"Ehi, Caffè! Cioccolato! … Ah, Zerlina: Giudizio!"

Caffè e Cioccolato: Virtù e Rischi da Mozart ai tempi moderni

LE PROPRIETÀ NUTRIZIONALI E GLI EFFETTI

Danilo Orlandini

Ordine dei Medici e Odontoiatri
Reggio Emilia

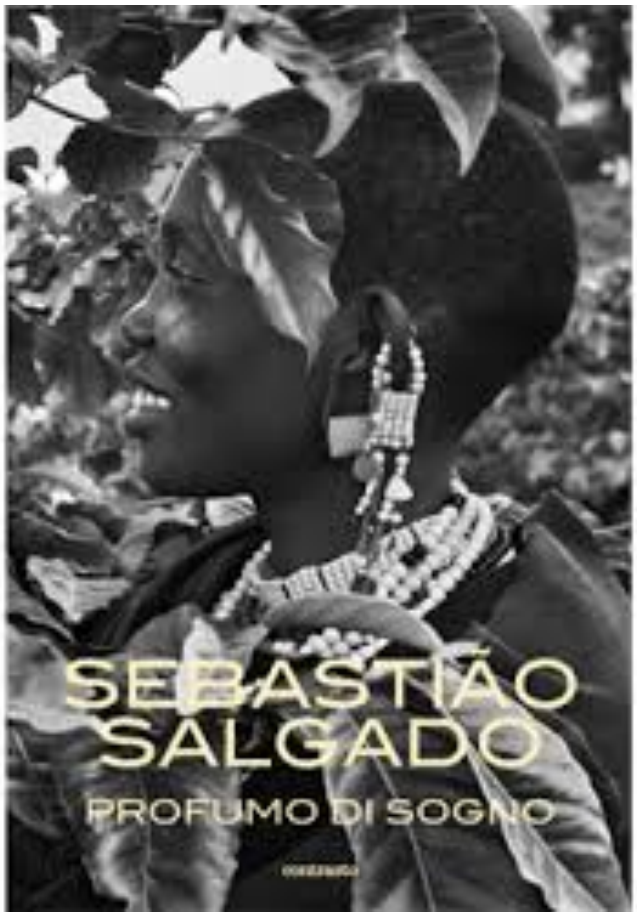
30 Gennaio 2016

Le immagini tratte dal volume di Salgado
sono sostituite dalla copertina del volume stesso

Il caffè è la bevanda ufficiale della cultura. Ogni arte e ogni artista, fin dall'illuminismo, hanno avuto con essa strettissimi rapporti; attraversando la cultura, il caffè crea benessere nei paesi consumatori e porta felicità al 20% della popolazione mondiale.

Andrea Illy

Fatturato mondiale	100 miliardi di dollari
Tazze di caffè	500 miliardi/anno
Lavoratori	25 milioni
Paesi produttori	42

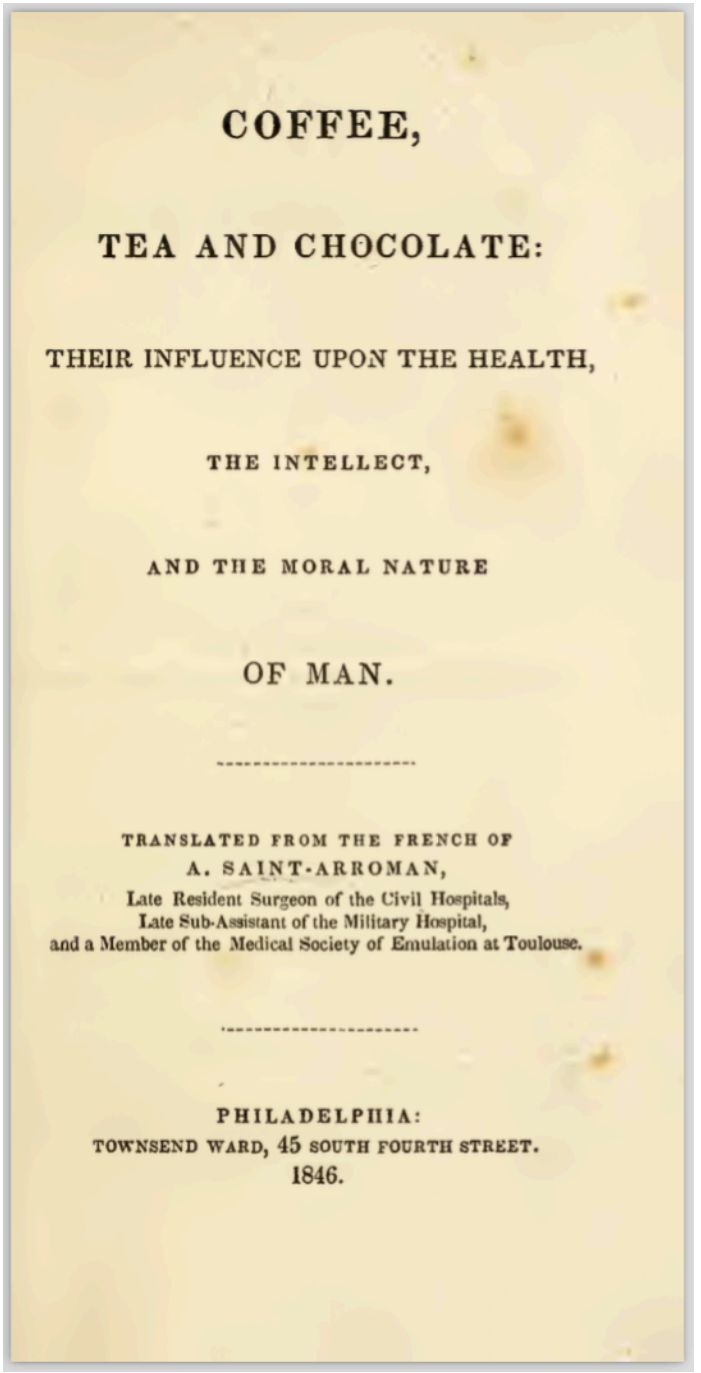


Un italiano occupa il posto d'onore nell’introduzione del caffè in Europa; Pietro della Valle, viaggiatore ammirevole, scrive da Costantinopoli nel 1615 a un romano, suo conoscente, informandolo che insegnerà all'Europa in che modo i turchi prendono ciò che egli chiama "Cahué,"

A Parigi, alla coffee-house di Du Laurent (o Le Procope) si incontravano Saurin, La Motte, Danchet, Boindin, Rousseau, ecc.; “ma i miti effluvi della bacca aromatica non potevano placare l'asprezza di tanti e accesi rivali”

Si racconta di Jean Jacques Rousseau che, una volta, mentre stava camminando nelle Tuileries colse l'aroma di tostatura del caffè, e disse al suo compagno "Ah, questo è un profumo in cui mi delizio, quando tostano il caffè vicino a casa mia, mi affretto ad aprire la porta e a far entrare tutto l'aroma.”

Roger Nord inveisce contro i locali: "L'uso di coffee-house sembra molto migliorato con una nuova invenzione, chiamato chocolate-houses, a beneficio di cornacchie e babbei di qualità, nelle quali si aggiunge il gioco a tutto il resto; come se il diavolo avesse eretto una nuova Università, e quelli fossero i collegi dei suoi professori, così come le sue scuole di disciplina".



COFFEE,

TEA AND CHOCOLATE:

THEIR INFLUENCE UPON THE HEALTH,

THE INTELLECT,

AND THE MORAL NATURE

OF MAN.

TRANSLATED FROM THE FRENCH OF
A. SAINT-ARROMAN,
Late Resident Surgeon of the Civil Hospitals,
Late Sub-Assistant of the Military Hospital,
and a Member of the Medical Society of Emulation at Toulouse.

PHILADELPHIA:
TOWNSEND WARD, 45 SOUTH FOURTH STREET.
1846.

"Il progresso di questa famosa pianta (THE) è stato qualcosa di simile al progresso della verità;

- sospettato in un primo momento, anche se molto appetibile per quelli che hanno avuto il coraggio di assaggiarlo;
- osteggiato come un intruso;
- abusato quando la sua popolarità sembra diffondersi;
- e trionfante alla fine, con l'approvazione di tutto il paese, dal palazzo al cottage,

solo grazie agli sforzi lenti e incessanti del tempo e delle proprie virtù"

Edinburgh Review, 1816, p. 117

CAFFÈ

COMPOSIZIONE CHIMICA E VALORE ENERGETICO PER 100g DI PARTE EDIBILE

Composizione chimica	valore per 100g	Note
Parte edibile (%):	100	
Acqua (g):	4.1	
Proteine (g):	10.4	
Lipidi(g):	15.4	
Colesterolo (mg):	0	
Carboidrati disponibili (g):	28.5	
Amido (g):		
Zuccheri solubili (g):		
Fibra totale (g):		
Fibra solubile (g):		
Fibra insolubile (g):		
Alcol (g):	0	
Energia (kcal):	287	

Valori Nutrizionali	per 1 tazzina di caffè espresso (60 ml)
Energia	4 kJ 1 kcal
Proteine	0,07 g
Carboidrati	0 g
Zuccheri	0 g
Grassi	0,11 g
Grassi Saturi	0,054 g
Grassi Monoinsaturi	0 g
Grassi Polinsaturi	0,054 g
Colesterolo	0 mg
Fibra	0 g
Sodio	8 mg
Potassio	68 mg

Type of coffee	Size*	Caffeine†
Brewed	8 oz. (237 mL)	95-200 mg
Brewed, decaffeinated	8 oz. (237 mL)	2-12 mg
Brewed, single-serve varieties	8 oz. (237 mL)	75-150 mg
Brewed, single-serve varieties, decaffeniated	8 oz. (237 mL)	2-4 mg
Espresso, restaurant-style	1 oz. (30 mL)	47-75 mg
Instant	8 oz. (237 mL)	27-173 mg
Instant, decaffeinated	8 oz. (237 mL)	2-12 mg
Specialty drink (latte or mocha)	8 oz. (237 mL)	63-175 mg

Adapted from Journal of Food Science, 2010; Pediatrics, 2011; USDA National Nutrient Database for Standard Reference, Release 26; Journal of Analytical Toxicology, 2006; Starbucks, 2014; Food and Chemical Toxicology, 2014; Keurig, 2014

Type of tea	Size*	Caffeine†
Brewed tea		
Black tea	8 oz. (237 mL)	14-70 mg
Black tea, decaffeinated	8 oz. (237 mL)	0-12 mg
Green tea	8 oz. (237 mL)	24-45 mg
Iced tea		
Instant, prepared with water	8 oz. (237 mL)	11-47 mg
Ready-to-drink, bottled	8 oz. (237 mL)	5-40 mg

Adapted from Journal of Food Science, 2010; Pediatrics, 2011; Journal of Analytical Toxicology, 2008; USDA National Nutrient Database for Standard Reference, Release 26; Journal of Analytical Toxicology, 2006; Starbucks, 2014; Food and Chemical Toxicology, 2014

La Caffeina, con la teobromina e la teofillina, è una metilxantina, un derivato metilato della xantina.

Le xantine costituiscono un gruppo di alcaloidi comunemente usati per la loro azione stimolante e broncodilatatrice.

La Caffeina ha un'emivita approssimativamente di 4-6 ore. Il suo metabolismo avviene principalmente nel fegato, dove il citocromo P450 nella sua isoforma CYP1A2 è pressappoco responsabile per il 95% del metabolismo primario.

Caffeine

- **Più del 95% degli adulti consuma caffeina dal cibo o dalle bevande.**
- **Consumo medio giornaliero: 110mg, donne dai 19 ai 30 anni**
  fino a 260mg, uomini dai 51 ai 70 anni
- **Limite superiore giornaliero: 400mg (healthy eating patterns)**
- **Una piccola percentuale di adulti introduce più di 400mg**
- **Il 90th percentile di introduzione di caffeina per gli uomini dai 31 ai 70 anni, e il 95th percentile per le donne di età superiore ai 31 anni è più alto di 400 mg al giorno.**
- **Le fonti di caffeina per gli adulti sono soprattutto caffè e the, che coprono circa dal 70 al 90 % del consumo totale di caffeina negli adulti di tutti i gruppi di età.**
- **Il consumo medio dei bambini (5 to 32 mg/d) e adolescenti (63 to 80 mg/d) è basso.**
- **Fonti di caffeina per i bambini e gli adolescenti sono distribuite tra caffè, tè e bevande zuccherate in quantità quasi uguali. Per i bambini piccoli, dessert e anche i dolci sono una fonte notevole di caffeina da certi ingredienti, come il cioccolato, ma l'assunzione di caffeina rimane basso.**

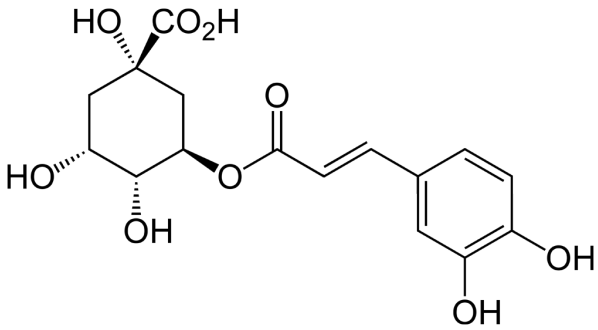
U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

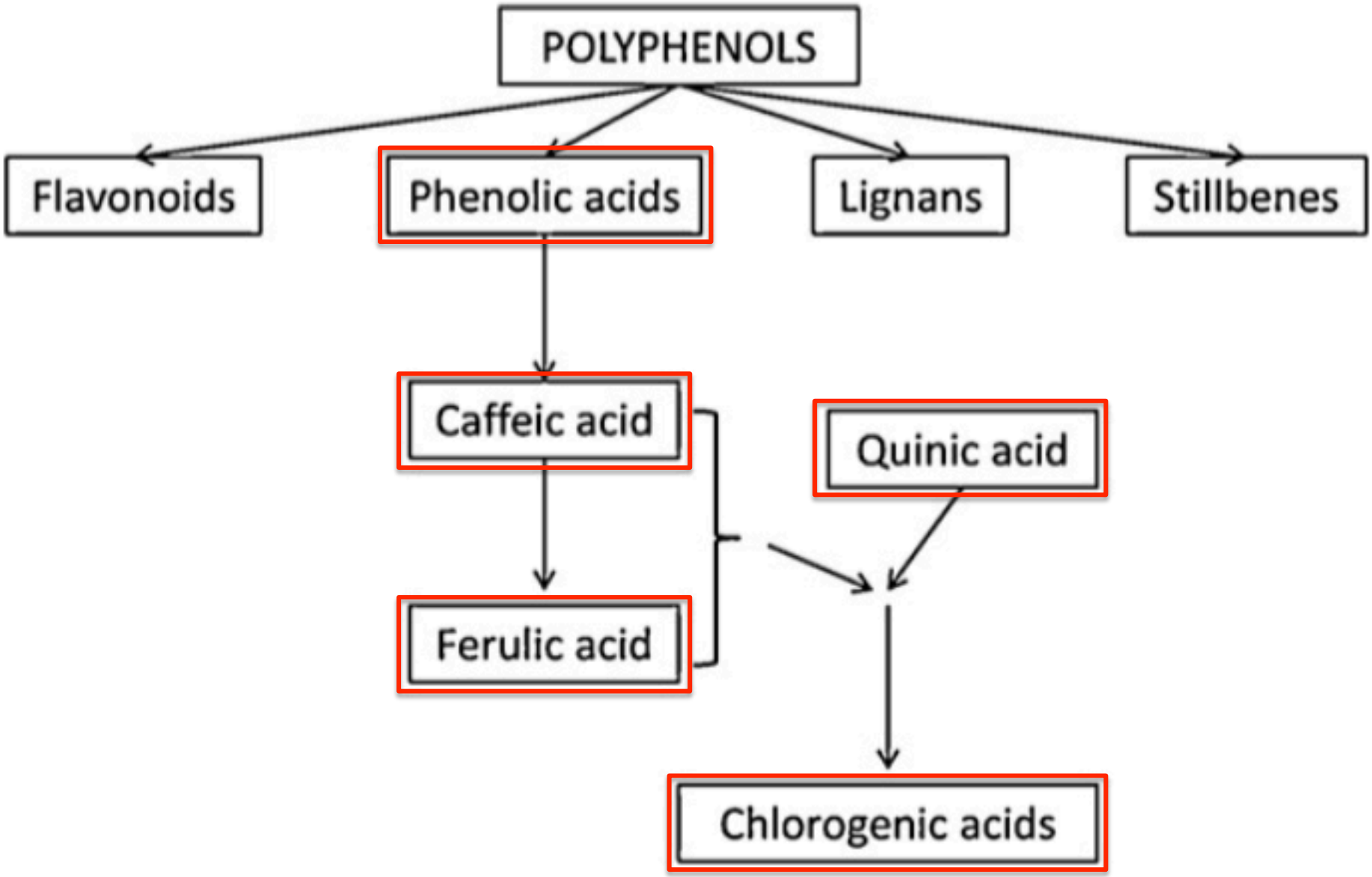
Se consumata con moderazione, la caffeina ha effetti per lo più positivi, soprattutto sulla vigilanza, il benessere e le prestazioni di resistenza intellettuale e fisica.
La caffeina è un blando stimolante del sistema nervoso centrale, ed il consumo abituale può diminuire il rischio di condizioni patologiche quali il declino cognitivo legato all'età, il morbo di Alzheimer e il morbo di Parkinson.
La caffeina non sembra avere effetti negativi significativi sulla funzione cardiovascolare.
La caffeina ha dimostrato di non portare a disidratazione e di non incidere in modo significativo sulla salute ossea o sulle funzioni gastrointestinali.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

