EFFECT OF DIETARY OREGANO, ROSEMARY AND PEPPERMINT AS FEED ADDITIVES ON NUTRIENTS DIGESTIBILITY, RUMEN FERMENTATION AND PERFORMANCE OF FATTENING SHEEP

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SUMMARY

his study was carried out to investigate the effect of inclusion of dietary supplementation of some medicinal plant (oregano, rosemary and peppermint) on nutrient digestibility, rumen fermentation, blood metabolites and performance of finishing lambs. Twenty-four Saidi male lambs with average body weight of 39.44 ± 0.61 kg were randomly distributed into four groups, each with six animals in a completely randomized design for 60 days' experimental period. The experimental groups were a control group fed basal diet containing 70% concentrate mixture plus 30 % wheat straw and treated groups was fed basal diet plus 2.5 % dried Oregano (Origanum vulgare L.) (ORG), the second group fed 2.5% dried Rosemary (Rosmarinus officinalis L.) (ROS) and the third group was fed 2.5% dried Peppermint (Mentha piperita L) (MEN). The oregano, rosemary and peppermint were added and mixed with concentrate mixture. Four digestibility trials were carried out using twelve rams. Inclusion oregano and rosemary were improved (P<0.05) the digestibility of crude protein as compared with control and peppermint diet. The addition medicinal plants to sheep ration increased (P<0.05) CF digestibility as compared with control one. The nutritive value of rations in terms of total digestible nutrients (TDN) and digestible crude protein (DCP) were significantly (P<0.05) higher in medicinal plants groups than that of control group. Supplements of medicinal plants in sheep diets decreased (P<0.05) ruminal ammonia-N and total protozoal count and increased ruminal VFA's while had no effect on rumen pH when compared with the control group. It was found that no significant (P> 0.05) differences among groups in body weight, average daily gain, feed intake and feed conversion. The average value of serum total protein, globulin and total antioxidant capacity (TAC) were significantly higher in group fed medicinal plant than the control. Serum cholesterol, triglycerides and urea concentration were decreased (P<0.05) in all medicinal plant groups when compared with control group. In conclusion, supplements of some medicinal plants like oregano; rosemary and peppermint to the diets of fatting lambs at rate of 2.5% in concentrate mixture improved nutrient digestibility, feeding value and rumen fermentation. Also, the growth performance and blood biochemical parameters were improved particular with addition oregano and rosemary in fattening sheep.

Keywords: Medicinal plant, oregano, rosemary, peppermint, nutrients digestibility, rumen fermentation, blood metabolite and, fattening sheep, performance.

INTRODUCTION

The potential of using phytogenic and herbal products as natural alternatives to antibiotics and growth promoters in ruminant nutrition has gotten more attention in recent years, such product may altering rumen microbial fermentation and affecting animal performance (Steiner, 2009; Giannenas, 2011; *Rojo et al.*, 2015, Matloup *et al.*, 2017). Also may have antibacterial activity and inhibit protein degradation in the rumen, thereby enhancing the intestinal supply of amino acids to the animal host (Wallace 2004). Previous studies showed that herbs or their extracts have some inhibitory effects on methane production, and protozoal number and activity (Bodas *et al.*, 2012, Hernandez *et al.*, 2017).

Oregano (*Origanum vulgare L.*) is an herb with high antioxidant capacity compared with several other medicinal herbs (Dragland et al., 2003). The principal compounds of oregano essential oil are carvacrol, thymol, γ -terpinene, *p*-cimene and linalool (Baser, 2002). Several studies have reported that oregano essential oil possesses antimicrobial (Burt, 2004) and antioxidant properties (Amorati *et al.*, 2013). Feeding oregano essential oil increased feed efficiency by activating beneficial gut microorganisms (Bendini *et al.*, 2002) while inhibiting pathogenic microorganism growth, i.e. *Escherichia coli* and *Staphylococcus aureus* (Preuss et al., 2005). Feeding oregano essential oil to buffalos reduced the total

microbial load and specific pathogens (Thao *et al.*, 2014). *In vitro* studies conducted by Tekippe *et al.* (2011) showed a sizable decrease in rumen methane production with oregano supplementation within 8 hrs after feeding.

