

SUPPLEMENTAL DATA

Fruit and vegetable consumption and health outcomes: an umbrella review of observational studies

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Supplementary Table 1. Summary results from meta-analyses investigating continuous linear exposure to fruit consumption and health outcomes. NA, not available.

Outcome	Number of Studies	Exposure (increment)	RR	I ²	Reference
Colorectal Cancer	13	100 g/d	0.98 (0.94, 1.01)	64%	Aune et al. 2011
Breast Cancer	10	200 g/d	0.94 (0.89, 1.00)	39%	Aune et al. 2012
Non-Hodgkin's lymphoma	5	1 serving	1.01 (0.97, 1.05)	45%	Chen et al. 2013
Stroke	8	200 g/d	0.68 (0.56, 0.82)	NA	Hu et al. 2014
Gastric cancer	16	100 g/d	0.95 (0.91, 0.99)	0%	Wang Q et al. 2014
All-cause mortality	7	1 serving	0.94 (0.90, 0.98)	77%	Wang X et al. 2014
CVD mortality	6	1 serving	0.95 (0.91, 1.00)	71%	Wang X et al. 2014
Cancer mortality	7	1 serving	0.99 (0.97, 1.00)	14%	Wang X et al. 2014
CHD	22	300 g/d	0.84 (0.75, 0.93)	32%	Gan et al. 2015
Bladder Cancer	8	200 g/d	0.97 (0.87, 1.08)	26%	Liu et al. 2015
T2DM	9	1 serving	0.91 (0.89, 0.94)	NA	Wu Y et al. 2015
Lung cancer	23	100 g/d	0.92 (0.89, 0.95)	1%	Vieira et al. 2016
Hypertension	5	1 serving	0.98 (0.97, 0.99)	NA	Wu L et al. 2016

Supplementary Table 2. Significance and direction of results from selected meta-analyses on fruit consumption and health outcomes. “S” denotes significant results; NS denotes non-significant results; symbols “+” and “-” denote direction of the association. NA, not available.

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Supplementary Table 3. Characteristics and main findings of meta-analyses of cohort studies on fruit consumption and same outcomes over time.

Outcome	Number Of Studies	RR	I2	Reference
Bladder cancer	11	0.91 (0.82, 1.00)	11%	Vieira et al. 2015
Bladder cancer	11	0.88 (0.79, 0.98)	34%	Yao et al. 2014
Bladder cancer	14	0.99 (0.99, 1.00)	43%	Xu et al. 2015
CHD	3	0.86 (0.71, 1.05)	NA	Law et al. 1998
CHD	7	0.89 (0.85, 0.93)	NA	Dauchet et al. 2006
CHD	9	0.87 (0.80, 0.95)	20%	He et al. 2007
CHD	26	0.86 (0.82, 0.91)	0%	Gan et al. 2015
Colon Cancer	NA	1.01 (0.86, 1.18)	25%	Huxley et al. 2009
Colon Cancer	11	0.89 (0.81, 0.87)	30%	Aune et al. 2011
Colorectal Cancer	16	0.99 (0.90, 1.08)	25%	Huxley et al. 2009
Colorectal Cancer	14	0.90 (0.83, 0.98)	41%	Aune et al. 2011
Gastric cancer	13	0.89 (0.78, 1.02)	NA	Lunet et al. 2005
Gastric cancer	22	0.90 (0.83, 0.98)	1%	Wang Q et al. 2014
Gastric cancer	30	0.93 (0.89, 0.98)	2%	Fang et al. 2015
Hypertension	8	0.73 (0.62, 0.86)	68%	Li et al. 2016
Hypertension	8	0.87 (0.79, 0.95)	64%	Wu L et al. 2016
Lung cancer	19	0.84 (0.75, 0.94)	49%	Wang M et al. 2015
Lung cancer	20	0.84 (0.79, 0.90)	21%	Wang Y et al. 2015
Lung cancer	29	0.82 (0.76, 0.89)	32%	Vieira et al. 2016
Pancreatic cancer	5	0.81 (0.61, 1.09)	45%	Paluszkiewicz et al. 2012
Pancreatic cancer	3	0.65 (0.52, 0.82)	0%	Alsamarrai et al. 2014
Pancreatic cancer	8	0.93 (0.83, 1.03)	35%	Wu Q et al. 2016
Rectal cancer	5	0.78 (0.63, 0.97)	25%	Huxley et al. 2009
Rectal cancer	7	0.91 (0.76, 1.09)	45%	Aune et al. 2011
Stroke	4	0.89 (0.85, 0.93)	NA	Dauchet et al. 2005
Stroke	19	0.77 (0.70, 0.84)	52%	Hu et al. 2014
T2DM	5	1.01 (0.88, 1.15)	4%	Hamer et al. 2007
T2DM	5	0.92 (0.81, 1.02)	NA	Cooper et al. 2012
T2DM	9	0.92 (0.86, 0.97)	37%	Li S et al. 2015
T2DM	12	0.91 (0.87, 0.96)	11%	Wang et al. 2016

