Dairy foods and diabetes – a protective role?

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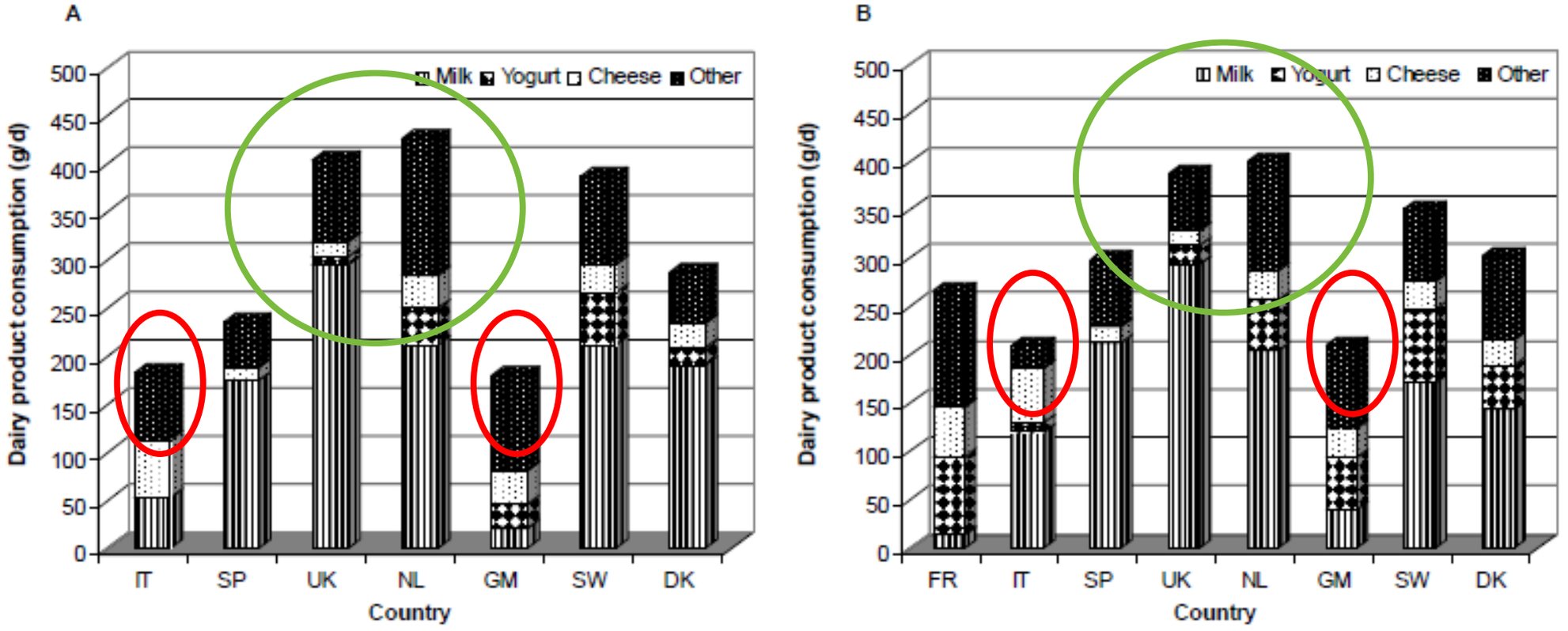
- Dairy consumption and diabetes risk
- Cardiometabolic effects of dairy
- Compounds: vitamin K, probiotics

Introduction

- Dairy is widely consumed source of vitamins, minerals, but also saturated fat and sodium
- Studies suggest health benefits for dairy consumption on type 2 diabetes

Dairy consumption in Europe



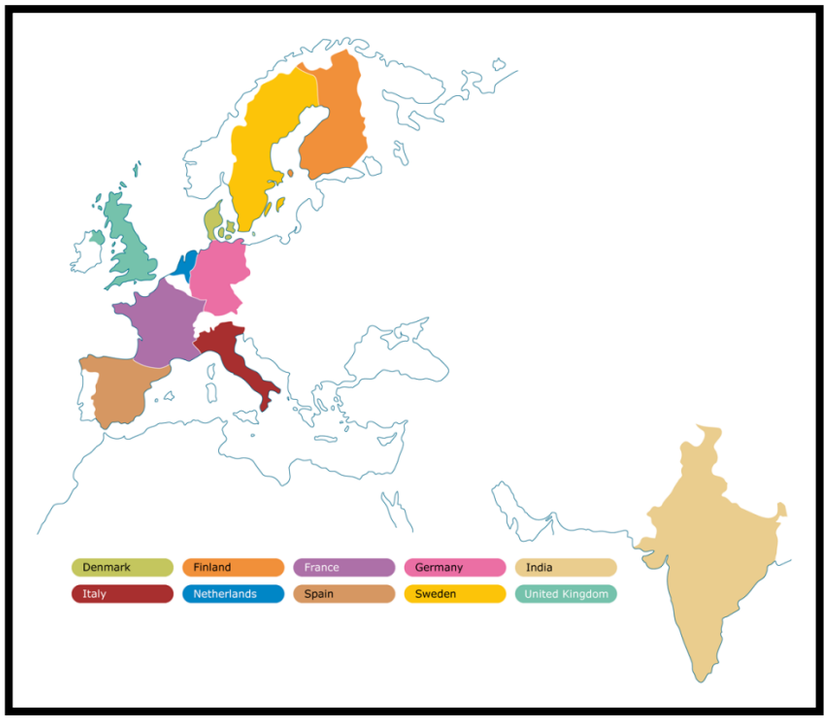
Sluijs et al. AJCN 2012

Dietary recommendations

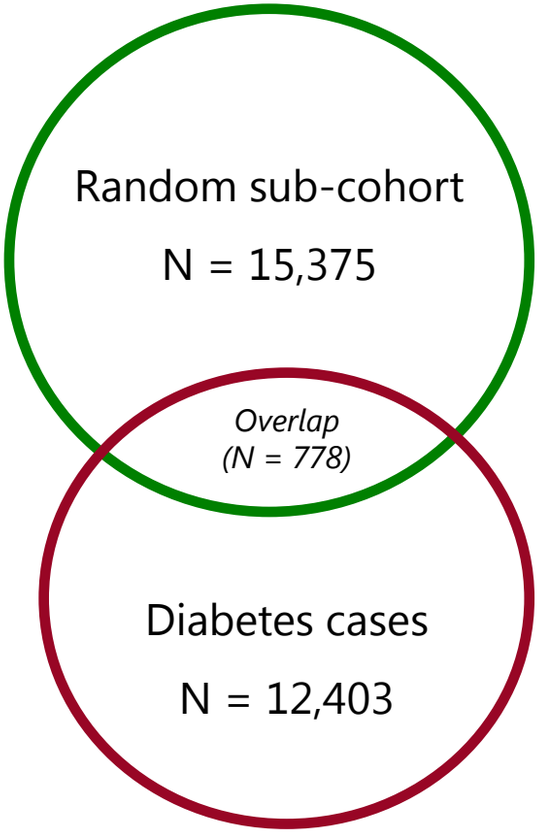
- Have some dairy or dairy alternatives (such as soya drinks); choosing lower fat and lower sugar options

