Evidence on dietary saturated and total fat

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Contents

Dietary Guidelines 2015-2020

European Food Safety Authority

Key Recommendations

Consume a healthy eating pattern that accounts for all foods and beverages within an appropriate calorie level.

A healthy eating pattern includes:[2]

- A variety of vegetables from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other
- Fruits, especially whole fruits
- Grains, at least half of which are whole grains
- Fat-free or low-fat dairy, including milk, yogurt, cheese, and/or fortified soy beverages
- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products
- Oils

A healthy eating pattern limits:

- Saturated fats and *trans* fats, added sugars, and sodium

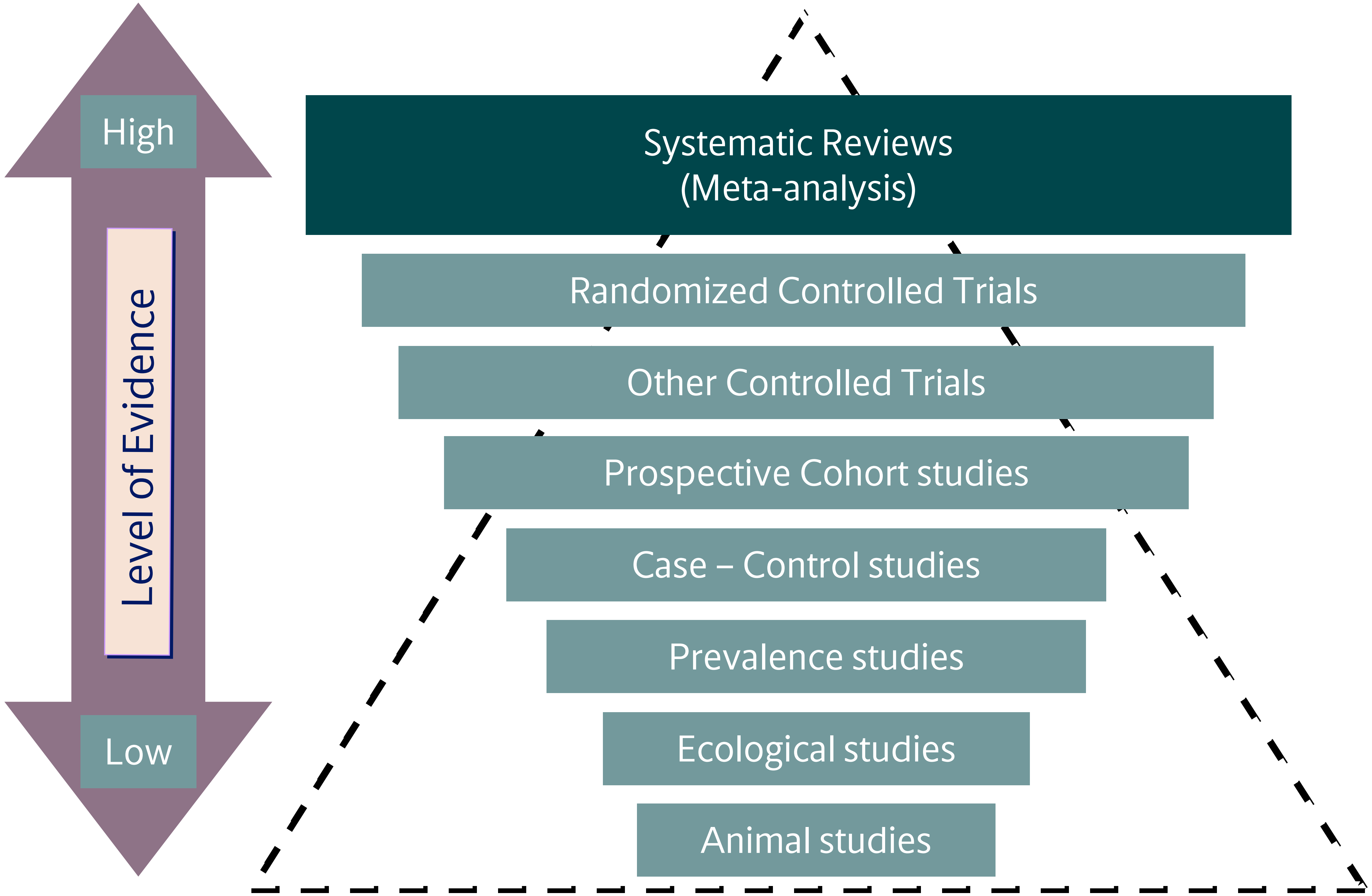
Key Recommendations that are quantitative are provided for several components of the diet that should be limited. These components are of particular public health concern in the United States, and the specified limits can help individuals achieve healthy eating patterns within calorie limits:

- Consume less than 10 percent of calories per day from added sugars[3]

EFSA: As low as possible

- Consume less than 2,300 milligrams (mg) per day of sodium[5]
- If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and up to two drinks per day for men—and only by adults of legal drinking age.[6]

Hierarchy in Scientific Evidence



The WHO evidence

Cochrane analysis by Hooper et al 2020 reviewed RCTs with a minimum of 24 months duration. The review included 15 studies involving approximately 59,000 people and was focused on the impact of saturated fat reduction dying, heart disease and stroke.

- There were eight main end-points. Seven of these were non-significant i.e. they found nothing. Again, this is never press-released; it should be the headline.
- 1) There was no significant effect from reducing saturated fat on total mortality.
- 2) There was no significant effect from reducing saturated fat on CVD mortality.
- 3) There was no significant effect from reducing saturated fat on CHD mortality.
- 4) There was no significant effect from reducing saturated fat on fatal heart attacks.
- 5) There was no significant effect from reducing saturated fat on non-fatal heart attacks.
- 6) There was no significant effect from reducing saturated fat on CHD events.
- 7) There was no significant effect from reducing saturated fat on strokes.
- The one significant finding was for CVD events: the risk ratio (RR) for CVD events from meta-analysis was 0.79 (95% CI 0.66 to 0.93). A sensitivity analysis for RCTs that did actually reduce saturated fat – excluding studies that aimed to reduce saturated fat but didn't – showed that the effect on CVD events was no longer significant.

BMJ 2019;366:l4137 doi: 10.1136/bmj.l4137 (Published 3 July 2019)

BMJ 2019;366:l4137 doi: 10.1136/bmj.l4137 (Published 3 July 2019)

ANALYSIS

WHO draft guidelines on dietary saturated and trans fatty acids: time for a new approach?

The 2018 WHO draft guidance on fatty acids fails to consider the importance of the food matrix, argue **Arne Astrup and colleagues**

Arne Astrup *head of department*[1], Hanne CS Bertram *professor*[2], Jean-Philippe Bonjour *honorary professor of medicine*[3], Lisette CP de Groot *professor*[4], Marcia C de Oliveira Otto *assistant professor*[5], Emma L Feeney *assistant professor*[6], Manohar L Garg *director*[7], Ian Givens *professor and director*[8], Frans J Kok *emeritus professor of nutrition and health*[4], Ronald M Krauss *senior scientist and Dolores Jordan endowed chair*[9], Benoît Lamarche *chair of nutrition*[10], Jean-Michel Lecerf *head of department*[11], Philippe Legrand *professor*[12], Michelle McKinley *reader*[13], Renata Micha *associate professor*[14], Marie-Caroline Michalski *research director*[15], Dariush Mozaffarian *dean*[14], Sabita S Soedamah-Muthu *associate professor*[16]

WHO 2023

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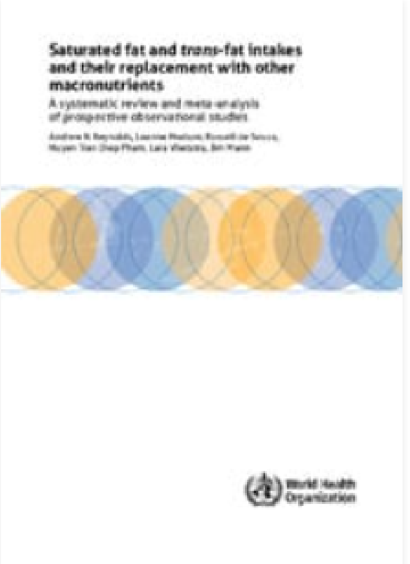
Home / Publications / Overview / Saturated fat and trans-fat intakes and their replacement with other macronutrients: a systematic review and meta-analysis of prospective observational studies

Saturated fat and trans-fat intakes and their replacement with other macronutrients: a systematic review and meta-analysis of prospective observational studies

28 February 2023 | Publication



Overview

Together with other modifiable risk factors such as physical inactivity, tobacco use and harmful use of alcohol, unhealthy diets – including high intakes of saturated fatty acids and *trans*-fatty acids – are a major risk factor for cardiovascular diseases and other diet-related noncommunicable diseases. Saturated fatty acids are found primarily in foods from animal sources and in some plant-derived oils and fats. *Trans*-fatty acids can be produced industrially by the partial hydrogenation of vegetable and fish oils, but also occur naturally in meat and dairy products from ruminant animals. This systematic review brings together the most current scientific evidence on health effects of saturated fatty acid and *trans*-fatty acid intake, including the effects of replacing saturated fatty acids and *trans*-fatty acids in the diet with other macronutrients on a wide range of key health outcomes.