Supplementary Table 4. Results of meta-analyses on fruit consumption and health outcomes with limited number of prospective cohort studies (<3) or case-control studies (either alone or mixed with prospective cohort studies).

Outcome	Number Of Studies	Type Of Study Included	Specific Exposure	RR	I2	Reference
Barrett's Esophagus	4	3CC + 1P	Highest vs. lowest	0.65 (0.37, 1.13)	77%	Zhao et al. 2016
Colorectal Adenoma	24	18CC + 6P	Highest vs. lowest	0.79 (0.71, 0.88)	27%	Ben et al. 2015
Crohn's disease	10	CC	Highest vs. lowest	0.57 (0.44, 0.74)	59%	Li F et al. 2015
Endometrial Cancer	14	13CC + 1P	Highest vs. lowest	0.90 (0.72, 1.12)	75%	Bandera et al. 2007
Esophageal cancer	29	24CC + 5P	Highest vs. lowest	0.53 (0.44, 0.64)	73%	Liu J et al. 2013
Glioma	17	P+CC	Highest vs. lowest	0.83 (0.66, 1.04)	83%	Li Y et al. 2014
Larynx cancer	8	P+CC	100g/day increase	0.73 (0.64, 0.83)	NA	Riboli et al. 2003
Mouth and Pharynx	12	P+CC	100g/day increase	0.53 (0.37, 0.76)	NA	Riboli et al. 2003
Thyroid Cancer	9	CC	Highest vs. lowest	0.97 (0.78, 1.21)	36%	Liu Z et al. 2014
Ulcerative colitis	8	CC	Highest vs. lowest	0.69 (0.49, 0.96)	51%	Li F et al. 2015
Wheezing	15	13CS + 2P	Highest vs. lowest	0.81 (0.74, 0.88)	NA	Seyedrezazadeh et al. 2014

Supplementary Table 5. Summary results from meta-analyses investigating continuous linear exposure to vegetable consumption and health outcomes. NA, not available.

Outcome	Number Of Studies	Exposure (increment)	RR	I ²	Reference
Colorectal Cancer	12	100 g/d	0.98 (0.97, 0.99)	0%	Aune et al. 2011
Breast Cancer	9	200 g/day	1.00 (0.95, 1.06)	17%	Aune et al. 2012
Non-Hodgkin's lymphoma	5	1 serving	0.96 (0.92, 1.00)	NA	Chen et al. 2013
Stroke	6	200 g/d	0.89 (0.81, 0.98)	NA	Hu et al. 2014
Gastric cancer	16	100g/d	0.96 (0.91, 1.01)	0%	Wang Q et al. 2014
All-cause mortality	7	1 serving	0.95 (0.92, 0.99)	86%	Wang X et al. 2014
CVD mortality	6	1 serving	0.96 (0.93, 0.99)	63%	Wang X et al. 2014
Cancer mortality	8	1 serving	0.99 (0.97, 1.01)	37%	Wang X et al. 2014
CHD	13	400 g/d	0.82 (0.73, 0.92)	36%	Gan et al. 2015
Bladder Cancer	6	200 g/d	0.95 (0.88, 1.04)	13%	Liu et al. 2015
T2DM	7	1 serving	0.96 (0.95, 0.99)	NA	Wu Y et al. 2015
Lung cancer	20	100 g/day	0.94 (0.89, 0.98)	0%	Vieira et al. 2016
Hypertension	7	1 serving	1.00 (0.98, 1.01)	NA	Wu L et al. 2016

Supplementary Table 6. Significance and direction of results from selected meta-analyses on vegetable consumption and health outcomes. “S” denotes significant results; NS denotes non-significant results; symbols “+” and “-” denote direction of the association. NA, not available.

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Supplementary Table 7. Characteristics and main findings of meta-analyses of cohort studies on vegetable consumption and same outcomes over time.