390 g/day for men, 325 g/day for women

InterAct – EPIC substudy on Type 2 Diabetes

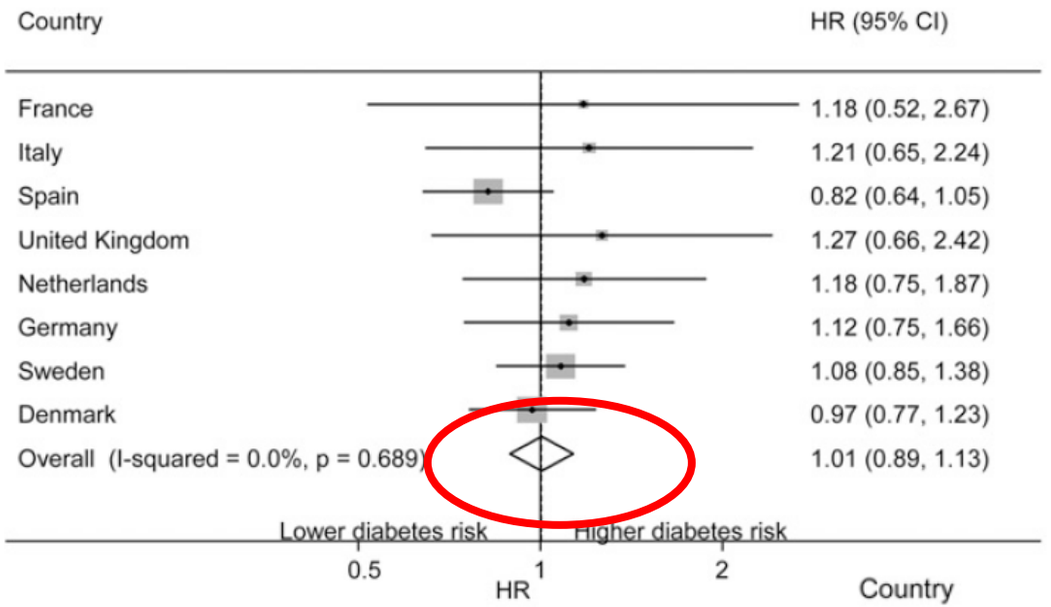


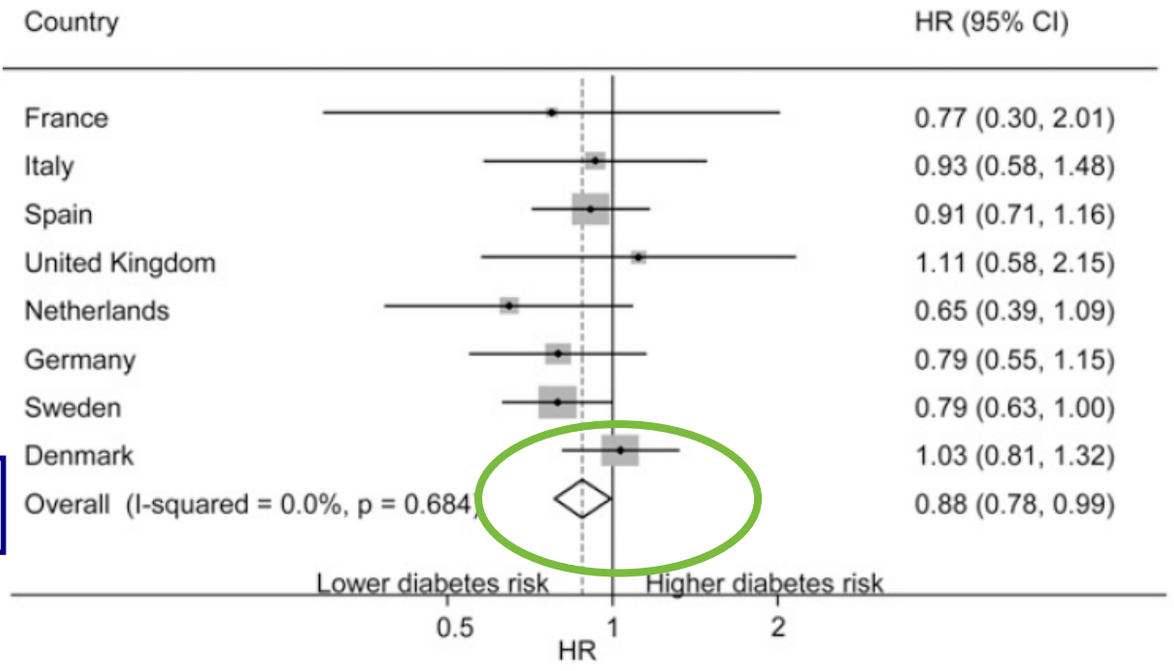
- 8 European countries, 26 centres
- Mean follow-up 12 years
- Case-cohort design



Discover how genetic and lifestyle behavioural factors, particularly diet and physical activity, interact in their influence on the risk of developing type 2 diabetes

Dairy consumption and type 2 diabetes- EPIC-InterAct





0.88; 0.78- 0.99

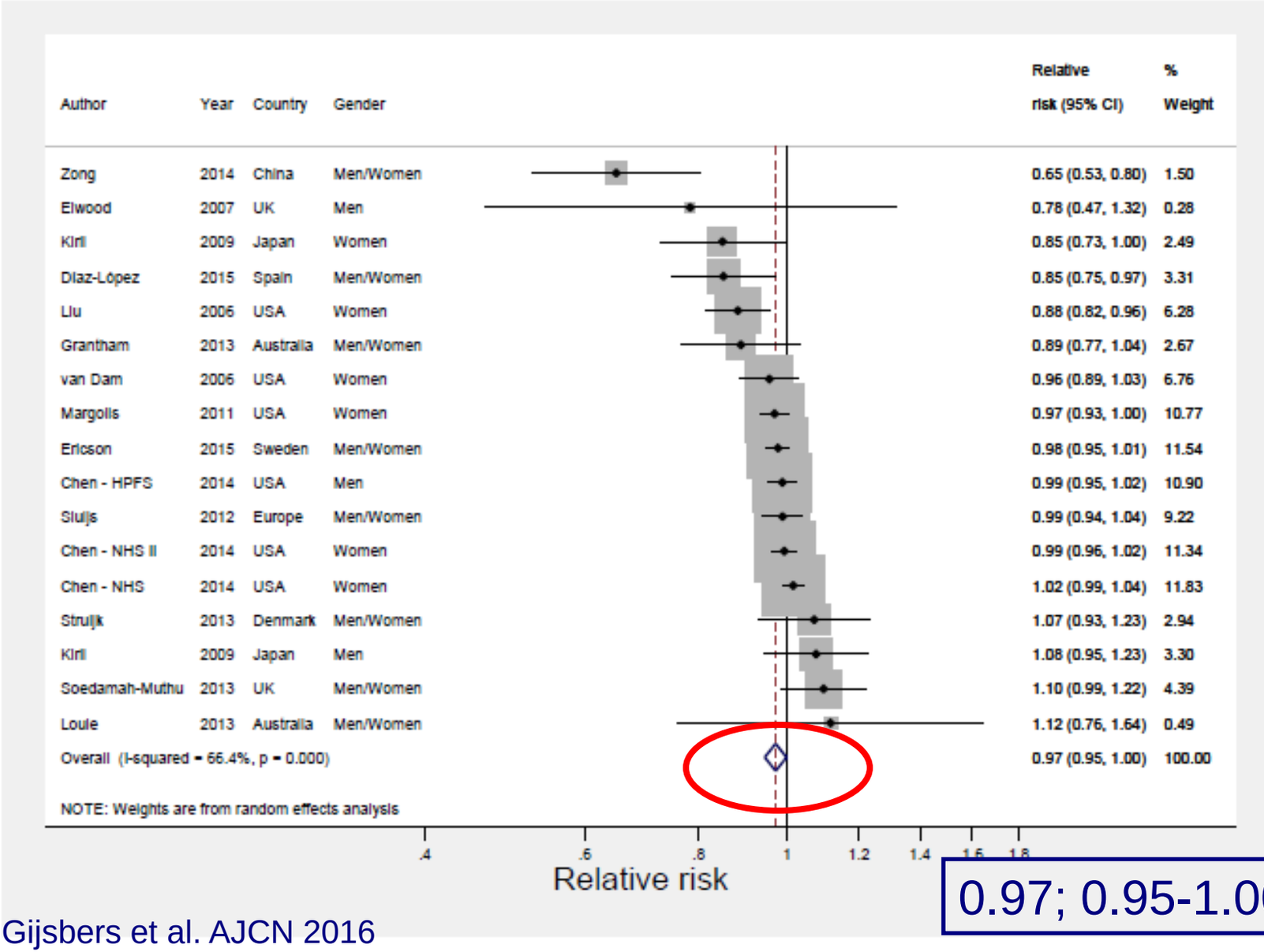
Sluijs et al. AJCN 2012

Meta-analysis dairy consumption and diabetes risk

- 22 prospective cohort studies
  - 579.832 individuals and 43.118 diabetes cases
  - Total dairy consumption 111 – 400 g/day
  - N=16 on total, low-fat and high-fat dairy
  - N=11 on milk intake
  - N=5 on fermented dairy

