a	0.214 ± 0.01 a
Feed consumed (kg/group)		630.12	568.29	610.01
Feed conversion ratio(kg/kg)		5.77	4.62	5.66

Means within the same raw bearing different letters are differerent significantly ($p<0.05$), otherwise they are not different significantly.

Carcass characteristics

In the present investigation, the overall mean of dressing percentages based on slaughter weight and empty body weight averaged 50.17 ± 0.36 and 56.50 ± 0.42%, respectively (Table 2). Such values are similar to those obtained by Alkass and Kak (2015) and Alkass and Hassan (2014). Also, it seems from Table (2), that the differences in dressing percentage among experimental groups lacked significance. Hence, slaughter weight and carcass weight of experimental groups are almost similar, so this result is expected. Previously, several authors indicated that treated lambs with zeranol had no significant effect on dressing percentage in lambs (Hutcheson et al., 1992; Eckerman, 2011; Eckerman, 2013; Castillo et al., 2014; Alkass and kak, 2015) in goat (Alkass and Blind 2016), as well as in cattle (Nwokolo., (1972).

Rib eye area and fat thickness

Results of the current study revealed that rib eye area and fat thickness averaged, respectively 12.88 ± 0.29 cm2 and 3.58 ± 0.18 mm (Table 2). Such values are within the range reported earlier for the same breed in Iraq (Alkass et al., 1987; Alkass and Hassan., 2014 and Alkass and Kak 2015). Rib eye area averaged 13.05 ± 0.52 cm^2 for control group, 12.88 ± 0.49 cm^2 for lambs treated with 12mg zeranol and 12.71 ± 0.56 cm^2 for lambs treated with 24 mg zeranol, and the differences among them was not significant. This result resemble those reported by Wilson (1972) Wiggins et al (1979) Mader (1985) Hutcheson (1992) and Alkass and Kak (2015) who noticed

no differences in rib eye area among treated lambs with zeranol and the intact lambs.

From the results presented in Table (2), it seems that lambs treated with 24 mg zeranol had significantly ($p<0.05$) thinner fat thickness (3.01 ± 0.21 mm) as compared with lambs received 12 mg zeranol (4.05 ± 0.28 mm) and numerically thinner than the intact lambs (3.69 ± 0.35 mm).Conversely, other researchers indicated no significant differences among treated group and control in fat thickness (Wilson., 1972; Wiggins et al., 1979; Hutcheson, 1992; Field et al., 1993; Alkass and kak, 2015).

Carcass tissue distribution

The overall means of lean, fat and bone percentages of the half carcass side were 58.20 ± 0.40, 25.66 ± 0.54 and 16.61 ± 0.35%., respectively (Table 3). These values reported herein are close to those noticed earlier for the same breed (Alkass and Hassan., 2014; Oramari et al., 2014 and Alkass and Kak, 2015). Also, it seems from the results given in Table (3), that implanting lambs with zeranol resulted in a significant ($p<0.01$) rise in the percentage of lean in both implanted lambs with 12mg zeranol (59.15 ± 0.74 %) and 24 mg zeranol (58.85 ± 0.73%) as compared with the control group (56.61 ± 0.22%). conversly a significant ($p<0.01$) rise in the fat percentage was noticed in intact (24.09 ± 0.55%) as compared with the lambs implanted with 12 mg zeranol (20.27 ± 0.86%) and 24 mg zeranol (19.81 ± 1.12%) (Table 3), however, no significant differences exist among treatment groups in the percentage of bone. The higher muscle development found in the whole side lambs receiving zeranol can be explained by the fact that the main effect of zeranol is to promote retention of body protein, obtaining an increase in muscle protein (Song and Choi, 2001; Prado, 2002; Sumano, 2002). Similar results have been observed by Eckerman (2011) who suggests that zeranol estrogen has a major effect in stimulating muscle growth in the leg. Similarly, Sharp and Dyer (1970) observed increased ($P<0.05$) percent body water and protein and decreased ($p<0.05$) percent body fat. However, other workers including Field et al (1993), Nasahlas et al (2002), Castillo et al (2014) and Alkass and Kak (2015) who observed minimal effects on carcass composition between lambs implanted with zeranol and control lambs.

