

Characterization and use of NDF digestibility as a tool to formulate rations for dairy cows in Israel

Yoav Shaani and Uzi Moallem

Abstract

Determining the concentration of roughage is necessary to maintain proper rumen function while maximizing the feed intake and is one of the main challenges nutritionists face when planning rations. There are several factors that influence the effectiveness of the use of roughage in maintaining proper rumen activity. Recently, several studies have suggested that using the indigestible fraction of NDF (uNDF) can lead to a more accurate formulation of diets for dairy cows that preserve rumen health without compromising cow health. However, NDF digestibility alone is likely insufficient to determine the effectiveness of roughage in the ration. The current study aimed to create a platform for more precise and economic planning of roughage inclusion in the ration by using the indigestible fraction of NDF. In the first part of this study, we determined the digestion rate of NDF for common feedstuffs in Israeli dairy farming, as well as the level of indigestible fiber fraction in the rumen at different incubation times. We also examined the correlation between the results found in *in-situ* incubation or using the Daisy instrument. A high correlation was found between the *in-situ* digestion results and those obtained with the Daisy, indicating that the Daisy instrument can be reliably used to determine digestion rates and other feed characteristics. As expected, we found significant differences in NDF digestion rates among the different feeds, which determines the persistence rate of indigestible NDF – uNDF.

Using the data from the first part of the study, we conducted an experiment in the individual feeding dairy barn in Beit-Dagan, where we used the 48-hour incubation undigestible NDF data for roughages (uNDF_{48f}) from the first part of the experiment. In this crossover design experiment, we tested two different rations that differed in their roughage concentration and NDF concentration from roughage but were identical in uNDF_{48f} concentration while maintaining similar energy, protein, and starch concentrations between the rations. In this experiment, we found that using the uNDF_{48f} measure, which led to the substitution of hay

with wheat straw in the ration, resulted in decreased milk production, FCM, and ECM, and decreased digestibility of ration components in the treatment group but improved most of the production efficiency calculations.

In the third experiment, we examined the interaction between uNDF levels in the rations and fiber length by using four different rations that differed in the roughage concentration and uNDF_{48f} concentration, but were identical in NDF concentration from roughage, while maintaining similar energy, protein, and starch concentrations between the rations. The change in chopping in the experiment was performed by pre-cutting of the wheat hay and straw used in the experiment to two different cutting lengths, and the change in uNDF_{48f} concentration in the rations was made by replacing part of the wheat hay with wheat straw. In this experiment, we found a significant interaction between chopping length and uNDF_{48f} concentration in the rations for both milk production and feed intake. The most significant differences between treatments were between the chopped hay treatment and the long hay treatment, while the differences were relatively small in rations that contained straw. This may be because the roughage used for cutting length changes in the experiment was hay, and therefore, in rations containing straw, the hay concentration in the ration was low (only 7.3% of DM) and likely did not produce significant changes in the physical structure of the ration. It also appears that due to the characteristics of wheat straw, we were unable to create significant changes in fiber length between the chopped straw and long straw rations, and therefore, no significant differences were found in most parameters tested between the two straw treatments.

In this series of experiments, we demonstrated that it is possible to reduce the concentration of roughage in the ration using the uNDF_{48f} parameter as a measure in ration planning without affecting milk production and production efficiency, but it is also important to consider other factors in the ration composition that affect feed intake and rumen health. Further research is needed to refine the use of this measure as a tool for planning dairy cow rations.