Truths and Myths about milk and dairy products: evidence based

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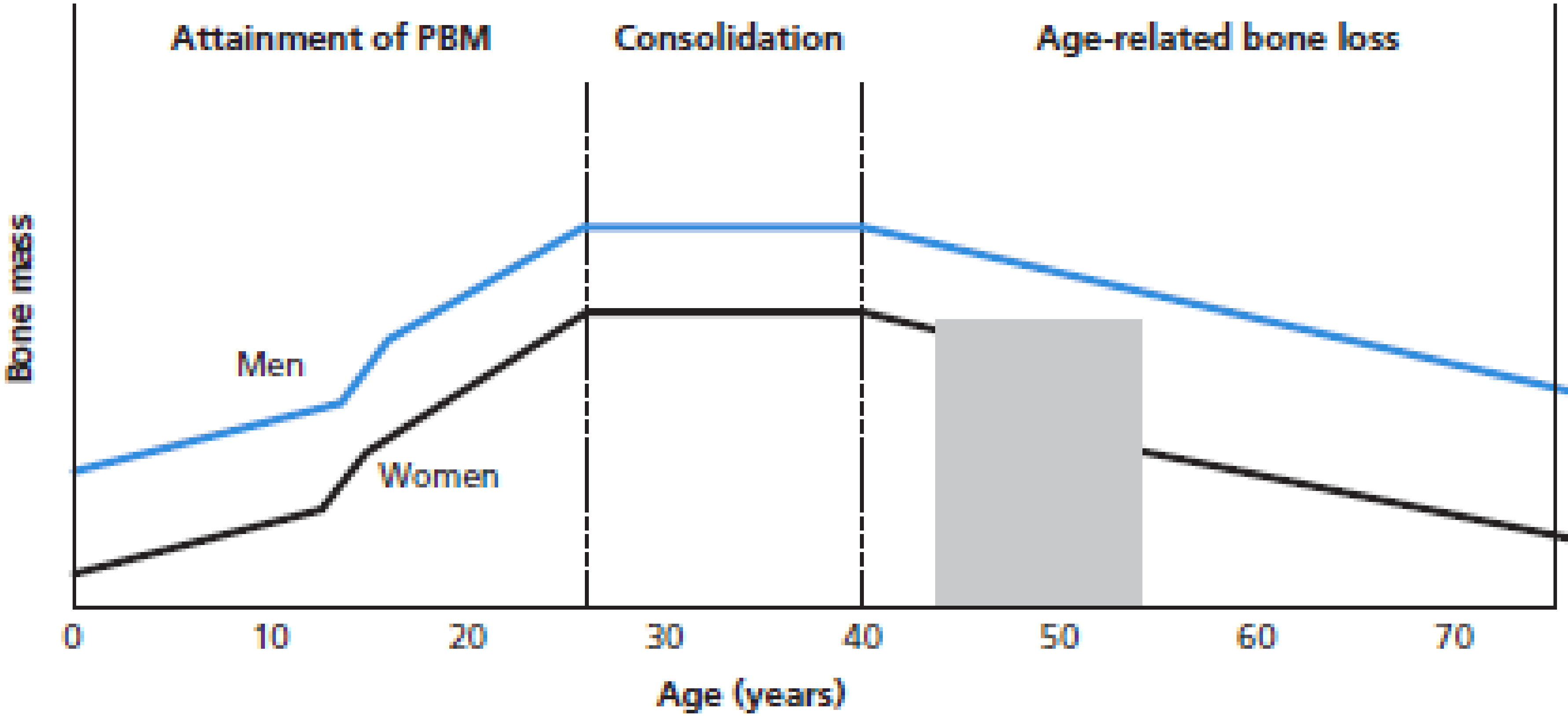
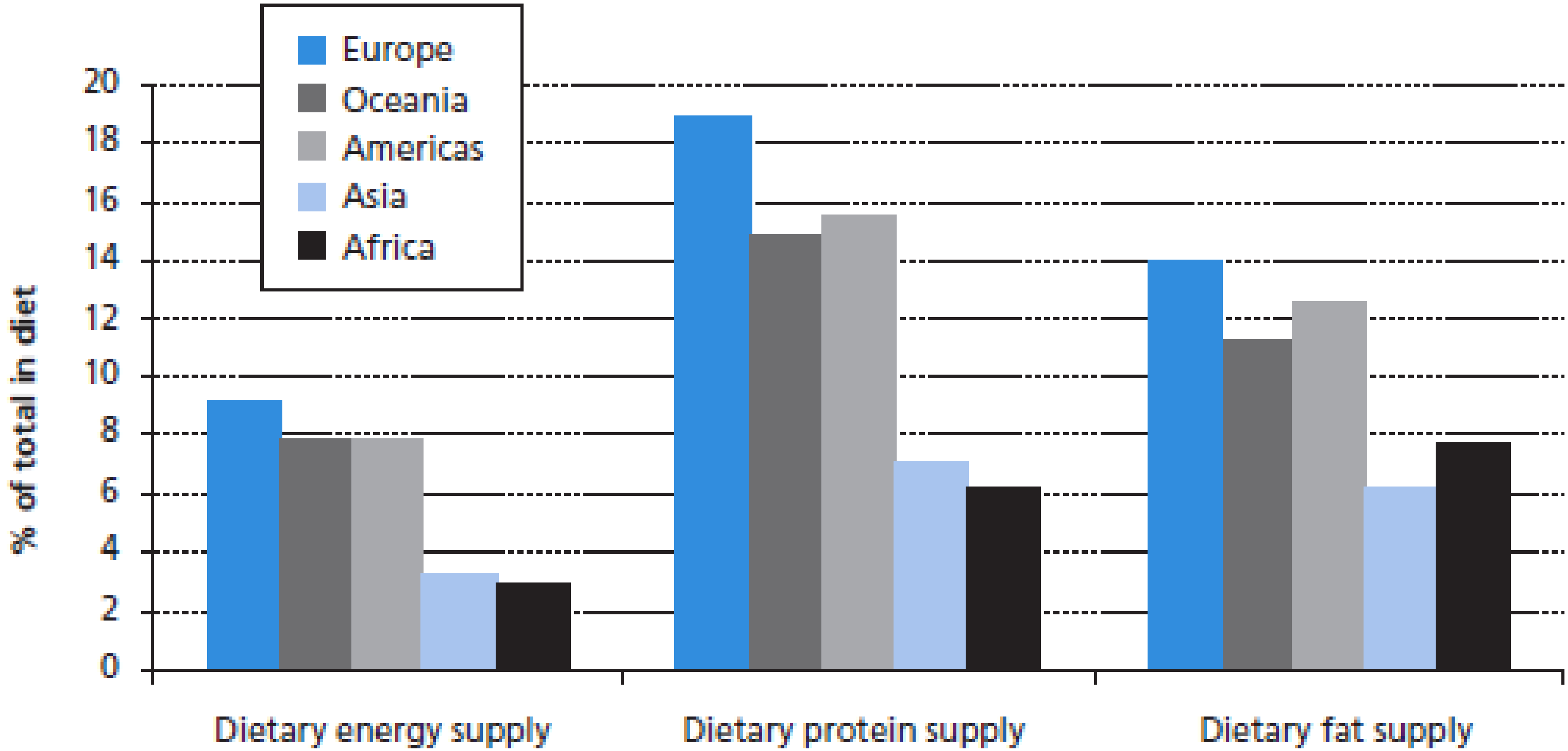
Changes in bone mass during the human life cycle



Critical times are: (1) attainment of peak bone mass (PBM: 0–28 years of age, with pubertal years being particularly crucial); (2) menopause (n; during the menopause and ≤ 10 years post menopause it is estimated that 1–2 percent of bone is lost per year); (3) age-related bone loss (a low bone mineral density threshold increases osteoporosis fracture risk)

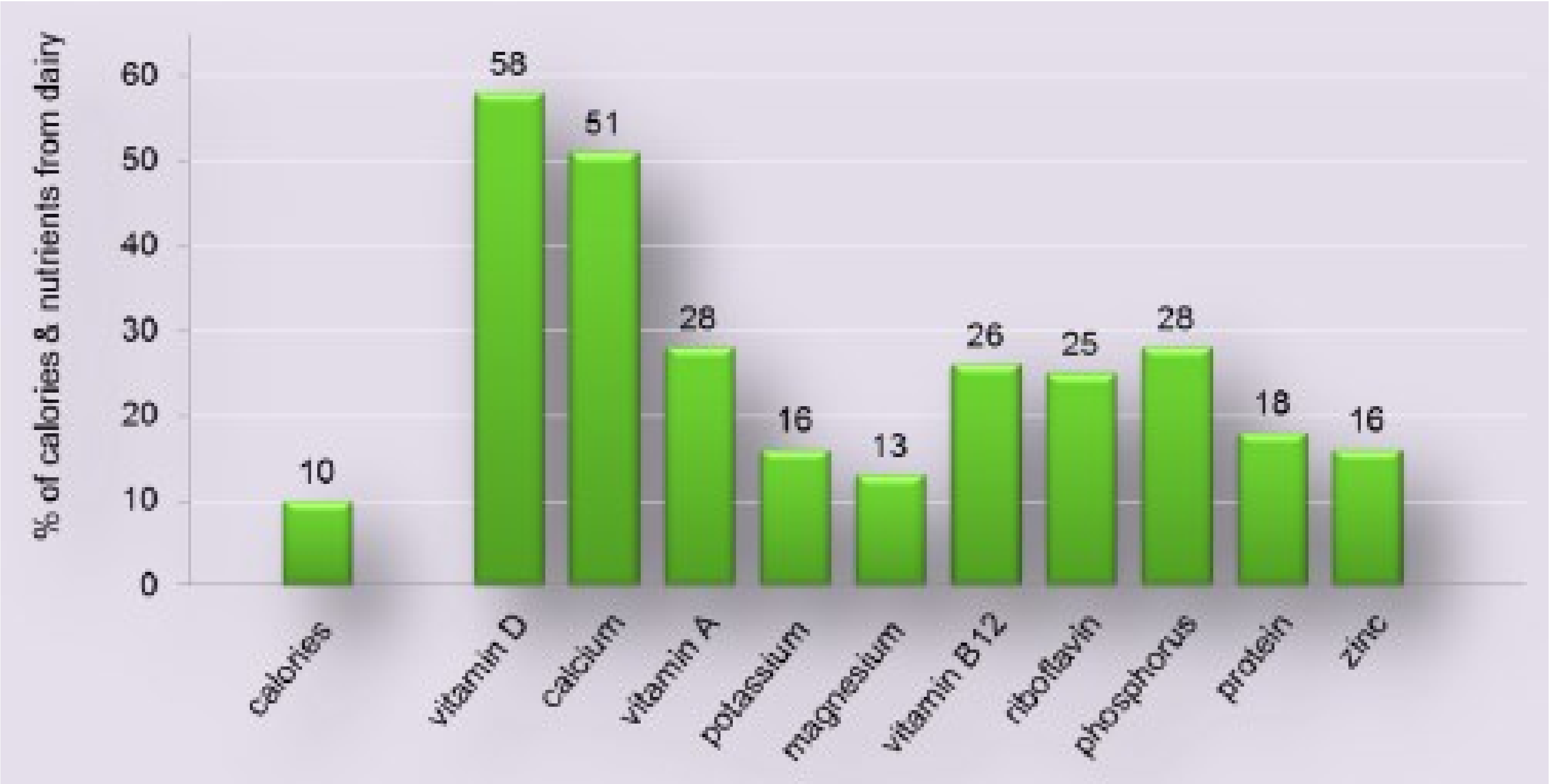
Source: Lanham-New, 2008

Milk as a source of dietary energy, protein and fat in Europe, Oceania, the Americas, Asia and Africa, 2009



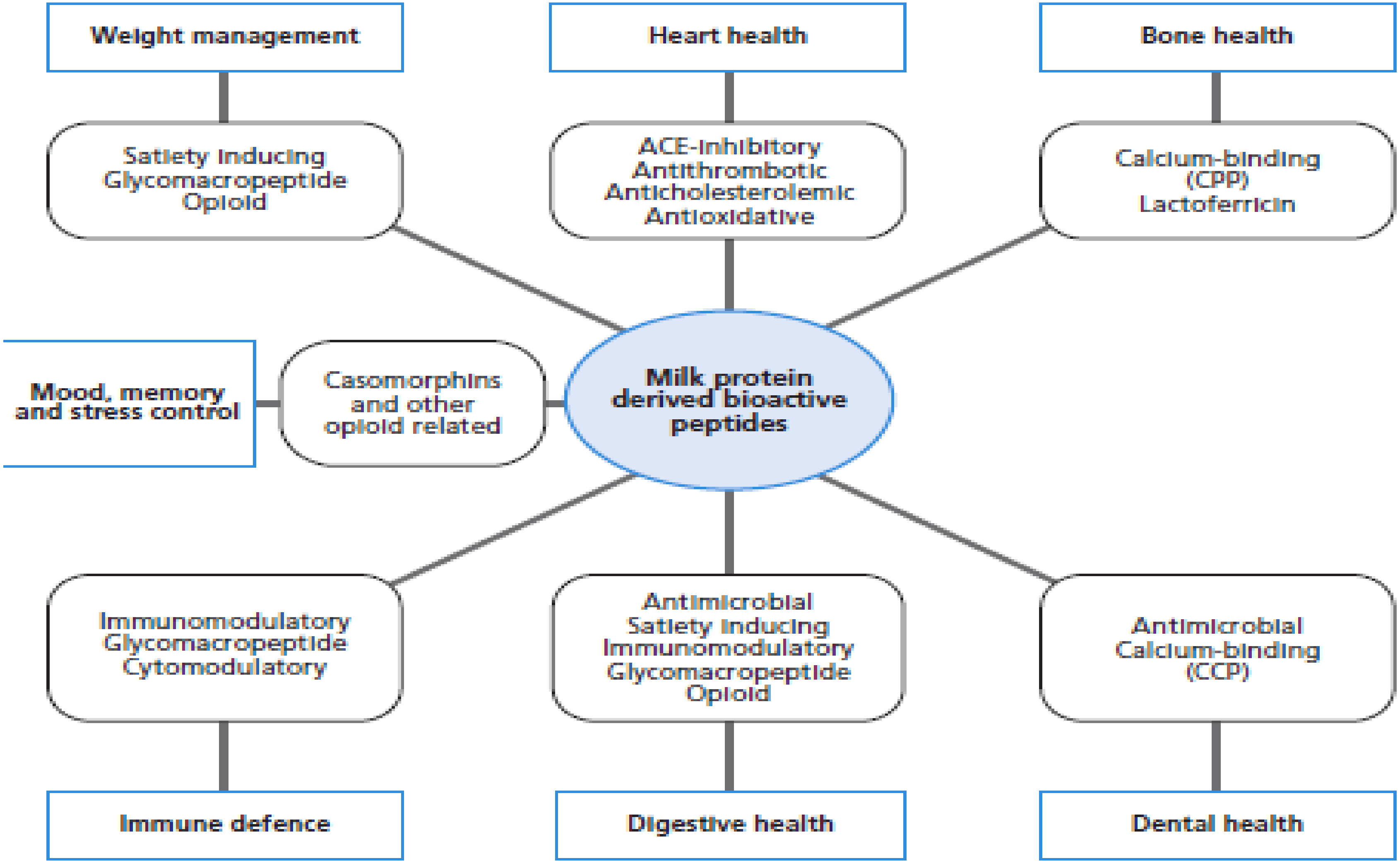
Source: Calculated from data for milk (excluding butter), 2009, from FAOSTAT (http://faostat.fao.org) Europe includes northern, southern, western and eastern Europe; Oceania includes Australia and New Zealand, Melanesia, Micronesia and Polynesia; Americas include northern, South and Central America and the Caribbean; Africa includes eastern, middle, northern, southern and western Africa; Asia includes central, eastern, southern, southeastern and western Asia

The dairy food group (milk, cheese and yogurt) is a substantial contributor of many essential nutrients in the US diet that are important for good health, including calcium, vitamin D, potassium, phosphorous, magnesium, zinc, protein, vitamin A, vitamin B-12 and riboflavin



NHANES, 2003-06

Functionality of milk protein-derived bioactive peptides and their potential health targets

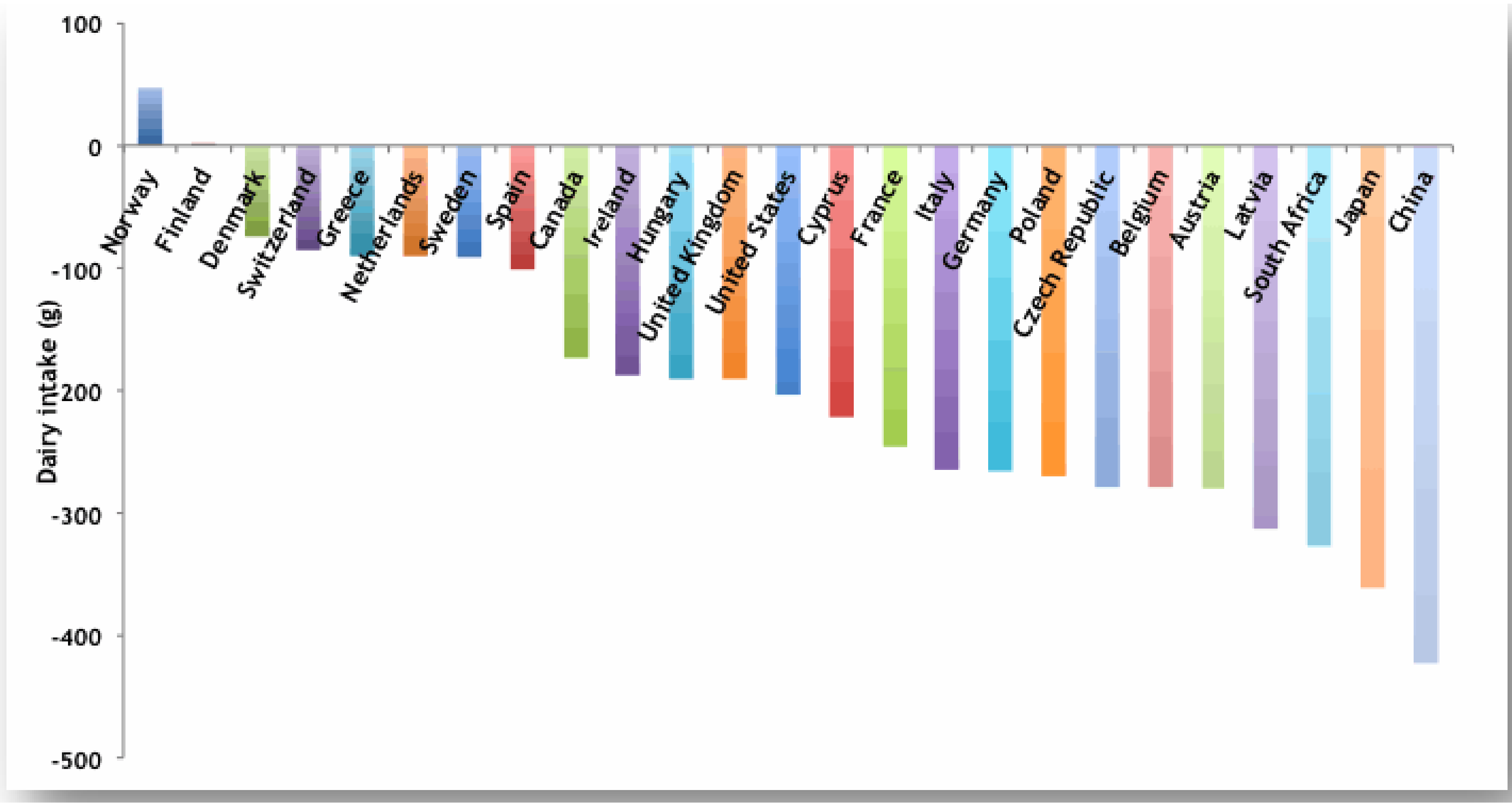


Per capita Milk Consumption from 2006 to 2012

	2006	2012	%
World	101	108	+7
Asia	61	71	+16
Africa	42	48	+14
Latin America	129	151	+17
Russia + Ukraine + Belarus	253	255	+1
EU + North America + Australia + New Zealand	290	284	-2

Available at https://slideplayer.com/slide/11662620/). From CNIEL/IDF, FAO Food Outlook, PRB

Milk and Dairy Product Consumption Compared to 450 grams/day



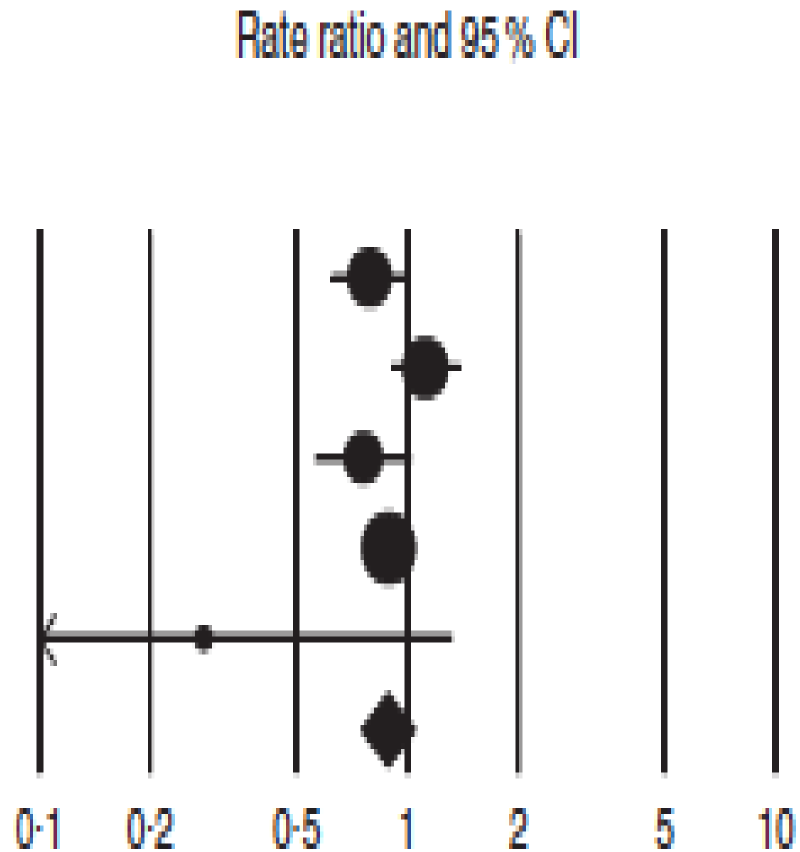
Total Mortality and CVD

Meta-analysis of total dairy intake and total CVD (high v. low intake analysis). SRRE, summary relative risk estimate

Study name	Rate ratio	Lower limit	Upper limit
Kondo 2013 (F)	0·79	0·62	1·00
Kondo 2013 (M)	1·12	0·90	1·39
Louie 2013	0·76	0·56	1·03
Sonestedt 2011	0·89	0·78	1·01
Bonthuis 2010	0·28	0·06	1·32
SRRE =	0·88	0·75	1·04

$P_H = 0{\cdot}076$

$I^2 = 52{\cdot}7$



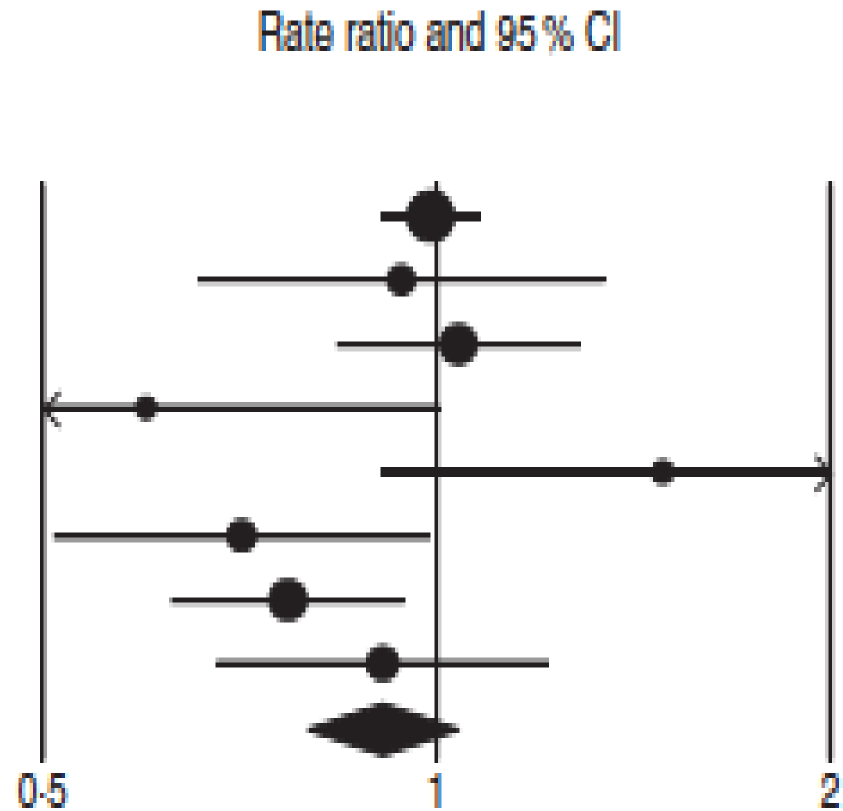
Alexander DD et al, Br J Nutr 2016, 115: 737–50

Meta-analysis of total dairy intake and total CHD (high v. low intake analysis). SRRE, summary relative risk estimate

Study name	Rate ratio	Lower limit	Upper limit
Bernstein 2010	0·99	0·91	1·08
Bostick 1999	0·94	0·66	1·34
Haring 2014	1·04	0·84	1·29
Kondo 2013 (F)	0·60	0·36	1·00
Kondo 2013 (M)	1·49	0·91	2·45
Louie 2013	0·71	0·51	0·99
Patterson 2013	0·77	0·63	0·95
Soedamah-Muthu 2012	0·91	0·68	1·22
SRRE =	0·91	0·80	1·04

$P_H = 0·038$

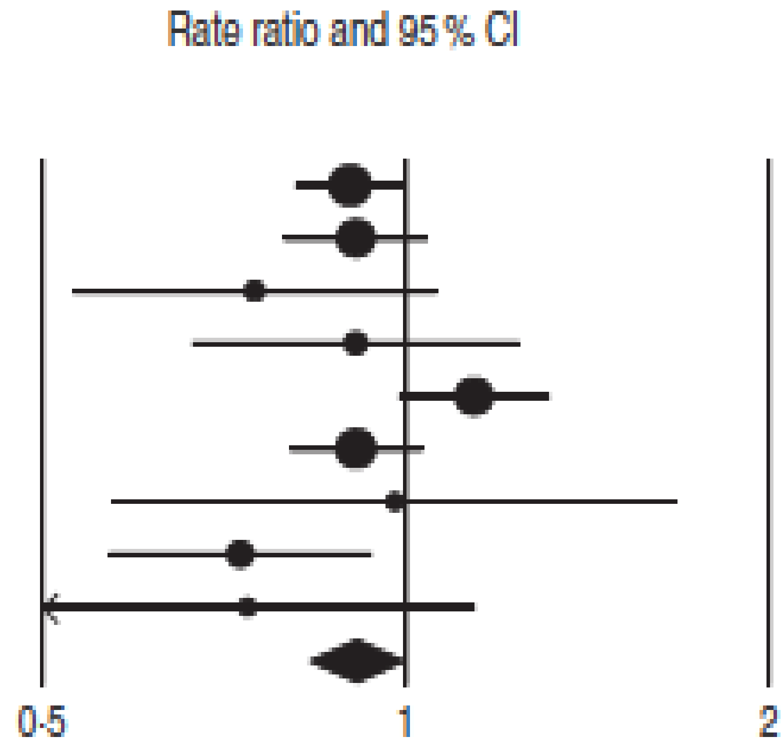
$I^2 = 52·8$



Alexander DD et al, Br J Nutr 2016, 115: 737–50

Meta-analysis of total dairy intake and total stroke. SRRE, summary relative risk estimate

Study name	Rate ratio	Lower limit	Upper limit
Bemstein 2012 (F)	0·90	0·81	1·00
Bemstein 2012 (M)	0·91	0·79	1·04
Kondo 2013 (F)	0·75	0·53	1·06
Kondo 2013 (M)	0·91	0·67	1·24
Larsson 2009 (ischaemic)	1·14	0·99	1·32
Larsson 2012	0·91	0·80	1·03
Louie 2013	0·98	0·57	1·68
Sauvaget 2003	0·73	0·57	0·94
Lin 2013	0·74	0·48	1·14
SRRE =	0·91	0·83	0·99