WHO TEAM

Nutrition and Food Safety

EDITORS

World Health Organization

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164

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Questions ?

- Is it justified to treat Saturated fat as one group ?

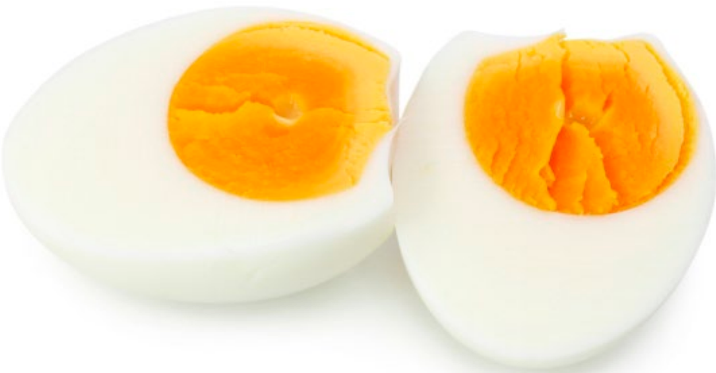
- When we now that they are composed of several different fatty acids with different chain length ?

- And very different food matrices ?

Whích foods are making a contribution t SFA intake ?

6 g/100 gram

21 g/100 gram



3 g/100 gram

14 g/100 gram

7 g/100 gram

19 g/100 gram

30 g/100 gram

7 g/100 gram

BMJ 2019;366:l4137 doi: 10.1136/bmj.l4137 (Published 3 July 2019)

Journal of the American Heart Association

No effect of saturated fat – but effects of food sources

ORIGINAL RESEARCH

Dietary Fatty Acids, Macronutrient Substitutions, Food Sources and Incidence of Coronary Heart Disease: Findings From the EPIC-CVD Case-Cohort Study Across Nine European Countries

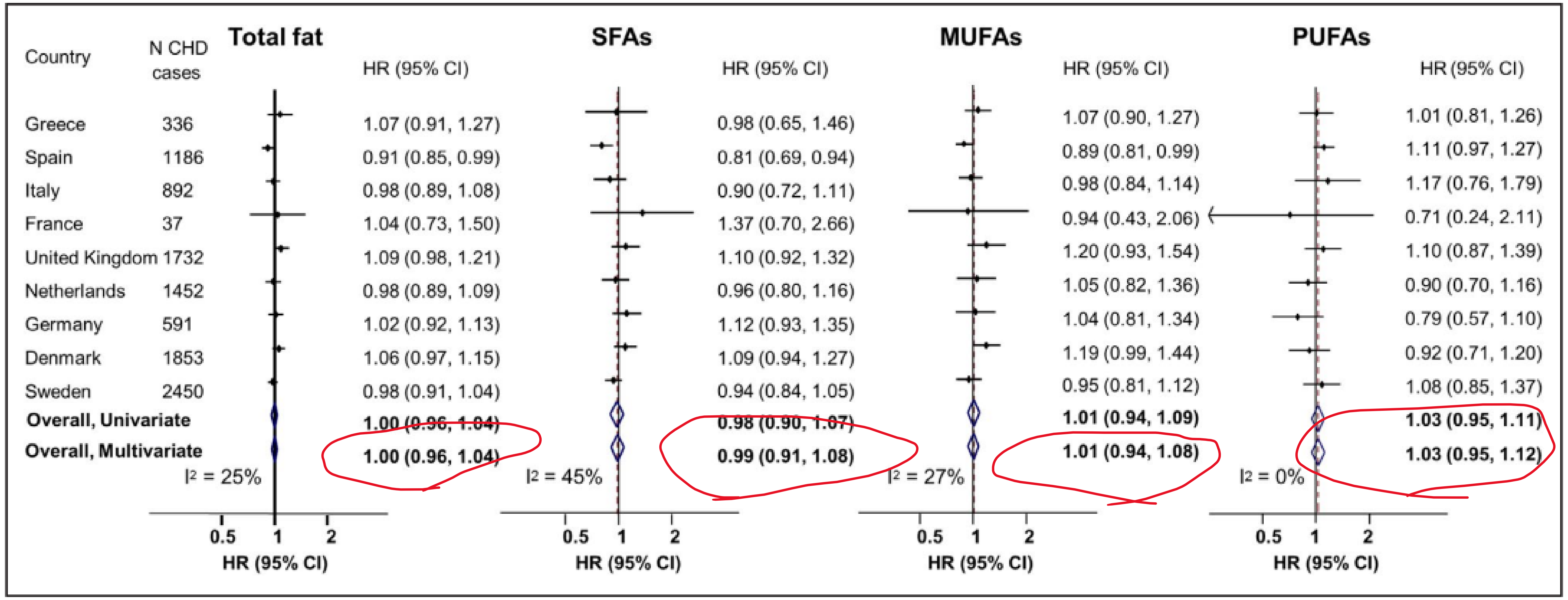


Figure 1. Associations of dietary consumption of each of total fat, saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs) (all per 5% of total energy intake) with incidence of coronary heart disease (CHD) in the EPIC-CVD (European Prospective Investigation into Cancer and Nutrition–Cardiovascular Disease) study.

CLINICAL PERSPECTIVE

What Is New?

- In a large prospective cohort study including men and women with diverse diets across 9 European countries, there were no strong associations between dietary saturated fatty acids (SFAs) and coronary heart disease (CHD) incidence, or between the substitution of polyunsaturated or monounsaturated fatty acids for saturated fatty acids and CHD incidence.
- In contrast, there were differences in CHD risk when food sources of SFAs were considered, with a lower CHD incidence with consumption of SFAs from fermented dairy products (yogurt and cheese) and fish, but a higher CHD incidence with consumption of SFAs from red meat and butter.

J Am Heart Assoc. 2021;10:e019814. DOI: 10.1161/JAHA.120.019814

Yogurt consumption in relation to mortality from cardiovascular disease, cancer, and all causes: a prospective investigation in 2 cohorts of US women and men

Daniela Schmid,[1,2] Mingyang Song,[3,4,5,6] Xuehong Zhang,[7] Walter C Willett,[3,4,7] Rita Vaidya,[8] Edward L Giovannucci,[3,4,7] and Karin B Michels[1,8]

TABLE 3 Association between yogurt consumption and mortality in 82,348 participants of the Nurses' Health Study and 40,278 participants of the Health Professionals Follow-Up Study between 1980 and 2012 (women) and 1986 and 2012 (men)[1]