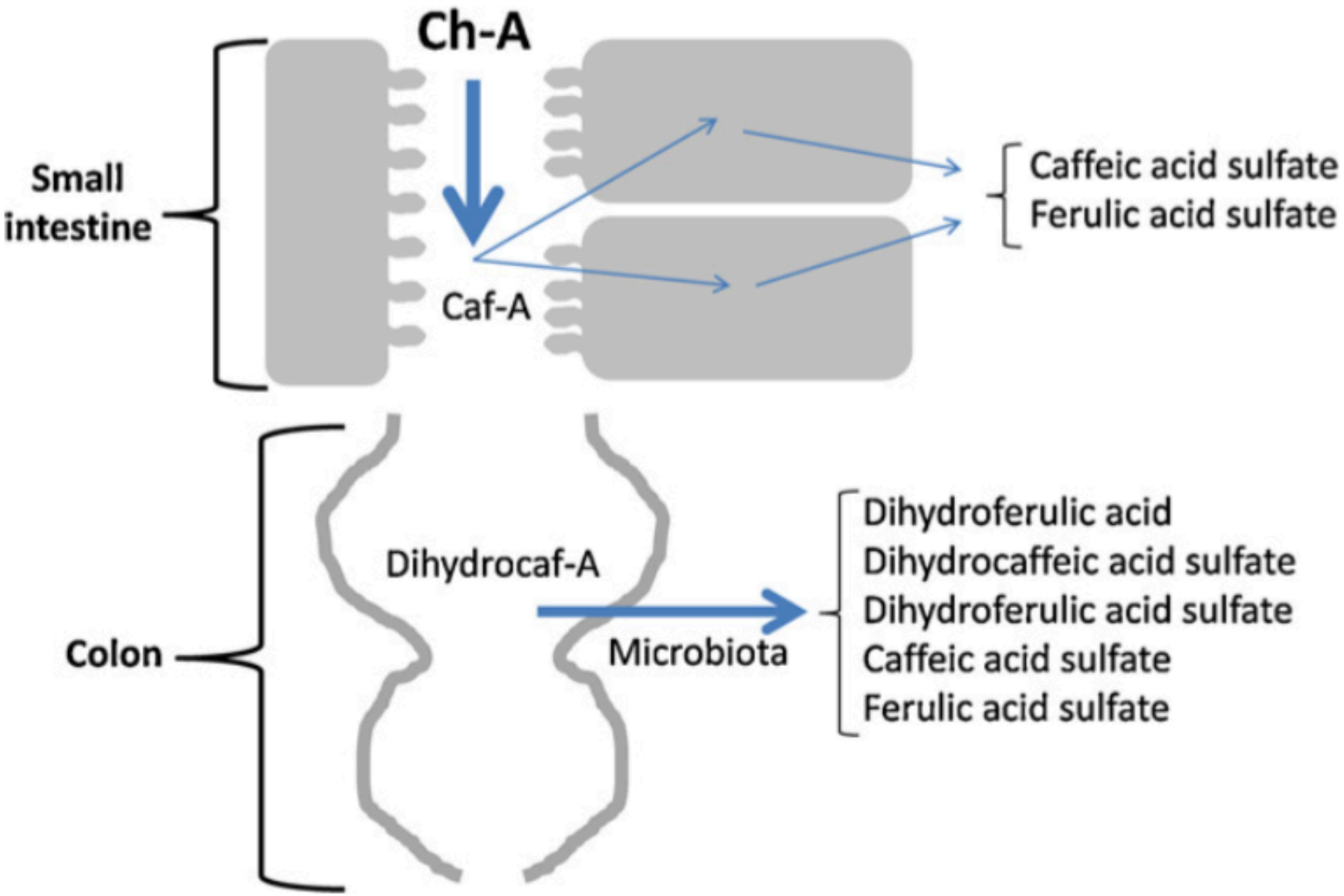
Il Caffè, come il the e il cacao, è ricco di polifenoli, composti classificati tra i flavonoidi, acidi fenolici, lignani, stilbeni, che hanno un considerevole potenziale antiossidante.
Il polifenolo più comune nel caffè è l'acido fenolico, principalmente acido caffeico, un tipo di acido trans-cinnamico, e il suo derivato acido clorogenico.

Il metabolismo dell'acido clorogenico e ancora poco chiaro, sebbene studi nell'uomo hanno confermato che è presente principalmente in due siti: il piccolo intestino e il colon.





A. Cano-Marquina et al. / Maturitas 75 (2013) 7–21



A. Cano-Marquina et al. / Maturitas 75 (2013) 7–21

ANTIOSSIDANTI

Diterpeni

i diterpeni hanno un effetto pleitropico che include l'aumento dei lipidi sierici, proprietà antiossidanti, antiinfiammatorie, antiangiogeniche.

Cafestol

Kahweol

L'interesse per questi composti è anche dovuto al fatto che sono i più importanti fattori di elevazione dei valori di colesterolo presenti nel caffè.

La quantità di diterpeni varia molto in relazione alla modalità di infusione

Caffè istantaneo	pochissimi (processo industriale)
Caffè filtrato a goccia:	pochissimi (legati dalla carta)
Caffè pressato alla Francese	molti
Caffè bollito	molti
Caffè turco	molti

Type of coffee	Preparation technique	Diterpenes per cup	
		Cafestol (mg)	Kahweol (mg)
Filtered	Boiled water is poured over finely ground roasted coffee beans in a paper filter, either by hand or by using an electric coffee maker	0.1	0.1
Percolated	Coarsely ground roasted coffee beans are extracted by recirculating boiling water until the desired brew strength is reached	0.1	0.1
Instant	2–3 g of soluble coffee granules are dissolved into 150–190 ml of hot water	0.2	0.2
Espresso	Hot water is forced under high pressure through a bed of finely ground, usually dark roasted, coffee beans	1.5	1.8
Mocha	Just overheated water is forced through a bed of finely ground, usually dark roasted, coffee beans	1.1	1.4
Boiled	Coarse grounds are boiled with water for 10 or more min, or infused with hot water ('infused' coffee), and the liquid is decanted without the use of a filter	3.0	3.9
Plunger pot	Hot water is poured onto coarse grounds, and after 2–5 min the metal screen strainer is pushed down to separate the grounds from the fluid	3.5	4.4
Turkish/Greek	Very fine/powdery grounds are brought to a boil once or repeatedly, or incubated with hot water ('mud' coffee), and the liquid is decanted without the use of a filter	3.9	3.9

Urgert R, van der Weg G, Kosmeijer-Schuil TG, et al. Levels of the cholesterol-elevating diterpenes cafestol and kahweol in various coffee brews. J Agric Food Chem 1995;43:2167–72.

Does drinking coffee cause cancer?

No

Il possibile legame tra il caffè e il cancro del pancreas, a cui si è prestata molta attenzione in passato, non è stato confermato dai più recenti studi. Al momento non c'è evidenza che il caffè o la caffeina aumentano il rischio di cancro.

American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention 2012

Rischio come mortalità totale (208.501 per 4.690.072 p/a)

HRs (95%CI)	Tazzine			
	≤ 1 al giorno	1.1-3	> 3	> 5
Caffè	0,95(0,91-0,99)	0,91(0,88-0,95)	0,93(0,89-0,97)	1,02(0,93-1,07)
Con Caffeina	0,97(0,94-1,00)	0,93(0,90-0,96)	1,00(0,95-1,05)	
Decaffeinato	0,92(0,89-0,94)	0,91(0,88-0,94)	0,94(0,88-1,00)	

Rischio come mortalità totale nei non fumatori

HRs (95%CI)	Tazzine			
	≤ 1 al giorno	1.1-3	> 3	> 5
Caffè	0,94(0,89-0,99)	0,92(0,87-0,97)	0,85(0,99-0,92)	0,88(0,78-0,99)
Con Caffeina	0,98(0,93-0,97)	0,92(0,87-0,97)	0,89(0,81-0,97)	
Decaffeinato	0,95(0,91-0,99)	0,93(0,86-0,99)	0,89(0,77-1,02)	

Ding M. et Al. Association of Coffee Consumption With Total and Cause-Specific Mortality in 3 Large Prospective Cohorts. Circulation. 2015 Dec 15;132(24):2305-15. doi: 10.1161/CIRCULATIONAHA.115.017341. Epub 2015 Nov 16.

Rischio di mortalità totale

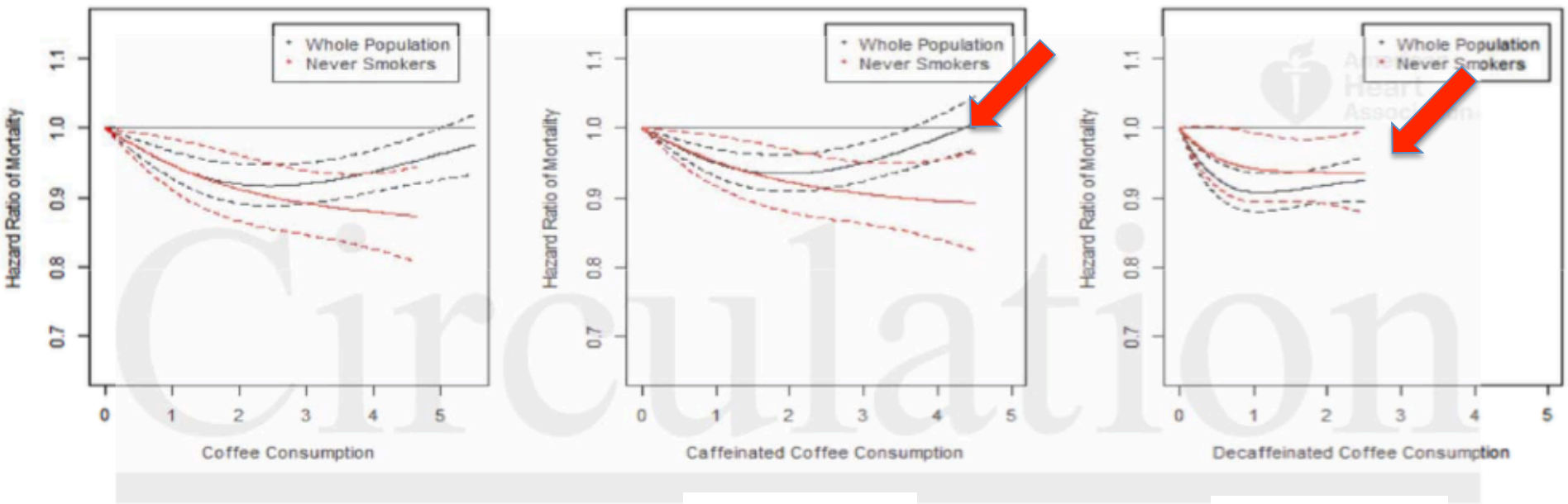
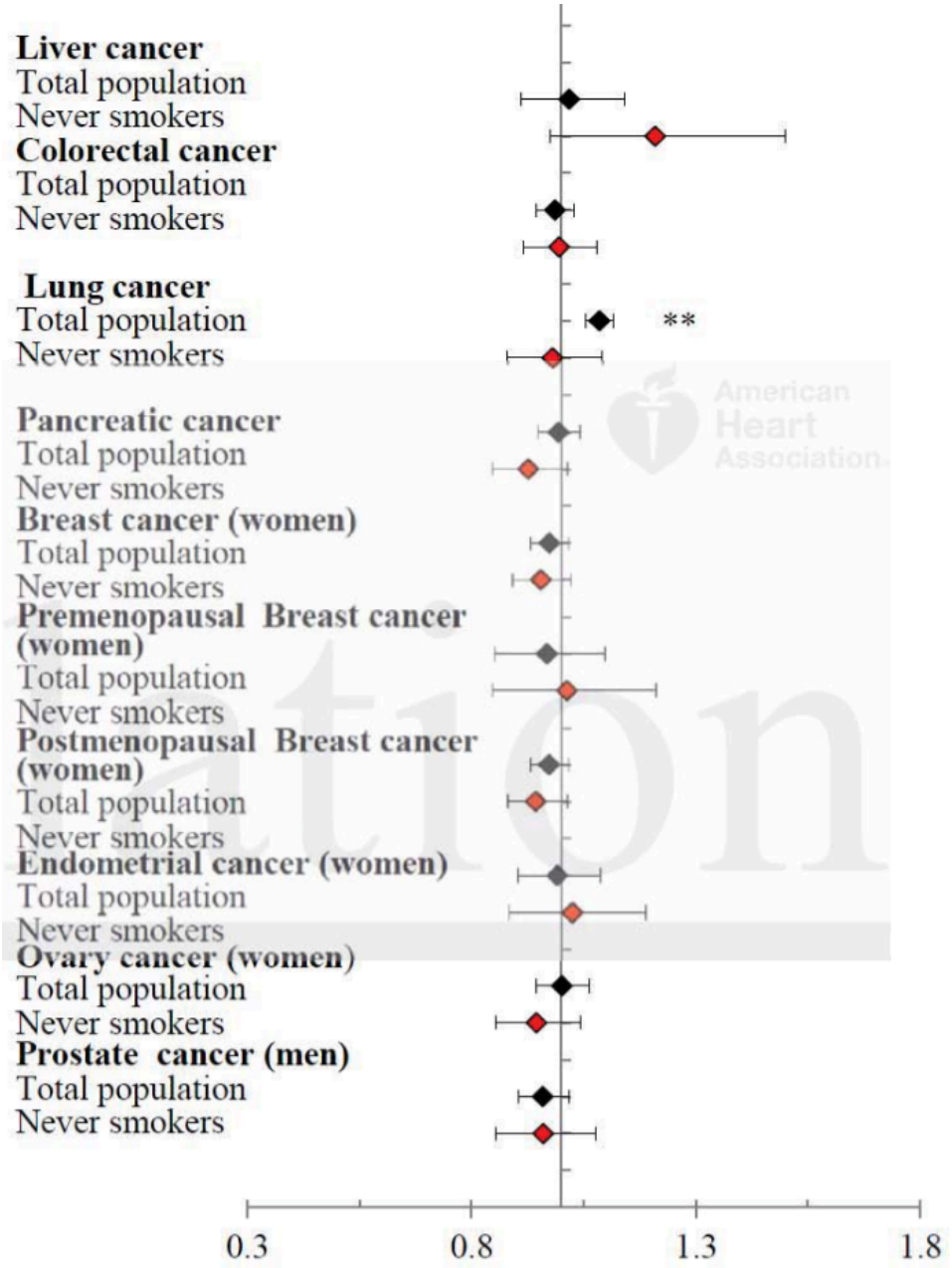