Outcome	Number Of Studies	RR	I2	Reference
Bladder cancer	9	0.92 (0.84, 1.01)	5%	Vieira et al. 2015
Bladder cancer	9	0.91 (0.82, 1.02)	34%	Yao et al. 2014
Bladder cancer	13	1.00 (0.99, 1.00)	28%	Xu et al. 2015
CHD	3	0.82 (0.66, 1.02)	NA	Law et al. 1998
CHD	7	0.97 (0.92, 1.04)	NA	Dauchet et al. 2006
CHD	9	0.84 (0.76, 0.92)	49%	He et al. 2007
CHD	16	0.87 (0.81, 0.93)	13%	Gan et al. 2015
Colon Cancer	NA	0.93 (0.82, 1.05)	19%	Huxley et al. 2009
Colon Cancer	11	0.87 (0.81, 0.94)	0%	Aune et al. 2011
Colorectal Cancer	16	0.95 (0.88, 1.04)	19%	Huxley et al. 2009
Colorectal Cancer	16	0.91 (0.86, 0.96)	0%	Aune et al. 2011
Gastric cancer	8	0.98 (0.86, 1.13)	NA	Lunet et al. 2005
Gastric cancer	19	0.96 (0.88, 1.06)	21%	Wang Q et al. 2014
Gastric cancer	22	0.98 (0.91, 1.05)	4%	Fang et al. 2015
Hypertension	6	0.97 (0.91, 1.02)	49%	Li et al. 2016
Hypertension	8	0.88 (0.79, 0.99)	68%	Wu L et al. 2016
Lung cancer	18	0.88 (0.81, 0.97)	31%	Wang M et al. 2015
Lung cancer	24	0.90 (0.84, 0.96)	32%	Wang Y et al. 2015
Lung cancer	25	0.92 (0.87, 0.97)	0%	Vieira et al. 2016
Pancreatic cancer	7	0.87 (0.75, 1.01)	0%	Paluszkiewicz et al. 2012
Pancreatic cancer	3	0.77 (0.54, 1.10)	56%	Alsamarrai et al. 2014
Pancreatic cancer	7	0.89 (0.80, 1.00)	0%	Wu Q et al. 2016
Rectal cancer	5	0.88 (0.69, 1.12)	19%	Huxley et al. 2009
Rectal cancer	8	0.94 (0.85, 1.04)	0%	Aune et al. 2011
Stroke	4	0.97 (0.92, 1.04)	NA	Dauchet et al. 2005
Stroke	16	0.86 (0.79, 0.93)	40%	Hu et al. 2014
T2DM	5	0.97 (0.86, 1.10)	5%	Hamer et al. 2007
T2DM	5	0.89 (0.75, 1.03)	NA	Cooper et al. 2012
T2DM	11	0.91 (0.82, 1.01)	57%	Wang et al. 2016

Supplementary Table 8. Results of meta-analyses on vegetable consumption and health outcomes with limited number of prospective cohort studies (<3) or case-control studies (either alone or mixed with prospective cohort studies).

Outcome	Number Of Studies	Type Of Study Included	Specific Exposure	RR	I2	Reference
Asthma	2	P	Highest vs. lowest	0.77 (0.35, 1.69)	NA	Seyedrezazadeh et al. 2014
Barrett's Esophagus	4	3CC + 1P	Highest vs. lowest	0.45 (0.29, 0.70)	61%	Zhao et al. 2016
Colorectal Adenoma	21	15CC + 6P	Highest vs. lowest	0.91 (0.80, 1.02)	41%	Ben et al. 2015
Crohn's disease	8	CC	Highest vs. lowest	0.66 (0.40, 1.09)	67%	Li F et al. 2015
Endometrial Cancer	10	CC	Highest vs. lowest	0.71 (0.55, 0.91)	61%	Bandera et al. 2007
Esophageal cancer	24	19CC + 5P	Highest vs. lowest	0.56 (0.45, 0.69)	75%	Liu J et al. 2013
Glioma	15	P+CC	Highest vs. lowest	0.77 (0.69, 0.87)	41%	Li Y et al. 2014
Larynx cancer	8	P+CC	100g/day increase	0.92 (0.83, 1.02)	NA	Riboli et al. 2003
Mouth and Pharynx	12	P+CC	100g/day increase	0.84 (0.67, 1.07)	NA	Riboli et al. 2003
Thyroid Cancer	5	CC	Highest vs. lowest	0.76 (0.58, 1.00)	16%	Liu Z et al. 2014
Ulcerative colitis	9	CC	Highest vs. lowest	0.71 (0.58, 0.88)	42%	Li F et al. 2015
Wheezing	11	10CS + 1P	Highest vs. lowest	0.89 (0.81, 0.98)	NA	Seyedrezazadeh et al. 2014

Supplementary Table 9. Variables investigated to address the strength of evidence from selected meta-analyses on fruit and vegetable consumption and health outcomes.