Gijsbers et al. AJCN 2016

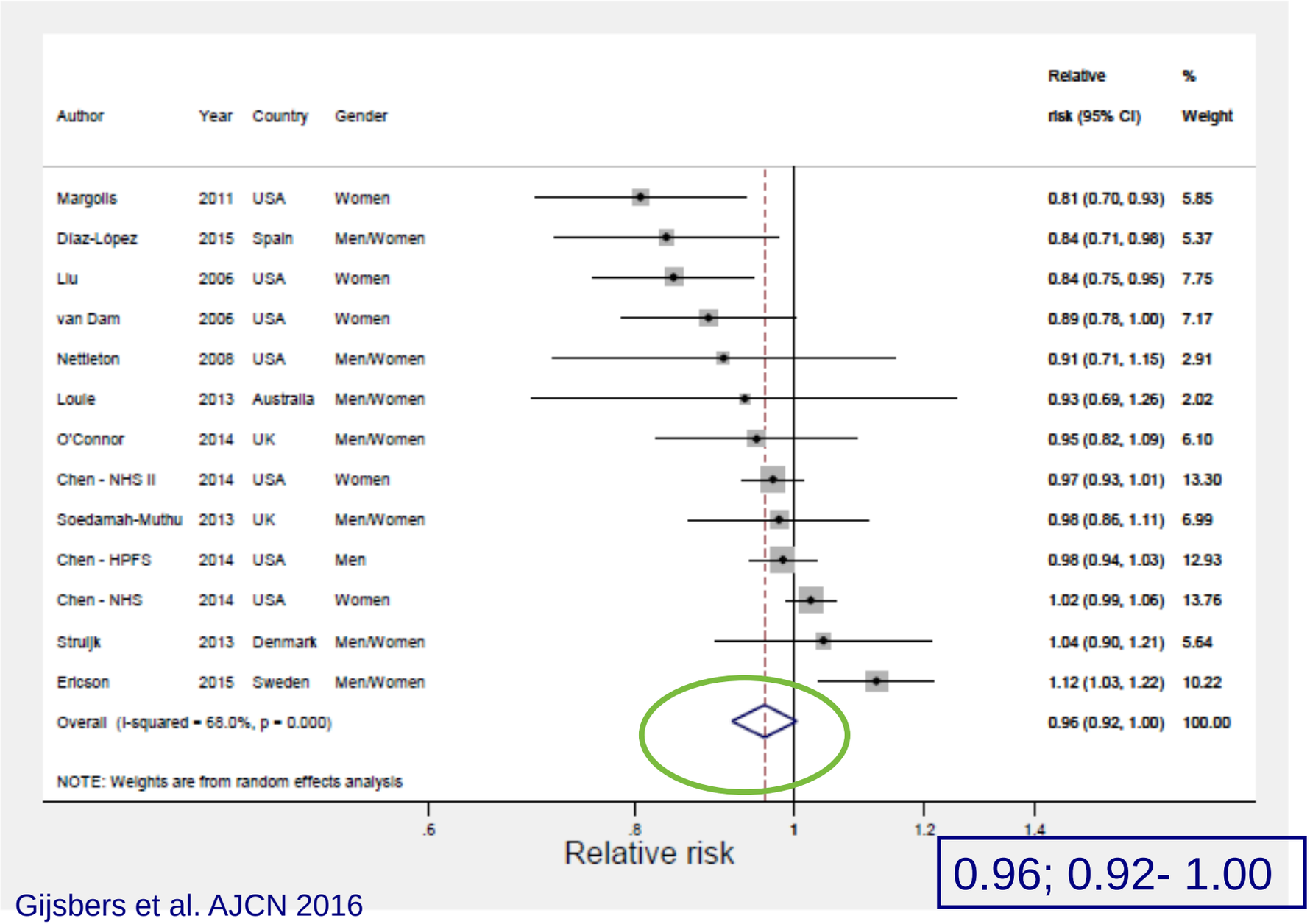
Total dairy consumption and diabetes risk



0.97; 0.95-1.00

Gijsbers et al. AJCN 2016

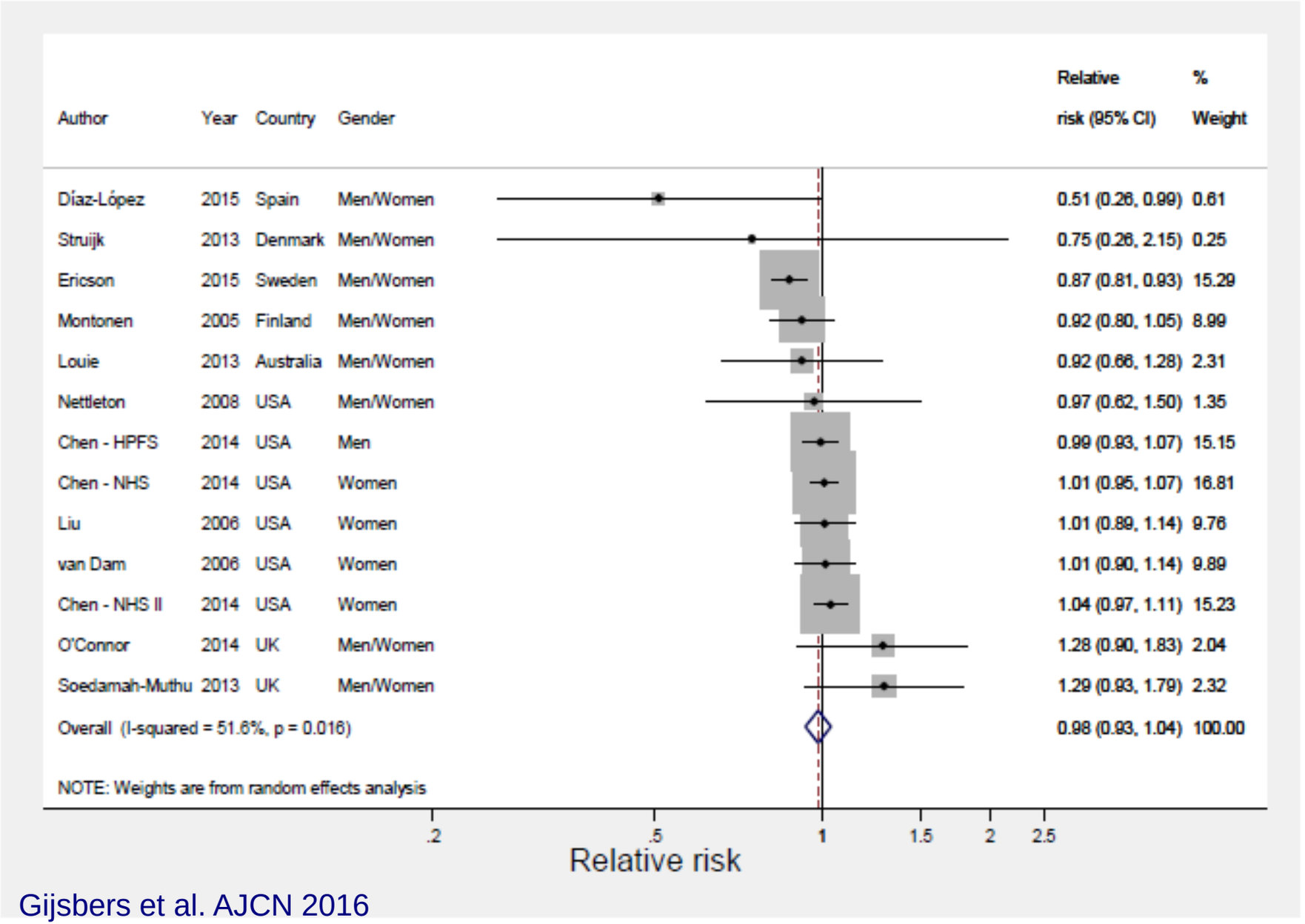
Low-fat dairy consumption and diabetes risk