Figure 1a

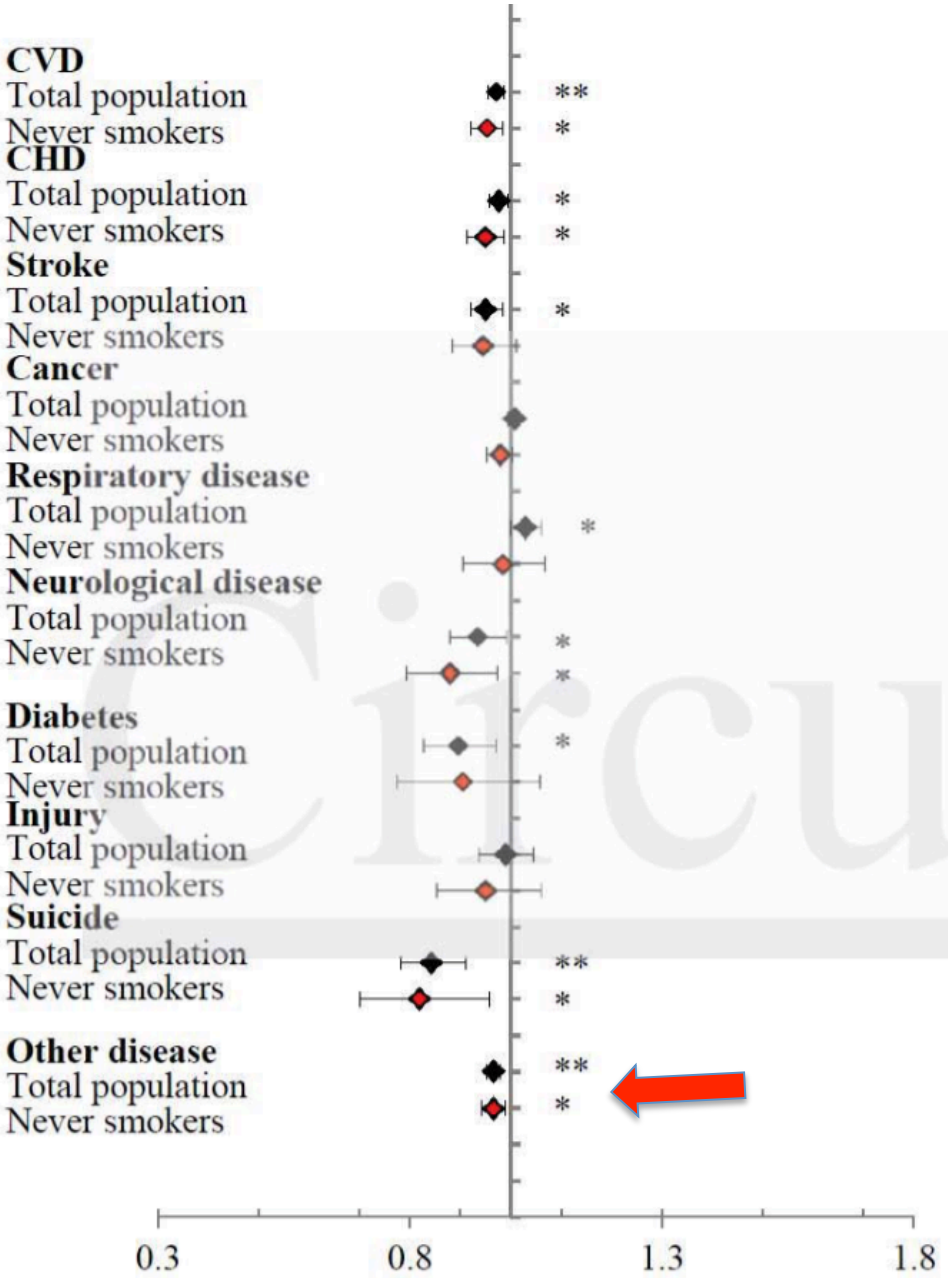
con caffeina

decaffeinato

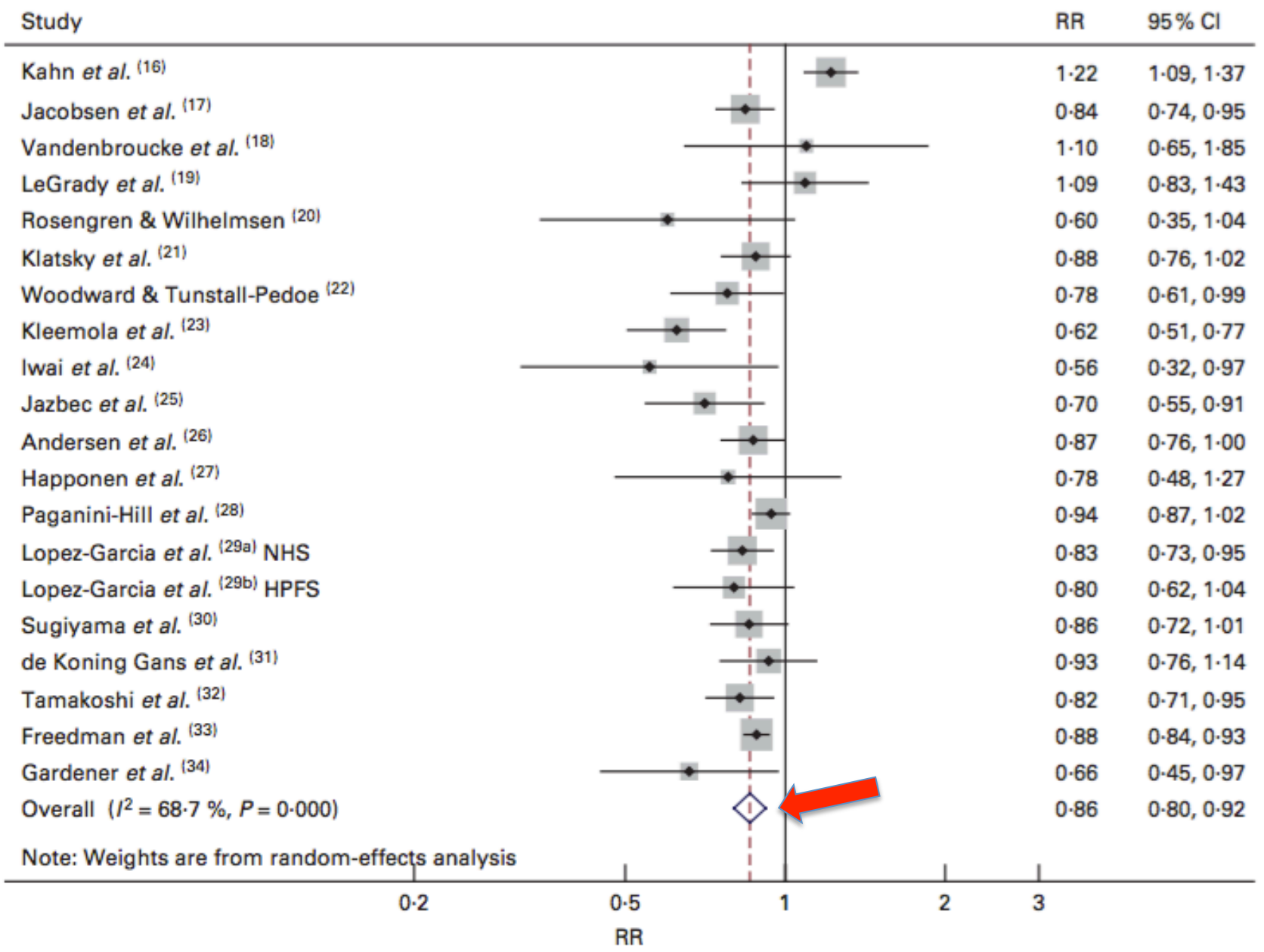
Ding M. et Al. Association of Coffee Consumption With Total and Cause-Specific Mortality in 3 Large Prospective Cohorts. Circulation. 2015 Dec 15;132(24):2305-15. doi: 10.1161/CIRCULATIONAHA.115.017341. Epub 2015 Nov 16.



Ding M. et Al. Association of Coffee Consumption With Total and Cause-Specific Mortality in 3 Large Prospective Cohorts. Circulation. 2015 Dec 15;132(24):2305-15. doi: 10.1161/CIRCULATIONAHA.115.017341. Epub 2015 Nov 16.

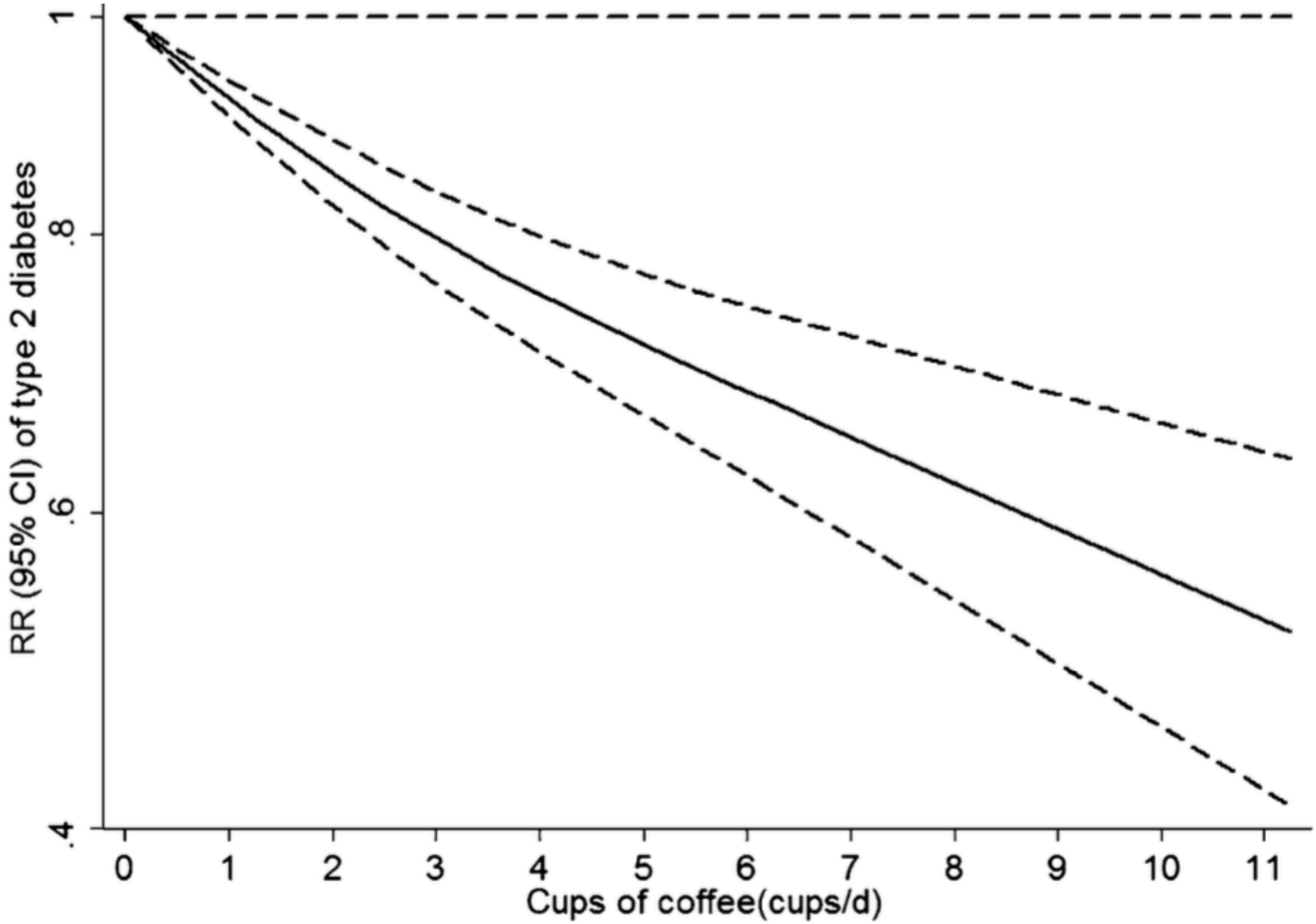


Ding M. et Al. Association of Coffee Consumption With Total and Cause-Specific Mortality in 3 Large Prospective Cohorts. Circulation. 2015 Dec 15;132(24):2305-15. doi: 10.1161/CIRCULATIONAHA.115.017341. Epub 2015 Nov 16.



