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Comparison of the nutritional composition of fresh fruit and fruit-based drinks

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Fruit and vegetables are important components of a healthy balanced diet, especially as sources of antioxidants and polyphenols, yet individuals fail to comply with the recommended five portions daily⁽¹⁾. The demand for 'smoothies' has grown from none to $>£20 \times 10^6$ over the last 5 years⁽²⁾. Smoothies are potentially a convenient and palatable way of assisting compliance with the recommended '5-a-day' guideline for fruit and vegetable intake. The aim of the present study was to determine whether nutritional components present in fresh fruit are retained during the production of a fruit-based drink and to elucidate whether a home-made fruit-based drink would be a satisfactory substitute for the commercial smoothie drink.

Pear, apple and kiwifruit (*Actinidia deliciosa*), along with the corresponding smoothie (v/v; 45% pear, 29.6% apple, 25% kiwifruit) were collected from a manufacturer. The fruits were analysed individually and these values used to calculate the expected nutritional composition of the final smoothie. Additionally, the fruits were also used to make a home-made fruit-based drink following the smoothie manufacturer's recipe, without the addition of ascorbate. The nutritional composition of the home-made smoothie was then compared with the commercial equivalent. The following nutritional components were determined by established methods: vitamin C using the Boehringer Mannheim assay⁽³⁾; antioxidant capacity by the ferric-reducing antioxidant power (FRAP) assay⁽⁴⁾ and the oxygen radical absorbance capacity (ORAC) assay⁽⁵⁾; polyphenolic content by the Folin-Ciocalteu⁽⁶⁾ method. β -Carotene was measured by extraction into hexane/acetone, absorbance measured and carotene quantified using $\epsilon_{450\text{nm}} = 138\,730\text{ M}^{-1} \cdot \text{cm}^{-1}$. Total sugars were assessed using the D-glucose–fructose–sucrose Boehringer Mannheim assay⁽³⁾. All assays were carried out in triplicate and statistical analysis was by SPSS (SPSS Inc., Chicago, IL, USA) using an independent *t* test.

The nutritional composition of pear, apple and kiwifruit extracts and home-made and commercial smoothies are shown in the Table (n 3).

	Pear		Apple		Kiwifruit		Expected composition	Home-made smoothie	Commercial smoothie
	Mean	SD	Mean	SD	Mean	SD			
AOX capacity: FRAP ($\mu\text{mol TE}/100\text{ g}$)	47.1	3.8	108	5.4	434	10.5	161†††	312	1374***
ORAC ($\mu\text{mol TE}/100\text{ g}$)	112	6.3	368	10.9	637	13.1	319†††	684	2254***
Vitamin C (mg/100 g)	13.2	0.59	11.3	0.5	38.2	2.8	18.8	15.5	29.7***
Total phenolics (mg GAE/100 g)	3.6	0.3	13	0.9	30.3	1.4	13.1†††	5.8	37.6***
β -Carotene ($\mu\text{g}/100\text{ g}$)	17	0	15	0.02	36	1.6	22.8	19.1	20.1
Sugars (mg/100 g)	9.4	0.2	10.3	0.5	9.9	0.4	9.8	9.0	9.0

TE, Trolox equivalent; GAE, gallic acid equivalent. Mean values were significantly different from those for home-made: *** $P < 0.001$. Mean values were significantly different from those for home-made: ††† $P < 0.001$.

Sugars and β -carotene levels for both smoothies were as predicted. The home-made drink had the expected vitamin C content, whilst that of the commercial drink was much higher, reflecting the addition of 4 g ascorbic acid/l. The phenolic content of the commercial smoothie was much higher than expected ($P < 0.001$), which may reflect a greater efficiency of homogenisation in the manufacturing process. The commercial smoothie also contained the highest antioxidant capacity. Thus, smoothies, both home-made and commercial, appear to be beneficial in assisting compliance with the '5-a-day' recommendation.

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