	Yogurt consumption, servings					
	Never	>0 to ≤1–3/mo	1/wk	2–4/wk	>4/wk	*P*-trend
All-cause mortality						
Women						
Cases/person-years	7013/832,189	5395/630,665	2506/282,535	4800/546,544	1117/133,960	
Age-adjusted HR (95% CI)	1 (ref)	0.75 (0.72, 0.78)	0.66 (0.63, 0.70)	0.66 (0.64, 0.69)	0.66 (0.62, 0.71)	<0.001
Multivariate-adjusted HR (95% CI)	1 (ref)	0.89 (0.86, 0.93)	0.85 (0.81, 0.89)	0.88 (0.84, 0.91)	0.91 (0.85, 0.98)	0.34
Men						
Cases/person-years	5941/421,654	2917/244,228	1002/84,800	2005/138,975	532/39,407	
Age-adjusted HR (95% CI)	1 (ref)	0.82 (0.79, 0.86)	0.77 (0.72, 0.83)	0.83 (0.79, 0.87)	0.84 (0.76, 0.92)	<0.001
Multivariate-adjusted HR (95% CI)	1 (ref)	0.99 (0.94, 1.03)	0.98 (0.91, 1.05)	1.04 (0.98, 1.10)	1.05 (0.95, 1.16)	0.70
CVD mortality						
Women						
Cases	1472/837,258	1127/634,560	472/284,372	925/550,095	211/134,767	
Age-adjusted HR (95% CI)	1 (ref)	0.75 (0.70, 0.82)	0.62 (0.56, 0.69)	0.64 (0.59, 0.70)	0.63 (0.55, 0.73)	<0.001
Multivariate-adjusted HR (95% CI)	1 (ref)	0.88 (0.81, 0.96)	0.78 (0.70, 0.87)	0.86 (0.78, 0.94)	0.92 (0.79, 1.08)	0.41
Men						
Cases	1795/425,569	874/246,199	319/85,436	592/140,304	153/39,750	
Age-adjusted HR (95% CI)	1 (ref)	0.83 (0.77, 0.91)	0.84 (0.74, 0.95)	0.81 (0.73, 0.89)	0.80 (0.68, 0.95)	0.004
Multivariate-adjusted HR (95% CI)	1 (ref)	0.96 (0.88, 1.05)	1.02 (0.90, 1.16)	0.97 (0.88, 1.08)	0.95 (0.79, 1.13)	0.19
Cancer mortality						
Women						
Cases	2738/836,077	2040/633,706	998/283,882	1812/549,218	397/134,602	
Age-adjusted HR (95% CI)	1 (ref)	0.78 (0.73, 0.82)	0.77 (0.71, 0.82)	0.70 (0.66, 0.75)	0.66 (0.59, 0.73)	<0.001
Multivariate-adjusted HR (95% CI)	1 (ref)	0.91 (0.86, 0.96)	0.94 (0.87, 1.02)	0.91 (0.85, 0.97)	0.87 (0.78, 0.98)	0.04
Men						
Cases	1938/425,416	975/246,084	315/85,443	598/140,301	174/39,730	
Age-adjusted HR (95% CI)	1 (ref)	0.84 (0.77, 0.90)	0.76 (0.67, 0.86)	0.78 (0.71, 0.86)	0.86 (0.73, 1.01)	0.03
Multivariate-adjusted HR (95% CI)	1 (ref)	1.00 (0.92, 1.08)	0.96 (0.85, 1.09)	0.98 (0.89, 1.09)	1.10 (0.93, 1.30)	0.42

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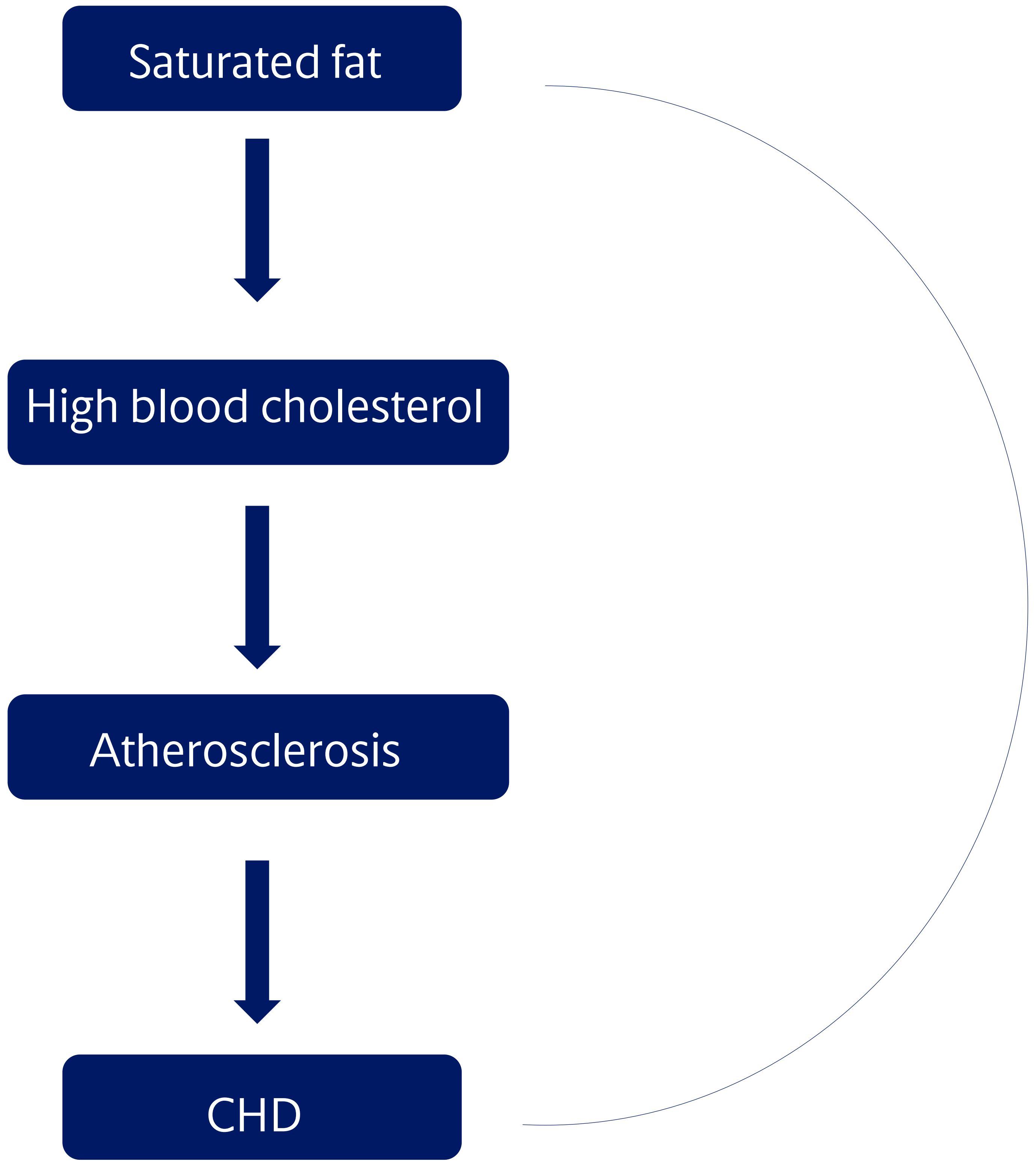
The lipid hypothesis and CHD

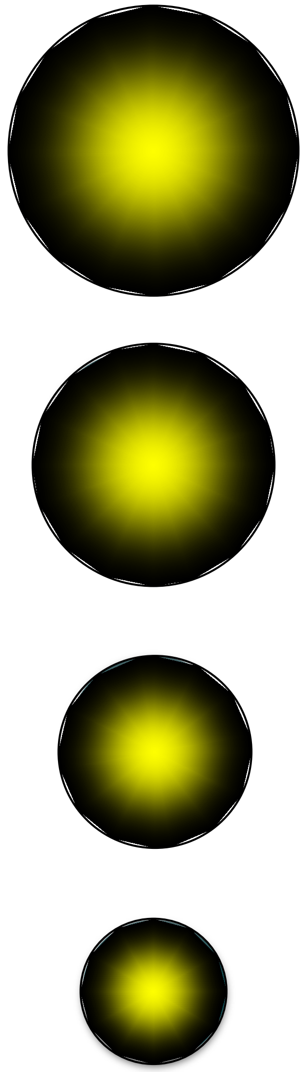


LDL is comprised of subclasses of particles with differing cholesterol content and atherogenic properties