Rosemary (*Rosmarinus officinalis* L.) is an aromatic herb which may be administered in diets of animals as a source of natural polyphenols. Rosemary has potent antioxidant properties as well as anticancer, anti-inflammatory and antibacterial effects (Habtemariam, 2016). The phenolic diterpenes are rosemary's antioxidant components. On the other hand, Monoterpenes such as pinene, myrecene, 1,8cineole and borneol are the main components of rosemary volatile oil. These substances have potent antibacterial and antimicrobial properties (Okoh *et al.*, 2010). In vitro study, rosemary leaves or its essential oil can alter ruminal fermentation. (Castillejos *et al.*, 2008), it has antioxidant properties in sheep (Gladine *et al.*, 2007). Hassanein (1982) reported that the Egyptian Rosemary was contain 0.97 % essential oil (on DM basis), consisting of limonene, phellandrene, thymol, and linalool.

Peppermint (*Mentha piperita L*) is a medicinal herb in the Labiatae family that was grown by the ancient Egyptians and mentioned in the thirteenth-century Icelandic pharmacopoeia. The medicinal parts are the essential oil extracted from the aerial parts of the flowering plant, the dried leaves, the fresh flowering plant and the whole plant. It is widely used in herbal medicine and believed to be particularly beneficial in building the immune system and fighting secondary infections. Menthol is the most common component of peppermint essential oil that has antibacterial properties (Schuhmacher et al., 2003). Peppermint is also high in polyphenolic compounds, that it may have powerful antioxidant effects (Dorman *et al.*, 2003).

The objective of the present study was to investigate the influence of addition dried oregano, rosemary and peppermint to the diets of finishing lambs on nutrient digestibility, rumen parameters, growth performance and blood metabolites.

MATERIALS AND METHODS

Animals, diets and management:

The experimental trail was carried out at the Animal Production Research Farm, Faculty of Agriculture, Assiut University. Twenty four Saidi fattening sheep weighing 39.44 ± 0.61 kg, were randomly assigned to four experimental groups (6 lambs per treatment). The experimental period consisted of two periods; 15-days adaptation period followed by 60 days experimental period. The experimental design was a completely randomized design. The treatments included: the control group fed diet consisting of concentrate feed mixture with wheat straw; and treated groups, they were fed basal diet plus 2.5% of dried Oregano (Origanum vulgare L.) (ORG), 2.5% dried Rosemary (Rosmarinus officinalis L.) (ROS) and 2.5% dried Peppermint (Mentha piperita L) (MEN). Animals were fed on ration that consisted of 70% concentrate feed mixture (CFM) and 30% wheat straw. The herbals plants were added at rate 2.5% of concentrate mixture. The quantity of concentrate mixture provided to lambs was adjusted every two weeks according to change in body weight, by using the recommendation of NRC (2006). The rations were offered twice daily at 8.00 am and 5.00 pm. The feed remainders were collected and weighed daily to determine the daily feed intake. The animals were weighed at the start and end of experiment as well as at biweekly intervals throughout the experiment. The feed conversion ratio was calculated by dividing the feed intake by the weight gain. Fresh water was available to lambs free of choice. The used concentrate and wheat straw were analyzed according to AOAC (2005), and their chemical composition is shown in Table (1).

Blood analysis:

Blood samples were collected monthly by taking 10 ml blood from the jugular vein of each lamb, at 2 hrs after the morning feeding. After that, the blood samples were centrifuged at 3000 rpm for 15 minutes for obtaining the serum. The collected serum was stored at $-20 \, {}_{\circ}C$ until chemical analyses. At the analyses, the serum was analysed for glucose, total protein, albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), urea, creatinine, triglycerides, total cholesterol and total antioxidant capacity (TAC). These biochemical parameters were analyzed by spectrophotometer (Hitachi 911 automatic analyzer) using commercial test kits.

In an adjust $(0/)$	Treatments*				Wheat
Ingredient (%)	Control	ORG	ROS	MEN	straw
Sorghum	10	10	10	10	-
Yellow ground corn	30	30	30	30	-
Wheat Bran	23	21	21	21	-
Cotton seed cake meal	33	32.5	32.5	32.5	-
Oregano	-	2.5	-	-	-
Rosemary	-	-	2.5	-	
Peppermint	-	-	-	2.5	
Limestone	2	2	2	2	-
Salt	1	1	1	1	-
Trace mineral and vitamin premix ^{\pounds}	1	1	1	1	-
Chemical composition (%):					
DM	91.58	91.57	90.87	91.34	95.36
OM	84.14	84.30	86.76	85.76	84.69
СР	15.32	15.87	15.67	15.23	3.26
EE	3.89	4.07	4.34	4.76	1.56
NDF	16.67	17.87	16.98	15.98	72.50
ADF	3.54	4.01	3.98	3.87	43.92

 Table (1): The ingredients and chemical composition of concentrate fed mixture and wheat straw of experimental rations.

