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EVALUATION OF THE NUTRITIVE VALUE OF SOME NATIVE TREE BROWSES AS FEED FOR RUMINANT IN NORTH EGYPT

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SUMMARY

The objectives of the current study were to evaluate the chemical composition, gas and methane production, metabolizable (ME) and Net energy (NE), organic matter digestibility (OMD), short chain fatty acids (SCFA) and microbial protein (MP) synthesis of nine native browse plants (Ficus carica, Olive, Prosopis Juliflora, Acacia saligna, Acacia nilotica, Tamarix Athel, Thymelaea hirsute, AtriplexNumararia and Atriplex Halimus) estimated by in vitro gas production technique, and to determine the relationships among chemical composition, ME, OMD, gas and methane production of these plants. The results that the studied browse species resulted in good nutritional per performance due to uniqueness of their nutrient composition and nutrient profile, also they have low and safe levels of anti-nutritional factors and relatively high degradability which qualify them as suitable feed supplements to low quality basal diets for ruminants.

Keywords: Native browses plants; chemical composition; relative feed value; in vitro gas production and methane emission

INTRODUCTION

Pasture is an important source for providing the nutrients requirements of ruminants. Unfortunately, as in many parts of the tropics and subtropics, there are no real grazing areas in Egypt, in addition to the fluctuating quantities and qualities of the year-round feed supply. The major constraint to livestock production in Egypt is the animal feed scarcity especially in summer. Therefore, the search for local alternative of feed sources has become very important to meet the nutrients requirements of animals and to reduce the import of feed ingredients and/or animal products. There is a large number of plant species and Industrial-agricultural by products that have the potential of being used as forage and feed sources for ruminants. Nyambati *et al* (2006) claimed that, seedpods of *Leucaena. leucocephala* can be used to provide cheap locally available feed high in protein. Solorio-Sánchez *et al*. (2000) showed that the leaves and seeds from a range of trees *(Burserasimaruba*, *Sesbaniagrandiflora*, *Gliricidiasepium*, *Guazumaulmifolia.Albizialebbeck*) have a good potential to supply highly digestible feed suitable for ruminants. Abayneh Derero and Getu Kitaw (2018) concluded that the tree species indigenous leguminous species, (*Acacia nilotica, Acacia tortilis* and *Tamarindus indica*) and non-leguminous species (*Berchemia discolour*, *Cordia sinensis, Dobera glabra* and *Ziziphus spina-christi*) are important sources of protein, energy and minerals. Therefore, utilization and domestication should target both the leguminous and non-leguminous types. Replacement of cotton seed meal by jojoba meal, a cheap protein source, does not adversely affect rumen fermentation and appears nontoxic for rumen microbes (Nasser, 2008). Among plant species there are a wide range that are unknown to the public and some that are underutilized because of the inadequate information on their nutritional value. The *in vitro* digestibility and gas production parameters were significantly correlated with chemical composition of shrubs (Nasser, 2009). During the feed shortages alternative feedstuffs such as acacia and leucaena plants which are semi parasitic have been used to meet nutrient requirement of ruminant (Heckman *et al*., 2014).

Specific essential oils have the potential to affect the efficiency of ruminal fermentation. Supplementing essential oils from M. microphylla and A. santolina could be promising methane-mitigating agents that have no adverse effects on ruminal fermentation and feed digestion (Sallam *et al*., 2011). Thus, feeding value and quality of these forages as feeds for ruminants evaluated through determining chemical composition and *in vitro* gas production technique are important to improve strategies for efficient utilization of these resources. The objective of this study was to assess the nutritive value of leaves of some fodder tree species in North Egypt based on chemical analysis and *in vitro* gas production technique.

MATERIALS AND METHODS

Samples and site description:

Whole leaves (rachis and leaflets) of nine different native browse plants species namely *Ficus carica* (Fig), *Olea europaea L* (Olive), *Prosopis Juliflora*, *Acacia saligna*, *Acacia nilotica*, *Tamarix Athel*, *Thymelaea hirsute*, *AtriplexNumararia* and *Atriplex Halimus* have been sampled from Borg el-

Arab area, Alexandria governorate, Egypt in 2020. Samples were dried at 65°C till constant weight, ground to pass through 1 mm screen, and then kept for chemical analysis and *in vitro* gas production assay.

