**Supplementary information**

**Effects of Elevated CO2 on Nutritional Quality of Vegetables – A Review**

By Dong et al

**Table S1. Effects of elevated CO2 on concentrations of carbohydrates in vegetables.**

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| Quality parameters | CO2 effects | Crops |
| Fructose | ↑ | ‡Broccoli (Krumbein et al., 2010), ‡§cucumber (Dong et al., 2018; Tang et al., 2018),§lettuce (Becker and Kläring, 2016), †‡potato (Högy and Fangmeier, 2009), ‡§strawberry (Sun et al., 2012; Wang and Bunce, 2004) and §tomato (Behboudian and Tod, 1995; Islam et al., 1994; Islam et al., 1996) |
| = | ‡§Cucumber (Dong et al., 2018; Tang et al., 2018), †‡potato (Donnelly et al., 2001; Vorne et al., 2002) |
| Glucose | ↑ | ‡§Cucumber (Dong et al., 2018; Tang et al., 2018), §lettuce (Becker and Kläring, 2016), †‡potato (Högy and Fangmeier, 2009), ‡§strawberry (Sun et al., 2012; Wang and Bunce, 2004) and §tomato (Behboudian and Tod, 1995; Islam et al., 1994; Islam et al., 1996) |
| = | ‡Broccoli (Krumbein et al., 2010), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), and †‡potato (Donnelly et al., 2001; Vorne et al., 2002) |
| Sucrose | ↑ | §Lettuce (Becker and Kläring, 2016), §spinach (Proietti et al., 2013), ‡§strawberry (Wang and Bunce, 2004) and §tomato (Islam et al., 1996) |
| = | ‡Broccoli (Krumbein et al., 2010), †‡potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002), ‡strawberry (Sun et al., 2012), †‡sugar beet (Demmers-Derks et al., 1998; Manderscheid et al., 2010) and §tomato (Behboudian and Tod, 1995; Islam et al., 1994; Islam et al., 1996) |
| Total soluble sugar | ↑ | §Chinese cabbage, lettuce and oily sowthistle (Jin et al., 2009), ‡§lettuce (Baslam et al., 2012; Becker and Kläring, 2016; Pérez-López et al., 2015a), ‡onion (Bettoni et al., 2017), †palak (Kumari et al., 2013), †potato (Kumari and Agrawal, 2014), §radish and turnip (Azam et al., 2013), §spinach (Proietti et al., 2013), ‡§strawberry (Sun et al., 2012; Wang and Bunce, 2004) and ‡§tomato (Behboudian and Tod, 1995; Helyes et al., 2012; Islam et al., 1994; Khan et al., 2013; Li et al., 2007; Zhang et al., 2014) |
| = | ‡Broccoli (Krumbein et al., 2010), §celtuce (Jin et al., 2009), ‡hot pepper(Li et al., 2017), ‡§lettuce (Baslam et al., 2012; Jin et al., 2009; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Donnelly et al., 2001; Vorne et al., 2002) and ‡§tomato (Li et al., 1999; Wei et al., 2018) |
|  | ↓ | §Celery (Jin et al., 2009), †‡§hot pepper (Li et al., 2017) and ‡tomato (Helyes et al., 2012) |
| Reducing sugar | ↑ | †Palak (Kumari et al., 2013), †‡potato (Högy and Fangmeier, 2009), §radish and turnip (Azam et al., 2013) and §tomato (Islam et al., 1996; Khan et al., 2013) |
|  | ↓ | †Potato (Kumari and Agrawal, 2014)  |
| Non-reducing sugar | ↑ | §Radish (Azam et al., 2013) |
| = | §Tomato (Khan et al., 2013) and §turnip (Azam et al., 2013) |
| Starch | ↑ | ‡§Cucumber (Dong et al., 2018), ‡lettuce (Pérez-López et al., 2015b), ‡onion (Bettoni et al., 2017), †palak (Kumari et al., 2013) and †‡potato (Donnelly et al., 2001; Kumari and Agrawal, 2014; Vorne et al., 2002) |
| = | ‡§Cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), ‡onion (Bettoni et al., 2017) and †‡potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002) |
| Lignin | ↑/= | §Celery (Liu et al., 2018) |
| Dietary fibre | ↑ | §Carrot, radish and turnip (Azam et al., 2013), ‡§cucumber (Dong et al., 2018) and §tomato (Khan et al., 2013) |
| = | ‡Cucumber (Dong et al., 2018; Tang et al., 2018) and §tomato (Khan et al., 2013) |
|  | ↓ | ‡§Cucumber (Tang et al., 2018) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05). †, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Table S2. Effects of elevated CO2 on concentrations of taste-related organic acids in vegetables.**

