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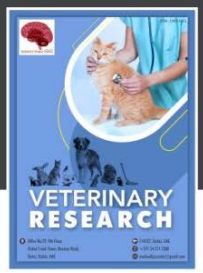

Effects of Ammoniated Sugar Beet Pulp by Different Levels of Ammonia and High Levels of Water on Parameters of *in vitro* Gas Production

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Abstract: The objective of the present study was to evaluate the effect of ammoniated of sugar Beet Pulp (BP) by different levels of ammonia and water on *in vitro* gas production parameters. The samples were left treated with water (90 and 120% of BP) and ammonia 1-3% of BP. The gas production data were fitted using an exponential equation of $P = b(1-e^{-ct})$ where b is the volume of gas produced, c is the fractional rate constant of gas production (/h), t is the incubation time (h) and P is the volume of gas produced at time t. The most cumulative gas production was for w90a1 in time 98 h incubation (68.5404 mL/200 mg of sample incubated). The chemical composition and parameters of OMD, ME SCFA and NEL were different among ammoniated sugar beet pulp used in this study.

INTRODUCTION

The goal of ruminant microbiologist and nutritionists is to manipulate the ruminal microbial ecosystems to improve the efficiency of converting feed to animal products consumable by humans. The ammoniated of feeds such as Roughage and proven to be a useful tool to reduce protein and nitrogen losses from the diet. The ammoniated sugar beet pulp is a process for treating BP with anhydrous Ammonia (NH_3) to improve crude protein, digestibility and available fiber and carbohydrates. It has been shown to improve the nutritive value of low quality forages such as corn stover (Kunkle *et al*., 1980). Ammoniated beet pulp and citrus pulp, containing no >20% crud protein equivalent, can be feed to beet cattle and dairy cattle in diets containing some concentrate and no >30-40% ammoniated beet pulp without adversely affecting intake or performance (McCall and Graham, 1953). The feeding of levels in excess of 40% of the diet generally results in a decrease in intake and performance (Krik *et al*., 1954, 1957). Most different of the chemical compound and nutrition quality of sugar beet pulp associated amounts of molasses and no don't have any information about fermentation parameters.

MATERIALS AND METHODS

The effect ammoniated sugar Beet Pulp (BP) was of evaluated in an *in vitro* gas production (Menke *et al*., 1979). Samples were moisture sugar beet pulp (90 and 120% of BP) ammoniated with ammonia 1-3% of BP and water (90 and 120% of BP). Treatments were ensiled for 2 weeks. Each treatment had 3 replicates. After 14 days, trial silages were evaluated for fermentational properties. Approximately, 0.2 g of each sample (four replicates)

ground through a 2 mm screen and was placed in a 125 mL glass vial. Blank vials were incubated with buffer alone. Then, vials were incubated in four replicate and blanks were incubated in two replicated. Three ruminally fistulated steer were used as donors of rumen fluid. Rumen content was collected before the morning feeding. The gas production method of Menke and Steingass (1988) was used. Rumen fluid was immediately strained through four layers of cheesecloth and mixed in a 2:1 with buffer, then, 30 mL of diluted fluid was added into the vials. Each vial was gassed with CO_2 then incubated at 38.6°C. The volume of gas produced was determined at 2, 4, 8, 12, 24, 36, 72 and 96 h after the incubation. The gas production data were fitted using an exponential equation of:

$$P = b\ (1\text{-}e^{-ct})$$

Where:
b = The volume of gas produced
c = The fractional rate constant of gas production (/h)
t = The incubation time (h)
P = The volume of gas produced at time t

Dry samples of diets were overnight at 550°C in a furnace (AOAC, 1990; method 942.05) and OM (Organic Matter) was subsequently calculated as 100 minus the percentage ash (AOAC, 1990; method 942.05). Total nitrogen of diets was determined by the kjeldahl method (AOAC, 1990; method 976.05), crud protein was calculated as N×6.25. Ether extract was determined following the (AOAC, 1990). The NDF (neutral detergent fiber) and ADF (acid detergent fiber) of diet were analyzed by the detergent system using the sequential procedure of Van Soest *et al*. (1991). The OMD of ammoniated beet pulp treatments was calculated using equation of Menke and Steingass (1988) as follows:

$$OMD\ (\%) = 14.88+0.889GP+0.45CP+0.651XA$$

Where:
GP = The 24 h net gas production (mL per 200 mg)
CP = Crude Protein (%)
XA = Ash content (%)