Chemical analysis:

Representative samples of the browse plant were subjected to the dry matter (DM), ether extract (EE), crude fiber (CF) and ash determinations following the procedure of AOAC (1990). Nitrogen (N) content was measured by the Kjeldahl method (AOAC 1990). Crude protein (CP) was calculated as N X 6.25. The neutral detergent fiber (NDF), acid detergent fiber (ADF) and hemicelluloses (HEMI) were determined according to Van Soest *et al*. (1991). All chemical analyses were carried out in triplicate.

In vitro gas production assay:

In vitro gas production was undertaken according to Menke and Steingass (1988). The rumen fluid was obtained before morning feeding from three fistulated Rahmany sheep, transferred to the laboratory in thermo flask and then filtered with four layers of cheesecloth under flushing with CO_2. The CO_2-flushed rumen fluid was mixed (1:2, v/v) with the buffered mineral solution (MB9) (Onodera and Henderson, 1980). Samples (200 mg) of the leaves of the experimental trees were accurately weighed into glass syringes fitted with plungers. The syringes were pre-warmed to 39°C before injecting 30 ml rumen fluid-buffer mixture into each syringe and excess gas was released and the syringes were incubated in a water bath at 39°C. Two blank syringes containing 30 ml of the medium only were also included. All the syringes were gently shaken 30 min after the start of incubation and then every hour for the first 12 h of incubation, thereafter five times daily. The gas production was recorded at 3, 6, 9, 12, 24, 48, 72 and 96 hours of incubation. Total gas values were corrected for blank incubations which contained rumen fluid only. Cumulative gas production (Y) at time (t) was fitted to the exponential model of Ørskov and McDonald (1979) as follows: Gas (Y) = a + b (1-exp-ct), where; a = gas production from the immediately soluble fraction, b = gas production from the insoluble fraction, c = gas production rate constant for the insoluble fraction (b), t = incubation time.

Determination of energy values, organic matter digestibility, short chain fatty acids and microbial proteins:

The energy values and the percentages of organic matter digestibility of forages were calculated from the gas produced up on incubation of 200 mg feed on dry matter basis after 24 h of incubation along with the levels of crude protein, ash and crude fat (Menke *et al*., 1979 and Menke and Steingass, 1988) as follows:

ME (MJ/kg DM) = 2.20 + 0.136 GP + 0.057 CP + 0.0029 CF2

OMD (%) =14.88 + 0.889 GP + 0.45 CP + 0.0651A

NE (Mcal/Ib) = [2.2 + (0.0272 ´ Gas) + (0.057 ´ CP) +(0.149 ´ CF)] / 14.64

Where: ME is the metabolizable energy, OMD (%) is the percentage of organic matter digestibility, GP is the 24 h net gas production (ml/200 mg DM) after 24 h of incubation. CP, crude protein (%), A, ash content (%), NE is the net energy; CF, crude fat (%) then, net energy unit converted to be MJ/kg DM.

Short chain fatty acids (SCFA) were calculated according to Getachew *et al*. (2005) as follows:

SCFA= (-0.00425 + 0.0222 GP) ´ 100

Where: GP is 24 h net gas production (ml/200 mg DM).

Microbial protein was calculated as 19.3 g microbial nitrogen per kg OMD according to Czerkawski (1986).

Statistical Analysis:

Data were subjected to one way of ANOVA in completely randomized design using version 9.1.3 of SAS software **(**SAS Institute, 2007) according to the model:-

$Y_{ii} = \mu + \alpha_i + e_{ii}$. Differences between means were tested for significance according to L.S.D procedures. Where; Y_{ii} = the observation on the tested variabes; μ = overall mean; α_i = the effect of j the effect of diet. e_{ii} = random error assumed to be independently and randomly distributed.

