coffee&health

from the institute for scientific information on coffee

Symposium report

Coffee and type 2 diabetes: A review of the latest research

Contents

Foreword

Type 2 diabetes is a major and growing health problem across Europe. The costs of treating diabetes and complications associated with the condition are also increasing. With this in mind, it is important to explore and acknowledge factors that might have a protective effect to help to reduce the risk of developing type 2 diabetes.

Eminent experts in diabetes gathered at the European Association for the Study of Diabetes (EASD) 2018 Annual Meeting in Berlin, Germany in October, to discuss the latest research in diabetes 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 type 2 diabetes' where leading researchers in this field presented the latest research.

Associate Professor Mattias Carlström led with a detailed review of his meta-analysis of associations between type 2 diabetes and coffee consumption. Professor Kjeld Hermansen followed with a review of 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 type 2 diabetes. This report details the research presented at the Symposium and the resulting questions and discussion from delegates.

Executive summary

Type 2 diabetes is an increasing problem across Europe, with associated health issues and costs. Strategies to reduce the risk of developing type 2 diabetes are of interest, particularly lifestyle initiatives to help individuals manage their diet and physical activity[1].

Meta-analyses have concluded that moderate coffee consumption is associated with a reduced risk of type 2 diabetes, suggesting that 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 day[2–9]. 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'[10].

The precise mechanisms behind this effect are unclear, but researchers have investigated potential roles for compounds found in coffee including caffeine, trigonelline, cafestol, cafeic acid and chlorogenic acid. It is suggested that a combination of such compounds, as found in coffee beverages, may be important[11–20], however, it was found that the components mentioned were not able to entirely substitute the effect of coffee.

Introduction — type 2 diabetes in Europe

Type 2 diabetes is a major health problem across Europe. The International Diabetes Federation in its 8th edition of the Diabetes Atlas revealed that around 58 million people currently living with type 2 diabetes across Europe and 36 million more people could be at risk of developing the condition[1]. Type 2 diabetes is strongly associated with overweight and obesity, and is considered a preventable condition if lifestyle is managed to prevent weight gain through diet and exercise[1].

Type 2 diabetes and coffee consumption

A number of meta-analyses have been published reviewing the associations between type 2 diabetes and coffee consumption. The research suggests that a moderate intake of coffee is associated with a lower risk of developing type 2 diabetes, compared to consuming none or less than 2 cups per day. The association is seen with both caffeinated and decaffeinated coffee[2–9].

Associate Professor Carlström presented his meta-analysis published in 2018 entitled 'Coffee consumption and reduced risk of developing type 2 diabetes'; 30 prospective studies were included in the meta-analysis, with a total of 1,185,210 participants[9].

The results suggested that the pooled relative risk of developing type 2 diabetes when comparing the highest coffee consumers (median 5 cups of coffee per day) versus the lowest (median 0 cups of coffee per day) was 0.71; in other words the highest coffee consumers had a 29% lower risk of type 2 diabetes when compared to the lowest consumers[9].

"Research suggests that a moderate intake of coffee is associated with a lower risk of developing type 2 diabetes, compared to consuming none or less than 2 cups per day. The association is seen with both caffeinated and decaffeinated coffee[2–9]."

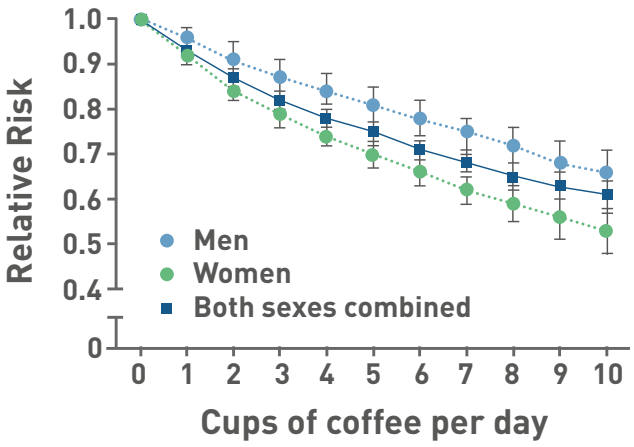
"In Associate Professor Carlström's meta-analysis published in 2018, the highest coffee consumers had a 29% lower risk of type 2 diabetes when compared to the lowest consumers[9]."