Forest plot of the prospective cohort studies of total mortality for high *v.* low/no coffee consumption. A total of thirteen studies[17–23,26,27,29a,b,31,33] used

Y Je, E Giovannucci: Coffee consumption and total mortality: a meta-analysis of twenty prospective cohort studies
British Journal of Nutrition (2014), 111, 1162–1173

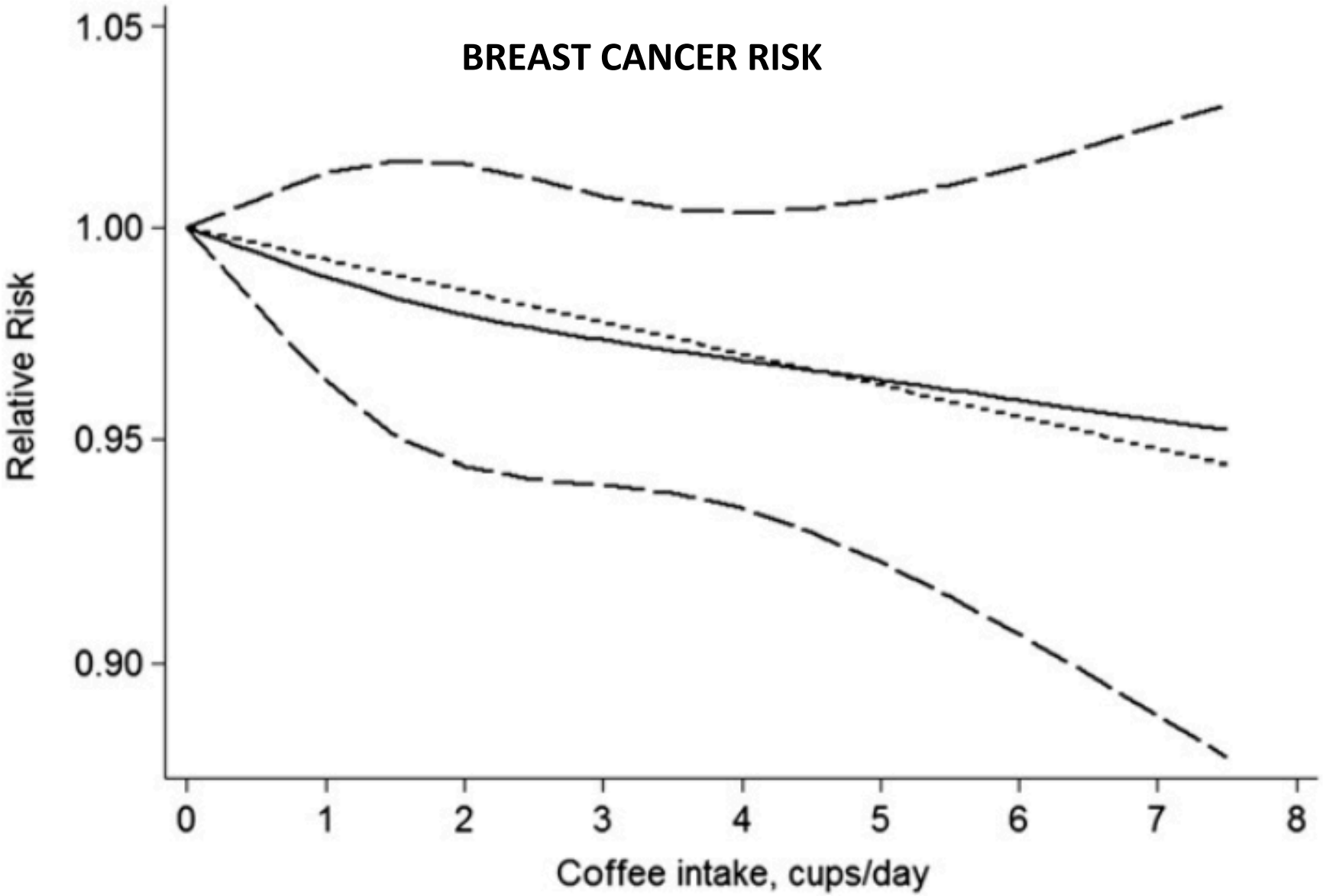


Coffee consumption was inversely associated with the risk of type 2 diabetes in a dose-response manner. Both caffeinated and decaffeinated coffee was associated with reduced diabetes risk.

Ming Ding et Al. Caffeinated and Decaffeinated Coffee Consumption and Risk of Type 2 Diabetes: A Systematic Review and a Dose-Response Meta-analysis Diabetes Care 2014;37:569–586 | DOI: 10.2337/dc13-1203

Il consumo moderato di caffè sia decaffeinato che con caffeina può diminuire il rischio di diabete di tipo 2 in donne giovani e di mezza età. I componenti del caffè diversi dalla caffeina possono influire sullo sviluppo del diabete di tipo 2.

van Dam RM, et Al.: **Coffee, caffeine, and risk of type 2 diabetes: a prospective cohort study in younger and middle-aged U.S. women.**
Diabetes Care. 2006 Feb;29(2):398-403.



W Jiang, Y Wu, X Jiang: Coffee and caffeine intake and breast cancer risk: An updated dose–response meta-analysis of 37 published studies
Gynecologic Oncology 129 (2013) 620–629

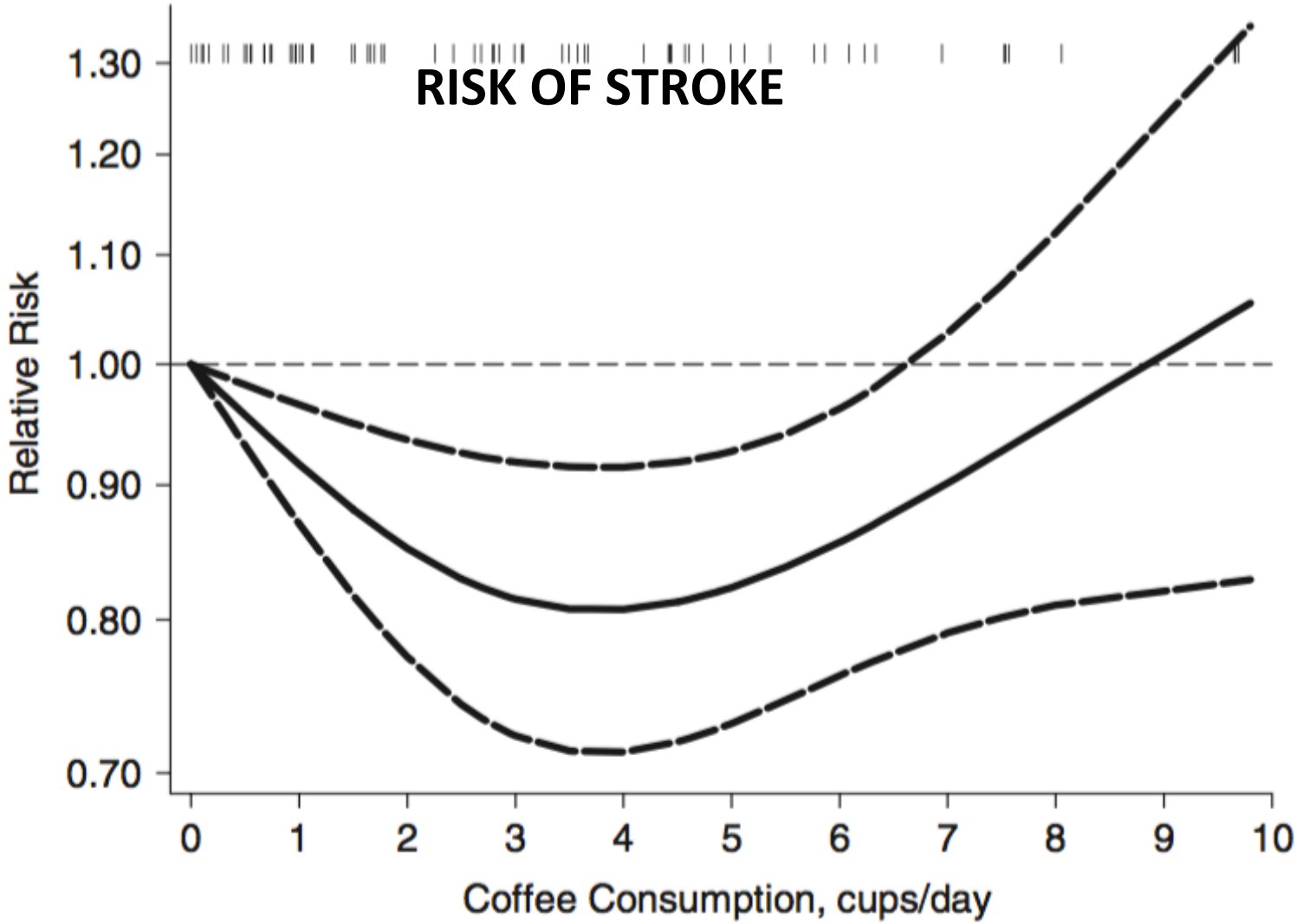
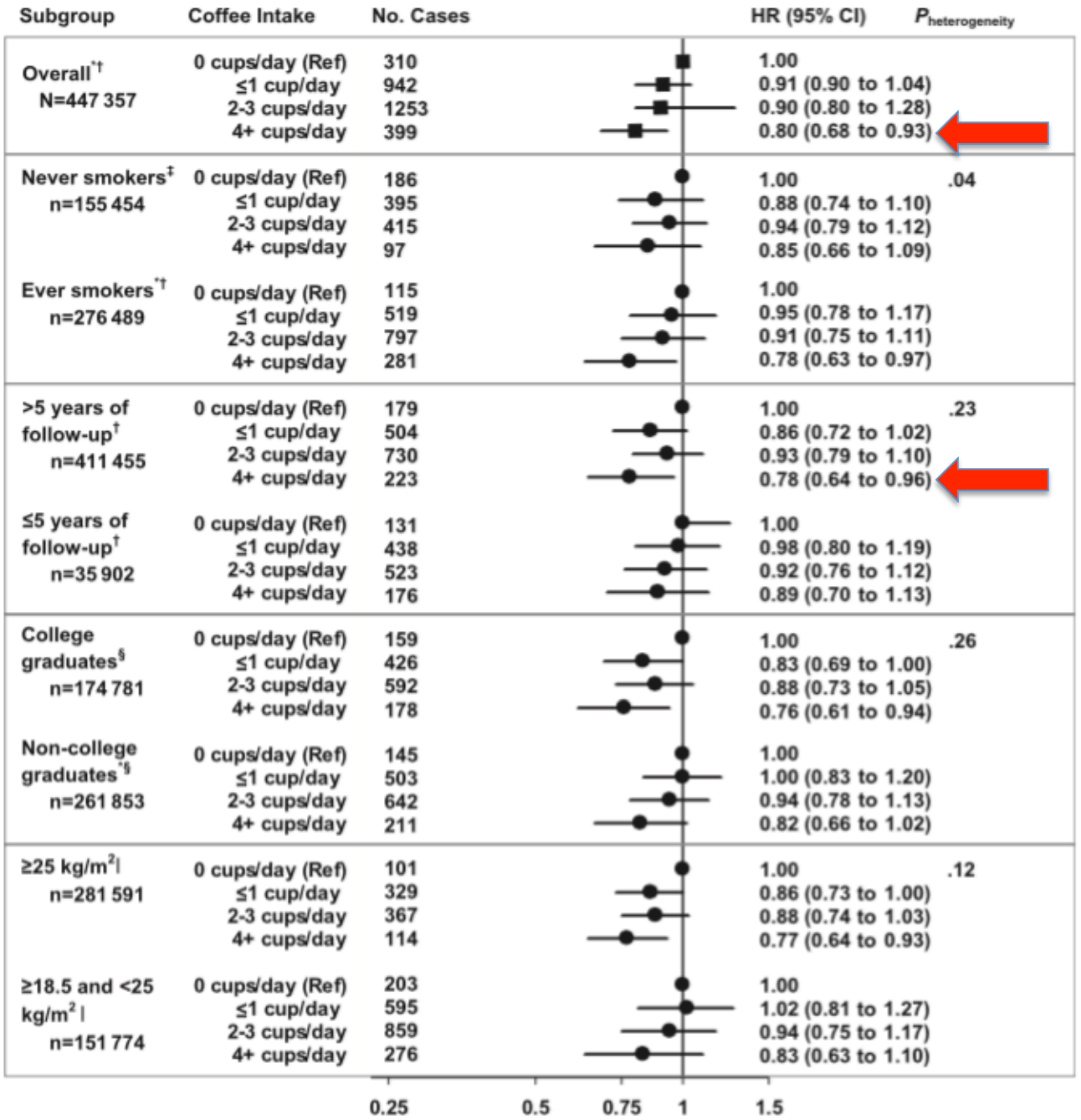


Figure 2. Adjusted relative risk of stroke associated with coffee consumption in a meta-analysis of published studies, 1966–2011. Coffee

Larsson S, Orsini N: Coffee Consumption and Risk of Stroke: A Dose-Response Meta-Analysis of Prospective Studies
Am J Epidemiol. 2011;174(9):993–1001

MELANOMA CUTANEO



E. Lott eld et al. Coffee Drinking and Cutaneous Melanoma Risk in the NIH-AARP Diet and Health Study
JNCI J Natl Cancer Inst (2015) 107(2): dju421

In vivo, il trattamento con caffè aumenta il peso dei muscoli, la forza di presa, la capacità di rigenerazione del muscolo contuso, e diminuisce il livello dei mediatori pro-infiammatori del siero, nel confronto con topi di controllo ugualmente anziani.

Guo Y1, et al.: **Coffee treatment prevents the progression of sarcopenia in aged mice in vivo and in vitro.**
Exp Gerontol. 2014 Feb;50:1-8. doi: 10.1016/j.exger.2013.11.005. Epub 2013 Nov 22.

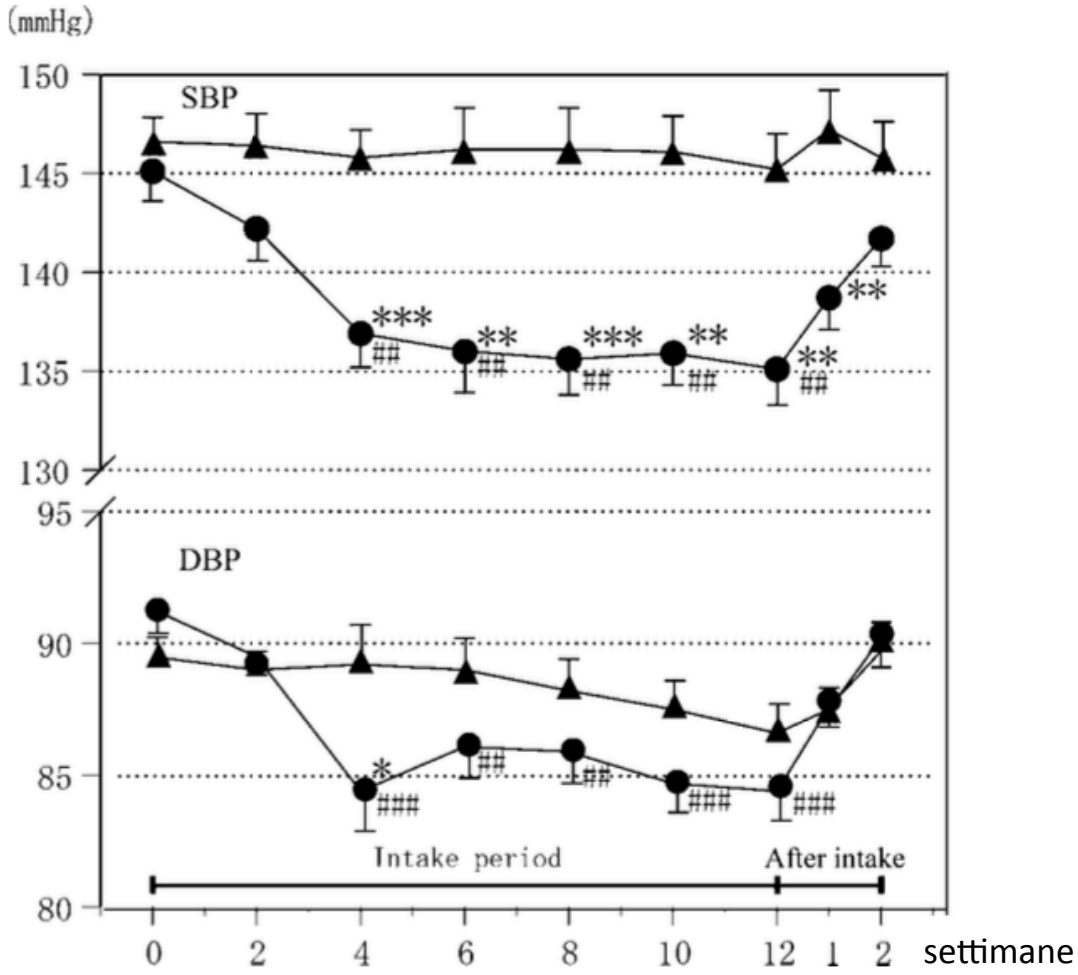


Figure 2. Change in BP: ▲, placebo group; ●, CGA group. Each value represents the mean ± SE (n=14). *p<0.05, **p<0.01, ***p<0.001 vs placebo group. #p<0.05, ##p<0.01, ###p<0.001 vs base-line value.

