Apples to Zucchini: The Scoop On Fruits & Veggies

Edwin Cox, M.D.

What We Mean by F&V

Includes:

- · Green leafy vegetables: lettuce, cabbage, spinach, kale
- · Cruciferous vegetables: Broccoli
- · Fruits fresh, dried, canned, juices

Excludes:

- · Grains, nuts, seeds
- · Potatoes
- · Legumes (possibly)

Is there <u>really</u> any doubt...

that fruits and vegetables are good for us?

Our mama told us: "Eat your veggies, they're good for you"

But not everyone <u>likes</u> fruits and/or veggies

Do we have to eat them?

Virtues of veggies and fruits

Vitamins

Minerals

Phytosterols

Carotenoids

Antioxidants

Fiber

Satiety without adding calories

Limitations of F&V

Very low energy density

- It is cumbersome, time-consuming and expensive
 and some would say unpleasant due to
 intestinal side effects to obtain one's entire
 energy requirement from fruits and vegetables
- For example, to get 2000 Cal from iceberg lettuce, cabbage, spinach and snap beans, you would have to eat 20 cups of each!

Role of F&V in diet

To provide micronutrients

To provide fiber

To slow absorption of accompanying starches and sugars, thereby reducing their glycemic index

To add interest to the diet

To promote satiety and thereby reduce unwitting intake of calorie-laden food

Fruit / vegetable consumption and mortality in England

Fruit and vegetable consumption and all-cause, cancer and CVD mortality: analysis of Health Survey for England data

Oyinlola Oyebode, Vanessa Gordon-Dseagu, Alice Walker, Jennifer S Mindell

Oyebode et al J Epidem Comm Hlth 2013

Fruits/vegs & mortality - UK

Health Survey for England (HSE) - annual survey

Random cross-section, age >34 yrs

65,226 subjects accessioned from 2001-08

Follow-up 7.7 yrs (median)

4,399 deaths (7.7%)

- · 1,398 cancer
- · 1,554 CVD

Adjusted for smoking, alcohol, social class, education

HSE F&V & mortality: factors

Smokers ate less F&V

Active individuals ate more F&V

Educated / higher social class ate more F&V

Heavy drinkers ate less F&V

Body mass index did not relate to F&V

HSE: F&V, mortality

Table 2 Association between portions of fruit and vegetables consumed and risk of death from any cause

	Portions of fruit and vegetables consumed in the previous day HRs (95% CI)							
Model	0<1*	1<3	3<5	5<7	7+			
Model 1†	1	0.84 (0.77 to 0.92)	0.71 (0.65 to 0.77)	0.63 (0.56 to 0.70)	0.60 (0.52 to 0.69)			
Model 2‡	1	0.88 (0.80 to 0.95)	0.76 (0.69 to 0.83)	0.70 (0.63 to 0.79)	0.67 (0.58 to 0.78)			
Model 2 excluding deaths within a year (n=84 894; D=3753)§	1	0.86 (0.79 to 0.95)	0.71 (0.63 to 0.81)	0.64 (0.53 to 0.76)	0.58 (0.46 to 0.71)			
Model 2, never-smokers only (n=43 973; D=1530)§	1	0.94 (0.80 to 1.10)	0.76 (0.64 to 0.90)	0.72 (0.60 to 0.88)	0.77 (0.61 to 0.97)			
Model 2, physical activity years only (n=42 857; D=2269)§	1	0.83 (0.74 to 0.94)	0.68 (0.58 to 0.80)	0.61 (0.48 to 0.76)	0.55 (0.41 to 0.73)			
Model 2, overweight and obese only (n=38 262; D=2143)§	1	0.86 (0.76 to 0.98)	0.73 (0.64 to 0.84)	0.63 (0.54 to 0.74)	0.63 (0.52 to 0.77)			
Model 2, normal weight only (n=15 970; D=968)§	1	0.93 (0.77 to 1.11)	0.77 (0.63 to 0.93)	0.70 (0.55 to 0.89)	0.52 (0.37 to 0.72)			

^{*}Reference category.

33% reduction in all-cause mortality in those consuming 7+ servings/d F&V

[†]Model 1: Adjusted for sex, age-group, cigarette smoking and social class.

[‡]Model 2: Adjusted for sex, age-group, cigarette smoking, social class, BMI, education, physical activity and alcohol intake.

