Proceedings of the Nutrition Society (2017), **76 (OCE3)**, E101 doi:10.1017/S0029665117001744

Irish Section Meeting, 21–23 June 2017, What governs what we eat?

Lipid oxidation within vegetarian long chain omega-3 polyunsaturated fatty acid oil nanoemulsions suitable for food fortification

K.E. Lane[1], Q. Zhou[2], S. Robinson[3] and W. Li[2]
[1]*School of Sport Studies, Leisure and Nutrition, Liverpool John Moores University, Liverpool, United Kingdom L17 6BD,*
[2]*Institute of Food Science and Innovation, University of Chester, Parkgate Road, Chester, CH1 4BJ. and*
[3]*NOW Food Research Centre, University of Chester, Parkgate Road, Chester, CH1 4BJ*

Long chain omega-3 (*n-3*) polyunsaturated fatty acids (LC3PUFA) in human diets are mainly obtained from oily fish, fish oil or fish oil based supplements(1). Current UK oily fish consumption is significantly short of recommended levels(2). Non-fish sources of LC3PUFA such as algal oils are particularly important for vegetarians/vegans, non-fish eaters and pregnant mothers(1; 3).

Nanoemulsions are systems with droplet sizes in range of 20 to 500 nm(4). The incorporation of algal oil into foods using nanoemulsions created with ultrasound has the potential to improve LC3PUFA bioavailability(5). However, the use of ultrasound in the creation of nanoemulsions may also affect the oxidation stability of LC3PUFA(6).

The aim of the present study was to analyse the oxidation stability of a nanoemulsion containing an algal oil rich in docosahexaenoic acid (22:6 *n*-3; DHA) using gas chromatography headspace analysis (GCHS).

GCHS measurements were conducted to compare bulk oil and nanoemulsions stabilised with soy lecithin (LN) and Tween 40 (TN) solely and in combination (LTN) over a storage period of 5 weeks at temperatures of 4, 20 and 40 °C. A propanal peak was identified and analysed using one -way repeated measures ANOVA tests with Tukey post hoc test.

	Week	0		1		2		5	
°C		Mean	SD	Mean	SD	Mean	SD	Mean	SD
40	Oil	24842	12532	–	–	119512	27131	266506[a, A]	98586
	LN	44913	2201	306664[a, A]	9482	203925[a, A]	90123	263618[a, A]	67145
	TN	13628	7430	107139	46935	357994[a]	85487	299928[a, A]	16948
	LTN	32084	0·00	71597	9864	271886[a]	42527	458613[a, A]	17751
20	Oil	24842	12532	–	–	153570[a, A]	57352	87246	3926
	LN	44913	2201	165865[a]	489	125430	44876	175276[a]	46031
	TN	13628	7430	56054	33169	226867[a]	3241	196127[a]	32536
	LTN	32084	0·00	57090	2770	67144	77958	209987[a]	123433
4	Oil	24842	12532	–	–	46504	32846	7065	5153
	LN	44913	2201	102757	38255	150174	6087	110398	38228
	TN	13628	7430	59698	5399	161155	135887	161859	12819
	LTN	32084	0·00	59321	773	140201	14239	130062	11497

[a]Significantly different at $p \leqslant 0{\cdot}05$ compared with week 0 at the same storage temperature; [A] Significantly different at $p \leqslant 0{\cdot}05$ compared with 4 °C at the same storage time.

Increased temperature and storage periods had a significant effect on the development of propanal for all samples stored at 40 °C ($p \leqslant 0{\cdot}05$). Nanoemulsions prepared with lecithin alone had significantly higher development of propanal in week 1 at 40 and 20 °C respectively ($p \leqslant 0{\cdot}05$). There were no significant differences for emulsion/emulsifier type for samples stored at 4 °C. To further evaluate oxidation status, research should now be conducted over the same storage periods and temperatures to analyse nanoemulsion droplet sizes, fatty acid composition and to identify and measure other recognised volatile compounds.

1. Lenihan-Geels G, Bishop KS (2016) *Omega-3 Fatty Acids: Keys to Nutritional Health*, Springer
2. Bates B, Cox L, Nicholson S *et al.* (2016) *National Diet and Nutrition Survey: Results from Years 5–6 (combined) of the rolling programme (2012/2013–2013/14)*. London, Public Health England.
3. Ryan L, Symington AM (2015) *J Funct Foods* **19**, Part B, 852–858.
4. Solans C, Solé I (2012) *Curr Opin Colloid Interface* **17**, 246–254.
5. Lane KE, Li W, Smith C *et al.* (2014). *Int J Food Sci Tech* **49**, 1264–1271.
6. Pingret D, Fabiano-Tixier AS, Chemet F. (2013) *Food Ctrl* **164**, 10–20.