Scientific Papers. Series D. Animal Science. Vol. LVIII, 2015
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

EFFECT OF PROTECTED ARGININE SUPPLEMENTATION TO RATION OF AWASSI LAMB ON THE CHEMICAL AND PHYSICAL ANALYSIS OF CARCASSES MEAT

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Abstract
The objective of this study was to investigate the effect of supplementation protected arginine to the Awassi lambs diets on the chemical and physical analysis of carcasses meat. Twenty five male Awassi lambs ages 3 - 3.5 months and averaged 24,924 kg live body weight were used . Lambs were distributed randomly into five similar group (5 lambs for each) and individually housed, and assigned to five experimental diets by amount of addition of protected arginine . T1 is the (control diet) neither added protected arginine, T2 treatment were lambs fed ***on*** *5g / day of protected arginine, T3 treatment were lambs fed diet control 5 g / cut of arginine twice a week (on eating a three-day break), T4 treatment were lambs fed diet control 7 g / day of arginine and T5 treatment were lambs fed diet control 7g / cut of arginine is the same way as the T3 treatment. All the lambs were assigned in homogeneous batches by the administrative, veterinary and nutritional rules along the experimental period (84 days). Fifteen lambs were slaughtered (3 lambs from each treatment), then carcasses chilled were for 24h at 2°C. Thereafter, several measured were taken in including some chemical and physical analysis. The results of chemical compassion of the leg and rack cuts were obtained treatment T5 was superior (P<0.01) higher than other treatments to record the highest percentage of moisture, protein and lowest percentage in fat. The lamb of T5 treatment was superior (P<0.01) in the results of chemical composition than the other treatments to recorded the highest percentage of moisture, protein, pH, water holding capacity and the lowest percentage of fat for each Longissimus dorsi and Semimembranosus muscles an compared with the other treatment . The lamb of T5 treatment was recorded the lowest percentage of drip loss and cooking loss than the other treatments. It can be concluded from this study that adding the protected arginine to the diets of Awassi lambs improved the quality characteristics of carcasses meat and structure compound by additive of7g protected arginine.*

Key words: *protected arginine, chemical and physical analysis, meat, Awassi lambs.*

INTRODUCTION

The quality of nutrition one of the important reasons that have a direct impact on the productivity of agricultural animals, especially the Iraqi sheep because of the low quantity and quality of forage available and the lack of certain nutrients, especially those related to the green forage and natural pastures, or low levels in the diet provided to the animal it may direct impact on the lower animal productivity agricultural, so attention must be paid to diversity and improved through additions unconventional to diets in order to improve their nutritional value, and access to animals for maximum production level. And this has been confirmed by research and modern technologies in the nutrition science, immunology and endocrinology that the use of nutritional elements such as chromium element and the amino acid arginine has play an important role in regulating the growth, reproduction and immunity in farm animals (Barb, 1991; Cunningham-Rundles, 1993; AL-Dabbas et al., 2008.) The studies were indicated in the nutrition science, immunology, endocrinology and organic chemistry that there are specific nutrients play an important role in regulating the growth and immune function and regulation metabolism (Cunningham-Rundles, 1993). Several studies were indicated that amino acid arginine has

promoting role on the biological and physiological activity in the animal body and on the secretion of growth hormone (Flynn et al., 2002), and prolactin (Rakoff et al., 1973), insulin and glycogen (Palmer et al., 1975), also affects on the immune system and the secretion of hormones, reproductive as well as, absorption of nitrogen and reduce the ammonia toxicity in the tissues (Madden, 1988) and regulate metabolism and immune response (Fu et al., 2005; Morris, 2006; Li et al., 2007) .But few studies that indicated the effect of adding the amino acid arginine protected to the diets in growth rates and the quantity and quality characteristics of the meat produced from the lambs carcasses. Therefore, the objective of this study was to investigate the effect of supplementation protected arginine to the Awassi lambs diets on the chemical and physical analysis of carcasses meat.