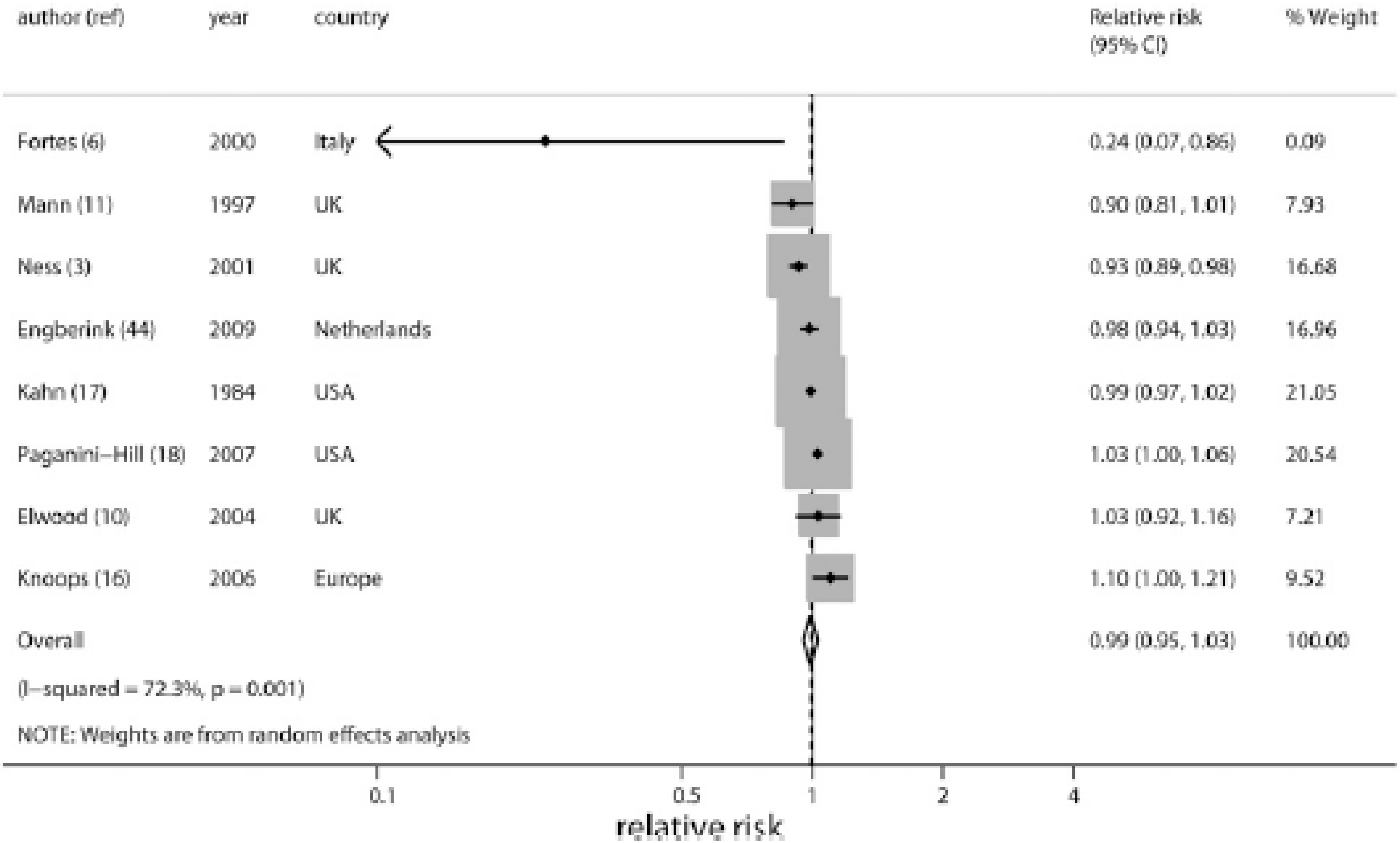
P_H = 0·324

I^2 = 0·0

Removal of Larsson 2009 in a sensitivity analyses resulted in and SRRE of 0·88 (95 % CI 0·83, –0·94) with no heterogeneity (P_H = 0·73, I^2 = 0·00)

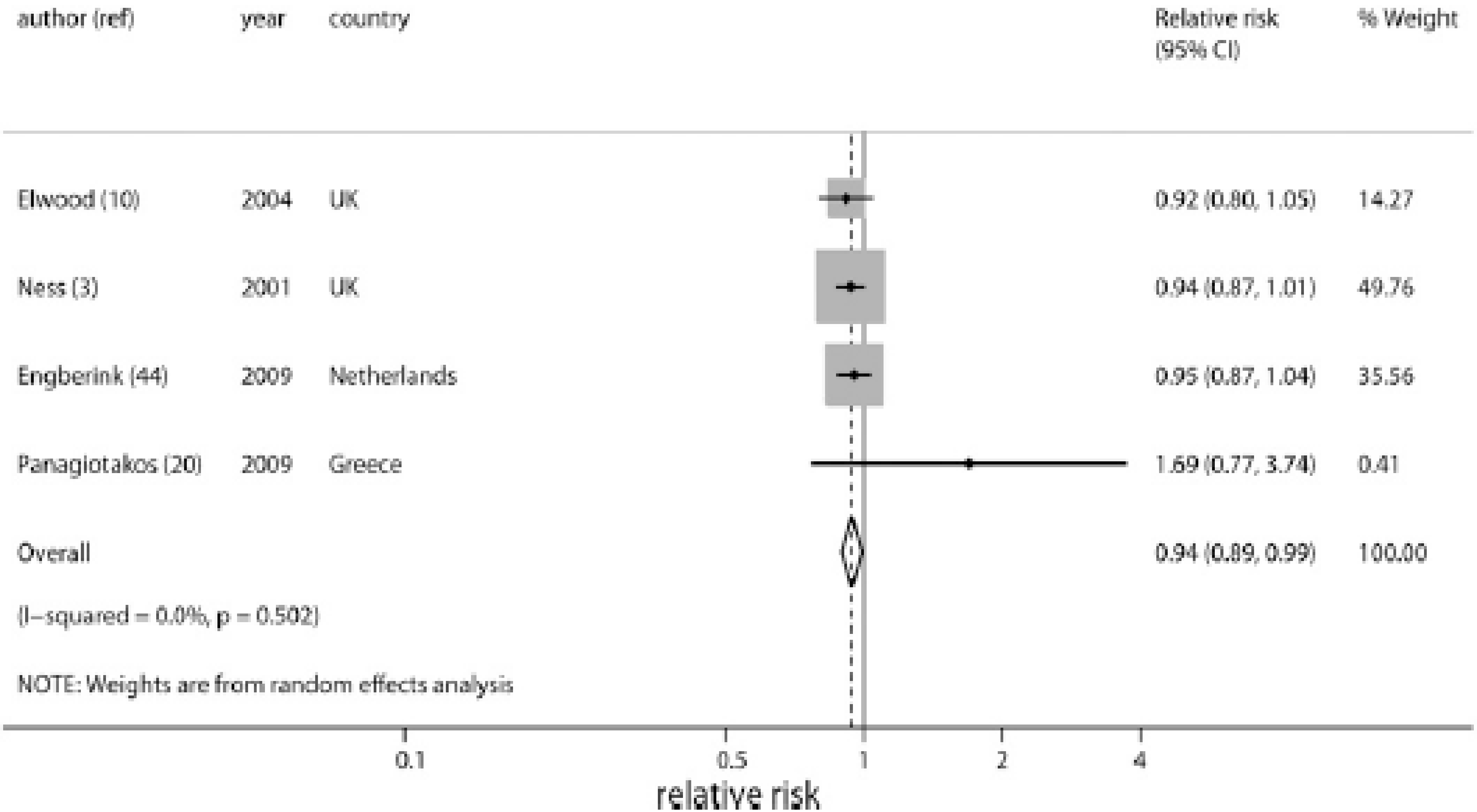
Alexander DD et al, Br J Nutr 2016, 115: 737–50

Relation between milk (per 200 mL/d) and all-cause mortality: dose-response meta-analyses of 8 prospective cohort studies (n = 62,779, no. of cases = 23,949)



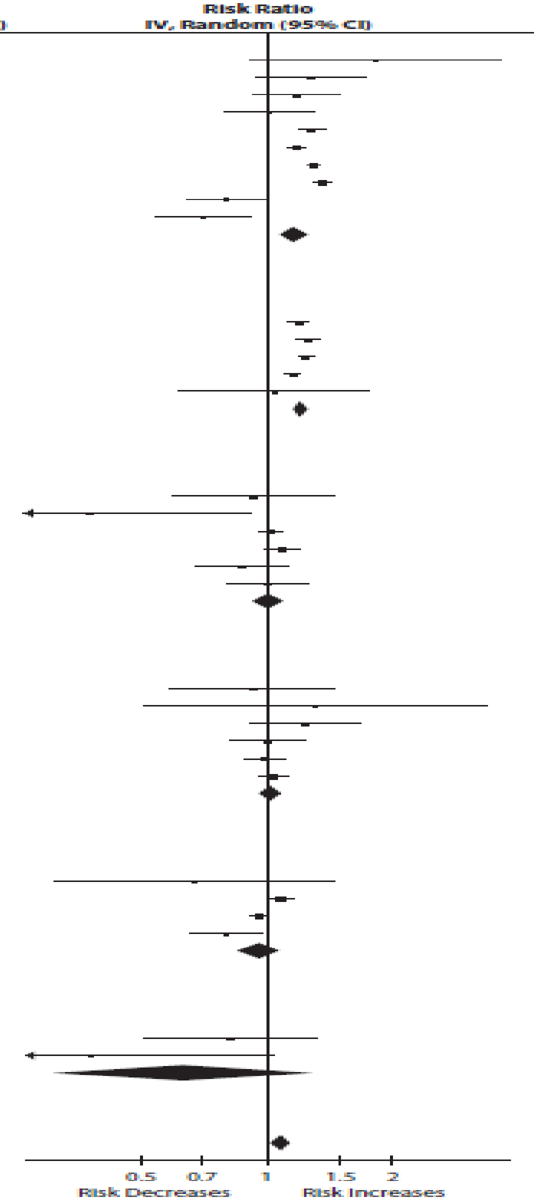
Soedamah-Muthu SS et al, Am J Clin Nutr 2011;93:158–71

Relation between milk (per 200 mL/d) and cardiovascular disease: dose-response meta-analyses of 4 prospective cohort studies (n = 13,518, no. of cases = 2283)



Soedamah-Muthu SS et al, Am J Clin Nutr 2011;93:158–71

Study or Subgroup	log(Risk Ratio); SE	Weight	Risk Ratio IV, Random (95% CI)
Meat			
Fortes et al.[16]	0.599; 0.348	0.5%	1.82 (0.92, 3.60)
Fraser and Shavlik[17] (M)	0.240; 0.153	1.9%	1.27 (0.94, 1.71)
Fraser and Shavlik[17] (F)	0.166; 0.122	2.5%	1.18 (0.93, 1.50)
Mann et al.[21]	0.014; 0.127	2.4%	1.01 (0.79, 1.30)
Pan et al.[27] (M)	0.255; 0.037	4.9%	1.29 (1.20, 1.39)
Pan et al.[27] (F)	0.174; 0.026	5.1%	1.19 (1.13, 1.25)
Sinha et al.[33] (M)	0.270; 0.016	5.2%	1.31 (1.27, 1.35)
Sinha et al.[33] (F)	0.310; 0.025	5.1%	1.36 (1.30, 1.43)
Thorogood et al.[36]	−0.223; 0.106	2.9%	0.80 (0.65, 0.98)
Whiteman et al.[38]	−0.343; 0.130	2.3%	0.71 (0.55, 0.92)
Subtotal (95% CI)		**32.9%**	**1.17 (1.08, 1.27)**
Heterogeneity: $\tau^2 = 0.01$; $\chi^2 = 61.50$ ($df = 9$; $P < .001$); $I^2 = 85\%$. Test for overall effect: $Z = 3.88$ ($P < .001$).			
Processed Meat			
Pan et al.[27] (M)	0.182; 0.027	5.1%	1.20 (1.14, 1.27)
Pan et al.[27] (F)	0.239; 0.033	4.9%	1.27 (1.19, 1.36)
Sinha et al.[33] (M)	0.225; 0.022	5.2%	1.25 (1.20, 1.31)
Sinha et al.[33] (F)	0.148; 0.018	5.2%	1.16 (1.12, 1.20)
Whiteman et al.[38]	0.045; 0.267	0.8%	1.05 (0.62, 1.76)
Subtotal (95% CI)		**21.2%**	**1.21 (1.16, 1.27)**
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 10.46$ ($df = 4$; $P = .03$); $I^2 = 62\%$. Test for overall effect: $Z = 9.09$ ($P < .001$).			
Milk			
Bonthius et al.[14]	−0.073; 0.229	1.1%	0.93 (0.59, 1.46)
Fortes et al.[16]	−0.968; 0.451	0.3%	0.38 (0.16, 0.92)
Goldbohm et al.[18] (M)	0.020; 0.034	4.9%	1.02 (0.95, 1.09)
Goldbohm et al.[27] (F)	0.086; 0.049	4.5%	1.09 (0.99, 1.20)
Mann et al.[21]	−0.135; 0.132	2.3%	0.87 (0.68, 1.13)
Whiteman et al.[38]	0.005; 0.116	2.6%	1.01 (0.80, 1.26)
Subtotal (95% CI)		**15.8%**	**1.01 (0.92, 1.11)**
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 8.09$ ($df = 5$; $P = .15$); $I^2 = 38\%$. Test for overall effect: $Z = 0.25$ ($P = .8$).			
Cheese			
Bonthius et al.[14]	−0.076; 0.231	1.1%	0.93 (0.59, 1.46)
Fortes et al.[16]	0.265; 0.480	0.3%	1.30 (0.51, 3.34)
Fraser and Shavlik[17] (M)	0.207; 0.154	1.9%	1.23 (0.91, 1.66)
Fraser and Shavlik[17] (F)	0.010; 0.106	2.9%	1.01 (0.82, 1.24)
Goldbohm et al.[18] (M)	−0.016; 0.057	4.3%	0.98 (0.88, 1.10)
Goldbohm et al.[18] (F)	0.039; 0.040	4.8%	1.04 (0.96, 1.12)
Subtotal (95% CI)		**15.2%**	**1.03 (0.97, 1.09)**
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 2.51$ ($df = 5$; $P = .78$); $I^2 = 0\%$. Test for overall effect: $Z = 0.88$ ($P = .38$).			
Butter			
Fortes et al.[16]	−0.401; 0.390	0.4%	0.67 (0.31, 1.44)
Goldbohm et al.[18] (M)	0.077; 0.034	4.9%	1.08 (1.01, 1.15)
Goldbohm et al.[18] (F)	−0.041; 0.027	5.1%	0.96 (0.91, 1.01)
Whiteman et al.[38]	−0.223; 0.098	3.1%	0.80 (0.66, 0.97)
Subtotal (95% CI)		**13.5%**	**0.96 (0.85, 1.08)**
Heterogeneity: $\tau^2 = 0.01$; $\chi^2 = 13.43$ ($df = 3$; $P = .004$); $I^2 = 78\%$. Test for overall effect: $Z = 0.68$ ($P = .5$).			
All dairy			
Bonthius et al.[14]	−0.199; 0.242	1.0%	0.82 (0.51, 1.32)
Fortes et al.[16]	−0.968; 0.510	0.3%	0.38 (0.14, 1.03)
Subtotal (95% CI)		**1.2%**	**0.64 (0.31, 1.29)**
Heterogeneity: $\tau^2 = 0.14$; $\chi^2 = 1.86$ ($df = 1$; $P = .17$); $I^2 = 46\%$. Test for overall effect: $Z = 1.25$ ($P = .21$).			
Total (95% CI)		**100.0%**	**1.09 (1.03, 1.14)**

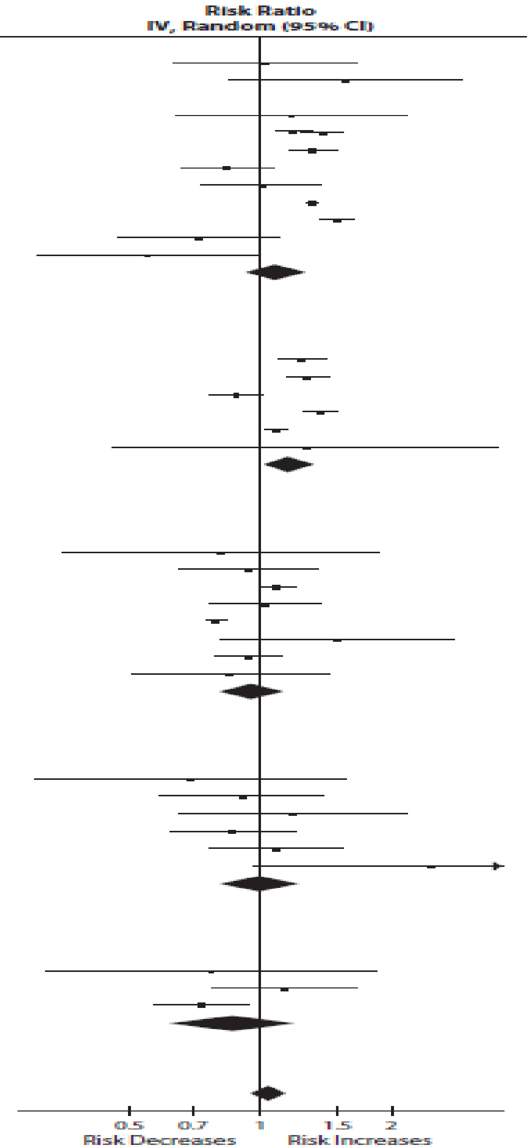


Heterogeneity: $\tau^2 = 0.01$; $\chi^2 = 277.85$ ($df = 32$; $P < .001$); $I^2 = 88\%$. Test for overall effect: $Z = 3.07$ ($P = .002$).
Test for subgroup differences: $\chi^2 = 37.57$ ($df = 5$; $P < .001$), $I^2 = 86.7\%$.

High consumption of foods containing saturated fat and the associated risk of all-cause mortality: meta-analysis of the association of food sources of saturated fat with mortality

O' Sullivan TA et al Am J Public Health. 2013; 103:e31–e42

Study or Subgroup	log(Risk Ratio); SE	Weight	Risk Ratio IV, Random (95% CI)
Meat			
Fraser and Shavlik[17] (M)	0.030; 0.248	2.1%	1.03 (0.63, 1.67)
Fraser and Shavlik[17] (F)	0.451; 0.314	1.5%	1.57 (0.85, 2.91)
Kinjo et al.[19]	−0.249; 0.048	4.3%	0.78 (0.71, 0.86)
Mann et al.[21]	0.166; 0.312	1.6%	1.18 (0.64, 2.18)
Pan et al.[27] (M)	0.329; 0.057	4.2%	1.39 (1.24, 1.55)
Pan et al.[27] (F)	0.278; 0.063	4.1%	1.32 (1.17, 1.49)
Qiu et al.[30]	−0.174; 0.123	3.5%	0.84 (0.66, 1.07)
Sauvaget et al.[32]	0.006; 0.161	3.0%	1.01 (0.73, 1.38)
Sinha et al.[33] (M)	0.270; 0.016	4.4%	1.31 (1.27, 1.35)
Sinha et al.[33] (F)	0.406; 0.046	4.3%	1.50 (1.37, 1.64)
Thorogood et al.[36]	−0.329; 0.218	2.3%	0.72 (0.47, 1.10)
Whiteman et al.[38]	−0.598; 0.293	1.7%	0.55 (0.31, 0.98)
Subtotal (95% CI)		**37.0%**	**1.09 (0.93, 1.27)**
Heterogeneity: $\tau^2=0.05$; $\chi^2=152.26$ ($df=11$; $P<.001$); $I^2=93\%$. Test for overall effect: $Z=1.04$ ($P=.3$).			
Processed Meat			
Pan et al.[27] (M)	0.223; 0.061	4.2%	1.25 (1.11, 1.41)
Pan et al.[27] (F)	0.252; 0.055	4.2%	1.29 (1.15, 1.43)
Sauvaget et al.[32]	−0.129; 0.068	4.1%	0.88 (0.77, 1.00)
Sinha et al.[33] (M)	0.322; 0.046	4.3%	1.38 (1.26, 1.51)
Sinha et al.[33] (F)	0.086; 0.029	4.4%	1.09 (1.03, 1.15)
Whiteman et al.[38]	0.244; 0.521	0.7%	1.28 (0.46, 3.54)
Subtotal (95% CI)		**21.9%**	**1.17 (1.02, 1.33)**
Heterogeneity: $\tau^2=0.02$; $\chi^2=40.56$, ($df=5$ $P<.001$); $I^2=88\%$. Test for overall effect: $Z=2.29$ ($P=.02$).			
Milk			
Bonthius et al.[14]	−0.211; 0.428	1.0%	0.81 (0.35, 1.87)
Bostick et al.[15]	−0.062; 0.184	2.7%	0.94 (0.65, 1.35)
Goldbohm et al.[18] (M)	0.086; 0.049	4.3%	1.09 (0.99, 1.20)
Goldbohm et al.[18] (F)	0.030; 0.148	3.1%	1.03 (0.77, 1.38)
Kinjo et al.[19]	−0.236; 0.027	4.4%	0.79 (0.75, 0.83)
Mann et al.[21]	0.406; 0.314	1.5%	1.50 (0.81, 2.78)
Sauvaget et al.[32]	−0.062; 0.089	3.9%	0.94 (0.79, 1.12)
Whiteman et al.[38]	−0.163; 0.268	1.9%	0.85 (0.50, 1.43)
Subtotal (95% CI)		**22.8%**	**0.96(0.81, 1.13)**
Heterogeneity: $\tau^2=0.03$; $\chi^2=39.42$ ($df=7$; $P<.001$); $I^2=82\%$. Test for overall effect: $Z=0.51$ ($P=.61$).			
Cheese			
Bonthius et al.[14]	−0.371; 0.417	1.0%	0.69 (0.31, 1.56)
Fraser and Shavlik[17] (M)	−0.094; 0.221	2.3%	0.91 (0.59, 1.40)
Fraser and Shavlik[17] (F)	0.174; 0.309	1.6%	1.19 (0.65, 2.18)
Goldbohm et al.[18] (M)	−0.145; 0.166	2.9%	0.87 (0.62, 1.20)
Goldbohm et al.[18] (F)	0.086; 0.181	2.7%	1.09 (0.77, 1.55)
Mann et al.[21]	0.904; 0.477	0.8%	2.47 (0.97, 6.29)
Subtotal (95% CI)		**11.4%**	**1.00 (0.81, 1.24)**
Heterogeneity: $\tau^2=0.01$; $\chi^2=5.87$ ($df=5$; $P=.32$); $I^2=15\%$. Test for overall effect: $Z=0.01$ ($P>.999$).			
All dairy			
Bonthius et al.[14]	−0.261; 0.448	0.9%	0.77 (0.32, 1.85)
Bostick et al.[15]	0.131; 0.194	2.6%	1.14 (0.78, 1.67)
Sauvaget et al.[32]	−0.315; 0.126	3.4%	0.73 (0.57, 0.93)
Subtotal (95% CI)		**6.9%**	**0.87 (0.62, 1.20)**
Heterogeneity: $\tau^2=0.04$; $\chi^2=3.75$ ($df=2$; $P=.15$); $I^2=47\%$. Test for overall effect: $Z=0.86$ ($P=.39$).			
Total (95% CI)		**100.0%**	**1.05 (0.95, 1.15)**

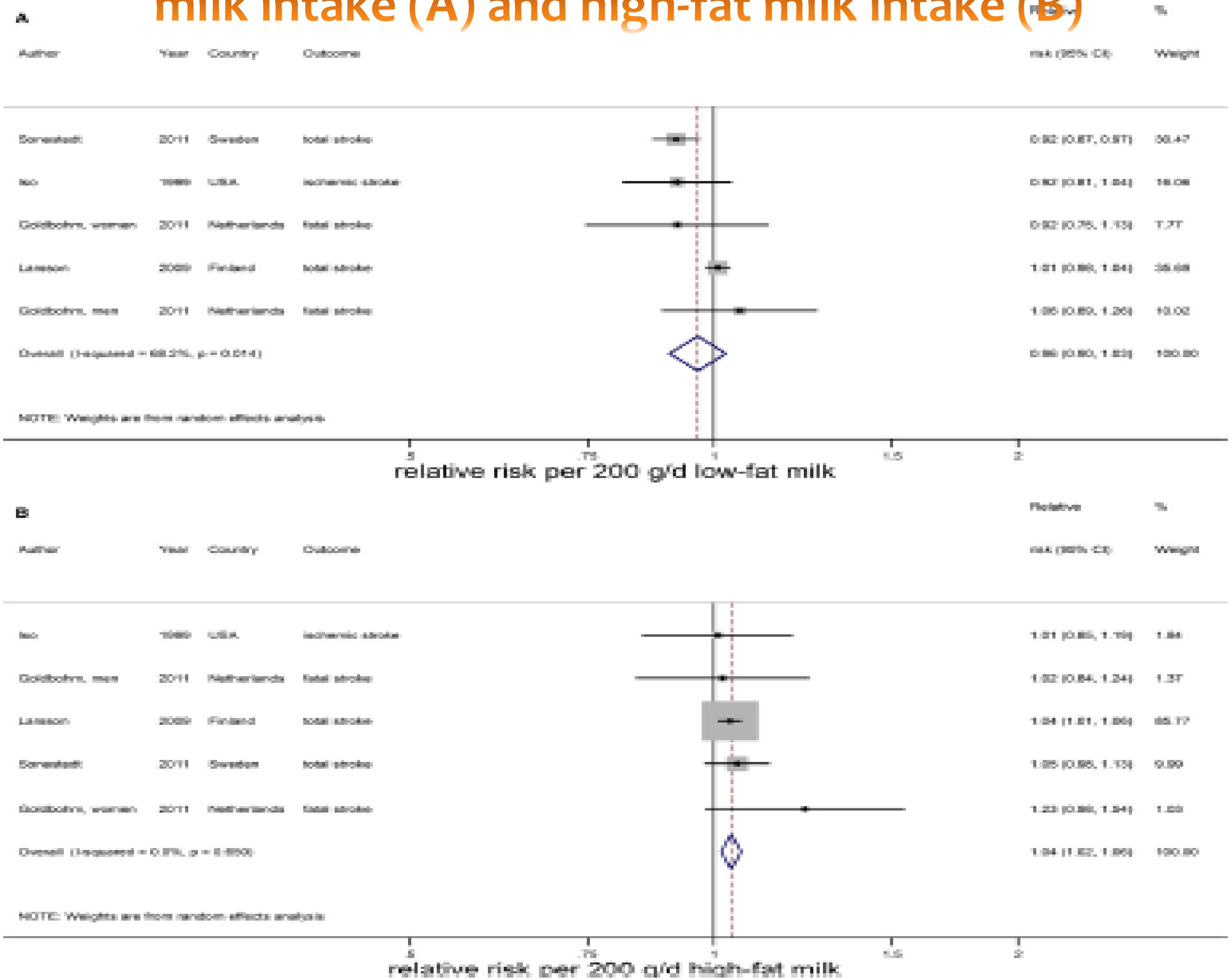


Heterogeneity: $\tau^2=0.05$; $\chi^2=475.09$ ($df=34$; $P<.001$); $I^2=93\%$. Test for overall effect: $Z=1.00$ ($P=.32$).
Test for subgroup differences: $\chi^2=5.30$, ($df=4$; $P=.26$); $I^2=24.6\%$.