^{§(}n) Number of study participants; (D) Number of deaths.

HSE: F&V, mortality

Model	Portions of fruit and vegetables consumed in the previous day HRs (95% CI)							
	0-<1*	1-<3	3-<5	5-<7	7+			
Cancer								
Number of participants (deaths)	10 607 (169)	28 805 (485)	24 968 (400)	13 082 (187)	7885 (95)			
Model 1†	1	0.87 (0.75 to 1.02)	0.78 (0.66 to 0.92)	0.71 (0.58 to 0.86)	0.70 (0.55 to 0.90)			
Model 2‡	1	0.89 (0.76 to 1.04)	0.81 (0.69 to 0.95)	0.75 (0.62 to 0.91)	0.75 (0.59 to 0.96			
CVD								
Number of participants (deaths)	10 607 (189)	28 805 (553)	24 968 (449)	13 082 (208)	7885 (83)			
Model 1†	1	0.88 (0.77 to 1.03)	0.78 (0.66 to 0.91)	0.74 (0.61 to 0.89)	0.63 (0.49 to 0.80			
Model 2‡	1	0.91 (0.78 to 1.05)	0.82 (0.70 to 0.95)	0.80 (0.66 to 0.96)	0.69 (0.53 to 0.88			

^{*}Reference category.

Ca mortality reduced 25% - 7+/d F&V CVD mortality reduced 31% - 7+/d F&V

[†]Adjusted for age-group, sex, social class, cigarette smoking and BMI.

[‡]Adjusted for age-group, sex, social class, cigarette smoking, BMI and additionally adjusted for physical activity, education and alcohol intake.

CVD, cardiovascular disease.

HSE: Mortality, F vs. V

Table 4	Association	between portions	of fruit or of vegetables	consumed and risk of de	eath, from all c	auses unless specified
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	Portions of fruit consumed in the previous day HRs (95% CI)					Portions of vegetables consumed in the previous day HRs (95% CI)			
Model	0-<1*	1-<2	2-<3	3-<4	4+	0-<1*	1-<2	2-<3	3+
Number of participants	32 428	17 862	14 727	9304	11 036	39 296	25 411	12 736	7914
Deaths	1574	948	767	452	465	2302	1253	474	177
Model 1†	1	0.86 (0.79 to 0.93)	0.82 (0.75 to 0.89)	0.75 (0.67 to 0.83)	0.73 (0.66 to 0.81)	1	0.81 (0.76 to 0.87)	0.76 (0.69 to 0.84)	0.63 (0.54 to 0.74)
Model 2‡	1	0.91 (0.84 to 0.99)	0.90 (0.82 to 0.98)	0.84 (0.76 to 0.93)	0.86 (0.77 to 0.96)	1	0.85 (0.79 to 0.91)	0.81 (0.73 to 0.89)	0.68 (0.58 to 0.79)
Model 3§¶: Model 2 Cancer deaths only	1	0.99 (0.86 to 1.14)	0.98 (0.84 to 1.14)	0.85 (0.70 to 1.11)	0.93 (0.77 to 1.11)	1	0.85 (0.76 to 0.96)	0.76 (0.63 to 0.90)	0.76 (0.59 to 0.97)
Model 4¶: Model 2 CVD deaths only	1	0.90 (0.78 to 1.03)	0.87 (0.76 to 1.01)	0.91 (0.76 to 1.08)	0.82 (0.68 to 0.98)	1	0.89 (0.79 to 0.99)	0.87 (0.74 to 1.03)	0.78 (0.60 to 1.01)
Model 5: Model 2, excluding deaths within a year	1	0.91 (0.83 to 0.99)	0.90 (0.82 to 0.99)	0.83 (0.74 to 0.93)	0.87 (0.78 to 0.97)	1	0.85 (0.79 to 0.92)	0.83 (0.75 to 0.92)	0.68 (0.58 to 0.80)
Model 6:§ Model 2, non-smokers only	1	0.96 (0.84 to 1.10)	0.94 (0.82 to 1.09)	0.78 (0.65 to 0.93)	0.86 (0.73 to 1.01)	1	0.84 (0.75 to 0.95)	0.85 (0.72 to 1.00)	0.76 (0.59 to 0.97)

^{*}Reference category.

