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PRODUCTIVE PERFORMANCE OF GROWING LAMBS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF DRIED *Moringa oleifera* LEAVES

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ABSTRACT

The present study was designed to investigate the effects of supplementing diet with three levels of dried *Moringa oleifera* leaves (MOL) on the digestibility, productive performance, blood biochemical constituents and dressing percentage of growing Saidi lambs. A feeding trial for 120 days was carried out on twenty seven weaned males of Saidi lambs 5-6 months age and weighed in average 20.11 ± 2.56 Kg. They divided according to their live body weight into three groups (9 lambs each), group R1 (0 g) as control, while groups R2 and R3 offered (30 and 60 g/h/d dried (MOL). The experimental rations fed according to NRC (1985). Results indicate that the apparent digestibility coefficients of all nutrients and feeding value of rations containing (MOL) ($P<0.05$) increased with increasing level of (MOL), compared to the control ration. Significant increase ($P<0.05$) was reported on total feed intake, total weight gain, average daily gain and better feed conversion ratio (FCR) for groups R2 and R3 compared with control group. The realized ADG were 182.00 and 184.67 g/day for R2 and R3, respectively, while lambs of the control recorded 159.83 g/day. Serum total protein, albumin, creatinine and urea-N were significantly ($P<0.05$) higher for lambs received (MOL) than those fed control diet, while, a significant ($P<0.05$) decrease in serum glucose noticed in group R2 compared to control group. Economic efficiency was better with the 30 g dried (MOL) ration (R2) than R1 and R3. Dressing percentage of lambs fed diets containing MOL were higher ($P<0.05$) than control group.

It could conclude that inclusion of dried *Moringa oleifera* leaves up to 60 g to diet of growing lambs could improve productive performance, digestibility coefficients, dressing percentage and economic efficiency without any adverse effects. However, more research is needed to assure these findings .

Keywords*: Moringa oleifera* leaves, Saidi lambs Feeding value, Productive Performance and Blood biochemical constituents.

INTRODUCTION

In Egypt, there is a gap between the available and required animal feeds. Livestock sector plays a significant economic role in most countries, and is essential for the food security of populations. Moreover, conventional feed resources (grains, cereals, legumes, etc.) for animal production are scarce and highly expensive in many parts of the world. Protein supplementation is often important to improve livestock performance, and this needs to be done with respect to the requirements of the animal in addition to the balance of other nutrients available. However, the prices of animal protein sources have been escalating continuously in recent times, whilst availability is often erratic. The problem has been worsened due to increasing competition between humans and livestock for these protein ingredients as food. *Moringa oleifera* fodder was multi-purpose plants of economic importance with several industrial and feeding values. The moringa are important source of high quality feed for ruminants and as supplements to improve the productivity of herbivores on low quantity feeds. It is one of the fastest growing trees in the world with high biomass yield, high crude protein of (+ 25%) and a balance of other nutrients in the leaves (Makkar and Becker, 1996, Foidl *et al,* 2001 and Asaolu *et al.,* 2010). Moringa is important browse plant for small ruminants. Diet supplementation with Moringa has not been fully documented (Gutteridge and Shelton, 1993 and Anjorin *et al.*, 2010).

Feed additives are defined as feed ingredients which stimulate growth or other types of performance, improve efficiency of feed utilization, or beneficial, in some manner, to the health or metabolism of the animal (AFCO, 1988).

