



Question: What is the relationship between dietary patterns and risk of colorectal cancer?

Table 3. Summary of studies examining the relationship between dietary patterns and risk of colorectal cancer

Author, Year Study Design; Location (Cohort) Risk of Bias*	Sample Size (Age) Number of breast cancer cases; Duration of Follow-up	Dietary Patterns**	Results	Summary of Findings
Index/Score Analysis				
Agnoili, 2013 PCS; Europe (European Prospective Investigation into Cancer and Nutrition (EPIC)) Risk of Bias: 2/24	N=45,275 (~50y) 435 cases; 11.3y	Italian Mediterranean Index	Italian Mediterranean Index: Lowest category (0-1 points, referent) vs. Highest (6-11) <ul style="list-style-type: none"> • <i>Whole sample:</i> HR=0.50 (95% CI=0.35-0.71; P for trend=0.04) • <i>Men:</i> HR=0.54 (95% CI=0.30-0.96; P for trend NS) • <i>Women:</i> HR=0.46 (95% CI=0.30-0.72; P for trend NS) 	Adherence to a typical Italian Mediterranean diet, as measured by the Italian Mediterranean Index, is associated with reduced risk of developing colorectal cancer. The reduction in risk was significant in both sexes, but was greater in women. The reduction in risk was also significant for all colon, distal colon and rectal sites considered separately, but non for the proximal colon.
Bamia, 2013 PCS; Europe (EPIC) Risk of Bias: 3/24	N=480,308 (25-70y) 4,355 cases; 11.6y	Modified Mediterranean Diet Score (MMDS)	MMDS score 0-3 (ref), vs. 4-5 points, vs. 6-9 points: <ul style="list-style-type: none"> • <i>Whole sample:</i> MMDS 4-5 points (HR=0.92, 95% CI=0.85-1.00), 6-9 points (HR=0.89, 95% CI=0.80-0.99) P for trend =0.02 • <i>Men:</i> MMDS 4-5 points (NS), 6-9 points (NS) • <i>Women:</i> MMDS 4-5 points (HR=0.89, 95% CI=0.80-0.99), 6-9 points (HR=0.88, 95% CI=0.77-1.01) P for trend=0.05 	Following a Mediterranean diet as measured by the MMDS is associated with moderately reduced colorectal risk. In analyses by sex this association was statistically significant only among women, but the interaction term for MMDS-by-sex in relation to colorectal cancer risk was not statistically significant.
Doubeni, 2012 PCS; US (NIH-AARP) Risk of Bias: 3/24	N=506,488 (50-71y) 7,676 cases; 11y	Mediterranean diet score	Mediterranean diet score: <ul style="list-style-type: none"> • <i>0-1 (lowest) vs. 8-9 (referent):</i> IRR=1.91 (95% CI=1.61-2.26) • <i>2 vs. 8-9 (ref):</i> IRR=1.71 (95% CI=1.46-2.01) • <i>3 vs. 8-9 (ref):</i> IRR=1.64 (95% CI=1.40-1.92) 	A disproportionately high risk of potentially preventable colorectal cancers among people with low SES was explained, in part, by unhealthy dietary patterns in low-SES populations (21.6% of variance). Nonconformity with the Mediterranean dietary patterns explained about one-fifth of



