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Comparative efficacy of *Ziziphus spina-christi* leaves or monensin on growing lambs performance.

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ABSTRACT

This study conducted to evaluate the influence of *Ziziphus spina-christi* leaves (ZSCL) as natural growth promoter and monensin as a synthetic growth promoter when both were supplemented into the basal diet that consisted of 40% berseem hay and 60% concentrate feed mixture (CFM) which served as control ration (R1). Tested rations consisted of control ration supplemented with 30 mg monensin (R2) or 15 g ZSCL (R3), per Kg DM intake. Nine Ossimi rams averaged 65±2.7 kg live body weight, 16-18 months old divided into 3 groups (3 animals each) according to live body weight for nutrients digestibility and dietary nitrogen utilization. Three Ossimi rams with rumen fistulae per treatment were used for rumen fermentation activity and total gas production. Twenty-one Rahmani lambs averaged 24±0.48 kg body weight and 4 months old divided into 3 groups (7 animals each) according to live weight for 120 days to investigate the growth performance of growing lambs fed the experimental rations. Results revealed no differences among the rations ($P>0.05$) in daily feed intake. Also, no effect was observed on digestibility of DM, EE and NFE among the experimental rations, while, digestibility of OM and CP in R2 ration were significantly ($P<0.05$) higher than R1 (control group), but similar to R3 ration. The rumen pH at 4 hrs after feeding did not significantly affected by rations. Total VFA concentration was significantly lower ($P<0.05$) with R2 ration compared with R1 and R3 rations. Ammonia-N, concentration also followed the same trend of TVFA'S among the experimental rations. Total gas production reduced ($P<0.05$) for R2 and R3 on incubation times; 24 hrs by (38.96 and 14.44%, respectively) and 48 hrs by (28.19 and 10.16 %, respectively), whilst, at 72 hrs time of incubation, total gas production significantly reduced ($P<0.05$) with R2 ration than R1 and R3 while no significant differences found between the two latter ones. Values of final weight and total gain of R2 were significant higher ($P<0.05$) than those of R1, but insignificant higher than R3. While, daily gain of R2 was significantly higher than R3. Therefore, the use of either monensin or *ZSCL* (15 g /kg DM) is highly recommended in the feeding practices of growing lambs as feed additives.

Keywords: lambs; *Ziziphus spina-christi*leaves; monensin; natural growth promoters.

INTRODUCTION

The long-awaited dream of ruminant nutritionists has been to manipulate and improve the efficiency of rumen fermentation. As intensification of livestock farming increases, antibiotics administered for therapy, prevention and growth promotion to increase feed efficiency (McEwen and Fedorka-Cray, 2002). Antibiotics play an essential role in economic development of modern animal production through the production of abundant quantities of nutritious, high-quality and low-cost food for human consumption (Upadhayay and Vishwa, 2014). Although the functioning mechanism of growth promoting is not quite clear, it believe that it suppresses the intestinal bacterial flora, particularly the pathogen type (Dibner and Richards, 2005) which leads to beneficial effect on the ecosystem of the gastrointestinal microflora that can significantly reflected on health and productive performance of farm animals (Cicerale *et al.*, 2012).

Monensin is a polyether ionophore antibiotic produced by fermentation of the bacterium species Streptomyces cinnamonensis which demonstrate to develop growth promotion properties (Herberg *et al.*, 1978). Stradiotti Júnior *et al.* (2004), reported that ionophores act on ruminal microbes by inhibiting gram-negative species. The inhibition of these bacteria increases the production of propionate because these bacterial species are mainly responsible of amino acid deamination and production of unwanted gases, such as methane and ammonia. Undoubtedly, there is a risk posed by antibiotic given as growth promoters for meat animals that arise controversy for these outcomes, whereas, over use of any antibiotic over a period of time may lead to the local bacterial populations become resistant to the antibiotic and the accumulation of these compounds in animal products. Therefore, this led to a dramatically drop of antibiotic usage nutritionally and eventually it has been banned in some cases in formulating rations for animal feeding (Gaucher *et al.*, 2015).

