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Effect of daily supplement of coriander seeds powder on weight gain, rumen fermentation, digestion and some blood characteristics of Awassi ewes

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ABSTRACT:

This experiment was carried out at the College of Agriculture, University of Baghdad to investigate the effect of *Coriandrum sativum* seeds powder on Awassi sheep diet. Body weight gain, inviter digestible co-efficient rumen fermentation and blood lipids were found out and analyzed. Sixteen Awassi ewes aged 3-4 months and weighed 17-20kg were used in the experiment. The experiment was carried out from 1.4.2017 to 4.6.2017. Ewes were randomly segregated into four groups where each group consisted of four ewes fed in the group feeding system. Two ration of concentration from 30% to roughage 70% and 70% concentration to 30% roughage with or without supplemented coriander 6 g/head/ day were used for the analysis. Results revealed non-significant differences in total and daily ewes weight increase when fed with 70-30 or 30-70 with or without coriander supplementation (3.95 and 3.38kg, and 0.088 and 0.061 g/day respectively). However, significant interaction ($p<0.05$) of ration ratio with coriander supplementation in daily weight increase was seen. No significant differences were noticed in *in vitro* digestion coefficient of dry and organic matter, stomach rumen fermentation, NH_3-N and TVFA, while significant reduction ($p<0.05$) in pH when feeding with high level of roughage (30-70) with or without coriander addition, compared to 70-30 ration (pH=6.71 and 7.35 respectively). Non-significant differences were noticed in cholesterol, HDL, VLDL due to the ration ratio (30:70 and 70:30). Significant increases ($P<0.01$) in triglyceride lipids LDL (49.32, 57.17, 40.27 and 46.29 respectively) when low level of concentration was used coriander supplementation also resulted in significant decrease ($P>0.01$) in triglyceride lipid and LDL (49.88 and 40.40 respectively). Interaction of ration ratio and coriander supplementation was significant ($P>0.05$) in triglycerides and LDL (30) rations (PH=6.71 and 7.35 respectively). Non-significant differences were noticed in cholesterol, HDL, VLDL due to the ration ratio (30:70 and 70:30). Significant increase ($P<0.01$) in triglyceride lipids LDL was seen (49.32, 57.17, 40.27 and 46.29 respectively) when low level of concentration was used coriander supplementation also resulted in the significant decrease ($P>0.01$) in triglyceride lipid and LDL (49.88 and 40.40 respectively). Interaction of ration ratio and coriander supplementation was significant ($P>0.05$) in triglycerides and LDL.

Keywords:

Coriander seed, *Coriandrum sativum*, Weight gain, Blood lipid, Rumen fermentation, Awassi lambs.

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INTRODUCTION

Supplementation of animal ration with some medicinal plants were regarded as a new way in the animal production targeting the improvement of production efficiency due to the increased production and immunity. It has been proved through numerous experiments that animal rations supplemented with medicinal plants were safe and had no recessive impact on general health (Scrimshaw and SanGiovanni, 1997).

Coriander (*Coriandrum sativum*) belonged to Umbelliferae family, it is a herb used as an antioxidant, anti-inflammatory and for removing heavy metals from the tissues by weakening their attachment to animal tissues and removing them out through the secretory system (Samuelsson, 2003) coriander (plant height 20 to 70 cm) leaves and seed contain essential oils, protein, vitamins, some minerals (Ca, P and Fe), crude fiber and carbohydrates, and has been used as a food additive (Kalemba and Kunicka, 2003). Coriander seed contains triglycerides lipids, petroselinic acid, and monounsaturated fatty acids (Ganesan *et al*., 2013). Seeds have high percent of oil (28.4% of seed weight) and these oils may be widely used in food industry (Yeung and Bowra, 2011), the constituents of coriander seed oils are aliphatic aldehydes (0.3-11.2%), linalool (58.0-80.3%), camphor (3.0-5.1%), α-pinene (0.2-10.9%), and acerat (0.2-5.4%) (Ganesan *et al*., 2013). Coriander is also regarded as an anti-bacterial (Keskin and Toroglu, 2011) and anti-fungal (*Aspergillus niger* and *Penicillium lilacinum*) (Zare-Shehneh *et al*., 2014).