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			<ul style="list-style-type: none"> 4 vs. 8-9 (ref): IRR=1.51 (95% CI=1.29-1.77) 5 vs. 8-9 (ref): IRR=1.37 (95% CI=1.17-1.61) 6 vs. 8-9 (ref): IRR=1.23 (95% CI=1.05-1.45) 	SES-related differences in incidence for all colorectal cancers, one-third for right colon cancers, nearly one-fifth for left colon cancers, and about one-tenth for rectal cancers.
Fung, 2010 PCS; US (National Health Survey (NHS), Health Professionals Follow-Up Study (HPFS)) Risk of Bias: 0/24	N=132,746 (30-55y (women), 40-75y (men)) 1,432 cases; ~26y (women); ~20y (men)	<ul style="list-style-type: none"> Alternate Mediterranean Diet Score (aMED) DASH Score 	aMED score was not associated with total risk of colorectal cancer in women or men (NS) DASH: <ul style="list-style-type: none"> <i>Colorectal cancer risk:</i> RR=0.80 (95% CI=0.70-0.91; P for trend=0.001 <i>Colon cancer risk:</i> RR=0.81 (95% CI=0.69-0.95; P for trend=0.002) <i>Rectal cancer risk:</i> NS 	Adherence to the DASH diet (based on the DASH score) was associated with lower risk of colorectal cancer. There was no association between adherence to the Mediterranean diet (based on aMED) and risk of colorectal cancer.
Jarvandi, 2013 PCS; US (NIH-AARP) Risk of Bias: 3/24	N=484,020 (50-71y) 7,598 cases; 9.2y	Healthy Eating Index 2005	HEI - 2005: <ul style="list-style-type: none"> <i>Whole sample:</i> Quartile 4 (ref) vs. quartile 1, HR =1.35 (95% CI=1.26-1.44) <i>Men:</i> Quartile 4 (ref) vs. quartile 1, HR=1.37 (95% CI=1.26-1.49) <i>Women:</i> Quartile 4 (ref) vs. quartile 1, HR=1.30 (95% CI=1.15-1.46) 	Poor diet measure by HEI-2005 score was associate with increased risk of colorectal cancer in both men and women.
Kyro, 2013 PCS; Denmark (Danish Diet, Cancer and Health Study)	N=55,880 women (50-64y) 1,025 cases; 13y	Nordic Food Index	Nordic Food Index (Score 0-1 (ref) vs. 5-6) and colorectal cancer risk: <ul style="list-style-type: none"> <i>Men:</i> NS <i>Women:</i> IRR=0.65 (95% CI=0.46-0.94; P for 	Adherence to the Nordic Food Index was associated with lower incidence of colorectal cancer among women, but not men.



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Risk of Bias: 5/24			trend=0.02)	
Mai, 2005 PCS; US (Breast Cancer Detection Demonstration Project) Risk of Bias: 6/24	N=37,135 women (~61y) 372 cases; 9.5y	Recommended Food Score (RFS)	No association with colorectal cancer risk in women.	There was no association between RFS score and risk of breast cancer.
Miller, 2013 PCS; US (NIH- AARP) Risk of Bias: 3/24	N=491,841 (50-71y) 6,752 cases; 1y	4 DASH Indexes (Dixon et al., Mellen et al., Fung et al., and Gunther et al.)	Men: <ul style="list-style-type: none"> • <i>Dixon's DASH index</i> (Category 1 (ref) vs. Category 4): HR=0.77 (95% CI=0.69-0.87) • <i>Mellen's DASH index</i> (Q1 (ref) vs. Q5): HR=0.78 (95% CI=0.71-0.86) • <i>Fung's DASH index</i> (Q1 (ref) vs. Q5): HR=0.75 (95% CI=0.68-0.83) • <i>Gunther's DASH index</i> (Q1 (ref) vs. Q5): HR=0.81 (95% CI=0.74-0.90) Women: <ul style="list-style-type: none"> • <i>Dixon's DASH index</i> (Category 1 (ref) vs. Category 4): NS • <i>Mellen's DASH index</i> (Q1 (ref) vs. Q5): HR=0.79 (95% CI=0.68-0.91) 	In this large prospective examination of 4 established DASH diet indexes and colorectal cancer, men with the highest scores on all 4 of the indexes and women with the highest scores on 3 of the indexes had significant reduced risk of colorectal cancer. Risk estimates were of similar magnitude for all indexes in men and 3 of the indexes in women (Mellens, Fungs, and Gunthers indexes). These findings suggested that the key underlying construct of the DASH dietary pattern is captured in each index, and greater compliance with this dietary pattern is protective against colorectal cancer.