ME (MJ kg^{-1} DM) content of ammoniated beet pulp treatments was calculated using equation of Menke and Steingass (1988) as follows:

$$ME\ (MJ\ kg^{-1}\ DM) = 2.20+0.136GP+0.057CP+0.0029CP2$$

Where:
GP = The 24 h net gas production (mL per 200 mg)
CP = Crude Protein (%)

Short Chain Fatty Acid (SCFA) is calculated using the equation of Ferguson and Neave (1942) and Krik *et al*. (1957). Where, gas is 24 h net gas production (mL/200 mg DM):

$$SCFA\ (mmoL/200\ mg\ DM) = 0.0222\times GP\times 0.00425$$

$$NEL\ (MJ/kg\ DM) = 0.096\times GP+0.0038\times CP+0.000173\times EE2-0.54$$

The vials were then incubated at 38°C for 24 h. Finally, the supernatant were discarded using filter studies (No. 42), the residues then were transferred to a 50 mL cruse and dried at 55°C until constant weight. The dry weight of the residue were calculated (W2) to measure IVDMD:

$$IVDMD = \frac{W1-W2}{W1}$$

The data was analyzed by SAS 9.2 program and Proc GLM in a factorial on base completely randomizing design. Data of chemical composition, *in vitro* gas production and fermentation properties of ammoniated BP means were separated by Tukey-Kramer test at 0.05 probability level.

RESULTS AND DISCUSSION

Chemical analysis of ammoniated sugar beet pulp shown in Table 1. In this investigate with increasing ammonia level was caused increase of crude protein and decrease of ADF, NDF, ASH but no effect on EE. There was no significant effect between treatment means ($p<0.3$), except crude protein contents. Ammonia treatment of the straw of various cereals doubled its nitrogen content. Ammoniated barley straw with urea (6% of DM) and 3 levels of water (20, 30 and 40% of straw) decrease NDF content but no significant effect on ADF content Caneque *et al*. (1998). Effect of ammoniated BP on *in vitro* gas production parameters is shown in Table 2. Increase level of ammonia caused to significant ($p<0.05$) decrease in both b and c parameters. Results of the present study demonstrated that the gas production parameters of the feed samples were significantly different ($p<0.05$). In addition, results indicated that the gas production parameters of the feed samples were significantly altered when ammonia and water were included in the medium. Gas production graph shown in Fig. 1.

Sugar beet pulp, citrus pulp and apple pomace contain relatively large amounts of pectins which readily bind ammonia, forming a stable compound; the nitrogen content of the ammoniated products increases twice or more (Ferguson and Neave, 1942; Miller, 1944; Rys and Sokol, 1963).

Table 1: Chemical composition of ammoniated beet pulp

La	LW	Cp	Ndf	Adf	Ee	Ash
1	90	14.95^{g}	38.40	22.4	0.5	8.90
2	90	19.9^{cd}	37.80	21.95	0.5	9.05
3	90	19.05^{d}	37.83	21.87	0.5	9.00
1	120	16.7^{f}	38.20	22.15	0.5	8.94
2	120	20.3^{c}	37.78	21.78	0.5	9.10
3	120	21.38^{b}	37.87	21.87	0.5	9.08

Table 2: Gas production parameters

LA	LW	B	C
1	90	64.8402±1.11^{a}	0.076±0.0012
2	90	59.1379±0.54^{d}	0.073±0.0017
3	90	56.8087±2.51^{e}	0.07201±0.0014
1	120	62.632±1.35^{b}	0.074±0.0008
2	120	60.1675±0.23^{c}	0.0725±0.0072
3	120	56.9768±2.87^{e}	0.07185±0.0018