High consumption of foods containing saturated fat and the associated risk of cardiovascular disease mortality: meta-analysis of the association of food sources of saturated fat with mortality

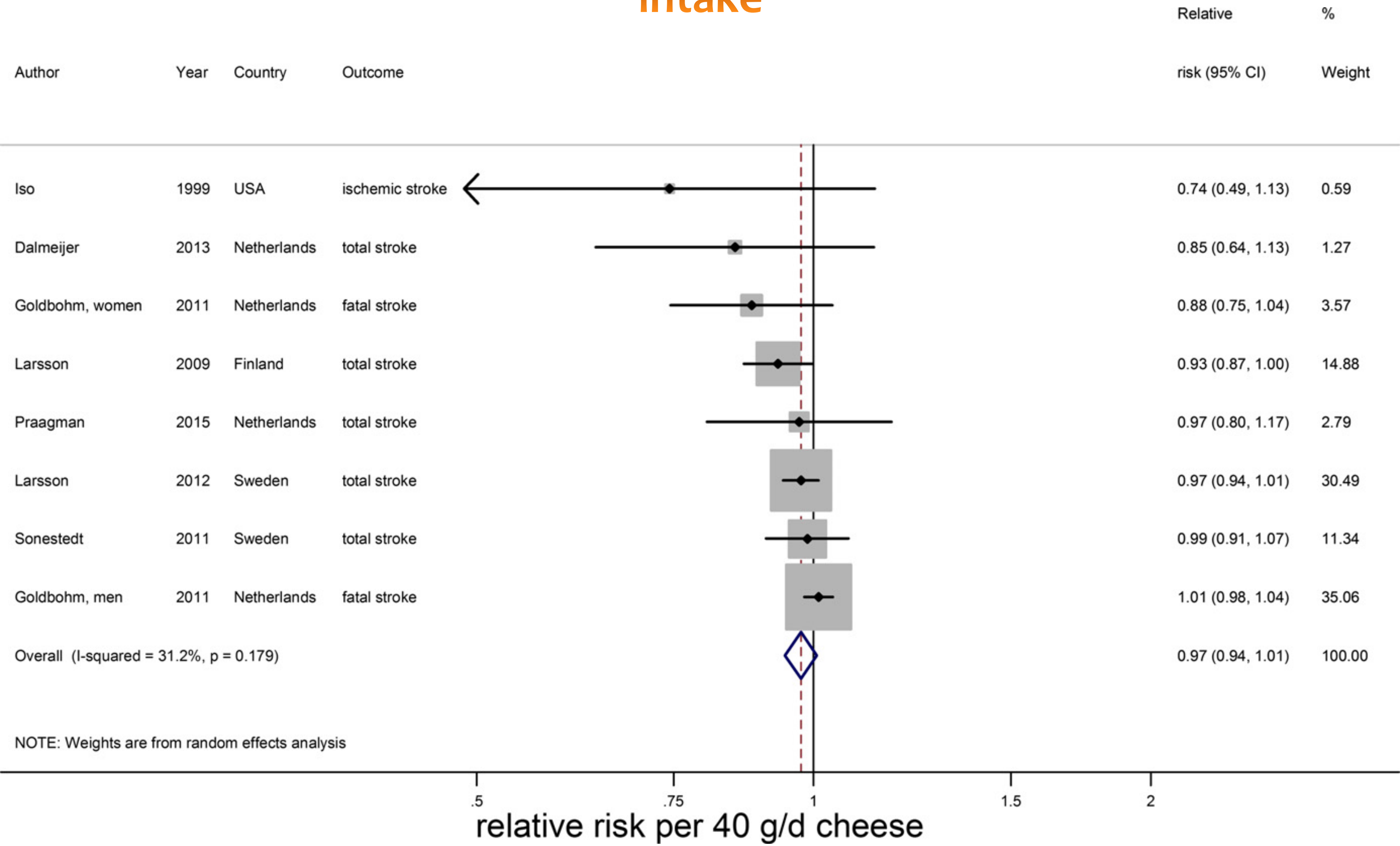
O' Sullivan TA et al Am J Public Health. 2013; 103:e31–e42

Relative risks of total stroke for an increment of 200 g/day in low-fat milk intake (A) and high-fat milk intake (B)



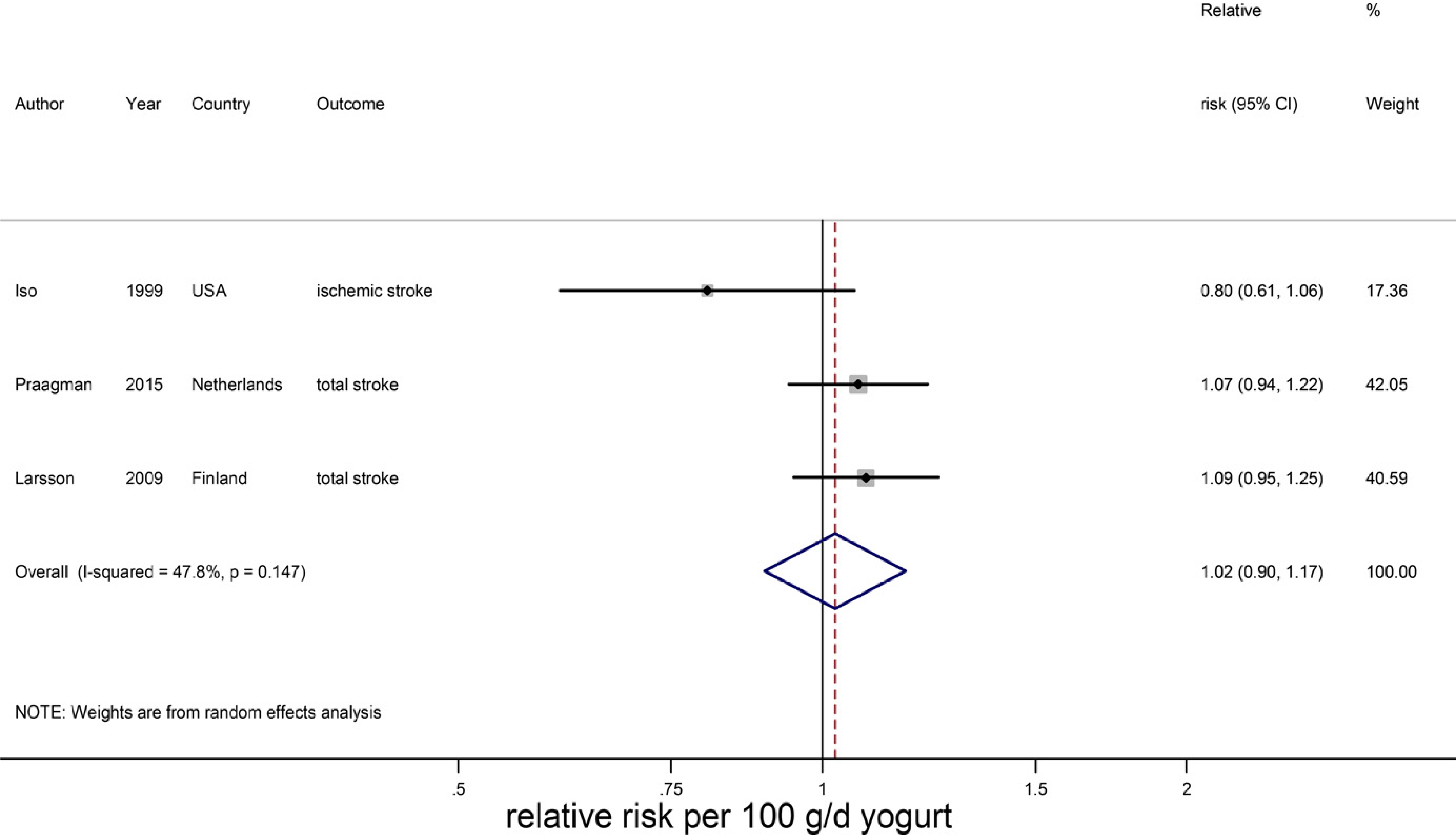
de Goede J et al J Am Heart Assoc. 2016;5:e002787 doi: 10.1161/ JAHA.115.002787)

Relative risks of total stroke for an increment of 40 g/day in cheese intake



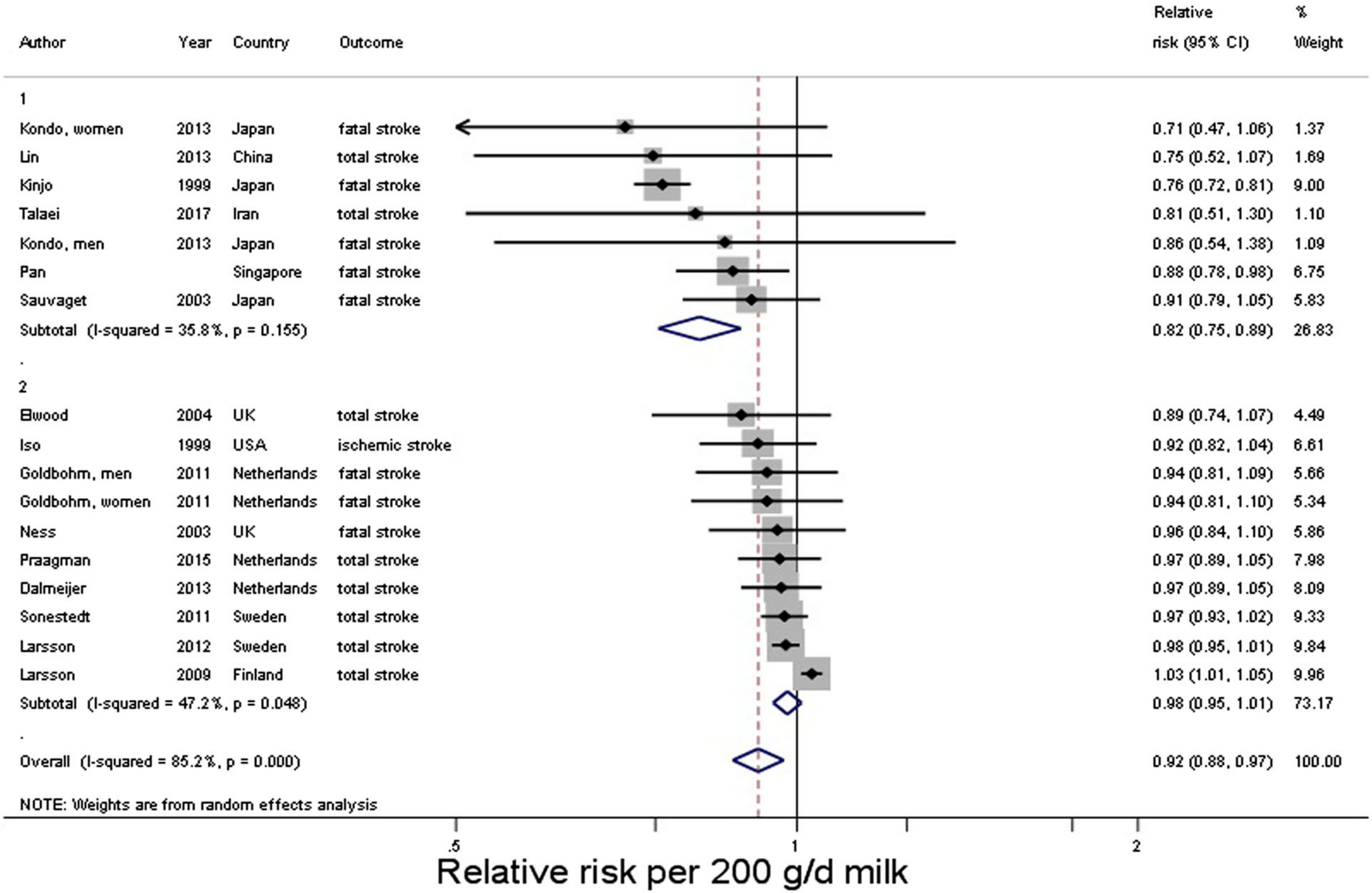
de Goede J et al J Am Heart Assoc. 2016;5:e002787 doi: 10.1161/ JAHA.115.002787)

Relative risks of total stroke for an increment of 100 g/day in yogurt intake



de Goede J et al J Am Heart Assoc. 2016;5:e002787 doi: 10.1161/ JAHA.115.002787)

Forest plot for milk intake and risk of stroke, stratified by continent



Soedamah-Muthu SS & de Goede J Curr Nutr Rep 2018; 7:171–182

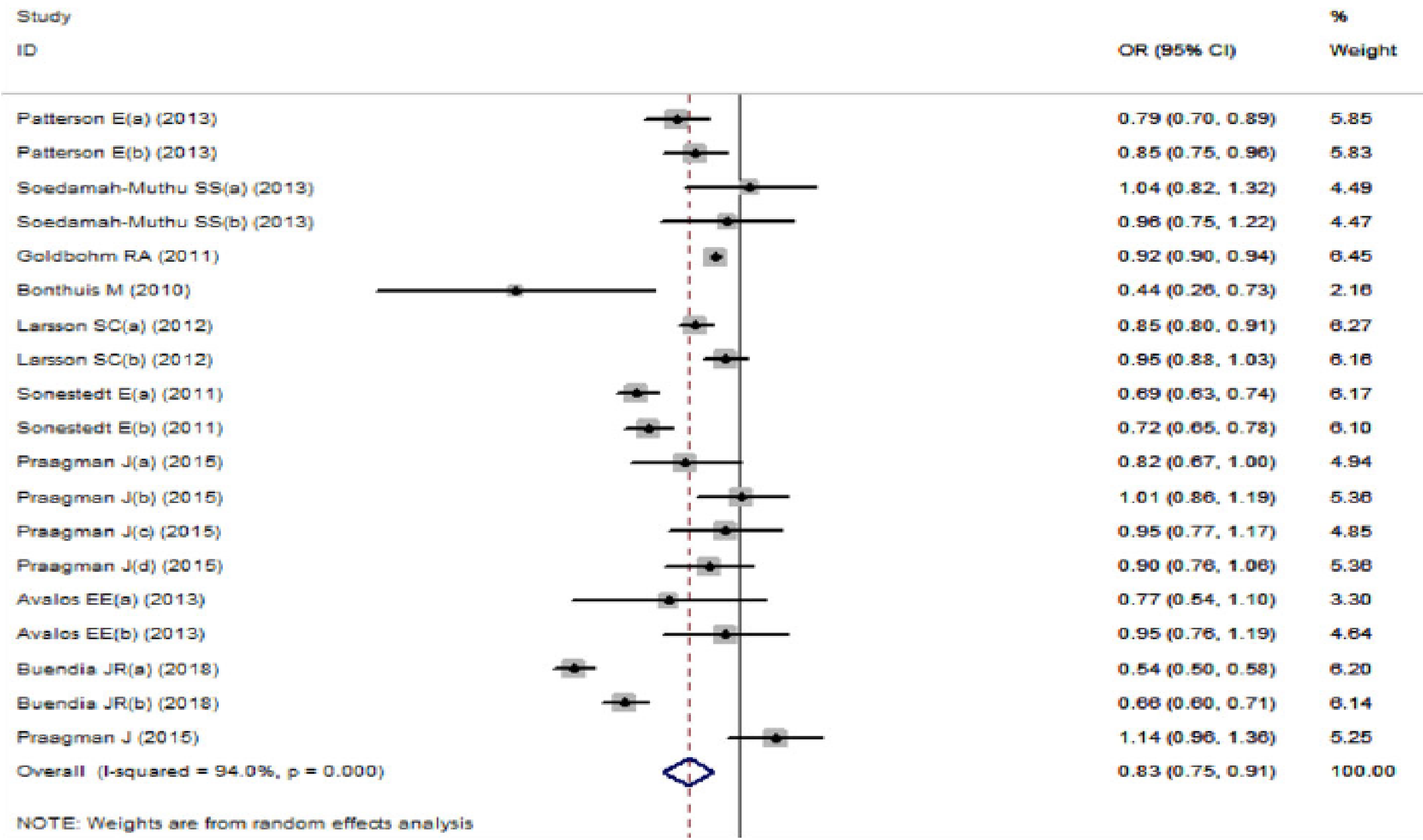
Fermented dairy foods intake and risk of cardiovascular diseases: A meta-analysis of cohort studies

Kui Zhang*, Xiaogang Chen*, Lin Zhang, and Zhenhua Deng

- 10 studies met the inclusion criteria for this study, with 385,122 participants, 1,392 Myocardial infarction, 4,490 coronary heart disease (CHD), 7,078 stroke, and 51,707 uncategorized CVD cases
- Overall, statistical evidence of significantly decreased **CVD risk** was found to be associated with fermented dairy foods intake **(OR . 0.83, 95% CI . 0.76–0.91**)
- In subgroup analysis, cheese and yogurt consumptions were associated with decreased **CVD risk (OR . 0.87**, 95% CI . 0.80–0.94 for **cheese** and **OR . 0.78**, 95% CI . 0.67–0.89 for **yogurt**)

Zhang K et al, Crit Rev Food Sci Nutr 2019, DOI: 10.1080/10408398.2018.1564019

Forest plot of cardiovascular diseases risk associated with fermented dairy foods



Zhang K et al, Crit Rev Food Sci Nutr 2019, DOI: 10.1080/10408398.2018.1564019

Diabetes Mellitus

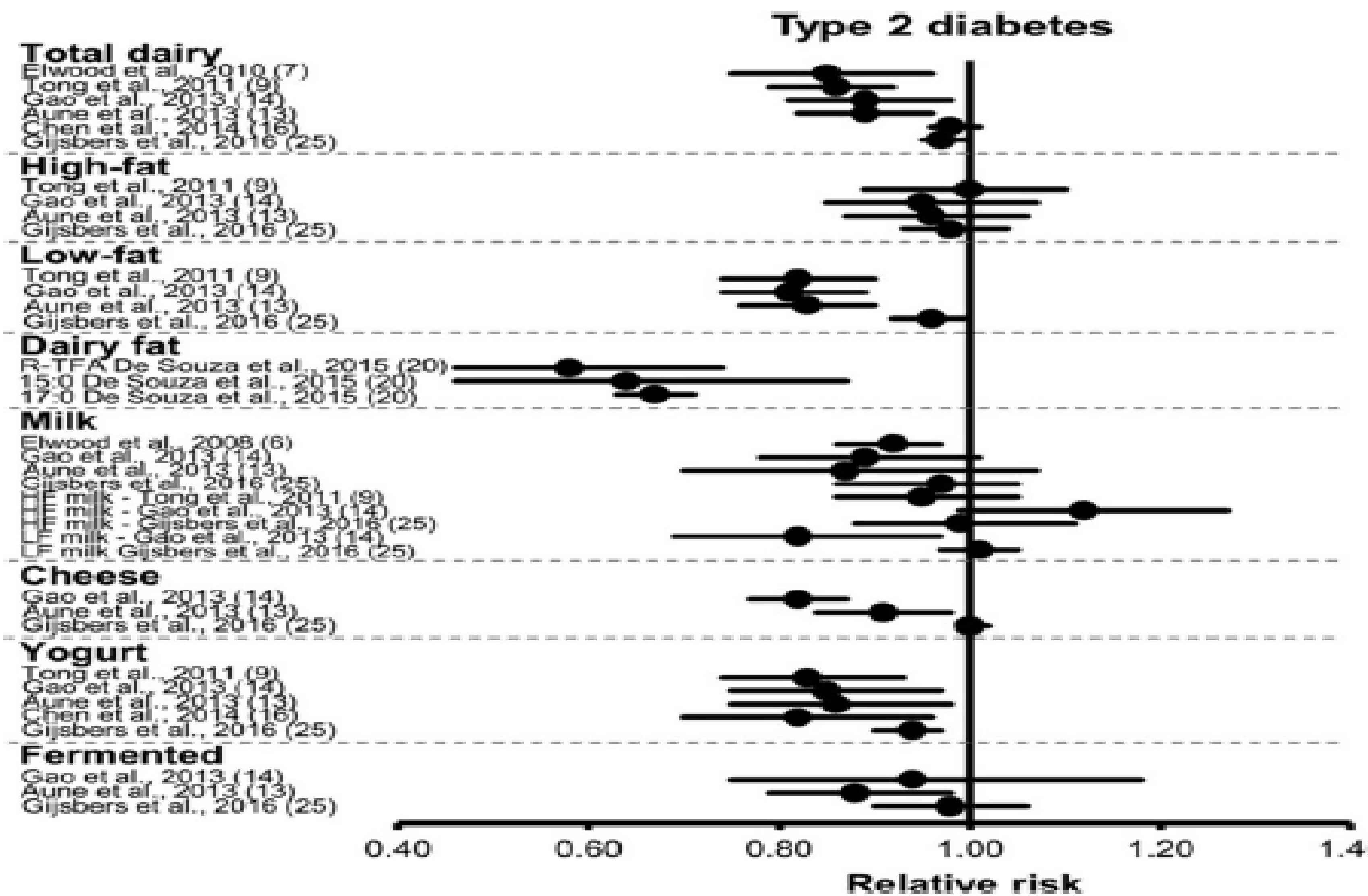
Dairy Consumption and Cardiometabolic Diseases: Systematic Review and Updated Meta-Analyses of Prospective Cohort Studies

Sabita S. Soedamah-Muthu[1,2] • Janette de Goede[3]

- Meta-analyses of cohort studies on type 2 diabetes, coronary heart disease (CHD), and stroke with nine studies
- Total dairy and low-fat dairy (per 200 g/d) were inversely associated with a 3–4% lower risk of diabetes
- Yogurt was non-linearly inversely associated with diabetes (RR = 0.86, 95%CI: 0.83–0.90 at 80 g/d)

Soedamah-Muthu SS & de Goede J Curr Nutr Rep 2018; 7:171–182

Summary of meta-analyses on dairy products and risk of type 2 diabetes



Soedamah-Muthu SS & de Goede J Curr Nutr Rep 2018; 7:171–182

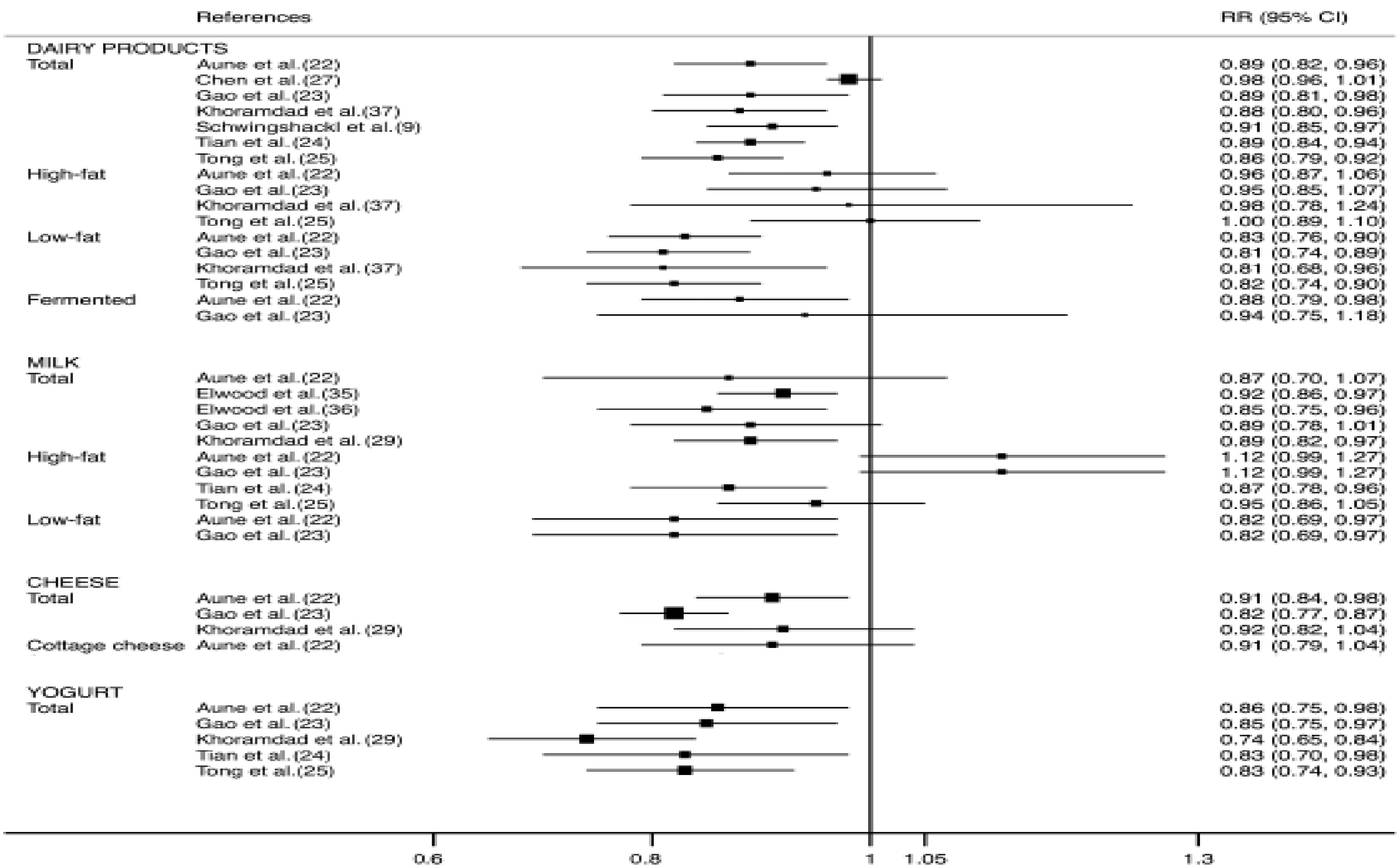
Effects of Milk and Dairy Product Consumption on Type 2 Diabetes: Overview of Systematic Reviews and Meta-Analyses

Celia Alvarez-Bueno,[1] Ivan Cavero-Redondo,[1] Vicente Martinez-Vizcaino,[1,2] Mercedes Sotos-Prieto,[3,4,5] Jonatan R Ruiz,[6] and Angel Gil[7,8,9,10]

- Forest plots summarized the risk ratios (RRs) reported by meta-analyses on high compared with low and dose–response dairy product consumption.
- 12meta-analyses were included, reporting data from4–22 cohort studies and from4–23 populations
- The participants' ages ranged from 20 to 88 y, and participants were followed up for from 4 to 30 y.
- Studies included 64,227–566,875 participants and reported 4810–44,474 cases of T2D

Alvarez-Bueno C et al, Adv Nutr 2019;10:S154–S163

Forest plot for the association between high compared with low dairy product consumption and risk of type 2 diabetes by type of dairy product



Alvarez-Bueno C et al, Adv Nutr 2019;10:S154–S163

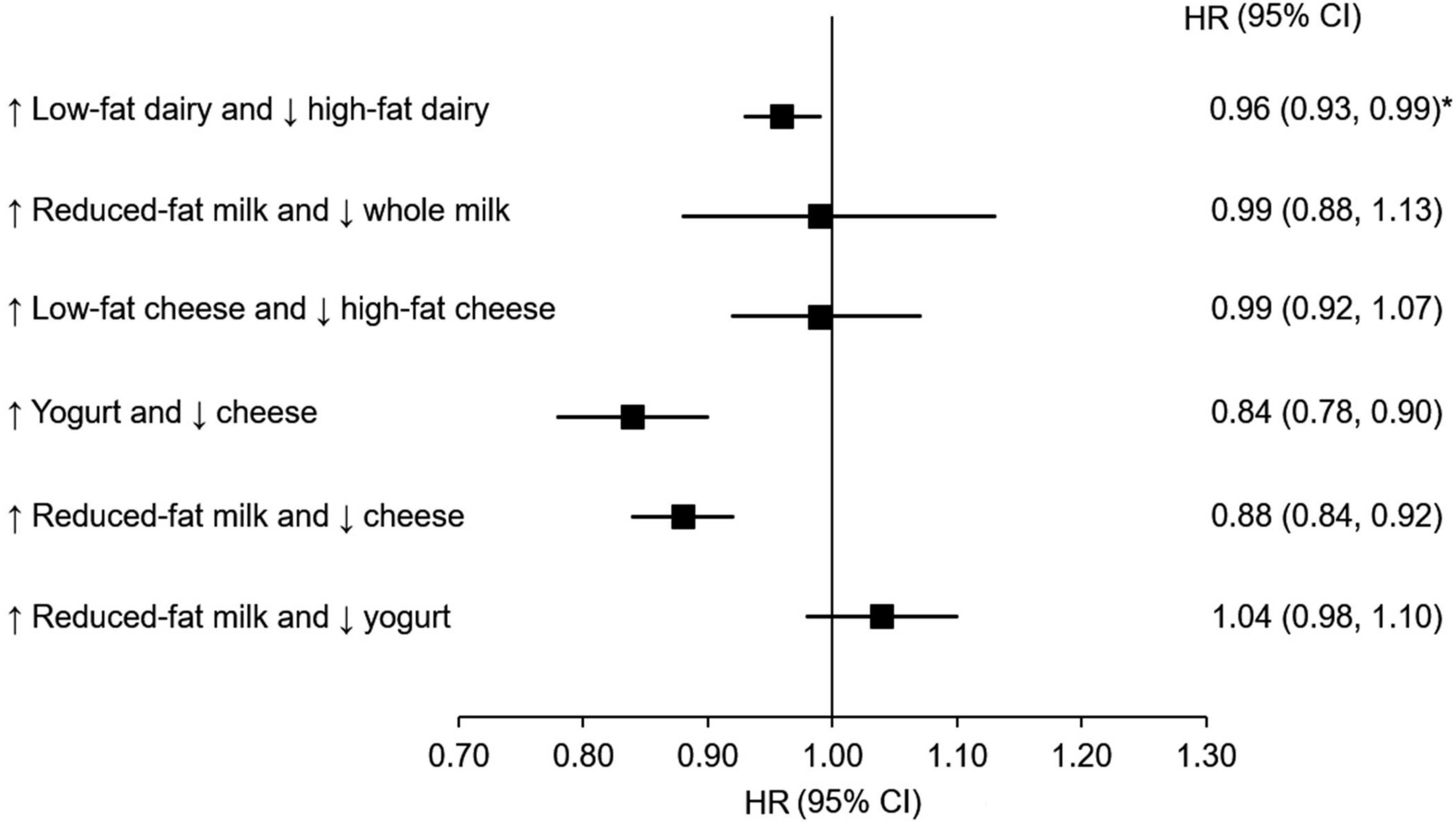
Changes in dairy product consumption and risk of type 2 diabetes: results from 3 large prospective cohorts of US men and women

Jean-Philippe Drouin-Chartier,[1] Yanping Li,[1] Andres Victor Ardisson Korat,[2,3] Ming Ding,[1] Benoît Lamarche,[4] JoAnn E Manson,[2,3,5] Eric B Rimm,[1,2,3] Walter C Willett,[1,2,3] and Frank B Hu[1,2,3]

- Methods:
  - Followed up 34,224 men in the Health Professionals Follow-Up Study (1986–2012), 76,531 women in the Nurses' Health Study (1986–2012), and 81,597 women in the Nurses' Health Study II (1991–2013).
- Results:
  - During 2,783,210 person-years, 11,90 incident T2D cases were documented

Drouin-Chartier JP et al, Am J Clin Nutr 2019;110:1201–12.

HRs (95% CIs) from substitution models for type 2 diabetes associated with increasing intake of a specific dairy product by 1 serving/d and concomitantly decreasing intake of another dairy product by 1 serving/d during a 4-y period



Pooled results from the Health Professionals Follow-Up Study (n = 34,224), the NHS (n = 76,531), and the NHS II (n = 81,597).

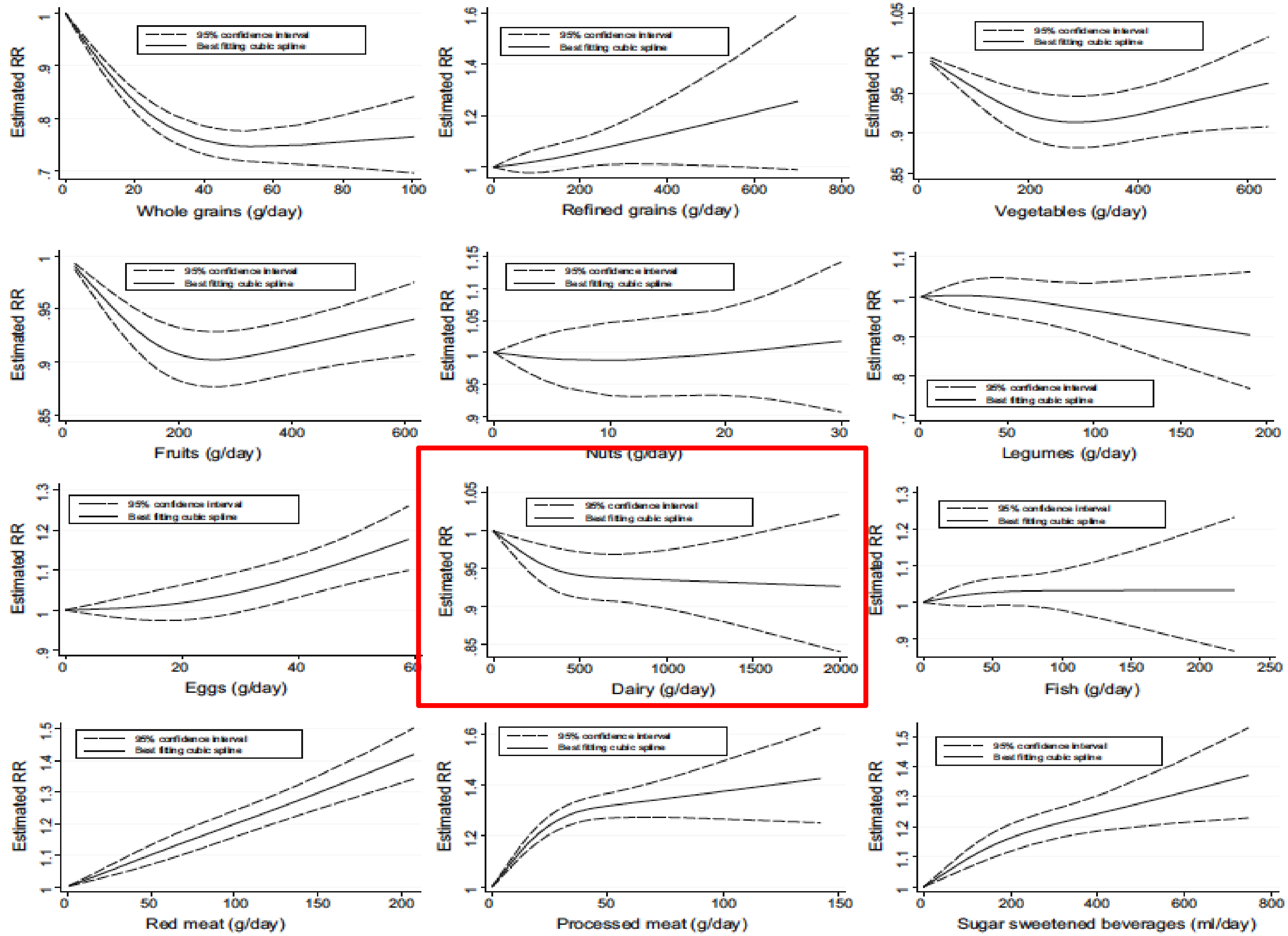
Drouin-Chartier JP et al, Am J Clin Nutr 2019;110:1201–12.