RESULTS AND DISCUSSION

Chemical composition

The species effect on the chemical composition of nine native browse plants leaves is given in Tables 1 and 2. The results showed that species had significant effects on the chemical composition (P<0.05). The crude protein (CP) content of the whole leaves (rachis and leaflets) of experimental plants ranged from 9.84 to 26.57%. The CP content of *Prosopis Juliflora* was significantly higher than that of the other experimental plants. All experimental plants leaves contain sufficient amount of protein for optimal microbial function. The crude ash contents of the tree leaves ranged from 4.78 to 25.85%. The crude ash content of Atriplex sp. was significantly higher than those of the other experimental plants. The results on the protein and ash of *Acacia saligna* were in agreement with those of Gebremeske *et al*. (2019). The ether extract (EE) contents of the whole tree leaves ranged from 2.04 to 5.16%. The EE of olive leaves was significantly higher than those of all other experimental plants except *Ficus carica*. Gross energy (GE) and digestible energy (DE) values of *Prosopis Juliflora* and *Olea europaea L.* (olive) leaves were significantly higher than those of the other experimental plants. As it is known that the energy value of fat is higher than those of carbohydrates and protein in feedstuffs. Therefore, the contribution of fat to the energy value of *Olea europaea L.* (olive) leaves and *Ficus carica*would be higher due to the high EE content compared with those of *Tamarix Athel* and *Thymelaea hirsute* leaves. The neutral detergent fiber (NDF) content of the tree leaves ranged from 35.03 to 52.9%. The NDF content of Tamarix sp.(Athel) was higher than those of all the other experimental plants. On the other hand, the acid neutral detergent fiber (ADF) content of the tree leaves ranged from 24.2 to 35.71%. Olive had the highest ADF and had the lowest CP contents (P<0.05). The NDF, ADF and ash contents of the olive leaves were near those reported by Olfaz *et al*, (2018) and Shakeri *et al*. (2017). The acid detergent fiber content of *Prosopis Juliflora w*as similar to that of *Thymelaea hirsuta* but lower than that of *Acacia saligna*.

Table 1. The effect of species on the chemical composition of tree leaves

Items	CP	EE	CF	NFE	Ash	GE kcal/kgDM	DE kcal/kg DM
Ficus carica	17.68	4.94	17.08	44.32	15.98	4011.4	3361.4
Olea europaea L. Olive	9.84	5.16	23.77	54.87	6.36	4304.6	3549.1
Prosopis Juliflora	26.57	3.33	24.66	45.02	5.44	4705.9	3908.3
Acacia saligna	16.22	3.98	22.65	49.07	8.08	4266.9	3480.7
Acacia nilutica	10.35	4.00	20.28	53.37	12-00	4017.3	3273.4
Tamarix sp(Athel)	10.03	2.04	18.96	52.81	16.18	3737.2	3087.1
Thymelaea hirsuta	13.08	2.48	22.26	40.27	21.91	3567.1	2962.4
Atriplex Numararia	14.52	4.29	16.75	38.59	25.85	3520.3	2938.6
Atriplex Halimus	10.94	3.36	14.49	47.16	24.05	3492.4	2921.3

CP, crude protein; EE, ether extract; CF, crude fiber; NFE, nitrogen free extract; GE, gross energy (kcal/kg DM) was was calculated according to Blaxter (1968). Each g CP= 5.65 kcal, g EE = 9.40, and g NFE and CF = 4.15 kcal; DE, Digestible energy (kcal/kg DM) was calculated according to DeBlas *et al*., (1992), using the following equation: (DE=GE × (0.867-0.0012ADF))

