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Chemical composition and *in sacco* digestibility of some Tunisian roughages

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Abstract

The present study aims at measuring the chemical composition and the ruminal degradability of some Tunisian roughage. The roughages were analysed to determine their chemical composition. Ruminal degradability of the roughages was determined using the technique of nylon bags. There were significant differences (P<0.05) among roughages with regard to immediately soluble fraction, insoluble but degradable fraction, and fraction rate of degradation.

Keywords: Ewes, Roughages, Ruminal degradability

Introduction

In Tunisia, roughages used as ruminant feed are hay and silage and use of green grass are (Barley, Egyptian clover, Lucerne, oat) still limited. Annual roughages area (hay, silage and greens) varied considerably and have an average of 330 000 ha during the last 5 years (Ministry of Agriculture, 2009). Generally, Tunisian roughages are poor and undiversified. It is essential to improve roughage quality, to compensate and satisfy annual increasing growing livestock population and to limit the widespread use of feed concentrates, compounds imported raw materials (maize and soybean meal). The objective of this study was to characterize some roughage, which represents large use in Tunisian cattle and sheep feeding from their chemical composition and rumen degradation characteristics.

Materials and Methods

The study focused on different roughages types, which are mostly used for Tunisian cattle and sheep feed. There are four green roughages: Egyptian clover (*Trifolium alexandrium*), oat (*Avena sativa*), barley (*Hordeum vulgare*) "Souihli" and barley "Manel" and two conserved roughages: hay and silage of vetch *(Vicia sativa)* oat.

For the determination on *in sacco* degradability, two Barbarine ewes (5 years old) with an average live weight of 52.3±3.5kg, fitted with permanent canulas in the rumen were used. Ewes were placed in individual cages and received daily hay oat completed by 400 g of concentrate (80% barly and 20% soybean meal).

Chemical analysis were conducted to determine contents of roughages in dry matter (DM) mineral matter content (MM), crude protein (CP) (AOAC, 1990), crude fiber (CB) (AOAC, 1990) and neutral detergent fibre (NDF) (Van Soest et al.,1991). The levels of soluble constituents or NDS were determined by difference compared with the NDF (NDS = 100-NDF).

Rumen degradability was determined using Nylon bags technique by using Orskov and McDonald (1979) model:

$$Dg=a+b(1-e^{-ct})$$

Where Dg is the rumen degradability of dry matter in t time

a: is the immediately soluble fraction,

b: is the fraction of potentially degradable and

c: is the speed of b expressed in% per hour.

Sachets Nylon size, 9x12 cm, containing about 3 g of each roughages were placed in the rumen. For each sampling, two bags of each roughage were removed, washed immediately with tap water to remove large particles that adhere and then washed 3 times for 15 minutes in a "Mini-Wash. The bags were dried in a ventilated oven at 50°C for 5 h, the incubation time in the rumen were 3, 6, 24, 48, 72 and 96 hours. The amount of degraded dry matter in the rumen at time t, was calculated by difference between initial amount and that the bag. The kinetics of DM degradation of different roughage was determined using the model Orskov and McDonald (1979).

Statistical Analysis

Means of chemical composition and ruminal degradation characteristics were compared using a one way variance analysis using Statistical Analysis Systems procedure (SAS, 1988).

Results and Discussion

Chemical composition of different roughages is listed in Table 1. Table 2 reported the proportions of disappeared rumen dry matter during the incubation for different roughages. Differences between means values for rumen disappeared matters in time‘t’ are significantly different (P<0.05). For green roughages, the rate of DM disappearance varied from 8.5% to 20% and Egyptian clover present the higher value. DM proportions disappearance for Vetch oats Silage at 3h and 6h were relatively higher. After 72 h incubation in the rumen, the disappearance of hay reached a 54.5% value. This value appears to be relatively high compared to that reported by Rouissi (1994) who studied hay and concentrate in sheep.