	Fruit 4+ servings/d	Veg 3+ servings/d
All-cause	-14%	-32%
Cancer	-7% (NS)	-24%
CVD	-18%	-22%

[†]Model 1: Adjusted for age, sex, social class, cigarette smoking and BMI.

^{\$}Model 2: Adjusted for age, sex, social class, cigarette smoking, BMI, physical activity, education, alcohol intake and mutually adjusted for portions of vegetables/portions of fruit consumed.

[§]Education and alcohol intake were not significant and therefore not included in this model.

[¶]The number of portions of fruit consumed was not significantly associated with mortality in this model.

CVD, cardiovascular disease.

HSE: Mortality, F&V

Vegetable portion	-15%
Salad	-13%
Pulses (legumes)	-5% (NS)
Fresh fruit	-4%
Dried fruit	-9%
Fruit juice	-3% (NS)
Frozen / canned fruit	+17%

Mortality & fruits / vegetables

Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies

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BMJ 2014 Meta-analysis

All-cause mortality, total F&V

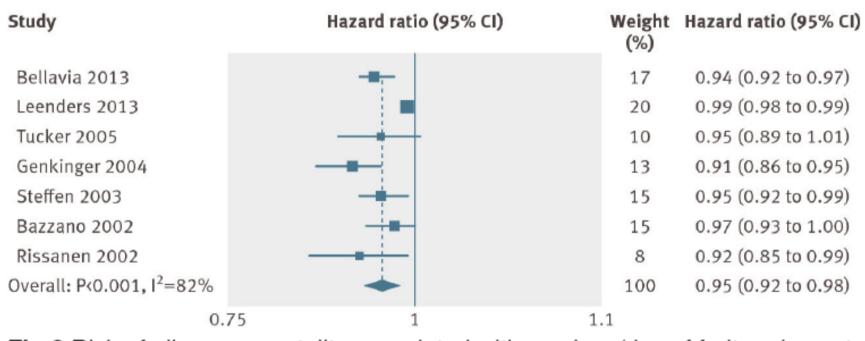


Fig 2 Risk of all cause mortality associated with servings/day of fruit and vegetables.

All-cause mortality, total F&V

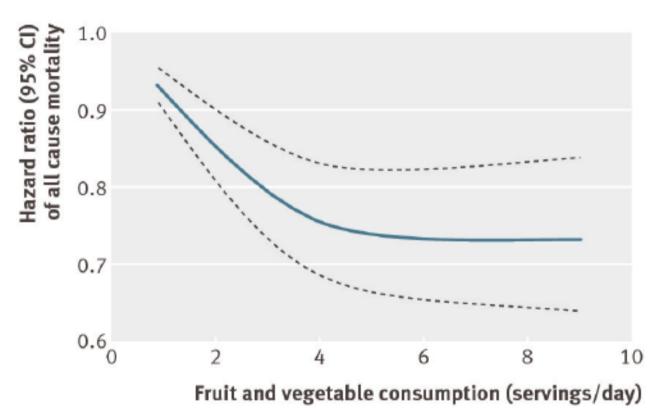


Fig 3 Dose-response relation between fruit and vegetable

All-cause mortality, fruit

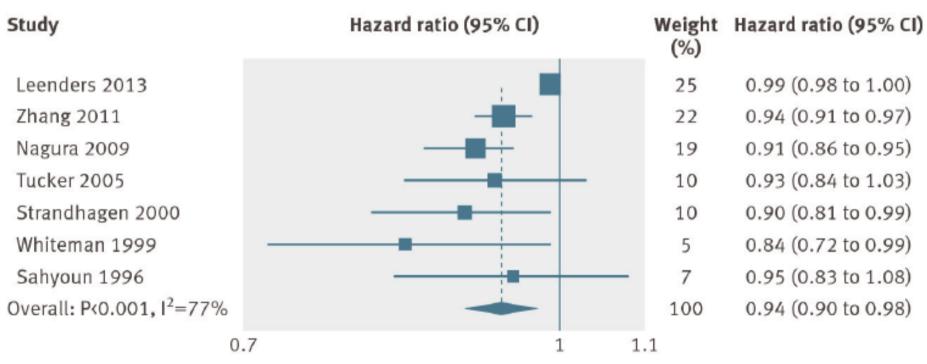


Fig 4 Risk of all cause mortality associated with servings/day of fruit. Weights ar