Chlorogenic acids (CGA)

http://dx.doi.org/10.1080/10641960600798655

Does caffeine cause sleep problems?

Caffeine intake may affect sleep patterns in some individuals, causing prolonged sleep latency, shorter total and deep sleep time and more frequent awakenings. The effects of caffeine on sleep are smaller in regular coffee consumers compared to occasional consumers.

Caffeine abstinence may improve sleep, reducing the time taken to fall asleep and improving sleep quality for some.

Human sensitivity to the effects of caffeine on sleep is variable and genetic differences are also known to play a role.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

Does caffeine consumption cause dehydration?

Caffeine, as a compound, is a mild diuretic which increases the frequency of urination but not the amount of fluid passed. Tolerance to this effect increases rapidly, so typically this does not affect regular caffeine consumers. Recent studies and literature reviews conclude that moderate caffeine consumption does not lead to dehydration in both regular caffeine consumers and also athletes performing in heat[9,10].

Therefore, advice to abstain from drinking moderate amounts of caffeinated coffee, in order to maintain adequate fluid balance, is unfounded.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

What are the recommendations on caffeine intake for the general population?

In Europe, the European Food Safety Authority (EFSA) advise that daily caffeine intakes up to 400mg and single doses up to 200mg do not raise concerns.

EFSA, (2015) Scientific Opinion on the Safety of Caffeine, *EFSA Journal,* 13(5):4102.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

The addition of caffeine (≥ 100 mg) to a standard dose of commonly used analgesics provides a small but important increase in the proportion of participants who experience a good level of pain relief.

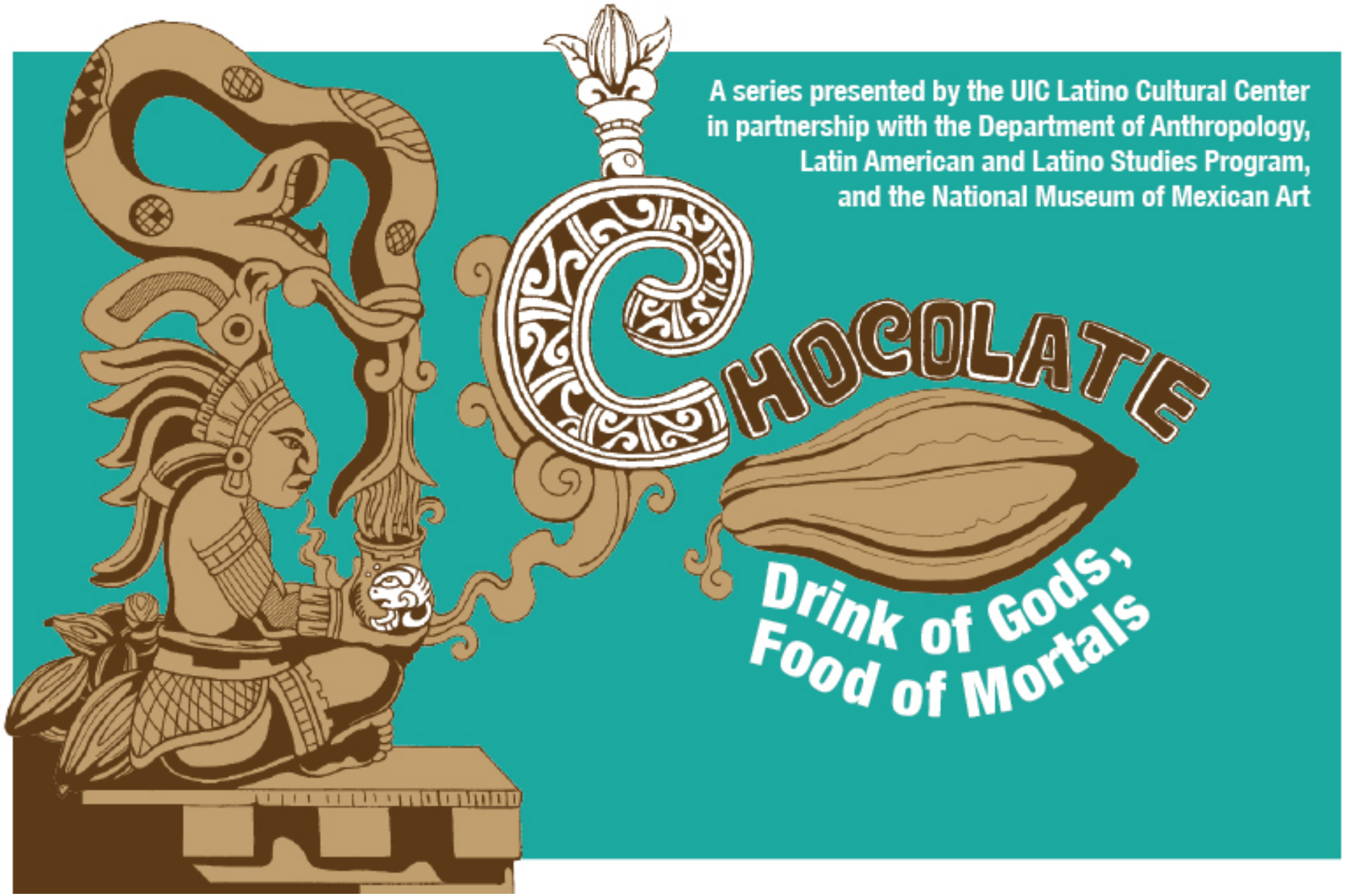
U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.

Rimuovere il guscio da entrambi i chicchi

Resti il solo seme pulito e asciutto

Fermentazione

Tostatura


A series presented by the UIC Latino Cultural Center
in partnership with the Department of Anthropology,
Latin American and Latino Studies Program,
and the National Museum of Mexican Art
CHOCOLATE
Drink of Gods,
Food of Mortals

In the past, due to its health effects, it was considered the drink of Gods, an association that gave rise to the scientific name of the cocoa tree, *Theobroma cacao*, from the Greek words theo (God) and broma (drink). This attribution was given to the tree by a Swedish naturalist Carl Von Linné (1707–1778). In fact, this name is symbolic of the social, religious, and economic importance of chocolate in both New and Old World cultures.

CACAO

Composizione chimica	valore per 100g	Note
Parte edibile (%):	100	
Acqua (g):	2.5	
Proteine (g):	20.4	
Lipidi(g):	25.6	
Colesterolo (mg):	0	
Carboidrati disponibili (g):	11.5	
Amido (g):	10.5	
Zuccheri solubili (g):	tr	
Fibra totale (g):		
Fibra solubile (g):		
Fibra insolubile (g):		
Alcol (g):	0	
Energia (kcal):	355	

CIOCCOLATO

COMPOSIZIONE CHIMICA E VALORE ENERGETICO PER 100g DI PARTE EDIBILE

Composizione chimica	valore per 100g	Note
Parte edibile (%):	100	
Acqua (g):	0.5	
Proteine (g):	6.6	
Lipidi(g):	33.6	
Colesterolo (mg):	0	
Carboidrati disponibili (g):	49.7	
Amido (g):	tr	
Zuccheri solubili (g):	49.7	
Fibra totale (g):	8	
Fibra solubile (g):		
Fibra insolubile (g):		
Alcol (g):	0	
Energia (kcal):	515	

CIOCCOLATO

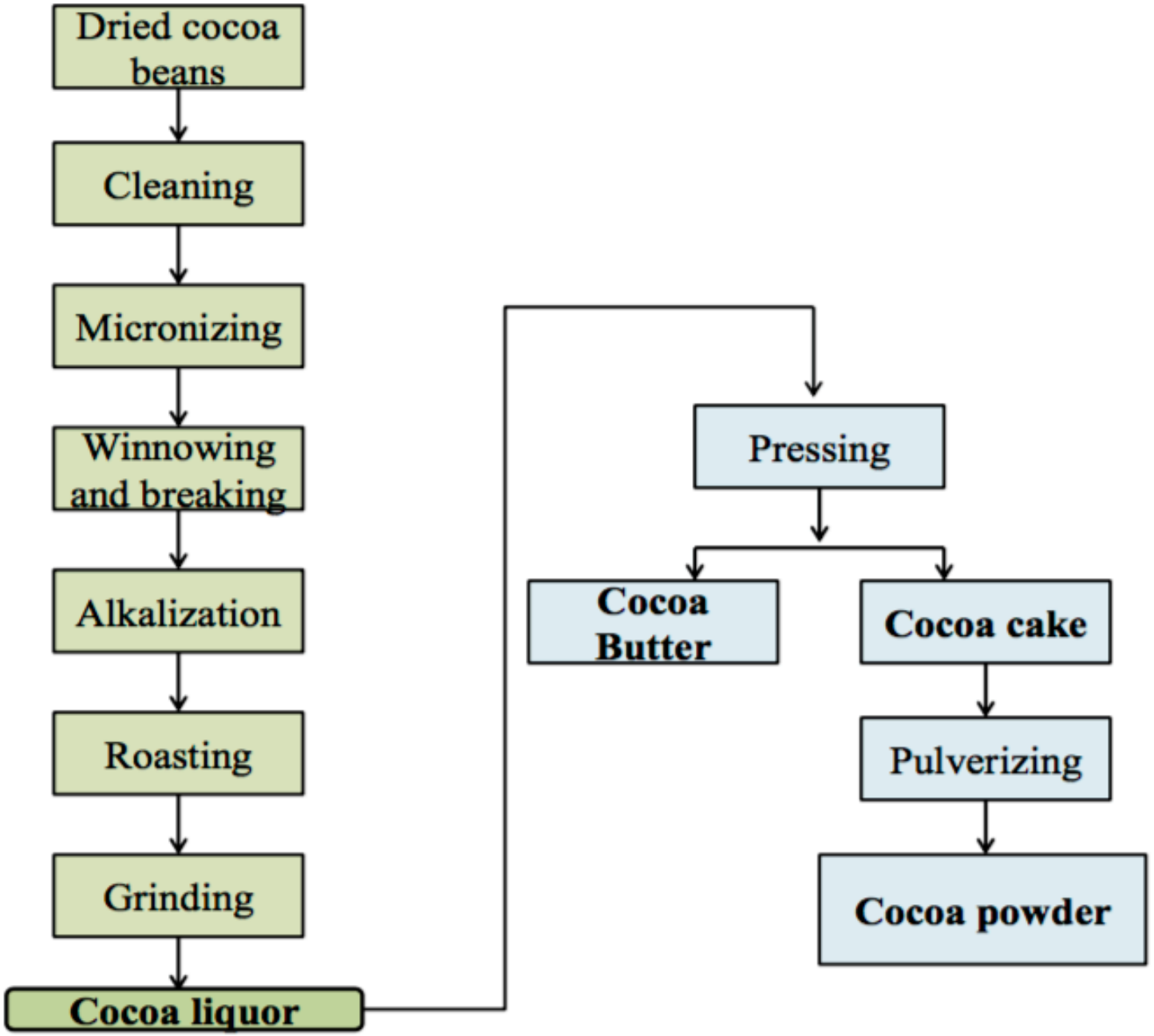
Composizione	g/100g di parte edibile
Lipidi totali(%): 33.6	
Saturi totali (%):	20.59
C4:0÷C10:0	0
C12:0	
C14:0	0.06
C16:0	8.48
C18:0	11.02
C20:0	0.32
C22:0	0.06
Monoinsaturi totali (%):	11.08
C14:1	
C16:1	0.1
C18:1	10.79
C20:1	
C22:1	0
Polinsaturi totali (%):	1.41
C18:2	1.03
C18:3	0.06
C20:4	0.32
C20:5	0
C22:6	0
Rapporto Polinsaturi/Saturi:	0.1

Valori nutrizionali

Burro di cacao

Quantità per 100 grammi
Calorie 884
Grassi 100 g
Acidi grassi saturi 60 g
Acidi grassi polinsaturi 3 g
Acidi grassi monoinsaturi 33 g
Colesterolo 0 mg
Sodio 0 mg
Carboidrati 0 g
Fibra alimentare 0 g
Zucchero 0 g
Proteina 0 g

Figure 1. Manufacturing processes of cocoa beans.



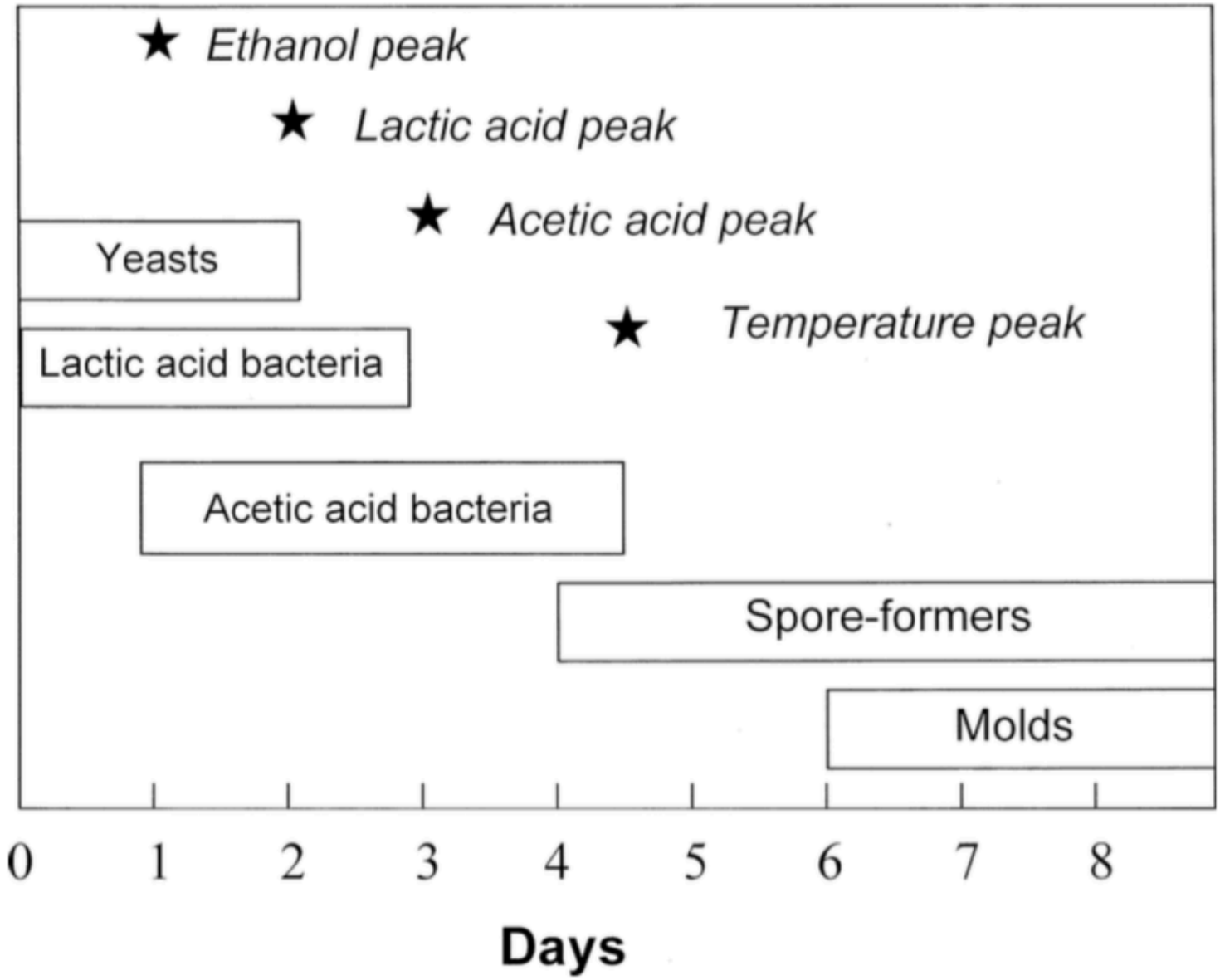


Figure 1 Schematic of a microbial succession during cocoa bean fermentations. The open boxes indicate the periods during the fermentations when a particular microbial group is most abundant and/or important. The stars indicate the timing of peaks of metabolites and temperature.

