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Effect of Management Systems and Zeolite Treatment on Growth Performance, Economic Efficiency, Carcass Traits and Blood Metabolites Efficiency of Ossimi sheep

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Abstract

The aim of this study was to investigate the effects of different management systems (Intensive and semi-intensive systems) and using Zeolite substance as growth promoting on growth performance of Ossimi male lamb's, carcass traits, blood metabolites and economic efficiency. Twenty male lambs at 6 months of age were divided randomly to two groups (ten lambs per each group) were fed individually. Frist group lambs were reared on semi-intensive management system. The second group of lambs was reared on intensive management system. Every management system was divided into two feeding group (five lambs per each group), first group was fed on diet containing 0% Zeolite (control diet) according to **NRC (2007)** recommendations and the second group was fed on diet containing 1% Zeolite (treatment group). All experimental lambs in each group weighed fasting individually to the nearest kilogram monthly till the end of experimental period (120 days). Both of the consumed diets and refusals, if any, were recorded daily. Body weight gain, average daily gain, feed intake, feed conversion ratio and economic efficiency were then calculated. At the end of the fattening period six male lambs from each group were slaughtered for carcass evaluation. Furthermore, blood samples were collected and analyzed. Results showed that intensive management system lambs group fed on diet containing 1% Zeolite had a better growth performance, carcass traits, blood metabolites and economic efficiency of lambs and it had higher advantages without adverse effect on the studied traits.

Keywords: Management Systems, Zeolite Treatment, Economic Efficiency, Carcass Traits, Ossimi Sheep.

Introduction

Sheep constitute an important component of livestock production in tropics and subtropics. Ossimi sheep and their crosses are an important local breed in Egypt which they dominate in the Upper Delta and the southern part of the Nile valley (**Yehia, 2006**). Meat yield is an output of lamb's growth (**Ali, 2007**). The grazing system with supplement had the advantage to allow producing light lambs saving a high amount of concentrates but achieving similar or even greater average daily gain (ADG) to that registered in dry lot lambs (**Carrasco *et al.*, 2009**). Alternative production systems are available to complement breed and forage resources that can maximize profitability by improving productivity and carcass characteristics of the sheep operation (**Dimsoski *et al.*, 1999**). Livestock production requires constantly finding new opportunities to improve the production results and preserve the health of domestic animals. In the last decade several researchers have been done on the possibilities of implementing natural Zeolite in livestock production (**Masic *et al.*, 1999; Nikkhah *et al.*, 2001; Ilic *et al.*, 2005; Pesev *et al.*, 2005; Ilic *et al.*, 2007; Shariatmandari, 2008**) because of its great ability to absorb various harmful substances in the body of the animals and the environment (mycotoxins, radionuclides, heavy metals, ammonia, carbon monoxide, pesticides and herbicides). It helps to achieve better production results and maintain the health and reproductive performance of domestic animals (**Adamovic *et al.*, 2001; Dakovic *et al.*, 2003; Medakovic and Zaric, 2005**). Also, **Stojković (2012)** had established that the newborn lambs, that were fed the product based on natural Zeolite through colostrum (The amount of 5 g/l of colostrum), had more than 50 percent higher concentration of immunoglobulin (IgG) after the period of six hours. Later, 24 and 48 hours after the birth, the values of IgG also increased, indicating the contribution of these drugs in strengthening the immune system of lambs in their first days of life. The present study aimed to investigate the effects of different Management systems (Intensive and semi-intensive) and using Zeolite substance on Ossimi male lamb's growth performance, economic efficiency, carcass traits and blood metabolites.

Materials and Methods

This study was carried out in the Experimental Sheep Farm belonging to the Faculty of Agriculture at Moshtohor, Benha University, Egypt during the period between 1 September 2020 to 31 December 2020.

Experimental animals and diets:

Twenty Ossimi male lambs 6 months old were divided randomly to two groups (ten lambs per each group) were fed individually. Frist group lambs were reared on semi-intensive management system. The second group of lambs was reared on intensive management system. Lambs in semi-intensive