Consequently, there is an urgent need to find an alternatives sources to play the same role of antibiotics (Gaucher *et al*.,2015). In this sense, *Z. spina-christi* leaves (ZSCL), belongs to Rhamnaceae family may be considered one of the most important medicinal plant which has recently been shown to have antibacterial, antifungal, antioxidant and anti-hyperglycemic functions (Asgarpanah and Haghighat, 2012). Moreover, flavonoids, alkaloids and saponins are the main phytochemicals that reported to occur in this plant. Furthermore, secondary metabolites of antimicrobial properties are expected to act on the appetite of the animal, gut microflora and on the stimulation of production of digestive enzymes (Asgarpanah and Haghighat, 2012).

The objective of this study was to investigate the effects of (ZSCL) as herbal natural feed additive as alternative to an antibiotic growth promoter on digestibility coefficients, performance, some blood parameters and ruminal functions in sheep.

MATERIALS AND METHODS

Digestibility trial and gas production technique

This trial was conducted at the Animal Experimental House of Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt to determine the digestibility coefficients, rumen parameters and total gas production. Nine Ossimi rams averaged 65±2.7 kg live body weight, 16-18 months old divided into 3 groups (3 animals each) according to live body weight. Daily intake of tested rations calculated according to NRC **(**1985**)** recommendations for rams. Animals fed individually the experimental rations which offered twice daily at 8:00 am and 4:00 pm and water was allowed freely all the day round. Residuals of rations collected just before offering the next morning day's feed. Animals in the control group (R1) fed 40% barseem hay and 60% concentrate feed mixture (CFM), while, R2 and R3 groups fed the same control ration plus 30 mg monensien or 15 g (ZSCL) per Kg dry matter, respectively, for a period of 26 days. The first three weeks as preliminary period and five days for collection. Representative samples of feces from each animal (10% of the whole amount) was oven-dried over- night at 60°C, fine ground and kept in plastic bottle until analysis, while 10% of the daily acidified urine was kept in glass bottles to determine urinary N content.

Chemical analysis:

Each of ZSCL powder, CFM, BH and feces were analyzed for proximate analysis according to A.O.A.C. (1995), whereas, nitrogen free extract was calculated by difference. Fiber fractions (NDF and ADF) analyzed according to Van Soest *et al.* (1991). Nitrogen in urine determined by micro-kjedahl methods. The chemical compositions of feed ingredients of the basal ration presented in Table (1).

Rumen liquor:

Rumen liquor samples (100ml) were collected from each animal (three rumen fistulaeted Ossimi rams per group) at 4 hrs post-feeding. Values of pH immediately estimated and recorded after collection using a hand pH meter (Orin-Res-EARH, model 30). Rumen liquor samples were filtered through 4 layers of cheesecloth followed by acidified with 0.1 N hydrochloric acid and concentrated orthophosphoric acid and stored by freezing for

Table (1): Chemical composition of feed ingredients and the Basal ration (% DM basis)

Item	*ZSCL*	CFM*	BH	Basal ration (R1)
DM	91.70	90.81	88.31	89.81
OM	91.10	89.49	85.91	88.06
CP	8.76	13.64	13.41	13.55
CF	17.71	10.75	24.76	16.35
EE	3.39	4.04	2.48	3.42
NFE	61.24	61.06	45.26	54.74
Ash	8.90	10.51	14.09	11.94
NDF	21.91	38.42	55.54	46.31
ADF	16.83	30.05	38.75	32.68
Phenolic contents				
Total phenols	**717.00**	**-**	**-**	**-**
Condensed	**3.17**	**-**	**-**	**-**

*Concentrates feed mixture (CFM) consists of yellow corn grain (55 %), wheat bran (20%), soybean meal (10%), cottonseed meal (12.50%), sodium chloride (1%), limestone (1.3%) and a vitamins-minerals mixture (0.2%).

determination of ammonia nitrogen (NH_3-N) concentration by using magnesium oxide (MgO) as described by Al-Rabbat *et al.* (1971) while total volatile fatty acid (VFA's) concentration was estimated by using steam distillation methods (Warner, 1964).