Table 2. The effect of species on the fiber fractions of tree leaves

Items	NDF	ADF	ADL	HC	CEL
Ficus carica (Fig)	35.03	24.20	6.70	10.83	17.50
Olea europaea L. (Olive)	44.56	35.42	19.40	9.14	16.02
Prosopis Juliflora	38.91	30.42	5.50	8.49	24.92
Acacia saligna	43.40	35.71	11.72	7.69	23.99
Acacia nilutica	39.11	28.48	6.62	10.63	21.86
Tamarix sp (Athel)	52.90	34.13	14.98	18.77	19.15
Thymelaea hirsuta	45.60	30.44	18.32	15.16	12.12
Atriplex Numararia	40.60	26.85	18.14	13.75	8.71
Atriplex Halimus	39.55	25.44	17.75	14.11	7.69

NDF, neutral detergent fiber; ADF, acid detergent fiber; ADL, acid detergent lignin; HC, hemi-cellulose, CEL, cellulose.

***In vitro* gas production :**

The rate and extent of the gas produced by rumen microbs when degrading the fodder tree leaves are shown in Tables 3 and 4. Chemical composition and degradability of feed are among the most important determinants for the amount of GP (Blümmel *et al*.,1999). Gas production is a function of the fermentation process of carbohydrates to different SCFAs, mainly acetate, butyrate and propionate (Menke & Steingas, 1988), thus amount of GP is mainly influenced by carbohydrates content in feed (Deaville & Givens, 2001), while the contribution of protein fermentation to GP is relatively small, yet positive (Menke & Steingas, 1988). The current results showed a cumulative gas production from 28.8 to 49 mL gas 200 mg-1 DM at 96 hours for leaves of the experimental browse plants. These results showed that the lowest gas production was obtained for Tamarix sp. (Athel) which also had the highest NDF, while the highest gas production was recorded for *Ficus carica*, which has the lowest NDF but the second highest protein content (Table 3). The results reported a negative correlation between fiber fractions (NDF, ADF, and ADL) and GP and digestibility. Gas production was positively correlated with CA and CP, whereas gas production was negatively correlated with the cell wall contents (NDF and ADF) and CT contents of the tree leaves (Ulger *et al*., 2017). Our results are in agreement with those of Salama *et al*. (2020) on pearl millet and other feed stuff studied by (Mokoboki *et al*., 2019). Data on gas produced by the insoluble slowly fermentable fraction b, degradation potential a+b, and the rate of particle degradation c are presented in

Table 4. The values of gas produced by fractions b, and a+b were greater for *Ficus carica* (Fig) as compared to other samples (48.32 and 49.39 ml/200 mg DM, respectively) ($p<0.05$). Also the highest gas production rate was obtained from *Ficus carica* (0.163 h-1) ($p<0.05$). The differences between plant species in fraction b, and a+b was influenced by the constituent components of the cell contents and the chemical composition of the feed ingredients which include CP, EE, cell wall content, and soluble minerals (Van Soest *et al*. (1991). The soluble organic matter is beneficial to stimulate rumen microbial growth and enhances their activity. The fraction b degradability is strongly influenced by the composition of the cell wall, wherein the fiber structure (lignocellulose bond) could inhibit the penetration of microbial enzymes thus resulting in lower nutrient degradation. Akinfemi *et al*. (2009) suggested that gas production from protein fermentation is relatively small as compared to that of carbohydrate while the contribution of fat to gas production is negligible. Methane production of plant leaves under study ranged from 30.9 to 41.4% but with non-signification differences among species. The differences between the studied plants were insignificant. Ulger *et al*. (2017) reported that methane production (mL) was positively correlated with DM, CA, CP and EE, whereas methane production (mL) was negatively correlated with the CT content of the tree leaves. The percentage of methane of feedstuffs should be lower than 14 % to have an anti-methanogenic potential (Lopez *et al*., 2010).