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management system were reared on ewe's milk during the period from birth to weaning at 4 months of age. Pre-weaning, lambs allowed to go out for grazing on Egyptian clover about 5 hours per day and feeding wheat straw *ad libitum*. Diets were offered twice daily in equal quantities at 8.00 am and 4.00 pm and estimated for each of the two groups every day. Both of the consumed diets and refusals, if any, were recorded daily. All lambs were individually weighed to the nearest kg at the start of the feeding period and thereafter weekly in the morning before feeding and drinking till the end of feeding period. Lambs in intensive management system were reared on ewe's milk plus dry concentrate starter (20% Protein) during the period from birth to weaning at 4 months of age. Post-weaning, lambs raised permanently in the pen and permitted some hours of the day to move to a yard attached with the pen. It was not permitted for these lambs either to go out of the pen or to graze. Lambs belong to intensive management system group were individually feeding wheat straw and Egyptian clover *ad libitum*, while the concentrate feed mixture was allowed according to **National Research Council (NRC, 2007)** recommendation based on the animal live body weight during the experimental period. Each management system which contains ten male lambs was divided into two groups (five male lambs per each), first group was fed on control diet (0% Zeolite) and the second was fed on control diet plus (treated diet with 1% Zeolite). Natural Zeolites (powder form) are aluminum silicates, which can capture ammonium ions (NH4), reducing the rate of their release and absorption from the rumen. It has therefore been suggested that their inclusion in ruminant diets favorably affects the nutritional efficiency of ruminants by improving the efficiency of nitrogen (N) utilization by rumen microbes (**Ruiz *et al.,* 2007**).

Table1. Daily feed intake of concentrate mixture dry matter per head (kg) according to **NRC (2007)** recommendations**.**

Lamb weight (kg)	10	20	25	30	35	40	45	50	55	60	65	70
Concentrate feed mixture (kg)	0.6	1.0	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.3	2.5

Table 2. Ingredient and chemical composition of male lambs ration.

Ingredients (%)	Male lambs ration
Yellow corn	22
Soybean meal	-
molasses	3
Sodium chloride	1
limestone	-
Vitamins and minerals mixture	-
cotton seed cakes	35
wheat bran	33
rice bran	4
calcium carbonate	2
Total	100
Chemical composition (%)	
Crude protein	14.11
Ether extract	5.22
Crude fiber	12.31
Ash	5.38
Nitrogen free extract (NFE)	62.98

Lambs live performance:

All experimental lambs in each group were individually weighed fasting in the morning to the nearest kilogram monthly till the end of experimental period (120 days). Fresh water supply was available *ad libitum*, while, the feed supply was provided twice daily once at 8:00 AM and another at 4:00 PM. Both of the consumed diets and refusals, if any, were recorded daily. Body weight, weight gain, average daily gain, feed intake; (to the nearest gram) feed conversion ratio and economical feed efficiency were then calculated.

Economic efficiency (Profitability):

Production profitability of different management systems and Zeolite treatment was evaluated using Finance analysis. The net return (NR) was calculated from the difference between total income (TI) and total costs (TC) according to

Sankhyan (1983) for each lamb**.** The total costs included: feeding costs, labor costs (price of a farmer working hour multiplied by the number of hours employed per lamb and veterinary care costs (drugs, vaccines, and veterinary supervision). Furthermore, water, electricity, equipment maintenance, litter costs and building rent value were also calculated per lamb in groups. The total income included: income value from final live body weight (lamb). All these parameters were estimated in L.E. over the course of the experiment.

Carcass traits:

At the end of experimental period six male lambs from each production system (three lambs from 0% Zeolite group and three lambs from 1% Zeolite group) were slaughtered. Lambs weight was calculated after fasting 18 hours before slaughter (**El-Mahdy *et al.*, 2000**). After complete bleeding, lambs were skinned and dressed out, hot carcass weight were recorded after removing all internal organs. Weights of prime cuts (round, loin, rack and shoulder) and second cuts (neck, brisket, flank and tail) were recorded. The meat (lean and fat) of 9, 10 and 11^{th} rib cut of each carcass were mixed to measure the pH-value by pH-meter with glass electrode as described by **Aitken *et al.*, (1962),** tenderness and Water Holding Capacity (WHC) were measured by taking a sample of about 0.3 g and putting it on ashless filter paper under pressure of 1000 g for 10 minutes (**Grau and Hamm, 1957**), two zones were measured using the planimeter, the water holding capacity was calculated by subtracting the area of internal zone from that of the outer zone, the internal zone exhibits tenderness of meat, results were presented in cm2 (Per 0.3 g sample). The meat (lean and fat) of 9, 10 and 11^{th} rib cuts of each carcass were mixed and dried at 60º C for moisture determination after constant weight was reached (48 hours). Samples from the mixture were analyzed according to **AOAC (1995)** for ether extract (EE), crude protein (CP) and ash percentages.