The World Health Organization (WHO) encourages using medicinal herbs and plants to substitute or minimize the use of chemicals through the global as trend to go back to nature. *Moringa oleifera lam* is commonly named as the miracle tree; it has an impressive range of medicinal uses with high nutritive value throughout the world (Moyo *et al.,* 2011). The leaves reported as a valuable source of -carotene, vitamins (B- complex, C, D and K) beside some important macro and micro-elements as calcium, potassium, zinc, iron, copper and selenium (Dorga *et al.,* 1975 and Booth *et al.* 1988). In the same time, moringa leaves are free from anti-nutritional factors, e.g. phenols, tannins, saponins and has high contents of iron (Up to 58.2 mg/100 g DM), -carotene (up to 40 mg/100 g DM) and vitamin C (Up to 0.92 g/100 g DM) (Makkar and Becker, 1996). On the other hand, moringa leaves effectively prevent morphological changes and oxidative damage in human and animals by enhancing the activity of antioxidant enzymes, reducing the intensity of lipid peroxidation and inhibiting generation of free radicals (Sreelather and Padma, 2009 and Osman *et al.* 2012). And it has been used to promote the immune system against microorganism's infection (Jaiswall *et al.,* 2009). In this study, Saidi lambs were used to test the different levels of dried *Moringa oleifera* leaves (0, 30 and 60 g) via its effect on the animals' body weights, digestibility, productive performance as well as blood parameters and dressing percentage of carcass.

MATERIALS AND METHODS

This research was carried out at Agriculture Research and Experimental Center, belongs to South Valley University, Faculty of Agriculture; Animal Production Research Institute, Agriculture Research Center and the Regional Center for Food and Feed, Agricultural Research Center, Giza. Fresh leaves (2^{nd} classed) were collected from a privet farm at El-Minia governorate on July 2015 and the leaves were trimmed from its twigs on a plastic sheet. The trimmed leaves spreaded thinly on plastic sheet under shade for 72 hrs and mixed regularly to ensure uniform drying for safe storage. The air-dried Moringa leaves finally grounded and recorded daily before offering to animals. Lambs housed in **three separated** pens and managed as any other commercial lambs flock.

A feeding trial lasted 120 days was carried out on twenty seven weaned males of Saidi lambs, 5 months old and weighed in average 20.11±2.56 Kg . Animals divided into 3 groups (9 lambs each). The experimental groups allotted randomly into three rations R1: control: CFM and clover hay without Moringa leaves supplementation, while R2 and R3 groups offered 30 and 60 g dried *Moringa oleifera* leaves, respectively. The experimental rations fed according to NRC (1985). Feeds offered in group feeding in two equal portions at 8:00 am and 4:00 pm. Refused feeds (if any) daily collected and recorded. The offered amounts of feed mixtures biweekly adjusted according to body weight changes. Drinking water was freely available all times. Throughout the feeding trials, digestibility trials were carried out. Four animals chosen randomly from each group to be subjected to digestibility trial for 14 successive days, 7 days as preliminary period and 7 days for feces collection in the metabolic cages. Collected feces dried at 65 °C overnight, finally ground and stored at –20 °C until chemical analysis

Blood samples collected twice from all lambs during the last month of the experimental period. Blood samples withdrawn from the external jugular vein of each animal at 6 hours post feeding. Blood samples centrifuged at 4000 rpm for 20 minutes. Serum separated and stored at –20 °C until biochemical analysis. Commercial kits purchased from Biomerieus (Marcyi; Etoile 69260, Charbonnieres, Les Bains, France) were used for all colorimetric determinations. At the end of feeding period, three lambs of each group were randomly chosen and slaughtered after deprived from feeding and water for 16 hours to determine dressing percentage.

Chemical analysis:

Feeds: Proximate chemical analysis of feeds, ingredients, feces and urine were done according to A.O.A.C. (2005), while digestible

energy (DE) and metabolizable energy (ME) MJ/kg DM of the tested rations were calculated according to (MAAF, 1975) equations.

Blood Serum Metabolites: Glucose concentration immediately determined in the whole blood according to **Trinder (1969)**. Total serum protein (TP) determined according to **Henry 1964, albumin according to Doumas** and **Blggs (1971,** Liver function assessed by measuring the activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) according to **Reitman and Frankel (1957).** Kidney function evaluated by measuring blood urea using the colorimetric method of **Henry and Todd (1974)**, Creatinine measured using the colorimetric method according to **Faulkner and King (1976)**. Cholesterol determined according to **Roeschlau *et al.* (1974)**.

