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REVIEW ARTICLE

Association between carotenoids and prostate cancer risk: A Meta-Analysis

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Supplementary tables

Supplementary Table 1. Subgroup analysis results of the association between β-carotene and prostate cancer

Subgroup	№ of studies (№ of datasets)	References	Meta-analysis model	OR [95% CI]	Z-test	Heterogeneity		
						I^2 (%)	T^2	X^2
All studies	11 (15)	[12, 13, 20–22, 24–28, 30]	RE	0.93 [0.78-1.11]	0.78 (*P* = 0.43)	54	0.06	30.12, df = 14 (*P* = 0.007)
Study type								
Case-control	9 (13)	[12, 13, 20–22, 25, 27, 28, 30]	RE	0.95 [0.78-1.16]	0.50 (*P* = 0.62)	56	0.07	27.57, df = 12 (*P* = 0.006)
Cohort	2 (2)	[24, 26]	RE	0.79 [0.46-1.35]	0.87 (*P* = 0.38)	50	0.08	2.01, df = 1 (*P* = 0.16)
Study location								
North America	6 (9)	[12, 13, 20–22, 24]	RE	1.02 [0.83, 1.26]	0.23 (*P* = 0.82)	42	0.04	15.60, df = 9 (*P* = 0.08)
Australia	3 (4)	[25–27]	FE	1.00 [0.76, 1.31]	0.01 (*P* = 1.00)	0	N/A	0.50, df = 2 (*P* = 0.78)
Europe	1 (1)	[28]	FE	0.72 [0.55-0.94]	2.39 (*P* = 0.02)	N/A		
Asia	1 (1)	[30]	FE	0.34 [0.17-0.69]	2.99 (*P* = 0.003)		N/A	
Methods								
Serum	7 (11)	[12, 13, 20–22, 24, 25]	RE	1.01 [0.84-1.23]	0.12 (*P* = 0.90)	38	0.04	16.11, df = 10 (*P* = 0.10)
Dietary	4 (4)	[26–28, 30]	RE	0.77 [0.53-1.12]	1.36 (*P* = 0.17)	68	0.09	9.29, df = 3 (*P* = 0.03)
Adjusted confounders								
Age	8 (12)	[12, 20–22, 25, 27, 28, 30]	RE	0.97 [0.78, 1.19]	0.32 (*P* = 0.75)	59	0.08	26.82, df = 11 (*P* = 0.005)
Family history of PC	4 (5)	[13, 20, 28, 30]	RE	0.70 [0.57-0.87]	3.19 (*P* = 0.001)	16	0.01	4.78, df = 4 (*P* = 0.31)
Body mass index	4 (5)	[13, 20, 28, 30]	RE	0.70 [0.57-0.87]	3.19 (*P* = 0.001)	16	0.01	4.78, df = 4 (*P* = 0.31)
Smoking	3 (5)	[13, 21, 22]	FE	1.06 [0.85, 1.32]	0.50 (*P* = 0.62)	4	N/A	4.17, df = 4 (*P* = 0.38)
Education	3 (4)	[20, 28, 30]	RE	0.67 [0.51, 0.90]	2.70 (*P*=0.007)	35	0.03	4.61, df = 3 (*P* = 0.20)
Study Center	3 (4)	[12, 21, 28]	RE	1.06 [0.71, 1.58]	0.28 (*P* = 0.78)	76	0.12	12.58, df = 3 (*P* = 0.006)
Height	2 (2)	[13, 27]	FE	0.95 [0.69, 1.29]	0.35 (*P* = 0.72)	9	N/A	1.10, df = 1 (*P* = 0.30)

BMI Body mass index, *df* degree of freedom, *FE* fixed effects, *N/A* not-applicable, *PC* prostate cancer, *OR* odds ratio, *RE* random effects.

Supplementary Table 2. Subgroup analysis results of the association between Lutein-Zeaxanthin and prostate cancer

