



coffee&health

from the institute for scientific information on coffee

The good things in life: can coffee protect against the risk of CVD mortality?

Contents

1	Foreword	2
2	Second edition summary	3
3	Executive summary	4
4	Introduction: the scale of cardiovascular disease in Europe	4
5	Cardiovascular disease — a preventable condition?	5
6	The role of lifestyle factors in reducing the risk of CVD mortality	6
7	Coffee and cardiovascular disease — an overview of the latest research	7
8	Geographical variability	8
9	Mechanisms of action behind the suggested favourable association between coffee consumption and CVD mortality risk	9
10	Conclusion	11





Foreword



Cardiovascular disease (CVD) remains a major public health concern across Europe, but improvements in medical interventions as well as significant developments in preventative aspects of care have reduced the risk of CVD mortality. With this in mind, it is important to explore and acknowledge factors which might have a protective effect to continue to make strides in reducing CVD mortality.

Eminent cardiovascular experts gathered at the European Association for Cardiovascular Prevention & Rehabilitation's 2015 congress in Lisbon, Portugal, to discuss the latest research in CVD aetiology, prevention, treatment and care. The Institute for Scientific Information on Coffee (ISIC), a not-for-profit organization devoted to the study and disclosure of science related to coffee and health, hosted a Satellite Symposium on the subject of 'Coffee and CVD Mortality' where leading researchers in this field presented the latest research. Esther Lopez-Garcia led with research on the role of lifestyle factors in CVD mortality risk reduction, Alicja Wolk presented the epidemiological evidence on coffee and CVD mortality, and Carlo La Vecchia detailed the conclusions from meta-analyses on coffee and CVD mortality.

The Symposium provided a unique opportunity to highlight and consider recent research, which has shown an association between moderate coffee consumption and a reduced risk of CVD mortality. This report details the research presented at the Symposium and highlights the potential role of coffee in CVD mortality risk reduction.



Prof. Doutor António Vaz Carneiro
Faculdade de Medicina
da Universidade de Lisboa



Second Edition

This summary of research into coffee consumption and cardiovascular disease (CVD) is based on findings presented during a symposium entitled 'Coffee and CVD Mortality', held at the EuroPREvent Symposium in 2015, and has been updated to include the latest research relevant to this discussion.

Since the publication of the first edition, a number of studies have also been published that review the effects of coffee consumption in specific patient groups:

- A meta-analysis of prospective studies in patients who had suffered an acute myocardial infarction observed an inverse, i.e. favourable association between habitual coffee consumption and mortality risk¹.
- A study of 75 patients with hypertension suggested that drinking coffee was associated with higher blood pressure compared to those who did not drink coffee. The effect was greatest in those who drank 3 or more cups of coffee per day².
- A study as part of the Women's Health Initiative concluded that coffee (both caffeinated and decaffeinated) and caffeine are not risk factors for high blood pressure in postmenopausal women³.
- A large patient study suggested that higher coffee intakes were associated with a reduced rate of atrial fibrillation (an irregular and abnormally fast heart rate). The effect increased from low intakes of coffee (1 cup per day) to higher intakes (7 or more cups per day)⁴.



Executive summary

Research presented within this report suggests that a moderate intake of coffee (3-5 cups per day) may provide protection against CVD mortality risk. The association between coffee consumption and CVD mortality risk is illustrated by a 'U-shaped' pattern in recent meta-analyses. The lowest CVD mortality risk is seen at an intake of approximately 3 cups of coffee per day, with a percentage risk reduction of up to 21%. It is important to note that results differ between varying populations; it is suggested that 2 cups of coffee per day may offer the greatest protection in a Japanese population, whilst 3 cups may provide the greatest protection in UK and US populations.

The precise mechanisms of action behind the suggested association are unknown, but areas of interest include the role of coffee and caffeine intake in reducing the risk of type 2 diabetes, a condition where CVD mortality risk is increased; and a reduced inflammatory response. The antioxidant profile of coffee has also been proposed as a potential mechanism that might affect the association between coffee consumption and reduced CVD mortality risk.