Food groups and risk of type 2 diabetes mellitus: a systematic review and meta-analysis of prospective studies

Lukas Schwingshackl[1] · Georg Hoffmann[2] · Anna-Maria Lampousi[1] · Sven Knüppel[1] · Khalid Iqbal[1] · Carolina Schwedhelm[1] · Angela Bechthold[3] · Sabrina Schlesinger[4,5] · Heiner Boeing[1]

- The relation between intake of 12 major food groups and risk of type 2 diabetes (T2D).
- Six out of the 12 food-groups showed a significant relation with risk of T2D, three of them a decrease of risk with increasing consumption (whole grains, fruits, and dairy), and three an increase of risk with increasing consumption (red meat, processed meat, and SSB) in the linear dose– response meta-analysis.
- Optimal consumption of risk-decreasing foods resulted in a 42% reduction, and consumption of risk-increasing foods was associated with a threefold T2D risk, compared to non-consumption

Schwingshackl L et al, Eur J Epidemiol (2017) 32:363–375



Non-linear dose–response relation between daily intakes whole grains (Pnon-linearity<0.001), refined grains (pnon-linearity = 0.07), vegetables (pnon-linearity<0.001), fruits (pnon-linearity<0.001), nuts (pnon-linearity = 0.67), legumes (pnon-linearity = 0.44), eggs (pnon-linearity = 0.09), dairy (pnon-linearity = 0.89), fish (pnon-linearity = 0.48), red meat (pnon-linearity = 0.30), processed meat (pnon-linearity <0.001), and sugar sweetened beverages (pnon-linearity = 0.007) and risk of T2D

Schwingshackl L et al, Eur J Epidemiol 2017; 32:363–375

Review

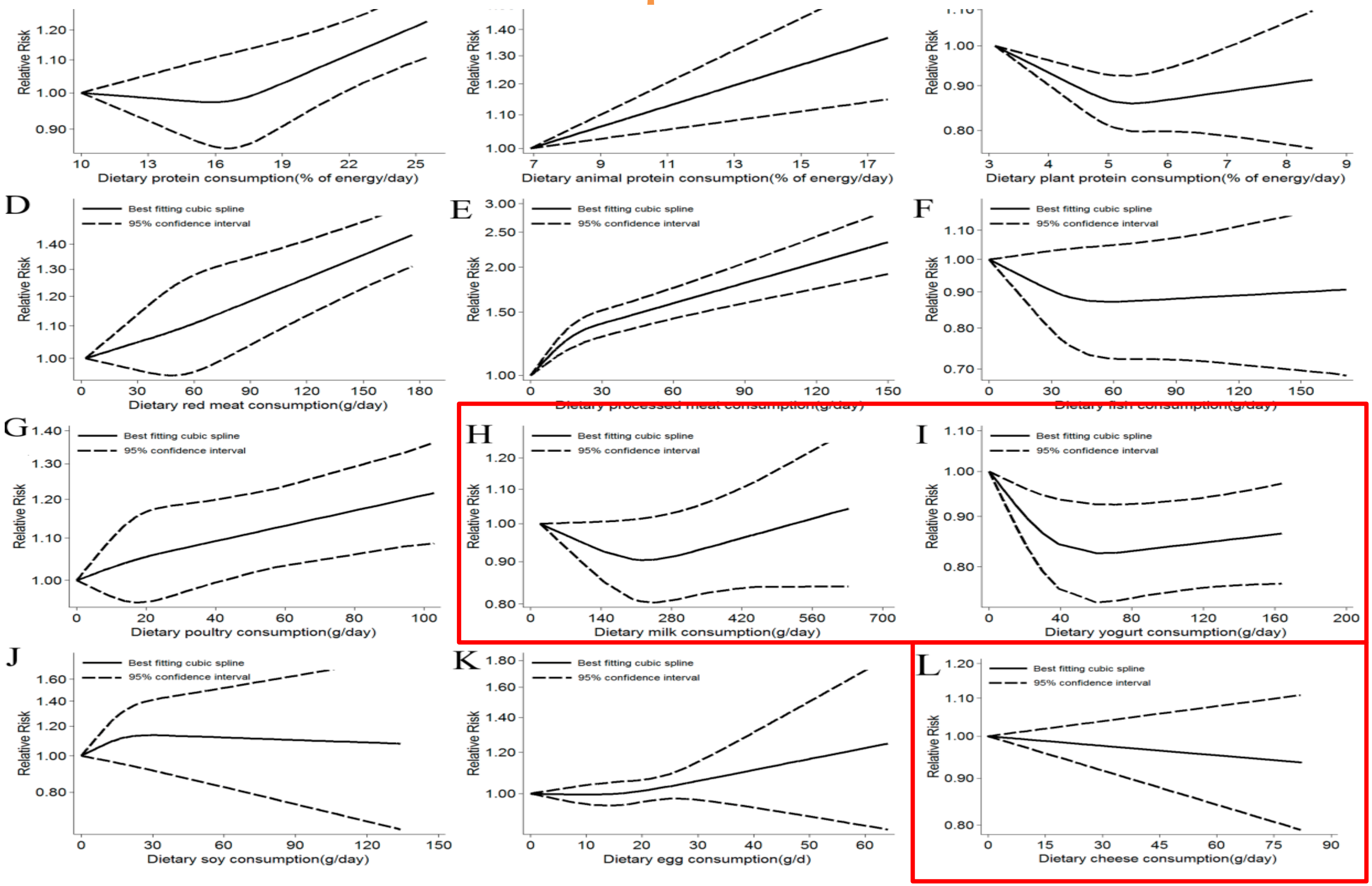
Dietary Protein Consumption and the Risk of Type 2 Diabetes: ADose-Response Meta-Analysis of Prospective Studies

Mengying Fan [1], Yuqian Li [2], Chongjian Wang [1], Zhenxing Mao [1], Wen Zhou [1], Lulu Zhang [1], Xiu Yang [1], Songyang Cui [1] and Linlin Li [1,*]

- Systematic retrieval of prospective studies
- T2D risk increased with increasing consumption of total protein and animal protein, red meat, processed meat, milk, and eggs, respectively, while plant protein and yogurt had an inverse relationship
- A non-linear with the risk for T2D was found for the consumption of plant protein, association processed meat, milk, yogurt, and soy
- This meta-analysis suggests that substitution of plant protein and yogurt for animal protein, especially red meat and processed meat, can reduce the risk for T2D

Fan M et al, Nutrients 2019, 11, 2783; doi:10.3390/nu11112783

Non-linear dose-response relationship between daily intake of total protein



Fan M et al, Nutrients 2019, 11, 2783; doi:10.3390/nu11112783

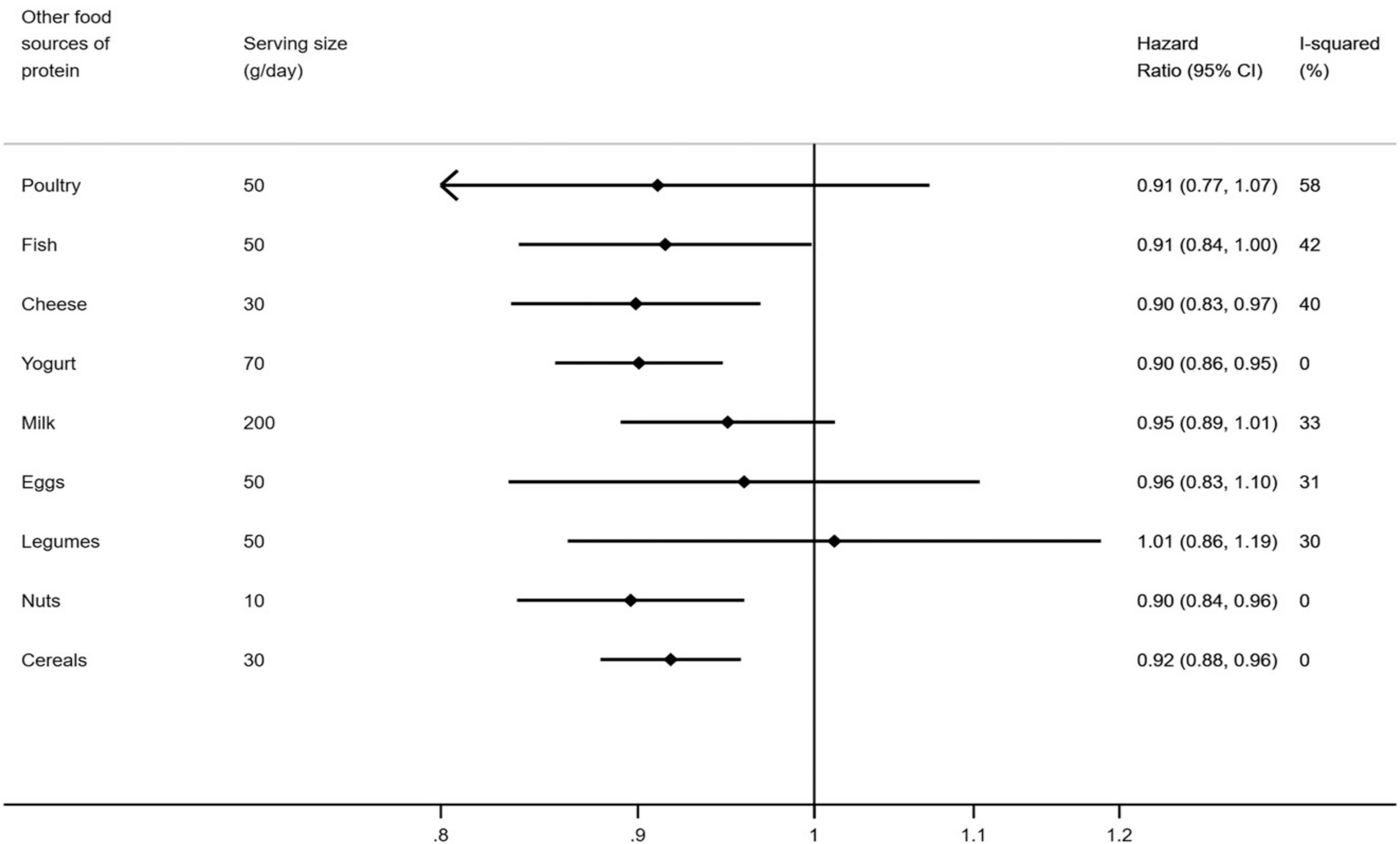
Replacement of Red and Processed Meat With Other Food Sources of Protein and the Risk of Type 2 Diabetes in European Populations: The EPIC-InterAct Study

Methods

- The European Prospective Investigation into Cancer (EPIC)-InterAct case cohort included 11,741 individuals with type 2 diabetes and a subcohort of 15,450 participants in eight countries
- Modeled the replacement of self-reported red and processed meat with poultry, fish, eggs, legumes, cheese, cereals, yogurt, milk, and nuts

Ibsen DB et al, Diabetes Care 2020;43:2660–2667 doi.org/10.2337/dc20-1038

The estimated association of replacing red and processed meat (per 50 g/day) with other food sources of protein and the incidence of type 2 diabetes in the EPIC-InterAct case-cohort study (n total526,460, n cases of type 2 diabetes511,741)



Ibsen DB et al, Diabetes Care 2020;43:2660–2667 doi.org/10.2337/dc20-1038

Potential Mechanisms

- Dairy is a major source of dietary calcium and magnesium, 2 minerals that have a role in the development of T2DM, for potential in improving pancreatic β-cell function and insulin sensitivity
- It could be partly explained by the fact that both dairy subgroups are a good source for vitamin K2 which is exclusively synthesized by bacteria and only present in fermented dairy products due to the bacterial starter fermentation. Vitamin K2 has recently been linked to a reduced risk of T2DM
- Additionally, these dairy subcategories are particularly high in the fat-soluble vitamin D, which has been found to be inversely associated with T2DM

Gao D et al PLoS ONE 2013,8(9): e73965

Hypertension

SYSTEMATIC REVIEWS AND META-ANALYSES

Dairy products consumption and the risk of hypertension in adults: An updated systematic review and dose—response meta-analysis of prospective cohort studies

Zahra Heidari [a,b], Nafiseh Rashidi Pour Fard [c], Cain C.T. Clark [d], Fahimeh Haghighatdoost [e,*]

Data synthesis:

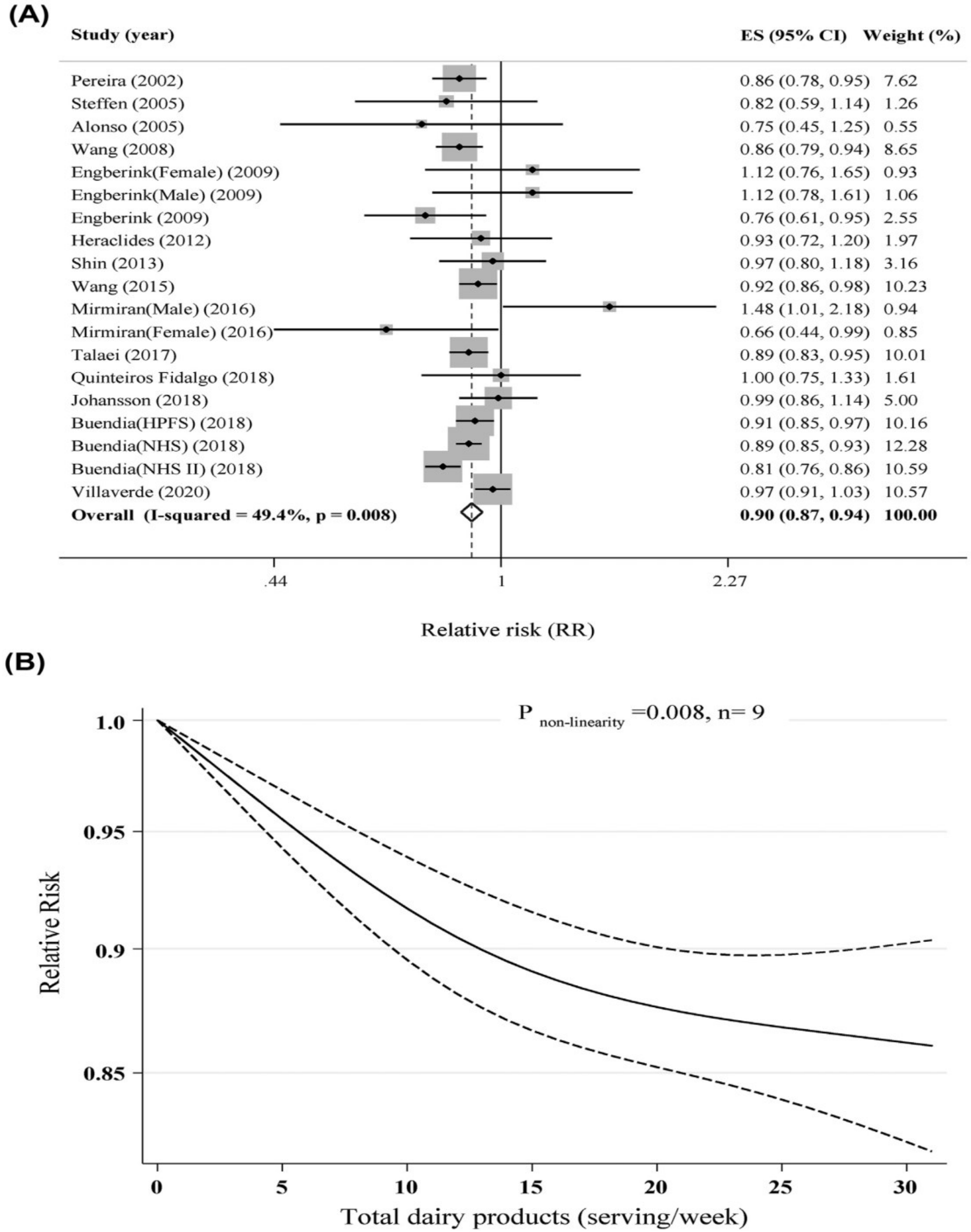
Sixteen studies were included in the current meta-analysis.

Results:

An inverse association was found between **total dairy products** (RR Z **0.90**; 95% CI: 0.87, 0.94; n = 16), **low-fat dairy products** (**RR = 0.86**; 95% CI: 0.77, 0.96; n Z 8), **milk** (**RR = 0.94**; 95% CI: 0.90, 0.99; n = 11), and **fermented dairy** (**RR = 0.95**; 95% CI: 0.91, 0.99; n = 8) consumption **and the risk of HTN**.

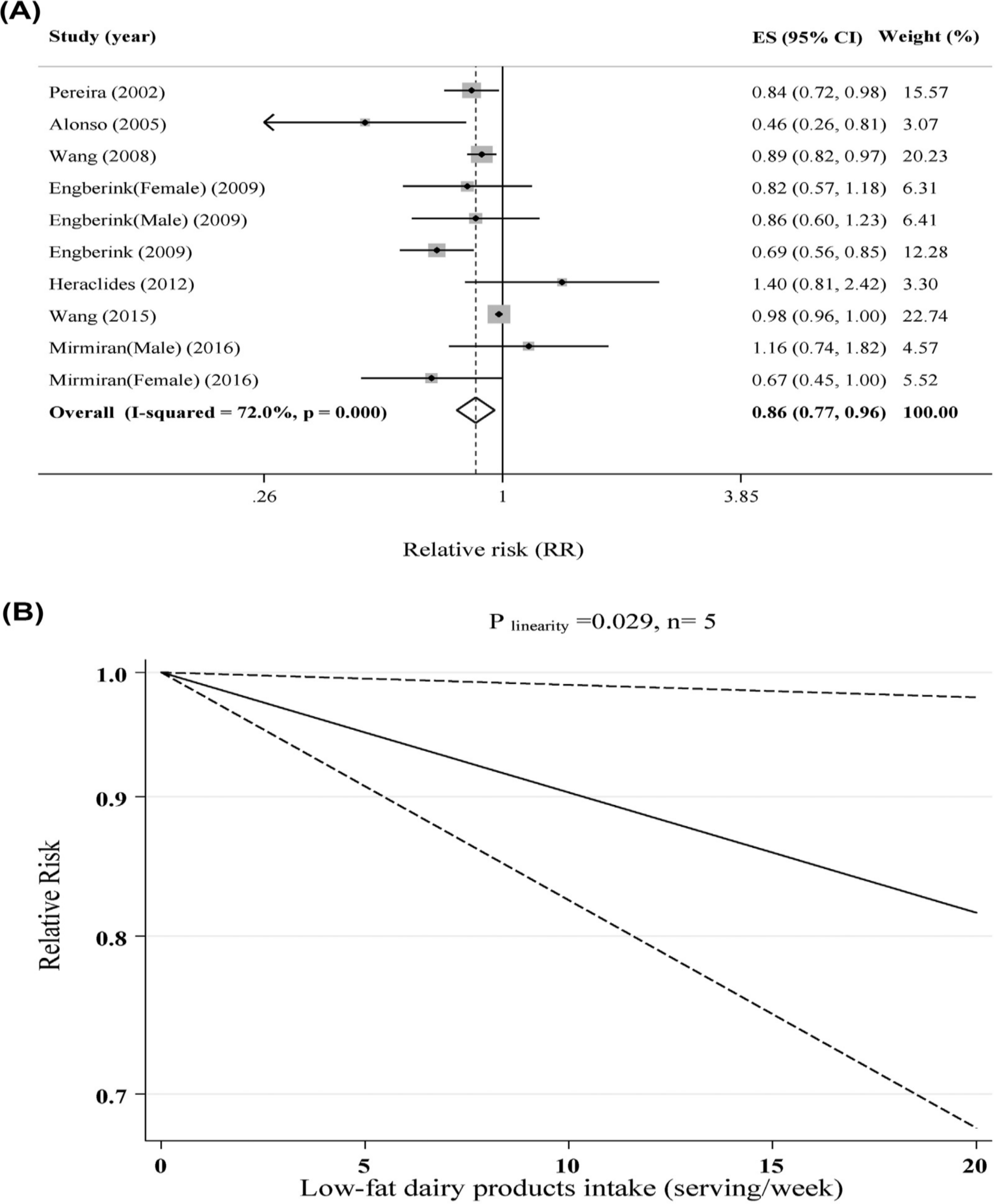
Dose-response analysis revealed a non-linear association between total dairy products and milk consumption and the risk of HTN, but a linear association for low-fat dairy products.

Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175



Forest plot (A) and dose-response analysis (B) of the relationship between total dairy and risk of HTN

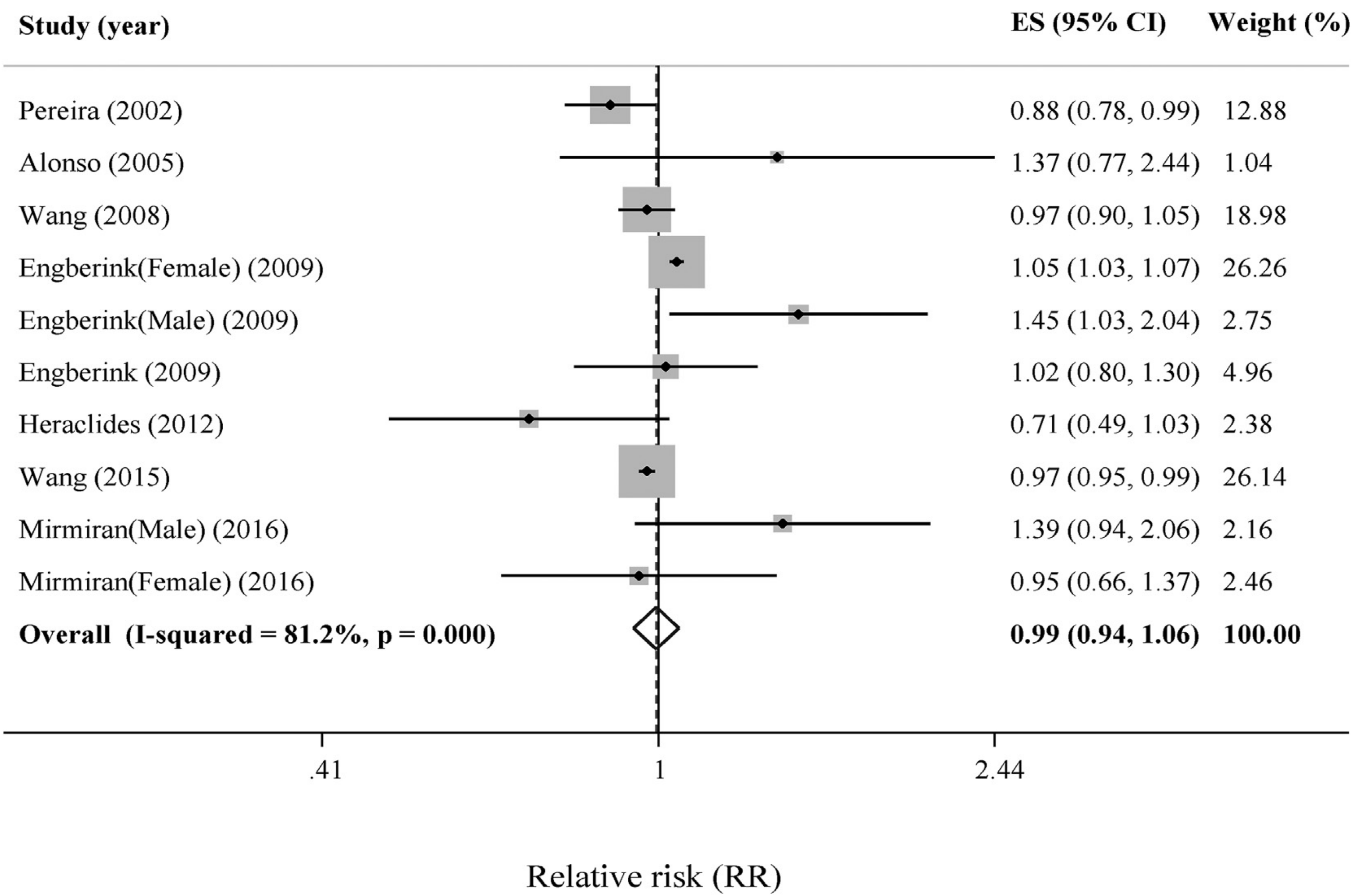
Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175



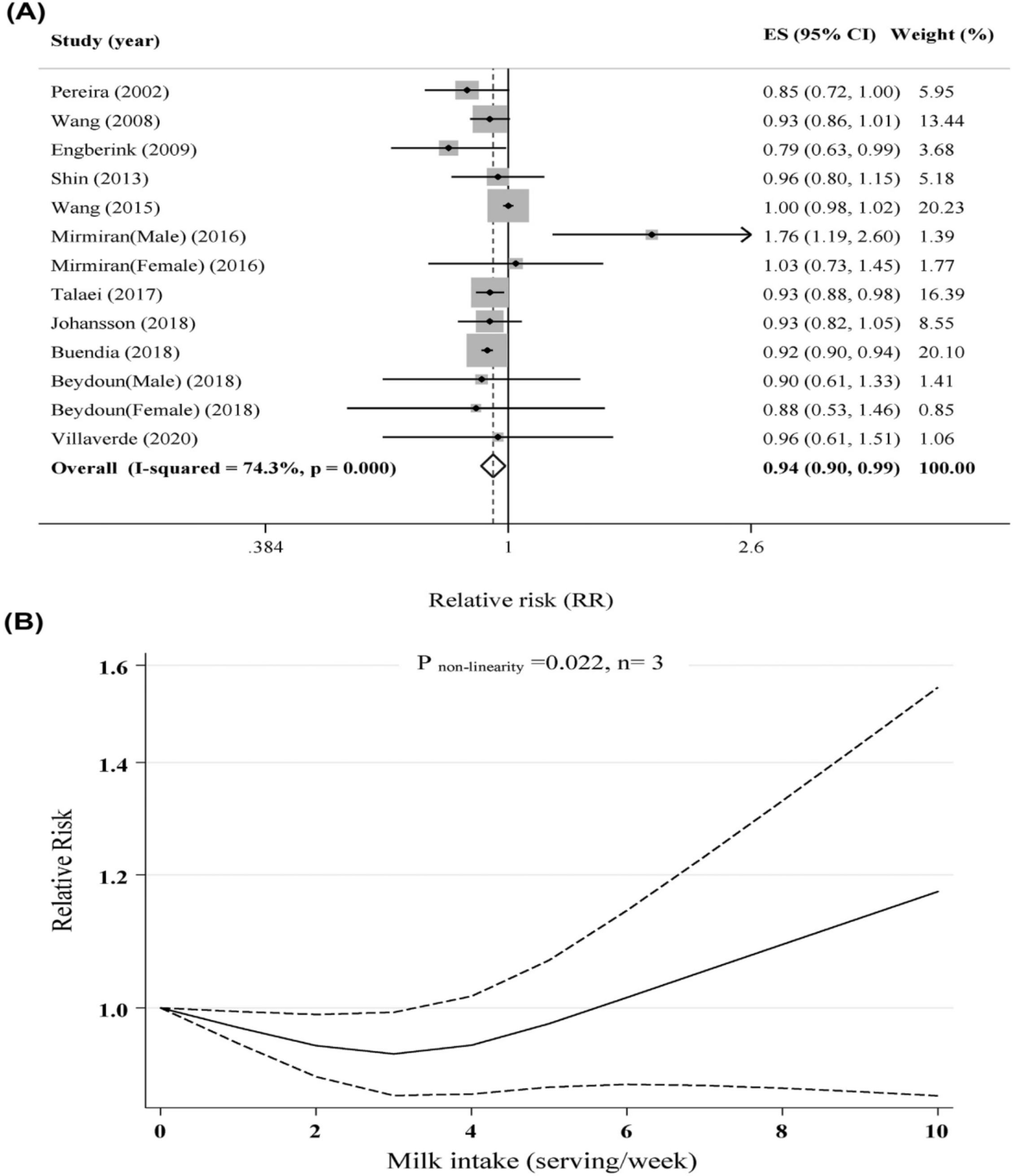
Forest plot (A) and dose-response analysis (B) of the relationship between low-fat dairy products intake and risk of HTN

Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175

Forest plot of the relationship between high-fat dairy products intake and risk of HTN