Blood samples and analysis:

Lambs blood samples were taken monthly morning before feeding from the jugular vein though a clean needle and putting it in ten ml test tube containing 10.5 mg. Ethylene diamine tetracetic potassium salt (EDTA) as an anticoagulant material. These samples were immediately centrifuged at 2500 rpm for 15 minutes to separate plasma. Plasma and serum samples were immediately collected and kept frozen at -20º C until performing the chemical analysis of**:** total protein, albumin, cholesterol, Creatinine, Urea, AST and ALT according to **Henry (1964)**, **Doumas *et al.*, (1971)**, **Reschlau *et al.*, (1974), Reitman and Frankel 1957, Potton and Crouch (1977) Reitman and Frankel (1957)**, respectively. The concentration of total globulins in each sample were obtained by subtracting albumin concentration from the total protein concentration and albumin globulin (A/G) ratio was calculated by dividing albumin by total globulin. The single radial immune diffusion technique was used to quantify total immunoglobulin IgG in blood plasma (Bind ARIDtm Binding site limited, Birmingham, UK) according to the method described by **Fahey and McKelvey (1965).** The method of IgG quantification involves antigen diffusing, radially from cylindrical well through an agarose gel containing an appropriate nonspecific antibody. Antigen antibody complexes are formed as a precipitation ring. The ring size increases until an equilibrium. There is a linear relationship between the ring diameter and antigen concentration (using IgG liquicolor® Kit).

Statistical analysis:

Statistical analysis was carried out by using the least squares procedure for analyzing the data with unequal subclass number described by **SAS (2004)**.

$$Y_{ijk} = \mu + M_i + Z_j + (MZ)_{ij} + e_{ijk}$$

Where:

Y_{ijk} = the observation of growth performance, economic efficiency, carcass traits and blood metabolites for ijk^{th} lamb; μ = general mean, common element to all observations; M_i = the fixed effect of the i^{th} Management system (1= Semi-intensive and 2= Intensive); Z_j = the fixed effect of the j^{th} Zeolite treatment (1= 0% Zeolite and 2= 1% Zeolite) ; $(MZ)_{ij}$ = the fixed effect of the interaction between the i^{th} Management systems and the j^{th} Zeolite treatment; e_{ijk} = Random error associated with the individual observation and assumed NID $\cong$ $(0, \sigma^2 e)$. Tests of significance for differences between means were carried out according to **Duncan (1955).**

Results and Discussions

Lambs growth performance:

Intensive management system lambs exhibited significantly ($P<0.05$) heavier final body weight and total weight gain than semi-intensive management system lambs (Table 3). These results agree with those observed by **Raju *et al.* (2015)** who found that the final body weight of eighteen Deccani lambs was 15.68 and 15.46 kg, for lambs kept under intensive and semi-intensive management systems, respectively, animals kept under intensive system could achieve superior body weight as compared with semi-intensive management system (9.12 % vs 6.25%). **Kochewad *et al.* (2018)** who recorded that the final weight of twenty-four of Deccani lambs at three months of age was 21.95 and 20.53 kg, for lambs under intensive and semi-intensive management systems, respectively and added that there were a significant ($P<0.05$) differences between lamb's body weight means due to management systems effect. **Karthik *et al.* (2021)** who reported

that the body weight gain of forty Nellore male lambs at period from four to fifteen months of age was 19.30 and 27,02 kg, for them under semi-intensive and intensive management systems, respectively and the differences between there were significant (P<0.001).

On the other hand, male lambs fed on diet containing 1% Zeolite had significantly (P<0.05) higher final body weight and total weight gain than male lambs fed on control diet (Table 3). These results agree with those stated by **Stojković *et al.* (2005)** who found that the final body weight of twenty lambs was 24.50 and 28.10 kg, for control group (without feeding Zeolite) and group received Zeolite Min-a-Zel S from birth until 14th day of life and Min-a-Zel Plus from their 15th day, respectively and the differences between means of lamb's final body weight were significant (P<0.01). Also, **Stojković *et al.* (2012)** stated that the body weight for fifteen lambs was 11.93, 17.79 and 24.48 kg, for lambs at the same ages for control group (without feeding Zeolite), whilst it was 12.20, 18.91 and 26.94 kg at 30, 60 and 90 days of age for group received Zeolite from 14th day of life, respectively and the differences between means of lamb's body weight at 60 and 90 days of age was significant (P<0.005). As well as, **Abdelrahman *et al*. (2021**) showed that the body weight for twenty-four Naemi male lambs at three months of age was10.72 and 11.91kg, for lambs fed on diet containing Zeolite levels 0 and 1%, respectively and there were a significant (P< 0.05) differences between lamb's body weight means due to zeolite levels effect.