Further work is required to confirm the association between coffee consumption and CVD mortality risk and to understand the underlying mechanisms of action.

Introduction: the scale of cardiovascular disease in Europe

Cardiovascular disease (CVD) is a term that covers diseases of the heart and blood vessels, including coronary heart disease and cerebrovascular disease such as stroke. Data published in 2016 in the European Heart Journal shows that cardiovascular diseases, principally coronary heart disease and stroke, remain the primary cause of death across Europe, responsible for 49% of all deaths in women and 40% of all deaths in men⁵. Over four million people die from CVD annually in Europe and overall, CVD is estimated to cost the EU economy €196 billion every year. Around 54% of the total cost is associated with health care, 24% with productivity losses and 22% with informal care of people with CVD⁶.

Although cardiovascular disease remains the main cause of death across Europe, the latest review of incidence confirms that decreases in age-standardised death rates from CVD have been observed across Europe⁵.



Cardiovascular Disease — a preventable condition?

The Global Burden of Disease Study 2013 assessed changes in population growth and ageing globally, contrasting this with changes in age-specific cardiovascular mortality rates⁷. Data from the majority of countries studied showed that CVD mortality rates are significantly lower than population growth, suggesting that changes in lifestyle and improvements in healthcare can help to control the negative impact that demographic changes could have on CVD mortality rates⁷.