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| Quality parameters | CO2 effects | Crops |
| Malic acid | ↑ | §Lettuce (Miyagi et al., 2017) |
|  | = | §Lettuce (Miyagi et al., 2017), †‡potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002) and ‡strawberry (Wang and Bunce, 2004) |
|  | ↓ | §Strawberry (Wang and Bunce, 2004) and §tomato (Islam et al., 1996) |
| Citric acid | ↑ | §Lettuce (Miyagi et al., 2017) |
|  | = | ‡Potato (Donnelly et al., 2001) and ‡strawberry (Wang and Bunce, 2004) |
|  | ↓ | †‡Potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002), §strawberry (Wang and Bunce, 2004) and §tomato (Islam et al., 1996) |
| Oxalic acid | ↑/= | §Spinach (Proietti et al., 2013) |
|  | ↓ | §Lettuce (Miyagi et al., 2017) and §tomato (Islam et al., 1996) |
| Titratable acidity | ↑ | ‡Onion (Bettoni et al., 2017) and §tomato (Zhang et al., 2014) |
| = | §Carrot, radish and turnip (Azam et al., 2013), ‡§cucumber (Tang et al., 2018), ‡onion (Bettoni et al., 2017) and §tomato (Khan et al., 2013; Li et al., 1999; Özçelik and Akilli, 1999; Zhang et al., 2014) |
| ↓ | ‡Onion (Bettoni et al., 2017) and †‡tomato (Mamatha et al., 2014) |
| Sugar/acid | ↑ | ‡§Cucumber (Tang et al., 2018), §strawberry (Wang and Bunce, 2004) and ‡§tomato (Wei et al., 2018; Zhang et al., 2014) |
|  | = | ‡§Cucumber (Tang et al., 2018) and ‡§tomato (Wei et al., 2018; Zhang et al., 2014) |
|  | ↓ | ‡Tomato (Wei et al., 2018) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05).†, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Table S3. Effects of elevated CO2 on concentrations of several nitrogenous compounds in vegetables.**

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| Quality parameters | CO2 effects | Crops |
| Total protein | ↑ | ‡Fenugreek (Jain et al., 2007), ‡lettuce (Baslam et al., 2012), †palak (Kumari et al., 2013) and †potato (Kumari and Agrawal, 2014) |
|  | = | ‡Cabbage (Reddy et al., 2004), ‡§cucumber (Dong et al., 2018; Tang et al., 2018) and ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), ‡spinach (Jain et al., 2007), ‡strawberry (Sun et al., 2012) and §sweet pepper (Piñero et al., 2017b)  |
|  | ↓ | ‡Broccoli (Schonhof et al., 2007), §carrot, radish and turnip (Azam et al., 2013), §Chines kale (La et al., 2009), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡fenugreek and spinach (Jain et al., 2007), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †‡potato (Donnelly et al., 2001; Fangmeier et al., 2002; Heagle et al., 2003; Högy and Fangmeier, 2009; Kumari and Agrawal, 2014), †palak (Kumari et al., 2013), sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) and §tomato (Behboudian and Tod, 1995; Khan et al., 2013) |
| Soluble protein | ↑ | ‡Onion (Bettoni et al., 2017),†palak (Kumari et al., 2013) and †potato (Kumari and Agrawal, 2014) |
| = | †‡§Hot pepper (Li et al., 2017) and ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b) |
| ↓ | ‡§Hot pepper (Li et al., 2017), ‡lettuce (Baslam et al., 2012), †palak (Kumari et al., 2013) and †potato (Kumari and Agrawal, 2014) |
| ⍺-amino-nitrogen | = | †‡Sugar beet (Demmers-Derks et al., 1998; Manderscheid et al., 2010) |
| ↓ | ‡Sugar beet (Demmers-Derks et al., 1998) |
| Free amino acids | ↑ | §Lettuce (Miyagi et al., 2017) and †potato (Kumari and Agrawal, 2014) |
| = | ‡Chinese cabbage (Reich et al., 2016) and §lettuce (Miyagi et al., 2017) |
| ↓ | †Potato (Kumari and Agrawal, 2014) |
| Nitrate | ↑ | §Celtuce (Jin et al., 2009), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b) and ‡tomato (Wei et al., 2018) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Donnelly et al., 2001; Högy and Fangmeier, 2009), §spinach (Proietti et al., 2013) and ‡§tomato (Wei et al., 2018; Wheeler et al., 1997) |
|  | ↓ | §Celery, Chinese cabbage, lettuce and oily sowthistle (Jin et al., 2009), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a), †‡potato (Donnelly et al., 2001; Vorne et al., 2002) and §spinach (Proietti et al., 2013) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05). †, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Table S4. Effects of elevated CO2 on concentrations of antioxidants in vegetables.**