Schwan RF: The Microbiology of Cocoa Fermentation and its Role in Chocolate Quality
http://www.researchgate.net/publication/8253678

Table 1 Yeasts isolated from cocoa fermentations in four countries

Brazil[22]	Ghana[32]	Malaysia[32]	Belize[100]
Candida bombi, Candida pelliculosa, Candida rugopelliculosa, Candida rugosa, Kloeckera apiculata, Kluyveromyces marxianus, Kluyveromyces thermotolerans, Lodderomyces elongisporus, Pichia fermentans, S. cerevisiae var. *chevalieri, Saccharomyces cerevisiae, Torulaspora pretoriensis*	*Candida* spp., *Hansenula* spp., *Kloeckera* spp., *Pichia* spp., *Saccharomyces* spp., *Saccharomycopsis* spp., *Schizosaccharomyces* spp., *Torulopsis* spp.	*Candida* spp., *Debaryomyces* spp., *Hanseniaspora* spp., *Hansenula* spp., *Kloeckera* spp., *Rhodotorula* spp., *Saccharomyces* spp., *Torulopsis* spp.	*Brettanomyces clausenii., Candida* spp., *C. boidinii, C. cacoai, C. guilliermondii, C. intermedia, C. krusei, C. reukaufii, Kloeckera apis, Pichia membranaefaciens, Saccharomyces cerevisiae, Saccharomyces chevalieri, Saccharomycopsis* spp., *Schizosaccharomyces malidevorans, Schizosaccharomyces* spp.

Table 2 Lactic acid bacteria isolated from cocoa fermentations in four countries

Brazil[29]	Ghana[32]	Malaysia[32]	Belize[100]
Lactobacillus. Acidophilus, Lb. brevis, Lb. casei, Lb. Delbrueckii, Lb. fermentum Lb. Lactis, Lb. Plantarum Lactococcus lactis, Leuconostoc mesenteroides, Pediococcus acidilactici, P. dextrinicus	*Lb. collinoides Lb. fermentum Lb. mali Lb. plantarum*	*Lb. collinoides, Lb. plantarum*	*Lb. brevis, Lb. buchneri, Lb. casei, Lb. Casei pseudoplantarum, Lb. cellobiosus, Lb. delbrueckii, Lb. fermentum, Lb. fructivorans, Lb. gasseri, Lb. kandleri, Lb. plantarum, Leuconostoc mesenteroides, Ln. oenos, Ln. paramesenteroides*

Schwan RF: The Microbiology of Cocoa Fermentation and its Role in Chocolate Quality
http://www.researchgate.net/publication/8253678

The main end- products of pulp carbohydrate catabolism were ethanol, lactic acid, acetic acid, and/or mannitol.

In the case of the fermentations on the selected **Ivorian farm**, the species diversity of lactic acid bacteria (LAB) and acetic acid bacteria (AAB) was restricted
Lactobacillus fermentum,
Leuconostoc pseudomesenteroides
Enterobacterial species, such as Erwinia soli and Pantoea sp

on the selected **Brazilian farms**, this
microbiota included:
Lactobacillus plantarum
Lactobacillus durianis
L. fermentum
Lactobacillus mali
Lactobacillus nagelii
L. pseudomesenteroides
Pediococcus acidilactici
Bacillus subtilis

Z.Papalexandratou et Al.: Comparison of the bacterial species diversity of spontaneous cocoa bean fermentations carried out at selected farms in Ivory Coast and Brazil
Food Microbiology 28 (2011) 964e973

Chemical compounds in chocolate that may affect human health

GRASSI

ANTIOSSIDANTI (flavonoids, epicatechin, catechin, and procyanidins)

AZOTATI (proteins and the methylxanthines theobromine and caffeine)

MINERALI E ALTRI COMPOSTI (potassium, phosphorus, copper, iron, zinc, and magnesium; valeric acid)

R. Latif Chocolate/cocoa and human health: a review

The Netherlands Journal of Medicine, march 2013, vol. 71, no 2

Table 1. Definition of flavonoid subclasses

Flavonoid subclass	Flavonoid compounds
Flavonols	Quercetin, kaempferol, myricetin, isorhamnetin
Flavones	Luteolin, apigenin
Flavanones	Eriodictyol, hesperetin, naringenin
Flavan-3-ols	Catechin, gallocatechin, epicatechin, epigallocatechin, epicatechin 3-gallate, epigallocatchin 3-gallate
Anthocyanidins	Cyanidin, delphinidin, malvidin, pelargonidin, petunidin, peonidin
Polymeric flavonoids	Proanthocyanidins (dimers, trimers, 4–6-mers, 7–10-mers, polymers, excluding monomers), theaflavins, thearubigins

Polyphenol content of cocoa extracts used in the study

Extracts	TP (GAE)	ORAC	Catechin	Epicatechin	Procyanidin (DP = 2 to DP = 10)
Natural Cocoa	62	825	1	4.5	34
Dutched Cocoa	21	325	0.1	1.5	6
Lavado Cocoa	100	1230	2.5	13	65.7

TP, Total polyphenols, GAE, gallic acid equivalents, ORAC, oxygen radical absorbance capacity. Values are expressed as mg polyphenol per gram of extract.

Dietary intake of flavanols and flavonols in the EPIC-InterAct subcohort[1]

Flavonoid	Mean ± SD	Median (5th, 95th percentile)	Main food sources
Flavanols, *mg/d*	334 ± 286	246 (60.9, 938)	Tea (39.1%), fruit (34.2%), wine (7.9%), chocolate (5.0%)
Flavan-3-ol monomers	146.2 ± 228.7	41.4 (9.2, 711.2)	Tea (81.0%), fruit (7.1%), wine (3.4%), chocolate (3.0%)
(−)-Epigallocatechin 3-gallate	66.7 ± 124.8	4.9 (0.2, 375.8)	Tea (97.0%), chocolate (1.6%), cakes (0.6%), fruit (0.5%)
(−)-Epicatechin 3-gallate	20.7 ± 36.7	3.0 (0.0, 110.3)	Tea (91.9%), herbal tea (5.5%), chocolate (1.2%), beer and cider (0.5%)
(−)-Epigallocatechin	20.2 ± 35.3	3.0 (0.5, 107.1)	Tea (91.3%), fruit (3.8%), beer and cider (2.5%), coffee (0.8%)
(−)-Epicatechin	19.3 ± 18.0	13.6 (3.2, 57.0)	Tea (40.4%), fruit (27.4%), chocolate (11.4%), wine (8.2%)
(+)-Catechin	13.5 ± 10.7	10.6 (2.7, 34.1)	Fruit (29.7%), wine (24.3%), tea (22.1%), beer and cider (9.8%)
(+)-Catechin 3-gallate	3.6 ± 6.8	0.3 (0.0, 20.3)	Tea (98.3%), herbal tea (1.7%)
(+)-Gallocatechin	2.2 ± 3.9	0.3 (0.0, 11.7)	Tea (93.8%), beer and cider (3.6%), fruit (0.4%), legumes (0.1%)
Proanthocyanidins	183 ± 140	151 (41.7, 423)	Fruit (56.8%), wine (11.7%), chocolate (6.8%), juices (4.5%)
Dimers	34.5 ± 29.5	26.8 (6.3, 86.4)	Fruit (38.0%), wine (25.7%), tea (17.8%), chocolate (5.6%)
Trimers	14.8 ± 12.3	12.1 (3.1, 34.7)	Fruit (52.2%), juices (11.4%), chocolate (8.8%), tea (7.4%)
4–6mers	40.6 ± 32.4	32.9 (8.5, 96.1)	Fruit (62.7%), chocolate (9.0%), wine (8.6%), juices (4.2%)
7–10mers	29.8 ± 24.8	23.8 (5.4, 73.5)	Fruit (64.9%), wine (8.7%), chocolate (6.1%), legumes (5.4%)
Polymers	63.0 ± 50.2	51.3 (12.5, 147.9)	Fruit (60.4%), wine (9.1%), legumes (7.8%), chocolate (5.9%)
Theaflavins	4.6 ± 8.8	0.08 (0, 26.4)	Tea (100%)
Flavonols, *mg/d*	24.8 ± 16.0	20.4 (7.8, 57.4)	Vegetables (27.2%), tea (26.4%), fruit (15.6%), wine (7.3%)
Quercetin	17.4 ± 10.0	15.1 (5.7, 36.8)	Vegetables (29.0%), fruit (21.1%), tea (20.3%), wine (6.6%)
Kaempferol	4.6 ± 5.1	2.6 (0.4, 15.1)	Tea (44.4%), vegetables (27.8%), beer and cider (17.4%), wine (2.8%)
Myricetin	2.3 ± 2.4	1.3 (0.3, 7.7)	Tea (51.8%), wine (22.1%), coffee (8.9%), vegetables (4.5%)
Isorhamnetin	0.5 ± 0.6	0.4 (0.1, 1.6)	Vegetables (58.8%), fruit (16.4%), wine (6.6%), herbal tea (4.2%)

[1] n = 15,258. EPIC, European Prospective Investigation into Cancer and Nutrition; 4–6mers, 4–6 monomers; 7–10mers, 7–10 monomers.

Cumulative evidence suggests that higher chocolate intake is associated with a lower risk of future cardiovascular events, although residual confounding cannot be excluded. There does not appear to be any evidence to say that chocolate should be avoided in those who are concerned about cardiovascular risk.

CS Kwok et Al.: Habitual chocolate consumption and risk of cardiovascular disease among healthy men and women
Heart 2015;101:1279–1287. doi:10.1136/heartjnl-2014-307050

Intervention with dark chocolate/cocoa products significantly reduced serum low-density lipoprotein (LDL) and total cholesterol (TC) levels.
No statistically significant effects were observed for high-density lipoprotein (HDL) and triglyceride (TG).
These data are consistent with beneficial effects of dark chocolate/ cocoa products on total and LDL cholesterol and no major effects on HDL and TG in short-term intervention trials.

OA Tokede et Al.: Effects of cocoa products/dark chocolate on serum lipids: a meta-analysis
European Journal of Clinical Nutrition (2011) 65, 879–886; doi:10.1038/ejcn.2011.64; published online 11 May 2011

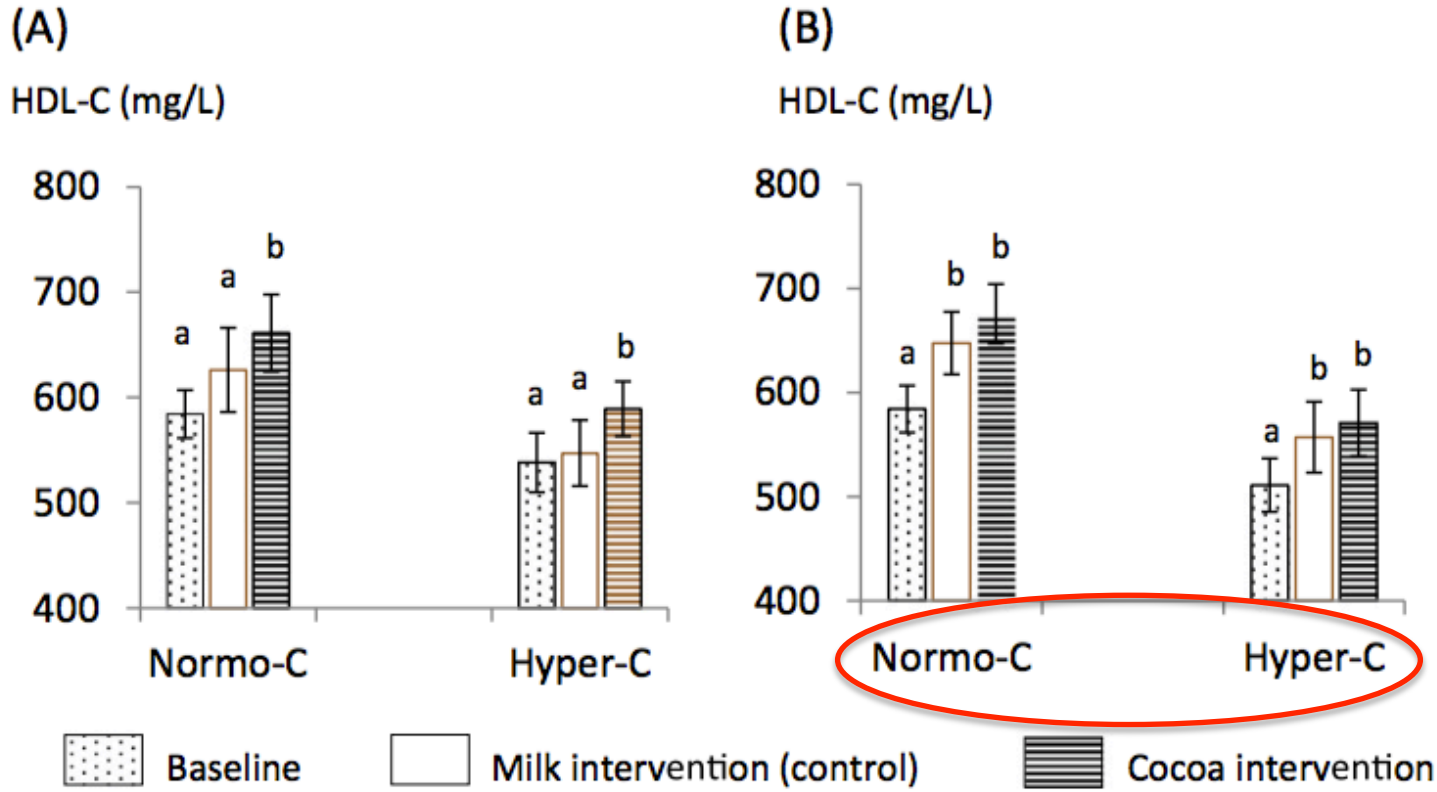


Fig. 1. Effects of consuming (A) the cocoa product rich in fibre (DFCP) and (B) the cocoa product rich in polyphenols (PPCP) on HDL-cholesterol (HDL-C) levels in normocholesterolemic (Normo-C) and hypercholesterolemic (Hyper-C) subjects. According to the general linear model of the variance for repeated measures analysis, the effect of consuming DFCP ($p < 0.001$) and PPCP ($p < 0.001$) on HDL-C was statistically significant, not showing differences between the groups. Different letters (a and b) denote significant differences according to the Bonferroni test within the normocholesterolemic or hypercholesterolemic group.

B.Sarriá et Al.: Effects of bioactive constituents in functional cocoa products on cardiovascular health in humans
Food Chemistry 174 (2015) 214–218

We found consistent acute and chronic benefits of chocolate or cocoa on FMD (Flow-mediated dilatation: test for assessing endothelial function) and previously unreported promising effects on insulin and HOMA-IR (Insulin resistance).

Larger, longer-duration, and independently funded trials are required to confirm the potential cardiovascular benefits of cocoa flavan-3-ols.

L. Hooper et Al.: Effects of chocolate, cocoa, and flavan-3-ols on cardiovascular health: a systematic review and meta-analysis of randomized trials
Am J Clin Nutr 2012;95:740–51.