Subgroups	№ of studies (№ of datasets)	References	Meta-analysis model	OR [95% CI]	Z- test	Heterogeneity		
						I^2 (%)	T^2	X^2
All studies	6 (9)	[12, 13, 20, 21, 28, 30]	RE	0.86 (0.64-1.15)	1.01 (*P* = 0.31)	72	0.13	28.26, df = 8 (*P* = 0.0004)
Study type								
Case-Control	6 (9)	[12, 13, 20, 21, 28, 30]	RE	0.86 (0.64-1.15)	1.01 (*P* = 0.31)	72	0.13	28.26, df = 8 (*P* = 0.0004)
Study location								
North America	4 (7)	[12, 13, 20, 21]	FE	0.96 [0.81, 1.14]	0.45 (*P* = 0.65)	0	N/A	4.29, df = 6 (*P* = 0.64)
Asia	1 (1)	[30]	FE	0.02 [0.10-0.10]	4.98 (*P* < 0.00001)		N/A	
Europe	1 (1)	[28]	FE	0.91 [0.69-1.20]	0.67 (*P* = 0.50)		N/A	
Methods								
Serum	4 (7)	[12, 13, 20, 21]	FE	0.96 [0.81, 1.14]	0.45 (*P* = 0.65)	0	N/A	4.29, df = 6 (*P* = 0.64)
Dietary	2 (2)	[28, 30]	RE	0.15 [0.00, 5.79]	1.01 (P = 0.31)	96	6.56	22.77, df=1 (*P* < 0.00001)
Adjusted confounders								
Age	5 (8)	[12, 20, 21, 28, 30]	RE	0.85 [0.61, 1.19]	0.93 (P = 0.35)	72	0.15	28.11, df = 7 (*P* = 0.0002)
Family history of PC	4 (5)	[13, 20, 28, 30]	RE	0.72 [0.38, 1.36]	1.01 (P= 0.31)	86	0.39	27.77, df=4 (*P* < 0.0001)
Education	3 (4)	[20, 28, 30]	RE	0.65 [0.28-1.49]	1.02 (P= 0.31)	89	0.57	27.61, df=3 (*P* < 0.00001)
Body mass index	4 (5)	[13, 20, 28, 30]	RE	0.72 [0.38, 1.36]	1.01 (P = 0.31)	86	0.39	27.77, df = 4 (*P* < 0.0001)
Study Center	2 (3)	[21, 28]	FE	0.88 [0.70, 1.11]	1.08 (P = 0.28)	0	N/A	0.22, df = 2 (*P* = 0.89)
Smoking	2 (3)	[13, 21]	FE	0.82 [0.60, 1.14]	1.17 (P = 0.24)	0	N/A	0.05, df = 2 (*P* = 0.97)
Caloric intake	2 (2)	[28, 30]	RE	0.15 [0.00, 5.79]	1.01 (P = 0.31)	96	6.56	22.77, df = 1 (*P* < 0.00001)

BMI Body mass index, *df* degree of freedom, *FE* fixed effects, *N/A* not-applicable, *PC* prostate cancer, *OR* odds ratio, *RE* random effects.

Supplementary Table 3. Subgroup analysis results of the association between α-Carotene and prostate cancer

Subgroups	№ of studies (№ of datasets)	References	Meta-analysis model	OR [95% CI]	Z- test	Heterogeneity		
						I^2 (%)	T^2	X^2
All studies	6 (6)	[12, 13, 21, 24, 28, 30]	RE	0.80 [0.60-1.07]	1.47 (*P* = 0.14)	59	0.07	12.16, df = 5 (*P* = 0.03)
Study type								
Case-Control	5 (5)	[12, 13, 21, 28, 30]	RE	0.86 [0.64-1.15]	1.01 (*P* = 0.31)	58	0.06	9.54, df = 4 (*P* = 0.05)
Cohort	1 (1)	[24]	RE	0.52 [0.27-0.99]	2.00 (*P* = 0.05)	N/A	N/A	N/A
Study location								
North America	4 (4)	[12, 13, 21, 24]	RE	0.87 [0.59, 1.29]	0.70 (*P* = 0.48)	61	0.10	7.64, df = 3 (*P* = 0.05)
Asia	1 (1)	[30]	FE	0.43 [0.21,0.85]	2.40 (*P* = 0.02)	N/A	N/A	N/A
Europe	1 (1)	[28]	FE	0.85 [0.66,1.11]	1.17 (*P* = 0.24)	N/A	N/A	N/A
Methods								
Serum	4 (4)	[12, 13, 21, 24]	RE	0.87 [0.59-1.29]	0.70 (*P* = 0.48)	61	0.10	7.64, df = 3 (*P* = 0.05)
Dietary	2 (2)	[28, 30]	RE	0.65 [0.33-1.27]	1.26 (*P*= 0.21)	70	0.17	3.36, df = 1 (*P* = 0.07)
Adjusted confounders								
Age	4 (4)	[12, 21, 28, 30]	RE	0.90 [0.64, 1.27]	0.58 (*P* = 0.56)	62	0.07	7.96, df = 3 (*P* = 0.05)
Family history of PC	3 (3)	[13, 28, 30]	RE	0.69 [0.49-0.99]	2.00 (*P*= 0.05)	46	0.05	3.69, df = 2 (*P* = 0.16)
Education	2 (2)	[28, 30]	RE	0.65 [0.33,1.27]	1.26 (*P*= 0.21)	70	0.17	3.36, df=1 (*P* = 0.07)
Body mass index	3 (3)	[13, 28, 30]	RE	0.69 [0.49-0.99]	2.00 (*P*= 0.05)	46	0.05	3.69, df = 2 (*P* = 0.16)
Study Center	2 (2)	[21, 28]	FE	0.91 [0.72, 1.15]	0.80 (*P* = 0.42)	7	N/A	1.07, df = 1 (*P* = 0.30)
Smoking	2 (2)	[13, 21]	RE	0.87 [0.50, 1.53]	0.47 (*P* = 0.64)	56	0.09	2.29, df = 1 (*P* = 0.13)
Caloric intake	2 (2)	[28, 30]	RE	0.65 [0.33-1.27]	1.26 (*P*= 0.21)	70	0.17	3.36, df = 1 (*P* = 0.07)