LA = Level of Ammonia; LW = Level of Water

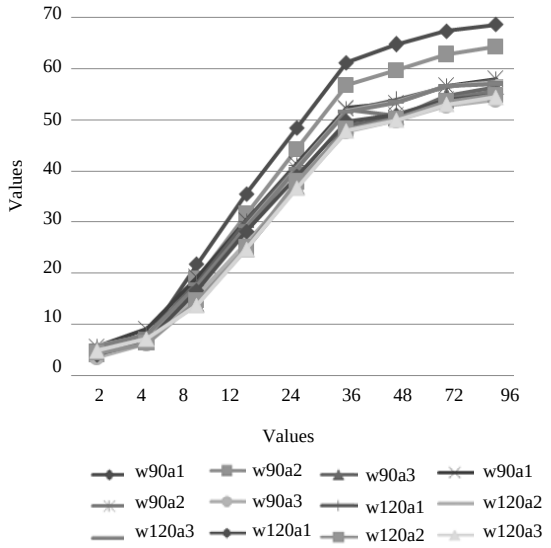

Fig. 1: Gas production; W= Level of added water, a= level of ammonia

Calculated amounts of *in vitro* Organic Matter Digestibility (OMD), Metabolizable Energy (ME), Short Chain Fatty Acid (SCFA) and Net Energy for lactation (NEl) of ammoniated sugar beet pulp are presented in Table 3 and 4. There was significant effect between treatments of ammoniated BP. Effect of ammoniated BP on *in vitro* digestibility is shown in Table 2. In 24 h increased level of ammonia cause decreased *in vitro* digestibility, however in low level of water (90% of BP) caused decreased digestibility but in high level of water (120% of BP) increased *in vitro* digestibility. Addition ammonia to wheat straw (3% of DM) and covered for 12 week caused *in vitro* dry matter disappearance (IVDMD) was increased (40.6 compared to 51.2) (Saenger *et al*., 1983). Ammoniated wheat straw with ammonium hydroxide at a level that resulted in 3.3% ammonia being added on a DM basis and addition of

Table 3: Fermentation properties

LA	LW	Total gas	SCFA	NEL
1	90	68.5404^{a}	1.06835257^{a}	5.638605^{a}
2	90	56.3447^{cd}	0.8107881^{e}	4.331104^{f}
3	90	55.5841^{d}	0.8911856^{bc}	4.742988^{cd}
1	120	57.6904^{c}	0.90436552^{b}	4.798572^{cd}
2	120	56.9279^{cd}	0.88920861^{bc}	4.739497^{cd}
3	120	54.7009^{e}	0.83582995^{d}	4.468817^{e}

Table 4: Fermentation properties

LA	LW	24 h gas	OMD	ME
1	90	48.3154	57.8324^{a}	8.77089^{a}
2	90	36.7134	47.5182^{f}	7.19302^{g}
3	90	40.3349	50.7377^{d}	7.68555^{cd}
1	120	40.9286	51.2655^{c}	7.76629^{cd}
2	120	40.2458	50.6585^{d}	7.67344^{d}
3	120	37.8414	48.521^{e}	7.34643^{f}

Table 5: The effects of different levels ammonia and water on *in vitro* digestibility of ammoniated BP

La	LW	24 h	96 h
1	90	0.71	0.890
2	90	0.69	0.890
3	90	0.69	0.920
1	120	0.74	0.9.0
2	120	0.72	0.925
3	120	0.70	0.940

LA = Level of Ammonia; LW = Level of Water

water (10, 20, 30, 40 and 50% of DM) shown IVDMD and nitrogen content were increased (Solaiman *et al*., 1979) (Table 5).

CONCLUSION

A significant difference of gas production parameters ($p<0.05$) was observed among the feed samples evaluated in the present study. Present results indicate increase level of ammonia caused a significant decrease ($p<0.05$) in both band c fractions of ammoniated BP. The most important finding of the present study is the different response of the feed samples evaluated when treated with ammonia.

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