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| Quality parameters | CO2 effects | Crops |
| Ascorbic acid | ↑ | §Celery, celtuce, Chinese cabbage, lettuce and oily sowthistle (Jin et al., 2009), §Chinese cabbage and lettuce (Fu et al., 2015), ‡lettuce (Baslam et al., 2012), ‡potato (Donnelly et al., 2001), §spinach (Proietti et al., 2013), ‡§strawberry (Wang et al., 2003) and †‡§tomato (Islam et al., 1996; Li et al., 2007; Mamatha et al., 2014; Zhang et al., 2014) |
|  | = | †‡§Hot pepper (Li et al., 2017), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †palak (Kumari et al., 2013), †‡potato (Högy and Fangmeier, 2009; Vorne et al., 2002), §spinach (Seo et al., 2017) and §tomato(Özçelik and Akilli, 1999) |
|  | ↓ | §Carrot, radish and turnip (Azam et al., 2013), †‡§hot pepper (Li et al., 2017) and §tomato (Khan et al., 2013)  |
| Total flavonoids | ↑ | §Chinese cabbage and lettuce (Fu et al., 2015), ‡ginger (Ghasemzadeh et al., 2010), §hongfengcai (Ren et al., 2014), ‡§lettuce (Becker and Kläring, 2016; Pérez-López et al., 2018; Sgherri et al., 2017), §onion and scallion (Thompson et al., 2004) and §strawberry (Wang et al., 2003) |
|  | = | ‡§Lettuce (Becker and Kläring, 2016; Pérez-López et al., 2018) and §chives and scallion (Thompson et al., 2004) |
|  | ↓ | ‡§Strawberry (Sun et al., 2012) and †‡tomato (Mamatha et al., 2014) |
| Anthocyanins | ↑ | §Hongfengcai (Ren et al., 2014), ‡§lettuce (Baslam et al., 2012; Becker and Kläring, 2016) and §strawberry (Wang et al., 2003) |
|  | = | ‡Lettuce (Baslam et al., 2012)  |
|  | ↓ | ‡Lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b) and ‡strawberry (Sun et al., 2012) |
| Total phenols | ↑ | §Chinese cabbage (Fu et al., 2015), ‡ginger (Ghasemzadeh et al., 2010), §hongfengcai (Ren et al., 2014), ‡§lettuce (Baslam et al., 2012; Fu et al., 2015; Pérez-López et al., 2015a; Pérez-López et al., 2018; Sgherri et al., 2017), ‡onion (Bettoni et al., 2017) and ‡tomato (Helyes et al., 2012) |
|  | = | ‡Cabbage (Reddy et al., 2004), §hongfengcai (Ren et al., 2014), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †palak (Kumari et al., 2013), §scallion (Levine and Paré, 2009) and §sweet pepper (Piñero et al., 2017b) |
|  | ↓ | ‡Lettuce (Pérez-López et al., 2015b; Pérez-López et al., 2018), ‡strawberry (Sun et al., 2012) and †‡tomato (Helyes et al., 2012; Mamatha et al., 2014) |
| Glutathione | ↑ | §Hongfengcai (Wang et al., 2016), ‡lettuce (Pérez-López et al., 2015a) and ‡§strawberry (Wang et al., 2003) |
|  | = | §Hongfengcai (Wang et al., 2016) and ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b)  |
| Lycopene | ↑ | ‡§Tomato (Helyes et al., 2012; Zhang et al., 2014) |
|  | = | §Sweet pepper (Piñero et al., 2017b) and †‡§tomato (Helyes et al., 2012; Krumbein et al., 2006; Li et al., 2007; Mamatha et al., 2014; Zhang et al., 2014) |
|  | ↓ | ‡Tomato (Helyes et al., 2012; Mamatha et al., 2014) |
| Carotenoids | ↑ | §Hongfengcai (Wang et al., 2016), †palak (Kumari et al., 2013) and §tomato (Zhang et al., 2014) |
|  | = | ‡Lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †palak (Kumari et al., 2013) and †§tomato (Mamatha et al., 2014; Zhang et al., 2014) |
|  | ↓ | ‡Lettuce (Baslam et al., 2012; Pérez-López et al., 2015b) and ‡tomato (Mamatha et al., 2014) |
| Lutein | ↑/= | §Tomato (Zhang et al., 2014) |
| β-carotene | ↑ | §Tomato (Zhang et al., 2014) |
|  | = | §Sweet pepper (Piñero et al., 2017b) and §tomato (Krumbein et al., 2006) |
| Chlorophyll a | ↑ | §Hongfengcai (Wang et al., 2016) |
|  | = | ‡Lettuce (Pérez-López et al., 2015a) and §sweet pepper (Piñero et al., 2017b) |
|  | ↓ | ‡Lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b) |
| Chlorophyll b | ↑ | §Hongfengcai (Wang et al., 2016), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b) and §sweet pepper (Piñero et al., 2017b) |
|  | = | §Hongfengcai (Wang et al., 2016) and §sweet pepper (Piñero et al., 2017b) |
| Total chlorophyll | ↑ | §Hongfengcai (Wang et al., 2016) and †palak (Kumari et al., 2013) |
| = | ‡Lettuce (Baslam et al., 2012) |
| ↓ | ‡Lettuce (Baslam et al., 2012)  |
| Total antioxidant capacity | ↑ | §Chinese cabbage (Fu et al., 2015), ‡ginger (Ghasemzadeh et al., 2010), §hongfengcai (Ren et al., 2014; Wang et al., 2016), ‡§lettuce (Fu et al., 2015; Pérez-López et al., 2015a; Pérez-López et al., 2013; Pérez-López et al., 2015b; Pérez-López et al., 2018; Sgherri et al., 2017) and ‡tomato (Helyes et al., 2012) |
|  | = | §Hongfengcai (Wang et al., 2016) , ‡lettuce (Pérez-López et al., 2018), §scallion (Levine and Paré, 2009) and ‡tomato (Helyes et al., 2012) |
| ↓ | ‡Lettuce (Pérez-López et al., 2018), §scallion (Levine and Paré, 2009), ‡strawberry (Sun et al., 2012) and †‡tomato (Mamatha et al., 2014) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05). †, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Table S5. Effects of elevated CO2 on concentrations of minerals in vegetables.**

