



coffee&health

from the institute for scientific information on coffee

Symposium report

Coffee and Metabolic Syndrome: A review of the latest research

Contents

1	Foreword	2
2	Executive Summary	3
3	Introduction — metabolic syndrome in Europe	4
4	Coffee consumption is associated with a reduced risk of metabolic syndrome	4
5	Caffeinated and decaffeinated coffee	5
6	A role for polyphenols?	6
7	Discussion	7
8	Federation of European Nutrition Societies	9
9	About ISIC	10
10	References	11





Foreword

Metabolic syndrome (MetS) describes a group of risk factors including central obesity, hypertension and abnormal blood lipids, that together increase the risk of cardiovascular problems and type 2 diabetes.

Eminent experts in nutrition gathered in Dublin on 15–18 October 2019 for the 13th European Nutrition Conference organised by the Federation of European Nutrition Societies (FENS). The conference, titled 'Malnutrition in an Obese World: European Perspectives', included discussions on the latest research on MetS as well as obesity. The Institute for Scientific Information on Coffee (ISIC), a not-for-profit organisation devoted to the study and disclosure of science related to coffee and health, hosted a Satellite Symposium on the subject of 'Coffee and Metabolic Syndrome: A review of the latest research' which was presented by leading researchers in this field.

Associate Professor Estefania Toledo collated a detailed review of meta-analyses considering associations between coffee consumption and MetS and discussed work in a Mediterranean cohort. Assistant Professor Giuseppe Grosso followed with a review of his own work in both Polish and Italian cohorts and, importantly, considered the potential mechanisms involved.

The Symposium provided a unique opportunity to consider recent research, which has shown an association between moderate coffee consumption and a reduced risk of MetS. This report details the research presented at the Symposium and the resulting questions and discussion from delegates.

Associate Professor Estefania Toledo, University of Navarra, Spain
Assistant Professor Giuseppe Grosso, University of Catania, Italy



Executive summary

Meta-analyses have suggested that coffee consumption at a level of 1–4 cups of coffee per day is associated with a reduced risk of MetS in observational studies^{1–4}. However, some variability is seen across studies but the overall results suggest an inverse association. Research suggests that specific components of MetS, namely type 2 diabetes and hypertension, are also inversely associated with coffee consumption^{5,6}. Associations with obesity are less clear⁷. A moderate coffee intake is considered to be 3–5 cups of coffee a day, in line with advice from the European Food Safety Authority's 'Scientific opinion on the safety of caffeine'⁸.

Researchers have considered a role for polyphenols contained in coffee and studies in both northern and southern European cohorts have identified that the phenolic acids, a type of polyphenol, may be involved in the effects described^{3,4}.

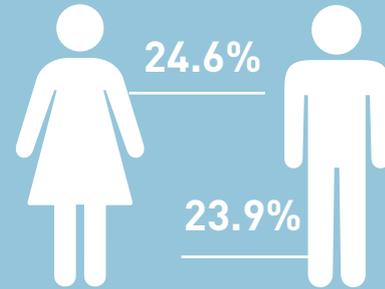
Further research is required to clarify the associations between coffee and MetS, and provide more detail on the mechanisms involved.





Introduction — metabolic syndrome in Europe

MetS is characterised by a number of components that are associated with accelerated arterial ageing and cardiovascular events. These include raised blood pressure, dyslipidaemia, raised fasting glucose and central obesity^{9,10}. Research across a European cohort has suggested that MetS has a prevalence of 24.3%, with women having a slightly higher incidence than men (24.6% vs 23.9%)^{11,12}.



“Research across a European cohort has suggested that MetS has a prevalence of 24.3%, with women having a slightly higher incidence than men (24.6% vs 23.9%)^{11,12}.”

Coffee consumption is associated with a reduced risk of metabolic syndrome

Prof. Toledo collated information from two meta-analyses, both published in 2016, which suggested that overall coffee consumption is associated with a reduced incidence of MetS, although some variability in the results from individual studies was observed^{1,2}.

Prof. Toledo specifically presented three longitudinal studies from the meta-analyses, the first being a cohort of 17,000 middle-aged adults in Norway¹³. In this study, the authors suggested that coffee consumption tended to be protective for MetS at low and intermediate levels of intake (1–4 cups of coffee per day), especially for men, although the results were not statistically significant. However, coffee consumption greater than 4 cups per day did not appear to be as protective. Further results from a group of more than 9,000 US adults, aged 45–64 (ARIC study) where 40% of the cohort developed MetS, concluded that the results showed tendency for coffee to be associated with a reduced risk of MetS, however the association was not significant¹⁴. In contrast, the Amsterdam Growth and Health study, which found a 10% incidence of MetS at age 36, suggested that none of the relationships between coffee consumption and the MetS or its components were significant¹⁵.