Outcome	Heterogeneity	Dose-response analysis	Agreement over time	Potential confounding	Reference
<i>Fruit</i>					
Asthma	⊕	⊕	○	○	Seyedrezazadeh et al. 2014
Cancer (bladder)	∅	⊕	⊕	∅	Xu et al. 2015
Cancer (breast)	∅	⊕	∅	⊕	Aune et al. 2012
Cancer (colon)	∅	○	∅	○	Aune et al. 2011
Cancer (colorectum)	∅	⊕	∅	⊕	Aune et al. 2011
Cancer (liver)	∅	○	○	○	Yang et al. 2014
Cancer (lung)	∅	⊕	⊕	⊕	Vieira et al. 2016
Cancer (NHL)	∅	⊕	○	○	Chen et al. 2013
Cancer (pancreas)	∅	○	⊕	○	Wu Q et al. 2016
Cancer (prostate)	∅	○	⊕	∅	Meng et al. 2014
Cancer (rectum)	∅	○	∅	○	Aune et al. 2011
Cancer (stomach)	∅	⊕	⊕	⊕	Fang et al. 2015
CHD	∅	⊕	⊕	⊕	Gan et al. 2015
CVD	∅	○	○	∅	Zhan et al. 2017
Depression	∅	○	○	○	Liu et al. 2016
Hip fracture	∅	○	○	○	Luo et al. 2016
Hypertension	⊕	⊕	⊕	∅	Wu L et al. 2016
Mortality (all-cause)*	⊕	⊕	○	⊕	Wang X et al. 2014
Mortality (cancer)*	∅	⊕	○	○	Wang X et al. 2014
Mortality (CVD)*	⊕	⊕	○	○	Wang X et al. 2014
Pancreatic diseases	∅	○	∅	○	Alsamarrai et al. 2014
Stroke (total)	⊕	⊕	⊕	○	Hu et al. 2014
T2DM	∅	⊕	∅	⊕	Wang et al. 2016
<i>Vegetable</i>					
Age-related cataract	∅	○	○	∅	Huang et al. 2015
Cancer (bladder)	∅	⊕	⊕	⊕	Xu et al. 2015
Cancer (breast)	∅	⊕	∅	○	Aune et al. 2012
Cancer (colon)	∅	○	∅	○	Aune et al. 2011
Cancer (colorectum)	∅	⊕	∅	⊕	Aune et al. 2011
Cancer (liver)	⊕	○	○	○	Yang et al. 2014
Cancer (lung)	∅	⊕	⊕	⊕	Vieira et al. 2016
Cancer (NHL)	∅	⊕	○	○	Chen et al. 2013
Cancer (pancreas)	∅	○	⊕	○	Wu Q et al. 2016
Cancer (prostate)	∅	○	⊕	∅	Meng et al. 2014
Cancer (rectum)	∅	○	⊕	○	Aune et al. 2011
Cancer (stomach)	∅	⊕	∅	○	Fang et al. 2015
CHD	∅	⊕	⊕	⊕	Gan et al. 2015
CVD	∅	○	○	∅	Zhan et a. 2017
Depression	∅	○	○	○	Liu et al. 2016
Hip fracture	∅	○	○	○	Luo et al. 2016
Hypertension	⊕	⊕	⊕	○	Wu L et al. 2016
Mortality (all-cause)*	⊕	⊕	○	⊕	Wang X et al. 2014
Mortality (cancer)*	∅	⊕	○	○	Wang X et al. 2014
Mortality (CVD)*	⊕	⊕	○	○	Wang X et al. 2014
Pancreatic diseases	∅	○	∅	○	Alsamarrai et al. 2014
Stroke (total)	∅	⊕	∅	○	Hu et al. 2014
T2DM	∅	⊕	∅	⊕	Wang et al. 2016

*from meta-analysis on continuous exposure (dose-response).