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**ORIGINAL ARTICLE**

# Determination of Chemical Composition and Dry Matter Degradation of Canola Straw by *in situ* Technique

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**ABSTRACT**

*This study was carried out to determine the chemical composition and ruminal degradability of canola Straw (CS). Samples were collected from several canola straw threshing farms in Moghan, Iran. Chemical composition for Dry Matter (DM), Crude Protein (CP), Organic Matter (OM), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) and Non-fibrous carbohydrate (NFC) of pooled samples were 93.33, 3.41, 25.3, 81.6, 62, and 9.1%, respectively. Degradation procedure was performed using nylon bags filled with 5 g of CS and suspended in the rumen of three fistulated Gezel rams for 0, 2, 4, 8, 16, 24, 48, 72 and 96 h and obtained data were fitted to a non-linear degradation model to calculate ruminal degradation characteristics. Results showed that soluble fraction (a) of CS were very low, especially in case of DM. Potential degradability (a + b) and effective degradability (Out flow rate 0.02$h^{-1}$) were of CS for DM 23.4and 16.6, respectively. It is conclude that, CS has low DM degradability in the rumen. In this study, the nutrient composition of canola straw commonly grown or produced in mogan, iran. The results should help us better understand the nutrition potential of canola straw and provide basic information in ruminant feeding.*

**Keywords**: Canola straw, chemical composition, degradability, nylon bags, ruminants.

## INTRODUCTION

In tropical zones in the world, ruminants depend on year round grazing on natural pastures or are fed with cutgrass and crop residues. Most of these areas face seasonal dry periods in which the availability of pasture decreases and also, there is a reduction in quality in terms of digestible energy and nitrogen content. Because in this area, straw is abundantly available from cultivating, farmers offer straw as the main roughage source to their animals. This is particularly the case in Southeast Asian countries such as Thailand, Vietnam and Indonesia. Feeding on only straw does not provide enough nutrients to the ruminants to maintain high production levels due to the low nutritive value of this highly lignified material. The high level of lignification and silicification, the slow and limited ruminal degradation of the carbohydrates and the low content of nitrogen are the main deficiencies of straw, affecting its value as feed for ruminants (Van Soest, 2006). As straw is poorly fermented, it has low rates of disappearance in the rumen and low rates of passage through the rumen, reducing feed intake (Conrad, 1996). In recent years, the accurate and precise determination of straw nutrition value is becoming more important. According to the canola straw, chemical composition was comparable between wheat and barley straw. The aim of this study was to determine the chemical composition and relative nutritive value of canola straw (CS) using In situ technique.

## MATERIALS AND METHODS

### Sample collection and chemical analysis

Canola Straw (CS) samples were collected from four Canola straw threshing farms in Dasht-e-Moghan, Ardebil province, Iran at summer 2010. Collected samples were pooled and ground for chemical and *in situ* procedures. Dry Matter (DM) was determined by drying the samples at 105° c overnight and ash by igniting the samples in muffle furnace at 525° c for 8 h. Nitrogen (N) content was measured by the Kjeldahl method (AOAC, 1990). Crude Protein (CP) was calculated as N×6.25. Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were determined by procedures outlined by Goering and Van Soest (1970) with modifications described by Van Soest *et al*. (1991).

### *In situ* degradation procedures

Three ruminally cannulated Gezel rams (about 55 kg BW) were used to determine *in situ* degradation characteristics. Rams were housed in individual tie stalls bedded with sawdust. Rams fed diets containing alfalfa hay (70%) and concentrate mixture (30%) at the maintenance levels. Dacron bags (18*9 cm; 40-45 micron pore size) were filled with 5 g dried and ground samples and then incubated in the rumen of rams for the periods of 0, 2, 4, 8, 16, 24, 48, 72 and 96 h. After the removal of bags from the rumen, bags were washed in cold water until rinse were clear and dried at 60oC for 48 h (Karsli and Russell, 2002). Then rumen degradation kinetics of DM, OM and CP was calculated using the nonlinear model proposed by Ørskov and McDonald (1979):