Large
more cholesterol/particle

Medium

Small and very small
less cholesterol/particle

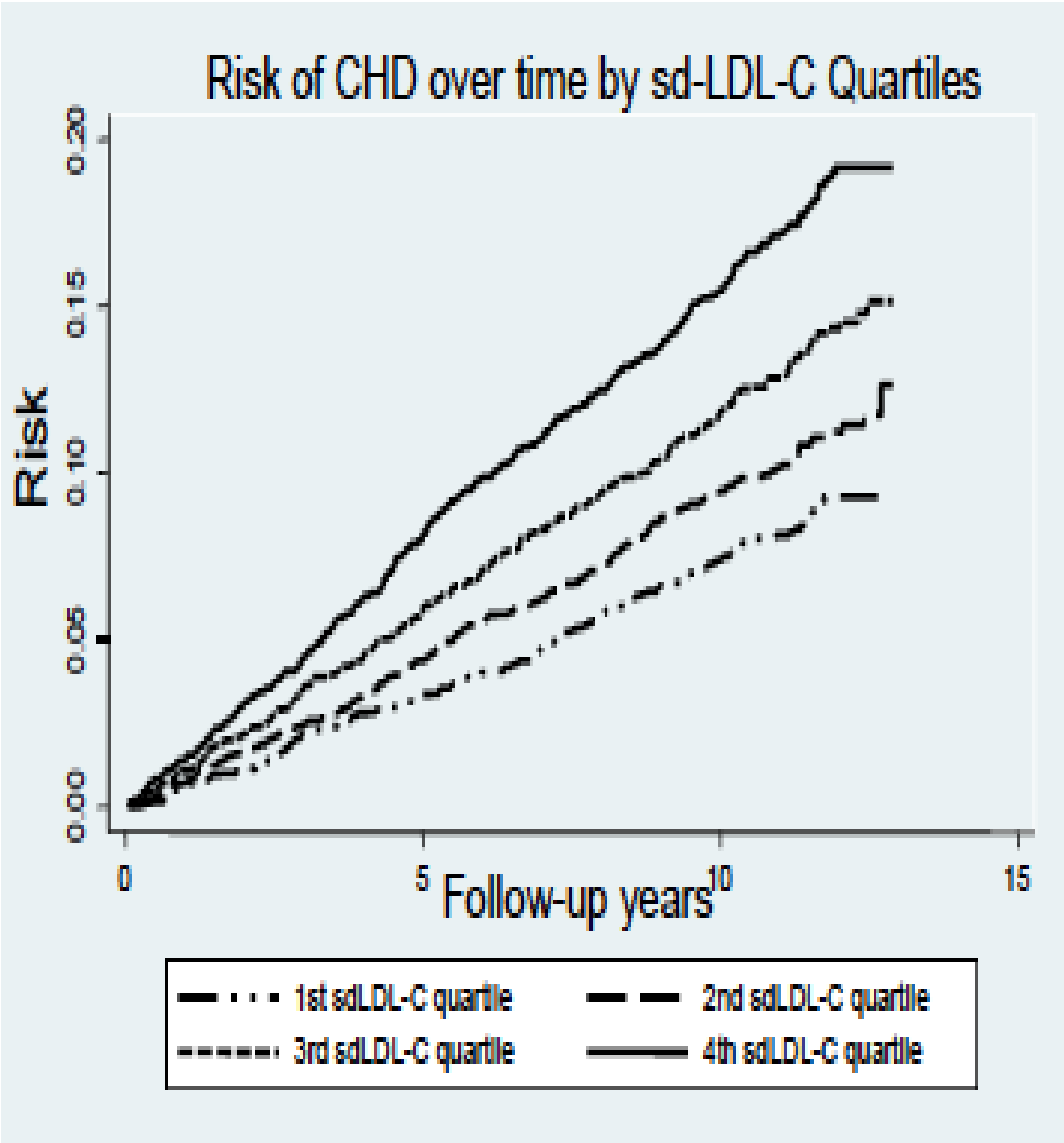


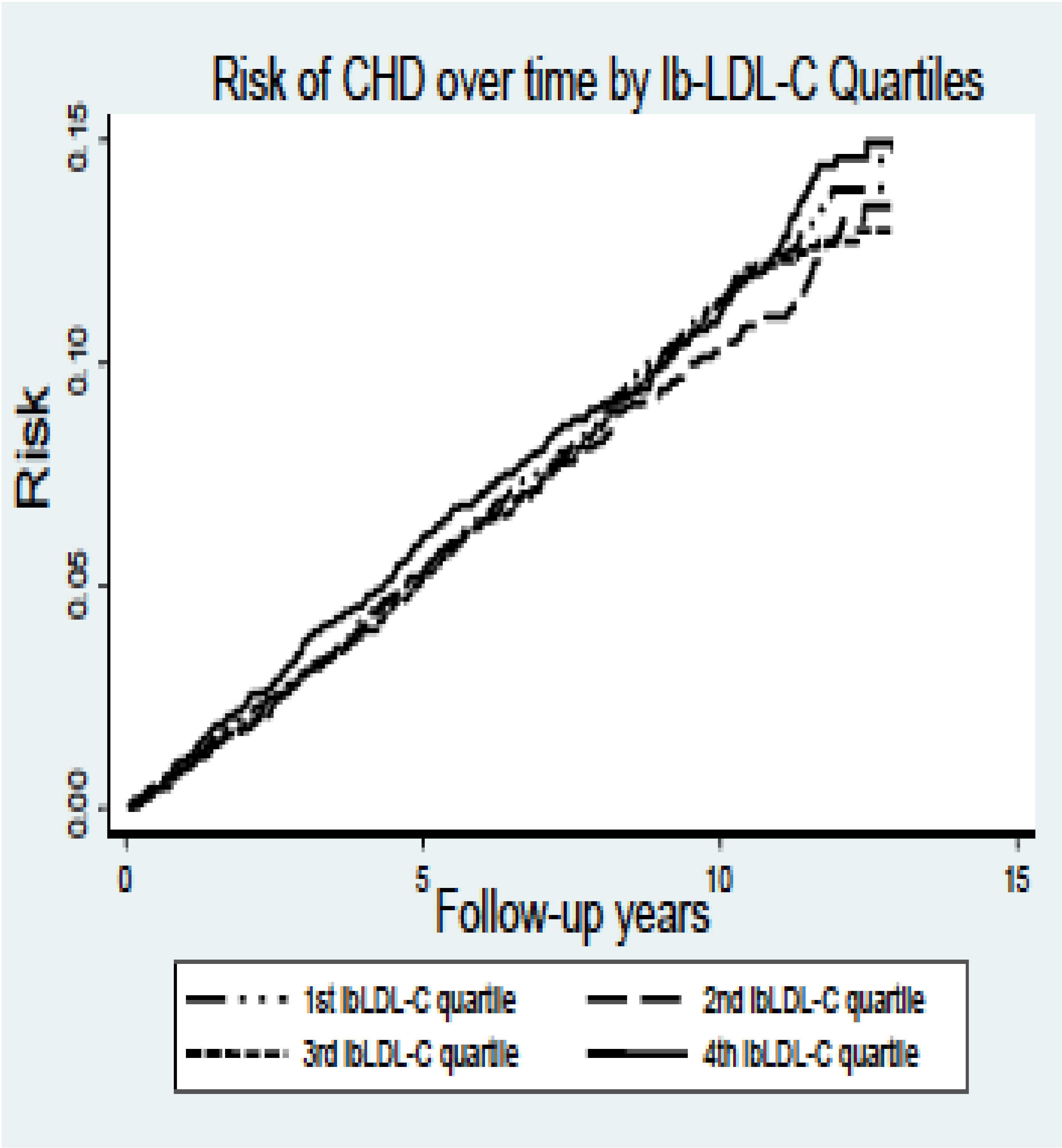
Reduced plasma clearance
Greater entry into artery
Greater retention
Faster oxidation

Distribution of subclasses varies widely among individuals and is independent of total LDL cholesterol

Berneis and Krauss, JLR 43:1155, 2002

Small, dense (sd)-LDL but not large, buoyant (lb)-LDL predicts CHD in ARIC (n=11,419; ~11 yr f/u))