£: The premix consist of (per kg): 20,000,000 IU vitamin A, 10,000 mg vitamin E, vitamin 200,000 IU D3, 10,000 mg Fe, 2500 mg Cu, 100 mg Mo, 20,000 mg Mn, 100 mg Co, 800 mg I, 20,000 mg Zn and 100 mg Se.

*ORG: Lambs received oregano, ROS: Lambs received rosemary, MEN: Lambs received peppermint

Digestibility Trials:

Four digestibility trials were carried out using twelve local rams (two years old and about 53 ± 1.50 kg body weights). Each digested trial lasted for 21 days; the first 15 days were considered as a preliminary period followed by 7 days collection period. Animals were randomly allocated into four experimental groups, each with 3 rams. The animals in group one were considered as a control, fed basal diet of concentrate mixture plus wheat straw and treated groups were fed basal diet plus 2.5% of dried Oregano (*Origanum vulgare L.*) (ORG), 2.5% dried Rosemary (*Rosmarinus officinalis L.*) (ROS) and 2.5% dried Peppermint (*Mentha piperita L*) (MEN).

Chemical analysis and digestion coefficients measurements:

During the collection period of feces, the daily feed intake of concentrate mixture and wheat straw was calculated by removal of residual feed from the offered one. Samples of diets were taken, dried, mixed and ground through 1mm screen and stored for chemical analyses. Feces were collected daily and 10% of its weight were taken and dried at 60-70 °C for 24 hrs. For chemical analysis, the fecal samples from each animal were combined and ground using a 1mm mill screen. The chemical analysis of feeds, residual and faeces were carried out using procedures of Association of the Official Analytical Chemists (AOAC, 2005). The apparent digestion coefficients of nutrients were calculated by expressing the difference between the content of nutrients in both consumed feed and feces as a percentage of its intake. The feeding value expressed as total digestible nutrient (TDN), digestible crude protein (DCP were calculated using the chemical analyses of used ingredients and the apparent digestibility rates of different nutrients in the consumed diets according to McDonald *et al.* (1988).

Sampling and analysis of rumen fluid:

On the last day of digestibility trial, ruminal contents were sampled at 2h after the morning feeding to determine pH, concentration of ruminal ammonia-N and total volatile fatty acids (VFAs). Approximately 100 ml of rumen fluid were collected from the ventral sac of rams by using a stomach tube and hand pump, and these rumen liquor samples were divided into two portions, the first portion filtrated through one layer of cheese-cloth, which utilized to measure the protozoa count. The total protozoa count was carried out according to Abou El-Naga (1967). Nevertheless, the second portion filtrated through four layers of cheese-cloth, and then the obtained filtrate was used immediately for measurement of pH using a digital pH meter (Orion research, model 201, digital pH meter), and ammonia-N concentration in rumen liquor was determined according to Chibnal and Williams (1943). Strained rumen liquor samples were

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acidified with 0.1 N hydrochloric acid and concentrated orthophosphoric acid to stop the microbial activity before its storage for analysis, and then the samples were kept frozen at -20°C for determination of total volatile fatty acids (VFA's) The concentration of total VFA's was determined by the steam distillation method (Warner, 1964) using Markham micro distillation apparatus.

Statistical analysis:

The results were analyzed statistically using SAS statistical program (SAS, 2002). The data were evaluated by using the General Linear Models (GLM) procedure for analysis of variance. The results were subjected to ANOVA tests accompanied by Duncan's multiple range test to detect the differences among the treatments. The data are presented as means \pm SE. Probability values of less than 0.05 (p < 0.05) were considered to be significant. The statistical analysis using the following model: $Y_{ij} = \mu + T_i + e_{ij}$ where, Y_{ij} =the measured trait, μ = the overall mean, T_i = effect of feeding regimes type (i= 1, 2, 3; where 1= control 1, 2= T2 and 3= T3 and e_{ij} = Random error.