MATERIALS AND METHODS

Twenty five male Awassi lambs ages 3 - 3.5 months and averaged 24.924 kg live body weight were used. The study carried out in plant breeding and improvement of sheep and goats of the Ministry of Agriculture / the Authority of the Agricultural Research in Baghdad. Lambs were distributed randomly into five equal groups (5 lambs for each) and individually housed, and assigned to the five experimental diets contenting amount of different protected arginine. Treatment T1 diet (control) canting non protected arginine, treatment (T2) canting 5 g/day, treatment (T3) were lambs fed diet 5 g/day with cut of arginine twice a week (on eating a three-day break), treatment (T4) canting 7 g/day and treatment (T5) were lambs fed diet control 7 g/day with cutting of arginine in the same way as the T3 treatment. All lambs were fed Alfalfa hay ad libitum as a basal diet. Lambs were introduced live body weight (3%) of concentration diet and the diets were offered once daily in the morning. Allowances were recalculated every week according to live weight. All the lambs were assigned in homogeneous batches by the administrative, veterinary and nutritional rules along the experimental period (84 days). Formulation and chemical composition of the experimental diets are shown in Table 1. The diets were contained on 14.82% crude protein and 11.10 MJ/kg DM. At the end of feeding trial, the lambs were slaughtered after over night with draw of feed. Slaughter was performed according to local Muslim practice. Fifteen lambs were Slaughtered (3 lambs from each treatment). Carcasses were weighed and chilled for 24 h at 4°C weighted again and cut into left and right sides, after removing the fat tail from the carcasses. The left side was cut into standardized wholesale cuts (Forrest et al., 1975). The cuts were weighed separately, the chemical analysis for the rack and leg were determined according to according to AOAC (2000). The right side was used to muscles dissection according to the procedures Butterfield et al. (1983) from pelvic limb (SM=*Semimembranosus*) and abdominal wall (LD=*Longissimus dorsi*) the surfaces of muscles are cleaned of all fat and connective tissues and then weight it, the chemical analysis for the LD and SM were determined according to according to AOAC (2000).

The ultimate pH of the muscles LD and SM were determine according to the procedure of Rashid et al. (1983), water holding capacity (WHC) was determined according to Dolatowski and Stasiak (1998), thaw loss and cooking loss were determined according to Denhertog - Meischke et al. (1997), Purchas and Barton (1976), respectively data was statistically analyzed using Completely Randomized Design Model (CRD) procedure by (SAS, 2001). Duncan's multiple range test was used to determine the significance of differences between treatments means.

Table 1. Formulation and chemical composition of concentrate diets

Ingredients	%	C.P %	C.F %	E.E %	NFE %	ASH %	OM %	DM %	M.E MJ/KG DM
Barley	34	3.77	2.72	0.54	22.34	1.82	29.38	31.19	3.88
Yellow corn	20	1.86	0.62	0.78	13.74	1.09	17.00	18.09	3.35
Wheat bran	30	3.57	4.38	1.13	16.41	1.72	25.49	27.21	3.29
Soybean meal	14	5.62	0.71	0.27	5.04	0.95	11.63	12.59	1.50
Salt	1.3	0	0	0	0	1.30	0	1.30	0
Calcium carbonate	0.7	0	0	0	0	0.70	0	0.70	0
Total	100	14.82	8.43	2,72	57.53	7.58	83.50	91.07	10.11

*ME (MJ/ kg DM) = 0.012 CP +0.031 EE+0.005 CF +0.014 NFE (MAFF, 1977)

RESULTS AND DISCUSSIONS

Chemical analysis of leg

The results of chemical analysis of the leg showed the presence of high significant differences ($P<0.01$) among the treatments (Table 2). All treatments added amino acid arginine protected had superiority than control treatment, and the fourth treatment T4 was recorded the highest moisture, protein and lower fat percentage was (58.47, 18.65 and 20.56%, respectively) as compared than the lowest percentages of moisture, protein and a higher percentage of fat in the control treatment was (55.40, 15.66 and 26.71%, respectively). The higher percentage of ash (1.71%) was recorded in treatment fifth addition (T5) as compared with other treatments, while the lowest percentage of ash in the control treatment (1.60%).

Chemical analysis of rack cut

From the results of the chemical analysis of the rack cut (Table 2) observed high significant ($P<0.01$) differences in treatments added amino acid arginine protected than control treatment. The fourth treatment T4 was recorded the highest moisture, protein and lower fat percentage was (58.10, 17.98 and 21.60%, respectively) as compared than the lowest percentages of moisture, protein and a higher percentage of fat in the control treatment was 54.86, 15.12 and 27.79%, respectively. The ash content was observed from the results the second treatment (T2) was recorded higher ash percentage (1.75%), as compared with the other treatments, while the lowest percentage in the control treatment was (1.58%). In light of what came clear that the addition of arginine protected led to improved the quality characteristics of the meat and the fourth treatment (which added to her 7 g arginine) was recorded higher moisture and protein percentages and lower fat percentage as compared with the other treatments. and these results reinforce what we got in the previous results (Al-Badri et al., 2010 a) who showed that increased meat percentage and decreased fat percentage and increased muscles weight and decreased fat deposition in the carcasses and this indicates to improved the efficiency of the muscle production than fat deposition in the carcasses.