***In vitro* gas production**

The rumen liquor collected prior to morning feeding from two fistulated Osimi rams for each experimental ration and immediately squeezed through four layers of cheesecloth then transported to the laboratory in a sealed thermos under flushing with CO_2. The buffered rumen liquid was then obtained by combining buffered solution (McDougall, 1948) with rumen liquid at ratio 1:2, respectively. The ground tested experimental samples (0.600 g) incubated with buffered rumen liquid in triplicate to determine the gas production after 72 hrs. of incubation using a modified version of the *in vitro* gas production technique of Navarro-Villa *et al.* (2012). Total gas values corrected for the blank incubation, and reported gas values expressed in ml per 1 gm of DM.

I- ***Feeding trial:***

The growth trial carried out at Malawi Experimental Research Station, El-Menia governorate, Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt, belonging to Animal Production Research Institute, ARC. Twenty-One Rahmani lambs averaged 24±0.48 kg body weight and 4 months old divided into 3 groups (7 animals each) according to live weight for 120d feeding trial. Animals fed the experimental rations and weighed individually at the initial point of the trial and then biweekly until end of the experiment.

The tested ration offered twice daily at 8 am and 4 pm and the remaining amounts from the previous day were measured. Water offered freely all the day round. The CFM and BH adjusted biweekly according to body weight changes. Daily feed intake and daily body weight gain recorded and feed efficiency (g feed/g gain) was calculated. Lambs weighed biweekly before morning feeding after 17 hours fasting period. The daily amounts of offered experimental rations calculated according to NRC (1985) recommendations for growing lambs.

Statistical analysis:

Collected data of measured parameters were subjected to one-way analysis (one-way, ANOVA) of variance applying the general linear model procedure of SAS (2004). Duncan's Multiple Range Test (1955)was applied to separate significant means.

RESULTS AND DISCUSSION

Digestibility coefficients, feeding values and nitrogen balance:

Result of digestibility, feeding values and nitrogen balance of the experimental diets are presented in Table (2). No significant effect was observed for digestibility of DM, EE and NFE due to supplementing control ration by monensin or ZSCL. However, digestion coefficient of OM and CP was significantly (P<0.05) higher with R2 ration compared to R1, but insignificantly higher than R3. These results are in line with several studies on the influence of tannin or monensin on nutrients utilization by ruminants. Ward *et al*. (1990a) reported 3% increase in OMD ($P < 0.05$) with monensin (101 mg·steer^{-1}·d^{-1} via a ruminal delivery device). Whereas, Ellis *et al*. (1983) suggested that the decreased rate of passage with monensin may explain the increase in digestion.

Table (2): Digestibility coefficients, feeding values and nitrogen balance of experimental rations.

Item	Experimental rations			±SE
	R1	R2	R3	
		Digestibility, %		
DM	70.67	74.43	72.11	1.262
OM	72.85^{b}	76.39^{a}	74.21^{ab}	0.729
CP	68.85^{b}	72.45^{a}	69.34^{ab}	0.983
EE	78.37	80.12	78.89	1.095
NFE	65.53	69.54	66.71	1.240
NDF	62.02^{a}	58.67^{b}	60.51^{ab}	0.839
ADF	60.54^{a}	57.42^{b}	58.96^{ab}	0.708
		Feeding value, %		
TDN	67.50b	70.69a	68.72b	0.613
DCP	9.33	9.82	9.41	0.242
		N- Utilization (g/d)		
N intake	27.63	28.07	27.79	0.355
N output	25.45	25.30	25.34	0.488
N Balance	2.18^{c}	2.77^{a}	2.45^{b}	0.062

a, b and c: Means in the same row with different superscripts are significantly different (P<0.05).