Effects independent of total LDL-C

Obesity and Nutritional Sciences
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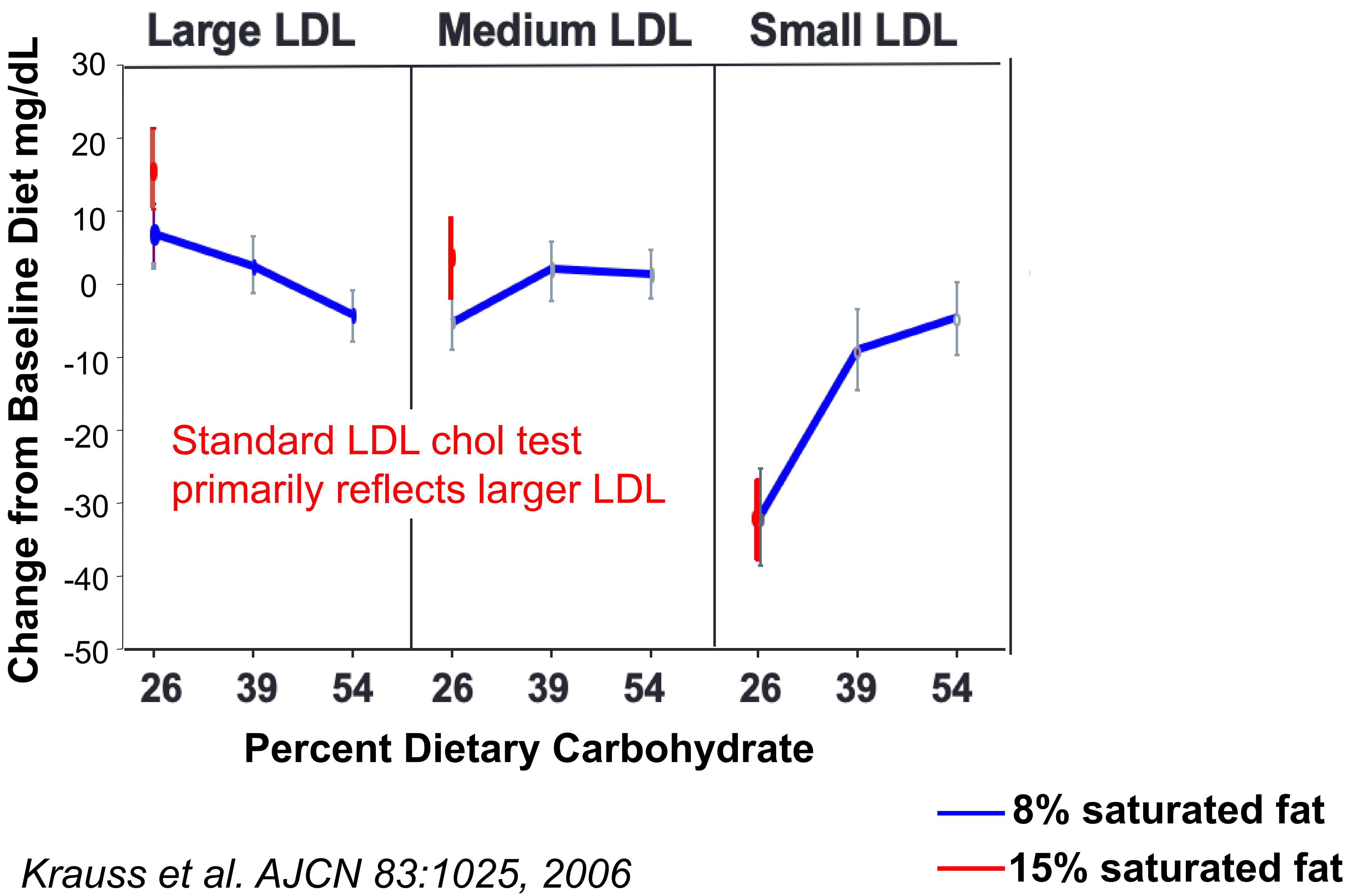
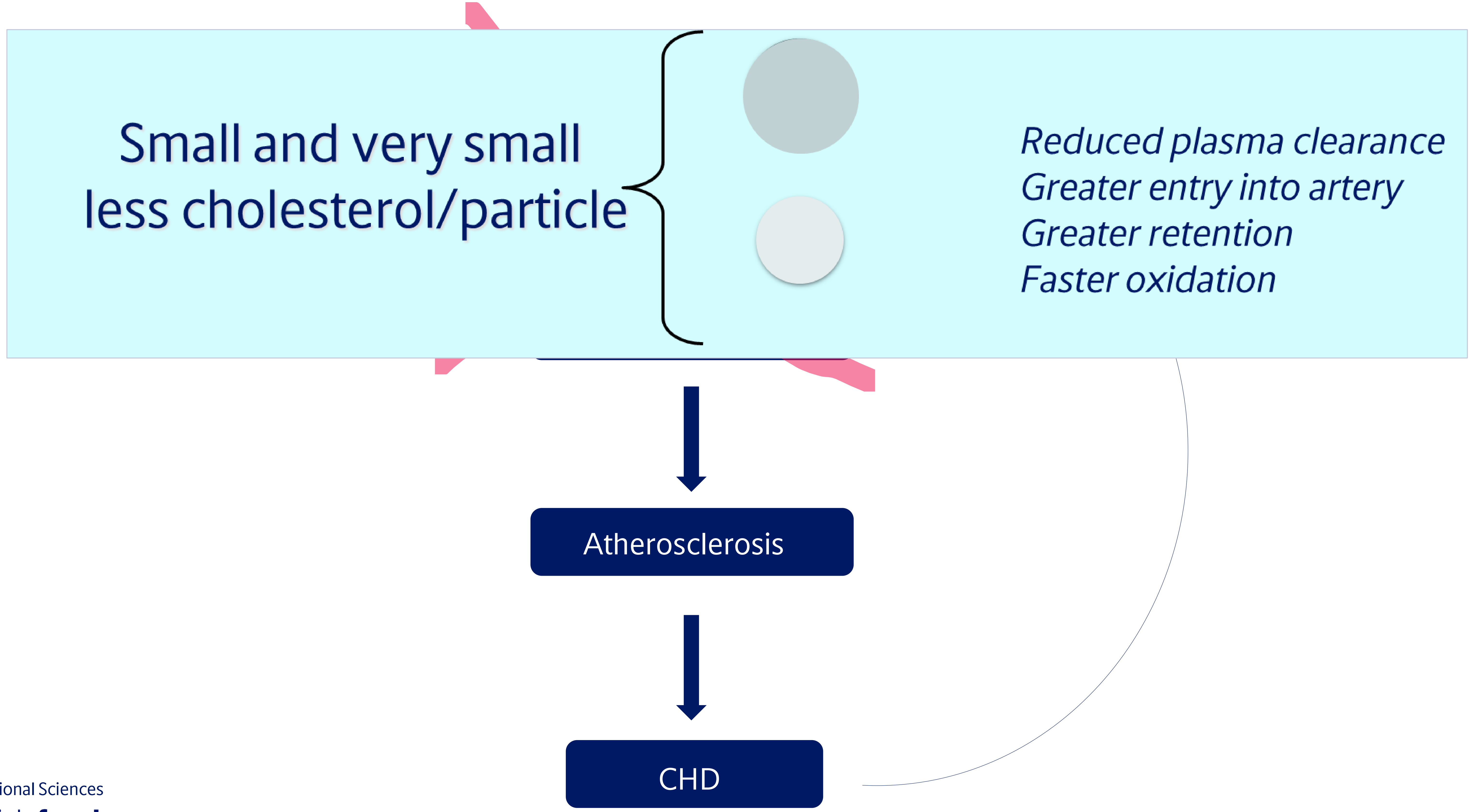
Hoogeveen et al., ATVB 34:1069, 2014

Divergent effects of dietary carbohydrates and saturated fat on LDL subclasses: higher carbohydrate (blue) raises only small LDL; higher saturated fat (red) raises larger LDL



Krauss et al. AJCN 83:1025, 2006

The lipid hypothesis and CHD



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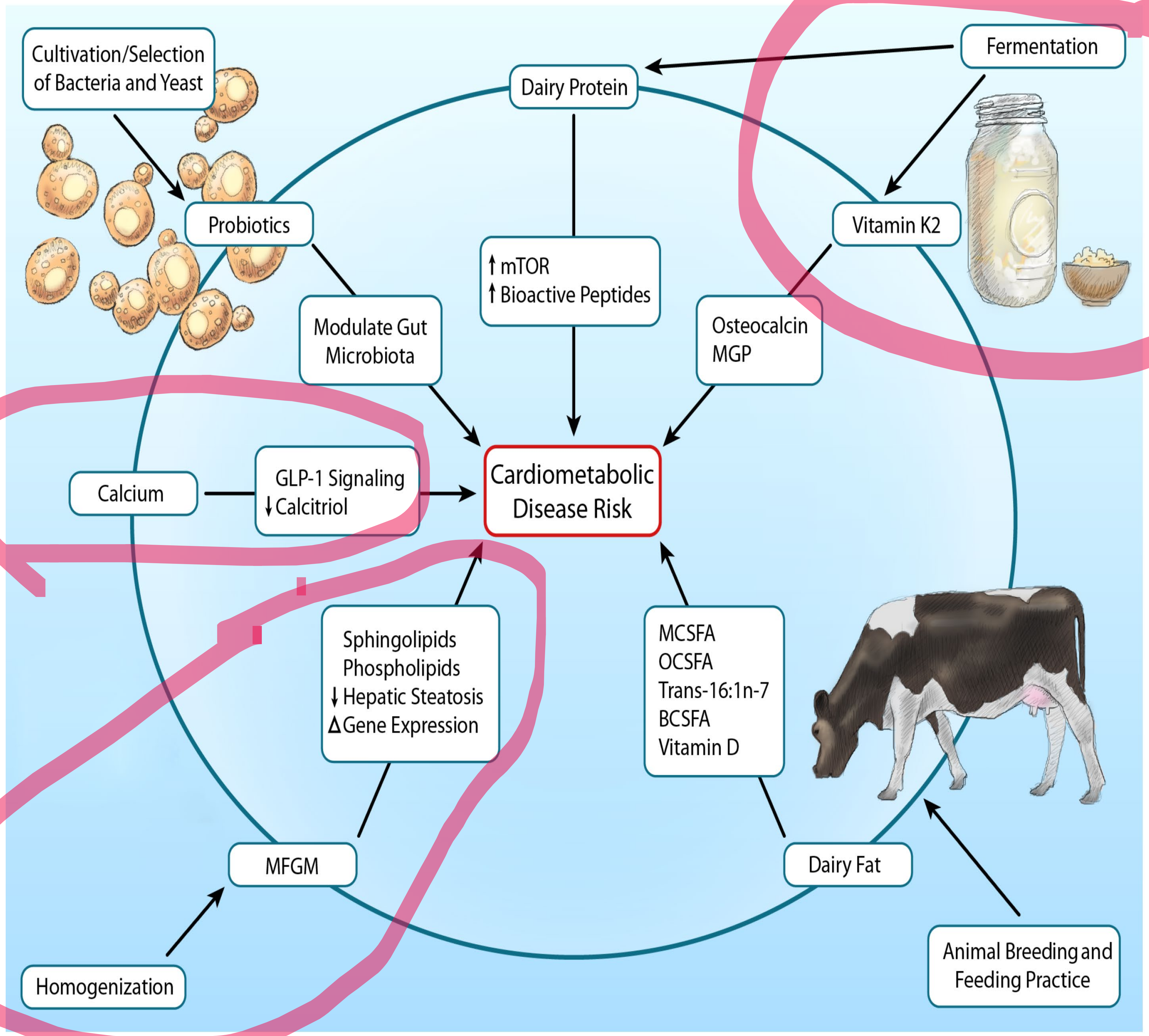
Saturated fat intake and CVD risk - the most recent evidence