Coriander is an anti-oxidant because of the high contents of riboflavin (0.0046), tocopherol (0.181), total polyphenol (18.7), gallic acid (0.173%), caffeic acid (0.08), ellagicacid (0.162), quercetin (0.608), and kaempferol (0.233) (Anita *et al*., 2014). Coriander seed oils scavenges hydroxyl group preventing oxidation injuries to the biological tissues, and increase glutathione level (Panjwani *et al*., 2010). Coriander seeds have been used in the sheep ration as additive resulted in improving animal health , white blood cells , protein level especially globulin (Al-Zwein, 2011), and some wool traits (Al-Zwein, 2010).

In addition, this additive helped reducing LDL cholesterol and increasing HDL cholesterol (Chitra and Leelamma, 1997). The aim of this study was to test the effect of coriander seed powder supplementation to Awassi ewe ration on the body weight gain, *in vitro* digestibility, rumen fermentation and a few blood traits.

MATERIALS AND METHODS

Growth experiment

An experiment was carried out in the animal field at the College of Agriculture, University of Baghdad. Sixteen Awassi ewes with 3-4 month old, 17-20 weight were considered for the experimental duration of 56 days. Ewes were divided randomly to four representative groups each including four ewes fed on concentrate: rough ration and two concentrates (30:70 and 70:30) with or without addition of 6 g/head/day to the concentrate feeding of the ewes at 8 am every day after feeding Alfalfa hay. Table 1 and 2 show the components and chemical composition of the concentrate, rough ration and coriander. All ewes weighed at the beginning of experimental duration and then weekly to measure the weight increase.

Stomach solute collection

At week before the end of the experiment stomach solute was collected from three animals of each treatment using rubber tube by Mana Syphon method (Chitra and Leelamma, 1997; Saeed, 2011). pH was

Table 1. Formulation of the concentrated diet (%)

S. No	Content of ratio	Percentage %
1	Yellow corn	38
2	Barley	15
3	Soybeans	10
4	Wheat bran	35
5	Salt	1
6	Limestone	1
7	Total	100

Table 2. The components and chemical composition of the concentrate and rough ration and coriander (dry mater)%

S. No	Ingredient (%)	Concentrate	Alfalfa hay	*Coriandrum sativum*
1	DM	98.12	90.82	94.07
2	OM	92.44	79.63	91.09
3	CP	13.05	9.88	15.09
4	CF	12.00	30.66	21.39
5	EE	0.97	0.02	0.14
6	NFE	66.42	39.07	54.47
7	ME(MJ/kg DM) *	12.06	8.20	10.54

Metabolizable energy (ME) values are estimated according to the equation (36)
*ME(MJ/kg DM) = 0.012(C.P) + 0.005(C.F) + 0.031(E.E) + 0.014(NFE); Nitrogen free extract (NFE) was calculated by the following formula (37)% NFE = OM – (CP % + EE% + CF%)

recorded and NH_3-N was determined by Kjeldahl method and Magnesium Oxide (MgO) was added (AOAC, 2005) using the following equation.

NH_3 (meg/100mf) = mp of HCL titrate normality 0.014/ volume of rumen liquor (1ml)*100 volatile fatty acids TVFAS (Warner, 1964) as in the following equation.

TVFA (mmol/L) = (ml NaOH titrate *normality of NaOH/volume of rumen liquor (1ml)*1000) (36)

Blood sampling

1 ml of blood samples were collected for all animals from jugular vein and serum was separated from samples using centrifugation at 3000rpm for 15 minutes aiming triglycerides (Toro and Ackemann, 1975) cholesterol (Shih *et al*., 2000), High Density Lipoprotein (HDL) and Very Low Density Lipoprotein (VLDL) determination. *In vitro* rumen digestion factor was determined by adding 10ml of rumen liquor in

Table 3. The effect of low and high concentrate supplemented with *Coriandrum sativum* on live weight gain/kg of Awassi lambs