In contrast to the present study, Cochran *et al.* (1990) reported that monensin had no effect on OMD in cattle grazed early-summer bluestem range (12% CP) with or without monensin (100 mg·steer−1·d−1 via a ruminal delivery device). Also, Fredrickson *et al.* (1993), reported similar results with monensin (68 mg steer^{-1}·d^{-1} via a ruminal delivery device) which had no effect (56.5 vs. 57.7% for control and monensin, respectively) on OMD in steers grazing native blue grama rangeland (7.1% CP, 85.4% NDF, and 53.0% ADF). The increased CP digestibility was supported by the hypothesis that the tannin-protein complex dissociates at the lower gut (low pH), hence making protein available to the host animal for enzymatic digestion (Reed *et al*. 1990), Whereas, D'Mello (1992) observed that protein-tannin complex dissociation at pH values below 4 and above 7. This enables protein to by-pass degradation in the rumen and undergo enzymatic hydrolysis in the abomasum and the hind gut (Jones and Mangan, 1977).

On the other hand, the amount of feed consumed, and the overall diet quality, could also affect animal performance. An intake below 50 g CT/kg DM may contribute to greater availability of amino acids absorption (Min *et al.*, 2003). Several researchers (Makkar *et al*. 1995; Waghorn and Shelton 1997) also reported that condensed tannin at a concentration less than 50 g/kg of DM did not affect ruminal fermentation parameters. Hervás *et al*. (2003) showed no significant effects for up to 63 g/kg condensed tannins from quebracho on rumen fermentation parameters of sheep.

Nagaraja (1995) showed that decreasing ruminal ammonia-N in animals fed ration supplemented with ionophores probably due to low activity of proteolytic bacteria which protects protein against rumen degradation, resulting high escape of protein into small intestine. This may be responsible of the increased productive performance of animals fed monensin or ZSCL diets.

On the other side, R2 had significant (P<0.05) lower value of digestibility regarding NDF and ADF than R1, but the decrease than R3 was insignificant. These results are in agreement with Reed (2001) who reported that the decrease in fiber digestibility was exacerbated by an anti-nutritional effect of the CT that released from herbal plant like ZSCL used in the present study (Table 1). The anti-nutritional effects of tannins are associated with their ability to build complexes with dietary polymers such cellulose, hemicellulose, and pectin (Mc Sweeney *et al.*, 2001), and their concentrations in the rumen liquor may have differed. However, ionophores, such as monensin have selectively properties for inhibiting gram-positive microorganisms (Bergenand Bates., 1984) which include most of the cellulolytic bacteria, capable of hydrolyzing fiber (e.g. *Ruminococcusalbus, Ruminococcusflavefaciens*, and *Butyrivibriofibrisolvens*). So, the effects of monensin on the degradation of NDF and ADF are in line with results reported by Jalč *et al*. (1992b) who found that degradation of NDF and ADF in sheep was reduced in the presence of monensin (125 to 625 mg/kg feed). In contrast, Hemphill *et al.* (2018**)** found that heifers receiving a limit-feed of corn stalk-based diet had no differences in NDF and ADF digestibilities (between 150 mg/d monensin diet and the free one).

The feeding values indicate that TDN values was significantly higher (P < 0.05) in lambs fed R2 (70.69%) than that of R3 (68.72%) or R1 (67.50%). Otherwise, digestible crude protein values were 9.82, 9.41 and 9.33 for R2, R3 and R1, respectively, without significant differences among the dietary rations. This might be a result of similarity of CP content in the three dietary treatments and at the mean time its value fully covering the nutritional requirements of animals in each experimental group. As more explanation, the lake of effect of ZSCL supplement on DCP value might be due to the small amount of ZSCL added and consequently the low concentration of CT that in turn unaffected significantly on CP utilization and DCP output. Additionally, higher concentrations (75 and 100 g/kg DM) of condensed tannins depress feed intake and rumen carbohydrate digestion (Barry and McNabb 1999).

Nitrogen retention considered as the most common index of the protein status of ruminant nutrition (Owen and Zinn, 1988). Results in Table (2) demonstrate that there were no significant differences regarding nitrogen intake and nitrogen output among the three experimental rations. However, nitrogen balance increased (*P* <0.05) in R2 and R3 groups by 27.06 and 12.39%, respectively, compared with R1 (control group).

Conversely, *PiÃ.et al*. (2017) reported that nitrogen balance not affected by increasing the levels of condensed tannins in cattle diet (0, 1, 2, 3 and 4% CT/kg DM). Also, Ebert *et al*. (2017) found that nitrogen intake and retained N did not differ among treatments for beef cattle with a commercially available CT extract at 3 levels (0, 0.5, and 1.0% of diet, DM basis).