Table 2. The effect of protected arginine addition to diets on the chemical analysis of leg and rack of Awassi lambs carcasses (Mean ± standard error).

Cut	Chemical analysis	Treatments				
		T1	T2	T3	T4	T5
Leg	moisture	55.40± 0.13 d	58.20± 0.05 ab	57.73± 0.11 c	58.74± 0.11a	57.88± 0.14 bc
	protein	15.66± 0.04 d	18.52± 0.09 a	17.59± 0.05 c	18.65± 0.12 a	17.96± 0.12 b
	fat	26.71± 0.07 a	21.13± 0.06 d	22.25± 0.09 b	20.56± 0.08 c	21.60± 0.05 c
	ash	1.60± 0.02 d	1.70± 0.02 a	1.67± 0.03 ab	1.65± 0.02 ab	1.71± 0.02a
Rack	moisture	54.86± 0.10 d	57.79± 0.04 b	57.30± 0.07 c	58.10± 0.09a	57.55± 0.07 bc
	protein	15.12± 0.10 d	17.68± 0.03b	17.40± 0.07 c	17.98± 0.06 a	17.75± 0.03 b
	fat	27.79± 0.05a	21.93± 0.06 d	22.75± 0.07 b	21.60± 0.03 e	22.20± 0.05 c
	ash	1.58± 0.01c	1.75± 0.02a	1.65± 0.02 abc	1.60± 0.00bc	1.70± 0.05ab

Means± SE within the same row having unlike letters (a-d) are significantly different among treatments (P<0.01). Control (T1), 5 g/day of protected arginine (T2), 5 g/day, cut of arginine twice a week (on eating a three-day break) (T3), 7 g/day of arginine (T4) and 7 g/day cut of arginine twice a week (on eating a three-day break) (T5).

Chemical analysis of *Longissimus dorsi* Muscle (LD)

The results in the table (3) revealed that effect significant differences for addition to the protected arginine in the chemical analysis of the LD muscle. The moisture percentage was increased in the addition treatments with a highly significant difference (P<0.01) compared with the control treatment. The highest percentage of moisture (70.98%) was found in the fifth treatment T5 and the lowest (69.80%) percentage of moisture in the control treatment. It is noticed that adding arginine led to increase the percentage of protein in the addition treatments with a highly significant difference (P<0.01) compared with the control treatment. The fourth treatment T4 recorded the highest (23.22%) percentage of protein while, the lowest percentage of protein (22.27%) was recorded in the control treatment. These results confirm data referred to previously about increasing the percentages of meat and decreasing the percentages of fat in the main cuts and whole half carcass and the full effect of the positive effect of the arginine to add to the diets of lambs this indicates improve the efficiency of the production of muscle to fat deposition in the carcass account (Al-Badri et al., 2010 b). On the other hand, the percentages of fat were decreased significantly in all addition treatments as compared with the control treatment. The highest percentage (5.55%) of fat in the LD muscle was found in the control treatment, while the fifth treatment T5 (which added to her 7 g arginine) was recorded the lowest (4.04%) fat percentage with a significant difference among the other treatments. It was clear from the results the no significant differences in the percentages of ash among treatments.