0.96; 0.92- 1.00

Gijsbers et al. AJCN 2016

High-fat dairy consumption and diabetes risk



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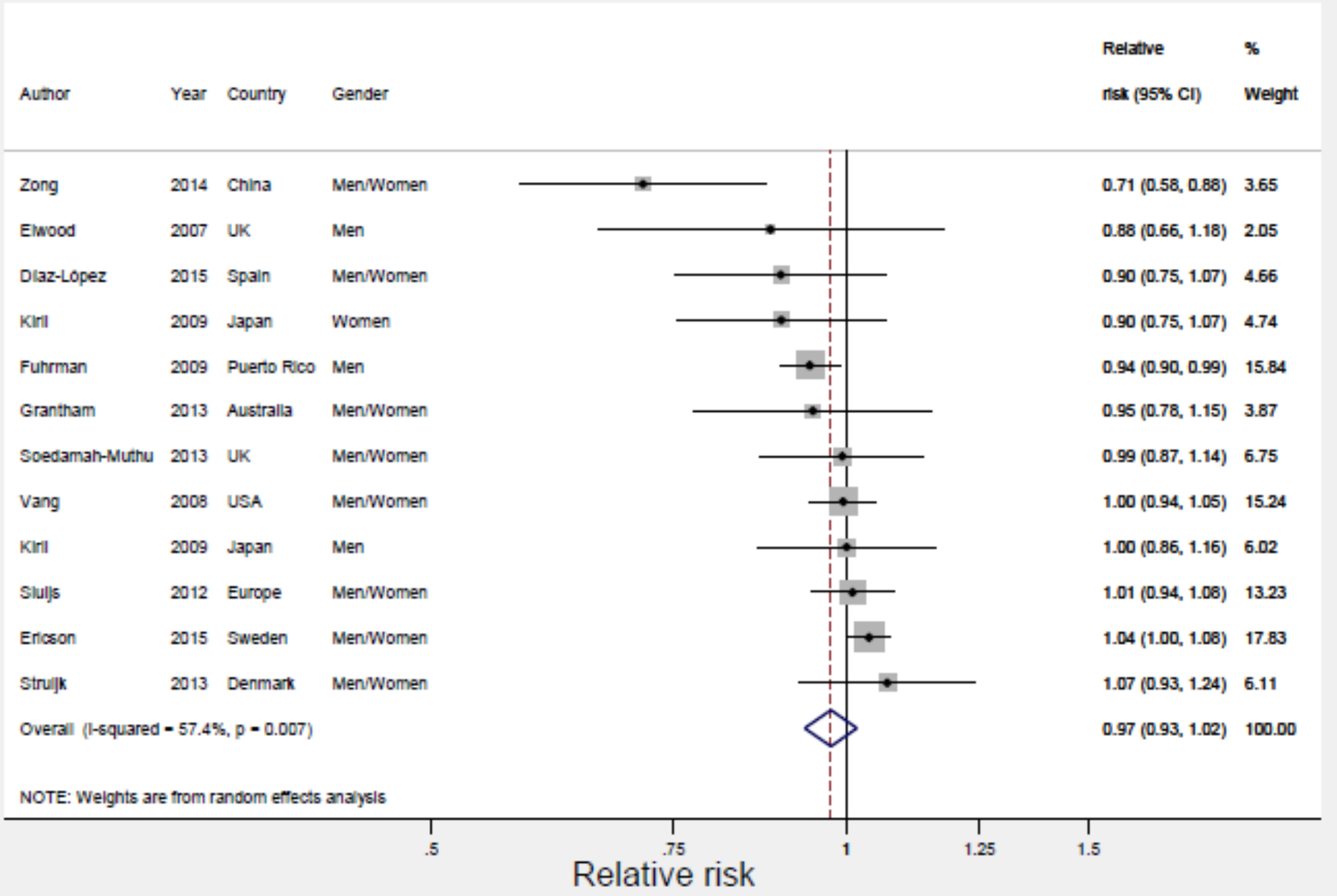
Total milk consumption and diabetes risk



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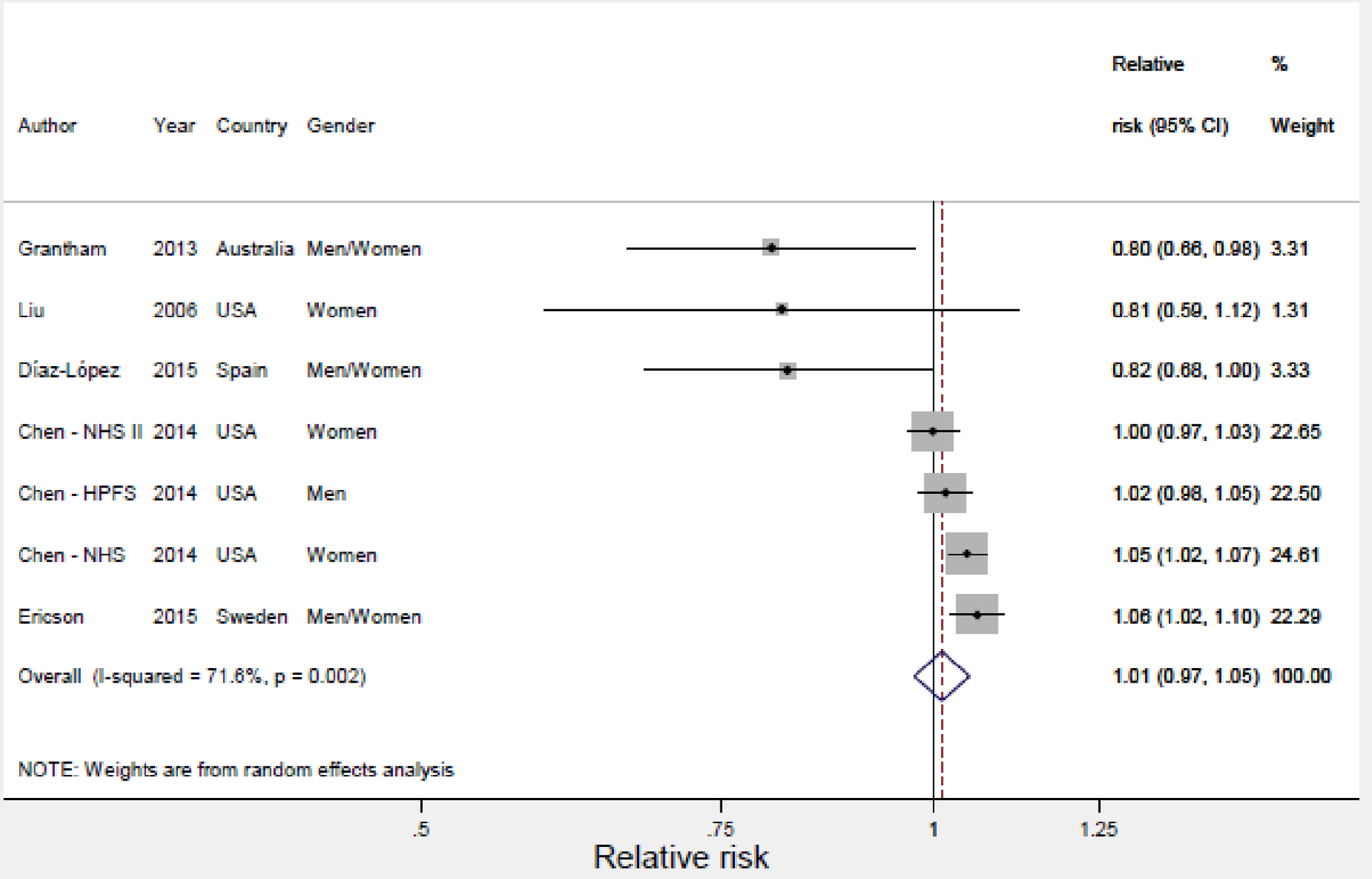
Low-fat milk consumption and diabetes risk