Table (2): Effect of Zeranol implantation on some ***carcass characteristics*** of Awassi lambs (mean ± s.e).

Traits	Overall mean	Experimental groups		
		Control	12 mg Zeranol	24 mg zeranol
No.	27	9	9	9
Slaughter wt	40.55 ± 0.22	40.72 ± 0.42 a	40.47 ± 0.33a	40.47 ± 0.43a
Hot carcass wt	20.35 ± 0.19	20.43 ± 0.17 a	20.45 ± 0.31 a	20.17 ± 0.49 a
Cold carcass wt	20.13 ± 0.18	20.29 ± 0.17 a	20.24 ± 0.28 a	19.86 ± 0.47 a
Shrinkage %	1.07 ± 0.15	0.70 ± 0.17 b	1.00 ± 0.22 ab	1.53 ± 0.33 a
Dressing % 1	50.17 ± 0.36	50.20 ± 0.42 a	50.51 ± 0.47 a	49.80 ± 0.92 a
Dressing % 2	56.50 ± 0.42	56.22 ± 0.52 a	56.61 ± 0.45 a	56.67 ± 0.42 a
Rib eye area (cm^2)	12.88 ± 0.29	13.05 ± 0.52 a	12.88 ± 0.49 a	12.71 ± 0.56 a
Fat thickness (mm)	3.58 ± 0.18	3.69 ± 0.35 ab	4.05 ± 0.28 a	3.01 ± 0.21 b

Means within the same raw bearing different letters are differerent significantly ($p<0.01$), otherwise they are not different significantly

Partitioning of fat

In the present study, total body fat averaged 6.35 ± 0.16 kg, and the relative contribution of carcass fat, non-carcass fat and fat tail being 34.04, 15.40 and 50.54%, respectively (Table 4). Moreover, it seems that intact lambs had significantly (p< 0.05) higher total body fat (6.94 ± 0.22 kg) as compared with lambs implanted with 12 mg zeranol (6.15 ± 0.21 kg) and 24 mg zeranol (5.94 ± 0.29 kg). This reduction of total body fat in lambs implanted with zeranol was associated mainly with a reduction in carcass fat only being 2.32 ± 0.04 , 2.05 ± 0.07 and 2.06 ± 0.16 kg, for control, lambs implanted with 12 mg and with 24 mg, respectively. Although the relative contribution of different fat depots to total body fat does not differ significantly among groups, however, the relative contribution of fat tail was higher (53.17 ±2.29 %) and non carcass fat was lower (13.30 ± 1.56 %) in lambs treated with 12 mg zeranol as compared with the intact and lambs implanted with 24 mg zeranol. To the best of our knowledge, no studies have been carried out on the influence of different doses of zeranol on carcass characteristics including partitioning of fat especially in fat-tailed sheep. However, it was observed that implanting lambs with zeranol did not affect (p> 0.05) actual or adjusted 12th rib fat, percentage of kidney and pelvic fat, or USDA yield grade, also Wilson et al (1972), and Wiggins et al (1979) reported that zeranol had little effect on carcass yield.

Testicular weight

In the present work, testicular weight was significantly (p<0.05) lighter in lambs treated with 12 mg zeranol (127.22 ± 16.95 g) and 24mg zeranol (107.22 ± 15.43g) as compared with untreated lambs (205.56 ± 20.09 g)). Such reduction in testicular weight amounted to 38.1 and 47.8% in lambs treated with 12 and 24 mg zeranol, respectively. Similarly, weight of testes was reduced approximately 50% by implanting lambs with 12 mg zeranol (Field et al., 1993) and Nold (1990) who reported implanting lambs at birth and again at weaning reduced testicle weight by 25%. Also, decreased testicular weight (Calkins et al., 1986), epididymal weight, seminiferous tubule diameter and testosterone (Calkins et al., 1986; Nold et al., 1992) have been observed in lambs implanted with zeranol post weaning. It has been suggested that the action of the estradiol implant is mediated through changes in luteinizing hormone secretion (D,Occhio et al., 1984), or by blocking gonadotropin release at the level of hypothalamus (Schanbacher., 1984). The net effect of estradiol implantation is increase in lipogenic activity, while lipolytic activity appears to remain unchanged (Prior et al., 1984).