Rumen Fermentation

The ruminal pH at 4 hrs after feeding was not significantly different (Table 3) due to supplementing the tested ration by R2 or R3 in comparison with R1. In all rations, pH values were within the normal range. Ionophores selectively inhibit the metabolism of gram-positive bacteria and protozoa in the rumen, which lack a protective outer membrane. Monensin's ability to inhibit lactate-producing rumen bacteria, including *S. bovis* and *Lactobacillus* species, was observed by Dennis and Nagaraja (1981) throughout sensitivity and growth rate trials. Subsequently, monensin enable ruminal pH to stabilize, mainly by inhibiting lactate-producing bacteria. Results of this study are in harmony with an earlier study indicated that ruminal pH values were not affected by CT in which rams fed diets with 0, 15 and 30 g/kg of *Cistus* CT. (Dentinho *et al*., 2014).

Table (3): Ruminal fermentation parameters (after 4 hrs of feeding) in Rahmani rams fed the experimental rations.

Item	Experimental rations			±SE
	R1	R2	R3	
pH	5.79	5.84	5.80	0.04
TVFA'S, eq/100ml	10.98^{a}	10.21^{c}	10.73^{b}	0.05
NH_3-N, mg/100ml	25.55^{a}	24.09^{c}	24.92^{b}	0.20

a, b and c: Means in the same row with different superscripts are significantly different (P<0.05).

Total VFA concentrations were significantly lower (P<0.05) with R2 than R1 and R3. An inverse relationship between rumen pH and volatile fatty acid concentrations has demonstrated across a variety of diets (Phillipson, 1942 and Briggs *et al.*, 1957). Overall, monensin reduced total VFA concentration by 7.01% compared with control ration. These results are in agreement with Tan *et al.* (2011) who reported that total VFA concentration decreased with increasing CT inclusion *in vitro*. Moreover, Vagnoni *et al*. (1995) observed more significant reduction of VFA (20.6%) when monensin (200mg·steer^{-1}·d^{-1})-supplemented into ammoniation /ureation of Bermuda grass hay diets for steers. Conversely, others (Ward *et al.*, 1990 a and b) reported no effect for monensin on total VFA concentration in the rumen of cattle consuming forage-based diets. Formation of VFA's, including propionic acid, in the rumen depends on the substrates available in the rumen and, therefore, the involved microbes (Szumacher-Strabel and Cieslak, 2012).The increase of propionic acid production from pyruvate in the succinate–propionate pathway, which consumes H_2, has become an alternative pathway for H_2 disposal from CH_4 formation (Moss *et al.*, 2000).

Regarding, Ammonia-N, its concentration was significantly lower with R2 (-5.71%) followed by R3 (-2.47%) relative to R1. The observed reduction in ammonia-N concentrations with condensed tannins in the present study are consistent with the findings obtained by (Powell *et al*. 2009 and Dschaak *et al*. 2011). It well known that tannins reduce degradation of dietary protein in the rumen either by forming protein–tannin complexes (Broderick and Albrecht, 1997) or inhibition of the activities of protease enzyme by tannin, consequently ammonia-N appeared in low concentration in rumen. Therefore, many authors indicated that the decrease in ammonia-N concentration with condensed tannins' diets could partly due to decrease in deamination of amino acids resulting high escaped protein into small intestine (Nagaraja, 1995 and Mc Sweeney *et al.*, 1988). Previously, Jones *et al.* (1994) reported that condensed tannins (*Onobrychisviciifolia*) inhibited growth and protease activity of *Butyrivibriofibrisolvens* and *Streptococcus bovis,* and to a lesser extent, *Prevotellaruminicola* and *Ruminobacteramylophilus*. In contrast**,** Fredrickson *et al*. (1993) found that monensin had no effect on ruminal ammonia-N concentration in cattle consuming forage-based diets with monensin.

In vitro total gas Production

Effect of experimental rations on *in vitro* total gas production kinetics shown in Table (4). *In vitro* gas production technique simulates the rumen environment, thus allowcharacterization of treatment-mediated changes within the rumen and characterization of the kinetics of fermentation (Getachew *et al.*, 1998).