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| Quality parameters | CO2 effects | Crops |
| P | ↑ | ‡Chinese cabbage (Reich et al., 2016), §cucumber (Tang et al., 2018), ‡lettuce (Baslam et al., 2012) and §sweet pepper (Piñero et al., 2017b) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Fangmeier et al., 2002; Högy and Fangmeier, 2009), ‡§sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) and §tomato (Wheeler et al., 1997) |
|  | ↓ | §Cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †‡potato (Heagle et al., 2003) and §tomato (Behboudian and Tod, 1995) |
| K | ↑ | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †potato (Kumari and Agrawal, 2014) and §turnip (Azam et al., 2013) |
|  | = | §Carrot and radish (Azam et al., 2013), ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Heagle et al., 2003), †sugar beet (Manderscheid et al., 2010), ‡§sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) and §tomato (Khan et al., 2013; Wheeler et al., 1997) |
|  | ↓ | §Cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †‡potato (Fangmeier et al., 2002; Högy and Fangmeier, 2009; Kumari and Agrawal, 2014), §sweet pepper (Piñero et al., 2017b) and §tomato (Behboudian and Tod, 1995) |
| Ca | ↑ | §Carrot (Azam et al., 2013), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡fenugreek and spinach (Jain et al., 2007), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015b), †potato (Kumari and Agrawal, 2014), §sweet pepper (Piñero et al., 2017b) and §tomato (Khan et al., 2013; Wheeler et al., 1997) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Heagle et al., 2003; Högy and Fangmeier, 2009), ‡spinach (Jain et al., 2007), ‡§sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) and §tomato (Behboudian and Tod, 1995) |
|  | ↓ | ‡Chinese cabbage (Reich et al., 2016), §cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †‡potato (Fangmeier et al., 2002; Kumari and Agrawal, 2014), §radish and turnip (Azam et al., 2013) and ‡sweet pepper (Piñero et al., 2017a) |
| Mg | ↑ | ‡§Cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012), †potato (Kumari and Agrawal, 2014) and §sweet pepper (Piñero et al., 2017b) |
|  | = | §Carrot (Azam et al., 2013), ‡Chinese cabbage (Reich et al., 2016), §cucumber (Tang et al., 2018),  ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Fangmeier et al., 2002; Heagle et al., 2003; Högy and Fangmeier, 2009) and §tomato (Behboudian and Tod, 1995; Wheeler et al., 1997) |
|  | ↓ | §Cucumber (Dong et al., 2018), ‡fenugreek and spinach (Jain et al., 2007), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), §radish and turnip (Azam et al., 2013), §sweet pepper (Piñero et al., 2017b) and §tomato (Khan et al., 2013) |
| S | = | ‡Broccoli (Schonhof et al., 2007), §carrot and turnip (Azam et al., 2013), ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), †potato (Högy and Fangmeier, 2009) and §tomato (Behboudian and Tod, 1995; Khan et al., 2013) |
|  | ↓ | ‡Chinese cabbage (Reich et al., 2016), §Chines kale (La et al., 2009) and §cucumber (Dong et al., 2018) |
| Fe | ↑ | ‡Lettuce (Baslam et al., 2012), †potato (Kumari and Agrawal, 2014), §radish (Azam et al., 2013) and §tomato (Khan et al., 2013) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡fenugreek (Jain et al., 2007), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b) and †‡potato (Fangmeier et al., 2002; Heagle et al., 2003; Högy and Fangmeier, 2009) |