Chemical analysis of the *Semimembranosus* Muscle (SM)

The results of the chemical analysis of SM muscle are shown in the table 3. It appears that the addition amino acid arginine treatments were superior (P<0.01) in the chemical

analysis of SM muscle as compared to the control treatment .It has been observed from the results that all addition arginine treatments were superior significantly (P<0.01) in the percentage of moisture, the highest percentage of moisture (73.60%) in the fifth treatment T5 with significant difference than other treatments, while the control treatment was recorded the lowest (72.58%) percentage of moisture. The results showed significant differences in the percentage of muscle protein among treatments, the highest (21.46%) percentage of protein in the fifth treatment T5. However, the control treatment had the lowest (20.62%) percentage of protein. Data indicated that differences among treatments were significant (P<0.01) in the percentages of fat (Table 3). The percentage of fat was decrease significantly (P<0.01) in all addition arginine treatments than control treatment. The highest (4.38%) percentage of fat was recorded in the control treatment while the fifth treatment T5 had the lowest (3.12%) percentage of fat with significant difference than other treatments. The ash percentage was observed from the results that second treatment (T2) was recorded higher ash percentage (1.71%), as compared with the other treatments, while the lowest percentage in the control treatment was (1.60%) and these results confirm what we got in the previous results (Al-Badri et al., 2010 b) about increasing the percentage of meat and decreasing of fat percentage and increased muscle weight and decreased of fat deposition in the carcass and this indicates to improvement in the efficiency of muscle production and decreasing of fat deposition in the carcasses.

Table 3. The effect of addition of arginine protected to diets on the chemical analysis of *Longissimus dorsi* (LD) and *Semimembranosus* (SM) of Awassi lambs carcasses (Mean ± standard error).

Muscle	chemical analysis	Treatments				
		T1	T2	T3	T4	T5
LD	Moisture	69.80± 0.05 d	70.60± 0.02c	70.52± 0.04c	70.80± 0.02b	70.98± 0.04 a
	protein	22.27± 0.02d	22.95± 0.05 b	22.71± 0.04 c	23.22± 0.02a	23.00± 0.05 b
	fat	5.55± 0.02 a	4.50± 0.06b	4.63± 0.01c	4.19± 0.03d	4.05± 0.02 e
	Ash	1.63± 0.01 a	1.70± 0.05 a	1.70± 0.01a	1.61± 0.01a	1.60± 0.05a
SM	Moisture	72.58± 0.04 d	73.05± 0.04 c	72.93± 0.09 c	73.31± 0.02b	73.60± 0.04a
	protein	20.62± 0.03d	21.21± 0.04b	20.96± 0.03c	21.30± 0.02b	21.46± 0.03a
	fat	4.38± 0.02 a	3.51± 0.02c	3.80± 0.02b	3.35± 0.02d	3.12± 0.02e
	Ash	1.60± 0.02 b	1.71± 0.01a	1.70± 0.02a	1.65± 0.02ab	1.61± 0.00b

Means±SE within the same row having unlike letters (a-e) are significantly different among treatments (P<0.01). Control (T1), 5 g/day of protected arginine (T2), 5 g/day cut of arginine twice a week (on eating a three-day break) (T3), 7 g/day of arginine (T4) and 7 g/day cut of arginine twice a week (on eating a three-day break) (T5).

Chemical and Physical Tests

pH and Water Holding Capacity (WHC)

The effect of addition arginine treatments on pH and WHC are summarized in Table 4. Statistical analysis indicated that pH and WHC were affected significantly ($P<0.01$) by addition arginine as compared with the control treatment. Add arginine effect in raising the pH significantly, the higher value (5.82) of pH was recorded in the fifth treatment T5 in LD muscle while the lower value (5.60) of pH was recorded in the control treatment LD muscle. Similar a tendency was obvious towards an increase the pH values in SM muscle by addition arginine as compared with the control treatment (Table 4). The results showed superiority of the fifth treatment (T5) to raise the pH value (5.74) with a significant difference than the other treatments.

Regarding the results of the water holding capacity (WHC), it appears that addition arginine treatments were superior ($P<0.01$) in WHC percentage as compared with the control treatment (Table 4). The highest (63.25%) WHC percentage in the fifth treatment (T5), while the lowest (62.95%) WHC percentage in the control treatment .In the same boat results of water holding capacity appeared in SM, data showed that WHC tended to increase with addition arginine treatments as compared with the control treatment. The fifth treatment (T5) had recorded the highest value (63.25%) of WHC than other treatments, while the control treatment had recorded the lowest value (60.55%) of WHC, and this may be due to high moisture and protein percentages and reduce the amount of fat in meat and that has contributed to increased water retention within the muscle and thus raise the meat's ability to holding the water and reflected that on raising the pH value in meat of the effect of addition amino acid arginine to diets lambs. All addition treatments were improved the chemical characteristics, especially the fifth treatment. In the absence of the studies who show the role of add arginine on the chemical composition of the lambs meat, it can be used the study conducted on rats made by Fu et al. (2005) who showed that the addition of arginine to food by 1.51% for a period of 10 weeks determinate the low results ($P<0.01$) for each of the abdominal fat weight (45%) and subcutaneous fat (25%) and a significant decrease ($P<0.05$) for each of the triglyceride (23%), Free Fatty Acid (27%) and percentage of fat (22-24%) in blood serum. Tan et al. (2008) also reported that, when feeding the pigs was on arginine by 1%, the treatment of arginine improved muscle content (*Longissimus dorsi*) of protein and glycogen, respectively an increase (4.8 0.42%).