Intensive management system lambs achieved highly significantly (P<0.01) better average daily gain, total feed intake and feed conversion ratio than semi-intensive management system lambs (Table 3). These results agree with those reported by **Zayed *et al.* (2020)** who found that the Sixteen Abou-Delik male lambs average daily gain from weaning age up to nine months of age was 84.1 and 79.9 g, under intensive and semi -intensive management systems, respectively and there were a significant differences between the two management systems (P<0.05). **Karthik *et al.* (2021)** reported that the average daily gain of forty Nellore male lambs at four to fifteen months was 53.02 and 74,24 g, under semi- intensive and intensive management systems, respectively and the differences between means was significant (P<0.001). The same authors revealed that the feed conversion ratio of forty male lambs aged fourteen to fifteen months was 8.92 and 7.44, under intensive and semi-intensive management systems, respectively, as well as there was a significant (P<0.001) differences between their feed conversion ratio.

Table3. Least-squares means (±standard errors) of factors affecting growth performance of growing Ossimi male lambs during the experimental period.

Items	Management systems (M)		Zeolite treatment (Z)		SEM*	*P-Value*		
	Semi-intensive	Intensive	0% Zeolite	1% Zeolite		M	Z	M×Z
Initial body weight, kg	42.28[b]	44.50[a]	41.51[b]	45.63[a]	±0.32	<0.05	<0.05	>0.05
Final body weight, kg	59.81[b]	66.68[a]	59.37[b]	66.15[a]	±0.47	<0.05	<0.05	>0.05
Total weight gain, kg	17.53[b]	22.18[a]	17.68[b]	20.52[a]	±0.30	<0.05	<0.05	>0.05
Average daily gain, grams	156[b]	191[a]	147[b]	183[a]	±2.71	<0.01	<0.01	>0.05
Total feed intake of DM, kg	145.90[a]	137.45[b]	142.25[a]	137.55[b]	±0.08	<0.01	<0.01	>0.05
Feed conversion ratio (Feed/intake/weight gain)	8.32[a]	6.20[b]	7.96[a]	6.70[b]	±0.18	<0.01	<0.01	>0.05

a, b Means within any classification, followed by different letters are significantly different (p<0.05).
*SEM- Standard error of mean.

Furthermore, male lambs fed on diet containing 1% Zeolite achieved better average daily gain, total feed intake and feed conversion ratio than male lambs fed on control diet. The differences between all means were highly significant (P>0.01) (Table 3). These results agree with those observed by **Roque *et al.* (2018)** who stated that the daily gain for forty Rambouillet ewe lambs was 140, 167, 197and 165 g /day, for lambs fed on diet containing 0, 20, 40 and 60 g Zeolite per kg dietary dry matter, respectively and the differences between ewe lambs daily gain were significant (P<0.05). **Esteves *et al.* (2021)** found that the average daily gain of twenty- four male Santa Ines lambs was 0.122, 0.132, 0.143 and 0.162 g/day, for lambs fed on diet containing Zeolite 0, 25,50 and 75 g per day, respectively and found a significant (P<0.05) differences between lamb's average daily gain due to, Zeolite treatments. **Ghoneem *et al.* (2021)** found that the average daily gain for thirty male Bakri lambs at six months of age was153.56 and 175.11 g/day, for lambs fed on diet containing 1and 2% Zeolite, respectively and were not significant, while the average daily gain was slightly higher for lambs fed diet containing 2%

Zeolite ration. Also, **Abdelrahman *et al.* (2021)** resulted that the feed conversion ratio for twenty-four Naemi male lambs at three-months of age was 4.12 and 3.65, for lambs fed on diet containing 0 and 1% Zeolite, respectively with a significant (P< 0.05) differences between Zeolite levels effect.

The differences between means of experimental male lamb's growth performance, due to the interaction between management systems and Zeolite treatment, were not significant (Table3).

Economic efficiency (Profitability):

Expense value, income, net return and economic efficiency are shown in Table 4. Economic efficiency and net profit for lambs were higher (1.15 and 683L.E./lamb) for intensive management lambs than that for semi-intensive management lambs (1.06 and 292 L.E./lamb). Economic efficiency and net profit were higher (1.11 and 512L.E./lamb) for lambs fed on diet containing 1% Zeolite than that for lambs fed on control diet (1.07 and 324 L.E./lamb). .