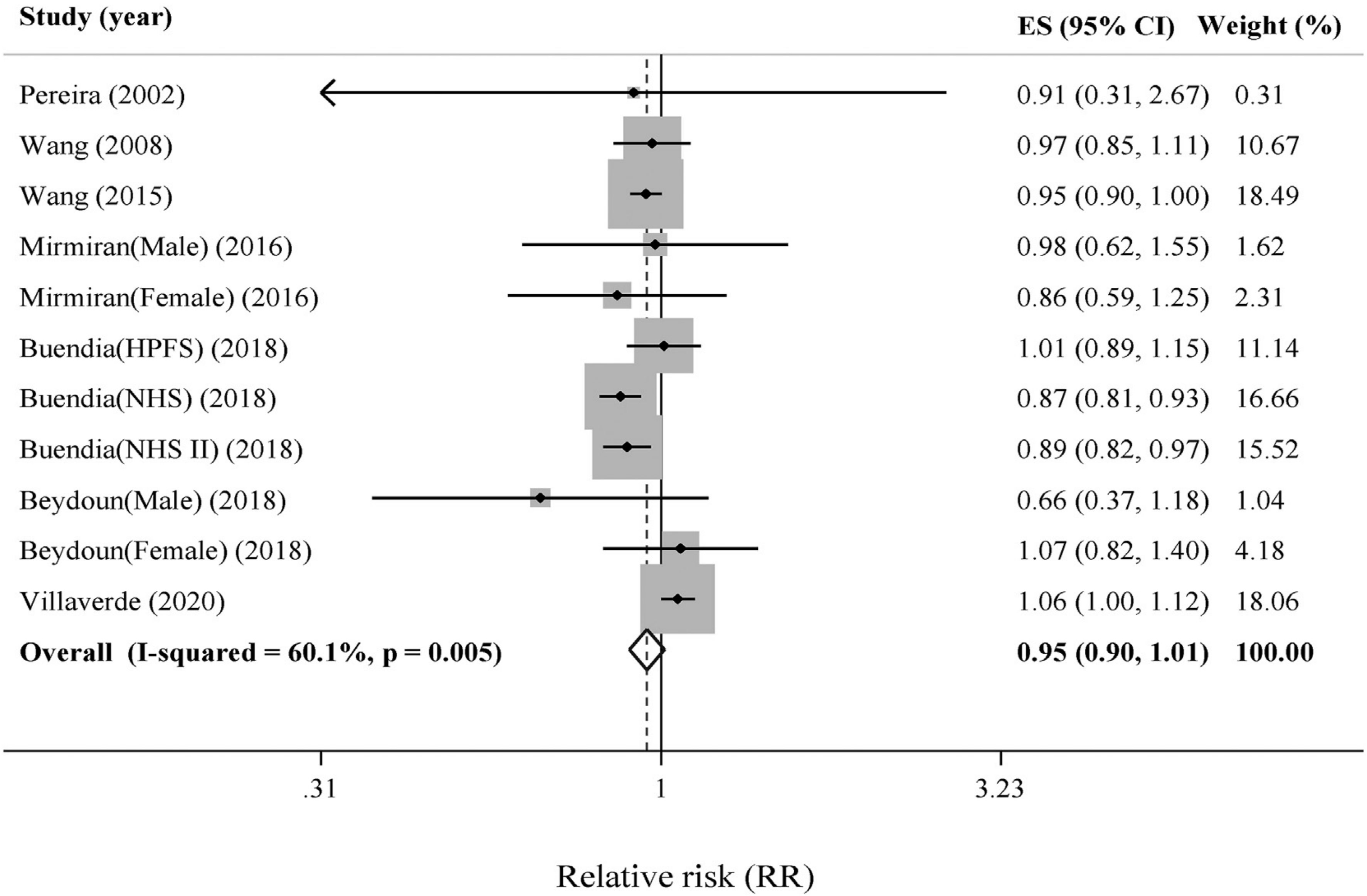
Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175



Forest plot (A) and dose-response analysis (B) of the relationship between milk intake and risk of HTN

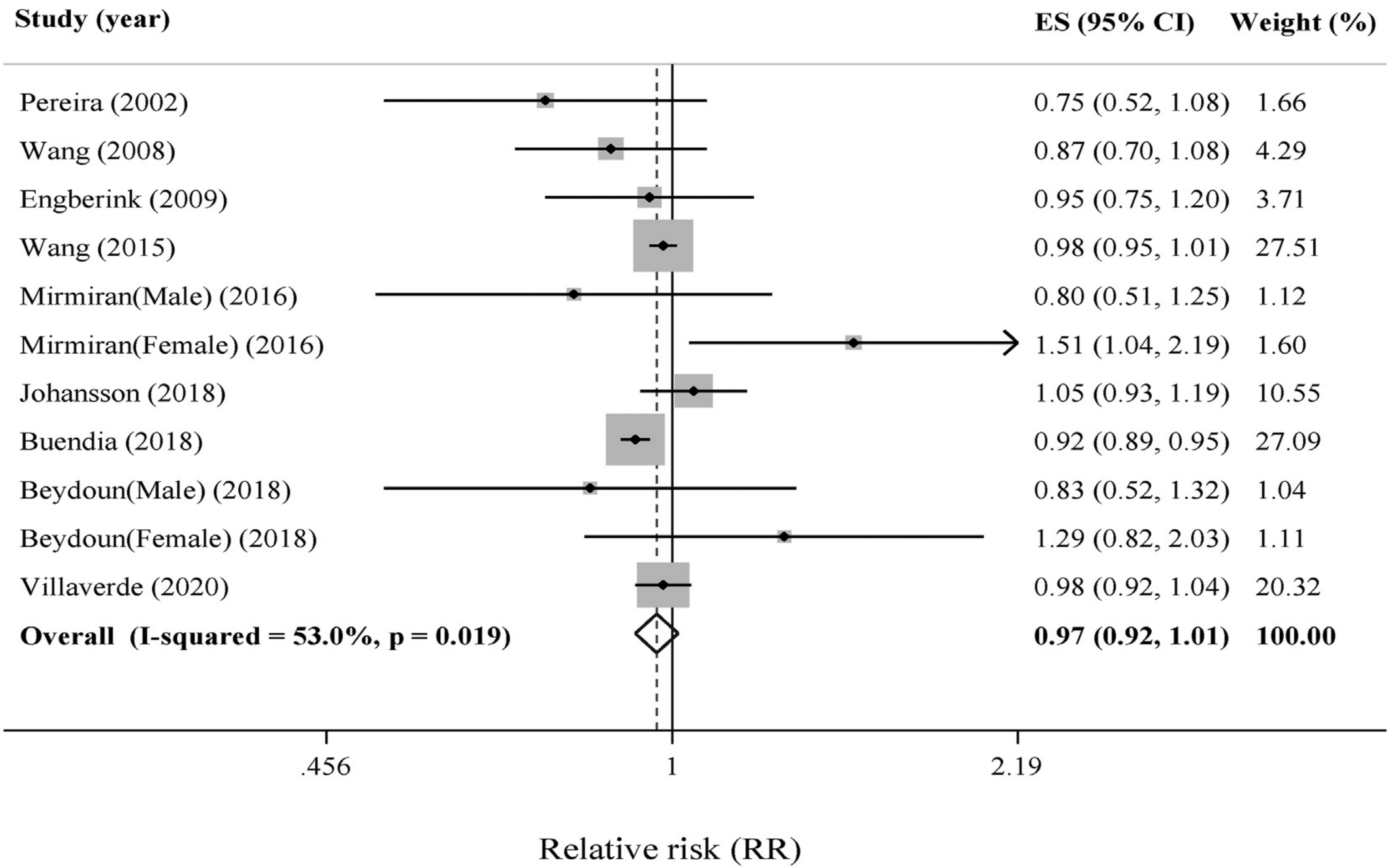
Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175

Forest plot of the relationship between yogurt intake and risk of HTN



Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175

Forest plot of the relationship between cheese intake and risk of HTN



Heidari Z et al, Nutr Metab Cardiovasc Dis 2021;31, 1962-175

Food Groups and Risk of Hypertension: A Systematic Review and Dose-Response Meta-Analysis of Prospective Studies

Lukas Schwingshackl,[1] Carolina Schwedhelm,[1] Georg Hoffmann,[2] Sven Knüppel,[1] Khalid Iqbal,[1] Violetta Andriolo,[1] Angela Bechthold,[3] Sabrina Schlesinger,[4] and Heiner Boeing[1]

- The aim of this systematic review and meta-analysis was to summarize the evidence on the relation of the intakes of 12 major food groups, including whole grains, refined grains, vegetables, fruits, nuts, legumes, eggs, dairy, fish, red meat, processed meat, and sugar-sweetened beverages (SSBs) with the risk of hypertension
- Prospective studies were included having quantitatively investigated the above-mentioned foods
- Meta-analysis on the highest compared with the lowest intake categories and linear and nonlinear dose-response meta-analyses to analyze the association.
- Overall, 28 reports were included in the meta-analysis

Schwingshackl L et al, Adv Nutr 2017;8:793–803

RRs from nonlinear dose-response analysis of 12 pre-defined food groups and risk of hypertension according to intakes of servings per day[1]

Food group and daily serving size	Servings/d						
	0	1	2	3	4	5	6
Inverse association							
Whole grains (30 g)	1.00	0.90 (0.87, 0.93)	0.87 (0.84, 0.90)	0.85 (0.80, 0.91)	NA	NA	NA
Fruits (80 g)	1.00	0.96 (0.95, 0.98)	0.93 (0.91, 0.96)	0.93 (0.91, 0.95)	0.93 (0.91, 0.95)	0.93 (0.90, 0.96)	NA
Dairy (200 g)	1.00	0.94 (0.91, 0.97)	0.90 (0.86, 0.94)	0.87 (0.82, 0.92)	0.85 (0.79, 0.92)	NA	NA
Nuts (28 g)	1.00	0.88 (0.80, 0.96)	NA	NA	NA	NA	NA
Legumes (100 g)	1.00	0.94 (0.88, 1.00)[2]	NA	NA	NA	NA	NA
Positive association							
Fish (100 g)	1.00	1.08 (1.05, 1.12)	NA	NA	NA	NA	NA
Red meat (85 g)	1.00	1.16 (1.14, 1.18)	1.35 (1.32, 1.38)	NA	NA	NA	NA
Processed meat (30 g)	1.00	1.07 (1.04, 1.09)	NA	NA	NA	NA	NA
SSB (250 mL)	1.00	1.06 (1.04, 1.08)	1.14 (1.11, 1.17)	NA	NA	NA	NA
No association							
Refined grains (30 g)	1.00	0.96 (0.92, 1.01)	0.96 (0.90, 1.02)	0.97 (0.91, 1.05)	1.00 (0.92, 1.08)	1.03 (0.92, 1.16)	NA
Vegetables (80 g)	1.00	0.99 (0.97, 1.01)	0.98 (0.95, 1.01)	0.98 (0.95, 1.02)	0.98 (0.95, 1.02)	0.99 (0.96, 1.02)	1.00 (0.96, 1.03)
Not applicable							
Eggs (55 g)	1.00	NA	NA	NA	NA	NA	NA

[1] Values are RRs (95% CIs). NA, not applicable; SSB, sugar-sweetened beverage

[2] This value refers to a three-fourths serving (75 g)

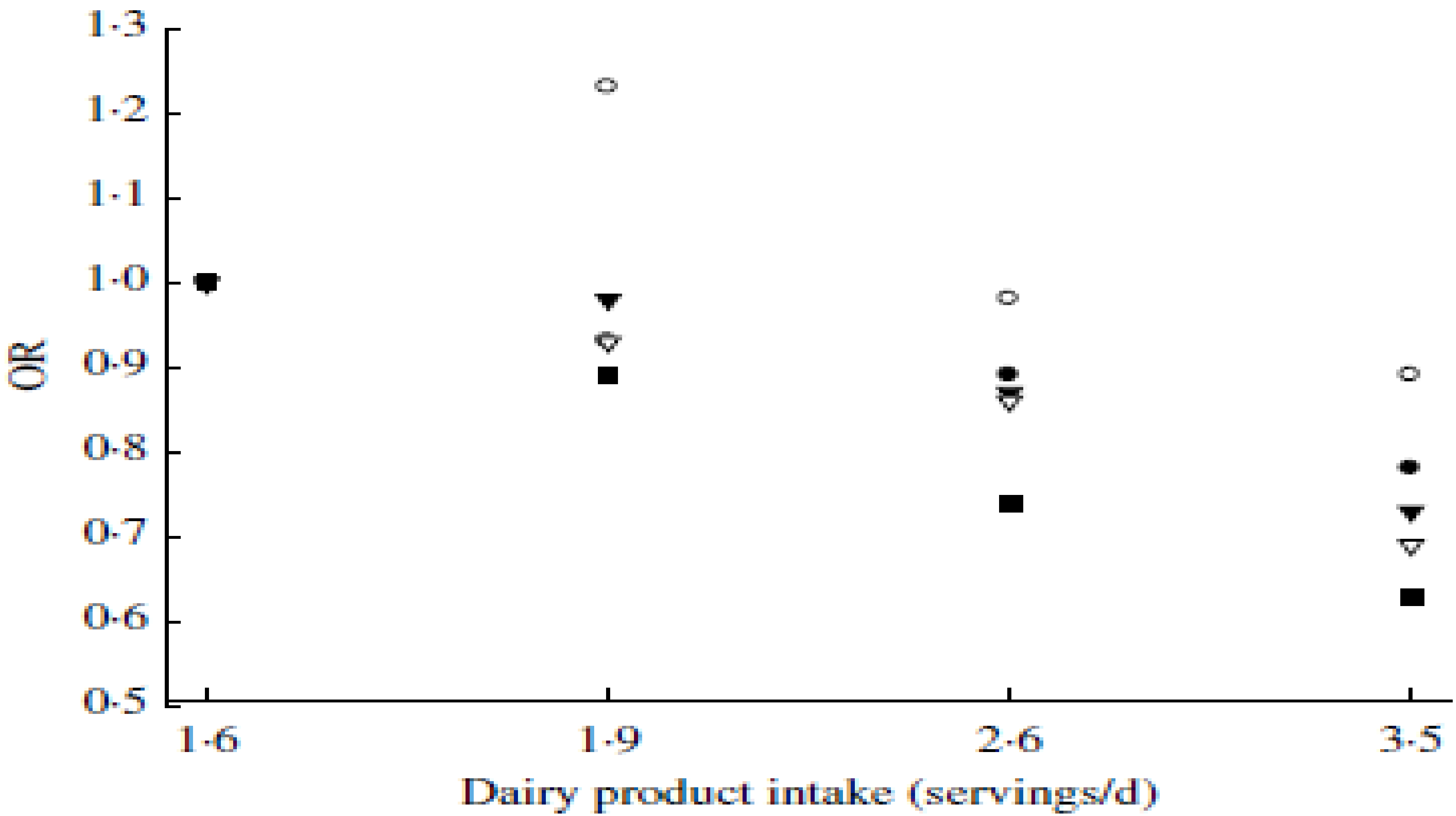
Schwingshackl L et al, Adv Nutr 2017;8:793–803

Potential Mechanisms

- Dairy is a major source of dietary calcium and potassium, 2 minerals that could lower BP
- An intake of 200 g of non-fortified milk provides ≈250 mg of calcium and 300 mg of potassium
- A meta-analysis of 40 randomized controlled trials showed a small but significant effect of ≈1 g/d of calcium supplementation on SBP and DBP (−1.9/−1.0 mm Hg)
- Significant reductions in BP (−2.4/−1.6 mm Hg) were also found for ≈2 g/d of potassium supplementation in a meta-analysis of 27 trials
- In addition, it has been suggested that other nutrients in dairy, such as magnesium, phosphorus, and proteins, could improve BP

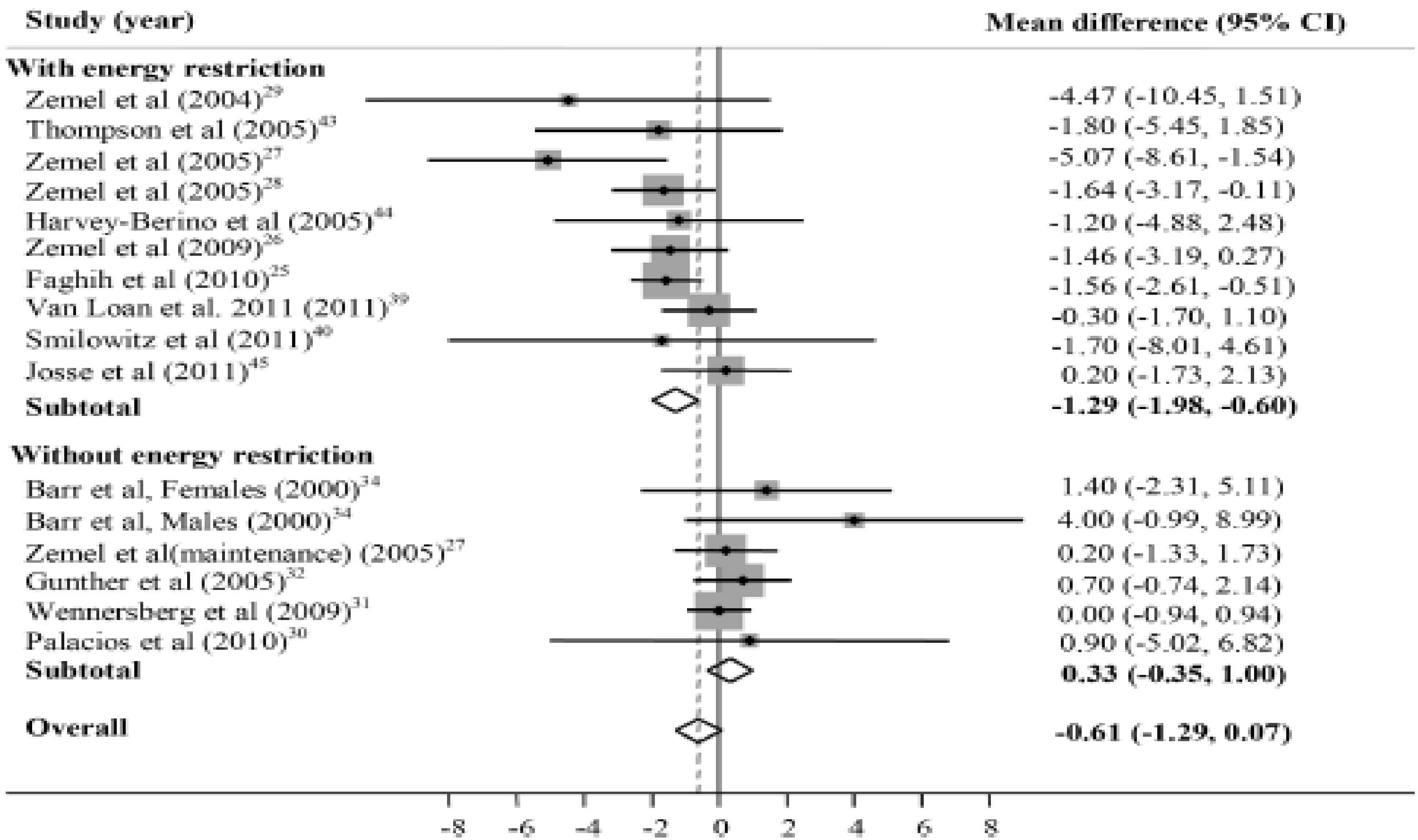
Obesity and Metabolic Syndrome

Risk for being overweight, obese and having an enlarged waist circumference in relation to the daily intake of dairy products



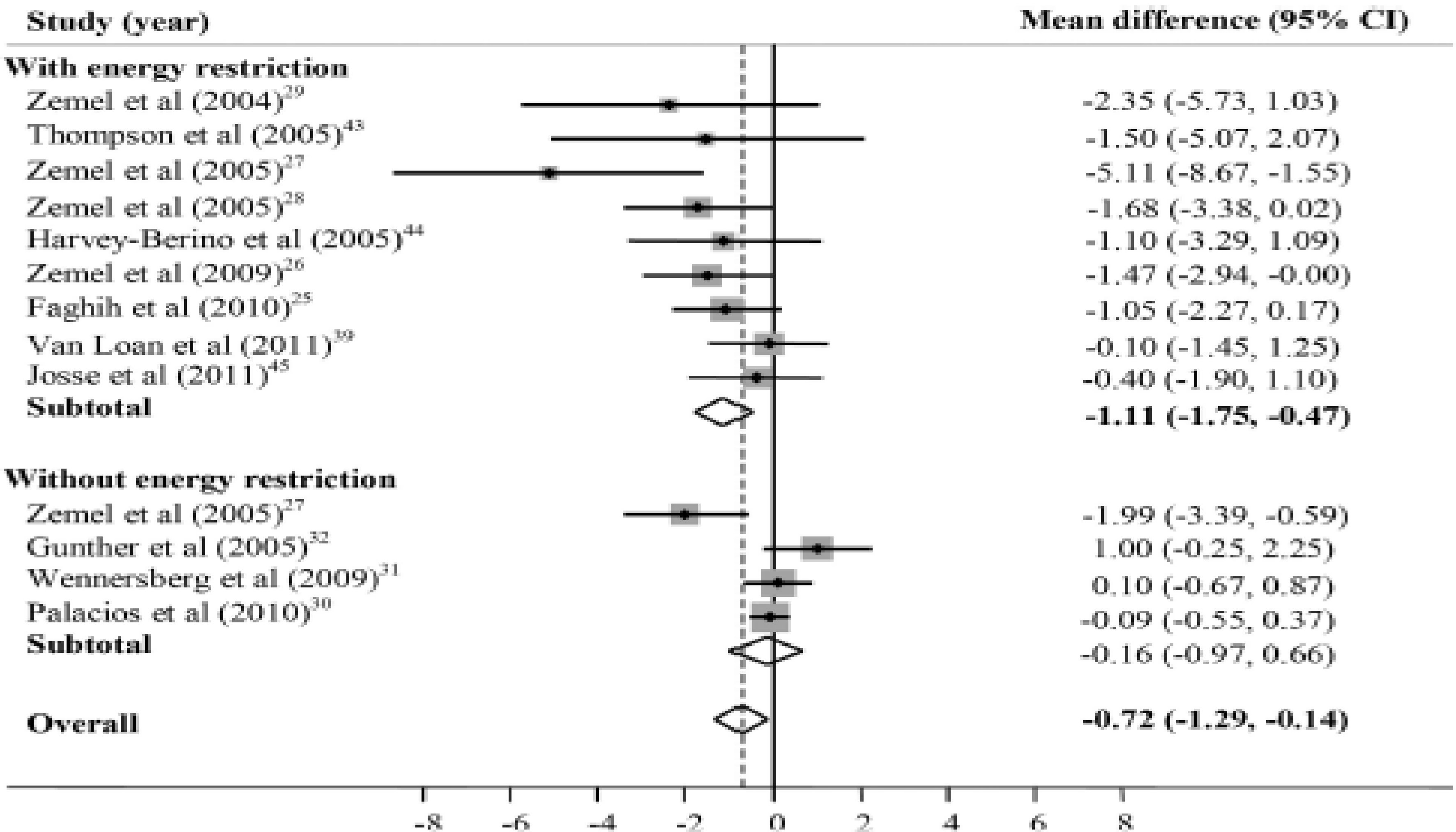
(X), Men OR for being overweight(24); (W), women OR for being overweight(24); (P), men OR for being obese(24); (L), women OR for being obese(24); (B), OR for enlarged waist circumference

Dougkas A et al Nutr Res Rev 2011;24:72-95



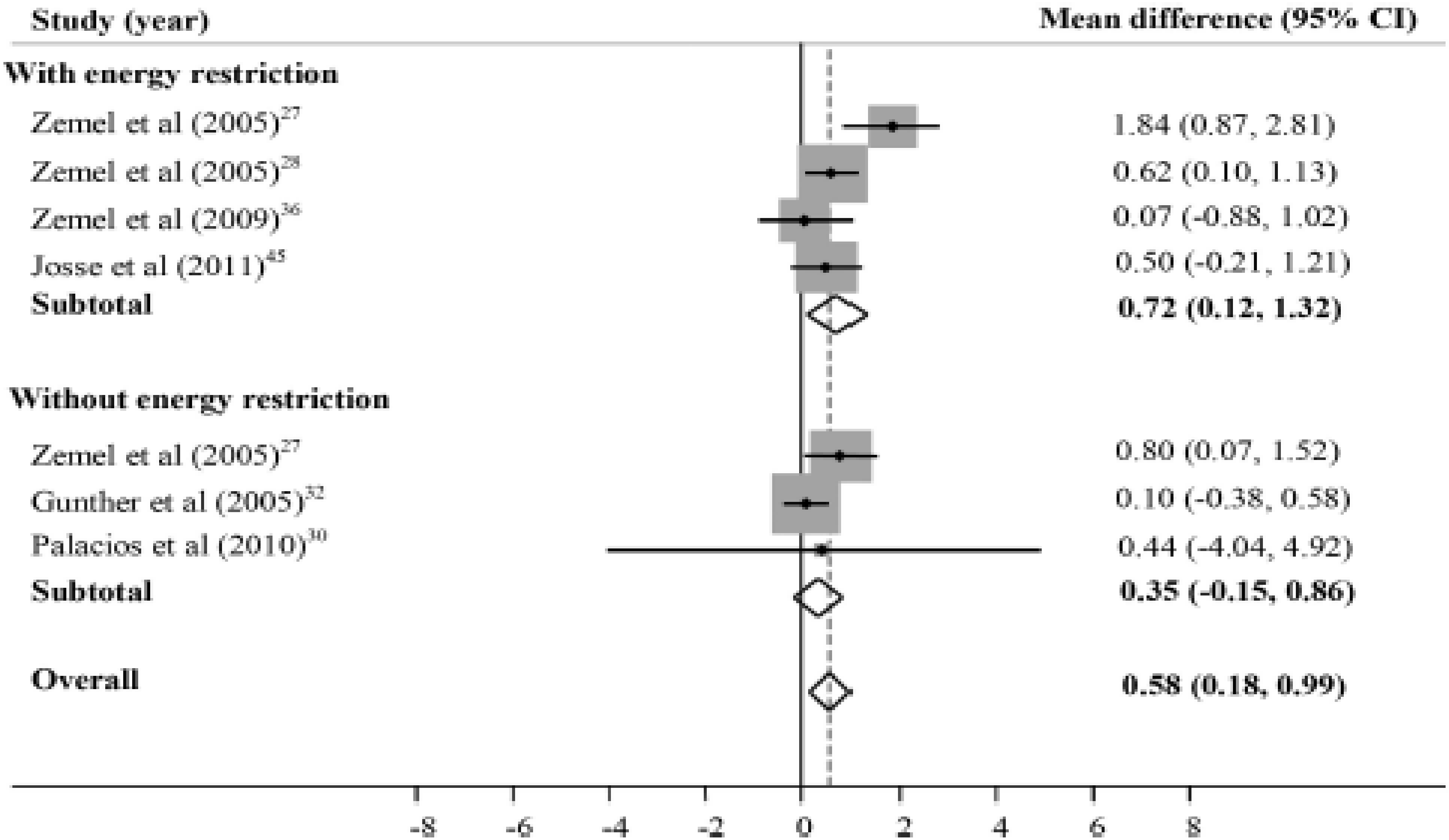
Forest plot of randomized controlled trials illustrating weighted mean difference in weight change between the dairy-supplemented and control groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the studies combined, slightly greater weight loss was seen among those with high dairy intake compared with those with low dairy intake (P-value for heterogeneity = 0.04, Q test, I2=41.2% and t2=0.64). Meta-analysis of studies that administered high dairy intake without energy restriction showed no significant effect of dairy intake on weight change (P-value for heterogeneity = 0.67, Q test, I2=0% and t2=0.0). For studies that administered energy restriction, we found the significant effect of dairy intake on weight loss (P-value for heterogeneity = 0.32, Q test, I2=12.5% and t2=0.15).

Abargouei AS et al, International J Obesity 2012,36: 1485-1493



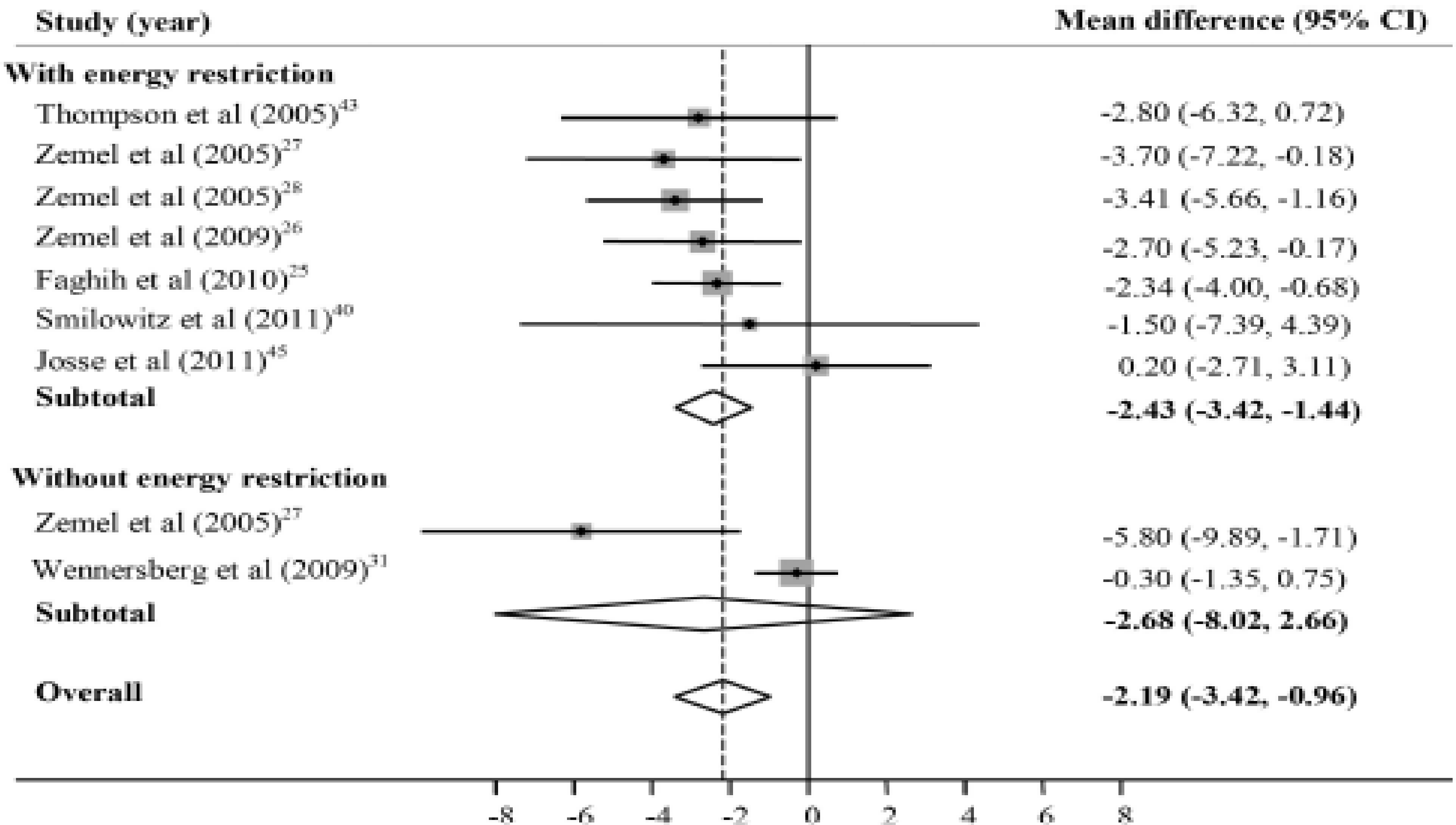
Forest plot of randomized controlled trials illustrating weighted mean difference in fat mass between the dairy-supplemented and control groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the eligible studies combined, the significant effect of dairy intake on reducing fat mass was observed (P-value for heterogeneity = 0.01, Q test, I2=56.1% and t2=0.51). For nine RCTs with energy restriction, the effect was also significant (P-value for heterogeneity = 0.33, Q test, I2=12.0% and t2=0.11). However, data from four RCTs that did not administer energy restriction indicated no significant effect of dairy intake on body fat mass (P-value for heterogeneity = 0.02, Q test, I2=70.7% and t2=0.46).