Table (3): Effect of Zeranol implantation on ***physical component*** of Awassi lambs (mean ± s.e).

Traits	Overall mean	Experimental groups		
		Control	12mg Zeranol	24 mg Zeranol
No.	27	9	9	9
Total lean %	58.20 ± 0.40	56.61 ± 0.22 b	59.15 ± 0.74 a	58.85 ± 0.73 a
Total fat %	25.66 ± 0.54	27.93± 0.54 a	24.50 ± 0.73 b	24.54 ± 1.05b
Total bone %	16.61 ± 0.35	16.22 ± 0.42 a	16.39 ± 0.36 a	17.22 ± 0.89a
Lean : fat	2.21 ± 0.069	2.02 ± 0.04 a	2.35 ± 0.08 a	2.27 ± 0.17 a
Lean : bone	3.53 ± 0.066	3.50 ± 0.08 a	3.61 ± 0.10 a	3.47 ± 0.15 a

Means within the same raw bearing different letters are differerent significantly (p<0.05), otherwise they are not different significantly.

CONCLUSION

From the results presented in the text it appears that implanting Awassi lambs with 12 and 24 mg zeranol resulted in a higher lean and lower fat contents in their carcasses as compared with intact lambs.

Table (4): Influence of Zeranol implantation on weight(kg)and percentage of ***fat partitioning*** of lambs (mean ± s.e).

Traits	Overall mean	Experimental groups		
		Control	12 mg Zeranol	24 mg zeranol
No.	27	9	9	9
Kidney & pelvic fat wt (kg)	0.20 ± 0.01	0.22 ± 0.02 a	0.17 ± 0.02 a	0.21 ± 0.02 a
Mesenteric & omental fat wt (kg)	0.77 ± 0.04	0.85 ± 0.06 a	0.65 ± 0.08 a	0.80 ± 0.07 a
Total non-Carcass fat wt (kg)	0.97 ± 0.05	1.08 ± 0.05 a	0.82 ± 0.10 a	1.02 ± 0.09 a
Fat tail	3.22 ± 0.13	3.54 ± 0.26 a	3.27 ± 0.20 a	2.86 ± 0.18 a
Carcass fat	2.14 ± 0.05	2.32 ± 0.04a	2.05 ± 0.07b	2.06 ± 0.10b
Non carcass fat %	15.40 ± 0.79	15.79 ± 1.19 a	13.30 ± 1.56 a	17.12 ± 1.13 a
Carcass fat %	34.04 ± 0.72	33.80 ± 1.49 a	33.52 ± 1.32 a	34.8 ± 1.01 a
Fat tail %	50.54 ± 1.31	50.39 ± 2.44 a	53.17 ± 2.29 a	48.05 ± 2.00 a
Total body fat kg	6.35 ± 0.16	6.94 ± 0.22 a	6.15 ± 0.21 b	5.94 ± 0.29 b

Means within the same raw bearing different letters are different significantly ($p<0.05$), otherwise they are not different significantly

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كارتێكرنا سێ ڕێژێن جیاواز ییّن زیرانولی ل سه رگه شێ، سالوخه ت و پێكهاتییّن كه له خێن به رخێن عه واسی

بوختە

٣٠ به رخێن عه واسی ییّن شیرڤه كری ل ژیێ ٣-٤ هه یڤی كو تێكراییا سه نگا وان یا ده ستپێكێ ١٠،٣٨± ٦٤**.** كغم بو هاتینه دابه شكرن بشێوه كێنه ڕێك بو سێ گروپیّن وه ك هه ڤ**.** گروپێ ئێكێ وه ك كونترول د هه مان ده مدا گروپێ دووێ و سیێ هاتنه چاندن ب هورمونێ زیرانولی ب تێكراییا ١٢و٢٤ملغم ل دیف ئێكدا**.**

به رخ هاتنه دانان دناف گوڤێن جودا جودادا**.** خوارن بو به رخا ب شێوه كێ ئازاد هاتە پێشكێشكرن **(**١٥**,.**٦٧٪ پروتین و ٢٩٥٠كیلو سعره**/**كغم **)** هه تا دهاتنه سه رژێكرن ل كێشا ٤٠ كیلوگرامیێ**.**

