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Determination of Potential Nutritive Value of Young, Old and Senescent Leaves of *Arbutus andrachne* Tree

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Abstract

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Potential nutritive value of young, old and senescent leaves of ***Arbutus andrachne*** *tree was measured using chemical composition and* ***in vitro*** *gas production technique. Maturity had a significantly adverse effect on the chemical composition and* ***in vitro*** *gas production kinetics. Although crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber contents decreased, condensed tannin (CT) and ash contents increased with maturity. The organic matter digestibility (OMD) and metabolisable energy (ME) ranged from 59.34 to 65.47 % and 8.84 to 9.76 MJ/kg DM, respectively. It is concluded that young and old leaves of* ***Arbutus andrachne*** *tree could be considered a moderate quality forage for sheep and goats. However, senescent leaves are only low quality forage.*

Keywords: *Arbutus andrachne* leaves, nutritive value, gas production.

Introduction

Tree foliage is important component of diets for ruminant animals such as goats, sheep, cattle and deer (Kamalak *et al.*, 2005a) and plays important role in the nutrition of herbivores in areas where few or no alternatives are available (Kamalak *et al.*, 2005a). *Arbutus andrachne,* an evergreen tree is distributed in most parts of Mediterranean area. There are considerable amount of biomass production from *Arbutus andrachne* tree through senescence, very important biological process in plants.

However, there is limited information on the potential nutritive value of young, old and senescent leaves of *Arbutus andrachne* tree. Therefore, the aim of this experiment was to determine the potential nutritive value of

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young, old and senescent leaves of *Arbutus andrachne* tree using the *in vitro* gas production and chemical composition.

Materials and Methods

The young, old and senescent leaves of *Arbutus andrachne* were collected from at least 10 different trees, then pooled and oven dried at 60C for three days. The dried leaf samples were grounded to pass through 1 mm sieve and placed in nylon bags for subsequent analysis.

Leaves were analysed for dry matter, ash, CP (AOAC, 1990), NDF (Van Soest and Wine, 1967), ADF (Van Soest, 1963) and condensed tannins (Makkar *et al.*, 1995).

Arbutus andrachne leaf samples milled through a 1 mm sieve were incubated *in vitro* rumen fluid in calibrated glass syringes following the procedures of Menke *et al.* (1979). Rumen fluid was obtained from three fistulated sheep fed twice daily with a diet containing alfalfa hay (60%) and concentrate (40%). Cumulative gas production data were fitted to non-linear exponential model as:

$$Y = a+b\ (1^{-\exp^{-ct}})$$

Where Y is gas production at time 't', a is the gas production from quickly soluble fraction, b is the gas production from slowly soluble fraction, c is the gas production rate constant (h^{-1}) and t is the incubation time (h).

ME (MJ/kg DM) and OMD were calculated using equation of Menke *et al.* (1979).

ME (MJ/kg DM) = 2.20 + 0.136 GP + 0.057 CP, where GP = 24 h net gas production (ml/ 200 mg); CP = Crude protein.

OMD (%) = 14.88 + 0.889GP + 0.45CP +0.0651 XA, where XA: ash content (%).

Data were subjected to one-way analysis of variance (ANOVA) using General Linear Model (GLM) of Statistica for windows. Significance between individual means was identified using the Tukey's multiple range test.

Results and Discussion

The maturity had an adverse (P<0.001) effect on the chemical composition of *Arbutus andrachne* leaves (Table 1). Dry matter, crude protein and ADF decreased (P<0.001) with maturity while ash and condensed tannins contents increased. The CP contents of *Arbutus andrachne* leaves obtained in the current study was lower than those obtained by Kamalak *et al.* (2004) and Karabulut *et al.* (2006), who reported CP contents of *Arbutus andrachne* leaves as 10.5 and 7.3%, respectively. The differences in CP contents among different studies can be attributed to the harvesting time of *Arbutus andrachne* leaves. Further, optimal utilization of CP in *Arbutus andrachne* leaves

Table 1
The effect of maturity on chemical composition (%) of *Arbutus andrachne* tree leaves

	Leaves			SEM
	Young	Old	Senescent	
Dry matter	93.28	93.74	93.28	0.165
Crude protein	4.90^{c}	3.46^{b}	1.13^{a}	0.262
Neutral detergent fiber	33.75^{b}	35.58^{c}	29.43^{a}	0.294
Acid detergent fiber	30.22^{b}	29.50^{b}	24.99^{a}	0.382
Ash	4.86^{c}	5.69^{b}	7.65^{a}	0.140
Condensed tannins	11.63^{a}	14.64^{b}	20.71^{c}	0.799

^{abc}Means within the same row with different superscripts differ (P<0.001), SEM: Standard error.