Statistical Analysis: The data for all traits statistically analyzed according to Snedecor and Cochran, 1980 in one way analysis of variance design using general linear model (GLM) procedure by computer program of SAS (1995) using the model:

$X_{ij} = \mu + A_i + e_{ij}$

Where: X_{ij} = represents observation, μ = overall mean,

A_i = effect of treatments (rations) and e_{ij} = experimental error (common error).

Significant differences among means were achieved using Duncan, (1955) multiple range test which applied whenever possible. Significant level was set at 5%.

RESULTS AND DISCUSSION

Nutritive analysis of rations: Data in Table (1) show that, rations (R2) and (R3) had higher values of CP, EE and NFE contents than control ration (R1), while ration (R1) had lower values of all contents except CF. Increasing Moringa oleifera leaves powder (MOL) in growing lambs diets, increased all nutrients content of rations including energy and ash contents. This mainly due to the high EE and NFE contents of MOL which is double content of CFM (6.40 vs. 3.10%), respectively. The high energy value of MOL was primarily due to its high NFE content (46.64%) and also EE. Since MOL was relatively high in NFE, it is potentially a high energy feedstuffs. Consequently, it is commonly included in rations for growing lambs.

Digestibility Coefficients and Feeding Values*:* Results obtained in Table (2) indicated that the apparent digestibility coefficients of all nutrients and feeding values increased with increasing supplementation level of moringa leaves powder **(MOL)** in diets. R-2 and R-3 significantly ($P< 0.05$) better in all digestion coefficient values than control ration. However, OM and EE digestibility were significantly higher ($P<0.05$) among all tested rations, which may due to the high energy and protein contents (OM, CP and EE%) which leads to increase the apparent digestibility significantly ($P<0.05$) with MOL supplement to the rations compared with control . These results can be explained in the light of chemical composition and the reduced particles size of MOL that may resulted in increasing DM intake, lowering rate of passage, increase digestion time in rumen and subsequently enhance digestibility of **(MOL)** containing rations for DM, CP, CF and EE. These results is in agreement with Sánchez *et al.* (2006) who observed an improvement in digestibility of DM, OM and CP due to increased level of *M. oleifera* leaf supplementation in dairy cows fed low-quality grass. In the contrary, **Sultana** *et al.* (2015) cleared that, digestibility of nutrients did not vary significantly among diets containing different levels of Moringa foliage.

Increasing supplementation of MOL was accompanied with increasing values of TDN and DCP which mainly attributed to the increase in digestibility of CP and other nutrients. The increase in TDN and DCP of R2 and R3 rations than the control ration, estimated as8.13 and 13.65% for TDN and 8.31 and 13.10% for DCP, respectively ($P <0.05$).

Table (1): Calculated nutrients composition and gross energy (GE) of the main ingredients and the experimental rations.**

Item	DM%	Nutrients% (DM basis)						GE, MJ /kg DM
		OM	CP	CF	EE	NFE	Ash	
CFM*	90.08	92.86	14.68	10.85	3.10	64.23	7.14	1.803
Clover hay (CH)	90.90	87.66	13.56	31.37	1.19	41.54	12.34	1.692
Dried moringa leaves (MOL)	92.50	81.52	20.75	7.73	6.40	46.64	18.48	1.691
Ration1 (CFM+CH) control	90.33	91.28	14.34	17.07	2.52	57.35	8.71	1.769
Ration 2 (CFM+CH+30 g MOL)	90.64	91.51	14.57	15.24	2.76	58.97	8.49	1.776
Ration3(1CFM+CH+60 g MOL)	90.35	91.13	14.73	15.22	3.44	58.34	8.84	1.772

*The concentrate feed mixture (CFM) consisted of wheat bran 40%, yellow corn grain 30%, undecorticatted cotton seed meal 24% , sugar cane molasses 3 %, lime stone 2 % and common salt 0.1 %.