ئه نجامیّن ڤه كولینێ ئاماژه بوێ چه ندێ ده ن كو تێكرا زێده بونا سه نگێ روژانه، ڕێژا خوریێ ل سه ر بنچینه یا سه نگا زیندی، هه روه ها به رفره هیا ماسولكا چاف ب ڤی شێوه ی بو ٠،٢١٢± ٠،٠٠٧غم ، ١٧**,** ٥٠ ± ٠،٣٦٪ و ٨٨**,** ١٢± ٠،٢٩ سم٢ ل دیف ئێكدا**.** چاندن ب زیرانولی چ كارتێكرنێن به رچاڤ لسه ر ڤان سه خله تان نه بون**.** ڕێژا به زێ كومبووی د به رخاندا د گروپێ چاندێ ب ٢٤ملغم زیرانولی كێمتر بوو**(** ٠،٠٥ **>** ١ **)** ب به راوردی دگه ل گروپیّن دی و هه روه سا دیاربو كو چاندنا زیرانولی ببو ئه گه رێ زێده بونا ڕێژا گوشتی و كێم بونا ڕێژا به زی **(**٠،٠١ **>** ١**)** بشێوه یه كێ به رچاف**.** ڕێژا گشتی یا به زی د كه له خێن به رخێن گروپێ كونترولی دا كێمتربو **(** ٠،٠٥ **>** ١ **)** **(**٩٤،٦ ± ٢٢،٠ كغم**)** ب به راوردی دگه ل به رخێن چاندی ب ١٢ملغم زیرانول **(**١٥،٦± ٢١،٠كغم**)** وئه ویّت چاندی ب ٢٤ملغم **(**٩٤،٥ ± ٢٩،٠كغم**)**. وئه ف كێم بونه بشێوه یه كێ سه ره كی یا گرێدای بو ب كێم بونا دوهنێ كه له خی بتنێ ڤه**.**

تأثير مستويات مختلفة من الزيرانول في النمو، صفات الذبيحة و مكونات الجسم للحملان العواسية

الخلاصة

تم توزيع ٣٠حملا" عواسيا" مفطوما" بعمر ٣– ٤ أشهر و بمعدل وزن إبتدائي ١٠،٢٨± ٦٤,. كغم عشوائيا" بالتساوي الى ثلاث مجاميع إذ عدت المجموعة الأولى سيطرة ، في حين تم غرس المجموعتين الثانية و الثالثة بالزيرانول و بمعدل ١٢و٢٤ملغم على التوالى. ووضعت كل مجموعة في حظيرة منفصلة و غذيت بصورة حرة على العلف المركز (١٥,.٦٧٪ بروتين خام و٢٩٥٠كيلوسعرة / كغم) حتى ذبحها عند وزن ٤٠كغم.

تشيرالنتائج إلى أن معدل الزيادة الوزنية اليومية ،نسبة التصافى منسوبة إلي الوزن الحي و مساحة العظلة العينية كانت٢١٢،٠± ٠٠٧،٠غم ، ١٧, ٥٠ ± ٣٦،٠٪ و ٨٨, ١٢± ٢٩،٠ سم٢ على التوالي و لم تكن الفروقات بين المجاميع معنوية. كان سمك الطبقة الدهنية للحملان المغروسة بـ ٢٤ ملغم زيرانول أقل معنويا" (٠٥،٠>١) مقارنة ببقية المجاميع. كما يتضح بأن حقن الحملان بالزيرانول قد أدىَ إلى زيادة معنوية في نسبة اللحم و انخفاض معنوي(٠١،٠>١) في نسبة الدهن. كان مجموع الدهن الكلي في ذبائح حملان السيطرة أعلى معنويا" (٠٥،٠>١) (٩٤،٦ ± ٢٢،٠ كغم) مقارنة بالحملان المغروسة بـ ١٢ ملغم زيرانول (١٥،٦± ٢١،٠كغم) و تلك المحقونة بـ ٢٤ملغم (٩٤،٥ ± ٢٩،٠كغم). و كان هذا الأنخفاض مرتبط أساسا" بأنخفاض دهن الذبيحة فقط.