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

Where:

P = Percentage of degradability for response variablesat t.

t = Time relative to incubation (h)

a = highly soluble and readily degradable fraction (%)

b = Insoluble and slowly degradable fraction (%)

c = Rate constant for degradation ($h^{-1}$)

e = 2.7182 (Natural logarithm base)

Following determination of these parameters, the effective degradability of DM in CS was calculated

Using equation described by Ørskov and McDonald (1979):

$ED = a + (b*c)/(c + k)$

Where:

ED = Effective degradability for response variables (%)

a = highly soluble and readily degradable fraction (%)

b = Insoluble and slowly degradable fraction (%)

c = Rate constant for degradation ($h^{-1}$)

k = Rate constant of passage ($h^{-1}$)

When calculating effective degradability, rate constant of passage was assumed to be 0.02, 0.05 and 0.08 per hour (Bhargava and Ørskov, 1987) so that the results could be extrapolated to other ruminants that differ in rumen capacity.

## RESULT AND DISCUSSION

### Chemical composition

The chemical composition of canola straws are shown in Table 1. Chemical composition, including the DM, CP, EE, OM, NDF, ADF, CF and Non-fibrous carbohydrate of CS were 93.33, 3.41, 2.44, 96.90, 81.6, 62, 3.45 and 9.1%, respectively.

Table 1: Chemical composition of Canola Straw (%)

| DM | CP | EE | OM | ADF | NDF | NFC |
|---|---|---|---|---|---|---|
| **93.33** | 3.41 | 2.44 | 25.3 | 62 | 81.6 | 9.1 |

DM: Dry Matter, CP: Crude Protein, EE: Ether Extract, OM: Organic Matter, ADF: Acid Detergent Fiber, NDF: Neutral Detergent Fiber and NFC: Non-fibrous carbohydrate

Table 2: Dry Matter degradation (%) of Canola straw at different incubation times

| **Incubation time (h)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **0** | 2 | 4 | 8 | 16 | 24 | 48 | 72 | 96 |
| **1.31** | 1.63 | 2.42 | 6.35 | 12.61 | 18.52 | 20.41 | 22.51 | 23.42 |

The table (2) can be seen that the degradation of dry matter until 72 hours have shown upward trend after the first hours of degradation of dry matter is reduced due to increase the bacteria colonies are at intervals of 4 to 72 hours. After this period of reduced substrate availability for microorganisms and bacteria growth inside the bags of dry matter loss and degradation rate decreases.

Table 3: Ruminal degradation parameters and effective degradability of Canola straw

| Items | DM |
|---|---|
| **a (%)** | 0.52 |
| **b (%)** | 23.9 |
| **a + b (%)** | 24.42 |
| **C($h^{-1}$)** | 0.051 |
| **Lag time (h)** | 1.3 |
| **ED (%) Out flow rate 0.02 $h^{-1}$** | 16.6 |
| **ED (%) Out flow rate 0.05 $h^{-1}$** | 11.6 |
| **ED (%) Out flow rate 0.08 $h^{-1}$** | 8.8 |

a: Washout fraction as measured by washing loss from nylon bags; b: Potentially degradable fraction; c: Rate of degradation of fraction b ($h^{-1}$) ; ED: Effective Degradability, DM = Dry Matter, OM = Organic Matter, CP = Crude Protein

Effective degradation, degradation of dry matter with respect to the retention time in the rumen. Effective Degradation of canola straw with increasing Material removal rate decreased. Because the increase in pass rates, fewer opportunities for invading microbes had food (Maheri-Sis *et al*., 2007)

## CONCLUSION

Results of current study indicated that canola straw soluble fraction was very low as well as other ruminal degradation parameters. It can be suggest that in further studies canola straw should be treated by different methods especially for preparing fermentable energy source (such as molasses) in order to improve nutritive value and dry matter intake. It seems that canola straw without any treatment only can be included in low levels in ruminant's diets.

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