Therefore, results of the present study showed that lambs reared in intensive management fed on diet containing 1% Zeolite increases profitability. These results agree with those of **Hassan (2015)** who reported that economic efficiency of twenty Ossimi male lambs at six months of age was 1.43 and 1.24, under intensive and semi-intensive management systems, respectively and there were a significant (P<0.05) differences between management systems. **Zayed *et al.* (2020)** estimated that the economic efficiency of Abou-Delik male lambs at nine months of age was 87.13 and 48.95, under intensive and semi-intensive management systems, respectively and there were highly significant differences (P<0.001) between the two management systems. Also, **Sallam *et al.* (2022)** stated that economic efficiency of forty-five male Barki lambs was 1.51 and 1.43, for lambs fed on diet containing 0 and 20 g, Zeolite, respectively for 141 days and there were a significant (P<0.05) differences between lambs economic efficiency due to, Zeolite treatments

Table4. Economic efficiency (Profitability) of growing Ossimi male lambs in different management systems and Zeolite treatments during the experimental period.

Items	Management system		Zeolite treatment	
	Semi-intensive	Intensive	0% Zeolite	1% Zeolite
Purchased lambs (L.E./ Lamb)	3171	3337	3113	3422
Feed intake cost (LE/ Lamb)	875	824	853	875
Building depreciation (L.E./ Lamb)	22	22	22	22
Water and electricity (L.E./ Lamb)	20	20	20	20
Veterinary management (L.E./ Lamb)	35	35	35	35
Labor cost (L.E./ Lamb)	150	150	150	150
Total cost (L.E./ Lamb)	4258	4388	4193	4524
Sheep sales (L.E./ Lamb)	4485	5001	4452	4961
Wool sales (L.E./ Lamb)	35	40	35	45
Litter sales (L.E./ Lamb)	30	30	30	30
Total returns (L.E./ Lamb)	4550	5071	4517	5036
Net profit (L.E./ Lamb)	292	683	324	512
Economic efficiency (Total returns/Total cost)	1.07	1.16	1.08	1.11

Price of feed intake: 6 (LE/Kg); Price of live weight of lamb: 75 (LE/Kg).

Carcass traits:

Lambs maintained under intensive management system had better fasted weight (58.25 kg), hot carcass weight (35.00 kg), dressing percent (60.10%), prime cuts (23.42 kg) and second cuts (11.58 kg) weight than semi- intensive management system lambs (54.86 kg, 30.96 kg, 56.43%, 20.23 kg and 10.73 kg, respectively) at the end of experimental period. The differences between means of male lamb's fasted weight, dressing percent, prime and second cuts weight due to management system effect, were significant (P<0.05) at the end of experimental period as shown in Table 5. These results agree with those observed by **Hassan (2015)** who reported that the first and second cuts of twenty Ossimi male lambs at six months of age were 16.41and 6.42 kg, for lambs under intensive management system, while it was12.13 and 4.57 kg, for lambs under semi-intensive management system, respectively and there was a significant (P<0.001) differences between the first and second cuts weight due to management system effect. **Kochewad *et al.* (2018)** stated that the fasted weight, hot carcass weight, dressing percentage of three Deccani lambs from each group slaughtered were 23.46, 10.13 Kg and 55.72%, for lambs under intensive while, it were 20.86, 8.72 kg and 54.99%, for lambs under semi-intensive management system, respectively and there were a significant (P<0.05) differences between lambs fasted weight due to management systems effect. **Rizwana *et al.* (2019)** showed that the first and second cuts neck, shoulder, loin and flank and leg weight of Dumbi lambs at three months of age were 0.86, 1.50, 1.10 and 1.50 kg, for lambs reared

under semi-intensive management system, whilst it was 0.71, 1.23, 1.01 and1.50 kg, for lambs reared under intensive management system, respectively and there was a significant (P<0.05) or (P<0.01) differences between lambs' neck, shoulder, loin and flank and leg.

Ossimi male lambs fed on diet containing 1% Zeolite had higher fasted weight (61.95kg), hot carcass weight (35.74kg), dressing percent (57.69%), prime (23.93kg) and second cuts (11.81kg) weights at the end of experimental period than lambs fed on control diet (56.16 kg, 30.23 kg, 53.83 %, 19.73kg and 10.50 kg, respectively). The differences between means of Ossimi male lambs fasted weight, hot carcass weight, prime and second cuts weight at the end of experimental period due to Zeolite treatment effect, was significant (P<0.05) as shown in Table 5. These results agree with those reported by **Toprak *et al.* (2016)** who resulted that the hot carcass weight for twenty-five Merino x Ile de France crossbred male lambs at four- month-old was 17.2, 17.6, 17.1 and 14.3 kg, for lambs fed on diet containing 0, 1, 2 and 3 % Zeolite, respectively and the differences between means of lamb's hot carcass weight was significant (P<0.05). Also**, Estrada *et al.* (2017)** found that the dressing percentage for forty ewes 1/4Pelibuey × 3/4 Katahdin was 58.53, 58.88, 59.78 and 58.31%, when ewes fed on diet containing 0, 1, 2and 3% Zeolite, respectively and they found no significant differences between ewes dressing percentage means.