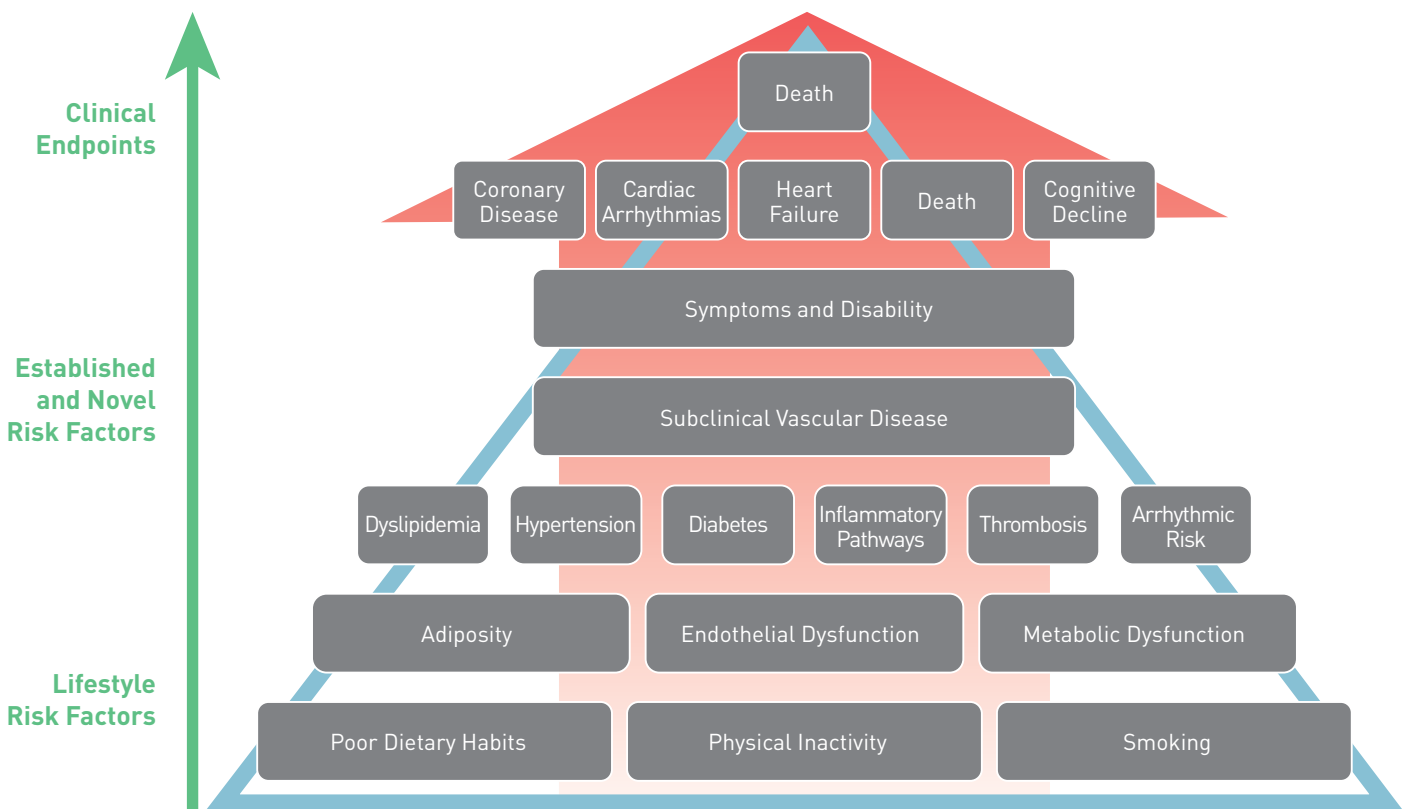


Figure 1: CVD Mortality Pathway – from lifestyle factors to health outcomes [Mozaffarian et al. (2008)]



The role of lifestyle factors in reducing the risk of CVD mortality

Lifestyle choices including poor dietary habits, smoking, significant alcohol consumption and a lack of physical activity have been shown to affect CVD mortality. 28% of CVD deaths are attributable to smoking, 17% to lack of physical activity, 14% to being overweight, 13% to poor diet quality and 7% to high alcohol intake⁸. Such lifestyle choices are associated with long-term adverse conditions such as diabetes, hyperlipidaemia and hypertension, which in turn can increase the risk of CVD⁹.

A Swedish study has shown that in males, a combination of 5 healthy behaviours (a healthy diet, moderate alcohol consumption (10 to 30g/day), no smoking, being physically active and having no abdominal adiposity) could prevent 79% of myocardial infarction events, although all factors were only present in 1% of participants¹⁰. Additionally, a US study suggests that half of CVD cases in women could be avoided by modifying lifestyle choices, as approximately 73% of CHD cases and 46% of clinical CVD cases were attributable to an unhealthy lifestyle¹¹. Research also suggests that following a Mediterranean-style diet is associated with a 7% reduction in overall mortality risk and a 4% reduction in the risk of CVD mortality¹².

Novel research into other behavioural choices not only confirms the importance of lifestyle factors but also suggests that a reduced risk of mortality is associated with sleeping for 7–8 hours per day, spending less than 8 hours sitting per day and having daily interaction with friends¹³. The authors concluded that when compared to those with none or one of a set of healthy behaviours, those with 6 positive behaviours (never smoking or stopped smoking for more than 15 years, being very or moderately physically active, having a healthy diet score above the median in the cohort, sleeping 7–8 hours per day, spending less than 8 hours per day sitting, and seeing friends daily) could reduce their all-cause mortality risk by up to 14 years¹³.



Coffee and Cardiovascular Disease — an overview of the latest research

The Global Burden of Disease Study 2013 assessed changes in population growth and ageing globally, contrasting this with changes in age-specific cardiovascular mortality rates⁷. Data from the majority of countries studied showed that CVD mortality rates are significantly lower than population growth, suggesting that changes in lifestyle and improvements in healthcare can help to control the negative impact that demographic changes could have on CVD mortality rates⁷.