S. No	Parameters	Initial live weight gain/kg	Final live weight gain/kg	Gain/kg	Gain/day
	Effect of concentrate: roughage ratio				
1	70:30	17.33±1.81	20.71±2.07	3.38±0.91	0.061±0.01
2	30:70	19.00±1.73	22.95±2.15	3.95±1.22	0.088±0.047
3	Significant	NS	NS	NS	NS
	Effect of *Coriandrum sativum*				
1	With *Coriandrum sativum*	19.16±1.24	23.31±1.78	4.15±1.16	0.105±0.042
2	Without *Coriandrum sativum*	17.16±2.15	20.35±2.31	3.183±0.94	0.044±0.021
3	Significant	NS	NS	NS	NS
	The interaction between the roughage ratio and the effect of *Coriandrum sativum*				
1	With *Coriandrum sativum* 70:30	17.66±2.02	20.16±2.31	2.50±0.28	$0.047±0.011^b$
2	Without *Coriandrum sativum* 70:30	17.00±3.51	21.26±3.98	4.26±1.82	$0.076±0.032^b$
3	With *Coriandrum sativum* 30:70	20.66±1.20	26.46±0.84	5.80±2.00	$0.162±0.07^a$
4	Without *Coriandrum sativum* 30:70	17.33±3.28	19.43±3.18	2.10±0.100	$0.0136±0.013^b$
5	Significant	NS	NS	NS	*

a and b: Means in the same row for each item with different superscripts differ significantly; * (P<0.05); NS: Not significant

Table 4. The effect of low and high concentrate supplemented with *Coriandrum sativum*, on inviter digestible coefficient

S. No	Parameters	DMD	OMD
	Effect of concentrate: roughage ratio		
1	70:30	58.12±7.57[a]	75.45±3.14[a]
2	30:70	64.41±3.92[a]	75.33±2.15[a]
3	Significant	NS	NS
	Effect of *Coriandrum sativum*		
1	With *Coriandrum sativum*	68.65±4.23[a]	77.25±1.57[a]
2	Without *Coriandrum sativum*	60.75±9.09[a]	77.71±0.58[a]
3	Significant	NS	NS
	The interaction between the roughage ratio and the effect of *Coriandrum sativum*		
1	With *Coriandrum sativum* 70:30	68.65±4.23[a]	77.25±1.57[a]
2	Without *Coriandrum sativum* 70:30	60.75±9.09[a]	77.71±0.58[a]
3	With *Coriandrum sativum* 30:70	64.41±3.92[a]	75.33±2.15[a]
4	Without *Coriandrum sativum* 30:70	58.12±7.57[a]	75.45±3.14[a]
5	Significant	NS	NS

Means in the same column for each item with different superscripts differ significantly; NS: Not significant

tubes pumped with CO_2 and incubated in water bath at 29°C for 48h.

Then pepsin enzyme was added and incubated using centrifugation, then dried at 105°C for 24h to determine the digestion factor for dried samples. It was weighed and then dried ash at 600°C for 3h to determine the organic matter digestion factor.

Statistical analysis

Data were statically analyzed as 2*2 factorial experiment using statistical program (SAS, 1996) and data were tested according to Duncan's multiple range test (Duncan, 1995) following: the mathematical equation given below:

Yijk= μ+Ri+Ej+REij+eijk

Yijk: Observation value

where, μ: mean; Ri= Effect of ratio; Ej= Effect of coriander; REij= Effect of interaction between ration and coriander and eijk= standard error.

RESULTS AND DISCUSSION

Table 3 revealed no significant difference in the total dry weight gain of ewes regardless of ration component. The rate of total and daily weight gains were 3.38, 3.95kg and 0.061, 0.088g/day respectively. Addition of coriander power increased total and daily weight gain with the values of (4.15, 3.183kg and 0.105, 0.044 g/day respectively but the differences were not significant. However adding coriander to low concentrate diet (30:70) increased the daily weight significantly (0.162g/day) compared to the control (0.047g/day) or even the same treatment but without coriander supplementation (0.136g/day). This increase may attribute to the improved the microenvironment of the rumen through the increased volatile fatty acids due to coriander. Ganesan *et al*. (2013) reported that one of the effective components of digested coriander is acetate where its percentage (0.2-5.4%) and the roughage diet were regarded as the main sources of ruminants nutrition which resulted in the optimum environment. These conditions may increase diet intake and increase digestion co-efficient as found in Holstein calf's (Seifzadeh *et al*., 2016). They fed these calves with medicine plant, and found that digestion coefficient of NDF and ADF were increased significantly.