This meta-analysis reflected data from previous reviews which have suggested that 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 day[3,8].

Associate Professor Carlström also discussed the results from the dose-response analysis, which suggested a 6% reduction in the risk of developing type 2 diabetes with every additional cup of coffee consumed. He concluded that the association between coffee consumption and type 2 diabetes risk appears to be linear, at least up to about 8–10 cups/day of coffee, but suggested that data on the influence of very high coffee consumption (>8–10 cups/day) on type 2 diabetes risk are limited[9]. It is important to note that moderate coffee consumption is typically defined as 3–5 cups per day, based on the European Food Safety Authority's review of caffeine safety[10].

COMPARISONS	HIGHEST VS. LOWEST CATEGORY		DOSE-RESPONSE (PER 1 CUP/DAY)	
	RR (95% CI)	P VALUE	RR (95% CI)	P VALUE
SEX				
Men	0.76 (0.67–0.85)	0.01	0.94 (0.92–0.96)	0.73
Women	0.68 (0.62–0.75)	0.02	0.92 (0.90–0.94)	<0.001
Both sexes	0.71 (0.61–0.82)	0.003	0.96 (0.95–0.97)	0.04
P value for difference (men vs. women)	0.18		0.03	

The inverse association between coffee consumption and type 2 diabetes was shown in both men and women, and although there were no clear differences between the sexes the effect was slightly greater in women[9].



Professor Carlström also reviewed data from different continents, with his meta-analysis showing the inverse relationship between coffee consumption and type 2 diabetes was consistent across European, US and Asian datasets[9].

Types of coffee beverages

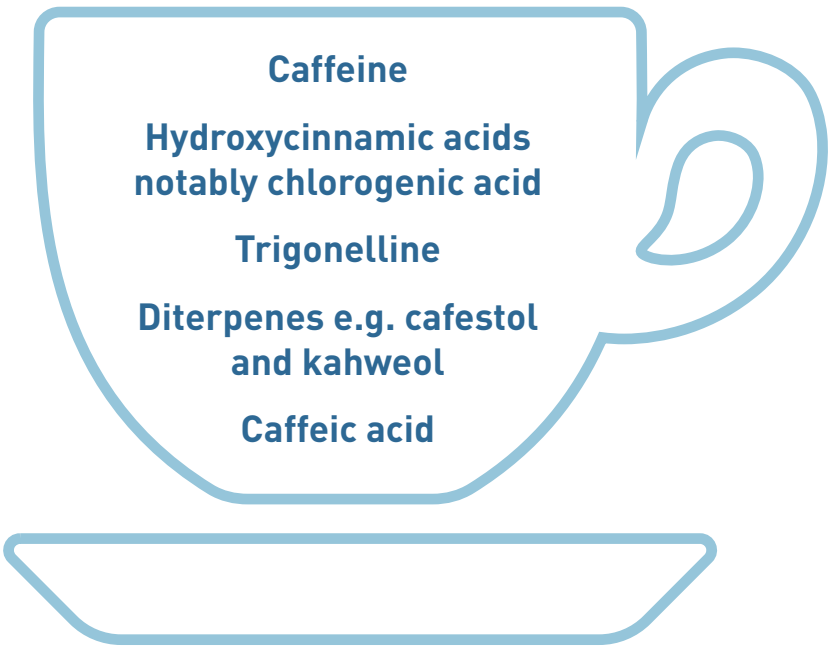
In discussing the research that was presented, delegates questioned the effect of different types of coffee beverages. Across Europe coffee habits vary widely, with short espresso style coffees popular in some countries whilst longer coffee drinks with additions such as milk popular elsewhere. The speakers both confirmed that although detailed research in the variety of coffee beverages is lacking, the association between coffee intake and a reduced risk of type 2 diabetes is most likely to be linked with coffee itself. Both speakers commented that additions such as sugar and syrups may not be advised.

Potential mechanisms

Although the meta-analyses conducted to date have consistently suggested that the risk of type 2 diabetes is inversely associated with coffee consumption, the potential mechanisms behind this effect are less clear.

Professor Hermansen presented a summary of the research that has been undertaken to identify and understand the potential mechanisms, suggesting that a number of routes may be involved including an antioxidant effect, an anti-inflammatory effect, thermogenic effects or the modulation of microbiome diversity.