Caffeinated and decaffeinated coffee

Prof. Toledo focussed on the SUN (Seguimiento University of Navarra) cohort, a large prospective cohort study (22,000 people, 91% retention rate) based at the University of Navarra, Spain. This study differs from the others discussed as it specifically considered caffeinated and decaffeinated coffee¹⁶. As with other studies, the analysis was adjusted for confounding factors including age, smoking, BMI, adherence to Mediterranean diet to control any bias that these may have had on the results. The authors concluded that the consumption of 1–4 cups of coffee per day was associated with a reduced risk of developing MetS, however higher intakes were not (unpublished data). This association was reported for both regular and decaffeinated coffee, and when reviewing each type of coffee individually, the association was similar however in both cases the statistical significance was lost.

Prof. Grosso described studies that consider individual aspects of the MetS before reviewing cohort studies he has been involved with. He also discussed the potential mechanisms to describe the associations.

An umbrella review on associations between various diseases and coffee consumption suggested that there was no evidence of increased risk of diseases including heart disease¹⁷. He highlighted a potential protective effect of moderate coffee consumption on some cancers, however, he reported a strong confounding effect of smoking, particularly in relation to cancer mortality. Once this confounding effect was accounted for he suggested that a moderate coffee consumption is associated with a reduction of CVD, cancer and all cause mortality¹⁸. In considering type 2 diabetes, Prof. Grosso reported that there appears to be a linear association between coffee consumption and a decreased risk of type 2 diabetes⁵. In relation to hypertension, Prof. Grosso's own work suggests that long-term coffee consumption is associated with a decreased risk of hypertension⁶. Further work on obesity, another risk factor for MetS, suggests a weaker association⁷. In summary, not all components of MetS are affected by coffee consumption, but some individual elements seem to be inversely related to coffee drinking.

He also discussed two cohort studies on MetS and coffee consumption, which both suggested an inverse association. The Polish arm of his work concluded that after adjusting for confounding factors, both higher coffee and tea consumption were negatively associated with MetS³. In relation to specific symptoms, those who drank more than 3 cups of coffee had lower BMI, waist circumference, systolic and diastolic blood pressure, triglycerides, and higher HDL cholesterol than those drinking less than 1 cup/day. In his Italian cohort no direct association between caffeine intake and MetS or its components was observed, however, coffee consumption was significantly related to reduced risk of MetS⁴.

**1–4 cups of
coffee per day**



was associated with



**a reduced
risk of
developing
MetS**

“The authors concluded that the consumption of 1–4 cups of coffee per day was associated with a reduced risk of developing MetS, however higher intakes were not (unpublished data).”



A role for polyphenols?

Prof. Grosso gave an overview of potential mechanisms behind the described effects, with particular emphasis on his work on polyphenols.

In the Polish cohort, coffee was the main source of polyphenols, followed by tea³. By contrast, in the Italian cohort the main sources of polyphenols were nuts followed by coffee⁴.

Prof. Grosso noted that MetS is inversely associated with total polyphenol consumption, specifically phenolic acids and flavonoids. Hydroxycinnamic acids were significantly inversely associated with MetS, and despite the variability in diets the main source of hydroxycinnamic acids in both the Polish and Italian cohorts was coffee^{3,4}. These striking similarities between both cohorts provide an insight into the potential mechanisms, and although firm conclusions cannot yet be reached, the importance of polyphenols and hydroxycinnamic acid in particular seem to be of note.

Prof. Grosso pointed out that for future work it is also important to consider individual genetic profiles as this may impact the metabolism of coffee within the body.



“Prof. Grosso noted that MetS is inversely associated with total polyphenol consumption, specifically phenolic acids and flavonoids. Hydroxycinnamic acids were significantly inversely associated with MetS, and despite the variability in diets the main source of hydroxycinnamic acids in both the Polish and Italian cohorts was coffee.^{3,4}”



Discussion

Delegates at the symposium were invited to join the speakers to discuss the research presented in more detail.



Different coffee based beverages

The audience were interested to understand if there was any information on specific types of coffee as the range of coffee based beverages available today is large and potentially includes a variety of additions such as milk, sugars and syrup. Both speakers stressed that the current body of research does not provide sufficient detail on the type of additions to coffee beverages. The SUN Cohort did record whether coffee beverages were caffeinated or decaffeinated, but there was no significant difference between the effect of these.



Type of coffee beans

Further discussion considered whether different types of coffee beans may have different impact but both speakers confirmed there was no research in this area at present. Prof. Grosso pointed out that one aspect of such research would involve analysis of components in different sources of coffee, which as a natural product is likely to be highly variable.



Intervention studies

Delegates suggested that intervention studies may provide more clarity on aspects of coffee and health, however both speakers agreed that such studies would be difficult to set up as coffee drinking is often part of a person's daily ritual, which has been established over many years. Individual aspects that determine sensitivity to coffee, such as genetic variability, which may define someone as a slow or a fast metaboliser of caffeine, would also need to be considered if asking people to change from their habitual intake. Finally, many of the health aspects of coffee are considered to be long-term changes and a short-term intervention study is unlikely to have an impact on some health outcomes, including MetS.