RESULTS AND DISCUSSION

Nutrient digestibility and nutritive value of the experimental rations:

The digestibility of dry matter and organic matter in rams fed the diet supplemented with peppermint were significantly lower (P<0.05) than other groups (Table 2). However, OM digestibility was higher (P<0.05) with inclusion rosemary in diet than the other groups. The digestibility of crude protein was improved (P<0.05) with supplement oregano and rosemary as compared with control and peppermint groups. The addition of medicinal plants to rams ration increased (P<0.05) CF digestibility as compared with control one. Dietary oregano, rosemary and peppermint had no effect (P> 0.05) on EE and NFE digestibility.

The enhanced nutrient digestibility particularly with inclusion oregano and rosemary may be related to the improvement of ruminal fermentation and kinetics. In addition herbs may have ability to stimulate the secretion of saliva and stimulate the function of pancreatic lipases, and amylases with increasing the activity of digestive enzymes of gastric mucosa (Kholif et al., 2017 and Frankič et al., 2009). Moreover, the presence of secondary metabolites in the herbs may have optimized the availability and activity of the rumen microflora and other ruminal functions, resulting in improved nutrient digestion by goats (Kholif et al., 2017). Also, Williams and Losa (2001) reported that plant extracts have the ability to stimulate the digestive secretions of saliva and digestive endogenous enzymes, with positive effects on protecting dietary protein from microbial degradation. These results are in harmony with those observed by Kholif et al. (2017). They observed that the digestibilities of OM, NDF, ADF, cellulose and hemicellulose were increased (P< 0.05) with rosemary treatment compared with the control treatment. Moreover, Hanafy et al. (2009) who noticed that medicinal plants addition in diets showed higher value of DM, OM, CF, NFE and EE digestibilities than the control. Zhou et al. (2019) reported that feeding sheep oregano essential oil at a rate of 7 g/day shifted microbial populations, allowing rumen fungi to proliferate, potentially improving ruminal fiber digestion.

It could be noticed that the most nutrient digestibility were decreased with supplement peppermint to the diets of rams when compared with other medicine plants or control group. These findings are consistent with those of Hosoda *et al.* (2005) they reported that digestibilities of dry matter, organic matter and crude protein decrease in cows fed peppermint. Imai *et al.* (2001) attributed the lower nutritional digestibilities with peppermint supplementation to peppermint's powerful antimicrobial action, which may have reduced ruminal microbial activity implicated in nutrient digestibilities.

The nutritive value of rations in terms of total digestible nutrients (TDN) and digestible crude protein (DCP) were significantly (P<0.05) higher in favor of medicinal plants groups (Table 2). Such improvement may be due to the increase nutrients digestibility of these rations. Similar results were found by Ishfaq et al. (2019) they recorded a significant (P<0.05) increase in DCP and TDN in *Mentha piperita* dietary compared to control group. Also, Sabbah-Allam and El-Elaime (2020) found that the feeding herbs improved (P<0.05) nutritive values as TDN, DCP compared with control ration.

Itam	Treatment*				
Item	Control	ORG	ROS	MEN	value
Nutrient digestibility					
Dry matter, DM	$79.66^{a}\pm0.57$	$80.34^{\mathrm{a}}\pm0.73$	$78.71^a\pm1.04$	$74.64^b\pm0.36$	0.001
Organic matter, OM	$75.46^b\pm0.66$	$77.23^b\pm0.80$	$85.41^{a}\pm0.31$	$72.80^{c}\pm0.58$	0.001
Crude protein, CP	$79.83^{b} \pm 0.91$	$84.10^{a} \pm 1.31$	$83.52^{\mathrm{a}}\pm0.90$	$77.19^{\text{b}}\pm0.58$	0.002
Ether Extract, EE	83.94 ± 2.36	79.33 ± 0.86	83.15 ± 2.45	79.19 ± 0.58	0.197
Crude fiber, CF	$73.23^{b} \pm 0.61$	$82.45^{\mathrm{a}}\pm0.51$	$84.42^{\mathrm{a}}\pm0.67$	$82.49^{a}\pm3.37$	0.008
Nitrogen free extract, NFE	87.63 ± 1.21	85.51 ± 1.00	82.27 ± 3.85	83.86 ± 2.88	0.519
Nutritive valu					
TDN	$74.52^b\pm0.42$	$79.19^{\mathrm{a}}\pm0.58$	$79.78^{\mathrm{a}}\pm0.97$	$79.78^{a}\pm0.80$	0.002
DCP	$9.51^{\rm c}\pm0.26$	$11.46^{ab}\pm0.58$	$12.74^a\pm0.64$	$10.53^{bc} \pm 0.38$	0.009

 Table (2): Effect of dietary medicinal plants on fattening sheep ration on nutrient digestibility and nutritive value, %.