|  | ↓ | §Carrot and turnip (Azam et al., 2013), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡fenugreek and spinach (Jain et al., 2007), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a), †potato (Kumari and Agrawal, 2014) and §sweet pepper (Piñero et al., 2017b) |
| Mn | ↑ | §Carrot, radish and turnip (Azam et al., 2013), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †potato (Kumari and Agrawal, 2014) and §sweet pepper (Piñero et al., 2017b) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Fangmeier et al., 2002; Heagle et al., 2003; Högy and Fangmeier, 2009) and ‡§sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) |
|  | ↓ | ‡Chinese cabbage (Reich et al., 2016), §cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012), ‡sweet pepper (Piñero et al., 2017a) and §tomato (Khan et al., 2013) |
| Cu | ↑ | §Carrot and turnip (Azam et al., 2013), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †potato (Kumari and Agrawal, 2014), §sweet pepper (Piñero et al., 2017b) and §tomato (Khan et al., 2013) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b) and †‡potato (Heagle et al., 2003) |
|  | ↓ | ‡§Cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012), §radish(Azam et al., 2013) and §sweet pepper (Piñero et al., 2017b) |
| Zn | ↑ | §Cucumber (Dong et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a) and †potato (Kumari and Agrawal, 2014) |
|  | = | ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012; Pérez-López et al., 2015a; Pérez-López et al., 2015b), †‡potato (Fangmeier et al., 2002; Högy and Fangmeier, 2009) and §sweet pepper (Piñero et al., 2017b) |
|  | ↓ | §Carrot, radish and turnip (Azam et al., 2013), ‡Chinese cabbage (Reich et al., 2016), ‡§cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Baslam et al., 2012), †‡potato (Heagle et al., 2003; Kumari and Agrawal, 2014) and §tomato (Khan et al., 2013) |
| B | ↑ | ‡Lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b) |
|  | = | ‡Lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †potato (Högy and Fangmeier, 2009) and ‡§sweet pepper (Piñero et al., 2017a; Piñero et al., 2017b) |
|  | ↓ | §Sweet pepper (Piñero et al., 2017b) |
| Mo | = | ‡Chinese cabbage (Reich et al., 2016) and ‡cucumber (Dong et al., 2018) |
|  | ↓ | §Cucumber (Dong et al., 2018) |
| Na | = | ‡§Cucumber (Dong et al., 2018; Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a), ‡sweet pepper (Piñero et al., 2017a) and †sugar beet (Manderscheid et al., 2010) |
|  | ↓ | §Cucumber (Tang et al., 2018), ‡lettuce (Pérez-López et al., 2015a; Pérez-López et al., 2015b), †potato (Kumari and Agrawal, 2014) and ‡sweet pepper (Piñero et al., 2017a) |
| Al | = | †Potato (Högy and Fangmeier, 2009) |
| Cd | = | §Carrot and turnip (Azam et al., 2013) and †potato (Högy and Fangmeier, 2009) |
|  | ↓ | §Tomato (Khan et al., 2013) |
| Cr | = | §Radish and turnip (Azam et al., 2013) |
|  | ↓ | §Carrot (Azam et al., 2013) and §tomato (Khan et al., 2013) |
| Ni | = | §Carrot and radish (Azam et al., 2013) |
|  | ↓ | §Turnip (Azam et al., 2013) and §tomato (Khan et al., 2013) |
| Pb | = | §Carrot, radish and turnip (Azam et al., 2013) |
|  | ↓ | §Tomato (Khan et al., 2013) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05). †, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Table S6. Effects of elevated CO2 on concentrations of other compounds in vegetables.**

