

orden. Las degradabilidades efectivas se calcularon utilizando las constantes estimadas por los dos modelos no lineales con y sin tiempo de retardo, por sumatoria de las degradaciones entre periodos sucesivos y por estimación de la relación entre la tasa de pasaje de la MS no degradada para las primeras horas de incubación y la de la MS insoluble. La degradabilidad máxima se estimó a través de la predicción de la asíntota de la hipérbola, determinando la intercepción de la doble recíproca de tiempo y materia seca no degradada. Los parámetros equivalentes entre modelos fueron comparados como observaciones apareadas dentro de cada recurso forrajero. La asociación entre parámetros y entre valores de degradabilidad se evaluó por análisis de correlación. Las diferencias entre parámetros comparables en VI y GrE fueron significativas ($P < 0,01$), la asociación fluctuó entre 0,72 y 0,96. Las correlaciones entre degradabilidades efectivas y máxima obtenidas mediante los distintos modelos fueron estrechas ($r > 0,97$). Todos los modelos estimaron con similar precisión la degradabilidad efectiva de la MS del alimento, independientemente del valor nutritivo del mismo. Por lo tanto, cualquiera de los modelos estudiados puede utilizarse para estimar la degradabilidad de la MS. Sin embargo, a partir de un trabajo experimental similar, puede obtenerse mayor información si ésta se procesa utilizando el modelo no lineal con tiempo de retardo.

Palabras clave: modelos, comparación, degradabilidad *in sacco*.

Factors affecting degradation of barley straw *in sacco* and microbial activity in the rumen of cows fed fibre-rich diets. II: The level of supplemental fishmeal

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A diet composed of 76.2% untreated barley straw + 23.8% rye grass hay was given to three nonlactating cows at 90% of *ad libitum* intake. The cows were supplemented via cannulae with three different levels of fishmeal in order to make the ration up to 8%, 10% and 14% crude protein on a dry-matter basis. Treatments were arranged in a Latin Square design. Nylon bags containing untreated barley straw were incubated in the rumen of the cows for up to 72 h. Degradability of dry matter, total organic matter and the individual components of the cell wall of barley straw were affected by the protein level of the diet. The inclusion of fishmeal to a level of 14% dietary protein produced the highest degradability of all parameters measured. The protein level also affected ammonia and total VFA concentrations; both fermentation products were highest in the treatment with the high fishmeal level. Rumen pH and rumen

outflow rate of liquid and particulate phases were not affected by protein level. The ATP concentration found in the solid residue, remaining after removal of the liquid phase from the rumen content, increases with increasing fishmeal level, while ATP in the liquid phase remained unchanged. This indicates that, under the conditions of this study, fishmeal exerts its effects on the microbes intimately associated to the fibre, and not upon the whole microbial population. The microbial DNA concentration of digesta nylon bags increased during the first 24 h of incubation and then decreased until the end of incubation, indicating a process of colonisation and depletion of degradable substrates.

Key words: protein level, straw degradation, rumen, cows.

Factors affecting degradation of barley straw *in sacco* and microbial activity in the rumen of cows fed fibre-rich diets. III. The amount of supplemental energy

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A basic diet composed of 76.2% untreated barley straw +23.8% grass hay was given to three non-lactating cows at 90% of *ad libitum* intake; the diet was supplemented with fishmeal to make the ration up to 12% protein on dry matter basis, a mineral-vitamin mixture and either 1.5 kg; 3.0 kg or 4.5 kg of rolled barley/cow x day in a Latin Square design. The inclusion of rolled barley affected the degradability of DM, OM and individual components of the cell wall of barley straw incubated in nylon bags for up to 72 h. The higher the energy level of supplementation, the lower the digestion of the cell wall components. The amount of starch influenced rumen pH, ammonia and VFAs concentrations, ATP and protozoal numbers, but no treatment effect could be detected upon the outflow rate of liquid or particulate phases. The ATP and DNA concentrations found inside the nylon bags suggest the presence of an inactive or less active population towards the substrate after 24 h of incubation.

Key words: energy, supplementation, straw degradation, rumen, cow.