Abargouei AS et al, International J Obesity 2012,36: 1485-1493



Forest plot of randomized controlled trials illustrating weighted mean difference in lean body mass between the dairy supplemented and control groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the studies combined, the significant effect of dairy consumption on lean body mass was seen (P-value for heterogeneity = 0.07, Q test, I2=48.9% and t2=0.13). For four RCTs that administered energy restriction, high dairy intake had resulted in a greater gain in lean body mass compared with that in the control group (P-value for heterogeneity = 0.06, Q test, I2=59.7% and t2=0.21). Such a finding was not obtained for three RCTs that had not administered energy restriction (P-value for heterogeneity = 0.29, Q test, I2=19.5% and t2=0.05).

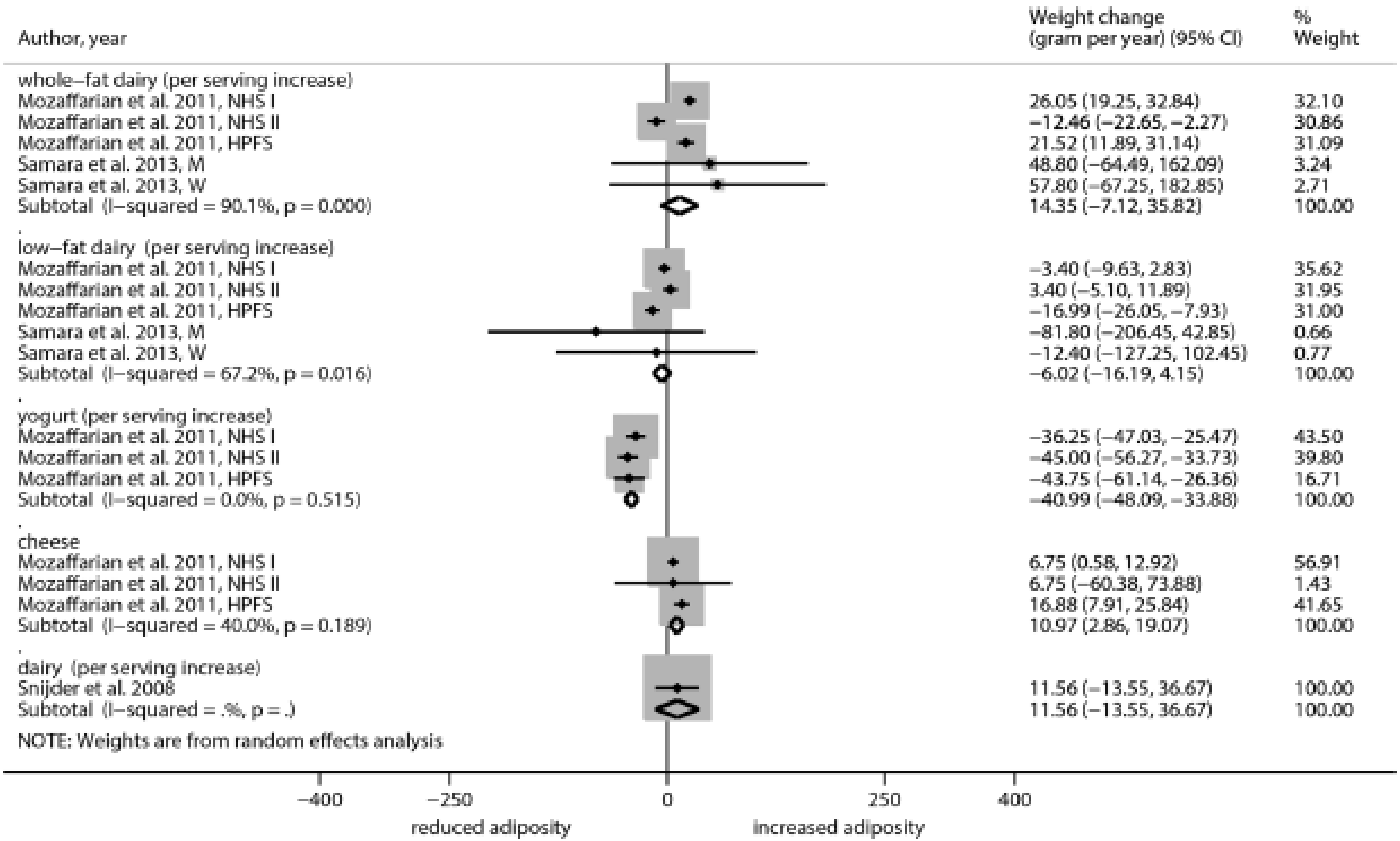
Abargouei AS et al, International J Obesity 2012,36: 1485-1493



Forest plot of randomized controlled trials illustrating weighted mean difference in WC between the dairy-supplemented and control groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the studies combined, the significant effect of dairy consumption on WC was seen (P-value for heterogeneity = 0.03, Q test, I2=53.4% and t2=1.63). For seven RCTs that administered energy restriction, high dairy intake had resulted in a greater reduction in WC compared with that in the control group (P-value for heterogeneity =0.60, Q test, I2=0.0% and t2=0.0). Such a finding was not obtained for two RCTs that had not administered energy restriction (P-value for heterogeneity = 0.01, Q test, I2=84.7% and t2=12.8)

Abargouei AS et al, International J Obesity 2012,36: 1485-1493

Forest plot of associations between changes in body weight (gram/year) and dairy consumption in cohort studies of adults



Schwingshackl L et al PLoS ONE 11(6): e0157461. doi:10.1371/journal.pone.0157461

Whole milk compared with reduced-fat milk and childhood overweight: a systematic review and meta-analysis

Shelley M Vanderhout,[1,3,4] Mary Aglipay,[3] Nazi Torabi,[5] Peter Jüni,[2,4] Bruno R da Costa,[2,4] Catherine S Birken,[6,7,8] Deborah L O'Connor,[1,8] Kevin E Thorpe,[2,4] and Jonathon L Maguire[1,2,3,4,6,7,8]

Methods:

Observational and interventional studies of healthy children aged 1–18 y that described the association between cow-milk fat consumption and adiposity

Results:

28 met the inclusion criteria: 20 were cross-sectional and 8 were prospective cohort

No clinical trials were identified

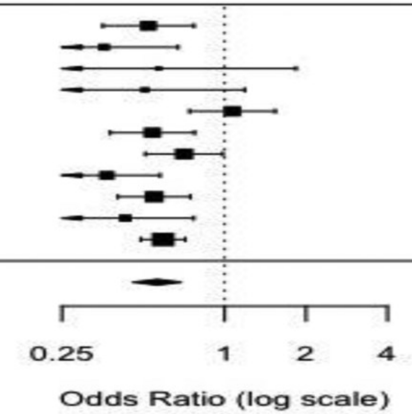
In 18 studies, higher cowmilk fat consumption was associated with lower child adiposity, and 10 studies did not identify an association

Vanderhout SM et al, Am J Clin Nutr 2020;111:266–279

Crude OR of overweight/obesity comparing children consuming whole milk with children consuming reduced-fat milk. (A) Cross-sectional studies only; (B) prospective cohort studies only.

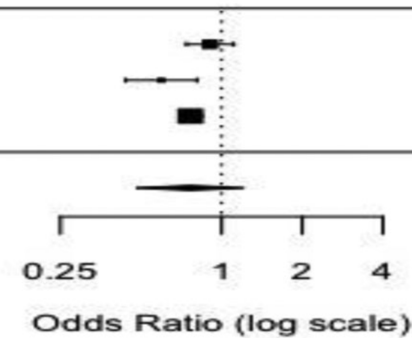
A Cross-sectional studies only.

Author, Year	N	Whole Milk	Reduced Fat Milk	Odds Ratio [95% CI]
Barba, 2005 (42)	884	759	125	0.52 [0.35, 0.77]
Barbiero, 2008 (43)	405	359	46	0.36 [0.19, 0.67]
Beck, 2017 (44)	135	41	94	0.57 [0.18, 1.83]
Charvet, 2019 (39)	197	38	148	0.51 [0.22, 1.19]
Gaylis, 2017 (46)	598	262	336	1.07 [0.74, 1.54]
Kim, 2019 (47)	529	196	340	0.54 [0.38, 0.77]
Mazahery, 2017 (49)	1155	852	303	0.71 [0.51, 0.98]
Nelson, 2004 (51)	451	350	101	0.37 [0.23, 0.58]
Nilsen, 2017 (52)	2104	366	1738	0.55 [0.40, 0.75]
Tovar, 2012 (57)	217	148	69	0.43 [0.24, 0.77]
Vanderhout, 2016 (58)	2738	1331	1407	0.59 [0.49, 0.72]
RE Model				0.56 [0.46, 0.69]



B Prospective cohort studies only.

Author, Year	N	Whole Milk	Reduced Fat Milk	Odds Ratio [95% CI]
Bigornia, 2014 (60)	2282	1224	1058	0.91 [0.74, 1.11]
Huh, 2010 (62)	852	452	400	0.60 [0.44, 0.81]
Scharf, 2013 (38)	8350	3491	4859	0.76 [0.70, 0.84]
RE Model				0.76 [0.48, 1.21]



Pooled effects were determined using random effects models; I2 = 73.8%. P values for pooled ORs: cross sectional studies P < 0.0001; prospective cohort studies P = 0.006.

Vanderhout SM et al, Am J Clin Nutr 2020;111:266–279

ARTICLE

Check for updates

Cow's milk fat and child adiposity: a prospective cohort study

Shelley M. Vanderhout[1,2], Charles D. G. Keown-Stoneman[3,4], Catherine S. Birken[5,6], Deborah L. O'Connor[1], Kevin E. Thorpe[3,4] and Jonathon L. Maguire[1,2]

BACKGROUND:

International guidelines recommend children aged 9 months to 2 years consume whole (3.25%) fat cow's milk, and children older than age 2 years consume reduced (0.1–2%) fat cow's milk to prevent obesity

The objective of this study was to evaluate the longitudinal relationship between cow's milk fat (0.1–3.25%) intake and body mass index z-score (zBMI) in childhood

METHODS:

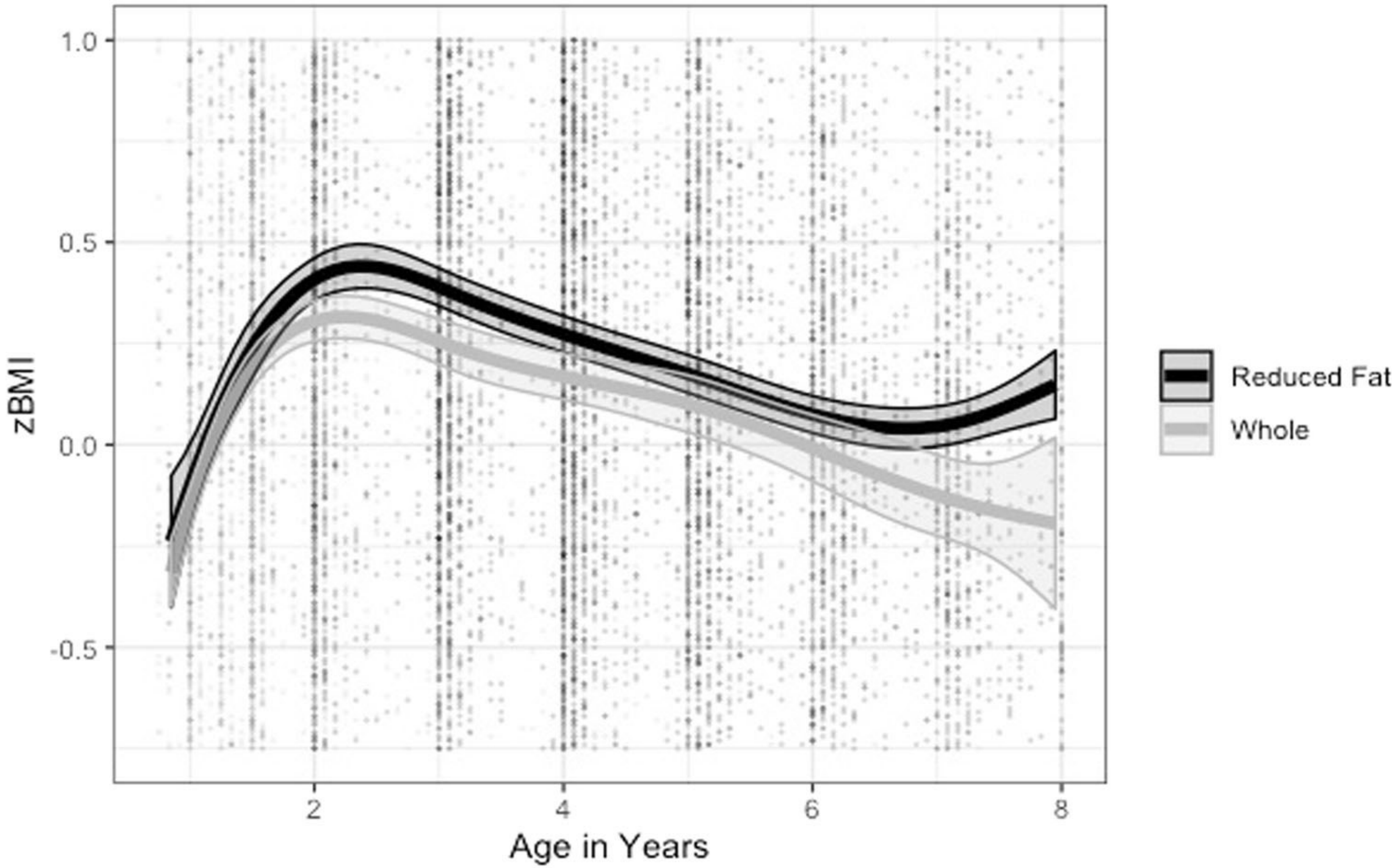
A prospective cohort study of children aged 9 months to 8 years was conducted through the TARGet Kids! primary care research network

RESULTS:

Among children aged 9 months to 8 years (N = 7467; 4699 of whom had repeated measures), each 1% increase in cow's milk fat consumed was associated with a 0.05 lower zBMI score (95% CI −0.07 to −0.03, $p < 0.0001$) after adjustment for covariates including volume of milk consumed

Vanderhout SM et al, Intern J Obes 2021; doi.org/10.1038/s41366-021-00948-6

The relationship between cow's milk fat and zBMI in children aged 9 months to 8 years, adjusted for clinically relevant covariates



Vanderhout SM et al, Intern J Obes 2021; doi.org/10.1038/s41366-021-00948-6

The relationship between cow's milk fat intake and odds of overweight (excluding obesity) and obesity relative to normal weight (−2 < zBMI ≤ 1), adjusted for clinically relevant covariates[a]

	Overweight (1 < zBMI ≤ 2)		Obesity (zBMI > 2)	
	aOR (95% CI)	*p* value	aOR (95% CI)	*p* value
Whole vs. 0.1–2%	0.84 (0.77–0.91)	<0.0001	0.82 (0.68–1.00)	0.047
Whole vs. 2%	0.81 (0.74–0.89)	<0.0001	0.83 (0.68–1.00)	0.05
Whole vs. 1%	0.96 (0.82–1.11)	0.57	0.87 (0.66–1.16)	0.35
Whole vs. 0.1%	0.83 (0.66–1.03)	0.09	0.69 (0.45–1.05)	0.08

Logistic generalized estimating equations were used and adjusted for volume of cow's milk, volume of sugary drink intake (including 100% juice, fruit drinks, and soft drinks) consumed in 250 ml cups per day, maternal ethnicity, self-reported family income, birth weight in kilograms, breastfeeding duration in months, and parent BMI.

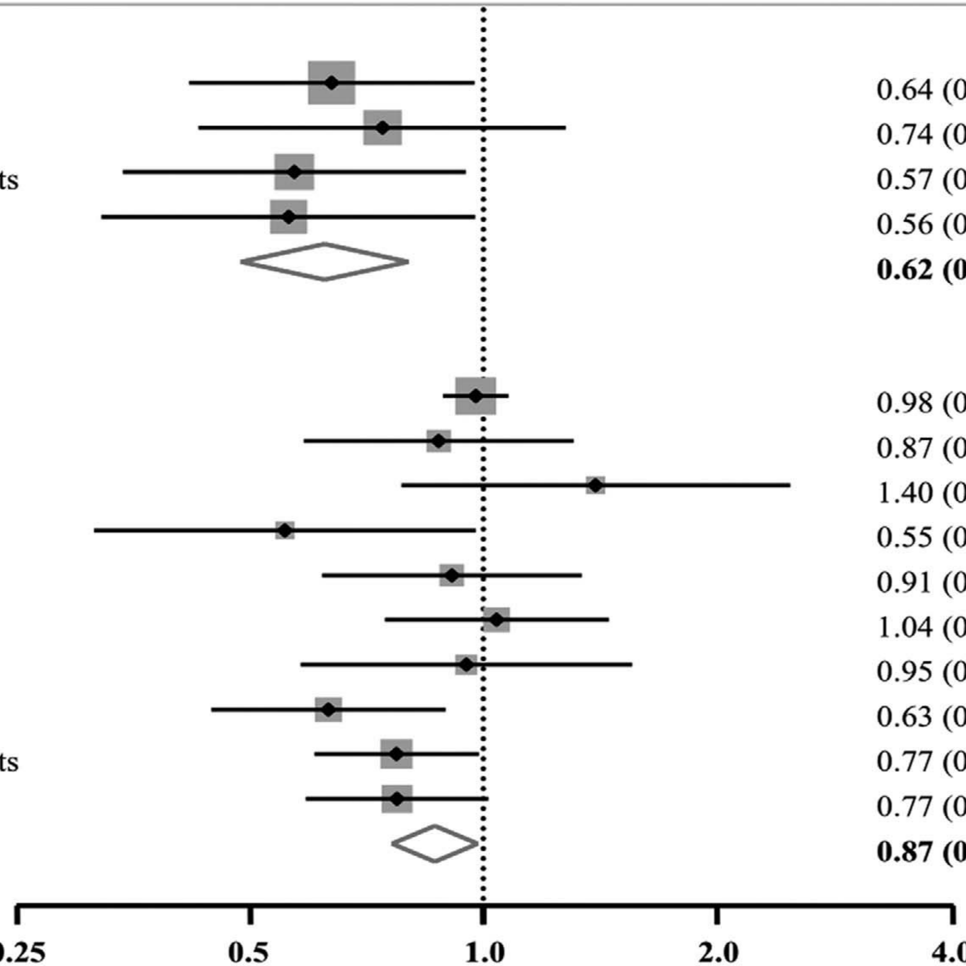
aOR adjusted odds ratio

[a]N = 7467

Vanderhout SM et al, Intern J Obes 2021; doi.org/10.1038/s41366-021-00948-6

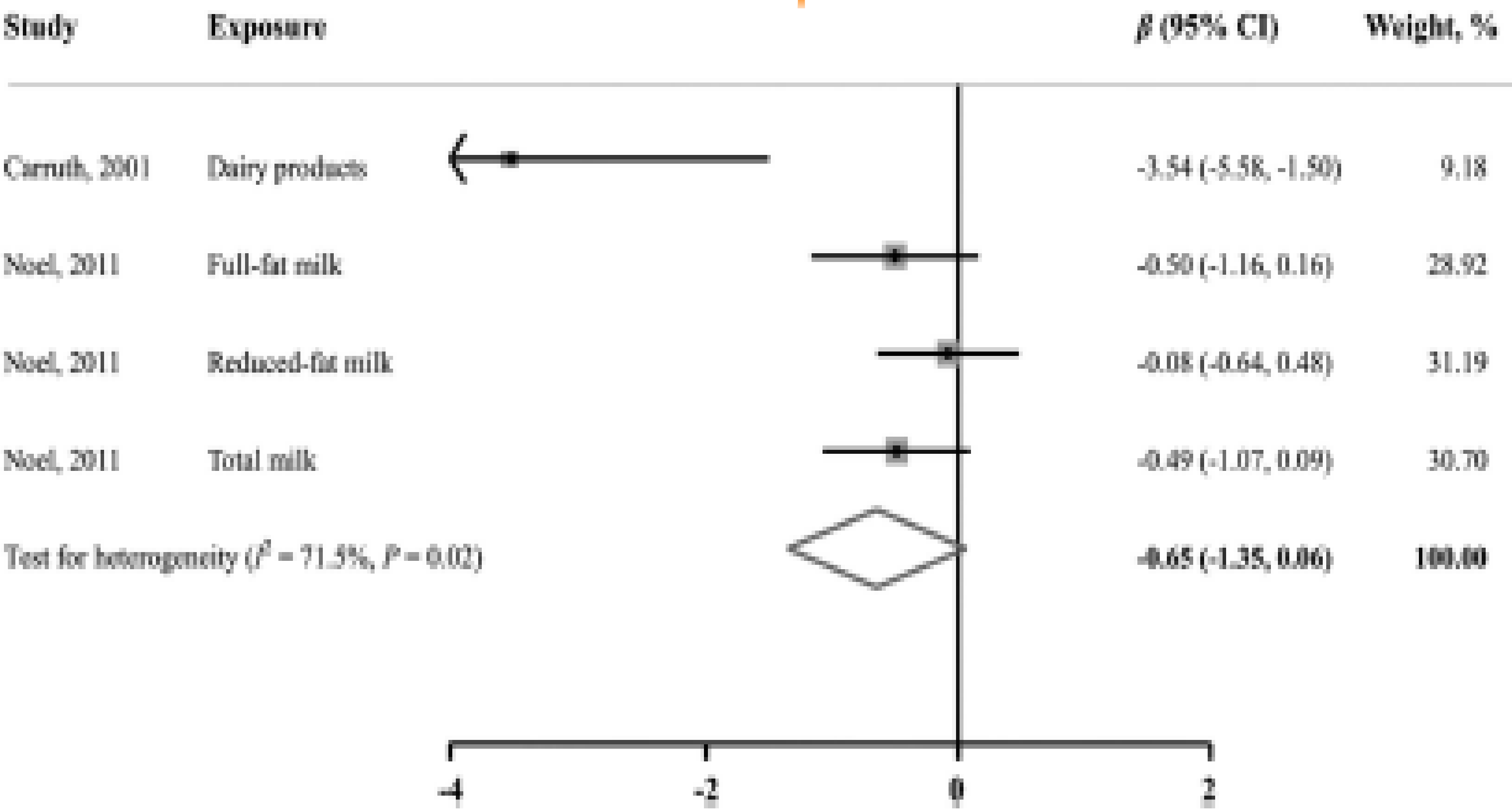
Multivariable-adjusted ORs and 95% CIs of childhood overweight/obesity in relation to dairy consumption. The dots indicate the adjusted ORs by comparing the highest with the lowest level of dairy intake or each 1 serving/day

Study	Exposure	OR (95% CI)	Weight, %
Highest *vs.* Lowest			
Scharf, 2013	Milk	0.64 (0.42, 0.97)	34.64
Bigornia, 2014	Full-fat dairy products	0.74 (0.43, 1.28)	20.96
Bigornia, 2014	Reduced-fat dairy products	0.57 (0.34, 0.95)	24.12
Bigornia, 2014	Total dairy products	0.56 (0.32, 0.97)	20.28
Test for heterogeneity ($I^2 = 0.0\%$, $P = 0.88$)		**0.62 (0.49, 0.80)**	**100.00**
Each 1 serving/day increment			
Huus, 2009	Cheese	0.98 (0.89, 1.08)	24.88
Huus, 2009	Cream/crème fraiche	0.87 (0.59, 1.31)	7.54
Huus, 2009	Ice-cream	1.40 (0.78, 2.49)	4.19
Huus, 2009	Milk	0.55 (0.31, 0.98)	4.32
Huh, 2010	1%/nonfat milk	0.91 (0.62, 1.34)	7.97
Huh, 2010	Reduced-fat milk	1.04 (0.75, 1.45)	9.77
Huh, 2010	Whole milk	0.95 (0.58, 1.55)	5.48
Bigornia, 2014	Full-fat dairy products	0.63 (0.45, 0.89)	9.20
Bigornia, 2014	Reduced-fat dairy products	0.77 (0.61, 0.99)	14.09
Bigornia, 2014	Total dairy products	0.77 (0.59, 1.01)	12.55
Test for heterogeneity ($I^2 = 40.6\%$, $P = 0.09$)		**0.87 (0.76, 0.98)**	**100.00**



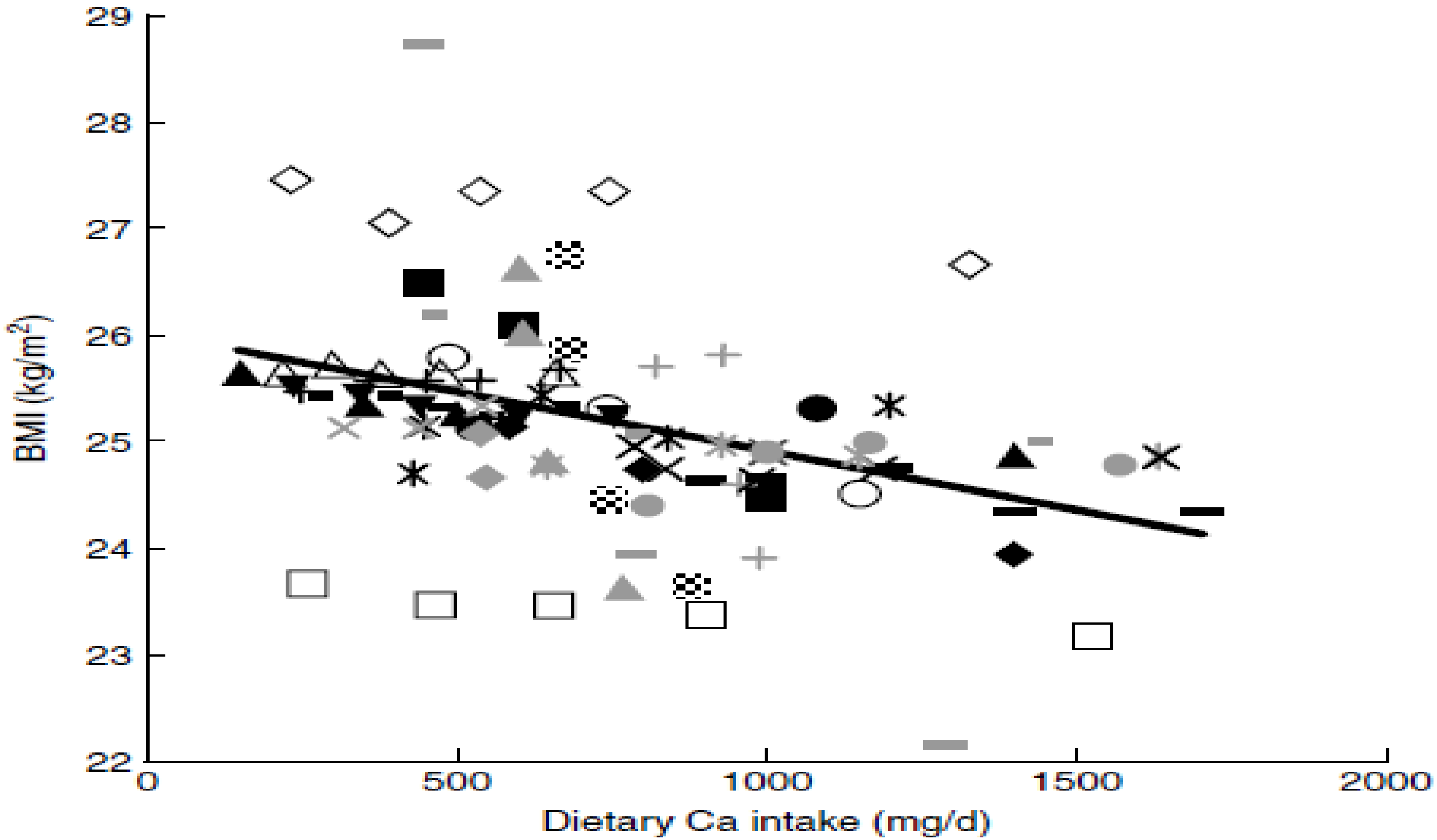
Lu L et al Eur J Clin Nutr 2016; doi:10.1038/ejcn.2015.226

Multivariable-adjusted β-coefficients and 95% CIs of percentage body fat in relation to dairy consumption. The dots indicate the adjusted β-coefficient with 1 serving/day increment in dairy consumption.