Coffee consumption	N. Studies	RR (95% CI)	P for heterogeneity
Cardiovascular disease (CVD) mortality			
Level of consumption			
Drinking <3 cups/day versus low			
All subjects	14	0.87 (0.79-0.96)	<0.001
Men	11	0.92 (0.79-1.05)	<0.001
Women	7	0.80 (0.71-0.90)	0.009
Drinking >3 cups/day versus low			
All subjects	14	0.88 (0.77-1.02)	<0.001
Men	11	0.92 (0.73-1.11)	<0.001
Women	8	0.80 (0.66-0.96)	0.005
Highest (when >4 cups/day) versus low			
All subjects	11	0.86 (0.77-0.97)	0.044
Men	8	0.90 (0.73-1.11)	0.006
Women	6	0.80 (0.71-0.89)	0.748

Figure 2: Coffee and cardiovascular disease – Associations between dose and relative risk [Malerba et al. (2013)]

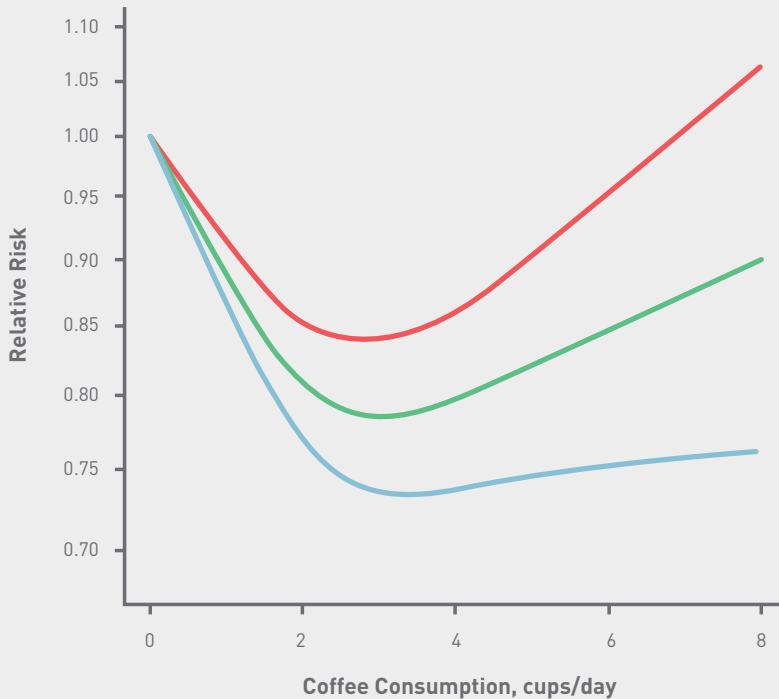


Figure 3: Relative risk of CVD in relation to coffee consumption (Crippa et al. (2014)). In Figure 3, the green line shows the average association between coffee consumption and CVD risk, whilst the red and blue lines show the higher and lower levels of the range respectively

A 2013 American study of over 2,500 CVD deaths suggests a positive association between coffee consumption and all-cause mortality in men, and also in men and women below 55 years of age¹⁵.

Two 2014 meta-analyses suggest an association between coffee consumption and CVD risk, proposing a 'U-shaped' pattern whereby optimal protective effects were achieved with 3-5 cups of coffee per day^{16,17}. The greatest risk reduction may be seen at 3 cups of coffee per day, with a reduced CVD mortality risk at 21%¹⁷.

A 2015 review concluded that studies have shown either a neutral or beneficial effect of coffee on cardiovascular health, and that coffee is safe to drink by both normal subjects and also by those with preexisting cardiovascular diseases and hypertension¹⁸.

Geographical variability

Variability regarding the optimal level of coffee consumption has been observed across differing countries, for instance results from Japan suggest an inverse, i.e. favourable, association at 2 cups of coffee per day, whilst studies from Europe and the US showed an inverse association at approximately 3 cups per day. Further results from a cohort study in Japan of 3,425 strokes and 910 incidences of CHD suggest that higher green tea consumption as well as coffee consumption (3-6 times per week and 1-2 cups per day) were inversely associated with risk of CVD and stroke¹⁹.

A study of European and African-American adults suggests that a reason for variability in the effect of coffee consumption on individuals may be attributable to genetics and individual responses to caffeine²⁰.



Mechanisms of action behind the suggested favourable association between coffee consumption and CVD mortality risk

Although the precise mechanism of action behind the suggested inverse, i.e. favourable association between coffee consumption and CVD mortality risk is not known, a number of theories are proposed.