Table 5. Least-squares means (±standard errors) of factors affecting carcass traits and meat quality of growing Ossimi male lambs during the experimental period.

Items	Management system (M)		Zeolite treatment (Z)		SEM*	*P-Value*		
	Semi-intensive	Intensive	0% Zeolite	1% Zeolite		M	Z	M×Z
Fasted weight, kg	54.86[b]	58.25[a]	56.16[b]	61.95[a]	±1.07	<0.01	<0.01	>0.05
Hot carcass weight, kg	30.96[b]	35.00[a]	30.23[b]	35.74[a]	±1.24	<0.05	<0.05	>0.05
Dressing percent, %	56.43[b]	60.10[a]	53.83[b]	57.69[a]	±1.16	<0.05	<0.05	>0.05
Prime cuts weight, kg	20.23[b]	23.42[a]	19.73[b]	23.93[a]	±2.15	<0.01	<0.01	>0.05
Second cuts weight, kg	10.73[b]	11.58[a]	10.50[b]	11.81[a]	±1.18	<0.05	<0.05	>0.05
Meat physical and chemical analysis:								
Water holding capacity (WHC)	11.21[b]	12.33[a]	10.92[b]	12.63[a]	±0.30	<0.05	<0.05	>0.05
Tenderness	6.33	6.10	6.88	5.55	±0.65	>0.05	>0.05	>0.05
pH value	5.69[a]	5.62[b]	5.68[a]	5.63[b]	±0.01	<0.05	<0.05	>0.05
Moisture, %	74.30[a]	73.48[b]	74.01[a]	73.76[b]	±0.11	<0.05	<0.05	>0.05
Protein, %	19.10[b]	20.16[a]	19.30[b]	19.96[a]	±0.17	<0.01	<0.01	>0.05
Fat, %	2.96[a]	2.48[b]	2.88[a]	2.56[b]	±0.08	<0.05	<0.05	>0.05
Ash, %	2.00[b]	2.31[a]	2.03[b]	2.28[a]	±0.04	<0.05	<0.05	>0.05

a, b Means within any classification, followed by different letters are significantly different (p<0.05).
*SEM- Standard error of mean.

Ossimi male lambs reared under intensive management system had a higher water holding capacity (WHC), protein and ash % for slaughtered lambs (12.33 cm ,20.16 and 2.31%, respectively) than male lambs reared under semi-intensive management system (11.21cm, 19.10% and 2.00%, respectively), while semi-intensive management system had a higher moisture, fat and pH value for slaughtered lambs (74.30%, 2.96% and 5.69, respectively) than intensive management system (73.48%, 2.48% and 5.62, respectively) and the two management systems had no effects on tenderness and the differences between means were not significant. The differences between means of male lamb's water holding capacity, protein and moisture due to management system effect, were significant (P<0.05) shown in Table 5. These results agreement with **Das *et al.* (2008)** who found that the moisture, protein, fat and ash percentage of the male Muzaffarnagari lambs at six months of age were 75.85 ,18.68, 4.01 and 1.01% , under semi-intensive management systems, while, it were 72.01, 19.92,6.64 and 1.06 %, under intensive management systems, respectively and they found that moisture, Protein, fat and ash percentage traits at nine months of age under semi-intensive management systems, were 73.03, 19.17,6.32 and 0.98 %, while, it were 70.01 , 20.01 , 8.86 and 1.05%, for lambs under intensive management systems, respectively, and , there was a significant differences between moisture and fat only at both ages (P<0.05). In the other species, **Tufekci and Olfaz (2019**) who stated that the meat pH value of thirty Saanen x Hair Goat at 2.5-3 months of age was 6.33vs 6.54 and 6.31vs 6.49 under intensive and semi-intensive management

systems, respectively and the differences between means were significant (P<0.05).