**GE, MJ/kg DM = 0.0226 CP + 0.0407 EE + 0.0192 CF + 0.0177 NFE (MAAF, 1975).

Phillips *et al.,* (1995) concluded that increasing diet fat content encouraged digestion of all nutrients especially CP and CF in growing lambs. Also, the observed progress in digestibilities of most nutrients for the MOL diets may due to its higher content of EE (2.76 and 3.44%) and NFE (58.97 and 58.34%) when compared with the control, which contained 2.52% and 57.53%, respectively (as explained by Khattab *et al.,* 1999). These results agree also with the findings of Gebregiorgis *et al.* (2012) who reported that, increment in protein intake increases the feed intake and digestibility.

Table 2: Digestion coefficients and nutritive values of the experimental rations, by sheep.

Item	Experimental rations			± SE
	R1 (CR) (0% ML)	R2 (30 g ML)	R3 (60 g ML)	
Digestion coefficients (%):				
DM	62.84^{c}	**67.30 ^{b}**	69.39 ^{a}	2.46 *
OM	62.40^{c}	65.72 ^{b}	68.25 ^{a}	1.69*
CP	61.21^{c}	65.32 ^{b}	67.47 ^{a}	1.45*
CF	56.14^{b}	61.08 ^{a}	63.12 ^{a}	1.56*
EE	62.42^{c}	70.36 ^{b}	73.05 ^{a}	2.09*
NFE	64.78^{c}	68.95 ^{b}	71.84 ^{a}	1.94*
Nutritive values:				
TDN, %	59.05^{c}	63.85^{b}	67.11^{a}	1.81*
DE (MJ/kg DM)*	1185.60 ^{c}	1248.68 ^{b}	1296.75 ^{a}	---
ME (MJ/kg DM)**	972.19 ^{c}	1023.92 ^{b}	10.63.31^{a}	---
DCP%	8.78 ^{b}	9.51 ^{a}	9.93 ^{a}	0.68*

a, b and c Means with different superscripts on the same row are different at (P<0.05).

**DE and **ME, calculated according to MAAF (1975) using equations being DE (MJ/kg DM) = Digestible organic matter (DOM X 19) & ME (MJ/kg DM) = DE X 0.82.*

Feed intake*:* Data presented in Table (3) illustrated that no significant differences in CFM consumption by lambs, while lambs fed 30 g MOL (R2) consumed more clover hay than other groups. In addition, the total feed intake decreased significantly (P<0.05) by increasing level of MOL in the diet. However, when DM intake related to metabolic body weight (g DM/kg W $^{0.75}$) the intake slightly reduced by increasing MOL offered. This might be a function of the increased feed bulk as MOL ratio increased in the ration. Meanwhile, when intake measured as TDN values it was increasing although concentrate increased because clover hay consumed increase (318.2 vs. 273.0 g). Accordingly, it seems that both feed bulk and nutritive value

(TDN) shared in monitoring consumption of feed.

Lambs fed rations supplemented with MOL also consumed more TDN and DCP than control ration. Feed consumption of R2 and R3 (rations containing MOL) lead to increase the consumption of TDN by 16.16 and 21.36% and DCP by 16.35 and 20.82%, for R2 and R3 rations, respectively. Generally, increasing level of MOL supplementation improved (P<0.05) feeding values on basis of TDN and DCP. This mean providing lambs with more energy and nitrogen from the tested rations. In this respect, Gebregiorgis *et al.* (2012) reported that increase of protein intake increases the feed intake, digestibility and, consequently, growth rate.