Data shows a statistically significant negative association between coffee consumption and subsequent risk of type 2 diabetes. Drinking 3–4 cups of coffee per day is associated with an approximate 25% lower risk of developing type 2 diabetes compared to consuming none or less than 2 cups per day²¹. People with diabetes typically have a higher CVD mortality risk, and some research suggests that the association between coffee consumption and a reduced risk of type 2 diabetes may also be linked to a decreased CVD risk²². Caffeine intake has also been associated with lower body weight and with decreased platelet aggregation, which may also impact CVD mortality²³.

Additional research suggests that coffee's anti-inflammatory properties may reduce risk of incident gout, induce higher adiponectin levels in Japanese males, inhibit inflammation in postmenopausal women, and produce beneficial effects on subclinical inflammation^{14,24}. Although the impact of these effects on CVD mortality is unknown, the role of the inflammatory mechanism is of interest.



The antioxidant potential of different foods and beverages may also provide further insight into potential mechanisms. Different antioxidant compounds found in coffee may affect the body: a 2016 paper concluded that coffee consumption increases the antioxidant capacity of plasma²⁵. However, there is a need for further research on the bioactive and potential health-giving roles of these compounds before conclusions can be drawn²⁶. Figure 4 highlights the key sources of antioxidants in the diet, taking absorption into consideration²⁷. Fruits, whole grains, vegetables and coffee are suggested to be key dietary sources of antioxidants.

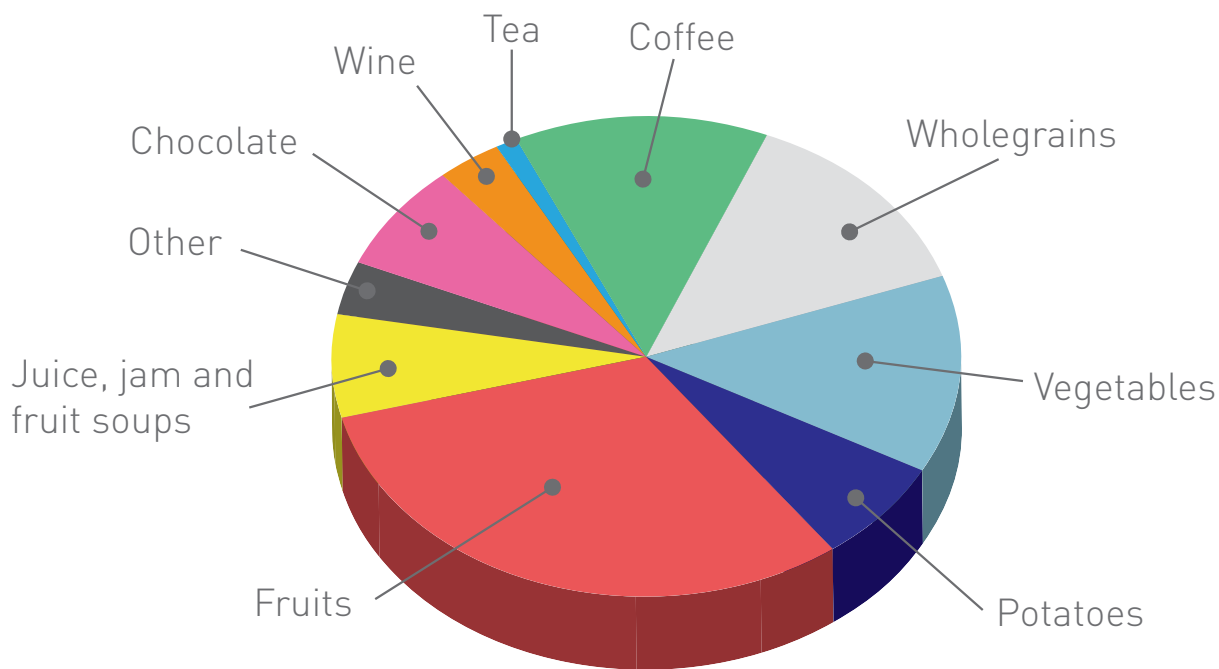


Figure 4: Key sources of antioxidants in the diet [Rautiainen S. (2012)]