Dairy & Cardiometabolic Health: Potential Mechanisms



Mozaffarian & Wu, Circulation Res 2018

Ice Creme – No evidence of adverse CMD effects: A role for ”Milk Fat Globule membrane” ?

Ice cream	< 1/month	1 - 3/month	1/week	≥2/week		
Cases/person-years	1,433/69,968	1,238/62,586	717/36,432	476/25,594		
Model 1[1]	1.00	1.03 (0.95, 1.11)	0.99 (0.91, 1.09)	0.94 (0.84, 1.04)	0.15	0.86 (0.73, 1.02)
Model 2[2]	1.00	1.03 (0.95, 1.11)	0.99 (0.91, 1.09)	0.94 (0.84, 1.04)	0.11	0.86 (0.72, 1.02)
Model 3[3]	1.00	0.98 (0.90, 1.06)	0.94 (0.85, 1.03)	0.88 (0.79, 0.99)	0.03	0.82 (0.67, 0.99)

Table 4 Multivariate relative risk (RR) of type 2 diabetes among men and women according to intakes of dairy foods *(Continued)*

Cases/person-years	3,373/122,3599	242/84,815	190/66,854	146/55,973		
Multivariate model	1.00	0.96 (0.84, 1.09)	1.04 (0.90, 1.21)	1.03 (0.87, 1.22)	0.65	0.98 (0.83, 1.14)
			2,518/570,309	1,219/271,411		
			83 (0.78, 0.89)	0.79 (0.72, 0.86)	<0.001	0.71 (0.62, 0.82)
			1.1/week	3.0/week		
Cases/person-years	1,185/436,526	1,679/598,547	830/306,473	257/89,696		
Multivariate RR (95% CI)	1.00	0.88 (0.82, 0.95)	0.77 (0.70, 0.84)	0.79 (0.69, 0.91)	<0.001	0.90 (0.73, 1.12)
Pooled						
Multivariate RR (95% CI)	1.00	0.87 (0.84, 0.91)	0.78 (0.74, 0.82)[d]	0.74 (0.70, 0.79)[d]	<0.001[d]	0.78 (0.71, 0.86)

Original Research Communications

Potential role of milk fat globule membrane in modulating plasma lipoproteins, gene expression, and cholesterol metabolism in humans: a randomized study[1]

Fredrik Rosqvist,[2] Annika Smedman,[2,4] Helena Lindmark-Månsson,[3,4] Marie Paulsson,[3] Paul Petrus,[6] Sara Straniero,[5] Mats Rudling,[5] Ingrid Dahlman,[6] and Ulf Risérus[2]*

Conclusions: In contrast to milk fat without MFGM, milk fat enclosed by MFGM does not impair the lipoprotein profile. The mechanism is not clear although suppressed gene expression by MFGM correlated inversely with plasma lipids. The food matrix should be considered when evaluating cardiovascular aspects of different dairy foods. This trial was registered at clinicaltrials.gov as NCT01767077.

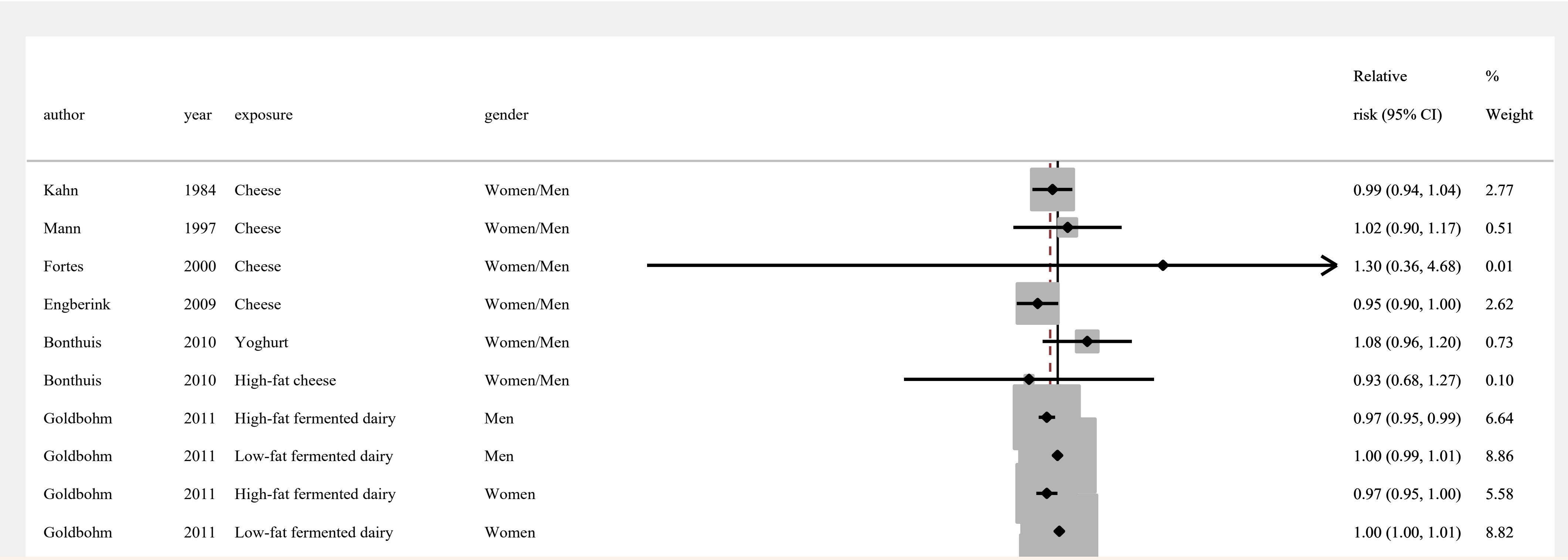
Dariush Mozaffarian | Professor

- Jean Mayer Professor of Nutrition
- Professor of Medicine, Tufts School of Medicine and Division of Cardiology, Tufts Medical Center
- Member, Clinical and Translational Science graduate program, Graduate School of Biomedical Sciences
- Editor-in-Chief, Tufts Health & Nutrition Letter

Dariush Mozaffarian is a cardiologist, Jean Mayer Professor at the Friedman School of Nutrition Science and Policy at Tufts University, Professor of Medicine at Tufts School of Medicine, and an attending physician at Tufts Medical Center. His work aims to create the science and translation for a food system that is nutritious, equitable, and sustainable. Dr. Mozaffarian has authored more than 500 scientific publications on dietary priorities for obesity, diabetes, and cardiovascular diseases, and on evidence-based policy approaches and innovations to reduce diet-related diseases and improve health equity in the US and globally. Some of his areas of interest include healthy diet patterns, nutritional biomarkers, Food is Medicine interventions in healthcare, nutrition innovation and entrepreneurship, and food policy. He is one of the top cited researchers in medicine globally, he has served in numerous advisory roles, and his work has been featured in an array of media outlets. Dr. Mozaffarian received his

- ”If this had been a patented drug”, he continued, “you can bet that the company would have done a $30 million randomized controlled trial to see if ice cream prevents diabetes.”

Updated meta-analysis of fermented dairy and CVD and mortality



Total 29 cohort studies are available for meta-analysis. Inverse associations were found between total fermented (included sour milk products, yogurt or cheese) with mortality (RR 0.98, 95% CI: 0.97-0.99; I^2=94.4%) and risk of CVD (RR 0.98, 95% CI: 0.97-0.99; I^2=87.5%). Also stratified analysis of total fermented dairy of cheese shown a lower 2% lower risk of CVD (RR 0.98, 95% CI: 0.95-1.00; I^2=82.6%). No associations were found for total dairy, high-fat/ low-fat dairy or milk with the health outcomes.