MetS conditions

The associations between coffee intake and individual aspects of the MetS were also discussed. The speakers advised that work on some symptoms has been undertaken. For instance, coffee consumption is associated with a reduced risk of type 2 diabetes and with a reduced risk of hypertension, particularly in women^{5,6}. But on other aspects the research is not as detailed and it can be hard to reach conclusions.



Menopausal women

The final area of discussion focussed on the health aspects of coffee consumption in menopausal women. The speakers suggested that although this has not been considered, the data from the cohorts could be reviewed to understand associations between coffee consumption in women of different ages. However, it was pointed out that research suggests that the inverse association between coffee consumption and hypertension and also depression was stronger in women. Prof. Grosso pointed out that differences observed between men and women in the Polish cohort could largely be explained by smoking status, as more men were more likely to be smokers.





Federation of European Nutrition Societies

The Federation of European Nutrition Societies (FENS) organises the European Nutrition Conference. It is held once every four years and provides a forum for leading experts to present their research and share knowledge in an international forum. The 2019 conference was held in Dublin, Ireland from 15 to 18 October 2019.

During the conference, on 16 October 2019, ISIC hosted a symposium titled 'Coffee and Metabolic Syndrome: A review of the latest research'. Two renowned speakers explored the research on coffee consumption and metabolic syndrome, discussing data from meta-analyses and research on potential mechanisms.

Associate Professor Estefania Toledo,
University of Navarra, Spain.

Assistant Professor Giuseppe Grosso,
University of Catania, 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 research 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 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.

About coffeandhealth.org

The website www.coffeandhealth.org is a science-based resource developed for health care and other professional audiences and provides the latest information and research into coffee, caffeine and health.

Follow us on twitter: @coffeandhealth





References

- 1 Marventano S. et al. (2016) Coffee and tea consumption in relation with non-alcoholic fatty liver and metabolic syndrome: A systematic review and meta-analysis of observational studies. *Clin Nutr*, 35(6):1269–1281.
- 2 Shang F., Li X., Jiang X. (2016) Coffee consumption and risk of the metabolic syndrome: A meta-analysis. *Diabetes Metab*, 42(2):80–7.
- 3 Grosso G. et al. (2015) Association of daily coffee and tea consumption and metabolic syndrome: results from the Polish arm of the HAPIEE study. *Eur J Nutr*, 54(7):1129–37.
- 4 Grosso G. et al. (2014) Factors associated with metabolic syndrome in a Mediterranean population: role of caffeinated beverages. *J Epidemiol*, 24(4):327–33.
- 5 Carlstrom M., Larsson S.C. (2018) Coffee consumption and reduced risk of developing type 2 diabetes: a systematic review with meta-analysis. *Nutr Rev*, 76(6):395–417.
- 6 Grosso G. et al (2017) Long-Term Coffee Consumption Is Associated with Decreased Incidence of New-Onset Hypertension: A Dose-Response Meta-Analysis. *Nutrients*, 9(8). pii: E890.
- 7 Lee A. et al. (2019) Coffee Intake and Obesity: A Meta-Analysis. *Nutrients*, 11(6). p ii: E1274.
- 8 EFSA (2015) Scientific Opinion on the Safety of Caffeine, *EFSA Journal*, 13(5):4102.
- 9 Khunti K. (2005) Metabolic syndrome *BMJ*, 331:1153.
- 10 Alberti K.G. et al. (2009) Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. *Circ*, 120(16):1640–5.
- 11 van Vilet-Ostaptchouk J.V. et al. (2014) The prevalence of metabolic syndrome and metabolically healthy obesity in Europe: A collaborative analysis of ten large cohort studies. *BMC Endocrine Dis*, 14(1):9.
- 12 Scuteri A. et al. (2015) Metabolic syndrome across Europe: different clusters of risk factors. *Eur J Prev Cardiol*, 22(4):486–91.
- 13 Wilsgaard T., Jacobsen K. (2011) Lifestyle factors and incident metabolic syndrome: The Tromsø Study 1979–2001. *Diab Res & Clin Prac*, 78(2):217–224.
- 14 Lutsey P.L. (2008) Dietary intake and the development of the metabolic syndrome: the Atherosclerosis Risk in Communities study. *Circ*, 117(6):754–61.
- 15 Driessen M.T. et al. (2009) Coffee consumption is not related to the metabolic syndrome at the age of 36 years: the Amsterdam Growth and Health Longitudinal Study. *Eur J Clin Nutr*, 63(4):536–42.
- 16 Navarro A.M. et al. (2019) Coffee consumption and risk of hypertension in the SUN Project. *Clin Nutr*, 38(1):389–397.
- 17 Grosso G. et al. (2017) Coffee, Caffeine, and Health Outcomes: An Umbrella Review. *Annu Rev Nutr*, 37:131–156.
- 18 Grosso G. et al. (2016) Coffee consumption and risk of all-cause, cardiovascular, and cancer mortality in smokers and non-smokers: a dose-response meta-analysis. *Eur J Epidemiol*, 31(12):1191–1205.