Table 3. Accumulative gas production (ml/200 mg DM) for experimental feedstuffs at different incubation times

Items	3	6	9	12	24	48	72	96
Ficus carica	9.0ab	14.0a	19.8a	26a	36.5a	46.0a	48.5a	49.0a
Olea europaea L. (Olive)	5.5d	11.3a	14.5bc	17.8bc	22.0bc	30.0bc	35.8bc	36.8b
Prosopis Juliflora	8.0b	12.0a	17.5b	20.5b	25.0b	32.0bc	34.0cde	35,0bc
Acacia saligna	8.0b	10.8a	15,0bc	16.0c	20.3cd	28.5cd	31.8de	32.3cd
Acacia nilutica	6.0c	11.0a	16.0b	16.0c	21.0cd	29.0bcd	32.0cde	32.0cd
Tamarix Athel	7.8b	10.3a	13.3c	16.3c	17.3d	24.5cd	26.8e	28.8d
Thymelaea hirsuta	7.3bc	10.5a	15.5b	19.5bc	27.0b	33.3bc	35.0bcd	35.0bc
Atriplex Numararia	7.0c	11.0a	15.5b	19.5bc	26.5b	36.0b	38.5b	38.5b
Atriplex Halimus	10.5a	13.0a	18.0ab	21.5b	27.8b	34.3bc	36.3bc	39.0b

a b c Column means with comman superscripts do not differ ($P>0.05$),

Table 4. Estimated kinetic parameters (ml/200 mg DM) for experimental feedstuffs at different incubation times

Items	b	a+b	c	CH4
Ficus carica (Fig)	48.321a	49.385a	0.163a	32.6a
Olea europaea L Olive)	34.150ab	38.540ab	0.033b	38.8a
Prosopis Juliflora	33.004bc	36.266c	0.065b	30.9a
Acacia saligna	27.814d	33.754bc	0.034b	31.5a
Acacia nilutica	28.448d	32.506bc	0.045b	31.3a
Tamarix Athel	22.733f	29.548bcd	0.032b	37.1a
Thymelaea hirsuta	34.115ab	35.265bc	0.060b	31.8a
Atriplex Numararia	37.158ab	39.265b	0.048b	38.7a
Atriplex Halimus	26.583d	32.403bc	0.070b	41.4a

a b c Column means with comman superscripts do not differ ($P>0.05$),(b), insoluble fraction; (a+b), degradation potential; (c) rate of particle degradation.

Energy values and Ruminal fermentation :

Estimated energy values (ME and NE), organic matter digestibility (OMD), microbial protein (MP) and short chain fatty acids (SCFA) of the tree leaves are given in Table 5. The results showed that ME, NE, OMD, MP and SCFA ranged from 5.49 to 7.96 MJ/kg DM, 2.33 to 3.15 MJ/kg DM, 38.54 – 54.99%, 46.49 to 66.33 g/kg OMD and 43.98 -77.28 mM, respectively. The results showed that the highest values were obtained from *Ficus carica* followed by *Prosopis Juliflora* and *Atriplex Numararia*. The lowest values for these parameters were observed on Tamarix sp (Athel) followed by *Acacia nilutica* ($P <0.05$). There was a positive correlation between metabolisable energy and net energy calculated from *in vitro* gas production together with CP and fat content with metabolisable energy value of conventional feeds measured *in vivo*(Menke and Steingass, 1988). Ulger *et al* (2017) reported that metabolizable energy content was positively correlated with DM, CA, CP and EE but negatively correlated with the CT contents of the tree leaves. Organic matter digestibility was positively correlated with CA and CP but negatively correlated with the cell wall contents and CT contents of the tree leaves (Ulger *et al.* 2017). Kamalak *et al*., 2011) reported that gas production, organic matter digestibility and metabolizable energy values decrease with increasing maturity of plant. The SCFA estimated from gas production ranged from 43.98 – 77.28 mM for leaves of experimental trees. There were significant differences among SCFA from different experimental feedstuffs. The highest value of SCFA was estimated for *Ficus carica* as evidenced from higher gas production which was evident in the first 24h of incubation (Table 3). Gas production from cereal straws incubated *in vitro* in buffered rumen fluid was closely related to the production of SCFA based on carbohydrate fermentation (Blummel, and Orskov, 1994). Getachew, *et al.,* 2002 reported a close association between SCFA and gas production *in vitro*.

