EFFECTS OF *Andrographis paniculata* ON THE EXTENT AND RATE OF *IN VITRO* GAS AND METHANE PRODUCTION

A. L. Yusuf[1,5], Y. M. Goh[2], A. A. Samsudin[1], A. B. Idris[1], A. R. Alimon[1,3] and A. Q. Sazili[1,4]*

[1]Department of Animal Science, Faculty of Agriculture, [2] Department of Veterinary Preclinical Sciences, Faculty of Veterinary Medicine, [3]Institute of Tropical Agriculture, [4] Halal Products Research Institute, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor D.E., Malaysia. [5]Department of Animal Science, Usmanu Danfodiyo University, P.M.B. 2346, Sokoto, Nigeria.

Livestock production have been reported as among the major source of anthropogenic methane (2) produced during the process of feed digestion. The process represents a significant loss of feed energy (2–12%) that increases costs of feed (3) and at the same time contributing to climate change which results to global warming (1). Several but expensive feeding strategies have been introduced such as addition of dietary fat by feeding diets containing crushed or whole oilseeds like cottonseed, sunflower seed, canola seed or flaxseed or dried corn distillers grain and ethanol by-products which saved up to 20% of the energy lost as methane. High quality forages such as corn silage and alfalfa, and ionophores compound, condensed tannins, saponins essential oils and rumen modifiers such as yeast have been used to methane production (4, 5). This could be achieved by dietary supplementation of cheaper, sustainable and less toxic herbs to ruminants like *Andrographis paniculata.* This herb contains active compounds in the form of diterpenoids and polyphenols (6) and some secondary metabolites such as alkaloids, glycosides, saponins, steroids, flavonoids, tannins and terpenoids (7), of which, mostly are potent antimicrobial agents. However, the influences of *Andrographis paniculata* on the ruminal gas production are yet to be clearly defined. Thus, the present study was carried out to determine if the inclusion of the plant would and parts affect the ruminal gas production. An *in vitro* digestibility study was conducted, through which, methane gas production was determined using gas chromatography. The measurement of the gas volume was carried out at 2 hrs interval over a period of 24 hrs.

Figure 1 shows the trend of gas production at 2hrs interval over the 24 hours of incubation period.

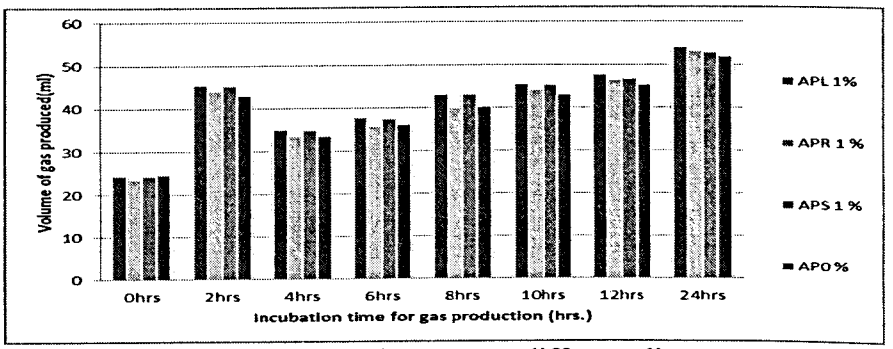

Figure 1. Differences in gas production among different dietary treatments over 24 hours of incubation

Generally, the gas production was slightly higher ($p>0.05$) in the diet containing APL throughout the incubation period. Although there was no significant difference seen in all the parameters studied ($p>0.05$), the total gas production shown by the

AP0 (control) was numerically lower (25.67 ± 0.37) compared to the other treatments (Table 1).

Table 1. Differences in gas production and rumen pH of different dietary treatments

Parameters	Treatments			
	APL (n=12)	APR (n=12)	APS (n=12)	AP0 (n=12)
Total GP (ml)	28.08 ± 1.29	28.08 ±0.88	26.47 ±1.37	25.67 ± 0.37
Rate GP (ml/hr)	1.17 ± 0.05	1.17 ± 0.04	1.10 ± 0.06	1.07 ± 0.12
Methane (ml/gDM)	17.53 ± 0.62	17.34 ±0.84	18.03 ±0.80	17.45 ± 1.00
pH (unit)	7.21 ± 0.01	7.20 ± 0.01	7.20 ± 0.02	7.19 ± 0.01

Mean ± standard error; Means with different superscripts within a row differ significantly at P<0.05. GP- gas production; APL- *Andrographis paniculata* leaves; APR - *Andrographis paniculata* roots; APS - *Andrographis paniculata* stem; AP0 – control diet (without *Andrographis paniculata*).

Irrespective of the parts, the inclusion of *Andrographis paniculata* did not significantly reduce the gas production. However, a slightly lower (26.47 ± 1.37) value was observed in APS treatment. Moreover, the rate of gas production was also slower in the control diet (AP0) with a slightly higher methane concentration observed in the APS. The results indicate that the low total and slow rate of gas production did not affect the concentration of methane in the gas produced under an average pH range between 7.19 ± 0.01 to 7.21±0.01 which was similar across all treatments. Although not significant, the differences observed in this study contradicted the earlier findings reported by (5) that plant extracts such as condensed tannins and saponins which were reportedly to be present in *Andrographis paniculata* (6;7) could reduce gas production. The slightly higher methane and low gas production demonstrated in this study could possibly be explained by low level of the inclusion of the plant in the diets.

1) Jason, W.J., Arlene, M.F., Larry, W.H. and Denise, L.M. (2006). Global health benefits of mitigating ozone pollution with methane emission controls. *Proc. of the Nat. Acad. Sci. USA*, 3988-3993.
2) Wood, C., Knipmeyer, C.K. (1998). Applied Environmental Science: global climate change and environmental stewardship by ruminant livestock producers. *Nat. Council for Agri. Edu,* 14
3) Penn, S. (2000). Agriculture alternatives: Meat goat production. http://agalternatives.aers.psu.edu/livestock/meatgoat.pdf
4) Onanong, P., Metha, W., Chalong, W., Sadudee, W. and Anusorn, C. (2009). Manipulation of ruminal fermentation and methane production by dietary saponins and tannins from mangosteen peel and soapberry fruit. *Arch. Anim. Nutr.*, 63 (5): 389-400.
5) Karen, B. (2011). Reducing methane emissions from livestock. *Agriculture and Agri Food Canada.* www.agr.gc.ca
6) Chao, W.W. and Lin, B.F. (2010). Isolation and identification of bioactive compounds in *Andrographis paniculata* (Chuanxinlian). *China Medicine*, 5(1):13-17.
7) Sule, A., Ahmed, Q.U., Samah, O.A. and Omar, M.N. (2010). Screening for antibacterial activity of *andrographis paniculata* used in malaysian folkloric medicine: a possible alternative for the treatment of skin infections. *Ethnobotanical Leaflets,* 14: 445-456.