These results could be due to the saponin compounds which are one of the main components of the plant extracts. The saponin conjugated to the cholesterol of protozoa membrane so inhibit its activity (Klita *et al*., 1996) in the stomach, so increase the diet use deficiency in the animal (Newbold *et al*., 1997). Hassan and Has-

Table 5. The effect of low and high concentrate supplemented with *Coriandrum sativum*, on rumen fermentation of Awassi lambs

S. No	Parameters	NH_3-N (mg/100ml)	TVFA (mmol/L)	PH
	Effect of concentrate: roughage ratio			
1	70:30	26.38±0.58[a]	123.57±4.91[a]	6.71±0.14[a]
2	30:70	28.81±2.69[a]	122.51±3.94[a]	7.35±0.12[b]
3	Significant	NS	NS	*
	Effect of *Coriandrum sativum*			
1	With *Coriandrum sativum*	28.62±0.58[a]	123.72±5.51[a]	7.03±0.08[a]
2	Without *Coriandrum sativum*	26.58±0.55[a]	122.37±3.03[a]	7.03±0.26[a]
3	Significant	NS	NS	NS
	The interaction between the roughage ratio and the effect of *Coriandrum sativum*			
1	With *Coriandrum sativum* 70:30	30.96±5.56[a]	123.93±8.67[a]	6.93±0.03[bc]
2	Without *Coriandrum sativum* 70:30	26.66±0.89[a]	121.10±0.75[a]	6.50±0.17[ac]
3	With *Coriandrum sativum* 30:70	26.27±0.97[a]	123.51±8.76[a]	7.13±0.14[ab]
4	Without *Coriandrum sativum* 30:70	26.49±0.85[a]	123.64±6.62[a]	7.56±0.18[a]
5	Significant	NS	NS	**

a, b and c: Means in the same column for each item with different superscripts differ significantly*(P<0.05), NS: Not significant

san (2009) found that addition of two levels (0 and 7.5 g of dried Nigel seed) to Karrady ewes ration increased the body weight of ewes fed with Nigel seeds compared to the control ewes. Similar trend was also found out by Sultana *et al*. (2012).

However, Table 4 shows no significant effects of ration type or coriander powder addition and their interaction on DMD and OMD. Table 5 shows no significant differences in the stomach fermentation NH_3-N and Total Volatile Fatty Acid (TVFA), whereas the pH

Table 6. The effect of *Coriandrum sativum*, low and high concentrate on blood lipids of Awassi female lambs

S. No	Parameters (100gm/dl)	S. Total cholesterol	S. Total triglyceride	High density lipoprotein (HDL)	Low density lipoprotein (LDL)	Very low density lipoprotein (VLDL)
	Effect of concentrate: roughage ratio					
1	70:30	14.36±1.78[a]	49.32±2.86[b]	6.00±0.51[a]	40.27±2.71[b]	2.83±0.40[a]
2	30:70	18.75±3.76[a]	57.17±0.99[a]	7.16±0.90[a]	46.29±1.26[a]	3.66±0.80[a]
3	Significant	NS	**	NS	**	NS
	Effect of *Coriandrum sativum*					
1	With *Coriandrum sativum*	18.57±3.19[a]	56.61±2.03[a]	6.50±0.88[a]	46.16±1.80[a]	3.66±0.66[a]
2	Without *Coriandrum sativum*	14.54±2.72[a]	49.88±2.82[b]	6.66±0.66[a]	40.40±2.44[a]	2.83±0.60[a]
3	Significant	NS	**	NS	NS	NS
	The interaction between the roughage ratio and the effect of *Coriandrum sativum*					
1	With *Coriandrum sativum* 70:30	15.14±2.83[a]	53.96±3.60[a]	6.33±0.66[a]	44.22±3.49[ab]	3.00±0.57[a]
2	Without *Coriandrum sativum* 70:30	13.58±2.68[a]	44.68±2.56[b]	5.66±0.88[a]	36.32±2.97[b]	2.66±0.66[a]
3	With *Coriandrum sativum* 30:70	22.00±5.58[a]	59.66±0.88[a]	6.66±1.85[a]	48.09±0.55[a]	4.33±1.20[a]
4	Without *Coriandrum sativum* 30:70	15.50±5.39[a]	55.08±2.49[a]	7.66±0.66[a]	44.49±2.10[ab]	3.00±1.15[a]
5	Significant	NS	*	NS	*	NS