Table 4. The effect of protected arginine addition to diets on the pH and water holding capacity (WHC) of *Longissimus dorsi* (LD) and *Semimembranosus* (SM) of Awassi lambs carcasses (Mean ± standard error)

Muscle	Test	Treatments				
		T1	T2	T3	T4	T5
LD	drip loss %	2.35± 0.05 a	2.09± 0.05b	2.17± 0.04 b	1.85± 0.02 c	1.70± 0.05 d
	cooking loss%	27.19± 0.22a	25.14± 0.12b	25.42± 0.15b	23.45± 0.14c	23.25± 0.10c
SM	drip loss %	2.67± 0.05a	2.20± 0.01b	2.26± 0.05b	1.98± 0.07c	1.80± 0.03d
	cooking loss%	28.11± 0.20a	26.70± 0.22b	26.54± 0.18b	26.15± 0.11c	25.97± 0.15c

Means± SE within the same row having unlike letters (a-d) are significantly different among treatments ($P<0.01$). Control (T1), 5 g/day of protected arginine (T2), 5 g/day cut of arginine twice a week (on eating a three-day break) (T3), 7 g/day of arginine (T4) and 7 g/day cut of arginine twice a week (on eating a three-day break) (T5).

Physical Tests Drip loss and Cooking loss

The results presented in Table 5 show that all the addition treatments exhibited low (P<0.01) drip loss and cooking loss percentages as compared with control treatment. The fifth treatment (T5) had the lowest percentages in drip loss (1.70%) and cooking loss (23.25%) while, the control treatment had the highest percentages in drip loss (2.35%) and cooking loss (27.19%) in LD muscle. Similar a tendency was obvious towards an decrease (P<0.01) the drip loss and cooking loss percentages in SM muscle by addition arginine as compared with the control treatment (Table 4). The fifth treatment (T5) had the lowest percentages in drip loss (1.80%) and cooking loss (25.97%) while, the control treatment had the highest percentages in drip loss (2.67%) and cooking loss (28.11%) in SM muscle. That is probably due to the mode of action of addition of arginine in increasing moisture bind, pH and WHC, and hence increases ability of meat tissue to retain water and reduce moisture loss during storage and cooking (Al-Rubeii et al., 2008).

Table 5. The effect of addition of arginine protected to diets on the drip loss and cooking loss percentages % (WHC) of *Longissimus dorsi* (LD) and *Semimembranosus* (SM) of Awassi lambs carcasses (Mean ± standard error).

Muscle	Test	Treatments				
		T1	T2	T3	T4	T5
LD	pH	5.60± 0.01 c	5.76± 0.02ab	5.73± 0.01b	5.80± 0.02ab	5.82± 0.03a
	WHC %	62.95± 0.10d	64.52± 0.05c	64.40± 0.05 c	64.89± 0.01b	65.11± 0.07a
SM	pH	5.58± 0.01d	5.65± 0.02ab	5.63± 0.01cd	5.71± 0.02ab	5.74± 0.02a
	WHC %	60.55± 0.03d	62.75± 0.02c	62.67± 0.04c	63.07± 0.06b	63.25± 0.05a

Means± SE within the same row having unlike letters (a-d) are significantly different among treatments (P<0.01). Control (T1), 5 g/day of protected arginine (T2), 5 g/day cut of arginine twice a week (on eating a three-day break) (T3), 7 g/day of arginine (T4) and 7 g/day cut of arginine twice a week (on eating a three-day break) (T5).

CONCLUSIONS

It is concluded that adding the protected arginine to the diets of Awassi lambs improved the efficiency of meat production, as well as quality and quantity characteristics of their carcasses and structure compound by additive of 7 g protected arginine, and this may give approve to the critical role of these additives in improving growth performance.

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