

Total Lipid and Fatty Acid Profiles in Fresh and Ensiled Forages Grown in Australia

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Meat is a good source of beneficial long-chain omega-3 polyunsaturated fatty acids (LCn-3PUFA) that have several health benefits, including reducing the risk of cardiovascular disease and mental health disorders. Concentrations of omega-3 are higher in meat when animals are fed forages compared with grain. While total lipid concentrations and omega-3 proportions have been well characterised in forages grown overseas (Dewhurst *et al* 2006), little research has examined the amount of lipid and omega-3 available in forages grown in Australia. The aim of the current study was to characterise total lipid concentrations and fatty acid profiles in a variety of fresh and ensiled forages grown in Australia in order to estimate their potential contribution to producing meat with increased levels of omega-3.

Silage was produced from several forage crops including an oat/pea mix grown at Wagga Wagga, N.S.W., a canola crop grown at Henty, N.S.W. and 6 varieties of maize grown at Orbost, Vic. Samples of fresh fine-chopped material were collected and frozen before ensiling and replicate bags (three per crop) of silage were produced. Total lipid was determined in freeze-dried material gravimetrically using the Folch procedure (Folch *et al* 1957). Following a one-step extraction and methylation (Lepage and Roy, 1986) fatty acids were quantified by gas chromatography (Clayton *et al* 2008a) in comparison to a standard mixture of fatty acid methyl esters and the proportion of each fatty acid in relation to the total identified was calculated.

The concentration of total lipid was higher ($P < 0.05$) in silage compared with fresh forage (Table 1), which was partly explained by a proportionate decrease in water soluble carbohydrate during ensiling (Clayton *et al* 2008b). The proportion of omega-3 fatty acid was approximately 40-45% of total fatty acids in the oat/pea and canola crops, compared with approximately 8-11% in maize, which is similar to previous research overseas (Dewhurst *et al* 2006). The proportions of most fatty acids were similar following ensiling compared with fresh material.

The amount of omega-3 ultimately transferred to meat depends on a number of factors, including biohydrogenation and metabolism in the rumen and subsequent absorption. Further work is necessary to determine the availability of omega-3 fatty acids from fresh versus ensiled material.

Table 1. Concentration of total lipid and proportion of individual fatty acids of interest from several forage crops grown throughout Australia

Forage	Type	Total Lipid (g/kg DM)	Fatty Acid (% Total Fatty Acids) ¹						
			C16:0	C18:0	C18:1n-9	C18:2n-6	C18:3n-3	SFA	n-6:n-3
Oat/Pea	Fresh	29.30	23.16	3.79	1.67	14.83	44.53	35.79	0.33
	Silage	37.90	20.61	4.88	2.04	16.29	44.54	34.31	0.37
Canola	Fresh	26.76	21.51	5.84	2.28	15.26	38.94	31.86	0.39
	Silage	36.00	20.13	6.10	1.95	16.37	42.60	32.91	0.38
Maize	Fresh	24.92	16.61	4.41	15.21	47.75	11.00	25.45	4.86
	Silage	33.50	17.18	3.09	16.99	47.66	8.43	26.00	6.13

¹SFA = total saturated fatty acids, n-6:n-3 = ratio of omega-6 (C18:2n-6) to omega-3 (C18:3n-3) fatty acids.

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