All-cause mortality, vegetables

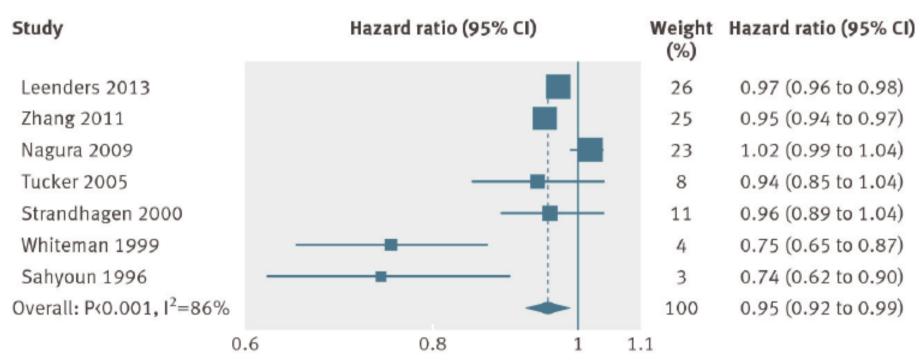


Fig 5 Risk of all cause mortality associated with servings/day of vegetables. Weig

Wang F&V conclusions

All-cause mortality

- · Decreased with fruit, vegetable, combined F&V Cardiovascular mortality
- · Decreased with fruit, vegetable, combined F&V Cancer mortality
- · Non-significant changes with F, V, combined F&V

PURE F&V study

Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study

Victoria Miller, Andrew Mente, Mahshid Dehghan, Sumathy Rangarajan, Xiaohe Zhang, Sumathi Swaminathan, Gilles Dagenais, Rajeev Gupta,

Lancet 2017

PURE F&V study

Prospective Urban Rural Epidemiology Study

Subjects: 135,335

Location: 7 regions, 18 countries, 613 communities

Enrollment: 2003-2013

Follow up: 7.4 years (median)

Events: 5,796 deaths 1,649 CVD deaths

4,784 CVD events

PURE F&V study

Data are from 135335 individuals. N Am/Eur=North America and Europe: Canada, Poland, and Sweden. S Amer=South America: Argentina, Brazil, Chile, and Colombia. Mid East=Middle East: Iran, occupied Palestinian territory, Turkey, and United Arab Emirates. S Asia=south Asia: Bangladesh, India, and Pakistan. SE Asia=southeast Asia: Malaysia. Africa=South Africa and Zimbabwe.

PURE: Mortality, fruit

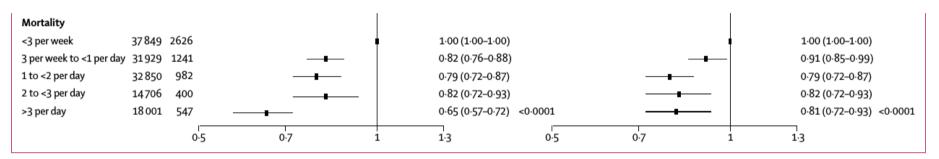


Figure 2: Association of fruit intake with cardiovascular outcomes and mortality

20% reduction for 1 or more servings / day CVD and non-CVD equally influenced

PURE: Mortality, vegetables

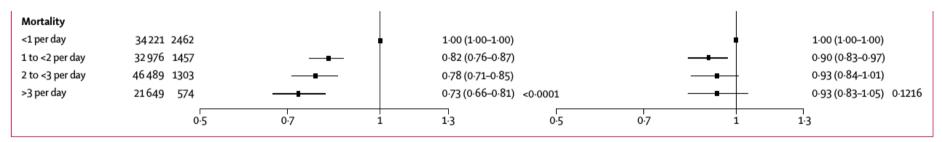


Figure 3: Association of vegetable intake with cardiovascular outcomes and mortality

10% reduction (not significant) for 1 or more servings / d

PURE: Mortality, legumes

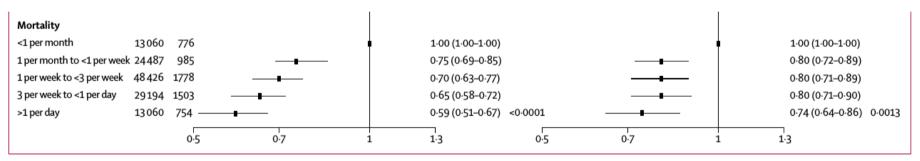


Figure 4: Association of legume intake with cardiovascular outcomes and mortality