Dairy contributes to prevent obesity: Childhood and adult

Meta-analyses of observational studies and RCT's find that dairy in children reduce risk of obesity with beneficial effect on body composition

The NEW ENGLAND JOURNAL of MEDICINE

Milk and Health

June 4, 2020
N Engl J Med 2020; 382:e86
DOI: 10.1056/NEJMc2005220
Metrics

International Journal of Obesity (2012) 1 - 9

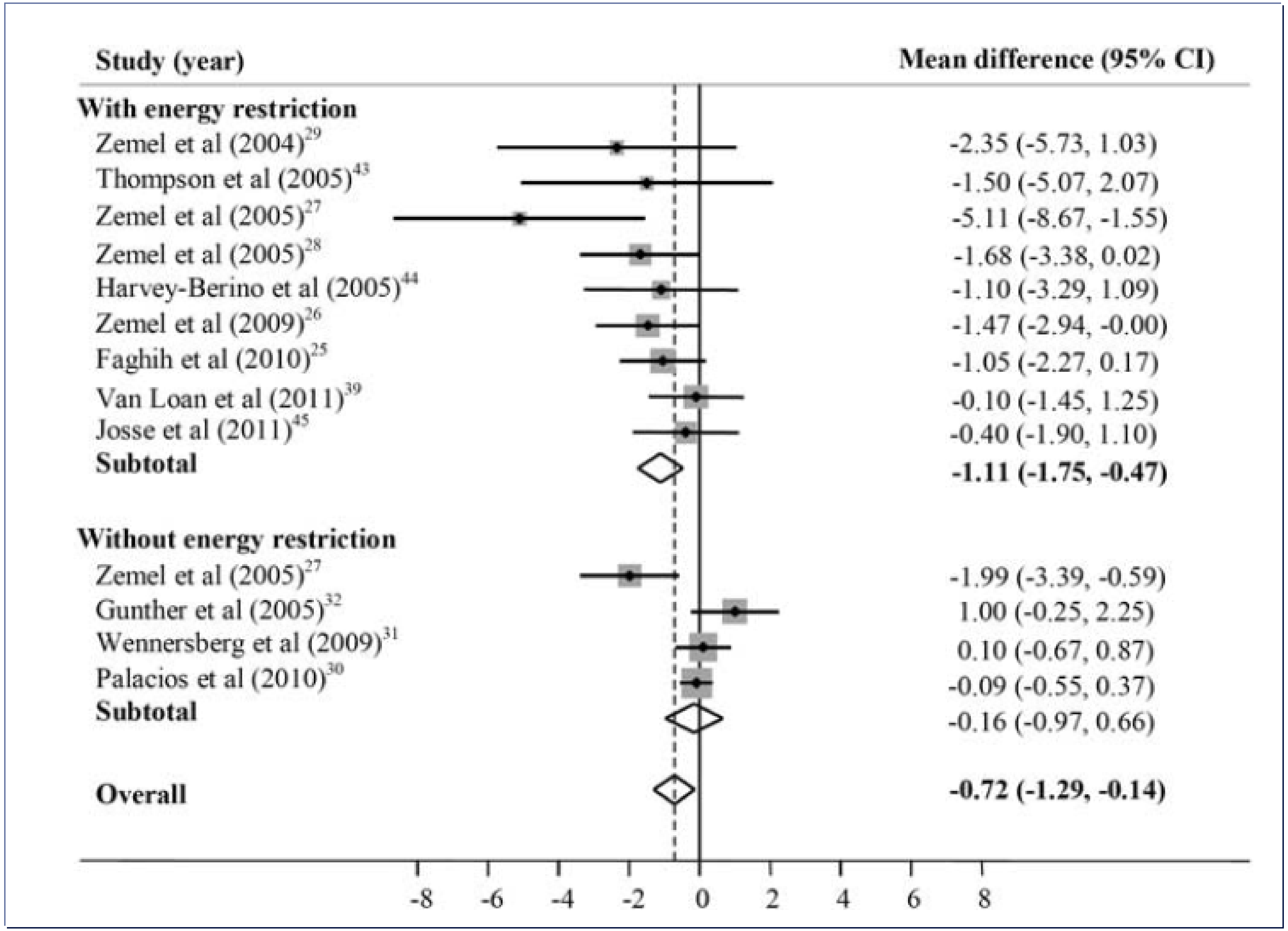
www.nature.com/ijo

ORIGINAL ARTICLE

Effect of dairy consumption on weight and body composition in adults: a systematic review and meta-analysis of randomized controlled clinical trials

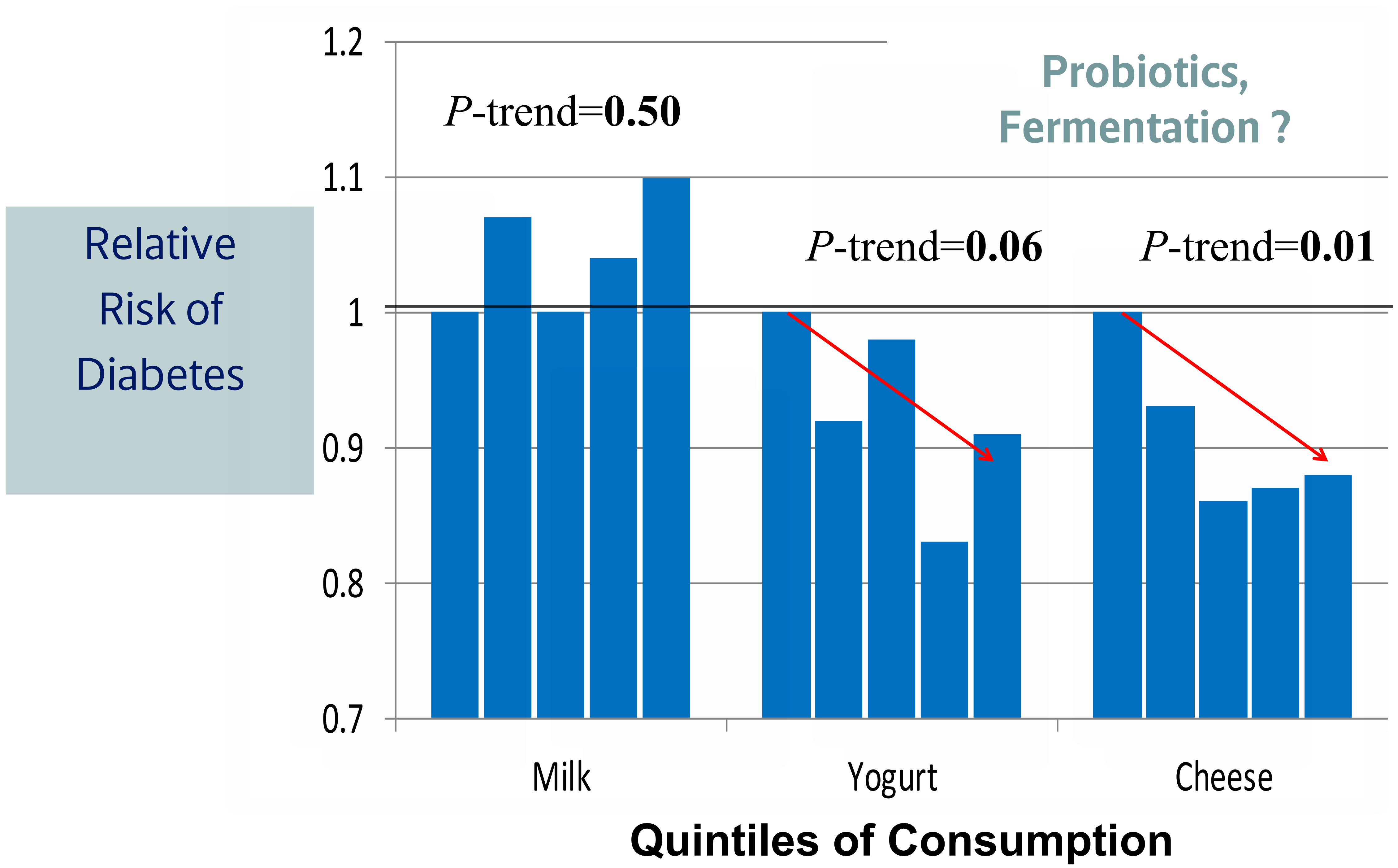
AS Abargouei[1,2], M Janghorbani[3], M Salehi-Marzijarani[3] and A Esmaillzadeh[1,2]