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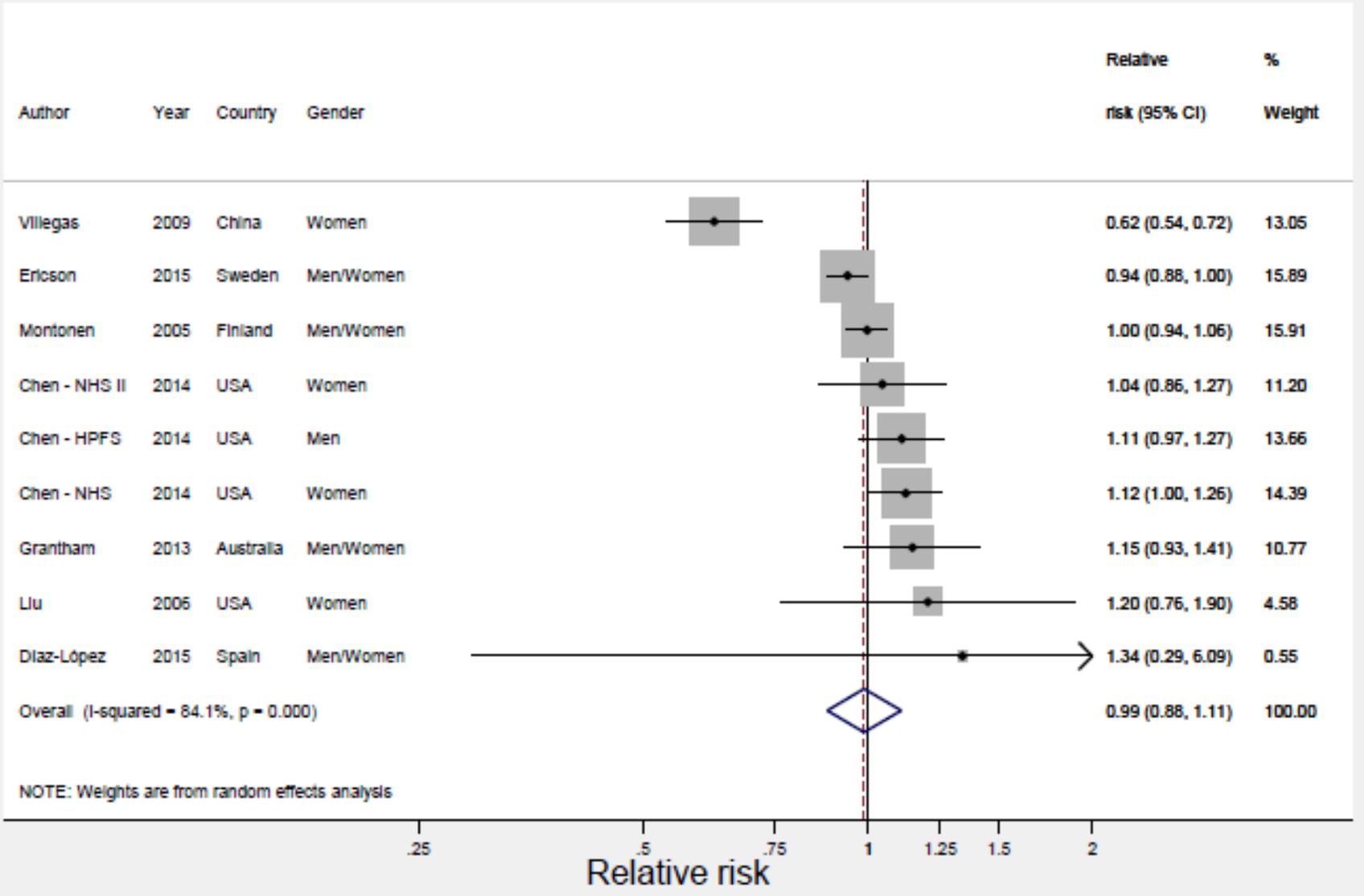
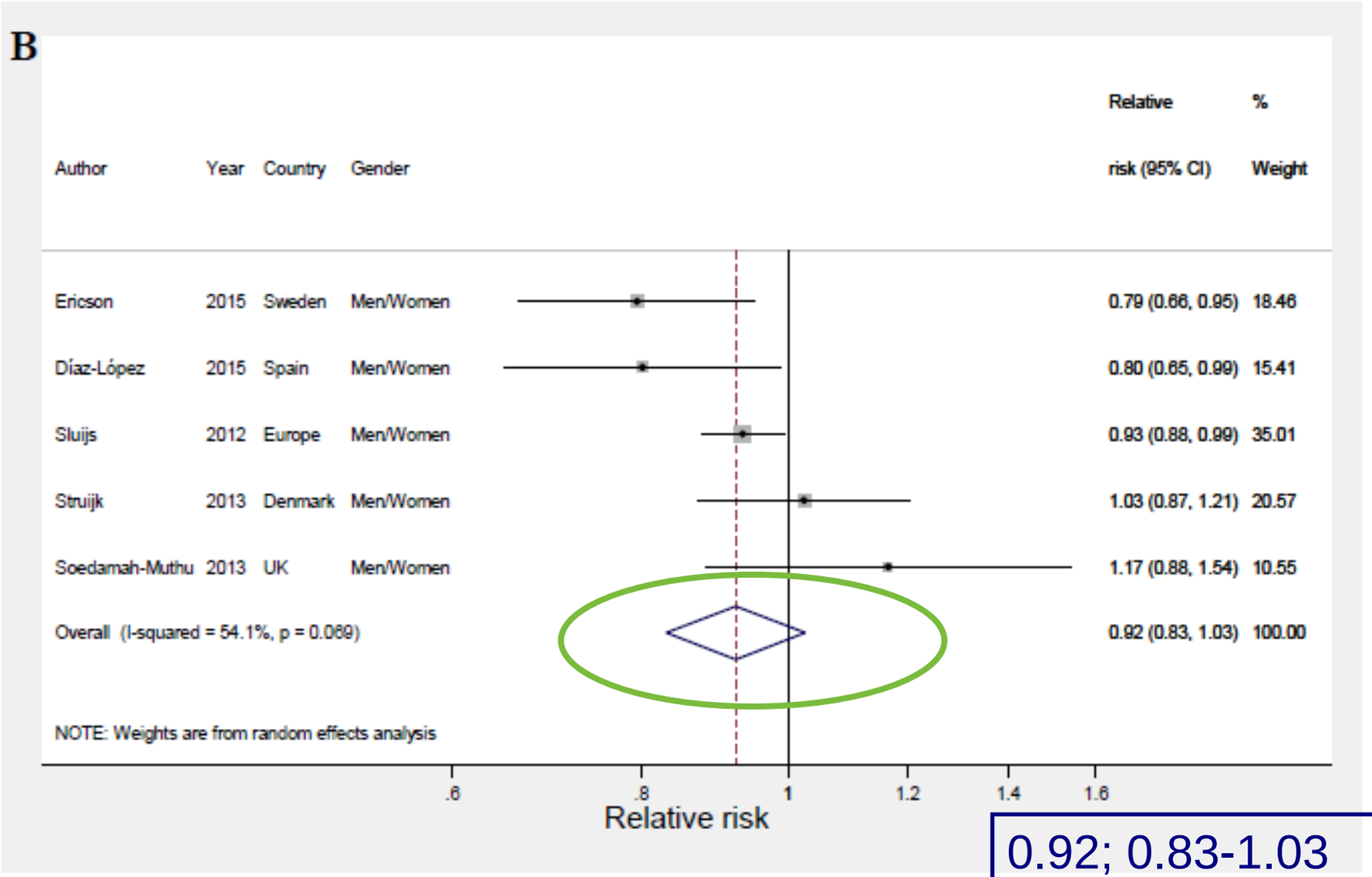
High-fat milk consumption and diabetes risk