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			<ul style="list-style-type: none"> • <i>Fung's DASH index</i> (Q1 (ref) vs. Q5): HR=0.84 (95% CI=0.73-0.96) • <i>Gunther's DASH index</i> (Q1 (ref) vs. Q5): HR=0.84 (95% CI=0.73-0.97) 	
Reedy, 2008 PCS; US (NIH-AARP) Risk of Bias: 4/24	N=492,382 (50-71y) 3,110 cases; 5y	<ul style="list-style-type: none"> • Healthy Eating Index 2005 • Alternative Healthy Eating Index • Mediterranean Diet Score (MDS) • Recommended Food Score 	Healthy Eating Index-2005 (Q1 (ref) vs. Q5): <ul style="list-style-type: none"> • <i>Men</i>: RR=0.72 (95% CI=0.62-0.83) • <i>Women</i>: RR=0.80 (95% CI=0.64-0.98) Alternative Healthy Eating Index (Q1 (ref) vs. Q5) <ul style="list-style-type: none"> • <i>Men</i>: RR=0.71 (95% CI=0.61-0.82) • <i>Women</i>: NS Mediterranean Diet Score (Q1 (ref) vs. Q5) <ul style="list-style-type: none"> • <i>Men</i>: RR=72 (95% CI=0.63-0.83) • <i>Women</i>: NS Recommended Food Score (Q1 (ref) vs. Q5) <ul style="list-style-type: none"> • <i>Men</i>: RR=0.75 (95% CI=0.65-0.87) • <i>Women</i>: NS 	Adherence to all four dietary pattern indexes predicted significantly decreased risk of colon cancer for men, but only the Healthy Eating Index - 2005 score predicted reduced colorectal cancer risk in women.
Factor/Cluster Analysis				
Butler, 2008 PCS; Singapore (Singapore Chinese Health	N=61,321 women (45-74y) 961 cases; 9.8y	<ul style="list-style-type: none"> • "Vegetable-fruit-soy" • "Meat-dim sum" 	No associations with colorectal cancer risk.	Neither individual nutrients or foods nor dietary patterns appear to explain the rise in colorectal cancer among Singapore Chinese population. Only alcohol intake was associated with colorectal cancer in our data



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Study) Risk of Bias: 3/24				This finding of no association with the meat-based pattern was not consistent with most previous studies.
Dixon, 2004 Data re-examined prospectively from multiple study-types (PCS, RCT, case-cohort); Alpha-Tocopherol Beta-Carotene Cancer Prevention Study (ATBC), the Netherlands Cohort Study (NLCS) , and the Swedish Mammography Cohort (SMC) Risk of Bias: 6/24	ATBC: N=27,111 NLCS: N=4,295 SMC: N=61,463 ATBC Colorectal Cases: 322 NLCS Colorectal Cases: 1,172 SMC Colorectal Cases: 586 Follow up: 6-14y	<ul style="list-style-type: none"> • "Vegetables" • "Pork, processed meat, potatoes (PPP)" 	<p>Vegetable pattern: No significant associations with colorectal cancer risk.</p> <p>PPP pattern:</p> <ul style="list-style-type: none"> • <i>ATBC men quartile 1 vs. quartile 4:</i> NS • <i>NLCS men quartile 1 vs. quartile 4:</i> NS • <i>NLCS women quartile 1 vs. quartile 4:</i> NS • <i>SMC women quartile 1 (ref) vs. quartile 4:</i> RR=1.37 (95% CI: 1.00-1.89; P for trend=0.03). 	Although certain dietary patterns may be consistent across European countries, associations between these dietary patterns and the risk of colon and rectal cancer are not conclusive.
Engeset, 2009 PCS; Norway	N=34,352 women (47.6y)	<ul style="list-style-type: none"> • "Traditional fish eaters" • "Healthy" 	When stratified by alcohol consumption, colorectal cancer risk was high among those consuming the " Alcohol Users " pattern and lower levels of fish	No overall relationship between cancers and the six different dietary patterns was found.



