Journal of Microbiology, Biotechnology and Food Sciences

*Chrenková et al. 2012 : 1 (February Special issue) 640-643*

**REGULAR ARTICLE**

# THE CHARACTERISTICS OF CRUDE PROTEIN AND NDF IN LUCERNE AND MAIZE SILAGES ACCORDING IN SITU AND CNCPS

*Mária Chrenková*, Mária Poláčiková, Zuzana Formelová, Zuzana Čerešňáková*

***Address*:** Animal Production Research Centre Nitra, Institute of Nutrition, Hlohovecká 2, 951 41 Lužianky, Slovak Republic

*Corresponding author: chrenkova@cvzv.sk

## ABSTRACT

According to Cornell Net Carbohydrate and Protein System (CNCPS) and in situ method were determined nutritional characteristics of crude protein (CP) in lucerne silage (LS) and maize silage (MS). Both LS and MS samples varied highly with concentrations in $g.kg^{-1}$dry matter (DM): Crude protein (CP) 90.6 – 196.0 and 56.0 – 82.5 ($P<0.05$); neutral detergent fibre (NDF) 366.3 – 690.2 and 362.8 – 482.2; acid detergent fibre (ADF) 305.7 – 592.9 and 201.7 – 243.2 ($P<0.01$); acid detergent lignin (ADL) 43.7 – 77.2 and 23.8 – 29.2 ($P<0.01$), respectively. Concentration of B2 was significantly higher in LS than in MS ($P<0.05$). *In situ* effective CP degradability (ECPD) of LS and MS were similar (75.6 % and 76.3 %). Effective NDF degradability was higher for MS than for LS (36.5 % and 33.2 %) but the difference was not significant.

**Key words:** CP; NDF; ADF; in situ method; CP degradability; CNCPS characteristics

## INTRODUCTION

Silages are the dominant part of dairy rations and so they are one of the key determinants of overall profitability. Traditionally, modern European systems have used *in situ* methods to describe protein and NDF availability in the rumen and in the small intestine

of ruminants, whereas the Cornell Net Carbohydrate and Protein System (CNCPS) mainly rely on chemical fractionation of nitrogen (Sniffen et al., 1992) and cell walls (Weisbjerg., 2010). Protein and cell walls (NDF) degradation are closely related. Concentration and quality of NDF affects the rumen degradability and intestinal digestibility of CP.

The aim of our experiment was to determined the CP and NDF characteristics *in situ* and CNCPS for lucerne silage (LS) and maize silages (MS).

## MATERIAL AND METHODS

According to Licitra et al. (1996) soluble and insoluble crude protein (CP) subfractions in buffer, neutral detergent (ND) and acid detergent (AD) were determined in six samples of maize silage (MS) and seven samples of lucerne silage (LS). Content of crude protein, neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined according to Decree of the Ministry of Agriculture of the Slovak Repub. No. 1497/4/1997-100. For effective CP and NDF degradability was used *in situ* method (Harazim and Pavelek, 1999). The data were analysed One-Way Analysis of Variance. The significant differences were declared at $P<0.01$ and $P<0.05$ using T-test. We also evaluated the correlation (Pearson) between in situ and CNCPS characteristics.

## RESULTS

Both LS and MS samples varied highly, with concentrations (in $g.kg^{-1}$DM): CP 90.6 – 196.0 and 56.0 – 82.5; NDF 366.3 – 690.2 and 362.8 – 482.2; ADF 305.7 – 592.9 and 201.7 – 243.2; ADL 43.7 – 77.2 and 23.8 – 29.2, respectively. Mean concentrations in LS and MS were significantly different for CP ($P<0.05$), ADF ($P<0.01$), and lignin ($P<0.01$). Buffer insoluble protein minus the protein insoluble in ND is fraction B2. Concentration of B2 was significantly higher in LS than in MS ($P<0.05$), but in % of total N the difference was non-significant (32.1 and 39.9, resp.). The fraction C (unavailable protein, CP bound to ADF) varied considerably in both LS and MS (for LS from 6.2 to 30.9 % and for MS 6.8 to 42.6 % of total N) but the means were similar (12.3 % and 17.4 %, resp.). There was found very high variability in content of protein bound to NDF (NDIN) and ADF (ADIN). Very high variation in NDIN and ADIN content among LS and MS samples could have been due to heat damage by incorrectly fermentation process. *In situ* effective CP degradability (ECPD) of LS and MS were similar (Table 1). Effective NDF degradability was higher for MS than for LS but the

difference was not significant. The rate of NDF degradability was higher ($P<0.05$) for LS than for MS.

