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Estimation of Nutritional Value of Almond Tree Leaves as a Feedstuffs for Ruminants Using Gas Production Technique

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Abstract: The aim of this study was to determine the chemical composition and to estimate the metabolizable energy and digestible organic matter of almond tree leaves. During the fall season, experimental materials were collected from different parts of East Azerbaijan province. After drying the samples and provide uniform mixing, chemical composition including dry matter (DM), crude protein (CP), ether extract (EE), crude ash (CA), cell wall (NDF), cell wall without hemicellulose (ADF) and nonfibrous carbohydrates (NFC) averaged, 91.32, 6.76, 3.5, 8.80, 20.8, 15.8 and 60.14%, respectively. Gas production test with mixtures of filtered rumen liquid of two Taleshi native male cattle rumen in times of 2, 4, 6, 8, 12, 24, 48, 72 and 96 hours were performed. The amounts of gas produced after 24 and 96 hours incubation, were equivalent to 52.89 and 60.05 ml per 200 mg dry matter of sample respectively. The digestibility of organic matter was 74.96 percent and, metabolizable energy was 11.03 (Mj kg^{-1} DM). Based on these results we can say that the almond tree leaves has relatively good nutritional value for ruminant nutrition.

Key words: Chemical composition · Almond leaf · Gas production · Metabolizable energy and Organic matter digestibility

INTRODUCTION

A major constraint to animal production in developing countries is the scarcity and fluctuating of feed supply. In addition because of the increase in human population, demand for food grains and other cash crops is increasing, resulting in a smaller area for fodder cultivation. Shrub and tree leaves are an important component of diets for goats, cattle, deer and sheep [1]. and play an important role in the nutrition of grazing animals system [2]. The gas production technique has proved to be efficient in determining the nutritive value of feeds containing anti-nutritive factors [3]. The aim of this study was to determine the chemical composition and nutritional value of almond tree leaves feeding in ruminants using gas production technique.

MATERIALS AND METHODS

Forage Samples: During the fall season, almond tree leaves were collected from different parts of East Azerbaijan province. Next, there were drying for one week and homogeneous mixture were papered for nutritive chemical analyzes.

Chemical Analysis: Dry matter (DM) was determined by drying the samples at 105°C overnight and ash by igniting the samples in a muffle furnace at 550°C for 6 h. Nitrogen (N) content was measured by the Kjeldahl method. [4] Crude protein was calculated as N X 6.25. Acid detergent fiber (ADF) content and neutral detergent fiber (NDF) content of leaves were determined using the method described by Van Soest *et al.* [5]. Condensed tannin was determined by butanol-HCl method as described by Makkar *et al.* [6]. All chemical analyses were carried out in triplicate.

In Vitro Gas Production: Rumen fluid was obtained from two fistulated cattle fed twice daily with a diet containing alfalfa hay (60%) and concentrate (40%). The samples were incubated in the rumen fluid in calibrated glass syringes following the procedures of Menke and Steingas [7]. as follows. 0.200 g dry weight of the sample was weighed in triplicate into calibrated glass syringes of

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100 ml in the absence. The syringes were pre-warmed at 39°C before injecting 30 ml rumen fluid-buffer mixture into each syringe followed by incubation in a water bath at 39°C. The syringes were gently shaken 30 min after the start of incubation and every hour for the first 10 h of incubation. Gas production was measured as the volume of gas in the calibrated syringes and was recorded before incubation (0) and 2, 4, 6, 8, 12, 24, 48, 72 and 96 hours after incubation. Total gas values were corrected for blank incubation which contained only rumen fluid. Cumulative gas production data were fitted to the model of Ørskov and McDonald [8].

$$y = a + b\,(1\text{-}\exp^{-ct})$$

Whereas:

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 = Incubation time (h)
y = Gas produced at time 't'

The OMD of forages was calculated using equations of *Menke et al.* [9] as follows:

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

Whereas:
GP is 24 h net gas production (ml / 200 mg),
CP = Crude protein (%)
XA = Ash content (%)

ME (MJ/kg DM) content of forages was calculated using equations of *Menke et al.* [9] as follows:

$$ME\ (MJ/kg\ DM) = 2.20 + 0.136\ GP + 0.057\ CP + 0.0029CP^2$$

Whereas:
GP is 24 h net gas production (ml/200 mg),
CP = rude protein

RESULTS AND DISCUSSION

The chemical composition of almond tree leaves is given in Table 1. Chemical composition including dry matter, crude protein, ether extract, crude ash, cell wall, cell wall without hemi cellulose and nonfibrous carbohydrates, averaged, 91.32, 6.76, 3.5, 8.8, 20.8, 15.8 and 60.14 percent, respectively. There are many factors affecting chemical composition and mineral content of concentrate feedstuffs such as stage of growth, maturity, species or drying method, growth environment [10] and soil types [11].

Table 1: The chemical composition of *almond tree leaves* (As g/kg DM)

Constituents	g/kg
Dry matter	925
Crude protein	67
Neutral detergent fiber	208
Acid detergent fiber	158
Ash	88
Polyphenolic compounds	34
Ether extract	35
Nonfibrous carbohydrates	601
Condensed tannin	12

Table 2: The gas production of Almond leaves

	Incubation times (h)								
Treatment	2	4	6	8	12	24	48	72	96
Gas volumes (ml)	7.11	18.63	29.93	35.82	45.35	52.89	56.16	57.62	60.05

Table 3: The parameters estimated from the gas production of almond leaves

	Estimated Parameters					
Treatment	a	b	a+b	c	OMD	ME
Almond leaves	9.09	66.54	75.63	0.140	73.74	11.03

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),
a+b : Potential gas production,
ME : Metabolizable energy (Mj kg^{-1} DM), OMD: Organic matter digestibility (%)

The gas production of Almond leaves is shown in Table 2. Amounts of gas in 24 and 96 hours incubation were, equivalent to 52.89 and 60.05 ml per 200 mg dry matter of sample respectively.

The gas production parameters, are given in Table 3. The gas production from the immediately soluble fraction (a), gas production from the insoluble fraction (b) and Potential gas production (a+b) were 9.09, 66.54 and, 75.63 ml, respectively and the gas production rate constant for the insoluble fraction (c) was 0.140 ml/h,. Digestibility of organic matter 73.74 percent and, metabolizable energy 11.03 (Mj Kg^{-1}) estimated.

Gas production can be regarded as an indicator of carbohydrates degradation, on the other hand, there was a positive correlation between NFC content of feeds and gas production, but feed cp, NH3-N and NDF levels were Negatively correlated with gas production [12].

Sallam and Sommart [13, 14] suggested that gas volume is a good parameter from which to predict digestibility, fermentation end product and microbial protein synthesis of the substrate by rumen microbes in the in vitro system. For gas volume and in vitro gas production characteristics, researchers suggested that gas volume at 24h after incubation is an indirect relationship with Metabolizable energy in feedstuffs [15]. Chemical composition and *in vitro* digestibility can be considered as useful indicators for the preliminary evaluation of the likely nutritive value of previously uninvestigated shrubs. Semi-arid browses are forages with high protein concentration and effective *In vitro* DM digestibility. As such, they have potential as a forage for farmers during the long period of dry season when feed is scarce.

CONCLUSION

The Cp concentration in the almond tree leaves was lower than animals Requirements [16], therefore recommended the use of these resources be used to supplement protein in ruminant diets. Also, the high percentage of gas production, dry matter degradation and low percentage of tannin compounds having tested samples, we can say that the almond tree leaves have relatively good nutritional value in ruminant nutrition.

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