Table 5. Estimated parameters of ME and NE (MJ/kg DM), OMD (%), MP (g/kg OMD) and SCFA (mM) of experimental feedstuffs

Items	ME (MJ/kg DM)	NE (MJ/kg DM)	OMD %	MP (g/kgOMD)	SCFA (mM)
Ficus carica	7.96a	3.15a	54.99a	66.33a	77.28a
Olea europaea L(Olive)	5.69c	2.64e	38.84c	46.85c	47.31c
Prosopis Juliflora	6.64b	3.08b	46.30b	55.85b	48.42c
Acacia saligna	5.84c	2.74d	40.49c	48.84c	43.98c
Acacia nilutica	5.58c	2.53f	38.54c	46.49c	45.09c
Tamarix sp (Athel)	5.55c	2.33h	38.67c	46.64c	45.09c
Thymelaea hirsuta	6.34b	2.57f	44.42b	53.58b	55.08b
Atriplex Numararia	6.63b	2.82c	46.66b	56.28b	58.41b
Atriplex Halimus	6.29b	2.58ef	44.04b	53.12b	56.19b

*a b c Column means with comman superscripts do not differ (P>0.05),*ME: Metabolisable energy (MJ/kg DM), NE: net energy (MJ/kg DM), OMD: Organic matter digestibility (%), MP: microbial protein (g/kgOMD), SCFA: short chain fatty acids (mM).

CONCLUSION

The *in vitro* gas production techniques can be used to assess the nutritive value of tropical and sub-tropical trees and to differentiate between their potential digestibility and metabolisable and net energy contents. The browses tree species had significant effect on the chemical composition and potential nutritive value. Chemical composition and *in vitro* digestibility are very useful techniques that may be applied in estimation of OMD, SCFA and ME. *Ficus carica* (fig), *Olea europaea L* (olive), *Prosopis Juliflora*, *Acacia saligna*, *Acacia nilutica*, Tamarix sp. (Athel), *Thymelaea hirsute*, *AtriplexNumararia* and *Atriplex Halimus* trees possessed the potentials of being included in the diet of ruminant animals. However, *in vitro* gas mitigation studies must be confirmed *in vivo* before practical field application is recommended and widely applied in ruminant nutrition.

REFERENCES

Abayneh, D., and G. Kitaw, 2018. Nutritive values of seven high priority indigenous fodder tree species in pastoral and agro-pastoral areas in Eastern Ethiopia. Agric & Food Secur (2018) 7:68.

Akinfemi, A., A.O. Adesanya and V.E. Aya, 2009. Use of an In Vitro Gas Production Technique to Evaluate Some Nigerian Feedstuffs. American-Eurasian Journal of Scientific Research 4 (4): 240-245.

AOAC, 1990. Official Methods of Analysis, 15th Edition. Association of Official Analytical Chemists, Washington, DC.

Blummel, M., and E.R. Orskov, 1994. Comparison of gas production and nylon bag degradability of roughages in predicting feed intake in cattle. Anim. Feed Sci. Technol., 40: 109-119.

Blümmel, M., K.P. Aiple, H. Steingaβ and K. Becker, 1999. A note on the stoichiometrical relationship of short chain fatty acid production and gas formation in vitro in feedstuffs of widely differing quality. Journal of Animal Physiology and Animal Nutrition 81(3):157-167.

Czerkawski J.W., 1986. *An Introduction to Rumen Studies.* Oxford, New York: Pergamon Press.

Deaville, E.R., and D.I. Givens. 2001. Use of the automated gas production technique to determine the fermentation kinetics of carbohydrate fractions in maize silage. Animal Feed Science and Technology 93(3-4):205-215.

Gebremeske, K., K. Mezgebe and A. Gesesse, 2019. Chemical composition and digestibility of Acacia species provenances in Tigray, Northern

Ethiopia.Livestock Research for Rural Development 31 (4) 2019

Getachew, G., E.De Peters, P.Robinson and J.Fadel, 2005. Use of an in vitro rumen gas production techniques to evaluate microbial fermentation of ruminant feeds and its impact on fermentation products. Anim. Feed Sci. Technol. 124: 547-559.