Gijsbers et al. AJCN 2016

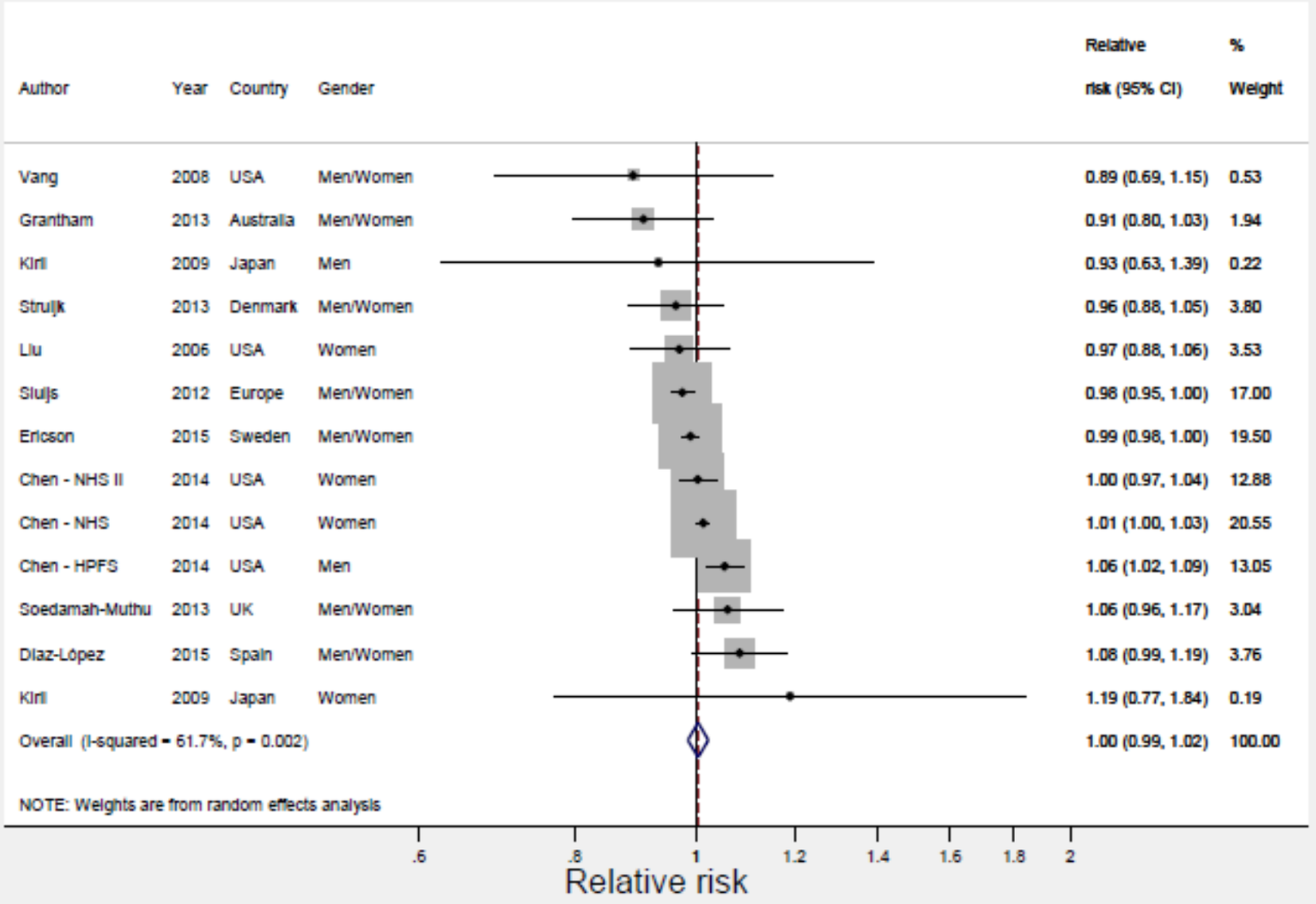
Fermented dairy consumption and diabetes risk



0.92; 0.83-1.03

Gijsbers et al. AJCN 2016

Cheese consumption and diabetes risk



Gijsbers et al. AJCN 2016

Sources of heterogeneity

Milk intake

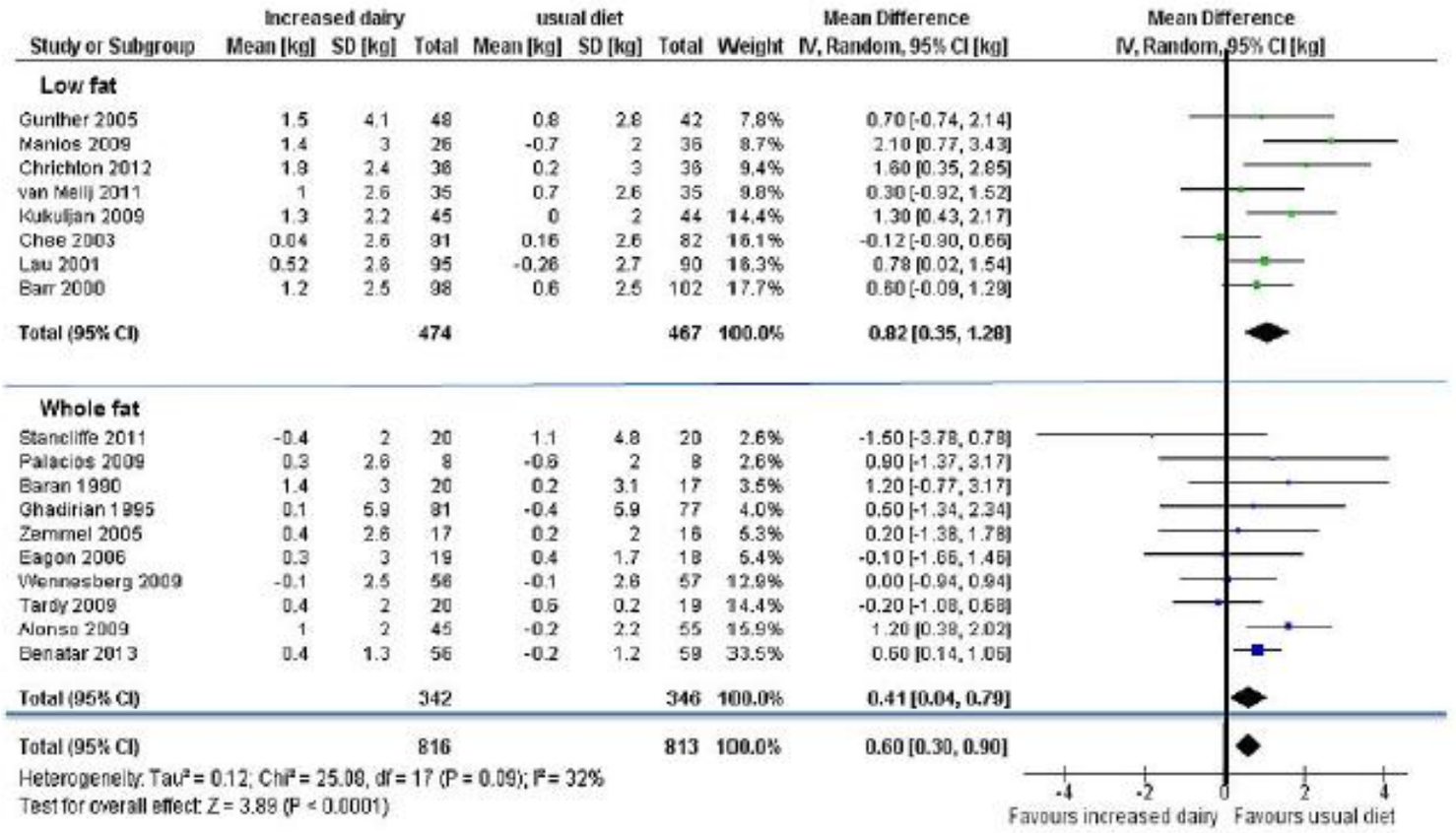
- Asian versus European populations
- Adjustment for major confounding factors

Fermented dairy

- Stronger association among women

Underlying mechanism: cardiometabolic outcomes

Figure2: Effects of whole & low fat dairy food on weight*



Study or Subgroup	Increased dairy Mean [kg]	SD [kg]	Total	usual diet Mean [kg]	SD [kg]	Total	Weight	Mean Difference IV, Random, 95% CI [kg]
Low fat								
Gunther 2005	1.5	4.1	48	0.8	2.8	42	7.8%	0.70 [-0.74, 2.14]
Manios 2009	1.4	3	26	-0.7	2	36	8.7%	2.10 [0.77, 3.43]
Chrichton 2012	1.9	2.4	38	0.2	3	36	9.4%	1.60 [0.35, 2.85]
van Meijl 2011	1	2.6	35	0.7	2.6	35	9.8%	0.30 [-0.92, 1.52]
Kukuljan 2009	1.3	2.2	45	0	2	44	14.4%	1.30 [0.43, 2.17]
Chee 2003	0.04	2.6	91	0.16	2.6	82	16.1%	-0.12 [-0.90, 0.66]
Lau 2001	0.52	2.6	95	-0.26	2.7	90	16.3%	0.78 [0.02, 1.54]
Barr 2000	1.2	2.5	98	0.6	2.5	102	17.7%	0.60 [-0.09, 1.29]
Total (95% CI)			**474**			**467**	**100.0%**	**0.82 [0.35, 1.28]**
Whole fat								
Stancliffe 2011	-0.4	2	20	1.1	4.8	20	2.6%	-1.50 [-3.78, 0.78]
Palacios 2009	0.3	2.6	8	-0.6	2	8	2.6%	0.90 [-1.37, 3.17]
Baran 1990	1.4	3	20	0.2	3.1	17	3.5%	1.20 [-0.77, 3.17]
Ghadirian 1995	0.1	5.9	81	-0.4	5.9	77	4.0%	0.50 [-1.34, 2.34]
Zemmel 2005	0.4	2.6	17	0.2	2	16	5.3%	0.20 [-1.38, 1.78]
Eagon 2006	0.3	3	19	0.4	1.7	18	5.4%	-0.10 [-1.65, 1.45]
Wennesberg 2009	-0.1	2.5	56	-0.1	2.6	57	12.9%	0.00 [-0.94, 0.94]
Tardy 2009	0.4	2	20	0.6	0.2	19	14.4%	-0.20 [-1.08, 0.68]
Alonso 2009	1	2	45	-0.2	2.2	55	15.9%	1.20 [0.38, 2.02]
Benatar 2013	0.4	1.3	56	-0.2	1.2	59	33.5%	0.60 [0.14, 1.06]
Total (95% CI)			**342**			**346**	**100.0%**	**0.41 [0.04, 0.79]**
Total (95% CI)			**816**			**813**	**100.0%**	**0.60 [0.30, 0.90]**