^{*a, b,c*} Means of the same row in each item with different superscripts are significantly different (P<0.05). *ORG: Lambs received oregano, ROS: Lambs received rosemary, MEN: Lambs received peppermint

Ruminal parameters:

Supplement oregano, rosemary and peppermint to the diets of rams at rate 2.5% of concentrate mixture did not affect ruminal pH (Table 3). However, inclusion of medicinal plants in sheep diets decreased (P<0.05) ruminal ammonia-N and total protozoal count compared with control group. Dietary oregano, rosemary and peppermint increased (P<0.05) ruminal VFA's concentration as compared with control one. However, no significantl differences were detected among medicinal plants groups.

It is known that the pH is an important index for evaluating dried medicinal plants effects for potentially modified the ruminal microbial population and influences the ruminal environment (Kumar et al., 2013). These results are in harmony with those obtained by El -Bordeny et al. (2008) and Hanafy et al. (2009) who sated that the pH value of rumen fluid was not significantly affected by medicinal plants supplementation. Similarly, Sabbah-Allam and El-Elaime (2020) found that addition of medicinal herbs to the ration of sheep didn't affect on pH value. However, the VFAs of rumen fluid were significantly (P<0.05) higher for groups received medicinal herbs than the control group. The same author attributed the higher value of volatile fatty acids concentration with experimental rations compared than control group due to the increase in OM digestibility in the experimental groups. Zhou et al. (2019) found no differences (P>0.10) between the groups received oregano essential and control group in the mean ruminal pH values. Also, Sahraei et al. (2014) found that ruminal pH did not change in sheep with supplemented rosemary essential oil at doses 100, 200 and 400 mg daily. However, ruminal ammonia-N was decreased and VFAs increased with these doses. Hristov et al. (2013) stated that the addition of oregano leaf to lactating dairy cows had no influence on rumen pH value. The lower ruminal ammonia-N with supplements medicinal plants in our study may be due to contains essential oils that have the ability to inhibit some bacterial attachment to feed particles (e.g. proteolytic bacteria), resulting in decreasing ammonia production (deamination) from amino acids (Wallace et al., 2002).

The variation in chemical structures and characteristics of the various EO in herbals plants used in this study resulted in a reduction in total ruminal protozoal count (Table 3). Each specific essential oil would have distinct performance characteristics due to its chemical composition (Zhou *et al.*, 2019). Actually, protozoon was demonstrated has ecto- and endo-symbiotic relationships with methanogenesis, and about 37% of CH4 could be produced by protozoa-associated methanogens (Newbold *et al.*, 1995). Therefore, feeding medicinal herbs decreases ruminal protozoa populations, which reduces rumen methane production and increases the animal's energy availability (Lettat *et al.*, 2013). In an in vitro study, Patra et al. (2012) found that the number of protozoa reduced linearly with increasing oregano oil dosages. In line with these findings, Imai et al. (2001) stated that essential oils present in peppermint (*Mentha piperita*) are known for their anti-microbial activity. Similarly, Agarwal *et al.* (2009) found that the numbers of holotrichs and spirotrichs declined significantly (P<0.001) with increasing dose of peppermint oil and consequently reduced number of protozoa.

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Item	Treatments*				
	Control	ORG	ROS	MEN	Value
pH	7.13 ± 0.12	6.61 ± 0.27	7.29 ± 0.26	7.16 ± 0.09	0.147
Ammonia(mg/100ml)	$36.57^a\pm0.95$	$30.45^{b} \pm 0.77$	$29.23^{b} \pm 1.48$	$29.97^b\pm0.89$	0.004
VFA (meq/100ml)	$8.33^b\pm0.50$	$11.62^{a} \pm 0.90$	$12.81^{a} \pm 1.34$	$12.01^{a} \pm 0.67$	0.035
Protozoa ×10 ⁶ /ml	$4.04^{a}\pm0.10$	$2.16^b\pm0.16$	$2.78^b \pm 0.44$	$2.27^{b}\pm0.31$	0.005

fable (3): Effect of dietary medicina	plants on fattening shee	p ration on rumen fermentation.
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^{*a, b,c*} Means of the same row in each item with different superscripts are significantly different (P < 0.05).