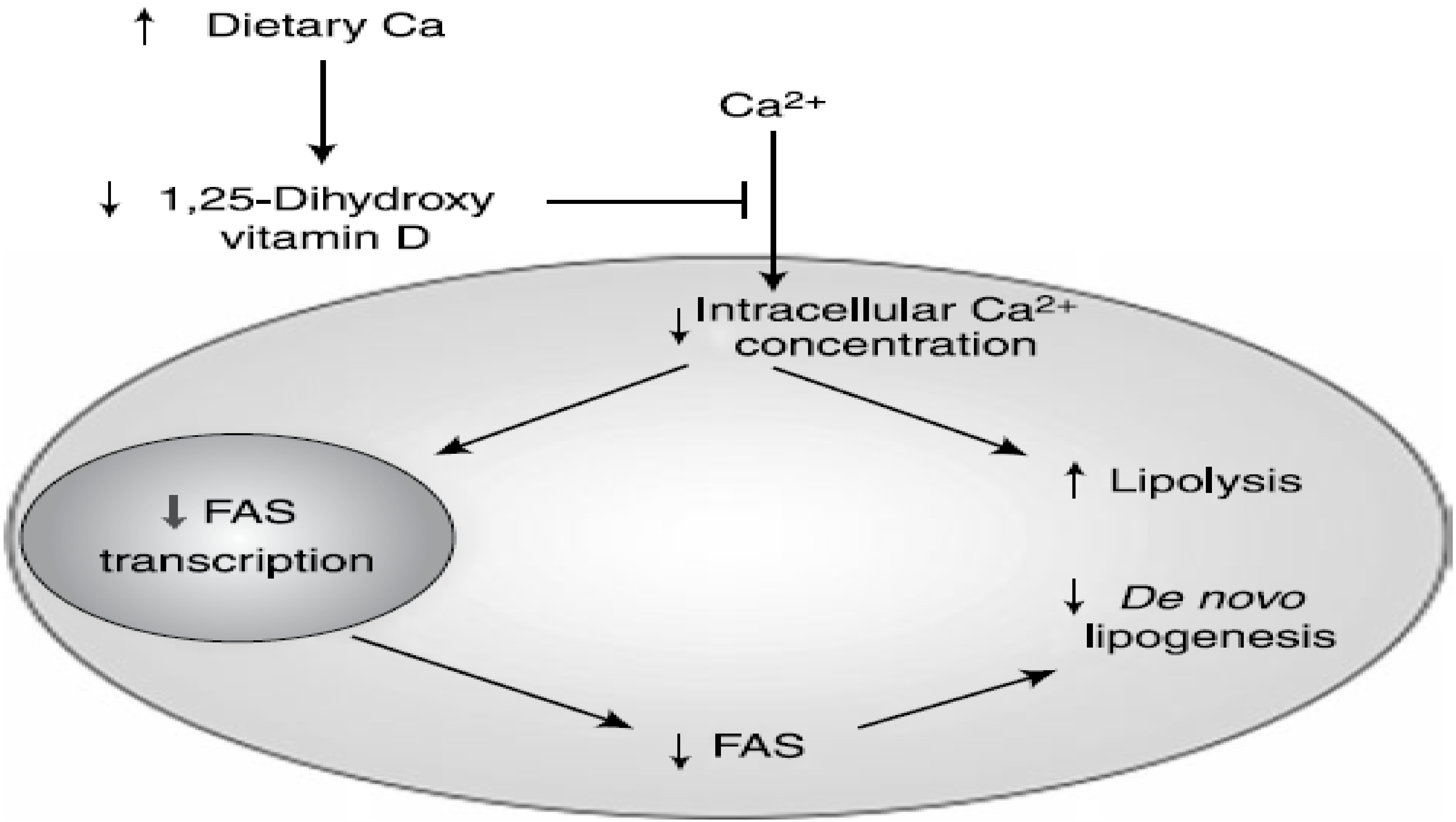


Lu L et al Eur J Clin Nutr 2016; doi:10.1038/ejcn.2015.226

Data derived from cross-sectional analysis of baseline data from eighteen large prospective cohorts showing the association between BMI and total dietary Ca intake adjusted for trial effects excluding the trials that reported only milk consumption



Dougkas A et al Nutr Res Rev 2011;24:72-95



Hypothesized mechanism of stimulation of lipolysis and inhibition of lipogenesis by dietary Ca. Increased dietary Ca intake lowers the level of the hormone 1,25-dihydroxy vitamin D, thereby lowering the uptake of Ca2+ into the cell. Decreased levels of intracellular Ca stimulate lipolysis and decrease the transcription of fatty acid synthase (FAS), resulting in the inhibition of lipogenesis

Van Meijl LEC et al Nutr Res Rev et al 2008;21:148-57

Milk protein for improved metabolic health: a review of the evidence

- Dairy protein may indirectly improve metabolic health by aiding loss of body weight and fat mass through enhanced satiety, whilst promoting skeletal muscle growth and function through anabolic effects of dairy protein-derived branch chain amino acids (BCAAs)
- BCAAs enhance muscle protein synthesis, lean body mass and skeletal muscle metabolic function
- The composition and processing of dairy protein has an impact on digestion, absorption, BCAA kinetics and function, hence the optimization of dairy protein composition through selection and combination of specific protein components in milk may provide a way to maximize benefits for metabolic health

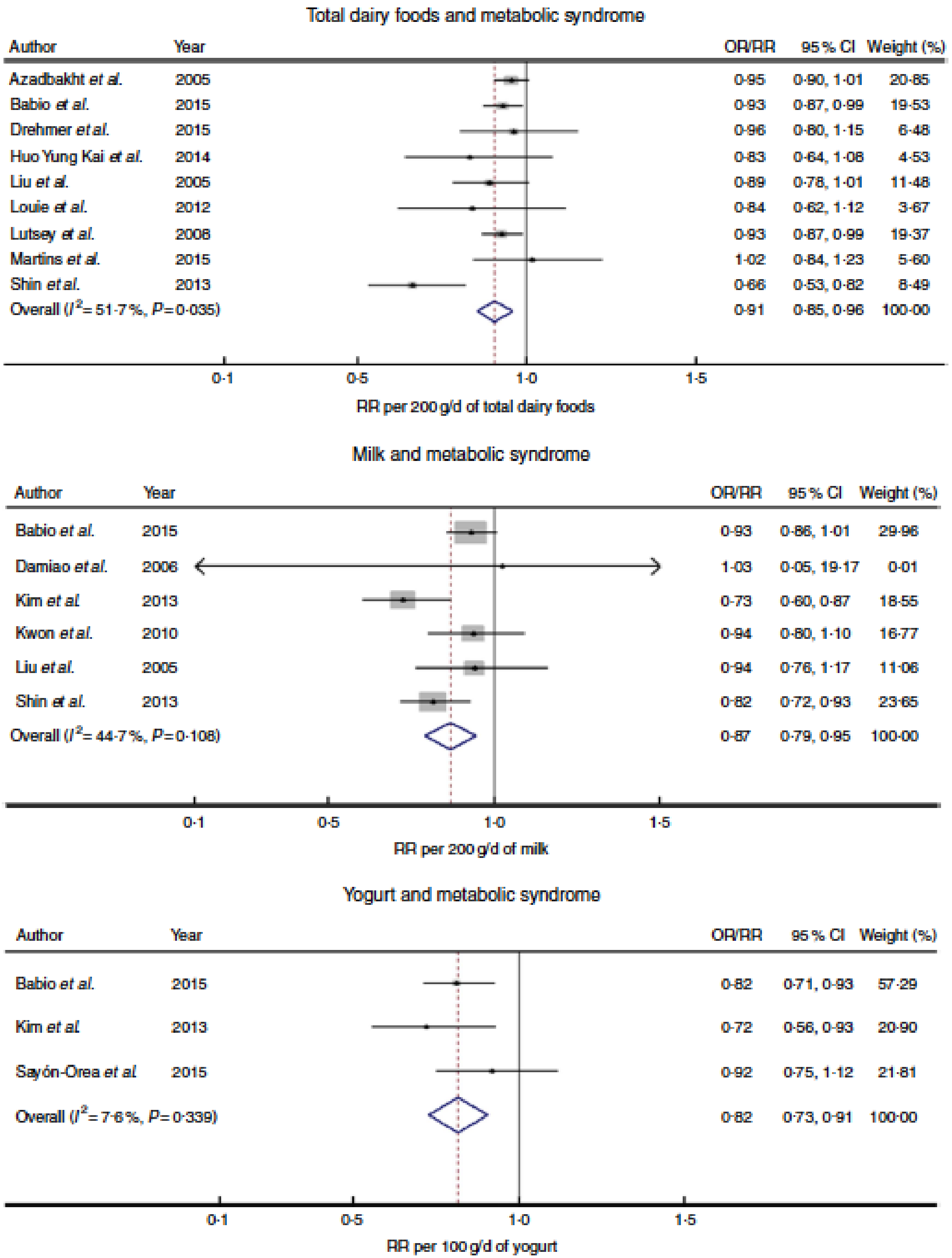
Mc Gregor RA & Poppitt SE Nutrition & Metabolism 2013;10:46

Dairy food consumption is associated with a lower risk of the metabolic syndrome and its components: a systematic review and meta-analysis

Mijin Lee[1], Hanna Lee[2] and Jihye Kim[1*]

- Ten cross-sectional studies, two nested case–control studies and twenty-nine cohort studies were included for the analysis
- In a dose–response analysis of cohort studies and cross-sectional studies, the pooled RR of the MetS for a one-serving/d increment of total dairy food (nine studies) and milk (six studies) consumption (200 g/d) were 0·91 (95% CI 0·85, 0·96) and 0·87 (95% CI 0·79, 0·95), respectively. The pooled RR of the MetS for yogurt (three studies) consumption (100 g/d) was 0·82 (95% CI 0·73, 0·91)
- Total dairy food consumption was associated with lower risk of MetS components, such as hyperglycaemia, elevated blood pressure, hypertriacylglyceriedmia and low HDL- cholesterol
- A one-serving/d increment of milk was related to a 12% lower risk of abdominal obesity, and a one-serving/d increment of yogurt was associated with a 16% lower risk of hyperglycaemia

Lee M et al, Br J Nutr 2018; doi:10.1017/S0007114518001460



The forest plot for the linear dose–response relationship between dairy food consumption (per increment of g/d) by subtype and the metabolic syndrome. RR, relative risk

Lee M et al, Br J Nutr 2018; doi:10.1017/S0007114518001460

Dairy Product Consumption in the Prevention of Metabolic Syndrome: A Systematic Review and Meta-Analysis of Prospective Cohort Studies

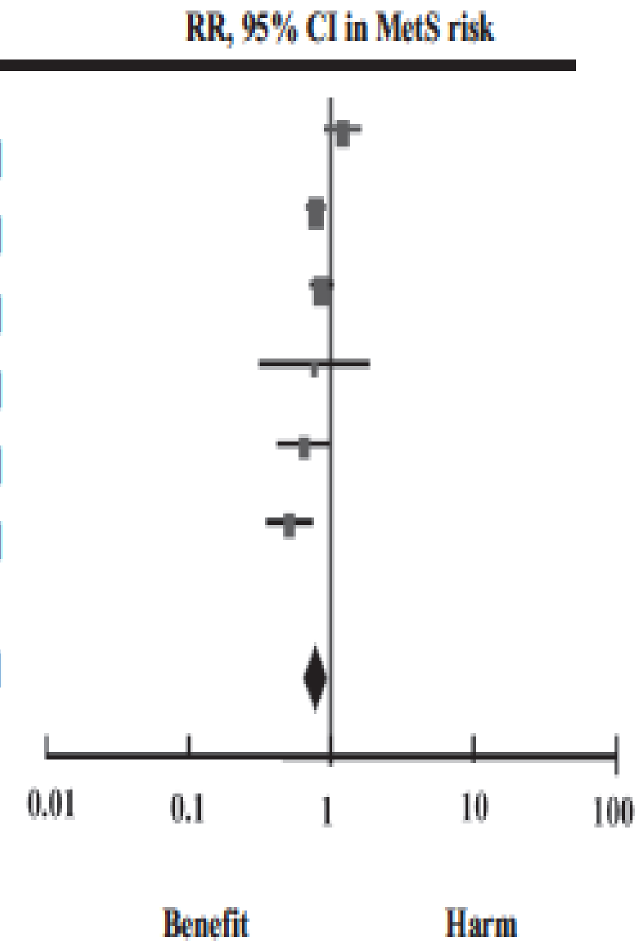
Guillermo Mena-Sánchez,[1,2] Nerea Becerra-Tomás,[1,2] Nancy Babio,[1,2] and Jordi Salas-Salvadó[1,2]

- 12 and 11 studies were included for the qualitative and quantitative synthesis, respectively.
- Total dairy product consumption was inversely associated with the risk of MetS (9 study comparisons; RR: 0.73; 95% CI: 0.64, 0.83).
- Low-fat dairy and total yogurt consumption were inversely associated with the risk of MetS (low-fat dairy: 2 study comparisons; RR: 0.77; 95% CI: 0.65, 0.91; total yogurt consumption: 4 study comparisons; RR: 0.74; 95% CI: 0.66, 0.82). The linear RR per 1 serving of yogurt/d was 0.77 (95% CI: 0.60, 1.00).
- Low-fat yogurt and whole-fat yogurt were inversely associated with the risk of MetS (low-fat yogurt: 2 study comparisons; RR: 0.72; 95% CI: 0.62, 0.84; whole-fat yogurt: 2 study comparisons; RR: 0.81; 95% CI: 0.70, 0.94).
- Total milk consumption was inversely associated with the risk of MetS (6 study comparisons; RR: 0.79; 95% CI: 0.64, 0.97). Whole-fat dairy consumption was not associated with MetS risk.

Mena-Sanchez G et al, Adv Nutr 2019;10:S144–S153

Association between total milk consumption and the risk of MetS incidence

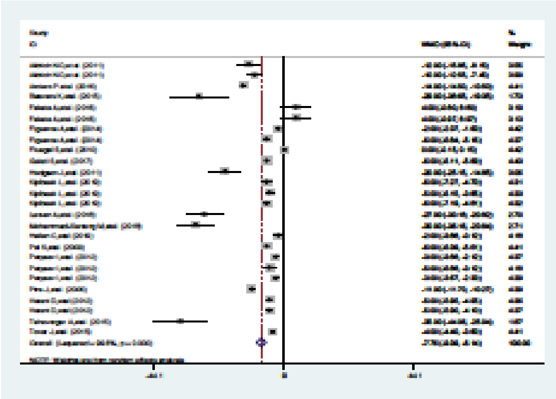
Study, Year	Events	Participants	Weight	RR [95% CI]
Lin Y et al. (22)	206	888	18.4%	1.21 [0.90, 1.62]
Shin H et al. (8)	1.240	7.240	25,0%	0.79 [0.67, 0.93]
Babio N et al. (13)	804	1.868	23.6%	0.85 [0.70, 1.03]
Damião R et al. (15)	57	151	4.6%	0.76 [0.31, 1.85]
Kim D et al. (Men) (23)	1.008	2.859	13.3%	0.64 [0.42, 0.97]
Kim D et al. (Women) (23)	750	2.651	15.0%	0.51 [0.35, 0.74]
Total (95% CI)	**4.065**	**15.657**	**100%**	**0.79 [0.64, 0.97]**



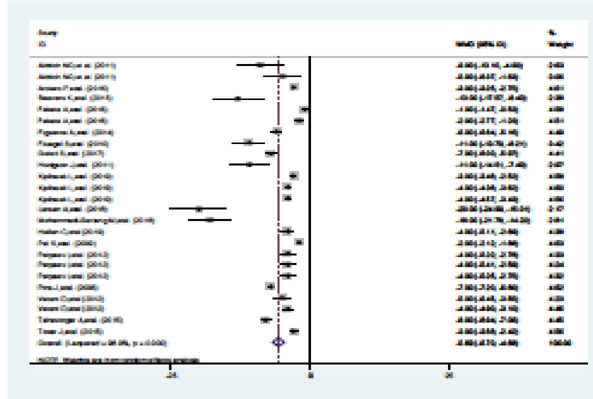
Heterogeneity: $Chi^2 = 14.61$, $df = 5$ ($P = 0.01$); $I^2 = 66\%$

Test for overall effect: $Z = 2.23$ ($P = 0.03$)

Mena-Sanchez G et al, Adv Nutr 2019;10:S144–S153

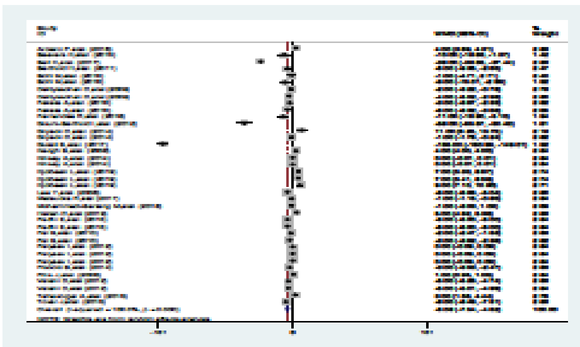


Systolic blood pressure

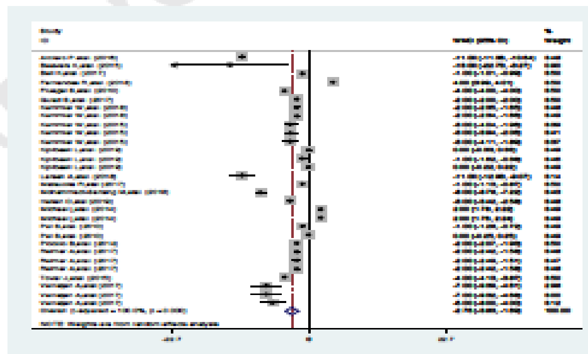


Diastolic Blood Pressure

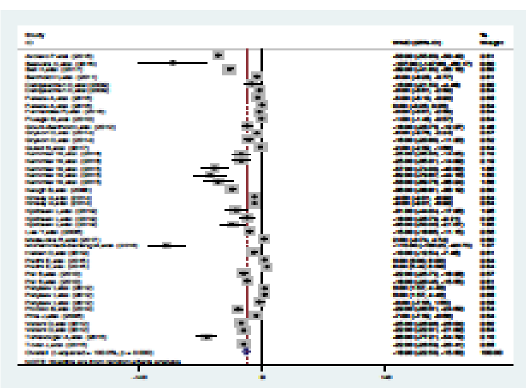
Forest plot of Effect of Whey protein on Components of Metabolic Syndrome



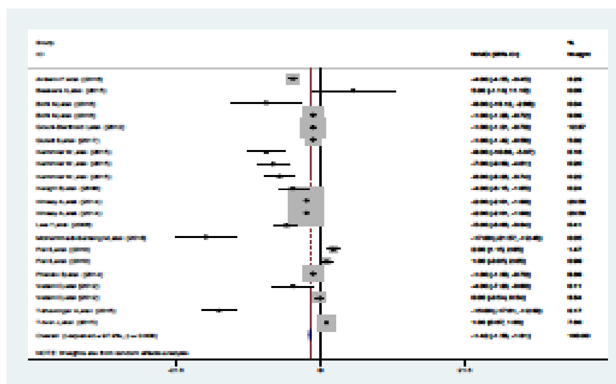
HDL



Waist circumference



Triglyceride



Fasting blood sugar

Mustafa M et al, Diabetes & Metabolic Syndrome: Clinical Research & Reviews 2019

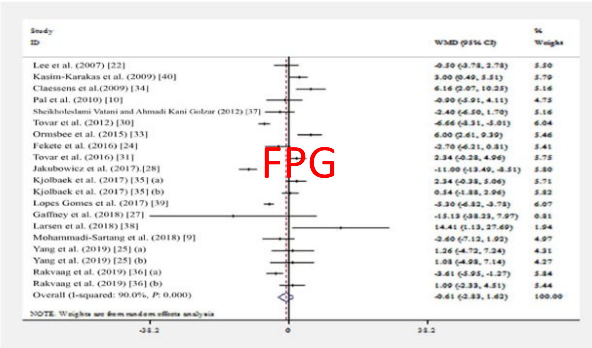
Effects of whey protein on glycemic control and serum lipoproteins in patients with metabolic syndrome and related conditions: a systematic review and meta-analysis of randomized controlled clinical trials

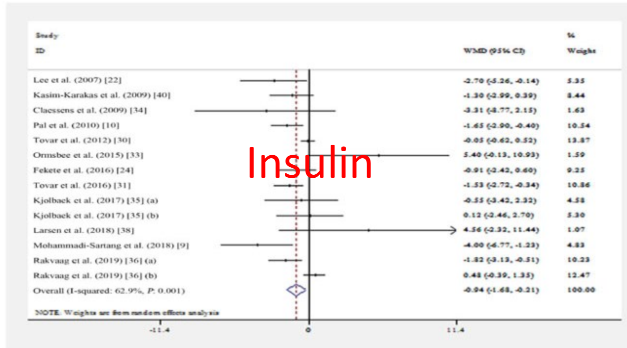
Elaheh Amirani[1], Alireza Milajerdi[2], Željko Reiner[3,4], Hamed Mirzaei[1], Mohammad Ali Mansournia[5] and Zatollah Asemi[1*]

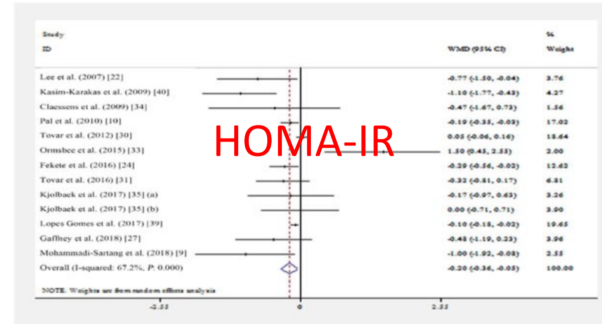
This systematic review and meta-analysis aimed to assess the effects of whey protein on serum lipoproteins and glycemic status in patients with metabolic syndrome (MetS) and related disorders

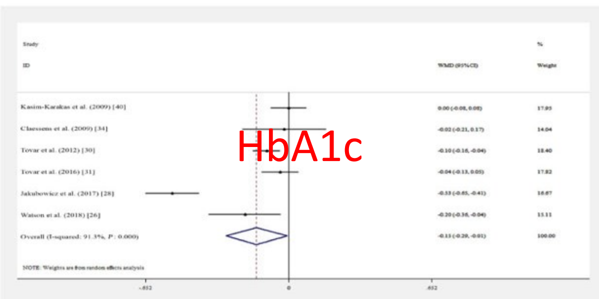
Amirani et al, Lipids Health Dis 2020;19:209

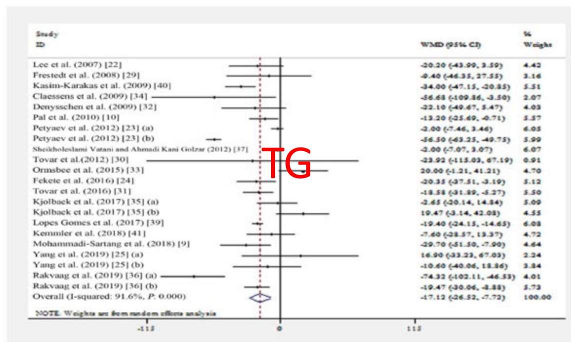
Meta-analysis of glycemic control and serum lipids. Weighted mean difference estimates