Table (4): *In vitro* total gas production kinetics (*ml* g^{-1} DM) of experimental rations.

Incubation times (hrs)	Experimental rations			±SE
	R1	R2	R3	
24	195.83[a]	119.54[c]	167.56[b]	3.094
48	246.47[a]	176.98[c]	221.43[b]	3.986
72	276.54[a]	203.76[b]	264.98[a]	3.967

a, b and c: Means in the same row with different superscripts are significantly different (P<0.05).

Total gas production was reduced (P<0.05) for R2 and R3 at incubation times 24 hrs by (38.96 and 14.44%, respectively) and 48 hrs by (28.19 and 10.16 %, respectively). While, at 72 hrs of incubation, total gas production was significantly lower (P<0.05) in R2, but insignificant with R3 than that of R1. These results are in consistent with those reported by Tan *et al*. (2011) who found that total gas production was linearly decrease with increasing the levels of CT inclusion. These results may indicate that, at lower levels of CT inclusion, feed particles may be free of CT attachment, as most of these particles would effectively bind with protein. At this level, microbial attachments to feed particles, for digestion, may not drastically altered, since no differences in DM digestibility observed. This result is supported by the study of Huang *et al.* (2010) who found that lower levels of CT (20–40mg g^{-1} DM) could significantly reduce total gas production and CH_4 production with no significant adverse effects on DM degradability. Recently, some researchers have shown that supplementation of tree leaves containing tannins mitigates enteric gas and methane emissions either directly by inhibition of methanogenesis or indirectly through inhibition of protozoa (Hristov *et al*., 2013).

Similarly, Supplementation of monensin (33 mg/kg of the dietary DM) effectively lowered total gas production, enteric methane production and number of protozoa in the rumen of goats (Hartanto *et al.*, 2017). Additionally, Quinn *et al*., (2009) observed a decrease in total gas production when compared control, with inclusion of monensin *in vitro* with high concentrate substrates. Another study by Singh and Mohani (1999) did not found any effect on *in vitro* gas production using 50 or 100 mg/d of monensin in rumen fluid donors. Similar results were reported by Garcia *et al*. (2000), Gonzales *et al.* (2009), and Meyer *et al.* (2009) with different levels of monensin (30 or 90 mg/kg DM).

Growth Performance

Data in Table (5) indicate no significant differences among groups in body weight at the start point of the experiment. Values of final weight and total gain of monensin (R2) were significantly higher (42.65 and 18.03Kg, respectively) than those of R1 (41.36 and 17.04

Kg, respectively) and insignificantly higher than those of ZSCL ration (41.98 and 17.49 Kg, respectively). While, daily gain was significantly higher with R2 than both R1 and the other tested ration (R3), with significant difference between R1 and R3 ration.

In agreement with the present study, Barajas *et al.* (2011) revealed similar enhancements in ADG (11–13%) of growing-finishing bulls supplemented with 6–29 g tannin/d and Volpi-Lagreca *et al*. (2013) who observed an enhancement respecting ADG and gain efficiency of feedlot heifers fed a whole corn diet supplemented with condensed tannin (40 – 83 g/d tannin). These results could be explained by the ability of tannins to bind with dietary proteins, rendering them to be less degradable within the rumen (Min *et al.* 2003), and thus the response of growth performance to supplemental tannins have been generally attributed to enhancement of intestinal metabolizable protein supply (Waghorn 1996).

The main findings show that the combination of increasing bypass protein flow to the small intestine and decreasing frothy gas production likely led to 2.64% increase in ADG with CT supplementation (R3) to lambs fed the experimental ration in this study. Collectively, this suggests that CT supplementation is effective on mitigating bloat and improving animal performance without deleterious effects on animals across the range of CT dosages investigated.

Thus, the inclusion of a limited quantity of tanniforus tree leaves in animal feed recommend to improve rumen function and productivity (Osakwe *et al*. 2004).