*ORG: Lambs received oregano, ROS: Lambs received rosemary, MEN: Lambs received peppermint

Growth performance:

The growth performance of lambs fed different rations is presented in Table (4). The body weight changes and average daily gains were not significantly (P> 0.05) affected by the experimental rations. Also, no effect was observed (P> 0.05) for fed intake and feed conversion ratio with feeding medicinal herbs rations. This finding is consistent with that of Bampidis *et al.* (2005) they reported that fattening lambs fed diets supplemented with 144 or 288 mg of oregano oil/kg of DM diet had no effect on growth performance. Similarly, Benchaar et al. (2006) found that the addition of a commercial combination of essential oil compounds (2 or 4 g/day) or utilizing peppermint powder (4 and 8 kg/1000kg) had no effect on DM intake or growth of beef calves fed a silage-based diet's.

	Trootmont*				P-
Item	Treatment.				
	Control	ORG	ROS	MEN	
Initial weight (kg)	39.75 ± 0.52	38.83 ± 0.67	39.50 ± 0.67	39.67 ± 0.56	0.709
Final weight (kg)	52.58 ± 1.37	53.50 ± 1.34	52.17 ± 1.22	50.83 ± 1.32	0.557
BW gain (kg)	12.83 ± 1.32	14.67 ± 1.38	12.67 ± 1.54	11.17 ± 1.44	0.408
Average daily gain (g)	213.89 ± 22.01	244.44 ± 23.04	211.11±25.70	186.11 ± 24.1	0.408
Feed intake (g/d)					
DMI of concentrate	1067.50 ± 91.24	1098.00 ± 99.53	1143.75 ± 91.50	1067.50 ± 91.25	0.929
DMI of forage	356.09 ± 36.15	372.10 ± 40.69	440.73 ± 52.16	338.55 ± 39.39	0.370
Total DM intake (g/d)	1423.59 ± 127.04	1470.10 ± 139.10	1584.48 ± 138.01	1406.05 ± 129.93	0.781
Total TDN intake (g/d)	1060.86 ± 94.67	1164.17 ± 110.15	1264.09 ± 110.10	1121.75 ± 103.66	0.583
Total DCP intake (g/d)	$135.38^{b} \pm 12.08$	$168.47^{ab} \pm 15.94$	$201.86^{a} \pm 17.58$	$148.06^{b} \pm 13.68$	0.027
Feed conversion ratio					
g DM/g gain	7.35 ± 1.40	6.42 ± 1.08	8.54 ± 1.89	8.02 ± 1.89	0.743
g TDN/g gain	5.48 ± 1.04	5.08 ± 0.85	6.81 ± 1.51	6.40 ± 0.94	0.676
g DCP/g gain	0.70 ± 0.13	0.74 ± 0.12	1.09 ± 0.24	0.84 ± 0.13	0.352

 Table (4): Effect of dietary medicinal plants on fattening sheep ration on performance of fatting lambs.

^{*a, b,c*} Means of the same row in each item with different superscripts are significantly different (P<0.05). *ORG: Lambs received oregano, ROS: Lambs received rosemary, MEN: Lambs received peppermint

Blood parameters:

The analysis of blood metabolites is shown in Table 5. Inclusion of oregano, rosemary and peppermint in the diets of Saidi fatting sheep at rate 2.5% of concentrate diet decreased serum glucose concentration (P<0.05), with no difference (P> 0.05) among medicinal plant groups. The average value of serum total protein, globulin and total antioxidant capacity (TAC) were significantly higher in medicinal plant groups than the control group. Moreover, the highest values of serum total protein, globulin and ALT were recorded in favor of oregano group, with the lowest A/G ratio when compared with other groups. Serum cholesterol, triglycerides and urea concentration were decreased (P<0.05) in all medicinal plant groups when compared with control one. The average value of AST in blood serum of lambs fed diets supplement with oregano and rosemary were higher (P<0.05) than those fed peppermint and control diets. Also, it was noticed that the creatinine concentration was decreased (P<0.05) with the inclusion of rosemary in the diet of lambs when compared with oregano and control groups.