Heterogeneity: Tau² = 0.12; Chi² = 25.08, df = 17 (P = 0.09); I² = 32%
Test for overall effect: Z = 3.89 (P < 0.0001)

Mean Difference IV, Random, 95% CI [kg]

-4 -2 0 2 4

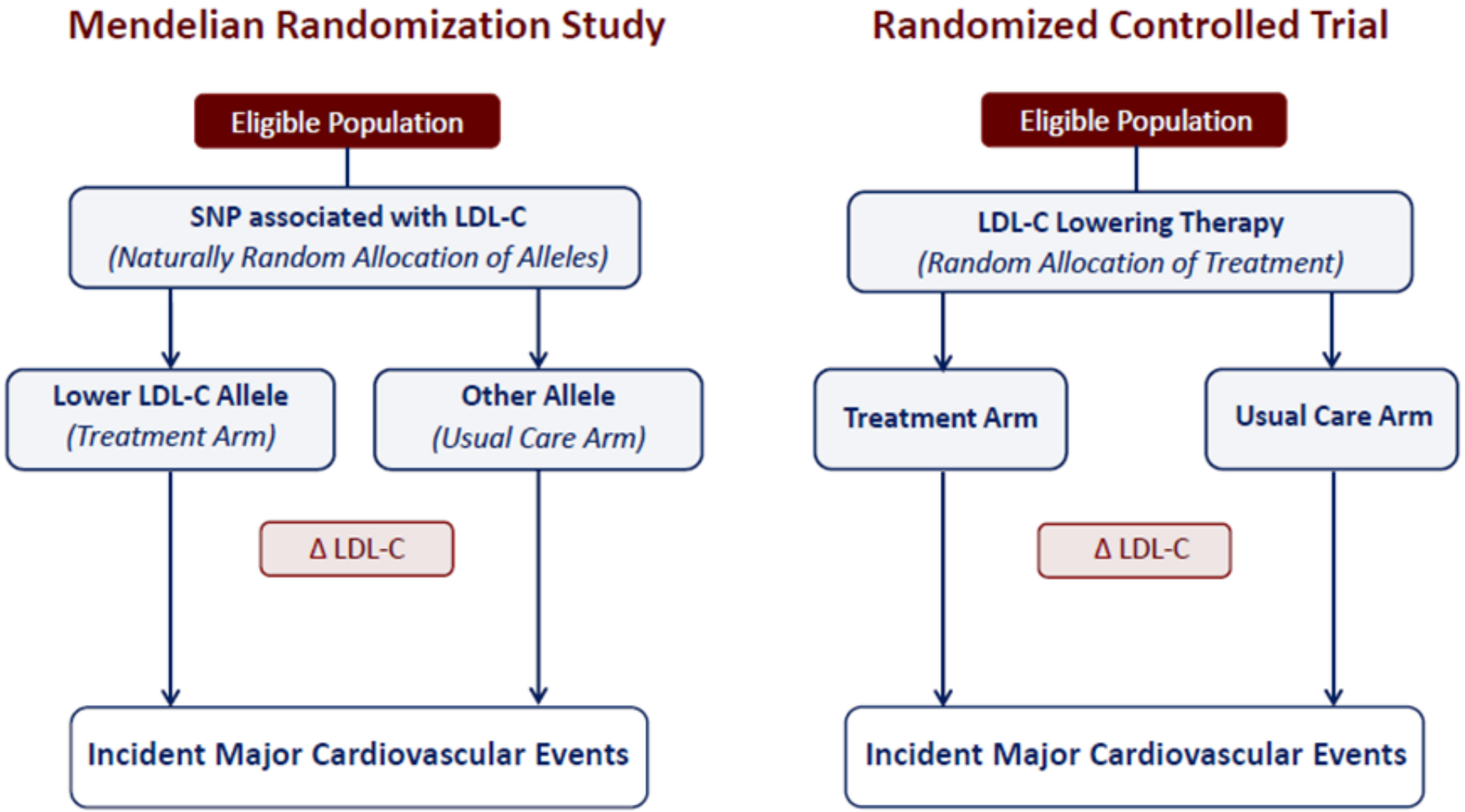
Favours increased dairy Favours usual diet

* Total number =1629, 82% female, mean baseline weight 77.7 (SD 16.2) kg, median study duration 26 (IQR10-39)weeks

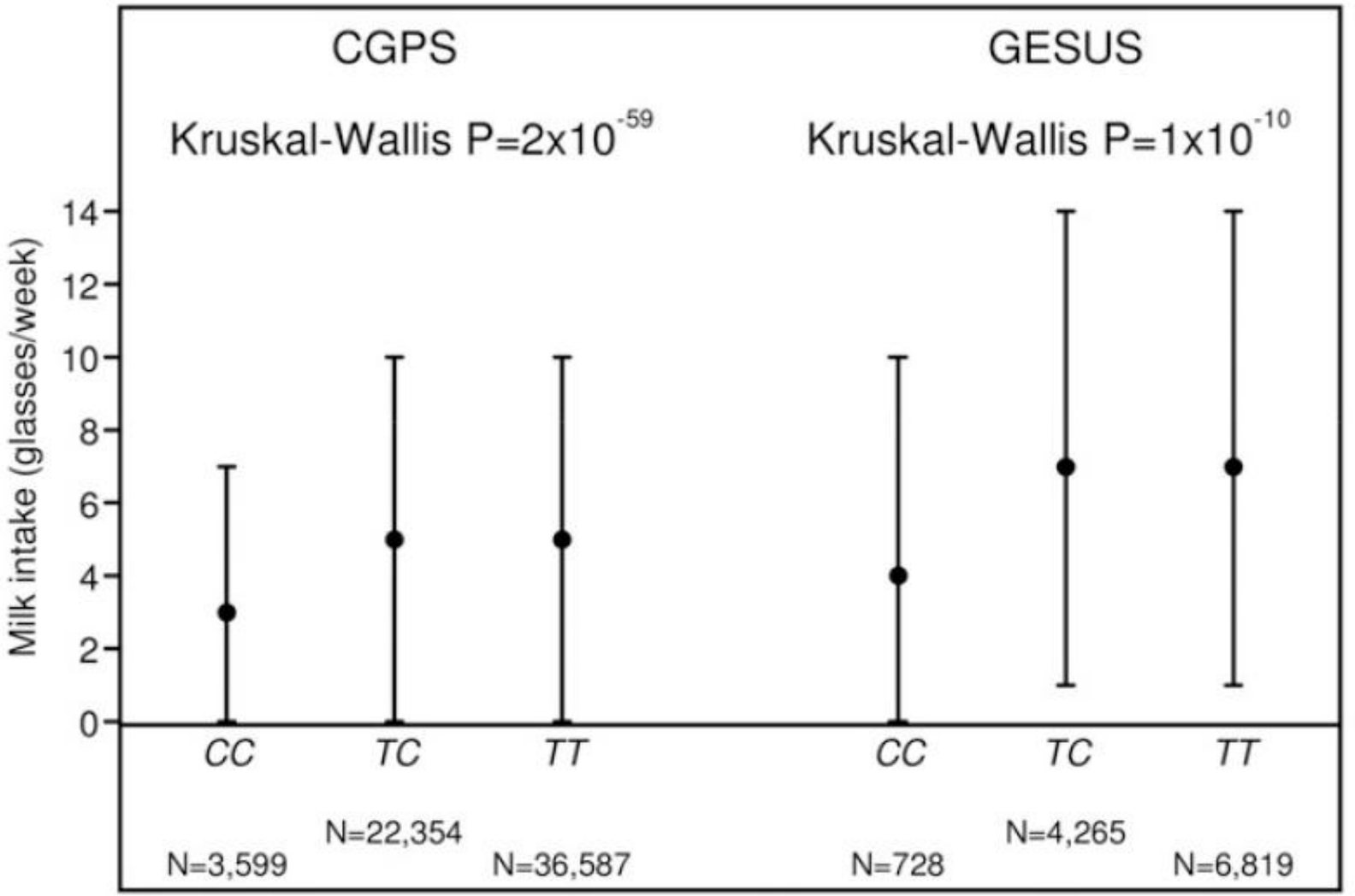
No effect on glycaemic parameters, blood lipids or blood pressure

