IN VITRO DETERMINATION OF THE ILEAL DIGESTIBILITY OF PROTEIN AND AMINO ACIDS IN NEW ZEALAND BARLEYS

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ABBREVIATIONS

AA	amino acid
Ala	Alanine
Arg	Arginine
ANF	anti-nutritional factor
Asp	Aspartic acid
APU	Animal Physiology Unit
CP	crude protein
CF	crude fibre
cw	compare with
Cys	Cysteine
Da	daltons
DM	dry matter
DP	digestible protein
EHC	enzymically hydrolysed casein
EAAL	endogenous amino acid loss
EL	endogenous loss
EPL	endogenous protein loss
FCR	feed conversion ratio
FIA	flow injection analysis
GI	gastro-intestinal
Glu	Glutamic acid
Gly	Glycine
HA	homoarginine
His	Histidine
HPLC	high performance liquid chromatography
Iso	Isoleucine
IV	intravenous
kgs	kilograms
Leu	Leucine
Lys	Lysine

MBM	meat and bone meal
Met	Methionine
MWCO	molecular weight cut off
N	Nitrogen
OMIU	O-methylisourea
Phe	Phenylalanine
Pro	Proline
SD	standard deviation
Ser	Serine
SAPU	Small Animal Production Unit
SPF	specific pathogen free
Thr	Threonine
Tyr	Tyrosine
UDM	undigested dry matter
Val	Valine
VFI	voluntary food intake
w/w	weight for weight

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Abstract

The aim was to evaluate a recently developed *in vitro* digestibility assay for predicting the apparent ileal digestibility of protein and amino acids in barley, and secondly to evaluate the statistical prediction of apparent ileal digestibility of protein in barley based on chemical and physical measurements.

Seventeen barleys were collected from six growing regions from throughout New Zealand in 1995. Ten of these were selected to provide a range in crude protein from 8.5 to 13.3% (DM basis). The ten barleys were subjected to several physical and chemical measurements, and to the *in vitro* assay. The barleys were given as sole sources of protein to growing rats (n=6) and ileal digesta were collected at slaughter and nitrogen and amino acid digestibility determined with reference to the marker, chromic oxide. Six of the barleys were treated with O-methylisourea to convert lysine to homoarginine, a synthetic analogue of lysine, to allow determination of endogenous ileal lysine and protein flows.

Mean *in vivo* apparent ileal digestibility of nitrogen ranged from 71.4% to 80.3%. *In vivo* true lysine digestibility ranged from 73.2% to 100% while endogenous protein loss ranged from 6.4 to 44.8 g/kg DMI.

Physical measures made on the barley included grain bulk density (kg/hecto litre), screenings (%) and 1000 seedweight (g) and were highly variable. They provided no significant ($p>0.05$) predictive ability for protein digestibility or endogenous ileal protein loss. Chemical measures included CP (%), NDF (%), ADF (%), lignin (%), total β-glucans (%) and gastro-intestinal (GI) extracted β-Glucans (%) and were also highly variable. True lysine digestibility was able to be predicted based on the levels of GI extracted β-glucans and crude protein ($r^2= 0.97$). *In vivo* endogenous ileal protein loss was predicted based on total β-glucans ($r^2 = 0.77$).

In vitro protein digestibility was not significantly correlated with *in vivo* values. The *in vitro* technique requires more development before it can be used for the routine evaluation of digestible protein in barleys.