26% reduction for 1 or more servings / day CVD mortality not reduced
Non-CVD mortality significantly reduced

Mortality & apple consumption in older women

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Apple intake is inversely associated with all-cause and disease-specific mortality in elderly women

Jonathan M. Hodgson¹*, Richard L. Prince^{2,3}, Richard J. Woodman⁴, Catherine P. Bondonno¹, Kerry L. Ivey⁵, Nicola Bondonno¹, Eric B. Rimm⁵, Natalie C. Ward^{1,6}, Kevin D. Croft¹ and Joshua R. Lewis⁷

Western Australia

Calcium Intake Fracture Outcome Study (CIFOS)

Women age 70+

Subjects: 1,456 Follow up: 15 yrs

Events: 607 deaths (42%)

CIFOS: Mortality, fruit

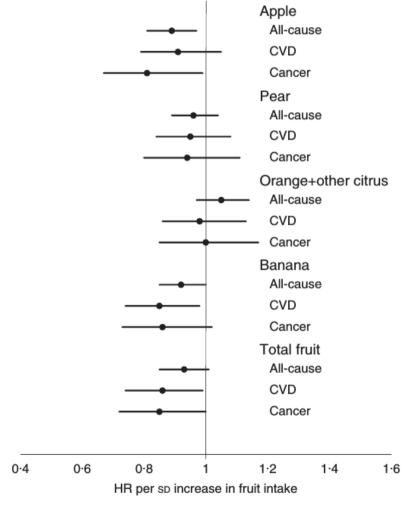


Fig. 1. Multivariable-adjusted hazard ratio (HR) for all-cause mortality (n 601), CVD mortality (n 235) and cancer mortality (n 156) per sp increase in intake of apple (sp 53 g/d), pear (sp 33 g/d), orange and other citrus fruits (sp 59 g/d), banana (sp 41 g/d) and total fruit (sp 129 g/d). The model included age, BMI,

CIFOS: Mortality, apple

Table 2. Hazard ratios (HR) for all-cause, CVD and cancer mortality according to apple intake catergory* (HR and 95% confidence intervals; numbers and percentages)

		Apple intake categories					
	< 5 g/d		5-	5–100 g/d		>100 g/d	
	HR	95 % CI	HR	95 % CI	HR	95 % CI	P_{trend} †
Median intake (g/d)		1		34		136	
Number of women (n)	2	259		1004		193	
Person-years follow-up (years)	31	67	12	949	:	2558	
All-cause mortality							
Deaths							
n	130		411		60		
%	50.2		40-9		34.2		
Age-adjusted	1.00		0.73‡	0.60, 0.89	0.58§	0.43, 0.78	0.001
Multivariable§	1.00		0.80‡	0.65, 0.98	0.65§	0.48, 0.89	0.01
CVDII mortality							
Deaths							
n		44		164		27	
%		17.0	16.3		14.0		
Age-adjusted		1.00	0.86	0.61, 1.19	0.68	0.42, 1.11	0.14
Multivariablell		1.00	0.90	0.64, 1.26	0.76	0.47, 1.24	0.30
Cancer mortality							
Deaths							
n	40		100		16		
%		15.4	10.0		8.3		
Age-adjusted		1.00	0·61§	0.42, 0.88	0.49‡	0.28, 0.88	0.04
Multivariable§		1.00	0.65‡	0.45, 0.95	0.53‡	0.29, 0.97	0.08

Fruits & vegetables: Conclusions

Increasing consumption of fruits and vegetables is associated with lower mortality, up to about 5 total servings per day

Both are beneficial; some studies show one or the other superior, others show equal benefit

Benefit of F&V is mostly due to factors other than fiber content, though its fiber is beneficial

Increased consumption of frozen / canned fruit is associated with higher mortality (+17% Q5 vs. Q1)

Fruit juice consumption is not the same as eating intact fruit, and may be harmful if sugar content is high

Plant-based foods: Recommendations

Aim for regular inclusion of a variety of legumes, vegetable portions, salads, fresh fruits, and dried fruits in your diet

Fruits and vegetable fiber does not convey the full benefit of fiber; aim for the majority of fiber from grains (cereals, pasta, breads)

Restrain consumption of canned fruit, frozen fruit and fruit juices, sugar and refined grain foods

Nuts are an excellent source of fuel, healthy fats, and fiber