Benatar et al. Plos one 2013

Mendelian randomization

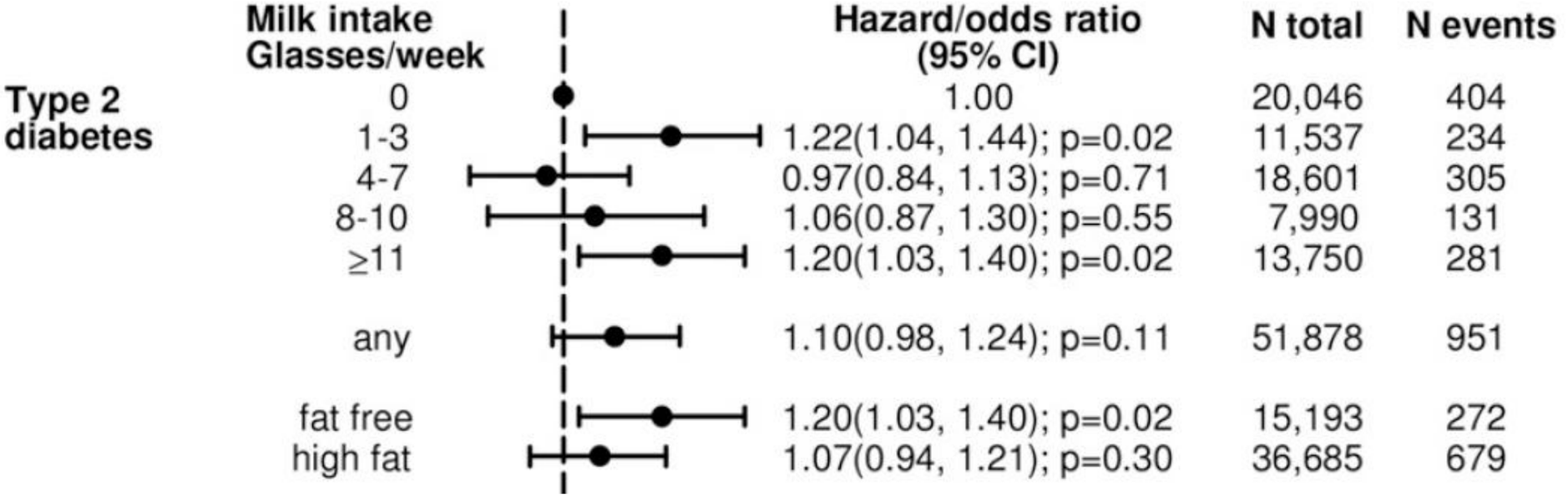


Milk intake and type 2 diabetes- Mendelian Randomization



Bergholdt et al. AJCN 2015

Milk intake and type 2 diabetes- Mendelian Randomization



- Genetic risk of type 2 diabetes per1 glass/wk of milk intake: 0.99 (0.93-1.06)

Intake of vitamin K2 and diabetes risk

Table 2—*Energy-adjusted phylloquinone and menaquinones intake and risk of type 2 diabetes among 38.094 Dutch men and women*

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	P_{trend} value	Per 50 μg
Phylloquinone						
Intake (μg/day)	100.1	155.7	211.4	308.1		
Age-, sex-, waist-adjusted	1.0	0.89 (0.73–1.08)	0.95 (0.79–1.14)	0.89 (0.74–1.07)	0.35	1.00 (0.97–1.03) $P = 0.92$
Multivariate adjusted*	1.0	0.89 (0.74–1.09)	0.94 (0.78–1.14)	0.88 (0.73–1.06)	0.26	0.99 (0.96–1.02) $P = 0.65$
Multivariate adjusted†	1.0	0.87 (0.71–1.06)	0.90 (0.74–1.09)	0.81 (0.66–0.99)	0.08	0.98 (0.95–1.02) $P = 0.31$
Menaquinones						
Intake (μg/day)	16.0	24.5	32.9	46.1		Per 10 μg
Age-, sex-, waist-adjusted	1.0	1.03 (0.85–1.25)	0.95 (0.78–1.15)	0.86 (0.71–1.05)	0.07	0.95 (0.91–1.01) $P = 0.060$
Multivariate adjusted*	1.0	1.04 (0.86–1.26)	0.97 (0.80–1.17)	0.88 (0.73–1.08)	0.13	0.96 (0.91–1.02) $P = 0.12$
Multivariate adjusted†	1.0	0.99 (0.82–1.21)	0.89 (0.72–1.10)	0.80 (0.62–1.02)	0.04	0.93 (0.87–1.00) $P = 0.038$

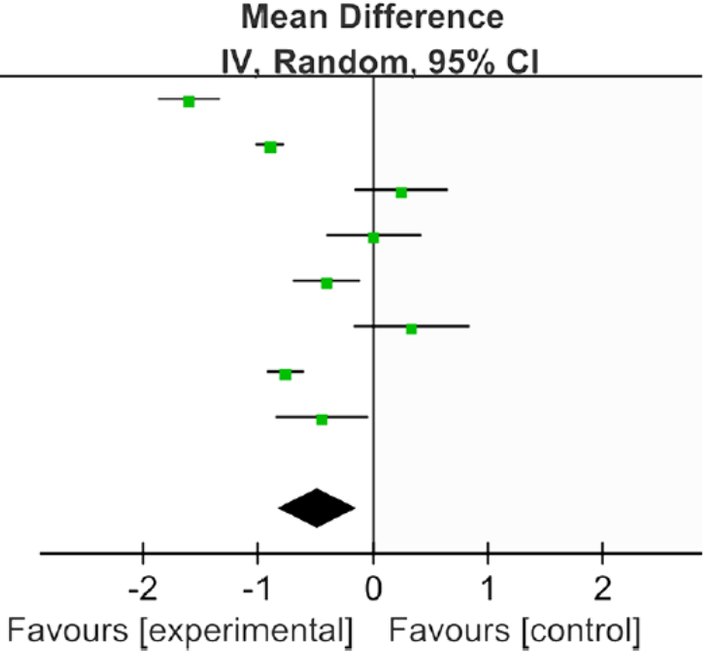
Beulens et al. Diabetes Care 2010

Probiotics and insulin sensitivity

Study or Subgroup	Participant	Weight	Mean Difference IV, Random, 95% CI
Asemi et al, 2013 (16)	54	13.0%	-1.60 [-1.87, -1.33]
Asemi et al, 2013 (28)	70	13.9%	-0.90 [-1.02, -0.78]
Ivey et al, 2014 (14)[a]	77	11.9%	0.24 [-0.17, 0.65]
Ivey et al, 2014 (14)[b]	79	11.8%	0.00 [-0.42, 0.42]
Laitinen et al, 2009 (20)	136	12.8%	-0.41 [-0.71, -0.11]
Lindsay et al, 2014 (21)	138	10.9%	0.33 [-0.18, 0.84]
Rajkumar et al, 2014 (23)	30	13.7%	-0.77 [-0.94, -0.60]
Rajkumar et al, 2014 (24)	30	11.9%	-0.45 [-0.86, -0.04]
Total (95% CI)		**100.0%**	**-0.48 [-0.83, -0.13]**

Heterogeneity: Tau² = 0.23; Chi² = 103.51, df = 7 (P < 0.00001); I² = 93%I² = 93%

Test for overall effect: Z = 2.68 (P = 0.007)



Ruan et al. Plos One 2015

Take home message

Dairy consumption is suggested to be associated with a reduced risk of type 2 diabetes,
in particular low-fat dairy and fermented dairy.

Substantial heterogeneity is present between different studies and should be accounted for in recommendations on dairy intake.

Recent Dutch recommendations on maintaining an intake of 2-3 consumptions per day also apply to risk of type 2 diabetes.

THANK YOU!