Getachew, G., G.M. Grovetto, M. Fondivilla B. Krishnamoorthy, H. Singh, Sphaghero, P.H. Steingass, P.H. Robinson and M.M. Kailas, 2002. Laboratory Variation of 24h in vitro gas production and estimated metabolizable energy values of ruminant feeds. Anim. Feed Sci Technol., 102: 169-180.

Heckman, M., P.Hejcmanova, M.Stesjskalova, V.Pavlu, 2014. Nutritive value of winter-collected annual twigs of main European woody species, mistletoe and ivy and its possible consequences for winter foddering of livestock in prehistory. The Holocene 24(6):659-667.

Kamalak, A., A.I. Atalay, C.O. Ozkan, E. Kaya and A. Tatliyer, 2011. Determination of potential nutritive value of Trigonella kotschi fenzl hay harvested at three different maturity stages. Journal of Veterinary Faculty, Kafkas University. 17(4):635–640.

Lopez, S., H.P.S.Makkar and C.R.Soliva, 2010. Screening plants and plant products for methane inhibitors. In, Vercoe P.E., Makkar H.P.S, Schlink A. (Eds): In vitro screening of plant resources for extra-nutritional attributes in ruminants: Nuclear and Related Methodologies. London, New York. pp.191-231,

Menke K.H., L.Raab, A.Salewski, H.Steingass, D.Fritz and W.Schneider, 1979. The estimation of digestibility and metabolizable energy content of ruminant feedstuffs from the gas production when they are incubated with rumen liquor *in vitro*. In: J. Agric. Sci. (Cambridge), 92. p. 217-222.

Menke K.H., and Steingass H., 1988. Estimation of the energetic feed value obtained from chemical analysis and in vitro gas production using rumen fluid. In: Anim. Res. Dev., 28. p. 7-55.

Mokoboki, H.K., A.N. Sebola, K.E. Ravhuhali and L. Nhlane, 2019. Chemical composition, in vitro ruminal dry matter degradability and dry matter intake of some selected browse plants. Cogent Food & Agriculture 5(1):1587811.

Nasser, M.E.A., 2009. Effect of partial or complete replacement of cottonseed meal by jojoba meal on gas production, rumen fermentation and produced amylase and carboxymethyle cellulase activity, *in vitro*. Livestock Research for Rural Development, 21(5), 2009.

Nasser, M. E. A.,2009. Effect of ensiling of *Acacia Saligna* and *Leucaena Leucocephala* leaves with different levels of urea on the chemical composition, *in vitro* gas production, energy values and organic matter digestibility. Alex. J. Agric. Res., 54(2), 43-51.

Olfaz, M., U.Kilic, M. Boga and M.Abdiwali, 2018. Determination of the *In Vitro* Gas Production and Potential Feed Value of Olive, Mulberry and Sour Orange Tree Leaves. Open Life Sci. 13: 269–278.

Onodera R., and Henderson C., 1980. Growth factors of bacterial origin for the culture of the rumen oligotrich protozoon, *Entodinium caudatum*. In: *J. Appl. Bacteriol.*, 48. p. 125-134.

Ørskov, E.R., and I.McDonald, 1979. The estimation of protein degradability in the rumen from incubation measurements weighted according to rate of passage. *Journal of Agricultural Science*92, 499.

Salama, H.S.A., H.M.El-Zaiat, S.M.A.Sallam and Y.A.Soltan, 2020. Agronomic and qualitative characterization of multi-cut berseem clover (*Trifolium alexandrinum* L.) cultivars. Journal of the Science of Food and Agriculture. doi:10.1002/jsfa.10424.

Salama, H.S.A., A.M.Shaalan, M.E.A.Nasser, 2020. Forage performance of pearl millet (Pennisetum glaucum [L.] R. Br.) in arid regions: Yield and quality assessment of new genotypes on different sowing dates. Chilean Journal of Agricultural Research 80(4) October-December 2020.