Conclusion

Research supports the view that moderate coffee consumption at approximately 3–5 cups per day may have a protective effect against CVD mortality risk. The mechanisms of action behind the associations are unclear, however areas of interest for future research include the anti-inflammatory and antioxidant properties of coffee, and the known association between coffee consumption and type 2 diabetes risk reduction, as CVD mortality is typically higher in this group. Due to the variation between studies on CVD and coffee consumption, further work is required to understand the associations in more detail.





The annual EuroPrevent Congress from the European Association for Cardiovascular Prevention and Rehabilitation provides a forum for leading experts to present their research and share knowledge in an international forum. The theme of the 2015 Congress was 'Addressing Inequalities in Cardiovascular Health'.

During the congress on 14 May 2015, ISIC hosted a symposium titled 'Coffee and CVD Mortality', with an expert panel of academics from across Europe.

The symposium was co-chaired by António Vaz Carneiro of the Faculty of Medicine, University of Lisbon, and Pedro Marques-Vidal, Secretary of the EACPR's Prevention, Epidemiology and Population Science Section.

Three expert speakers explored the role nutrition and coffee can play in preventing CVD mortality:

- **Esther Lopez-Garcia**, Associate Professor, Universidad Autonoma, Madrid, Spain.
- **Alicja Wolk**, Professor of Nutritional Epidemiology, Karolinska Institute, Stockholm, Sweden.
- **Carlo La Vecchia**, Professor of Epidemiology, Department of Clinical Sciences and Community, University of Milan, Italy.

About ISIC

The Institute for Scientific Information on Coffee (ISIC) is a not-for-profit organization, established in 1990 and devoted to the study and disclosure of science related to "coffee and health." Since 2003 ISIC also supports a pan-European education programme, working in partnership with national coffee associations in nine countries to convey current scientific knowledge on "coffee and health" to health care professionals.

ISIC's activities are focused on:

- the study of scientific matters related to "coffee and health"
- the collection and evaluation of studies and scientific information about "coffee and health"
- the support of independent scientific research on "coffee and health"
- active dissemination of balanced "coffee and health" scientific evidence and knowledge to a broad range of stakeholders.

ISIC respects scientific research ethics in all its activities. ISIC's communications are based on sound science and rely on evidence and scientific studies derived from peer-reviewed scientific journals and other publications.

ISIC members are six of the major European coffee companies: illycaffè, Jacobs Douwe Egberts, Lavazza, Nestlé, Paulig, and Tchibo.