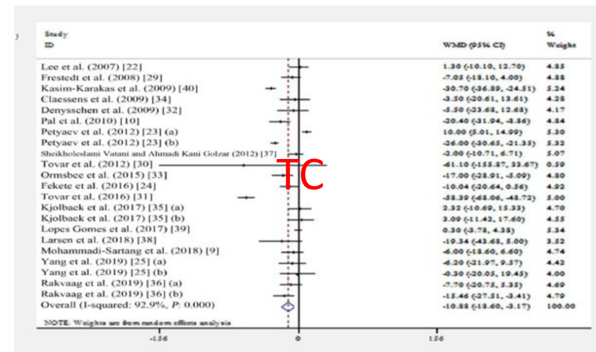


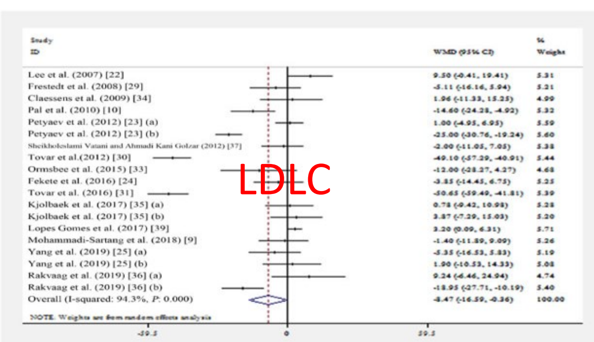


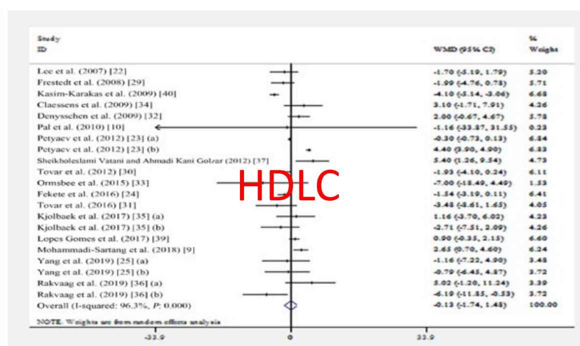


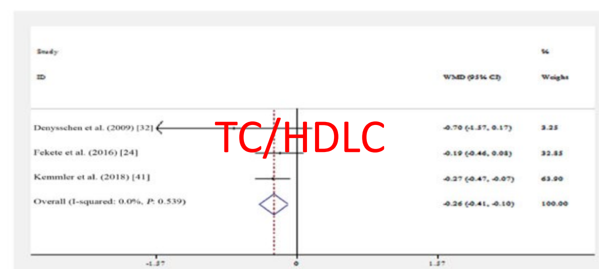








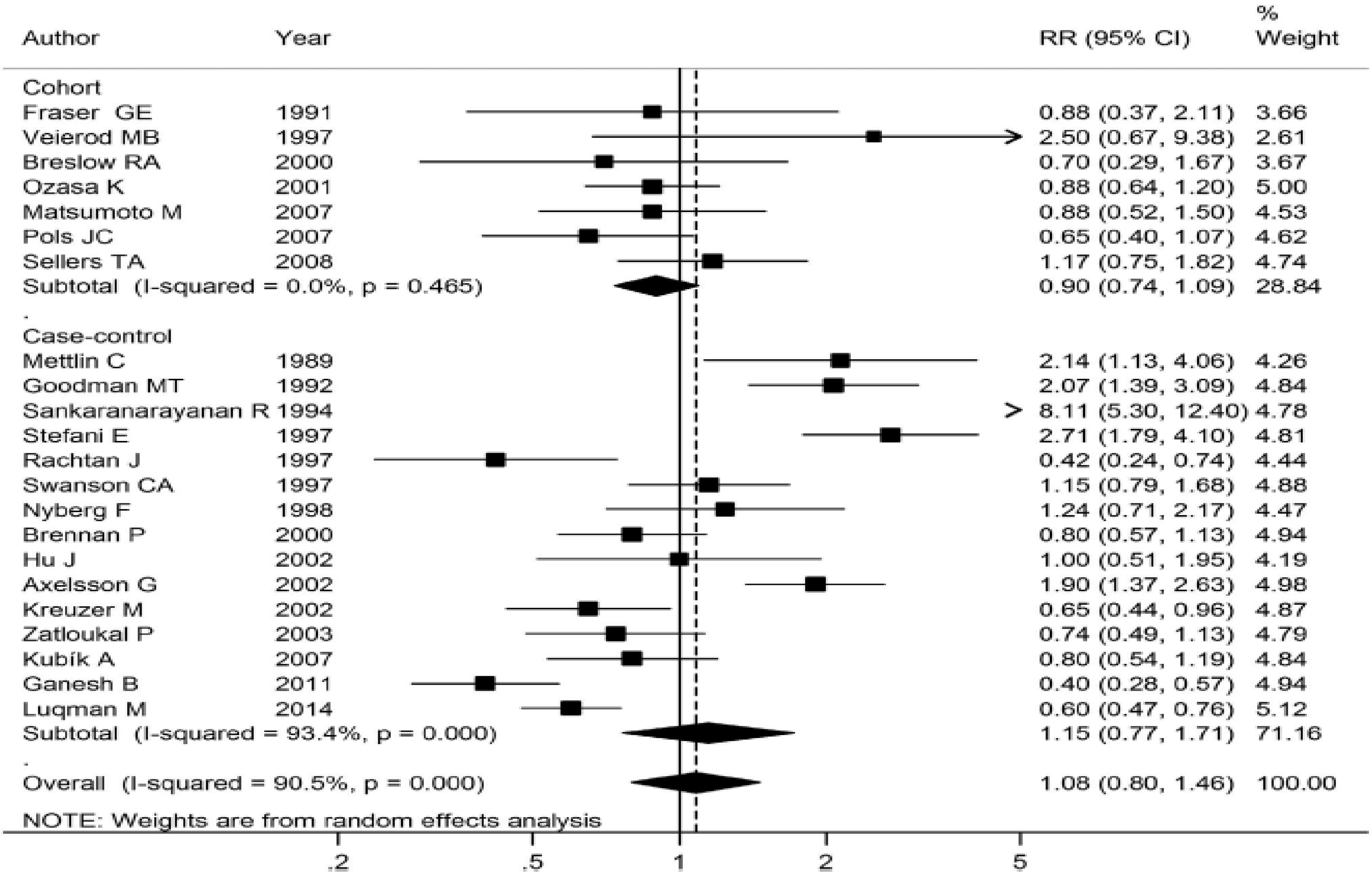




Amirani et al, Lipids Health Dis 2020;19:209

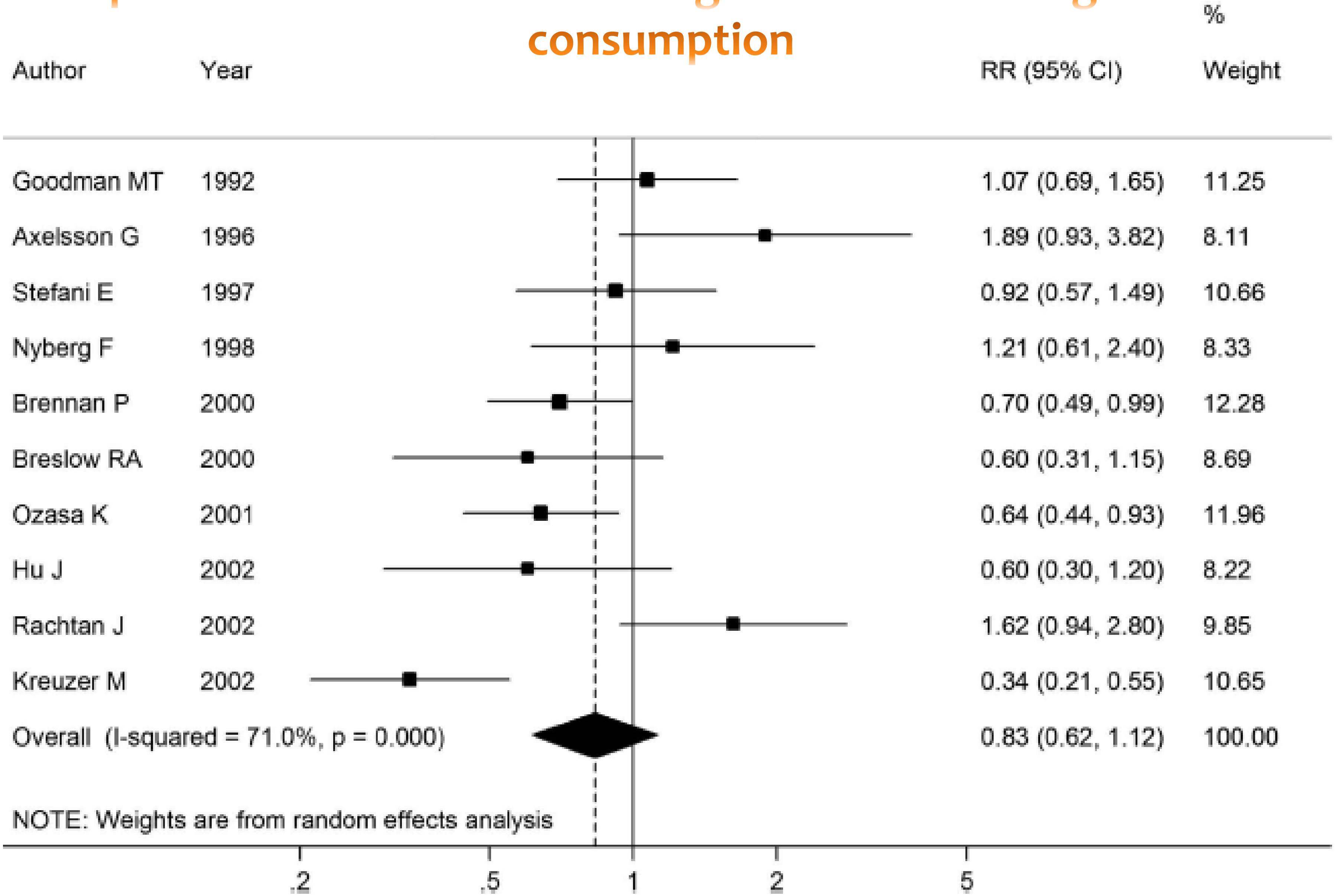
Cancer

Forest plot of milk intake and lung cancer risk for high versus low consumption



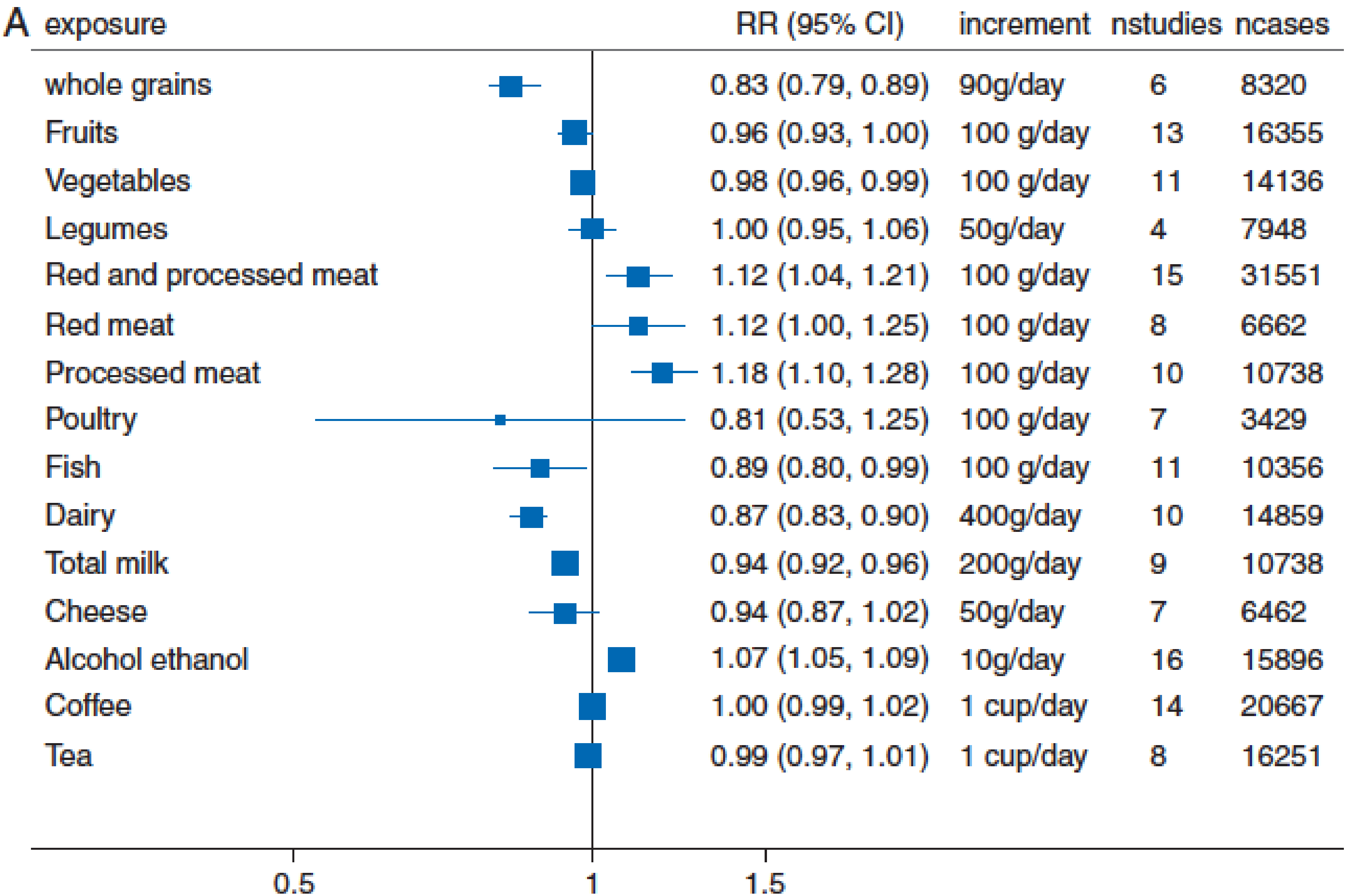
Yang, Y. et al. Sci. Rep. 6, 20624; doi: 10.1038/srep20624 (2016)

Forest plot of cheese intake and lung cancer risk for high versus low consumption

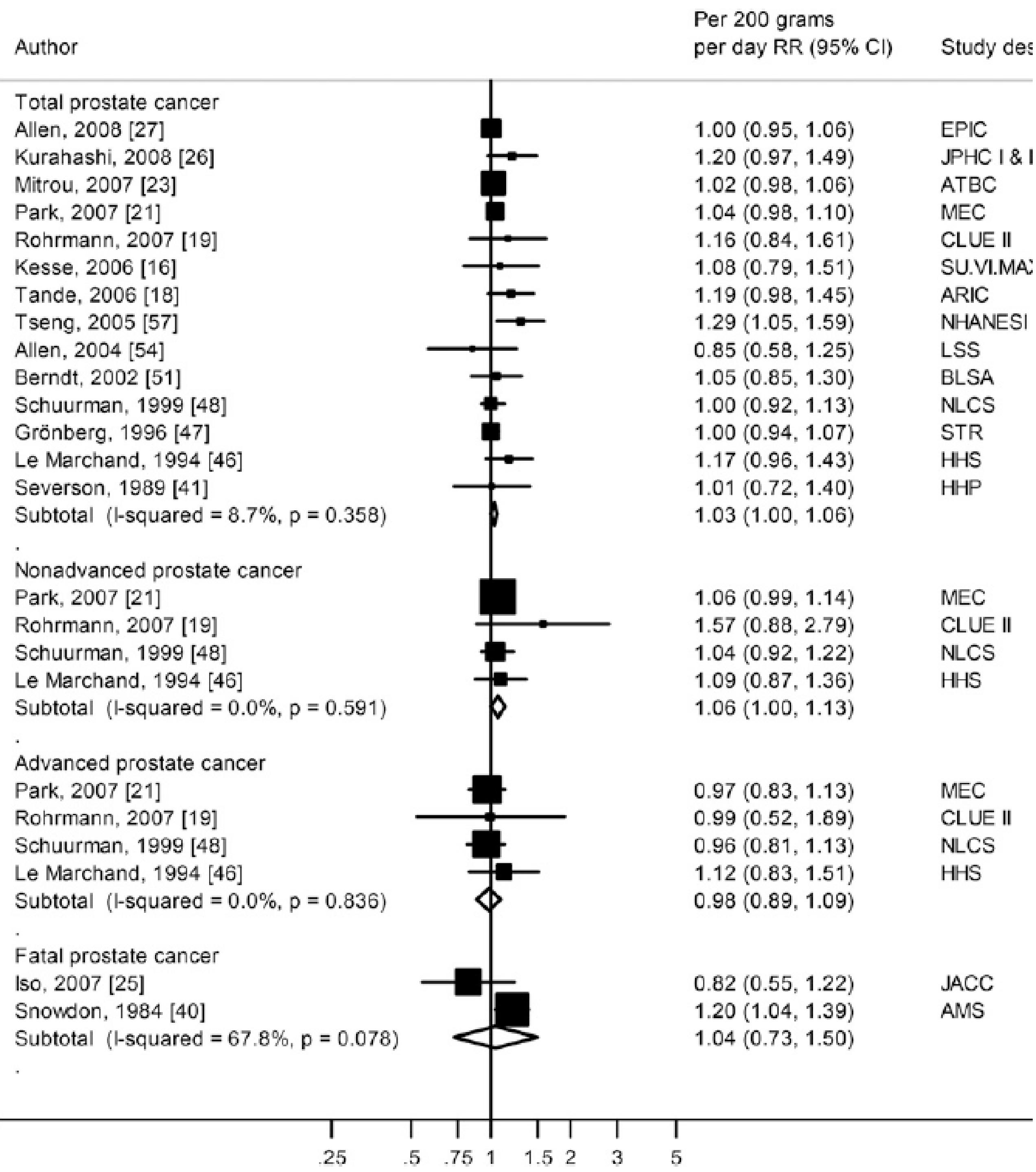


Yang, Y. et al. Sci. Rep. 6, 20624; doi: 10.1038/srep20624 (2016)

(A) Dose–response meta-analysis of foods and beverages and risk of colorectal cancer



Viera AR et al



Intake of milk and prostate cancer risk

Aune D et al. Am J Clin Nutr 2015;101:87–117.

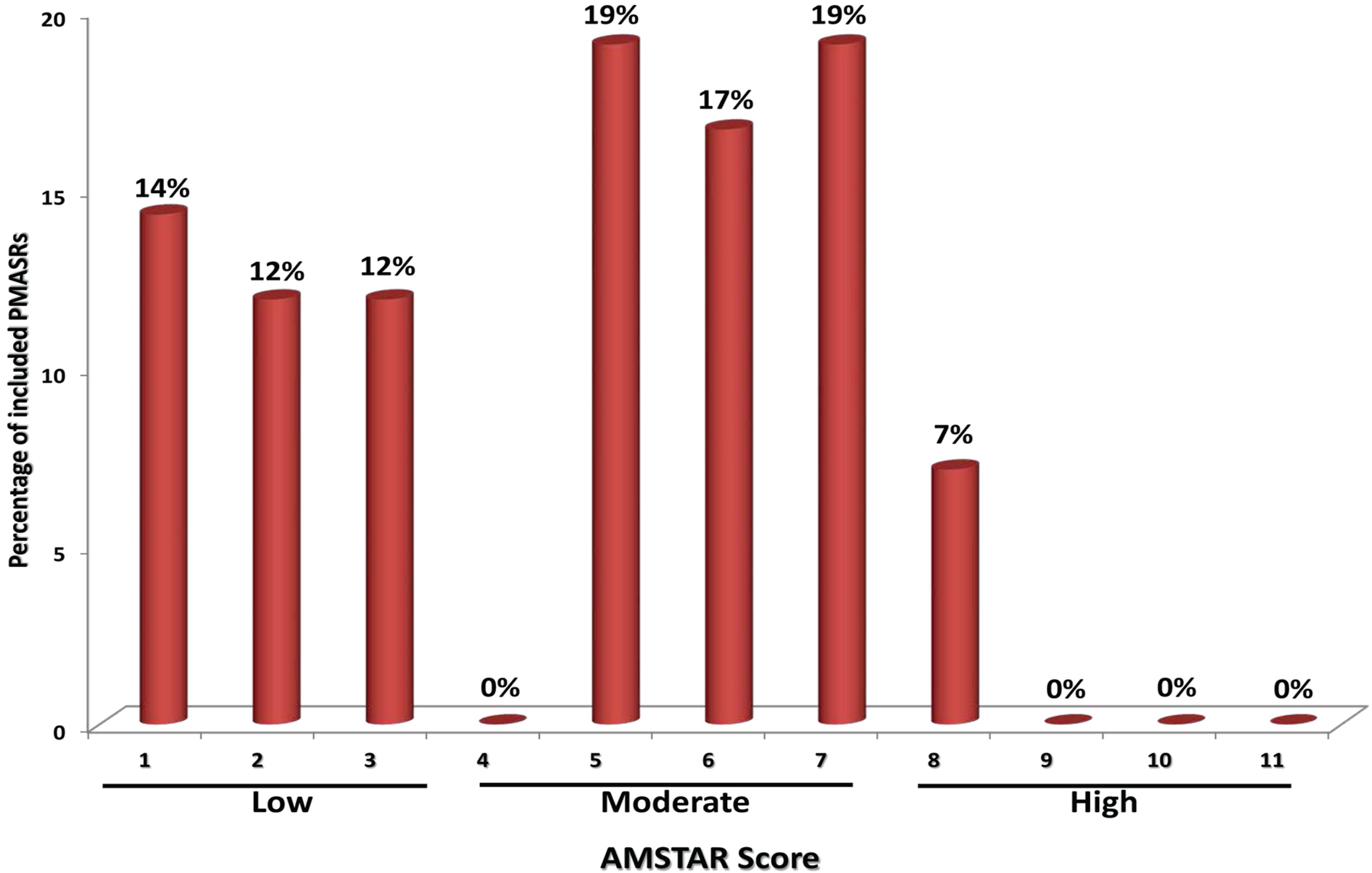
Dairy product consumption and development of cancer: an overview of reviews

Maya M Jeyaraman,[1,2] Ahmed M Abou-Setta,[1,2] Laurel Grant,[3] Farnaz Farshidfar,[1] Leslie Copstein,[1] Justin Lys,[1] Tania Gottschalk,[4] Danielle Desautels,[3,5,6] Piotr Czaykowski,[2,3,5,6] Marshall Pitz,[2,3,5,6,7] Ryan Zarychanski[1,2,3,5,6,7]

- Objectives To provide a comprehensive systematic overview of current evidence from pooled analyses/meta-analyses and systematic reviews (PMASRs) pertaining to dairy consumption and incident cancer and/or all-cause or cancer-specific mortality.
- Design Overview of reviews.
- Setting Community setting.
- Primary and secondary outcomes measures
    - Primary outcome measure is development of any type of cancer.
    - Secondary outcome measures are all-cause mortality and cancer-specific mortality

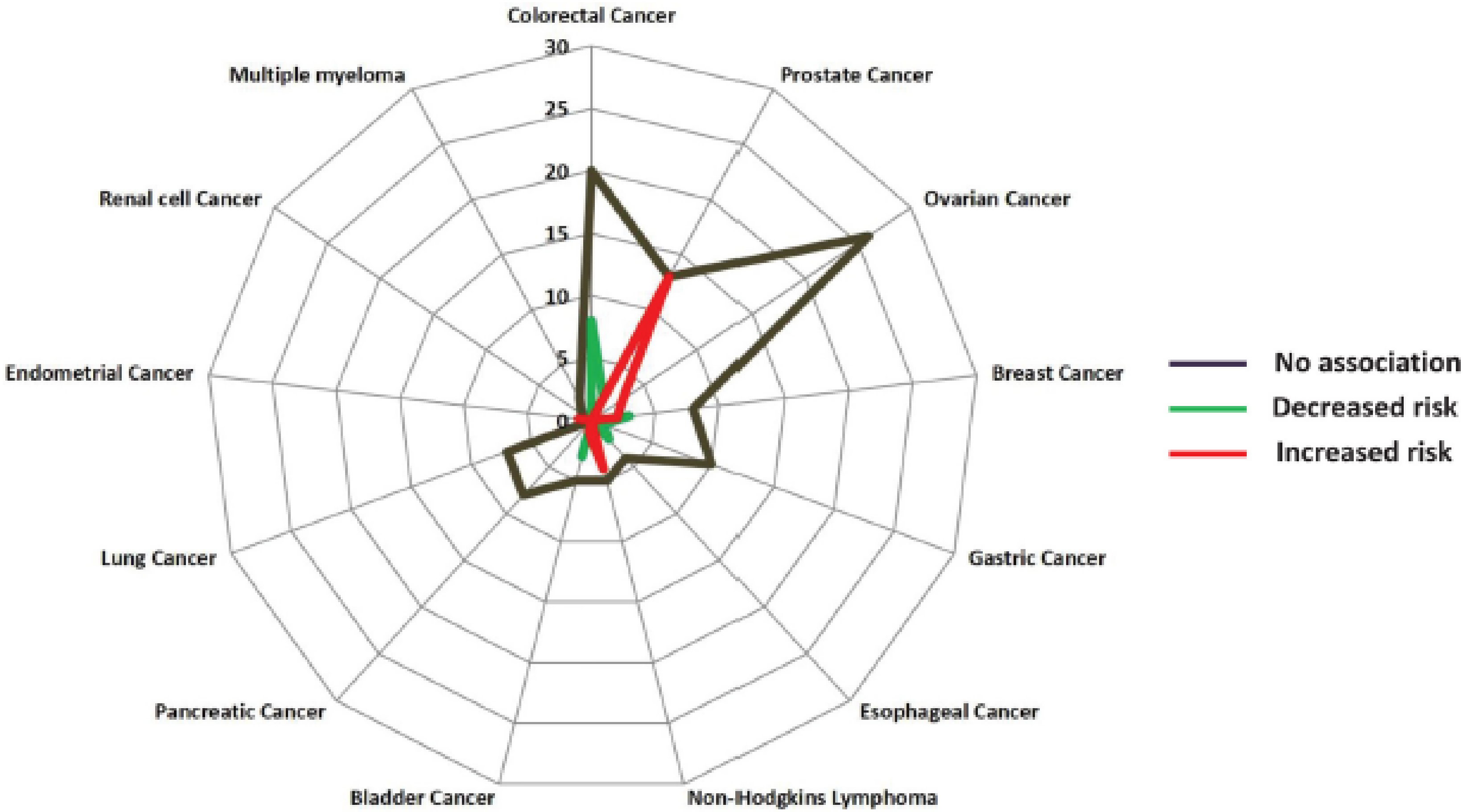
Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Bar chart depicting the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) scores of included pooled analyses/meta-analyses and systematic reviews (PMASRs).



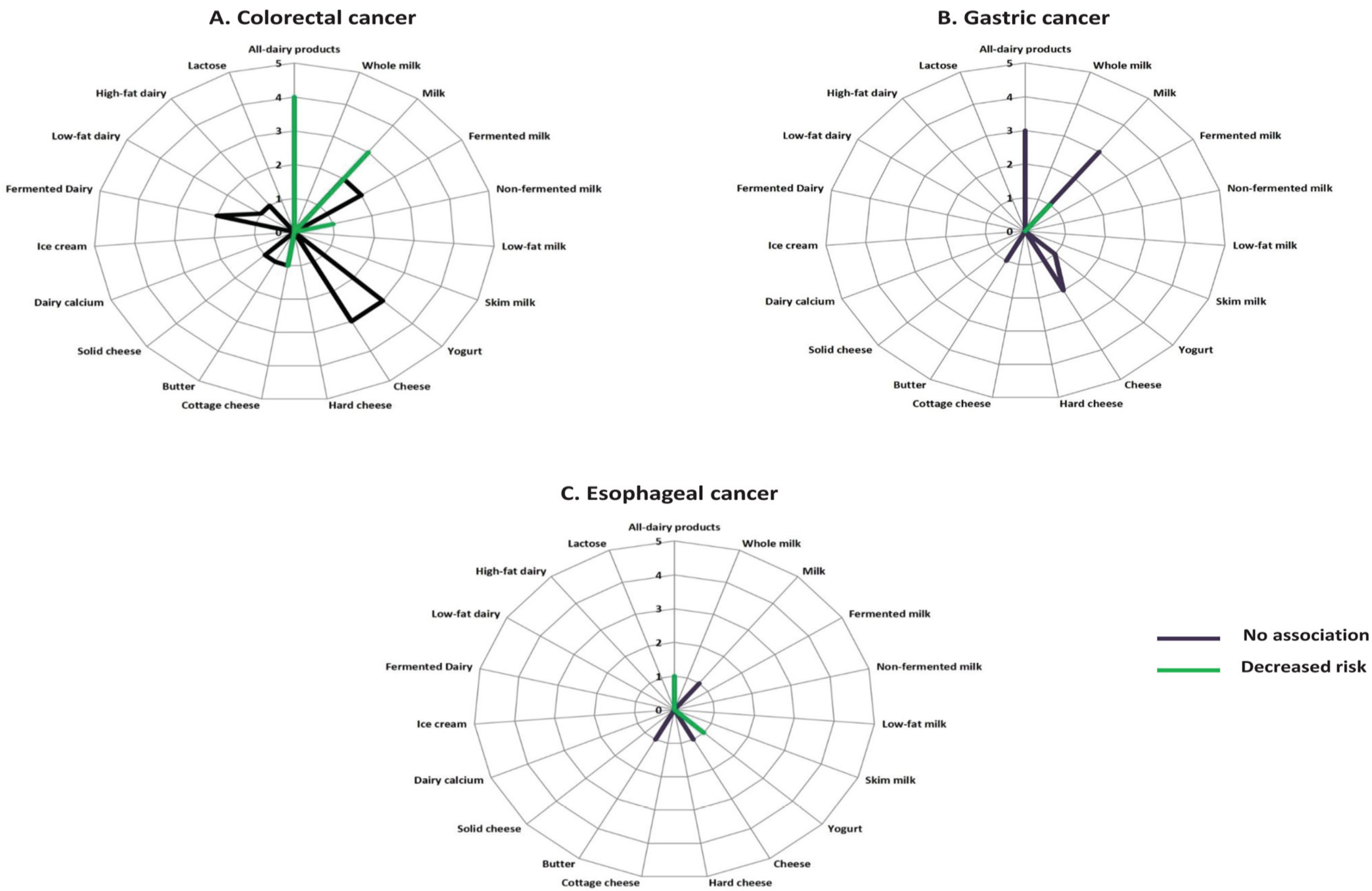
Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Radar plot depicting the nature of association between dairy consumption and risk of cancer (as reported in included pooled analyses / meta- analyses and systematic reviews (PMASRs)).



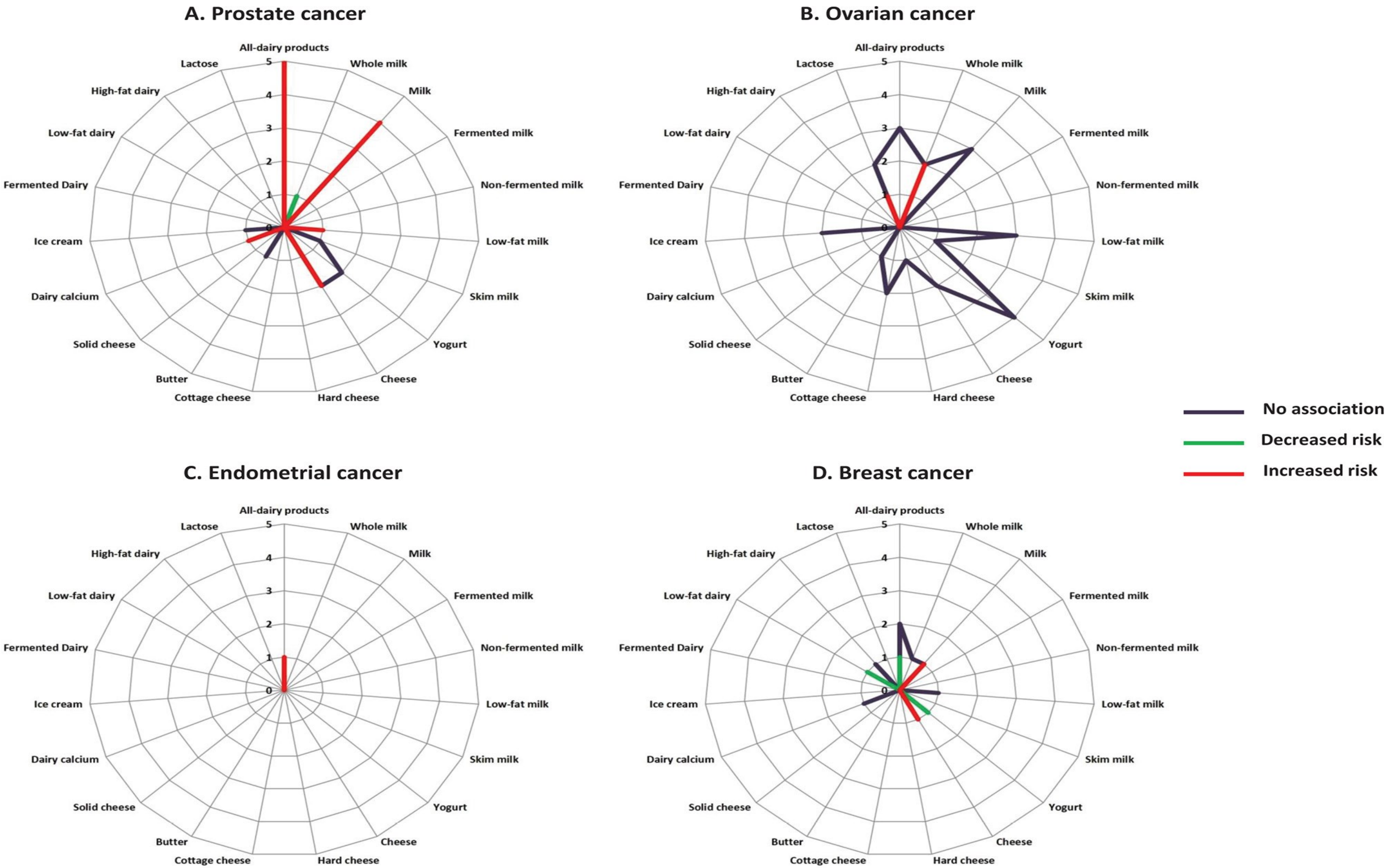
Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Radar plots depicting the associations between various dairy products consumption and risk of gastrointestinal cancer



Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Radar plots depicting the nature of association between various dairy products consumption and risk of hormone-dependent cancers



Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Prostate cancer

- Twenty-eight meta-analyses explored associations between various dairy products consumption and risk of prostate cancer
- Thirteen meta-analyses showed non-significant association between ‘all-dairy products’, milk, skim milk, yogurt, cheese, butter or ice cream consumption and risk of prostate cancer.
- Two meta-analyses showed decreased risk of prostate cancer with higher whole milk and cheese consumption.
- Thirteen meta-analyses showed increased risk of prostate cancer with higher consumption of ‘all-dairy products’, milk, low-fat milk, cheese or dairy calcium.

Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Breast cancer

- Thirteen meta-analyses explored associations between various dairy products and risk of breast cancer
- Eight meta-analyses showed non-significant associations between ‘all-dairy products’, whole milk, milk, low-fat milk, cheese, dairy calcium or high-fat dairy consumption and the risk of breast cancer
- Three meta-analyses showed decreased risk of breast cancer with higher consumption of ‘all-dairy products’, yogurt or low-fat dairy
- Two meta-analyses showed increased risk of breast cancer with higher consumption of milk or cheese

Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Conclusion

- None of the included primary studies in the PMASRs were randomized controlled trials (RCTs); thus we are only able to infer associations and not causality.
- In the context of variable and often discordant PMASRs, it can be suggested that higher consumption of dairy products may be associated with decreased risk of gastrointestinal cancers and that an uncertain or no established cancer risk associated with hormone-dependent or other hormone-independent cancers
- Limited data precluded the ability to evaluate the association of dairy consumption on either all-cause mortality or cancer-specific mortality

Jeyaraman MM, et al. BMJ Open 2019;9:e023625. doi:10.1136/bmjopen-2018-023625

Umbrella

Milk consumption and multiple health outcomes: umbrella review of systematic reviews and meta-analyses in humans

Xingxia Zhang[1,2], Xinrong Chen[1,2], Yujie Xu[3], Jie Yang[2], Liang Du[4], Ka Li[1,2*] and Yong Zhou[2*]

- Umbrella review of meta-analyses and systematic reviews in humans
- Totally, 41 meta-analyses with 45 unique health outcomes were included
- Dose–response analyses indicated that an increment of 200 ml (approximately 1 cup) milk intake per day was associated with a lower risk of cardiovascular disease, stroke, hypertension, colorectal cancer, metabolic syndrome, obesity and osteoporosis
- Beneficial associations were also found for type 2 diabetes mellitus and Alzheimer's disease
- Conversely, milk intake might be associated with higher risk of prostate cancer, acne and Fe-deficiency anaemia in infancy
- Potential allergy or lactose intolerance need for caution
- Milk consumption does much more good than harm for human health

Zhang X et al. Nutr Metab (Lond) (2021) 18:7

Conclusion

- As full-fat dairy products are rich in saturated and trans fat, as well as sodium (cheese) dietary guidelines recommend consumption of fat-free or low-fat dairy products in place of full-fat
- However, dairy products vary greatly in both their nutrient content and their bioactive ingredients, and research increasingly highlights the importance of focusing on whole foods (i.e., the food matrix) as opposed to single nutrients, such as saturated fat
- Dairy products, particularly yogurt and cheese, do not have adverse effects on insulin sensitivity, blood lipid profile, and blood pressure
- Protective effects against cardiovascular disease and type 2 diabetes, total and some types of cancer, even against obesity and metabolic syndrome

Thank you very much for your attention