HRs (95% CIs) for DM by category of chocolate intake in 15,999 physicians without cardiovascular disease or heart failure at baseline[1]

Frequency of chocolate intake	*n*	Cases, *n* (%)	Incidence rate/1000 PY	HRs (95% CIs) for DM		
				Age-adjusted model 1	Multivariate model 2	Multivariate model 3
None	3806	240 (6.3)	6.8	Referent	Referent	Referent
1–3 servings/mo	4672	280 (6.0)	6.3	0.93 (0.79, 1.11)	0.88 (0.74, 1.05)	0.85 (0.72, 1.0
1 serving/wk	3250	182 (5.6)	5.9	0.86 (0.71, 1.05)	0.84 (0.69, 1.02)	0.81 (0.66, 0.98)
≥2 servings/wk	4271	241 (5.6)	6.0	0.88 (0.73, 1.05)	0.82 (0.68, 0.98)	0.77 (0.63, 0.93)
P-linear trend	—	—	—	0.21	0.07	0.02

[1]Cox proportional hazards models were used to estimate HRs (95% CIs). Model 1 was adjusted for age. Model 2 was adjusted as for model 1 and for cohort status, BMI, smoking status, exercise, and alcohol consumption. Model 3 was adjusted as for model 2 and for total caloric intake and intakes of whole grains, nuts, and red meat. DM, type 2 diabetes mellitus; PY, person-years.

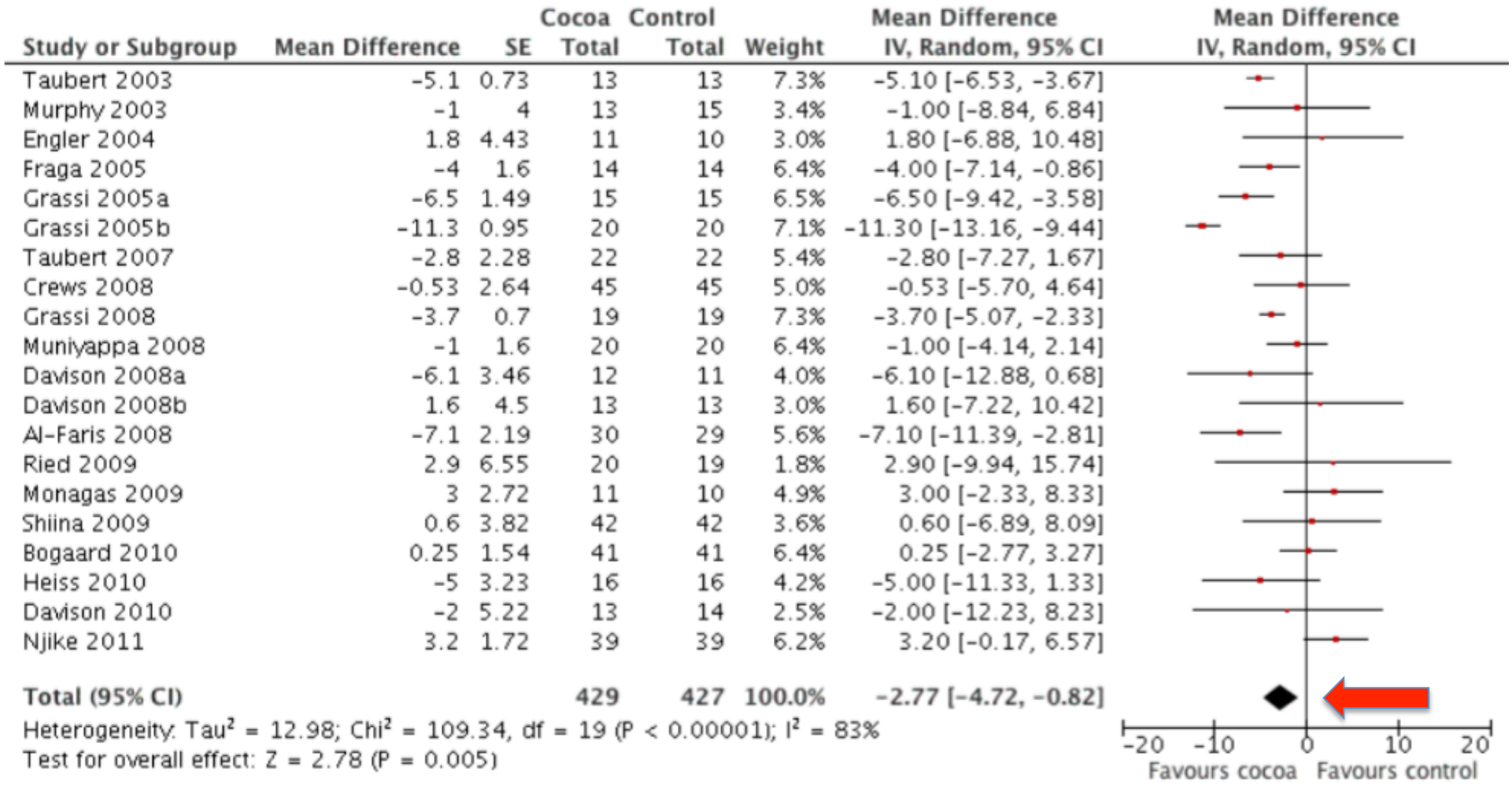
Self-reported chocolate intake was significantly and inversely associated with incident DM and such relation appeared to be limited to normal body weight and younger men after comprehensive adjustment for lifestyle, clinical, and dietary risk factors.

Matsumoto C. et Al.: Chocolate consumption and risk of diabetes mellitus in the Physicians' Health Study
Am J Clin Nutr 2015;101:362–7

Our meta-analysis suggests that dark chocolate is superior to placebo in reducing systolic hypertension or diastolic prehypertension. Flavanol-rich chocolate did not significantly reduce mean blood pressure below 140 mmHg systolic or 80 mmHg diastolic.

K.Ried et Al.: Does chocolate reduce blood pressure? A meta-analysis
BMC Medicine 2010, 8:39

Figure 3. Forest plot of comparison: 1 Effect of cocoa on BP, outcome: 1.1 SBP.



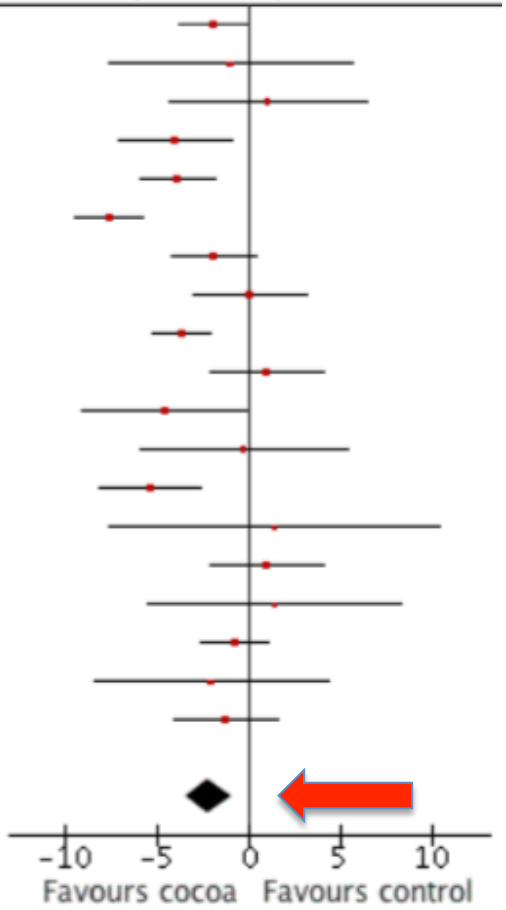
Ried K, Sullivan TR, Fakler P, Frank OR, Stocks NP. Effect of cocoa on blood pressure. Cochrane Database of Systematic Reviews 2012, Issue 8. Art. No.: CD008893. DOI: 10.1002/14651858.CD008893.pub2.

Figure 4. Forest plot of comparison: 1 Effect of cocoa on BP, outcome: 1.2 DBP.

Study or Subgroup	Mean Difference	SE	Cocoa Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
Taubert 2003	-1.9	0.99	13	13	7.4%	-1.90 [-3.84, 0.04]
Murphy 2003	-1	3.39	13	15	2.6%	-1.00 [-7.64, 5.64]
Engler 2004	1	2.76	11	10	3.4%	1.00 [-4.41, 6.41]
Fraga 2005	-4	1.6	14	14	5.8%	-4.00 [-7.14, -0.86]
Grassi 2005a	-3.9	1.03	15	15	7.3%	-3.90 [-5.92, -1.88]
Grassi 2005b	-7.6	0.94	20	20	7.5%	-7.60 [-9.44, -5.76]
Taubert 2007	-1.9	1.15	22	22	6.9%	-1.90 [-4.15, 0.35]
Crews 2008	0.07	1.6	45	45	5.8%	0.07 [-3.07, 3.21]
Grassi 2008	-3.7	0.78	19	19	7.9%	-3.70 [-5.23, -2.17]
Muniyappa 2008	1	1.6	20	20	5.8%	1.00 [-2.14, 4.14]
Davison 2008a	-4.6	2.3	12	11	4.2%	-4.60 [-9.11, -0.09]
Davison 2008b	-0.3	2.88	13	13	3.2%	-0.30 [-5.94, 5.34]
Al-Faris 2008	-5.4	1.41	30	29	6.3%	-5.40 [-8.16, -2.64]
Ried 2009	1.4	4.62	20	19	1.6%	1.40 [-7.66, 10.46]
Monagas 2009	1	1.6	11	10	5.8%	1.00 [-2.14, 4.14]
Shiina 2009	1.4	3.54	42	42	2.4%	1.40 [-5.54, 8.34]
Bogaard 2010	-0.8	0.93	41	41	7.5%	-0.80 [-2.62, 1.02]
Davison 2010	-2.1	3.26	13	14	2.7%	-2.10 [-8.49, 4.29]
Njike 2011	-1.25	1.44	39	39	6.2%	-1.25 [-4.07, 1.57]
Total (95% CI)			**413**	**411**	**100.0%**	**-2.20 [-3.46, -0.93]**

Heterogeneity: $Tau^2 = 4.65$; $Chi^2 = 60.05$, df = 18 ($P < 0.00001$); $I^2 = 70\%$

Test for overall effect: Z = 3.41 (P = 0.0006)



Ried K, Sullivan TR, Fakler P, Frank OR, Stocks NP. Effect of cocoa on blood pressure. Cochrane Database of Systematic Reviews 2012, Issue 8. Art. No.: CD008893. DOI: 10.1002/14651858.CD008893.pub2.

Table 3. Biochemical and anthropometric measurements and mean differences ± standard deviation (SD) at bas[illegible]e and after the intervention period

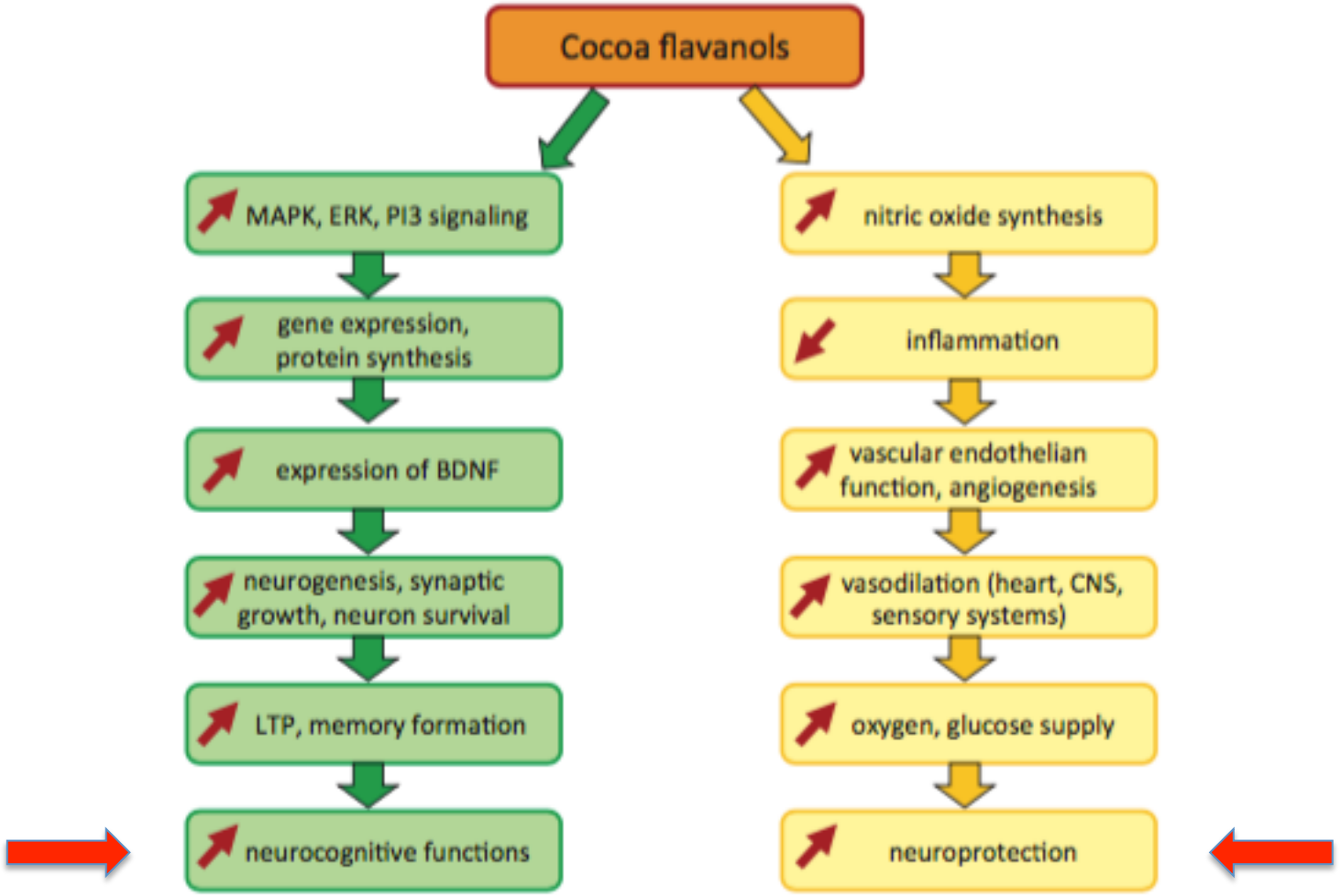
	DCG (n = 32)				WCG (n = 28)				
	Before	After	Differences	P*	Before	After	Differences	P*	P**
Diastolic blood pressure (mmHg)	85.15 ± 8.56	79.21 ± 8.89	-5.93 ± 6.25	0.001	86.96 ± 8.08	87.14 ± 8.09	-1.07 ± 7.97	0.920	0.002
Systolic blood pressure (mmHg)	137.03 ± 10.61	130.62 ± 11.19	-6.40 ± 6.25	0.001	137.32 ± 8.55	136.25 ± 8.34	0.17 ± 7.99	0.470	0.004
FBS (mg/dl)	138.06 ± 26.99	130.21 ± 23.67	-7.84 ± 19.15	0.027	134.89 ± 34.46	138.89 ± 30.04	4.00 ± 20.58	0.312	0.019
Fasting insulin	9.77 ± 6.29	9.36 ± 4.70	-0.40 ± 4.68	0.625	10.37 ± 4.63	11.45 ± 5.98	1.04 ± 6.19	0.572	0.141
HbA1c (%)	7.24 ± 1.02	7.10 ± 0.83	-0.14 ± 0.34	0.025	7.55 ± 0.94	7.45 ± 1.19	-0.10 ± 0.78	0.504	0.552
Triglyceride (mg/dl)	118.84 ± 46.02	112.37 ± 41.65	-6.46 ± 19.91	0.110	140.57 ± 47.94	143.57 ± 44.07	3.00 ± 17.82	0.331	0.055
Total cholesterol (mg/dl)	155.65 ± 35.23	153.15 ± 31.35	-2.50 ± 15.55	0.370	158.64 ± 40.33	152.42 ± 37.49	-6.21 ± 19.49	0.103	0.454
LDL cholesterol (mg/dl)	90.59 ± 29.31	87.53 ± 22.44	-3.06 ± 20.56	0.406	95.03 ± 38.75	94.35 ± 35.02	-0.67 ± 9.52	0.709	0.340
HDL cholesterol (mg/dl)	41.87 ± 8.73	42.21 ± 9.17	0.34 ± 7.66	0.802	38.53 ± 9.24	38.57 ± 8.00	0.03 ± 4.63	0.968	0.414
Apo-lipoproteins AI (mg/dl)	149.81 ± 17.89	154.37 ± 16.02	4.56 ± 12.36	0.045	152.14 ± 25.61	150.46 ± 25.56	-1.67 ± 12.19	0.472	0.060
Apo-lipoproteins B (mg/dl)	86.53 ± 20.11	82.06 ± 17.94	-4.46 ± 9.44	0.012	87.96 ± 23.79	85.46 ± 21.05	-2.50 ± 11.70	0.268	0.354
hsCRP (nm/l)	26.71 ± 34.66	18.82 ± 23.72	-7.88 ± 17.98	0.043	18.59 ± 20.70	17.21 ± 15.53	-1.38 ± 14.90	0.831	0.276