In the present study, the addition of 30 mg monensin/Kg DM intake caused significant increase in final weight, total gain and daily gain in comparison with those of control. The better growth performance observed in lambs fed monensin may be due to the metabolic effect of using energy (at a ruminal or systemic level) where lambs fed monensin consumed more feed and therefore showed more ADG.

In relation to the present study, there are numerous recent reports, for instance, Barreras *et al.* (2013) observed increase of 6% in ADG and 5% in gain efficiency in beef heifers fed a steam-flaked corn-based finishing diet supplemented with monensin. In addition, Montano *et al*. (2014) reported that antibiotic supplementation (monensin, 34 mg/kg) for steam-flaked corn-based finishing diet of steers tended to increase daily gain by 7% and increase gain efficiency (11%).

Otherwise, Fluharty ***et*** *al.* (1999) did not find significant differences in ADG or feed conversion in lambs due to ionophores supplementation. Lastly, the response of using ionophores/monensin are very variable and could partially referred to the different experimental conditions and may be influenced by factors such as feed intake, rumen filling, passage rate, animals breed, body conditions, diet or different physiological stages (Rodrigues *et al.*, 2001 and Borges *et al.*, 2008).

Daily feed intake of growing lambs fed the experimental rations expressed as total DMI and DMI as percent of BW presented in Table (5). The obtained results of daily feed intake indicate that R2 had the highest values of total DMI (1.196 Kg/h/d) and DMI as percent of BW (3.56%) followed by R3 (1.173 Kg/h/d and 3.53%, respectively) and R1 (1.163 Kg/h/d and 3.54%, respectively) without significant differences among them.

The results of this study are in match with other studies indicated that tannin-rich leaves, in combination with concentrate rations, could be fed to animals without any adverse effect on intake (Raghavan, 1990). Also, no significant effect on voluntary feed intake were observed with the inclusion of ZSCL and such response had been widely reported (Silanikove *et al.*, 1994 and Zhu *et al.*, 1992). Otherwise, Volpi-Lagreca *et al*. (2013) observed that dry matter intake enhanced with feedlot heifers fed a whole corn diet supplemented with condensed tannin. This can happen as a result of astringency effect of tannin on the mouth vocal mucosa of animals consuming the supplement that masked by the presence of the other palatable ingredients in the supplementary diets (40:60, roughage: concentrate ratio) which enable animals to consume all the supplementary diet. Komolong *et al*. (2001) reported that moderate levels (1- 4%) of tannins in the diet from various plant sources exerted no significant effect on feed intake. Whereas, high levels of dietary tannin (> 5%) have markedly depressed feed intake in ruminants (Frutos *et al*. 2004) that may be due to altered palatability.

Table (5): Growth performance, daily feed intake, feed conversion and feed efficiency in weaned Rahmani lambs fed experimental diet.

Item	Experimental rations			±SE
	R1	R2	R3	
Initial weight, (kg)	24.32	24.62	24.49	0.35
Final weight, (kg)	41.36^{b}	42.65^{a}	41.98^{ab}	0.37
Total gain, (kg)	17.04^{b}	18.03^{a}	17.49^{ab}	0.29
Average daily gain(g per day)	142.00^{c}	150.25^{a}	145.75^{b}	1.21
Daily feed intake:				
Total DMI (Kg/h/d)	1.163	1.196	1.173	0.04
DMI as %BW	3.54	3.56	3.53	0.07
Feed conversion ratio				
(kg DMI / kg body gain)	8.19	7.96	8.05	0.11

$^{a, b,c}$ and ^{d}: Means denoted within the same row with different superscripts are significantly (P<0.05) different at P<0.05.

Additionally, Montano et al. (2014) obseved no effects on dry matter intake with monensin supplementation (34 mg/kg) into steam-flaked corn-based finishing diet and, as well, growth performance and digestive function of steers did not affected**.** Finally, an earlier study conducted by Fluharty ***et*** *al.* (1999) stated that adding ionophores to the diet resulted in increasing (P<0.05) dry matter intake.