Daily gain and Feed Conversion of the growing lambs (Table 3) indicate that lambs fed diet containing MOL (R2 and R3) were significantly heavier (P<0.05) by 7.14 and 8.19%, over those fed the control diet. Lambs received 60 g MOL recorded the highest (P<0.05) average of daily gain (ADG) followed by those received 30 g MOL. Average daily gain of R2 and R3 were 182.00 and 184.67 g/day *vs.* 159.83 g/day for control (R1). In this respect, these results are in agreement with **Taie *et al* (1998),** as they found that feeding high energy diets resulted in greater daily body weight gain. While contradict with results of **Mushi *et al.* (2009) and Mahgoub** *et al.* (2005) who observed that increasing concentrate in the diet increased growth rate of goats. Also, Gebregiorgis *et al.* (2012) and Babker and Abdalbagi (2015) reported that mixing of *M. stenopetala* leaves with grass improved DMI, body weight, and nitrogen retention capacity in male sheep. The crude protein of MOL had reported by Becker, (1995) to be of better quality for ruminants because its high content of by-pass protein. Higher proportions of by-pass protein have also reported to result in faster weight gains in livestock (McNeill *et al.*, 1998). Murro *et al.* (2003) reported that *offering Moringa oleifera* dried leaves at rate 20% of total diet of growing sheep and goats, caused 20% improvement in growth rate but poorer feed conversion. Moyo *et* al. (2011) recorded that, goats fed MOL and sun flower cake had similar average daily weight gain which was higher (P<0.05) than those of the control diet. **Sultana** *et al*. (2015) stated that, average daily weight gain was significantly (P<0.05) higher in goats diets contained 100, 75, 50 and 25% Moringa foliage than those on control diet.

Concerning feed efficiency (FE), estimated as Kg DM or Kg TDN/kg gain, it was recognized that as MOL increased in diet, the feed efficiency improved. Meanwhile, all MOL fed groups had better FE than the control, i.e., use of dried MOL as supplement to growing lambs caused better feed efficiency (Table 3). In the contrary, **Sultana** *et al*. (2015) mentioned that, feed conversion ratio (FCR) of goats fed different levels of moringa foliage was affected by the diets.

Accordingly, feed cost per kg gain and economic efficiency was better with R2 and R3 rations than control ration. However, Owen *et al. (*2013) revealed that MOL can conveniently used up to 15% as expensive source of protein in rabbit diet without compromising performance and favoring production cost positively and the use of MOL as feed substitute reduced costs..

In addition, feed efficiency expressed as kg DM and TDN were significantly (P<0.5) different and the values were, 6.92 and 6.79 for R2 and R3 vs. 7.43 kg DM/kg gain for control, respectively. While feed efficiency expressed as TDN were 4.42 and 4.61 for R2 and R3 vs. 4.33 kg /kg gain for control, respectively. These findings are in agreement with Ayers *et al*. (1996); Okorie, (2003) and Babker and Abdalbagi (2015) who illustrated that, feed conversion ratio of growing goats fed diet supplemented with Moringa leaves were better than those fed control diet. Babker and Abdalbagi (2015) pointed that, crude protein content of Moringa leaves were higher, compared to other types of Hay and that crude fiber content was low when mixing Moringa leaves with other fodders, which can also

Table 3: Performance of growing lambs fed different levels of moringa leaves.

Item	Experimental rations			± SE
	R1 (CR) (0% ML)	R2 (30 g ML)	R3 (60 g ML)	
No. of Animals	9	9	9	---
Duration of trail, day	120	120	120	---
Av. Initial weight, kg	20.00	20.17	20.18	2.56 NS
Av. Final live wt., Kg	39.20 [b]	42.00 [a]	42.41 [a]	3.21*
Total gain, kg	19.23 [c]	21.83 [b]	22.17 [a]	2.15*
Av. Daily gain, g	159.83 [c]	182.00 [b]	184.67 [a]	3.27 *
Feed consumption:				
Av. CFM, g	900.8	912.6	920.9	0.54 NS
Clover hay DM intake, g	273 [b]	318.2[a]	273 [b]	1.14*
Moringa leaves suppl., g	---	30	60	---
Total daily DM intake, g	1173.8 [c]	1260.8 [a]	1253.9 [b]	2.65 *
Daily DM intake, g /kg w $^{0.75}$/h/d)	74.91 [b]	87.59 [a]	72.03 [c]	1.23 *
Av. daily intake TDN, kg	0.693 [c]	0.805 [b]	0.841 [a]	2.76 *
Av. daily DCP, g	103.05 [c]	119.90 [b]	124.51 [a]	2.89 *
Feed Efficiency:				
Kg DM/Kg gain	7.34 [a]	6.92 [b]	6.79 [b]	0.94 *
Kg TDN/Kg gain	4.33 [a]	4.42 [a]	4.61 [a]	0.86 NS
Kg DCP/Kg gain	0.644 [a]	0.658 [a]	0.674 [a]	0.24 NS
Feed cost/kg gain, *LE*	19.64 [c]	19.48 [b]	20.57 [a]	1.03 *
Daily revenue	6.87 [b]	7.83 [a]	7.94 [a]	0.72 *
Economic efficiency	1.19 [b]	1.21[a]	1.09 [c]	0.17 *
Hot carcass weight, kg	19.75 [c]	22.33 [b]	22.90 [a]	1.36*
Dressing percentage	50.36 c	53.18 b	54.01 a	2.87*