He highlighted a number of potentially clinically relevant compounds present in coffee including the following:



Caffeine

Caffeine is a central nervous system stimulant, and researchers have investigated whether it may reduce insulin sensitivity in the body[11,12].

Research has suggested that acute caffeine consumption can decrease insulin sensitivity in healthy adults, supporting the suggestion that the inverse association between coffee intake and diabetes incidence is not attributable to caffeine. Equally, meta-analyses have suggested that both caffeinated and decaffeinated coffee are associated with a reduced risk of type 2 diabetes[3,8], a finding also observed by Professor Carlström[9], suggesting caffeine does not explain the effect.

Comparing the highest versus the lowest coffee consumption categories, caffeinated coffee was associated with a 27% reduced risk and decaffeinated coffee with a 20% reduced risk of developing type 2 diabetes[9]. The association was linear, in other words the risk reduced with additional cups of coffee. Professor Carlström highlighted that the risk of type 2 diabetes decreased by 7% and 6% respectively with each additional cup of caffeinated or decaffeinated coffee[9]. Given that both caffeinated and decaffeinated coffee are associated with a reduced risk of type 2 diabetes, it is unlikely that caffeine itself is a potential mechanism.

The question of acceptable levels of coffee intake was raised and the speakers confirmed that a moderate coffee intake was advised, of approximately 3–5 cups of coffee a day. The European Food Safety Authority (EFSA) Scientific Opinion on the Safety of Caffeine, advises that caffeine intakes from all sources up to 400 mg per day and single doses of 200mg do not raise safety concerns for adults in the general population[10]. Pregnant women should limit their caffeine intake to 200mg per day, from all sources[10]. A typical cup of coffee provides 75mg caffeine.

"Meta-analyses have suggested that both caffeinated and decaffeinated coffee are associated with a reduced risk of type 2 diabetes[3,8], a finding also observed by Professor Carlström[9], suggesting caffeine does not explain the effect."

Other coffee components

Professor Hermansen highlighted the coffee components chlorogenic acid (CGA) and trigonelline, where research has suggested that administration of these individually may significantly reduce early glucose and insulin responses, but not the overall response over a longer period of time[13]. He commented that it is difficult to identify a potential role for both CGA or trigonelline when administered individually[13]. A 2017 literature review postulated that chlorogenic acid may have a significant impact on glucose metabolism regulation and, therefore, on related disorders including diabetes[14].

"Coffee may also partly inhibit postprandial hyperglycemia in turn helping to reduce the risk of type 2 diabetes[19]."

Professor Hermansen detailed further work on individual coffee components, concluding that coffee compounds, when extracted and administered individually, did not seem to replicate all the positive effects observed when coffee itself is consumed[15].

Professor Hermansen suggested that a combination of coffee compounds including chlorogenic acid, trigonelline, cafestol and caffeic acid, as found in coffee itself rather than extracted from coffee, may be important. In fact, research suggests that these may improve metabolic syndrome symptoms[16]. He also highlighted a potential role for cafestol as research suggests it may increase insulin and improve glucose uptake in muscles[16–18].

Coffee may also partly inhibit postprandial hyperglycemia in turn helping to reduce the risk of type 2 diabetes[19]. A cross-sectional multi-ethnic study in non-diabetic adults, suggested that the effect of caffeinated coffee is positively related to insulin sensitivity while decaffeinated coffee improves pancreatic beta-cells function[20].

The question of the impact of lipids in unfiltered coffee was raised and Professor Hermansen commented that research has suggested that unfiltered coffee and boiled coffee, such as is popular in Scandinavian countries, may cause a small increase in LDL cholesterol. However, he commented that this effect is small and likely to have little impact on overall cholesterol levels[21,22].

Currently, it is difficult to clarify the precise mechanism behind the association between coffee consumption and a reduced risk of type 2 diabetes, despite the fact that the data is compelling. Professor Hermansen concluded his presentation by pointing out that further long-term human studies are required to identify and understand the associations in more detail.