DCG: Dark chocolate group; WCG: White chocolate group; FBS: Fasting blood glucose; HbA1c: Hemoglobin A1c; LDL: Low-density lipoprotein; HDL: High-density lipoprotein; hsCRP: Highly sensitive C-reactive protein; Data adjusted for age, sex, energy intake; * Values refer to variation from week 0 to week 8 within groups (Paired t-test); ** Values refer to comparisons between groups with adjusting for age, sex, energy intake (ANCOVA test)

Rostami A, et Al.: High-cocoa polyphenol-rich chocolate improves blood pressure in patients with diabetes and hypertension.
ARYA Atheroscler 2015; 11(1): 21-9.

The blood pressure and cholesterol lowering effects of dark chocolate consumption are beneficial in the prevention of cardiovascular events in a population with metabolic syndrome. Daily dark chocolate consumption could be an effective cardiovascular preventive strategy in this population

E.Zomer et Al.: The effectiveness and cost effectiveness of dark chocolate consumption as prevention therapy in people at high risk of cardiovascular disease: best case scenario analysis using a Markov model
BMJ 2012;344:e3657 doi: 10.1136/bmj.e3657



Sokolov A.N. et Al.: Chocolate and the brain: Neurobiological impact of cocoa flavanols on cognition and behavior
Neuroscience and Biobehavioral Reviews 37 (2013) 2445–2453

This dietary intervention study provides evidence that regular CF (Cocoa flavanol) consumption can reduce some measures of age-related cognitive dysfunction, possibly through an improvement in insulin sensitivity. These data suggest that the habitual intake of flavanols can support healthy cognitive function with age.

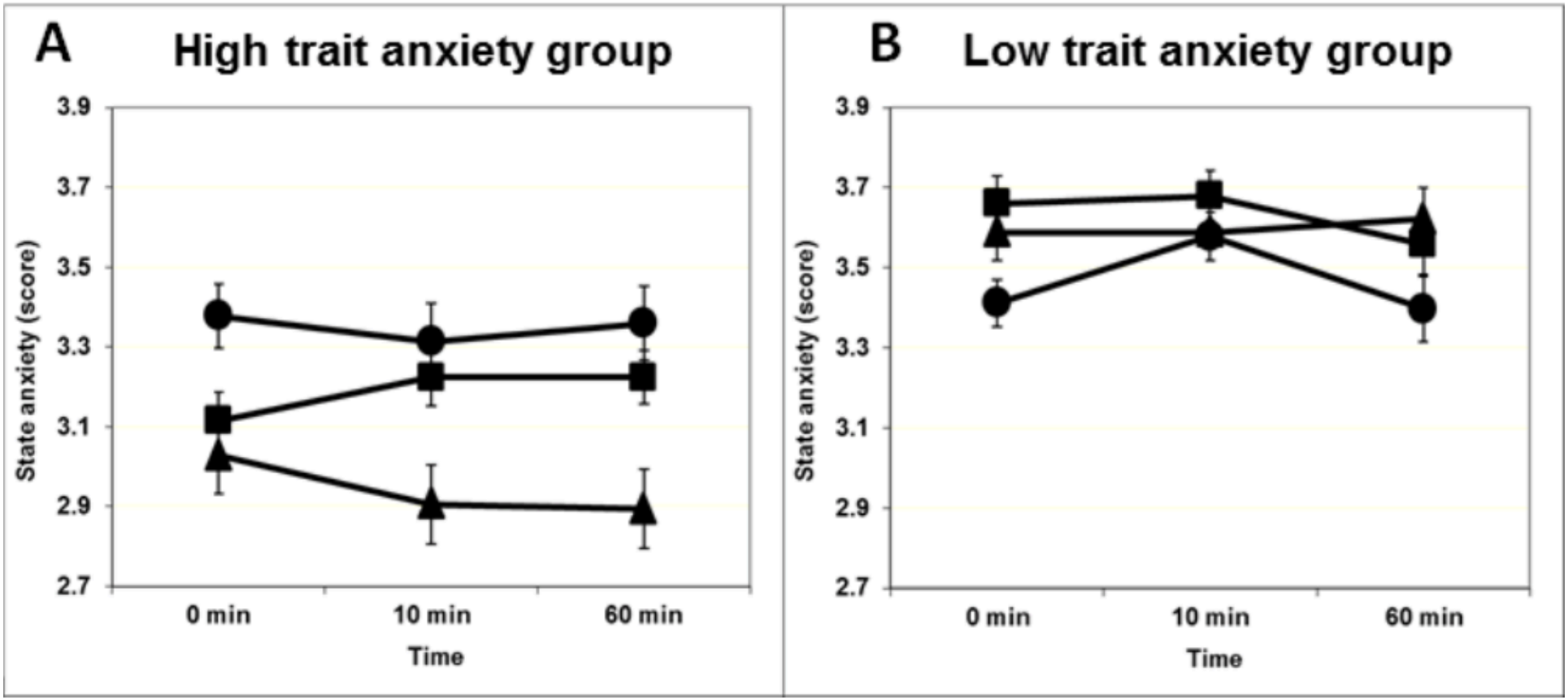
D. Mastroiacovo et Al.: **Cocoa flavanol consumption improves cognitive function, blood pressure control, and metabolic profile in elderly subjects: the Cocoa, Cognition, and Aging (CoCoA) Study—a randomized controlled trial**
Am J Clin Nutr 2015;101:538–48

A randomized clinical trial in older adults shows that high dietary intake of cocoa flavanols enhances memory performance and neural function in the dentate gyrus of the hippocampus, a region critical for learning and memory.

J. Pa et Al.: **Flavanol-rich food for thought**
Nat Neurosci. 2014 December ; 17(12): 1624–1625. doi:10.1038/nn.3876.

There is increasing evidence that the consumption of flavonoid-rich foods can beneficially influence normal cognitive function. In addition, a growing number of flavonoids have been shown to inhibit the development of Alzheimer disease (AD)-like pathology and to reverse deficits in cognition in rodent models, suggestive of potential therapeutic utility in dementia.
The flavonoids act to maintain the number and quality of synaptic connections in key brain regions and thus flavonoids have the potential to prevent the progression of neurodegenerative pathologies and to promote cognitive performance.

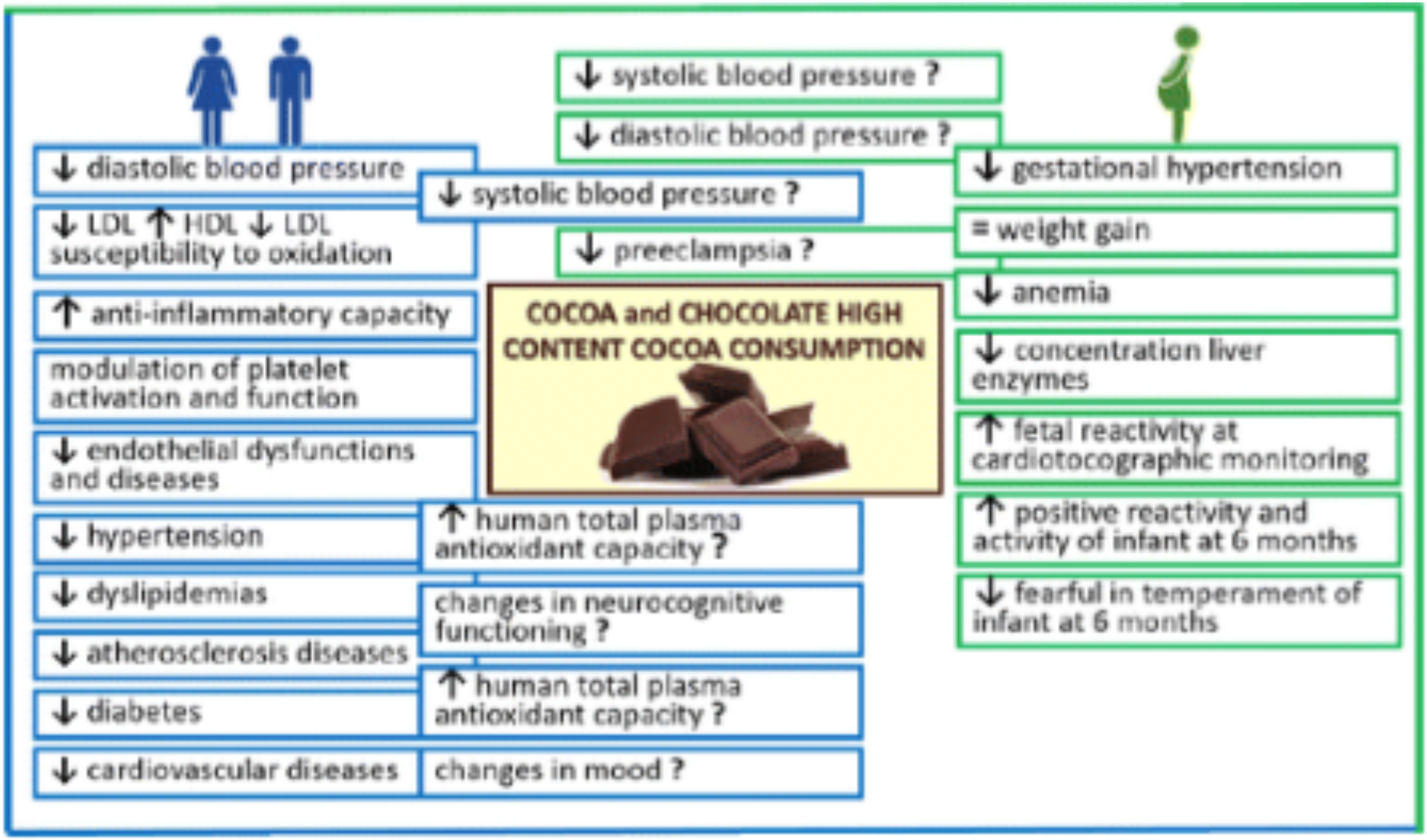
RJ Wlliams et Al.: Flavonoids, cognition, and dementia: Actions, mechanisms, and potential therapeutic utility for Alzheimer disease
Free Radical Biology & Medicine 52 (2012) 35–45



FPJ Martin et Al.: **Everyday Eating Experiences of Chocolate and Non-Chocolate Snacks Impact Postprandial Anxiety, Energy and Emotional States**
Nutrients 2012, 4, 554-567; doi:10.3390/nu4060554

Flavanol-rich cocao-derived products have been studied in both neuromolecular and psychological tests. Neuromolecular effects of flavanols in cocoa-derived products include antioxidant, vasodilatory, anticoagulant, and antiinflammatory properties that may serve to counteract depressive brain disorders. Psychological studies in humans have described links between intake of flavanol-rich cocoa-derived products such as dark chocolate and improved mood, while behavioral studies in laboratory animals have reported antidepressant effects of flavanols.

D.F. Smith: Benefits of flavanol-rich cocoa-derived products for mental well-being: A review
http://dx.doi.org/10.1016/j.jff.2012.09.002



Brillo E. et Al.: **Chocolate and Other Cocoa Products: Effects on Human Reproduction and Pregnancy**
J. Agric. Food Chem., Article ASAP **DOI:** 10.1021/acs.jafc.5b01045

Potential health benefits of chocolate consumption

Cocoa and cardiovascular diseases

- *Rich source of antioxidants*
- *Blood pressure lowering effects*
- *Effects on blood vessels and nitric oxide*
- *Inhibits platelet activation*
- *Antidiabetic effects*
- *Antistress effects*
- *Anti-obese effects*

Effects on the neurons

- I*ncreased cerebral blood flow*

Antitumour effects

- *Inhibits the growth of cancerous cells (in vitro)*

R. Latif Chocolate/cocoa and human health: a review
The Netherlands Journal of Medicine, march 2013, vol. 71, no 2

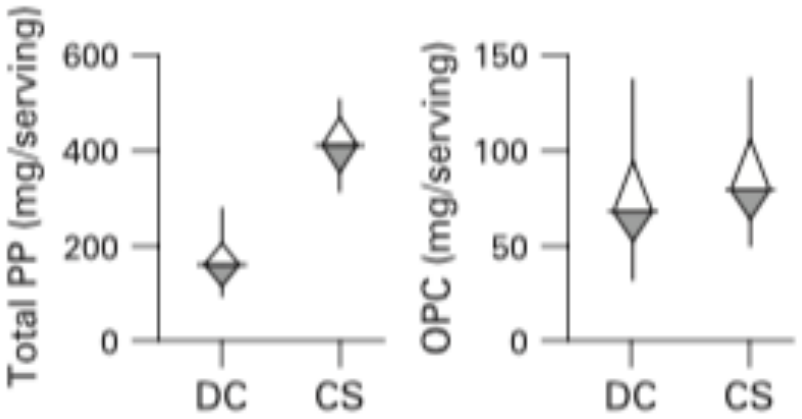


Figure 1 Comparison of dark chocolate and red wine: total polyphenols (PP) and oligomeric procyanidins (OPC) mg/serving. Calculated for a serving of equal calorific value (130 Calories (543.9 kJ): 25 g dark chocolate (DC) (n = 60, representative commercial products from the EU and USA), or 175 ml dry red wine, Cabernet sauvignon (CS) alcohol 13% B/V (n = 100, representative wines from around the world).[22] Horizontal lines, median values; triangles, 25th and 75th centiles; vertical lines,10th to 90th centile ranges. Mann–Whitney U test: CS was significantly greater per serving than DC for total PP ($p<0.001$) and OPC ($p<0.01$).

R.Corder : Red wine, chocolate and vascular health: developing the evidence base
Heart 2008;94;821-823


GRAZIE PER LA PAZIENZA
(E ORA VIENE IL BELLO E .....IL BUONO!!!)