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DETERMINATION OF NUTRITIVE VALUE OF TOMATO POMACE USING IN VITRO GAS PRODUCTION TECHNIQUE

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ORIGINAL ARTICLE

ABSTRACT: *This study was carried out to the determination of nutritive value of Tomato Pomace (untreated and treated with two levels of urea) using gas production technique. The gas production was measured at 2, 4, 6, 8,10, 12, 16, 24, 36, 48, 72 and 96 h. The gas production of unteated and treated with 1 and 2 leaves of tomato pomace at 72 h were 168.21, 164.21 and 156.66 ml/g DM and there were significant differences (P<0.05). Data showed that Tomato Pomace can be used as a high energy feed in ruminant rations to support growth and lactation, with fewer negative effects on rumen fermentation than starch rich feeds.*

Key words: *Gas production, Tomato Pomace, Treated with Urea*

INTRODUCTION

In Middle East, animals suffer from under feeding and malnutrition due to the shortage of locally produced feeds which are not sufficient to cover the nutritional requirements of the animals. Middle East is facing a shortage of compatible sources in ruminant feeds. Therefore, it is necessary that better use of unusual food sources, which are not considered as human foods. Industrial use of agricultural waste, such as citrus pulp, tomatoes and grape pomace can be an important part of the diet of ruminants (Alipour and Rouzbehan, 2007). Developing food industrial factories consequently produced large amount of wastes and by-products. Damping or burning wastes or agro-industrial by-products causes potential air and water pollution problems. High-moisture wastes are also difficult to burn. Many by-products have a substantial potential value as animal feedstuffs (Aghajanzadeh et al, 2010). Feeding by-products of the crop and food processing industries to livestock is a practices as old as the domestication of animals by humans. It has two important advantages, these being to diminish dependence of livestock on grains that can be consumed by humans (which was almost certainly the primary original reason), and to eliminate the need for costly waste management programs (which has become very important in by-product has increased, particularly in developed countries.

Tomato (*Solanum Lycopersicum*) is one of the most widely cultivated vegetable crops in Mediterranean countries. After the juice is extracted, a residue, tomato pomace, which primarily consists of water, tomato seeds, and peels, is left. The high water content of this by-product limits its length of storage. Because of storage problems, tomato pomace is often dried. Dried tomato pomace has been fed to dairy cows and sheep (Weiss et al., 1997). Dried tomato pomace contains 22.6-24.7% protein, 14.5 – 15.7% fat and 20.8 – 23.5% fiber and this by-product is a good source of vitamin B1, B2 and A (Aghajanzadeh et al., 2010).

The nutrient composition of feeds using chemical analysis is well documented in literature, but this does not provide enough information on the feeds nutritive value. Fermentation characteristics of feedstuffs in rumen fluid can be studied *in vivo*, *in situ*, and *in vitro*. Because in vivo determinations of rumen fermentation characteristics are laborious, expensive, and difficult to standardize, *in situ* and *in vitro* techniques have been developed.

The in vitro gas production system helps to better quantity the nutrient utilization and its accuracy in describing digestibility in animal has been validated in numerous experiments. Although, gases produced during rumen fermentation are colossal waste products and of no nutritive value to the ruminant, but gas production test are used routinely in feed research as gas volumes are related to both the extent and rate of substrates degradation (Akinfemi et al., 2009). This experiment was designed to determine nutritive value of tomato pomace using gas production techniques.

MATERIALS AND METHODS

Sample Collection

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Tomato Pomace samples were collected in Tomato processing CO. All samples were thoroughly mixed, and a composite sample (100g) was taken. Half of samples were treated with 1 and 2% urea and placed in nylon silos until 21d. All samples were dried in an oven at 100°C until a constant weight was achieved. All samples were then ground to pass throught a 2-mm screen in Wiley mill before incubation.

Measured in vitro gas production

In vitro gas production: Rumen fluid was obtained from two fistulated wethers fed twice daily with a diet containing alfalfa hay (60%) and concentrate (40%). Equal volumes of ruminal fluid from each sheep collected 2 h after the morning feeding squeized through four layers and mixed with McDougall (1948) buffer pre warmed to 39° C. The inoculums was dispensed (20 mL) per vial into 100 mL serum vial (containing of 300 mg sample per vial) which had been warmed to 39° C and flushed with oxygen free CO2. The vials were sealed immediately after loading and were affixed to a rotary shaker platform (lab-line instruments Inc, Iran) set at (120 rpm) housed in an incubator. Vials for each time point, as well as blanks (containing no substrate), were prepared in triplicate. Triplicate vials were removed after 2, 4, 6, 8, 10, 12, 16, 24, 36, 48, 72 and 96 h of incubation.

Cumulative gas production data were fitted to the model of Orskov and McDonald, 1979). $P=a+b(1-e^{-ct})$ that a=The gas production from the immediately soluble fraction (mL), b=The gas production from the insoluble fraction (mL), c=The gas production rate constant for the insoluble fraction (b), t=The incubation time (h) and P=The gas production at the time t.

Calculations and Statistical Analysis

Data were analyzed as a completely randomized design using a general linear model (GLM) procedure of SAS, with Duncan's multiple range test used for the comparison of means. Feeds were the only sources of variation considered.

RESULTS AND DISCUSSION

The gas test data are shown in Table 1. Gas production influenced by the microbial activity of rumen fluid may affect the rate of fermentation. Since gas production of treatments was little during the first 36h of fermentation, there were no significant differences between treatments. But processing of in vitro gas production showed that untreated tomato Pomace have a high gas production in other times (P<0.05).

Datt and Singh (1995) showed more gas production in feedstuffs can be correlated with high metabolically energy, high fermentable nitrogen for microbial activity, resulting high growth rate and enhanced ruminal biomasses.

Treatment of *Tomato Pomace* with urea increases samples pH due to hydrolysis of urea to NH_3 and has been shown to be effective in preservation of stored samples. The high gas yield in untreated samples probably resulted from high soluble CP, supply of N for growth of microorganism and high ruminal fermentation capacity for structural and nonstructural carbohydrate. Our results were lower than Kim et al. (2007) and Rodrigus et al. (2009). Obtained data showed that increasing soluble CP in feedstuffs, decrease gas production.

Table 1. Means of gas production feeds by incubation at different times in the gas test method ($mlLg^{-1}$ DM)

Feed	Incubation times (h)											
	2	4	6	8	10	12	16	24	36	48	72	96
TP	13.07	24.13	48.03	58.82	66.39	72.64	85.70	105.30	119.51	148.23a	168.21a	178.42
TP + 1% Urea	11.30	25.14	50.03	60.60	67.94	73.75	85.92	104.86	117.51	148.01a	164.21a	172.64
TP + 2% Urea	11.30	22.57	50.03	60.38	67.27	72.64	84.59	105.30	117.95	139.79b	156.66b	170.21
SEM	0.769	0.840	0.736	0.850	1.072	1.033	0.559	0.800	0.666	1.326	2.071	3.472

Means within a column with different subscripts differ (p<0.05).

CONCLUSION

Tomato Pomace widely can be used as a high energy feed in ruminant rations to support growth and lactation, with fewer negative effects on rumen fermentation than starch rich feeds.

Treating with urea, increase pH (when product NH_4^+) and that decrease anti-nutritional factors and the end of this process is increasing of ruminal degradation of feeds. Increasing soluble CP in feedstuffs, decrease gas production.

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