European Association for the Study of Diabetes

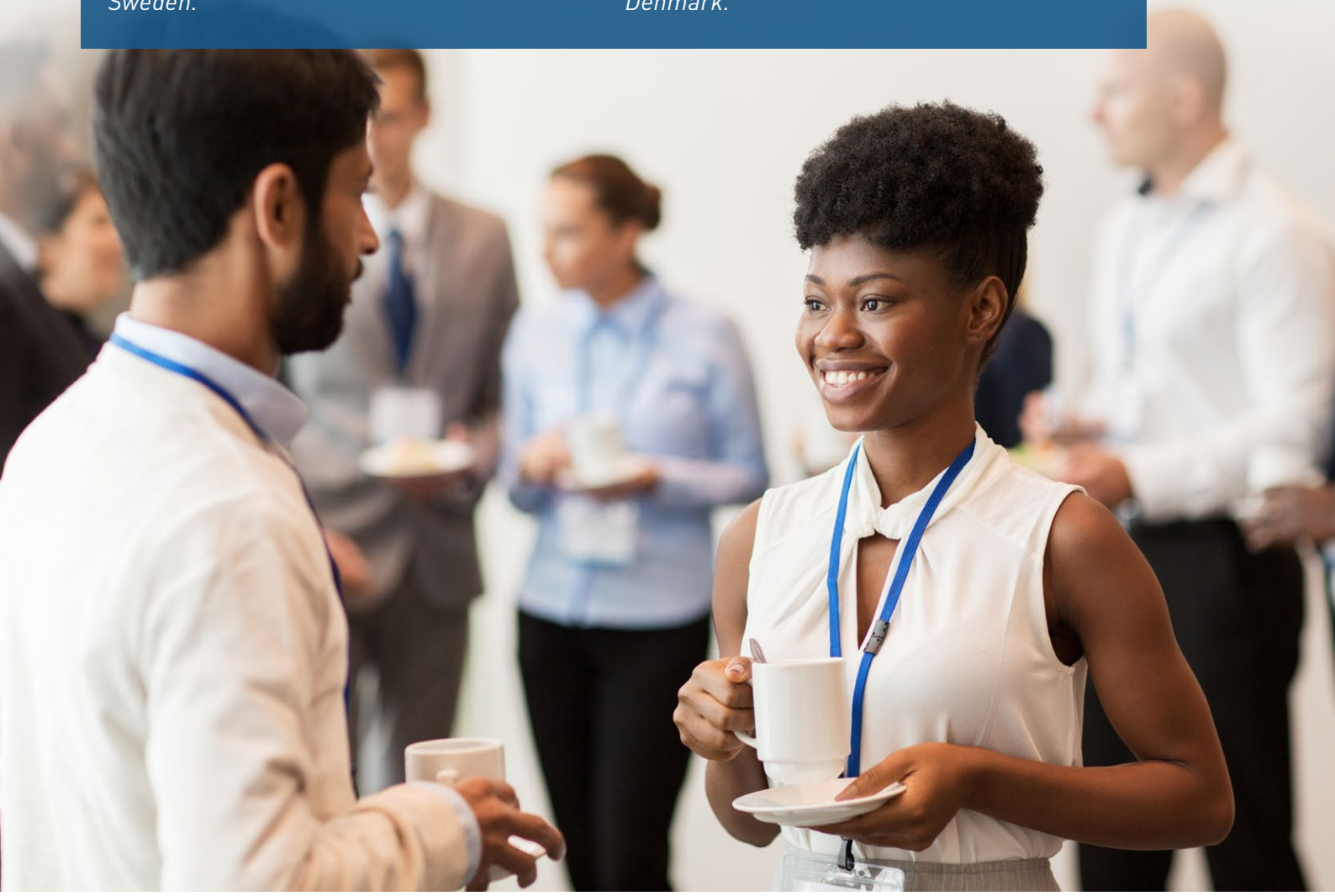
The annual meeting of the European Association for the Study of Diabetes (EASD) provides a forum for leading experts to present their research and share knowledge in an international forum.

During the meeting on 3 October 2018, ISIC hosted a symposium titled 'Coffee and Type 2 Diabetes: A review of the latest research' with experts working in this area.

Two renowned speakers explored the research on coffee consumption and type 2 diabetes, discussing data from meta-analyses and research on potential mechanisms.

Associate Professor Mattias Carlström,
Department of Physiology and Pharmacology, Karolinska Institutet, Sweden.

Professor Kjeld Hermansen,
Department of Endocrinology and Internal Medicine, Aarhus University Hospital, Denmark.



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 coffeeandhealth.org

The website www.coffeeandhealth.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.

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