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The blood values of the current study were within specified reference limits by Boyd (1984). Serum total protein, albumin, globulin and urea-N are indicators of protein catabolism, and kidney function (Hosten, 1990). The increase of globulin with supplement medicinal herbs may be due to its containing of steroidal flavonoid terpens which stimulate the normal secretion of cortisone (Sabbah-Allam and El-Elaime, 2020).

The mechanism by which medicinal plants supplementation reduces cholesterol has not been fully explored. However, the hypocholesterolemic effect of oregano and rosemary might be due to their active components that inhibit hepatic 3-hydroxyl-3- methylglutary co-enzyme A (Kholif et al. 2017). Yang et al. (2010a) sated that essential oil supplementation can impact certain blood metabolites such as triglycerides by modifying feed intake. Kholif et al. (2017) reported that the addition of rosemary and lemongrass to the diet reduced blood cholesterol levels (P 0.001). However, no effects were found with the supplement of lemongrass and rosemary on serum total protein, albumin, globulin, urea-N, glutamicpyruvic transaminase and glutamate- oxaloacetate transaminase concentrations. Aruoma et al. (1996) reported that the secondary compounds of rosemary can exert an antioxidant activity of lipids due to their content of phenolic diterpenes. Similarly, Velioglu et al. (1998) stated that the addition of rosemary may delay or inhibit the oxidation of other substances by inhibiting the beginning or propagation of oxidative chain reactions. Khamisabadi et al. (2016) found that adding of either thyme or peppermint to the ration of lambs reduced significantly triglyceride, glucose and urea when compared with control ration. However, many previous studies reported that the inclusion medicinal plants to the diets of sheep did not effect on blood biochemical parameters (Pettersson et al., 2008; Sahraei et al., 2014; Mohamadi et al., 2017; Sabbah-Allam and El-Elaime, 2020).

Item	Treatment*				P- value	
	Control	ORG	ROS	MEN	i vuluo	
Glucose, mg/dl	124.25 ^ª ± 1.70	83.92 ^b ± 1.55	84.92 ^b ± 1.27	82.83 ^b ± (0.00)1
Total protein, g/dl	6.80 [°] ±0.09	8.57 [°] ± 0.15	$7.92^{b} \pm 0.05$	7.88 ^b ± 0.	03 0.00)1
Albumin, g/dl	3.09 ^b ± 0.12	$3.21^{b} \pm 0.09$	3.80 ^a ± 0.12	3.41 ^b ±0	0.12 0.00)3
Globulin, g/dl	3.71 ^c ± 0.15	5.36 ^a ± 0.20	$4.12^{bc} \pm 0.11$	4.47 ^b ± 0	.13 0.00)1
A/G ratio	0.85 ^a ± 0.07	$0.61^{b} \pm 0.04$	$0.93^{a} \pm 0.05$	$0.77^{a} \pm 0$.05 0.00)3
Cholesterol, mg/dl	89.28 ^ª ± 5.85	59.19 ^{bc} ± 4.89	55.02 ^c ± 2.82	70.17 ^b ± 6	5.40 0.00)2
Triglycerides, mg/dL	93.05 [°] ± 0.61	67.77 ^c ± 1.24	$47.60^{d} \pm 2.07$	85.15 ^b ± (0.74 0.00)1
ALT(U/l)	16.20 ^b ± 1.49	$20.81^{a} \pm 0.25$	$15.58^{b} \pm 0.40$	15.81 ^b ± (0.00)1
AST(U/l)	69.13 ^c ± 1.39	$114.80^{a} \pm 1.55$	$88.60^{b} \pm 1.86$	69.60 ^c ± 2	2.22 0.00)1
Urea, mg/dl	70.52 ^ª ± 1.52	59.97 ^b ± 1.33	$61.05^{b} \pm 1.19$	54.73 ^c ± (0.00)1
Creatinine, mg/dl	$0.93^{a} \pm 0.03$	$0.95^{a} \pm 0.03$	$0.80^{b} \pm 0.02$	0.86 ^{ab} ± 0	0.04 0.03	35
HDL, mg/dl	42.57 ± 4.74	44.94 ± 2.84	43.77 ± 4.57	46.78 ± 3	.59 0.89	95
TAC (mmol/L)	$0.69^{d} \pm 0.01$	$0.95^{b} \pm 0.02$	$1.03^{a} \pm 0.01$	0.88 ^c ± 0.	01 0.00)1

Table (5): Effect of dietary medicinal plants on fattening sheep ration on some blood parameters.