Ossimi male lambs fed on diet containing 1% Zeolite exhibited higher water holding capacity, protein and ash% for slaughtered lambs (12.63 cm, 19.96 % and 2.28 %, respectively) than Ossimi male lambs fed on control diet (10.92 cm , 19.30 % and 5.68 %, respectively), while Zeolite treatment had not effect on tenderness and moisture and the differences between them were not significant , although male lambs fed on control diet exhibited higher fat % and pH value (2.88 % and5.68, respectively) than male lambs fed on diet containing 1% Zeolite (2.56 % and 5.63, respectively) for slaughtered lambs. The differences between means of male lamb's water holding capacity, protein, ash, fat and pH value due to Zeolite feeding effect, were significant (P<0.05) as shown in Table 5. These results disagree with those stated by **Forouzani *et al.* (2004)** who reported that the dry matter, crude protein and crude fat of twelve Mehraban male lambs and at 310 days of age were 344, 171 and 136 g/kg, for lambs for fed control diet; it was 336, 171and 143 g/kg, for lambs fed 30g Zeolite/kg diet and it were 331, 172 and 150 g/kg, for lambs fed Zeolite 60g/kg diet, respectively and there were no significant differences between lambs crude protein and crude fat due to Zeolite levels effect. **Tánori *et al.* (2022)** who reported that the pH value, water holding capacity (WHC), moisture, ash, fat and protein % of twenty-eight Kathadin male lambs were 5.86, 80.79%, 73.32, 0.98, 4.64 and 21.30 for lambs fed on control diet respectively, while it were 5.92, 80.14 %, 71.84, 0.98, 4.94 and 21.08 for lambs fed on 1% Zeolite, respectively, with no significant differences.

The differences between means of experimental male lamb's carcass traits and meat quality, due to the interaction between management systems and Zeolite treatment, were not significant (Table5).

Blood metabolites:

Intensive management system Ossimi lambs exhibited higher blood total protein, albumin, globulin, A/G ratio, ALT, AST, creatinine, urea, total cholesterol and immunoglobulin (5.91, 3.56, 2.35 g/dl, 1.51, 23.10, 57.88U/L, 0.42, 13.16, 65.25 and 60.00 mg/dl, respectively) than semi- intensive management system lambs at the end of experimental periods (5.01, 3.11, 1.90 g/dl, 1.64, 24.30, 64.81U/L, 0.62, 16.36, 74.75 and 54.31mg/dl, respectively). The differences between means of Ossimi male lamb's blood metabolites due to management system effect were significant (P<0.05) as shown in Table 6. These results are in a good agreement with results of **Raju *et al.* (2015)** who found that blood cholesterol and uric acid of Deccani lambs were 61.40 and 57.00 mg/dl, for lambs under semi-intensive, while, it were 50.50 and 71.00 mg/dl, for lambs under intensive management systems, respectively as well as, there was a significant difference between lamb's blood cholesterol (P<0. 05). **Harby *et al.* (2021)** who resulted that difference between blood creatinine, AST and ALT of Ossimi male lambs at nine months of age was affected significantly (P<0.05) by management system.

Ossimi male lambs fed on diet containing 1% Zeolite exhibited higher total protein, albumin, globulin, A/G ratio, ALT, AST, creatinine, urea, total cholesterol and immunoglobulin (5.71, 3.46, 2.25 mg/dl, 1.54, 21.61, 57.25U/L, 0.45, 13.98, 67.78 and 59.86 mg/dl, respectively) at the end of experimental periods than male lambs fed on control diet (5.21, 3.21, 2.00 mg/dl, 1.61, 25.78, 65.45U/L, 0.59, 15.55, 72.21 and 54.45 mg/dl, respectively). The differences between means of male lamb's blood metabolites due to Zeolite treatment effect were significant (P<0.05) as shown in Table 6. Results obtained by **Toprak *et al.* (2016)** who resulted that the total protein for twenty-five Merino x Ile de France crossbred male lambs at four- months of age was 6.60 mg/dl, for lambs fed 0% Zeolite, while, it was 6.45 mg/dl, for lambs fed 1% Zeolite, as well as, 6.98 mg/dl, for lambs fed 2 % Zeolite and it was 7.08 mg/dl, for lambs fed 3% Zeolite and there was a significant (P<0.05) differences between lamb's blood total protein (mg/dl) means due to Zeolite treatment effect.

On the other hand, **Ghoneem *et al*. (2021)** found that blood albumin, globulin, urea and creatinine for thirty male Bakri lambs at six months of age were 2.38, 4.06, 39.20 and 1.26 mg/dl, for lambs fed 1% Zeolite, while it was 2.50, 4.06, 37.60 and 1.30 mg/dl, for lambs fed 2% Zeolite, respectively and the differences between lamb's albumin and globulin, were not significant. **Sallam *et al.* (2022)** who stated that differences between means of blood total protein, albumin, A/G ratio, cholesterol and creatinine of forty-five male Barki lambs during 141 days were not significantly affected by the Zeolite treatments.

The differences between means of experimental male lamb's blood metabolites, due to the interaction between management systems and Zeolite treatment, were not significant (Table6).

Table 6. Least-squares means (±standard errors) of factors affecting blood metabolites of growing Ossimi male lambs during the experimental period.