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(EPIC-Norway) Risk of Bias: 4/24	133 cases; 7y	<ul style="list-style-type: none"> • "Average, less fish, less healthy" • "Western" • "Traditional bread eaters" • "Alcohol users" 	(HR=1.48 (95% CI=1.09-2.03, P=0.0136)) No other association with colorectal cancer found.	
Flood, 2008 PCS; US (NIH-AARP) Risk of Bias: 4/24	N=492,382 (~62y) 3,110 cases; 4.5y	<ul style="list-style-type: none"> • "Fruit and vegetable" • "Fat-reduced and diet foods" • "Meat and potatoes" 	Men: Q1 ref <ul style="list-style-type: none"> • "<i>Fruit and vegetable</i>" factor Q1 vs. Q5: RR=0.81 (95% CI 0.70-0.93; P trend 0.004) • "<i>Fat-reduced and diet foods</i>" factor Q1 vs. Q5: RR=0.82 (95% CI 0.72-0.94; P trend=0.001) • "<i>Meat and potatoes</i>" factor Q1 vs. Q5: NS Women: Q1 ref <ul style="list-style-type: none"> • "<i>Fruit and vegetable</i>" factor Q1 vs. Q5: NS • "<i>Fat-reduced and diet foods</i>" factor Q1 vs. Q5: NS • "<i>Meat and potatoes</i>" factor Q1 vs. Q5: RR=1.48 (95% CI 1.20-1.83; P trend=0.0002) 	A dietary pattern characterized by frequent meat and potatoes consumption was associated with an increased risk of colorectal cancer in women, but not men. A dietary pattern typified by frequent consumption of fat-reduced and diet foods was associated with a significant reduction in risk among men, and trend toward significance (P=0.06) was seen with women. A vegetables and fruits pattern was associated with reduced risk among men, but not associated women.
Fung, 2003 PCS; US (NHS) Risk of Bias: 0/24	N=76,399 women (30-55y) 546 cases; 12y	<ul style="list-style-type: none"> • "Prudent" • "Western" 	Colon cancer risk: Q1 ref <ul style="list-style-type: none"> • "<i>Prudent</i>" pattern was not significantly associated with risk of colon cancer (NS) • "<i>Western</i>" Q1 vs. Q5: RR=1.46 (95% CI=0.97-2.19; P for trend=0.02) Rectal Cancer Risk: No association with risk of rectal cancer.	Consuming a "Western" dietary pattern was associated with increased risk of colon cancer, but not rectal cancer. Consuming a "Prudent" dietary pattern was not associated with either colon or rectal cancer.



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Kesse, 2006 PCS; France (EPIC-France) Risk of Bias: 4/24	N=67,484 women (~51y) 172 cases; 6.3y	<ul style="list-style-type: none"> • "Healthy" • "Western" • "Drinker" • "Meat eaters" 	<ul style="list-style-type: none"> • "Healthy": (Quartile 1 vs. quartile 4), NS • "Western": (Quartile 1 vs. quartile 4), NS • "Drinker": (Quartile 1 vs. quartile 4), NS • "Meat Eaters": (Quartile 1 (ref) vs. quartile 4), RR=1.58 (95% CI=0.98-2.53; P for trend=0.02) 	The "Meat Eaters" pattern was associated with increased risk of colorectal cancer in women. This association was stronger in women above 51y vs. below. Other diets were not associated with colorectal cancer risk.
Kim, 2005 PCS; Japan (Japan Public Health Center Study Cohort 1) Risk of Bias: 5/24	N=42,112 (40-59y) 370 cases; 10y	<ul style="list-style-type: none"> • "Prudent" • "Traditional" • "Western" 	<p>Males: No association with colorectal cancer risk.</p> <p>Females total colon cancer:</p> <ul style="list-style-type: none"> • <i>"Traditional" dietary pattern, quartile 1 (ref) vs. quartile 4: OR=2.06 (95% CI 1.10-3.84, P for trend 0.11)</i> • <i>"Western" dietary pattern, quartiles 1 (ref) vs. quartile 4: OR=2.21 (95% CI 1.10-4.45, P for trend 0.74)</i> • No association with total colorectal or rectal cancer risk 	Traditional and Western dietary pattern was significantly associated with increased risk of colon cancer in females. Dietary patterns were not associated with total colorectal cancer risk in females. No dietary patterns were associated with total colorectal or site specific colorectal cancers in males.
Terry, 2001 PCS; Sweden (Swedish Mammography Cohort) Risk of Bias: 7/24	N=61,463 women (40-74y) 460 cases; 9.6y	<ul style="list-style-type: none"> • "Healthy" • "Western" • "Drinker" 	No associations with colorectal cancer risk in women.	No clear association between three distance dietary patterns and colorectal cancer risk.
Wirfalt, 2009 PCS; US (NIH-	N=492,306 (50-71y)	<ul style="list-style-type: none"> • "Many foods " • "Vegetable and fruit" 	Colorectal cancer risk with "Many foods" as referent group:	A food pattern characterized by high intake of vegetables, fruits and other foods high in micronutrients and low in fat, was