a, b and c means with different superscripts on the same row are different at (P<0.05).

**Based on free market prices of feed ingredients 2016, the cost of experimental rations was estimated as the total prices of ingredients used in the concentrate feed mixture, clover hay and moringa leaves, being, 2550, 1600 and 10 L.E., respectively and the price of one kg body weight on selling, 43.0 L.E.*

**Economic efficiency Y = [(A-B/B)], where A= selling cost of obtain gain, and B=feeding cost of this gain.*

contribute towards better livestock performance and good-quality products.

In the contrary, Murro *et al.* (2003) reported that feeding 20% *Moringa oleifera* dried leaves of total diet of growing sheep and goats, caused 20% improvement in growth rate but poorer feed conversion. Moyo *et al*. (2011b) showed that, growth performance of goats fed diets containing Moringa leaves was better (P<0.05) than those fed control diet.

Final live body weight of lambs fed rations supplemented with MOL were heavier than those fed control ration. These results are in agreement with findings of Babker and Abdalbagi (2015) who mentioned that the highest body weight gain of goats support earlier findings that *M. oleifera* has high nutritional value (Ram, 1994; Makkar and Becker, 1996 and Anwar *et al.*, 2007). Increase in the body weight of goats might due to the fact that *M. oleifera* is rich in amino acids, vitamins and minerals particularly iron (Subadra *et al.*, 1997; Faye, 2011). However, all of the best was the significant increase of body weight and its captivity, where the energy expenditure is minimal (Fadi *et al.*, 2010). Babker and Abdalbagi (2015) reported that, moringa can help small and medium-scale farmers to overcome shortages in good quality feeds and therefore sustain and improve their livestock productivity. Moyo *et al.* (2011) mentioned that, slaughter weights of goats fed diet containing MOL was higher than those fed

control diet. **Sultana** *et al.* (2015) illustrated that, the final live weight of goats fed control diet was significantly lower (P<0.05) than goats fed 100, 75, 50 and 25% moringa foliage.

Results in (Table 3) indicated that dressing percentage and hot carcass weight of lambs fed rations supplemented with MOL were heavier than those fed control ration. These results are in accordance with findings of Moyo *et al.* (2011) who showed that hot carcass weight and dressing percentage were higher (P<0.05) for goats fed MOL than those fed control diet. Also, The findings that supplementation with *M. oleifera* increases slaughter and carcass weights of goats were consistent with the literature of Yayneshet *et al*. (2008); Safari *et al.* (2009) and Mushi *et al.* (2009).

Clinical biochemical constituents*:* As shown in Table (4), the concentration of blood glucose, total protein and albumin reported in this study were significantly (P<0.05) higher for lambs fed diets supplemented with dried moringa leaves. The superior values obtained for the diet supplemented with MOL show that the high level of total protein and albumin is safe and beneficial, and not detrimental, because the levels of some chemical of moringa leaves are beneficial and has good impact on some qualities of rumen undegradable protein, thus improving protein availability and utilization (Moyo *et al.,* 2014 and Babker and Abdalbagi, 2015). In the contrary, Mahmoud (2013) indicated that there were insignificant (P<0.05) differences in blood globulin, urea and creatinine among experimental rations of lambs fed CH plus 25 % *Moringa oleifera* stems from CFM and 25% *Moringa oleifera* stems from CH plus CFM. Also, in dairy cows, Khalel *et al.,* (2014) illustrated that blood glucose, total protein and albumin were higher (P<0.05) for dairy cows fed moringa rations than those fed control ration.