References

- 1 Brown O.I. (2016) Coffee reduces the Risk of Death after Acute Myocardial Infarction: A Meta-Analysis. *Coron Art Dis*, published online ahead of print.
- 2 Lopez-Garcia E. et al. (2016) Habitual coffee consumption and 24-hour blood pressure control in older adults with hypertension. *Clin Nutr*, published online ahead of print.
- 3 Rhee J.J. et al. (2016) Coffee and Caffeine Consumption and the Risk of Hypertension in Postmenopausal Women. *AJCN*, 103(1):210-7.
- 4 Mostofsky E. et al. (2015) Risk of Atrial Fibrillation Associated with Coffee Intake: Findings from the Danish Diet, Cancer, and Health Study. *Eur J Prev Cardiol*, 23(9):922-930.
- 5 Townsend N. et al. (2016) Cardiovascular disease in Europe: epidemiological update 2016. *Eur Heart J*, published online ahead of print.
- 6 European Heart Network, 'European Cardiovascular Disease Statistics 2012'
Available at: <http://www.ehnheart.org/cvd-statistics.html>
- 7 Roth G.A. et al. (2015) Demographic and Epidemiologic Drivers of Global Cardiovascular Mortality. *N Engl J Med*, 372:1333-1341.
- 8 Van Dam R. (2008) Combined impact of lifestyle factors on mortality: prospective cohort study in US women. *BMJ*, 337:a1440.
- 9 Mozaffarian D. et al. (2008) Beyond established and novel risk factors: lifestyle risk factors for cardiovascular disease. *Circulation*, 117(23):3031-8.
- 10 Akesson A. et al. (2014) Low-Risk Diet and Lifestyle Habits in the Primary Prevention of Myocardial Infarction in Men — A Population-Based Prospective Cohort Study. *J Am Coll Cardiol*, 64(13):1299-1306.
- 11 Chomistek A.K. et al. (2015) Healthy lifestyle in the primordial prevention of cardiovascular disease among young women. *J Am Coll Cardiol*, 65(1):43-51.
- 12 Struijk E.A. et al. (2014) Dietary patterns in relation to disease burden expressed in Disability-Adjusted Life Years. *Am J Clin Nutr*, 100(4):1158-65.
- 13 Martinez-Gomez D. et al. (2013) Combined impact of traditional and non-traditional health behaviors on mortality: a national prospective cohort study in Spanish older adults. *BMC Med*, 11:47.
- 14 Malerba S. et al. (2013) A meta-analysis of prospective studies of coffee consumption and mortality for all causes, cancers and cardiovascular disease. *European Journal of Epidemiology*, 28(7):527-39.
- 15 Liu J. et al. (2013) Association of Coffee Consumption with All-Cause and Cardiovascular Disease Mortality. *Mayo Clinic Proceedings*, 88:10.
- 16 Ding M. et al (2014) Long-term coffee consumption and risk of cardiovascular disease: a systematic review and a dose-response meta-analysis of prospective cohort studies. *Circulation*, 129(6):643-59.
- 17 Crippa A. et al. (2014) Coffee consumption and mortality from all causes, cardiovascular disease, and cancer: a dose-response meta-analysis. *Am J Epidemiol*, 180(8):763-75.
- 18 Chrysant S.G. (2015) Coffee Consumption and cardiovascular health. *Am J Cardiol*, 116(5):818-821.
- 19 Kokubo Y. et al. (2013) The Impact of Green Tea and Coffee Consumption on the Reduced Risk of Stroke Incidence in Japanese Population: The Japan Public Health Center-Based Study Cohort. *Stroke*, 44(5):1369-74.
- 20 Coffee and caffeine Consortium et al. (2015) Genome-wide meta-analysis identifies six novel loci associated with habitual coffee consumption. *Mol Psychiatry*, 20(5):647-56.
- 21 Huxley R. et al. (2009) Coffee, Decaffeinated Coffee, and Tea Consumption in Relation to Incident Type 2 Diabetes Mellitus. *Archives of Internal Medicine*, 169:2053-2063.
- 22 Huxley R. et al. (2009) Coffee, decaffeinated coffee, and tea consumption in relation to incident type 2 diabetes mellitus: a systematic review with meta-analysis. *Arch Intern Med*, 169(22):2053-63.



- 23 Montagnana M et al. (2012) Coffee intake and cardiovascular disease: virtue does not take center stage. *Semin Thromb Hemost*, 38(2):164-77. .
- 24 Aquedelo-Ochoa G.M. (2016) Coffee consumption increases the antioxidant capacity of plasma and has no effect on the lipid profile or vascular function in healthy adults in a randomized controlled trial. *J Nutr*, 146(3):524-531.
- 25 Kempf K. et al. (2010) Effects of coffee consumption on subclinical inflammation and other risk factors for type 2 diabetes: a clinical trial. *Am J Clin Nutr*, 91(4):950-7.
- 26 Natella F. et al. (2002) Coffee drinking influences plasma antioxidant capacity in humans. *J. Agric. Food Chem*, 50:6211-6216.
- 27 Rautiainen-Lagerström S. (2012) Antioxidants from Diet and Supplements in Relation to Cardiovascular Diseases. PhD thesis. Karolinska Institutet, Stockholm, Sweden. ISBN 978-91-7457-787-7.