BMI Body mass index, *df* degree of freedom, *FE* fixed effects, *N/A* not-applicable, *PC* prostate cancer, *OR* odds ratio, *RE* random effects.

Supplementary Table 4. Subgroup analysis results of the association between β-Cryptoxanthin and prostate cancer

Subgroups	№ of studies (№ of datasets)	References	Meta-analysis model	OR [95% CI]	Z- test	Heterogeneity		
						I^2 (%)	T^2	X^2
All studies	6 (7)	[12, 13, 20, 21, 28, 30]	RE	0.80 [0.58,1.09]	1.42 (P = 0.16)	70	0.12	19.74, df=6 (p=0.003)
Study type								
Case-control	6 (7)	[12, 13, 20, 21, 28, 30]	RE	0.80 [0.58,1.09]	1.42 (P = 0.16)	70	0.12	19.74, df=6 (p=0.003)
Study location								
Asia	1 (1)	[30]	RE	0.15 [0.06,0.34]	4.51 (P< 0.00001)	N/A	N/A	N/A
Europe	1 (1)	[28]	RE	0.90 [0.69,1.16]	0.80 (P = 0.42)	N/A	N/A	N/A
North America	4 (5)	[12, 13, 20, 21]	FE	0.98 [0.80, 1.20]	0.20 (P = 0.84)	0	N/A	0.93, df = 4 (P = 0.92)
Methods								
Serum	4 (5)	[12, 13, 20, 21]	FE	0.98 [0.80,1.20]	0.20 (P = 0.84)	0	N/A	0.93, df=4 (p=0.92)
Dietary	2 (2)	[28, 30]	RE	0.38 [0.07-2.23]	1.07 (P = 0.28)	94	1.52	16.56, df=1 (p<0.0001)
Adjusted confounders								
Age	5 (6)	[12, 20, 21, 28, 30]	RE	0.80 [0.58,1.09]	1.42 (P = 0.16)	70	0.12	19.74, df=6 (p=0.003)
Family history of PC	4 (5)	[13, 20, 28, 30]	RE	0.70 [0.44,1.12]	1.49 (P = 0.14)	78	0.20	17.81, df=4 (p=0.001)
Education	3 (4)	[20, 28, 30]	RE	0.64 [0.35,1.15]	1.49 (P = 0.14)	83	0.28	17.59, df=3 (p=0.0005)
Body mass index	4 (5)	[13, 20, 28, 30]	RE	0.70 [0.44,1.12]	1.49 (P = 0.14)	78	0.20	17.81, df=4 (p=0.001)
Study Center	2 (2)	[21, 28]	FE	0.88 [0.70, 1.12]	1.03 (P = 0.30)	0	N/A	0.11, df = 1 (P = 0.74)
Smoking	2 (2)	[13, 21]	FE	0.88 [0.60, 1.29]	0.66 (P = 0.51)	0	N/A	0.14, df = 1 (P = 0.70)
Caloric intake	2 (2)	[28, 30]	RE	0.38 [0.07-2.23]	1.07 (P = 0.28)	94	1.52	16.56, df=1 (p<0.0001)

BMI Body mass index, *df* degree of freedom, *FE* fixed effects, *N/A* not-applicable, *PC* prostate cancer, *OR* odds ratio, *RE* random effects.