

## Carotenoid and polyphenol compounds in tomatoes

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### 1 BACKGROUND

The Heritage Food Crops Research Trust are interested in understanding the health benefits of tomato. The aim of the present investigation was to determine the polyphenol and carotenoid content of nine tomato cultivars.

### 2 MATERIALS AND METHODS

Nine cultivars of tomato provided by Mark Christensen, Heritage Food Crops, were stored at -18°C from when they arrived at The New Zealand Institute for Plant and Food Research Limited (PFR), Palmerston North until analysis. These samples constitute Chemistry Workbench sample set SC44.

To obtain a representative sample for chemical analysis, all, or a portion of the frozen tomato fruit provided, was homogenised with dry ice. A subsample of frozen powdered tomato fruit was extracted with solvent for carotenoid (tetrahydrofuran/methanol) or polyphenol (ethanol/water/formic acid) analysis. Carotenoid content was determined by high performance liquid chromatography diode array detection (HPLC-DAD). Polyphenol content was determined by high performance liquid chromatography mass spectrometry (HPLC-MS). Each component was quantified by comparison with an authentic standard, with the exceptions of tetra-cis (TC) lycopene which was quantified as all-trans (AT) lycopene equivalents, and crypto-chlorogenic acid which was quantified as chlorogenic acid (CGA) equivalents. The quantitative results are expressed on a per weight basis (mg/100 g fresh weight).

### 3 RESULTS

Carotenoid concentrations of the nine cultivars are shown in Table 1. 'Orange Teardrop version 2' was the only non-red tomato cultivar in which both AT and TC-lycopene were detected in this analysis.

**Table 1: Known carotenoid compound concentrations (mg/100 g fresh weight; FW) in samples of tomato fruit measured by high performance liquid chromatography diode array detection (HPLC-DAD). Carotenoids measured were all-trans (AT) and tetra-cis (TC) lycopene, lutein and beta-carotene ( $\beta$ -carotene). These compounds were not detected (n.d.) in all samples.**

Cultivar	AT-lycopene	TC-lycopene	Lutein	$\beta$ -carotene
Golden Green	n.d.	3.34	0.04	1.18
Moonglow	n.d.	3.46	n.d.	0.71
Olga's Round Golden Chicken Egg	n.d.	2.61	0.03	0.74
Tangella version 2	n.d.	3.67	0.04	1.14
Amish Yellowish-Orange Oxheart version 2	n.d.	3.28	0.04	1.44
Orange Teardrop version 2	0.20	4.29	0.06	3.50
Small Sweet Orange version 2	n.d.	3.89	0.05	1.24
Alfred	4.02	n.d.	0.12	1.42
Daniella	2.84	n.d.	0.12	1.55

Most polyphenols analysed were not detected in these samples (Table 2). Only the polyphenols listed were looked for in this analysis. Chlorogenic acid (CGA), crypto-chlorogenic acid (crypto-CGA), and quercetin-rutinoside (q-rut) were detected in all samples. Kaempferol-rutinoside (k-rut) and cis-4-p-coumaroyl-quinic acid (p-CQA) were the only other polyphenol compounds detected in some of these samples.

**Table 2: Polyphenol compound concentrations (mg/100 g fresh weight; FW) in samples of tomato fruit measured by high performance liquid chromatography mass spectrometry (HPLC-MS). Compounds analysed were catechin (CAT), chlorogenic acid (CGA), crypto-chlorogenic acid (crypto-CGA), cyanidin-3-glucoside (cy-glu), epicatechin (eCAT), kaempferol-3-O-rutinoside (k-rut), cis-4-p-coumaroyl-quinic acid (p-CQA), phloridzin (phldz), procyanidin B1 (proCy B1) and B2 (proCy B2), quercetin (q), quercetin-3-galactoside (q-gal), quercetin-3-rhamnoside (q-rha), quercetin-3-rutinoside (q-rut). Most of these compounds were not detected (n.d.) in the samples.**

Cultivar	CAT	CGA	crypto-CGA	cy-glu	eCAT	k-rut	p-CQA	phldz	proCy B1	proCy B2	q	q-gal	q-rha	q-rut
Golden Green	n.d.	0.25	0.38	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.20
Moonglow	n.d.	0.14	0.18	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.10
Olga's Round Golden Chicken Egg	n.d.	0.18	0.19	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.14
Tangella version 2	n.d.	0.34	0.41	n.d.	n.d.	0.00	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.43
Amish Yellowish Orange Oxheart version 2	n.d.	0.25	0.26	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.25
Orange Teardrop version 2	n.d.	0.10	0.18	n.d.	n.d.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.10
Small Sweet Orange version 2	n.d.	0.54	0.45	n.d.	n.d.	0.05	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.39
Alfred	n.d.	0.21	0.24	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.14
Daniella	n.d.	0.24	0.21	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.20

### **3.1 Qualifying statements**

The results given in this report apply only to the samples provided to PFR, which may or may not be representative of all examples of the tomato variety.

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