Effect of high vs low dairy on fat loss



Dairy Foods and Risk of Diabetes

340,234 Europeans, 8 countries, 12,403 cases



Sluijis et al., AJCN 2012

SUPPLEMENT

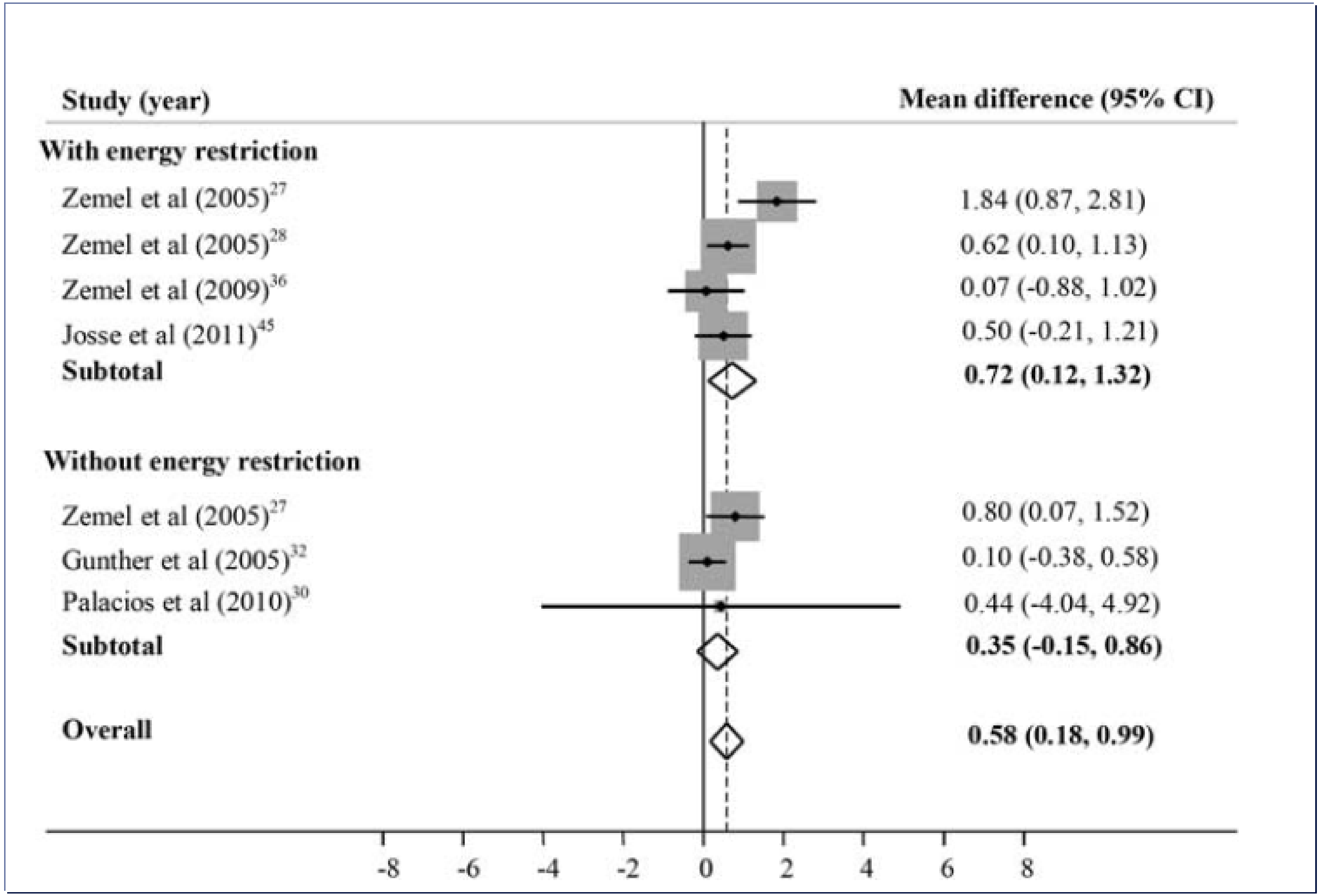
Effects of Milk and Dairy Product Consumption on Type 2 Diabetes: Overview of Systematic Reviews and Meta-Analyses

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]

[1] Health and Social Research Center, Universidad de Castilla-La Mancha, Cuenca, Spain; [2] Facultad de Ciencias de la Salud, Universidad Autónoma de Chile, Talca, Chile; [3] Department of Environmental Health, Harvard TH Chan School of Public Health, Boston, MA; [4] Department of Food Sciences and Nutrition, School of Applied Health Sciences and Wellness, [5] Diabetes Institute, Ohio University, Athens, OH; [6] PROFITH (PROmoting FITness and Health through Physical Activity) Research Group, Department of Physical Education and Sport, Faculty of Sport Sciences, [7] Department of Biochemistry and Molecular Biology II, School of Pharmacy, [8] Institute of Nutrition and Food Technology "José Mataix," Biomedical Research Center, University of Granada, Granada, Spain; [9] Instituto de Investigación Biosanitaria ibs GRANADA, Complejo Hospitalario Universitario de Granada, Granada, Spain; and [10] CIBEROBN (CIBER Physiopathology of Obesity and Nutrition CB12/03/30028), Instituto de Salud Carlos III, Madrid, Spain

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. Most studies reported an inverse association between T2D incidence and dairy product consumption, especially for *1*) total dairy products (range: 0.86–0.91), *2*) low-fat dairy products (range: 0.81–0.83), *3*) low-fat milk (RR: 0.82), and *4*) yogurt (range: 0.74–0.86). Dose–response analyses showed a decreased T2D risk for *1*) 200–400 g/d of total dairy products (range: 0.93–0.97) and *2*) 200 g/d of low-fat dairy products (range: 0.88–0.91). Total dairy product consumption is associated with a lower risk of T2D, especially for yogurt and low-fat dairy consumption. The association with cheese is moderate. Moreover, dose–response analyses showed that the risk of T2D decreased by each unit increase in consumption of total dairy products and low-fat dairy products. *Adv Nutr* 2019;10:S154–S163.

Effect of high vs low dairy on fat free mass



From single nutrients to whole foods: the importance of the food matrix

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THE PRESENT AND FUTURE

JACC STATE-OF-THE-ART REVIEW

Saturated Fats and Health: A Reassessment and Proposal for Food-Based Recommendations

JACC State-of-the-Art Review

Arne Astrup, MD, DMSc,[a] Faidon Magkos, PhD,[a] Dennis M. Bier, MD,[b] J. Thomas Brenna, PhD,[c,d,e] Marcia C. de Oliveira Otto, PhD,[f] James O. Hill, PhD,[g] Janet C. King, PhD,[h] Andrew Mente, PhD,[i] Jose M. Ordovas, PhD,[j] Jeff S. Volek, PhD, RD,[k] Salim Yusuf, DPhil,[i] Ronald M. Krauss, MD[l,m]

ABSTRACT

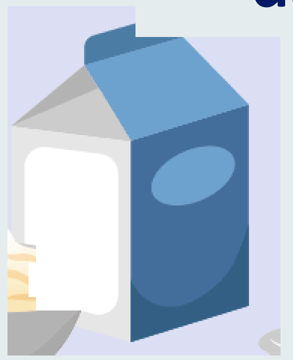
The recommendation to limit dietary saturated fatty acid (SFA) intake has persisted despite mounting evidence to the

Previous advice: restrict SFA intake to reduce risk of CVD

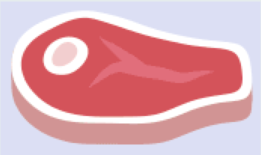
↓

Current evidence base: health effects of SFAs depend on the interacting effects from naturally occurring food components and from unhealthy compounds introduced by processing

Whole-fat dairy



Unprocessed red meat



Dark chocolate

=

Complex food matrix with high SFA content but also other nutrients and non-nutritive components (e.g. proteins, micronutrients, phospholipids, probiotics)

=

No increased CVD or diabetes risk

↓

New recommendations should emphasize food-based strategies that translate for the public into understandable, consistent, and robust recommendations for healthy dietary patterns

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Pure fats for cooking ?

Conclusions

- Different SFA have very different biological effects on cardio-metabolic health
- SFA are rarely consumed in a pure form, and the food matrix completely alters the health effects (dark chocolate, ice crème, cheese, yoghurt, olive oil)
- There is good evidence to show that many foods with high content of SFA are nutrient-dense and reduce risk of obesity, type 2 diabetes, and CVD.

Research studies, including meta-analyses, that treat "saturated fat" as a homogenous entity, should be abandoned.
Future analyses should be "food-based" which also makes it easier to leverage findings into tangible recommendations and dietary advise.

Thank you for your attention