Table 4: Effect of the experimental rations on some blood serum parameters of growing lambs.

Item	Experimental rations			± SE
	R1 (CR) (0% ML)	R2 (30 g ML)	R3 (60 g ML)	
AST, U/L	35.20 [a]	34.02[b]	32.17 [c]	1.38*
ALT, U/L	18.54 [a]	17.11 [b]	16.87 [c]	1.05*
T. Protein, g/dI	6.42[b]	7.82 [a]	7.95 [a]	1.12 *
Albumin, g/d	3.10[b]	3.75 [a]	3.80 [a]	1.04 *
Creatinine, g/d	1.10 [c]	1.56 [b]	1.90 [a]	1.39 *
Urea-N, g/dl	13.20 [b]	14.42 [a]	14.85 [a]	1.35 *
Glucose, mg/dl	77.60 [a]	72.5 [b]	70.62 [c]	1.65*
Cholesterol, mg/dl	105.16 [a]	88.60 [b]	88.50 [c]	3.05*

a, b and c means with different superscripts on the same row are different at (P<0.05).

Moringa leaves are also a good protein source that is a convenient substitute of some meals (soybean and rapeseed) for ruminants, and they are able to improve the microbial protein synthesis in the rumen (Soliva *et al.,* 2005).
Farooq *et al.,* (2007) stated that the *M. oleifera* plant is one of the highly potential antidiabetic plants, probably because the presence of the ability of its compounds and some flavonoids to inhibit α-amlylase activity that regulate the amount of glucose in the blood. The present values of the three experimental groups were within the normal range of sheep (Stanek *et al.,* 1992). However, the significant high blood glucose level with moringa feeding might support the assumption that, feeding moringa foliage could help in bypassing some soluble carbohydrates to be absorbed as glucose, which helps in increasing the metabolizable energy intake. In this concern, Annison *et al.* (2002**)** and Khalel *et al.,* (2014) found a linear

relationship between glucose entry rate and metabolizable energy intake.

Feeding dried MOL leaves up to 60 g of the whole daily ration did not badly affects liver or kidney functions. In this respect, Khalel *et al.*, (2014) mentioned that, creatinine, aspartate (AST) and alanine (ALT) transaminases were comparable among groups. Moreover, blood cholesterol and urea were decreased with Moringa rations, however the effect was more pronounced with 40% Moringa ration of dairy cows (Khalel *et al.*, (2014). On the other hand, the significantly lower cholesterol level associated with feeding Moringa might related to the higher phytonutrients content of moringa than other common forages (Alain *et al.*, 2016). Astuti *et al.* (2011) and Khalel *et al.*, (2014) reported that rations contained *M. oleifera* with certain amount of saponin had good effect on animal health as expressed in low serum cholesterol and normal essential fatty acids concentration. The present values of the three experimental groups were within the normal range of cows (**Stanek *et al.*, 1992**). The lower blood urea level associated with feeding Moringa forage was expected from the higher dietary N utilization of rations containing Moringa than that contained clover hay only. Hoffmann *et al.* (2003) assumed that, the high utilization of Moringa nitrogen could be regarded to its cationic protein and rumen microbes interaction that make them available in the small intestine in an intact form. Anyway, there is a need for more studies concerning energy and protein utilization of fresh or dry Moringa leaves in the feeding practices of growing lambs.

It could be concluded that *Moringa oleifera* leaf could be used up to 60 g diet inclusion level for growing lambs to improve feeding system without any adverse effect on the productive performance and blood indices, resulted in superior nutrition, better daily gain and feed efficiency and better economic efficiency. However more research is needed to assure these findings.