Table 2
The effect of maturity on gas production kinetics, metabolisable energy and organic matter digestibility of *Arbutus andrachne* tree leaves

	Leaves			
	Young	Old	Senescent	SEM
c	6.50^{b}	6.13^{b}	5.73^{a}	0.121
a	3.39^{B}	3.73^{B}	2.65^{A}	0.227
b	65.31^{B}	63.17^{A}	62.38^{A}	0.600
a+b	68.71^{b}	66.90^{ab}	65.04^{a}	0.607
ME	9.76^{c}	9.29^{b}	8.84^{a}	0.106
OMD	65.47^{c}	62.29^{b}	59.34^{a}	0.700

Means within the same row with different superscripts differ. ^{AB}(P<0.01), ^{ab}(P<0.001).

SEM: Standard error, a is the gas production from the immediately soluble fraction (ml), b is the gas production from the insoluble fraction (ml), a + b = the potential gas production (ml), c is the rate of gas production per h, ME: Metabolisable energy, OMD: Organic matter digestibility.

could be limited by high levels of CT due to tannin activity through the chemical binding with dietary nutrients.

The NDF and ADF contents of *Arbutus andrachne* leaves obtained in the current study were consistent with findings of Kamalak *et al.* (2004) but inconsistent with findings of Karabulut *et al.* (2006). The CT contents of *Arbutus andrachne* leaves obtained in the current study was higher than those by Karabulut *et al.* (2006) but comparable to that of Kamalak *et al.* (2004). The ash contents of *Arbutus andrachne* leaves obtained in the current study were consistent with those obtained by Karabulut *et al.* (2006) and Kamalak *et al.* (2004).

The gas production rate (c), gas production from quickly and slowly soluble fraction and potential gas production of young and old leaves were higher than those obtained for senescent leaves (Table 2). The gas production rates obtained in the current study were lower than those obtained by Kamalak *et al.* (2005b).

The maturity also adversely effected ME and OMD of leaves of *Arbutus andrachne* (Table 2).

Thus it is concluded that whereas, young and old leaves of *Arbutus andrachne* tree have considerable potential as moderate quality forage for sheep and goats, senescent leaves serve only as low quality forage.

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ए. कामालाक, ओ. कैनबोलात, ए.आई. अटाले, एम. कैप्लान। आर्बुलस एंड्राचने वृक्ष के नवीन, पुरातन और जीर्णमान पत्तों का शक्य पौषणिक मान मापन।

रसायनिक संरचना और पात्रे गैस उत्पादन तकनिकी द्वारा आर्बुटस एंड्राचने वृक्ष की नवीन, पुरातन और जीर्वामान पत्तियों का शक्य पौषणिक मान ज्ञात किया गया। प्रौढ़ता का रासायनिक संरचना और पात्रे गैस उत्पादन गतिजता पर सार्थक कुप्रभाव पाया गया। प्रौढ़ता के साथ अपरिष्कृत प्रोटीन (सीपी), उदासीन अपक्षारक रेशा (एनडीएफ) और अम्ल अपक्षारक रेशा (एडीएफ) में कमी एवं संघनित टैनिन (सीटी) और भस्म की मात्रा में वृद्धि हुयी। कार्बनिक पदार्थ की पाच्यता और चयापचयी ऊर्जा के मान क्रमश: 59.34 से 65.47 प्रतिशत और 8.84 से 9.76 एम जे प्रति किग्रा थे। निष्कर्ष यह निकला कि भेड़ों और बकरियों के लिए आर्बुटस एड्राचने के नवीन और पुरातन पत्ते एक औसत किस्म का चारा हो सकते हैं।