a and b: Means in the same column for each item with different superscripts differ significantly** (P<0.01)* (P<0.05), NS: Not significant

decreased significantly (6.71) with high roughage percent (70:30) (7.35). This was expected since high percent of roughage increase stomach fermentation. These results agreed with those of Agle *et al.* (2010); Aguerre *et al*. (2011) who reported that the difference in the ration had no significant effect on NH_3-N and TVFA.

However, Chen *et al*. (2015) in the laboratory experiment found that low roughage: concentrate resulted in the significant increase of NH_3-N and TVFA. On the other hand, fed yaks bulls on different percentages of concentrate: roughage diets (30:70, 40:60, 50:50, and 60:40) and found that no significant differences in NH_3-N and TVFA. Moreover, no significant changes in NH_3-N, TVFA and pH were noticed when coriander (6g/head/day) was added (Chen *et al*., 2015). Adding coriander to the diet regardless of the roughage: concentrate ratio has no significant effect, but interaction was significant and the lowest pH value found with high roughage without coriander (6.50), while the highest was found with the high concentrate with or without coriander (7.13 and 7.56) respectively. Results of this experiment of pH changes coincided with the results of Hadjipanayiotou and Antoniou (1983); Cerrillo *et al*. (1999). High starch content fermentation will increase lactic acid concentration which reduces pH value by increasing roughage. Volatile Fatty Acid (VFA) are the final fermentation products by domesticated rumen microorganism and are regarded as the milestoal of energy source to animals where 70% of this energy can by supplemented from these Volatile Fatty Acid (VFA) (Christaki *et al*., 2012). Much field research showed no significant difference in the concentration of TVFA due to the application of volatile oils to the sheep (110mg/day), and cow (1g/day) diet (Newbold *et al*., 2004; Beauchemin and McGinn, 2006). Similar trend was found by Busquet *et al*. (2006) in laboratory experiment when the effect of some medicinal on rumen permutation was tested. Each treatment received 3g/l of the above extracts and showed no significant effects on VFA level while increasing the extracts concentration decreased volatile fatty acid and rumen digestion coefficient.

Table 6 revealed that total cholesterol, HDL, and VLDL were not affected significantly when ewes fed on highest was with low level of concentrate (49.32, 57.17 and 40.37, 46.29 respectively). This increase may be due to the conjugation of the triglyceride with fibers which is effective to produce acetate that taken up directly to blood vines. These results disagree with the findings of Chen *et al*., (2015) where feeding with different levels of roughage: concentrate had no significant effects on cholesterol, triglyceride and low density lipoprotein. Adding coriander powder had no significant effects on cholesterol, HDL, LDL and VLDL, while significant decrease was noticed in triglycerides (Table 6) and this may be due to the volatile oils, tannins and saponins of the coriander which is very important in the inhibition of the buildup of triglycerides and cholesterol so as to prevent their accumulation in blood. Moreover, triglycerides conjugated with fibers and send it out of the animal body before reaching blood cycle.

Interactive effect of ration type and coriander was significant, where adding coriander to 30:70 ration increased triglycerides ($p<0.05$) while Low Density Lipoprotein (LDL) was decreased and this may be attributed to the coriander seed powder components of linalool oil which is medically and nutritionally important. Some researches revealed that trigonal seeds had significant effect on same blood traits.

Al-Shaikh *et al*. (1999) found that feeding goats on three different levels of trigonal (0, 25 and 50%) added to the diet, had no significant effects on cholesterol and triglycerides and these results in the contradiction with those of Idris *et al*. (2014) who found that feeding sheep on pellets contain Nigella sativa seed oil (479) 4.7% increased LDL, HDL, cholesterol and triglycerides.

CONCLUSION

It can be concluded that coriander supplemented ration of Awassi ewes reduced triglyceride and LDL compared to the ewes fed with ration without coriander, Moreover coriander is safe and had no side effects on the animal performance.

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