Results of feed conversion of growing lambs fed the experimental rations indicated no significant differences among the experimental groups. In agreement to these findings, Fluharty ***et*** *al.* (1999) did not found significant effects on feed conversion due to ionophore supplementation to diets of lambs. The improvement in gain efficiency in this trial could due in part to increases of ADG (R2 and R3) and to increases on estimated TDN values (R2 and R3, respectively) of these diets.

CONCLUSIONS

It could conclude that both supplementation of *monensin* (30 mg monensin /Kg DM) *or Ziziphus spina-christi* leaves (15 g /kg DM) represent viable feed additives for the diets of growing lambs and can improve digestibility, nitrogen balance and growth performance with somewhat superior results with monensin supplement. Further research is necessary to examine the impact of highest levels of addition of *Ziziphus spina-christi* leaves on growth and rumen fermentation.

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مقارنة فاعلية أوراق شجر السدر أو المونينسين على أداء الحملان النامية

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أجريت هذه الدراسة بهدف تقييم مدى تأثير إضافة أوراق شجر السدر مقارنة بإضافة المونينسن على العليقة الاساسية المكونة من 40% دريس برسيم و60% علف مركز والتى تمثل عليقة المقارنة بالتجربة (R1). استخدم بهذه التجربة تسعة كباش اوسيمى بمتوسط وزن 65±2.7 كجم وعمر 16-18 شهر قسمت الى ثلاث مجموعات (3 حيوانات بكل مجموعة) تبعا لوزن الجسم الحى لتقييم معاملات الهضم للعناصر الغذائية وميزان النيتروجين. كما استخدم 3 كباش اوسيمى مزودة بفستيولات لتقدير نشاط الكرش واجمالى الغاز الناتج. كما استخدم ا21 حمل رحمانى بمتوسط وزن 24± 0.48 كجم وعمر 4 شهور والتى قسمت الى ثلاث مجموعات (7 حملان بكل مجموعة) وتم التوزيع تبعا الى وزن الجسم واستمرت تجربة النمو مدة 120 يوم لدراسة أداء النمو لتلك الحملان النامية المغذاة على العلائق التجريبية (30 جرام مونينسين أو 15 جم من أوراق شجر السدر لكل كجم عليقة مأكولة , R2 و R3 على الترتيب) . اظهرت النتائج انه لا يوجد فروق معنوية فى اجمالى المأكول اليومى بين المجاميع. أيضا، لم يظهر أى تأثير معنوى على معاملات هضم كلا من المادة الجافة ومستخلص الاثير والمستخلص الخالى من الازوت فى حين كانت الفروق معنوية عالية فى معاملات هضم كلا من المادة العضوية والبروتين الخام عند مقارنة (R2) بعليقة المقارنة (R1) وبالمثل حدث مع العليقة (R3). لم تتأثر قيم الأس الايدروجينى بالمعاملات المختلفة. أظهرت قيم الاحماض الدهنية الطيارة الكلية وتركيز أمونيا الكرش انخفاض معنوى بالمجموعة R2 عند المقارنة بالمجموعة R1 . أظهر إجمالى الغاز الناتج بالكرش إنخفاض معنوى فى المجموعة R2 و R3 مقارنة بمجموعة R1 عند فترة تحضين 24 ساعة (38.96% و14.44% على الترتيب) وعند زمن تحضين 48 ساعة بحوالى (28.19% و10ز16% على الترتيب) ، فى حين عند زمن تحضين 72 ساعة كان اجمالى الغاز الناتج منخفض معنويا فى المجموعة R2 عن المجموعة R1 و R3 فى حين لم تكن تلك الفروق معنوية بين المعاملتين R1 و R3 . تم تسجيل أعلى قيم معنوية للوزن النهائى واجمالى الزيادة فى الوزن لمجموعة المونينسين (R2) مقارنة بالمجموعة R1 ولكن لم تكن تلك الفروقات معنوية بالنسبة للمجموعة R3. فى حين سجلت المجموعة R2 أعلى قيم معنوية للزيادة اليومية مقارنة بمجموعة R1 وR3. وبالتالى يمكن أن نستنتج من ذلك أمكانية استخدام كلا من المونينسين أو اوراق شجر السدر (15 جم/كجم عليقة) كاضافات غذائية فى التغذية التطبيقية للحملان النامية .