Sallam, S. M, S.A.Abdelgaleil, I.C.Bueno, M.E.Nasser, R.C.Araujo and A.L.Abdalla, 2011. Effect of some essential oils on in vitro methane emission. Archives of Animal Nutrition, 65(3):203-214.

SAS Institute, Inc, 2007. SAS Technical Report AS/STAT Software: Changes and Enhancements User's Guide, Volume 2, Version 9.1.3, Fourth Edition, Cary, NC: SAS Institute, Inc.

Shakeri, P, Z.Durmic , J.Vadhanabhuti, P.E.Vercoe , 2017. Products derived from olive leaves and fruits can alter in vitro ruminal fermentation and methane production. J. Sci. Food Agric.; 97:1367–1372.

Solorio-Sánchez, F J, I. Armendariz-Yañez and J. Ku-Vera, 2000. Chemical composition and in vitro dry matter digestibility of some fodder trees from South-east México, Livestock Research for Rural Development 2000 (12) 4.

Steel,R.G., and A.Torrie, 1980.Principles and procedures of statistics 2nd ed. McGraw Hill, New York, U.S.A.

Ulger, I., Kamalak, A., Kurt, O., Kaya, E., Guven, I. 2017. Comparison of the chemical composition and anti-methanogenic potential of Liquidambar orientalis leaves with Laurus nobilis and Eucalyptus globulus leaves using an in vitro gas production technique. Cien. Inv. Agr. 44(1):75-82.

Van Soest PV, J.B.Robertson, and B.A.Lewis, 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. J. Dairy Sci., 74(10):3583-3597.

تقييم القيمة الغذائية لبعض أنواع الأشجار المحلية كعلف للمجترات في شمال مصر

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أهداف الدراسة الحالية هي تقييم التركيب الكيميائي وإنتاج الغاز والميثان والقابلية للتمثيل الغذائي (ME) وصافي الطاقة (NE) وهضم المواد العضوية (OMD) والأحماض الدهنية قصيرة السلسلة (SCFA) وتخليق البروتين الميكروبي (MP) لتسعة نباتات محلية (أوراق كلا من نبات التين البرشومي Ficus carica ، الزيتون Olive، وبروسوبيس جوليفلورا Prosopis Juliflora ، أكاسيا ساليجنا Acacia saligna، أكاسيا نيلوتيكا Acacia nilotica، الأثل Tamarix Athel، المثنان Thymelaea hirsute، أتريبلكس نوماراريا Atriplex Numararia و أتريبلكس هاليموس Atriplex Halimus) المقدرة بتقنية إنتاج الغاز معمليا، ولتحديد العلاقات بين التركيب الكيميائي و ME و OMD و إنتاج الغاز والميثان في هذه النباتات. أظهرت النتائج أن قيم البروتين الخام (CP) ، وألياف المنظفات المحايدة (NDF) ، وألياف المنظفات الحمضية (ADF) ، وإنتاج الغاز والميثان ، و ME ، و NE ، و OMD ، و MP و SCFA تراوحت بين ٩.٨٤ إلى ٢٦.٥٧٪ ، ٣٥.٠٣ إلى ٥٢.٩٪ ، من ٢٤.٢٠ إلى ٣٥.٧١٪ ، ٢٨.٨ إلى ٤٩ مل ، ٣٠.٩ إلى ٤١.٤٪ ، ٥.٤٩ إلى ٧.٩٦ ميجا جول / كجم DM، 2.33 إلى ٣.١٥ ميجا جول / كجم DM، 54.99 - 38.54٪ ، 46.49 إلى ٦٦.٣٣ جم / كجم OMD و ٤٣.٩٨ -٧٧.٢٨ ملم ، على التوالى. أظهرت النتائج أن الأنواع الخاضعة للدراسة لديها خصائص غذائية جيدة ومستويات منخفضة وآمنة من العوامل المضادة للتغذية وقابلية عالية للتحلل نسبيًا مما يجعلها مكملات غذائية مناسبة للأنظمة الغذائية القاعدية منخفضة الجودة للحيوانات المجترة.