Items	Management system (M)		Zeolite treatment (Z)		SEM*	*P-Value*		
	Semi-intensive	Intensive	0% Zeolite	1% Zeolite		M	Z	M×Z
Total protein, g/dl	5.01[b]	5.91[a]	5.21[b]	5.71[a]	±0.09	<0.05	<0.05	>0.05
Albumin, g/dl	3.11[b]	3.56[a]	3.21[b]	3.46[a]	±0.05	<0.05	<0.05	>0.05
Globulin, g/dl	1.90[b]	2.35[a]	2.00[b]	2.25[a]	0±.04	<0.05	<0.05	>0.05
A/G ratio	1.64[a]	1.51[b]	1.61[a]	1.54[b]	±0.01	<0.05	<0.05	>0.05
ALT , U/L	24.30[a]	23.10[b]	25.78[a]	21.61[b]	±0.30	<0.05	<0.05	>0.05
AST , U/L	64.81[a]	57.88[b]	65.45[a]	57.25[b]	±0.97	<0.05	<0.05	
Creatinine , mg/dl	0.62[a]	0.42[b]	0.59[a]	0.45[b]	±0.01	<0.05	<0.05	>0.05
Urea , mg/dl	16.36[a]	13.16[b]	15.55[a]	13.98[b]	±0.20	<0.05	<0.05	>0.05
Total cholesterol, mg/dl	74.75[a]	65.25[b]	72.21[a]	67.78[b]	±0.43	<0.05	<0.05	>0.05
Immunoglobulin, mg/dl	54.31[b]	60.00[a]	54.45[b]	59.86[a]	±0.41	<0.05	<0.05	>0.05

a, b Means within any classification, followed by different letters are significantly different ($p<0.05$).
*SEM- Standard error of mean.

Conclusion

From the previous results it can be concluded that Ossimi lambs reared at intensive management system fed on diet containing 1% Zeolite had the better growth performance, carcass traits, immune response and economic efficiency without adverse effect on the studied traits during 120 days of experimental period. Thus, sheep breeders must use intensive management system with diet containing 1% Zeolite to earn these advantages.

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تأثير نظم الرعاية والمعاملة بالزايوليت على أداء النمو والكفاءة الأقتصادية وصفات الذبيحة ومكونات الدم في ذكور حملان أغنام الأوسيمى

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كان الهدف من أجراء البحث دراسة تأثير نظم الرعاية (المكثفة والشبه مكثفة) وأستخدام الزايوليت على أداء النمو وصفات الذبيحة ومكونات الدم والكفاءة الأقتصادية فى أغنام الأوسيمى الذكور. تم أستخدام 20 من الحملان الذكور في عمر 6 أشهر قسمت الى مجموعتين رعائية (كل مجموعة تحتوي على 10 حملان) يتم تغذيتها فرديا. المجموعة الأولى تم تربيتها تحت نظام الرعاية الشبه مكثف والمجموعة الثانية تم تربيتها بالنظام المكثف مع أضافة بادىء للحملان النامية (يحتوي على نسبة بروتين 20%) وكل مجموعة رعائية تم تقسيمها الى مجموعتين تغذية (كل مجموعة تحتوي على 5 حملان) المجموعة الأولى تم تغذيتها على العلف التقليدى طبقا لتوصيات NRC (2007)والمجموعة الثانية تم تغذيتها على علف يحتوي على 1% زايوليت (كمادة محفزة للنمو). كل مجموعات التجربة تم وزن شهريا لأقرب جرام حتى نهاية فترة التجربة (120 يوم) فى الصباح الباكر قبل التغذية والشرب. تم تسجيل كلا من المأكول والمتبقى يوميا كذلك تم حساب الزيادة اليومية والكلية لوزن الجسم والمأكول الكلى ومعامل التحويل الغذائى والكفاءة الأقتصادية. فى نهاية التجربة تم ذبح 6 حملان من كل مجموعة لتقييم صفات الذبيحة وكذلك تم جمع عينات الدم لتحليل مكوناته. أظهرت النتائج أن الحملان فى نظام الرعاية المكثف والتى تتغذى على عليقة تحتوي على 1% زايوليت أعطت أفضل نتائج أداء النمو والكفاءة الأقتصادية وصفات الذبيحة ومكونات الدم عن باقى المجموعات. لذلك يمكن أن نستخلص من ذلك أن نظام الرعاية المكثف للحملان المغذاه على عليقة تحتوي على 1% زايوليت تعطى أفضل نتائج دون تأثير سلبي على الصفات المدروسة.