THE EFFECT OF DRY HEAT ON THE TOTAL AMINO ACID COMPOSITION OF FIELD PEAS

R.J. VAN BARNEVELD, E.S. BATTERHAM and B.W. NORTON*

The application of heat to field peas has been shown to significantly decrease the utilisation of ileal digestible lysine when fed to growing pigs (van Barneveld et al. 1991). Similar responses have also been shown with threonine, methionine and tryptophan in heat-damaged proteins (Andersen and Batterham 1991). In comparison, branch chain amino acids, such as isoleucine, appear to be less susceptible to damage from heat than other amino acids (Batterham and Andersen 1991). The aim of this experiment was to compare the effect of heating on the total amino acid composition of field peas, in an attempt to identify possible compounds responsible for the poor utilisation of lysine.

Dry heat was applied at 110°, 135°, 150° or 165°C to field peas (*Pisum sativum var dundale*) using forced-air dehydrators with times of 160, 230, 320, and 440 minutes required to bring 140 kg batches of peas to the respective temperatures. Temperatures were maintained for 15 minutes. Total amino acid analysis was completed in duplicate by the late Mr R L Davies, following hydrolysis at 110° for 24 hours with constant boiling point hydrochloric acid (HCl) under nitrogen. Amino acids were separated by ion exchange chromatography and measured after reaction with ninhydrin, with norleucine used as an internal standard. Results expressed in g/16gN are as follows:

	Heat treatments					Statistics		
Amino acid	Raw	110°	135°	150°	165°	Treat	Linear†	SEM
Threonine	3.80	3.60	3.75	3.70	3.80	NS	NS	0.081
Alanine	4.20	4.10	4.30	4.25	4.55	*	**	0.071
Cystine	0.70	0.80	0.70	0.60	0.55	NS	*	0.050
Valine	4.70	4.55	4.85	4.75	5.10	*	*	0.087
Methionine	0.65	0.60	0.65	0.65	0.50	NS	NS	0.059
Isoleucine	4.20	4.10	4.30	4.20	4.60	*	**	0.077
Leucine	6.80	6.65	6.95	6.85	7.35	NS	*	0.141
Tyrosine	3.10	2.95	3.15	3.05	3.20	NS	NS	0.097
Phenylalanine	4.45	4.35	4.55	4.55	4.70	NS	NS	0.134
Lysine	7.05	6.70	6.85	5.55	4.00	***	***	0.132
Arginine	8.05	8.40	8.70	7.85	6.95	NS	*	0.346

† Analysis using heat treatments 110°, 135°, 150° and 165° only.

Significant losses in lysine, cystine and arginine are consistent with losses demonstrated in pure proteins by Bjarnson and Carpenter (1970). Alanine and the branch-chain amino acids, valine, isoleucine and leucine, however, all showed significant increases in concentration. No other amino acid concentrations were altered by heating.

Lysine losses during heating may be the result of a Maillard type reaction between the ε-amino group and carbonyl compounds resulting from the destruction of cystine (Bjarnson and Carpenter 1970). Due to the fact that the utilisation of the lysine remaining in the heated field peas is also reduced, however, it is reasonable to suggest that unnatural 'amide' bonds may be forming between the ε-amino group of lysine and carboxylic groups in the proteins, which would be undetectable by total amino acid anaylsis. This does not explain the lower utilisation of methionine, threonine and tryptophan but does not discount changes within these molecules.

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NSW Agriculture, Wollongbar Agricultural Institute, Wollongbar, NSW 2477
* Department of Agriculture, The University of Queensland, St Lucia, Qld 4072