## CONCLUSION

There was found very weak correlation between selected parameters of CP quality. It could be affected by the large variability of observed parameters in both groups of silages.

**Table 1** Characteristics of protein and NDF assessed by the in situ or CNCPS methods

| Item | Method | Feedstuffs | | | | P-value |
|---|---|---|---|---|---|---|
| | | Maize silage (n=6) | | Lucerne silage (n=7) | | |
| | | x | *v %* | x | *v %* | |
| **CP (g.kg$^{-1}$ DM)** | | 70.6 | 15.6 | 157.0 | 22.5 | 0.0108 |
| **NDF (g.kg$^{-1}$ DM)** | | 457.0 | 13.9 | 458.7 | 24.8 | 0.9747 |
| **ADF (g.kg$^{-1}$ DM)** | | 237.8 | 13.6 | 389.4 | 24.6 | 0.0037 |
| **ADL (g.kg$^{-1}$ DM)** | | 29.8 | 19.5 | 95.2 | 48.5 | 0.0057 |
| **NDIN (g.kg$^{-1}$ DM)** | CNCPS | 16.9 | 46.6 | 24.9 | 71.0 | 0.3347 |
| **NDIN (% of total N** | CNCPS | 24.0 | 47.6 | 16.5 | 79.9 | 0.2987 |
| **ADIN (g.kg$^{-1}$ DM)** | CNCPS | 12.2 | 79.8 | 18.3 | 57.3 | 0.3010 |
| **ADIN (% of total N)** | CNCPS | 17.4 | 77.5 | 12.3 | 68.8 | 0.4269 |
| **B2(g.kg$^{-1}$ DM)** | CNCPS | 27.2 | 28.3 | 48.0 | 32.7 | 0.0134 |
| **B2 (% of total N)** | CNCPS | 39.9 | 37.7 | 32.1 | 39.7 | 0.3314 |
| **EDCP (%)** | *In situ* | 75.6 | 6.7 | 76.3 | 12.1 | 0.8735 |
| **c[1] EDCP (%/h)** | *In situ* | 0.0423 | 50.1 | 0.0628 | 43.0 | 0.1619 |
| **EDNDF (%)** | *In situ* | 36.5 | 32.0 | 33.2 | 21.9 | 0.4563 |
| **c[2] EDNDF (%/h)** | *In situ* | 0.020 | 29.8 | 0.0379 | 37.2 | 0.0150 |
| **CPID[2] (%)** | *In situ* | 40.4 | 36.4 | 46.5 | 15.9 | 0.3599 |

Legend: [1] rate of crude protein and/or NDF degradability in the rumen; [2] intestinal digestibility of undegraded crude protein

**Acknowledgments:** The work has been carried out with financial support from the Commission of the European Communities, FP7, KBB-2007-1 and of the project "BELNUZ 26220120052" by the Operational Programme Research and Development funded from the European Regional Development Fund."

## REFERENCES

HARAZIM, J. - PAVELEK, P. 1999. Determination of crude protein and amino acids degradability by method in sacco in the rumen. In *Proceeding of international meeting „Stanovení využitelnosti živin u přežvýkavců“,* Opava, Slovakia, 1999.

LICITRA, G. - HERNANDEZ, T. M. - VAN SOEST, P. J. 1996. Standardization of procedures for nitrogen fractionation of ruminant feeds. In *Animal Feed Science Technology*, 57, p. 347 - 358.

MPSR. 1997. Výnos ministerstva pôdohospodárstva SR 1497/4/1997-100 o úradnom odbere vzoriek a laboratórnom skúšaní krmív. Vestník MP SR, 1997, roč. XXIX.

SNIFFEN, C. J. - O´CONNOR, J. D. - VAN SOEST, P. J. - FOX, D. G. - RUSSELL, J. B. 1992. A net carbohydrate and protein system for evaluating cattle diets: II. Carbohydrate and protein availability. In *Journal of Animal Science,* 70, p. 3562 - 3577.

WEISBJERG, M. R. 2010. Estimation of NDF degradation parameters in practise. In *EAAP - 61st Annual meeting, Heraklion,* p. 165