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AARP) Risk of Bias: 3/24	3,110 cases; 4.5y	<ul style="list-style-type: none"> • "Fatty meats" • "Fat-reduced foods" • "Diet foods and lean meats" 	Men: <ul style="list-style-type: none"> • "Vegetables and fruit": HR=0.85 (95% CI=0.76-0.94) • "Fatty meats": NS • "Fat-reduced foods": NS Women: No associations with colorectal cancer risk.	associated with reduced colorectal cancer incidence after multivariate adjustments in men, but not women. This same association was seen for men in rectal cancer incidence, but not significant in colon cancer. Other dietary patterns showed no significant associations after multivariate adjustments for men or women.
Wu, 2004 PCS; US (HPFS) Risk of Bias: 2/24	N=47,311 men (~54y) 474 cases; 14y	<ul style="list-style-type: none"> • "Prudent" • "Western" 	No associations with colorectal cancer risk in men.	The data do not provide evidence for association between higher prudent or western pattern scores and risk of colon cancer in fully adjusted models. Partially adjusted models support a moderate association between higher western pattern scores and higher risk of total colon cancer.
Reduced Rank Regression				
Fung, 2012 PCS; US (NHS) Risk of Bias: 2/24	N=67,714 women (30-55 y) 985 cases; 20y	"C-peptide"	Total colorectal cancer risk: "C-peptide" dietary pattern Q1 (ref) vs. Q5: RR=1.29 (95% CI=1.05-1.58; P for trend=0.048) Colon cancer risk: "C-peptide" dietary pattern Q1 (ref) vs. Q5: RR=1.35 (95% CI=1.07-1.70; P for trend=0.0009) Rectal cancer risk: NS	Consuming a dietary pattern correlated with C-peptide (higher in meat, fish, sweetened beverages; lower in coffee, high fat dairy, whole grains) was associated with increased risk of colon cancer, especially among overweight/sedentary women.
Other Dietary Patterns Methods				



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Key, 2009 PCS; UK (EPIC-Oxford) Risk of Bias: 9/24	N=52,706 women (~45 y) 228 cases; 8y	<ul style="list-style-type: none"> • Vegetarians • Non-vegetarians: • Meat eaters • Fish eaters 	“Vegetarians” vs. “Non-vegetarians” (ref): IRR=1.49 (95% CI=1.09-2.03; P for trend=0.015) “Vegetarians” vs. “Meat eaters” (ref): IRR=1.39 (95% CI=1.01-1.91; P for trend=0.012) “Fish eaters” vs. “Meat eaters” (ref): NS	Risk of colorectal cancer was higher in vegetarians compared to non-vegetarians, and in vegetarians compared to meat eaters.
Beresford, 2006 RCT; US (Women’s Health Initiative Dietary Modification Trial) Risk of Bias: 4/24	N=46,755 (50-79y) 480 cases; 8.1y	<ul style="list-style-type: none"> • Intervention dietary goal: 20% calories from fat, 5 daily servings of fruits and vegetables, 6 daily servings of grains • Comparison group: Received nutrition information, but no other instructions 	No associations with colorectal cancer risk in women.	An intervention aimed toward a low-fat eating pattern did not reduce colorectal cancer risk in postmenopausal women. The self-reported first occurrence of polyps or adenomas was lower in dietary intervention women, suggesting that longer follow-up (currently planned) may reveal delayed benefit in favor of the intervention.

*Risk of Bias as determined using the Nutrition Evidence Library Bias Assessment Tool

**Additional details regarding the dietary patterns, as reported by the authors, are found in the “Description of Evidence” section of the Evidence Portfolio