The a, b and c constants (table 3) estimated by $Dg=a+b(1–e^{-ct})$ show significant differences between both regimens for the fraction “a”. The value of “a” varied from 5.2 to 23.5% of DM for green oat and Vetch-oat silage respectively. These values corresponds those reported by Chermiti et al. (2000). Likewise significant differences were observed for the fraction “b”. The lowest value (51.1% DM) was observed for the vetch-oat silage and the highest value (71.2% DM) was measured for the green barly “Souihli”. For hay it was 65.7% DM witch is greater than reported by Khazaal et al. (1993) for dried roughages (15. 9 to 49.3% DM). The rate of disappearance “c” of the fraction “b” differed also between roughages (P<0.05) and was higher for the green roughages except for that of oat which has an important NDF content (54% DM).

Table 1: Chemical composition of roughages

	%					
Roughages	DM	OM	CP	CF	NDF	NDS
Green roughages						
Egyptian clover	11. 2	86. 2	19.1	21. 3	42	58. 3
Oat	17. 5	89. 9	11. 5	28. 7	54	46. 3
Barly ‘Souihli’	16. 1	89. 2	10. 4	27. 7	55	45. 0
Barly ‘Manel’	13. 0	86. 5	11. 2	24. 1	51	49. 0
Conserved roughages						
Vetch-oat silage	29. 0	89. 5	7. 6	26. 0	47	53. 0
Vetch-oat hay	89. 2	93	8. 2	25. 2	56	44. 0

DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fibre; NDF: Neutral Detergent Fiber; NDS: Neutral detergent soluble Fraction.

Table 2: Ruminal disappearance of dry matter roughages

	Rumen incubation time (hours)					
	3	6	24	48	72	96
Green roughages						
Egyptian clover	20. 0^{a}	22. 0^{bc}	53. 8^{a}	67. 6^{a}	72. 0^{ab}	75. 5^{ab}
Oat	8. 5^{b}	11. 7^{b}	38. 7^{b}	48. 6^{b}	60. 4^{ac}	64. 5^{ac}
Barly ‘Souihli’	15. 0^{b}	25. 6^{bc}	55. 8^{a}	66. 0^{a}	74. 0^{ab}	73. 0^{ab}
Barly ‘Manel’	15. 0^{b}	18. 5^{b}	56. 0^{a}	64. 0^{a}	77. 5^{b}	77. 0^{ab}
Conserved roughages						
Vetch-oat silage	26. 5^{a}	33. 0^{a}	48. 9^{a}	65. 0^{a}	67. 3^{a}	72. 0^{a}
Vetch-oat hay	11. 2^{b}	12. 0^{b}	36. 3^{b}	46. 5^{b}	54. 5^{c}	61. 0^{c}
MSE	1. 10	1. 36	1. 21	1. 13	1. 16	1. 10

a, b, c: Values in the same column affected by same letters are not significantly different (p>0.05); MSE: Mean standard error.

Table 3: Constants of ruminal degradability calculated from the model $Dg = a+b (1 – e^{-ct})$

Roughages	a	b	a+b	c
Green roughages				
Egyptian clover	10. 4^{bc}	65. 5^{ab}	75. 9^{ab}	0. 044 ^{ab}
Oat	5. 2^{c}	63. 0^{ab}	68. 2^{b}	0.025^{bc}
Barly « Souihli »	6. 3^{c}	70. 0^{a}	76. 3^{ab}	0.057^{a}
Barly « Manel »	7. 3^{bc}	71. 2^{a}	78. 5^{ab}	0.044^{ab}
Conserved roughages				
Vetch-oat silage	23. 5^{ab}	51. 1^{b}	74.6^{ab}	0. 033^{abc}
Vetch-oat hay	17. 8^{a}	65. 7^{ab}	83. 5^{a}	0. 011^{c}
MSE	1. 46	2. 19	1. 44	0. 003

a, b, c: Means within the same column with different superscripts are different ($p < 0.05$) ; MSE: Mean standard error. a is immediately soluble fraction, b is slowly degradable fraction and c is fraction b speed of degradation.

Conclusion

Chemical composition of the roughages studied in this experiment and their characterization based on biological parameters such as constants degradability, showed considerable variability, especially the immediately soluble fraction. Results showed significant differences among roughages with slowly degradable fraction. It is recommended to continue this work using important number of roughages to generate data. This data can be used in practice to prepare the effective food rations for animals meet needs.

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