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PRODUCTIVE PERFORMANCE OF GROWING LAMBS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF DRIED *Moringa oleifera* LEAVES

الأداء الانتاجى للحملان النامية المغذاة على علائق مضاف اليها مستويات مختلفة من أوراق المورينجا أوليفيرا الجافة.

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1 قسم بحوث تغذية الحيوان - معهد بحوث الإنتاج الحيوانى – مركز البحوث الزراعية – الدقي – مصر
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تم اجراء هذه الدراسة لبحث تأثير اضافة مستويين من مسحوق أوراق المورينجا أوليفيرا الجافه على القيمة الهضمية و الأداء الانتاجى و مكونات الدم و تصافى الذبيحة للحملان الصعيدى . استخدم فى هذه الدراسة 27 حمل عمر 5- 6 شهور بمتوسط 11.20+ 2.56 كجم وزن حى قسمت الى ثلاثة مجموعات تجريبية (9 حملان فى المجموعة). وزعت المجموعات التجريبية على ثلاثة علائق تجريبية (1) عليقة مقارنة (كنترول): صفرأوراق مورينجا. بينما أضيف للمجموعات الثانية و الثالثة 30 و 60 جرام مسحوق أوراق مورينجا لكل رأس / يوم على التوالى . وكانت التغذية على العليقة الأساسية مكونة من مخلوط العلف المركز و دريس البرسيم . امتدت تجربة التغذية 120 يوم حيث تضمنت تقدير كمية الغذاء المأكول و معاملات الهضم و القيمة الغذائية و معدلات النمو و الكفاءة التحويلية و الاقتصادية و نسبة تصافى الذبائح ووظائف الكبد و الكلى للحيوانات و كان من النتائج المتحصل عليها من هذة الدراسة:

زاد معامل الهضم الظاهري لكل المركبات الغذائية و كذلك القيمة الغذائية و الطاقة الممثلة للعلائق المحتوية على مسحوق أوراق المورينجا بدرجة معنوية (5%) عن مجموعة الكنترول. كان المأكول اليومى معبرا عنه بالكجم / رأس / يوم أو كجم مادة جافة منسوبة لحيز الجسم التمثيلى أعلى معنويا (5%) مع الحملان التى غذيت على علائق تحتوى مستويات مختلفة من مسحوق اوراق المورينجا عن الحملان التى غذيت على عليقة المقارنة. أيضا اشارت النتائج الى ان هناك زيادة معنوية (5%) فى معدل الزيادة الوزنية (182.00 & و 184.67) جم / يوم للحملان التى أضيف لعلائقها 30 و 60 جم /رأس/ يوم مقابل (159.83) جم/يوم لعليقة الكنترول و كذلك تحسن التحويل الغذائى للحملان التى اضيف الى علائقها مسحوق أوراق المورينجا مقارنة بمجموعة الكنترول . كان تركيز البروتين الكلى و الألبيومين و اليوريا نيتروجين أعلى (5%) معنويا فى سيرم الدم للمجموعات التى تلقت مسحوق أوراق المورينجا عن مجموعة الكنترول و من ناحية اخرى فقد انخفض تركيز سكر الجلكوز فى سيرم الدم بصورة معنوية (5%) فى مجموعتى مسحوق أوراق المورينجا عن مثيلاتها فى مجموعة الكنترول . كانت الكفاءة الأقتصادية للمجموعة التى اضيف اليها 30 جم |رأس|يوم مسحوق أوراق المورينجا (الثانية) أفضل من المجموعتين الأولى و الثالثة على التوالى .

من هذة الدراسة يمكن أن يوصى باستخدام مسحوق أوراق المورينجا حتى 60 جرام /رأس/ يوم لتحسين النظام الغذائى للمجترات الصغيرة من حيث الهضم و الأداء الانتاجى و الحالة الصحية و نسبة التصافى للحملان النامية لزيادة الأستفادة من الغذاء و معدل النمو اليومى و الكفاءة الغذائية و الاقتصادية بدون حدوث تأثيرات عكسية . وعلى أية حال فان النتائج المتحصل عليها تحتاج الى مزيد من الدراسات التأكيدية.