^{a, b,c} Means of the same row in each item with different superscripts are significantly different (P<0.05). *ORG: Lambs received oregano, ROS: Lambs received rosemary, MEN: Lambs received peppermint

CONCLUSION

In conclusion, dietary supplements with some medicinal plants like oregano; rosemary and peppermint to the diets of fatting lambs at rat 2.5% of concentrate mixture improved nutrient digestibility and feeding value of rations and modified rumen fermentation. The body weight changes and blood biochemical parameters were improved particularly with addition oregano and rosemary in f diets.

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تأثير إضافة أوراق البردقوش ، أوراق أكليل الجبل و النعناع على معاملات الهضم وتخمرات الكرش وأداء خراف التسمين

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أجريت هذه التجربة بهدف دراسة تأثير إضافة أوراق البردقوش و أوراق أكليل الجبل و النعناع على معاملات الهضم وتخمرات الكرش وبعض مكونات الدم وعلى أداء خراف التسمين. تم استخدام 24 خروف تسمين بمتوسط وزن 39.44 ± 0.61 كجم . قسمت الخراف الى أربعة مجاميع (عدد 6 خروف فى المجموعة) لمدة 60 يوم وكانت العليقة المقدمة لهذه المجموعات كألاتى: مجموعة الكنترول: المخلوط المركز: تبن القمح (70: 30 على أساس المادة الجافة).مجموعة أوراق البردقوش: عليقة المجموعة المت +2.5% من أوراق البردقوش المجفف الى المخلوط المركز. مجموعة أوراق أكليل الجبل : عليقة المجموعات كألاتى: محموعة أكليل الجبلا لمجفف الى المخلوط المركز. مجموعة أوراق أكليل الجبل : عليقة المجموعة الكنترول أكليل الجبلا لمجفف الى المخلوط المركز. مجموعة أوراق أكليل الجبل : عليقة المجموعة الكنترول المخلوط المركز، تم تغذية الحيوانات بشكل فردى ومتابعة وزن الخراف كل 15 يوم لتحديد المقررات الغذائية حسب حالة الحيوان. وتم حساب معدل الزيادة اليومية وتم تسجيل المأكول وتم أخذ عينة دم للتحليلات الكيمائية. تم اجراء تحرية هذه على سائل الكرش وتم

والنتائج تشير الى الأتى: لم يتأثر وزن الجسم ومعدلات الزيادة اليومية بشكل معنوى بالمعاملات المختلفة. هناك زيادة معنوية في معاملات هضم البروتين مع معاملات أوراق البردقوش و أوراق أكليل الجبل مقارنة بمجموعتي الكنترول والنعناع. المجموعات المعاملة ادت الى تحسن معنوى فى معاملات هضم الالياف مقارنة بمجموعة الكنترول. المجموعات المعاملة ادت الى تحسن معنوى فى القيمة الغذائية للعلائق فى صورة TDN او DCP مقارنة بمجموعة الكنترول. المجموعات المعاملة ادت الى تحسن معنوى فى القيمة البروتوزوا وزياد ة انتاج معالات هضم الالياف مقارنة بمجموعة الكنترول. هجموعات المعاملة ادت الى تحسن معنوى فى القيمة والجلوبيولين ومضادات الأكسدة الكلية فى مجموعات المعاملة الذت الى فض التاري والعاد والجلوبيولين ومضادات الأكسدة الكلية فى مجموعات المعاملة مقارنة بمجموعة الكنترول. والمعام التاري معالي معنوى ول

من النتائج يمكن استنتاج أنه يمكن باستخدام كلا من أوراق البردقوش و أوراق أكليل الجبل و النعناع بمستوى2.5% من المخلوط المركز و أدى ذلك الى تحسن في معاملات الهضم والقيمة الغذائية والى تغيرات جيدة فى تخمرات الكرش وكذلك ساعد فى تحسين خصائص بعض مكونات الدم.