|  |  |  |
| --- | --- | --- |
| Quality parameters | CO2 effects | Crops |
| α-chaconine | = | †‡Potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002) |
|  | ↓ | †‡Potato (Högy and Fangmeier, 2009; Vorne et al., 2002) |
| α-solanine | = | †‡Potato (Donnelly et al., 2001; Högy and Fangmeier, 2009; Vorne et al., 2002) |
| Aliphatic glucosinolates | ↑ | ‡Broccoli (Schonhof et al., 2007) and §Chines kale (La et al., 2009) |
| = | ‡Cabbage (Reddy et al., 2004)  |
| Aromatic glucosinolates | = | ‡Cabbage (Reddy et al., 2004) |
| Ash | = | §Carrot, radish and turnip (Azam et al., 2013) and §tomato (Khan et al., 2013) |
|  | ↓ | §Tomato (Khan et al., 2013) |
| Capsaicin | ↑/=/↓ | †Hot pepper (Li et al., 2017) |
| Chloride | = | †Potato (Högy and Fangmeier, 2009) |
| Cadaverine | ↑/↓ | §Sweet pepper (Piñero et al., 2017b) |
| Fat  | ↓ | §Carrot, radish and turnip (Azam et al., 2013) and §tomato (Khan et al., 2013) |
| Glycoalkaloids | ↑ | §Potato (Nitithamyong et al., 1999) |
|  | = | ‡Potato (Donnelly et al., 2001; Vorne et al., 2002) |
|  | ↓ | †‡Potato (Högy and Fangmeier, 2009; Vorne et al., 2002) |
| Glycine betaine | ↓/= | ‡Sugar beet (Demmers-Derks et al., 1998) |
| Indolyl glucosinolates | = | ‡Cabbage (Reddy et al., 2004) and §Chinese kale (La et al., 2009) |
| ↓ | ‡Broccoli (Schonhof et al., 2007) |
| pH | ↑ | ‡Onion (Bettoni et al., 2017) |
|  | = | ‡Onion (Bettoni et al., 2017) and §tomato (Özçelik and Akilli, 1999) |
| Putrescine | ↑ | §Sweet pepper (Piñero et al., 2017b) |
| Sulphate  | = | ‡Chinese cabbage (Reich et al., 2016) and †potato (Högy and Fangmeier, 2009) |
| Total soluble solids | ↑ | ‡Onion (Bettoni et al., 2017) and ‡§tomato (Behboudian and Tod, 1995; Helyes et al., 2012; Wei et al., 2018; Zhang et al., 2014) |
| = | ‡Hot pepper (Li et al., 2017), ‡onion (Bettoni et al., 2017) and †‡§tomato (Li et al., 1999; Mamatha et al., 2014; Özçelik and Akilli, 1999; Wei et al., 2018; Zhang et al., 2014) |
| ↓ | †‡§Hot pepper (Li et al., 2017) and ‡tomato (Helyes et al., 2012; Mamatha et al., 2014) |
| Volatile terpenoids | ↓ | §Hongfengcai (Ren et al., 2014) |

↑ increase, ＝ no significant change, ↓ decrease (*p*<0.05). †, ‡ and § indicate the ratios of concentrations of elevated CO2 to ambient CO2 are <1.5, 1.5-2.0 and >2.0, respectively.

**Figure S1. The production, harvested area and yield of total vegetables from 1961 to 2016 in the whole world.** The data were downloaded from the website of FAO STAT (FAOSTAT, 2017). FAOSTAT is founded by the Food and Agriculture Organization of the United Nations, which provides free access to the data related to food and agriculture from over 245 countries or territories since 1961.

**Figure S2. The relationship of the sample size (number of replicates) with the effect size (nature log of response ratio, %) to test the publication bias.** The dash line and solid line represents the zero line and mean effect size of all parameters used in this study, respectively. “E” and “A” represent for parameterscollected under elevated and ambient CO2, respectively.

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