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coffee & health topics

Intended for professional audiences

Type 2 diabetes

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1. Summary

- Recent scientific evidence links moderate coffee consumption with a reduced risk of developing type 2 diabetes.
- The association is documented in several different populations and shows a consistent dose response, i.e. lower risk at higher consumption levels:
 - 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.
 - Every additional cup of coffee up to 6-8 cups per day (regular or decaffeinated) is associated with a 5-10% lower risk of developing type 2 diabetes.
- The mechanisms underlying this association between moderate coffee consumption and reduced risk of developing type 2 diabetes need further investigation.
 - It is unlikely that caffeine is responsible for the effect.
 - Other coffee constituents, in particular antioxidants like chlorogenic acid and trigonelline, may play a role.

2. Type 2 diabetes

The scale of the issue

More than 370 million people worldwide have diabetes¹. In 2012, 4.8 million people died and \$471 billion were spent as a result of diabetes. The WHO predicts that deaths caused by diabetes will increase by two thirds between 2008 and 2030².

In Europe the prevalence of diabetes amounts to 6.7% or 55 million sufferers. Of this, 38.6% of cases remain undiagnosed, which means that 21.2 million Europeans are unaware that they have diabetes. It is predicted that by 2030 the number of people with diabetes in the EU will rise to 64 million¹.

A role for diet and lifestyle

Type 2 diabetes (non-insulin dependent diabetes, NIDDM, or maturity onset diabetes) is characterized by high blood glucose together with insulin resistance and relative insulin deficiency. The target tissues for insulin (muscle, liver and fat-tissue) become insensitive or resistant to the action of insulin. This means that more insulin is needed to obtain the same response from the target tissues.

Type 2 diabetes is primarily influenced by lifestyle factors such as diet, physical activity, alcohol consumption and smoking.



3. Coffee consumption and type 2 diabetes

Regular coffee consumption linked to a lower risk of type 2 diabetes

A statistically significant negative association for coffee and type 2 diabetes has been observed in different populations. In addition, there is a dose response relationship, i.e. lower incidence at higher levels of consumption. Taken together, these are a strong indication for a true association between consumption of coffee and the lower incidence of type 2 diabetes.

A 2002 Dutch cohort study of 17,111 adults and 306 new cases of type 2 diabetes³, showed a statistically significant negative association between coffee consumption and subsequent risk of developing type 2 diabetes. This finding was replicated in a 2009 systematic review with meta-analysis covering 457,922 individuals and 21,897 newly diagnosed cases of type 2 diabetes from eight different countries⁴.

Every additional cup of coffee per day is associated with a 5-10% lower risk of developing 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 day.

More recently, eight more epidemiological studies have been published^{5,6,7,8,9,10,11,12}. All eight have confirmed the inverse association for coffee consumption.

Two further review papers, both published in 2012, add to the existing body of evidence suggesting that habitual coffee consumption is associated with a lower risk of type 2 diabetes^{13,14}.

Decaffeinated coffee and tea also linked to lower risk of type 2 diabetes

As with caffeinated coffee, the majority of published studies which have evaluated the relationship between decaffeinated coffee or tea drinking and risk of type 2 diabetes have reported similar negative associations^{1,6,7,9}.



5. Potential mechanisms

The one thing still lacking with these associations between consumption of regular coffee, decaffeinated coffee or tea and a lower risk of developing type 2 diabetes, is a plausible mechanism.

Caffeine unlikely to play a role

Since coffee and tea are the main sources of caffeine in the diet in most countries, it is difficult to directly separate an effect of caffeine from either coffee or tea. However, since decaffeinated coffee is reported to have a similar effect to regular coffee, it is unlikely that caffeine plays a role in the negative association for development of type 2 diabetes.

Antioxidant effect?

A Finnish study tested the effects of a progressively increasing coffee consumption in obese volunteers (in the first month participants abstained from coffee, for the second month 4 cups of coffee were consumed per day and in the third month, participants had 8 cups per day). Coffee consumption appeared to have beneficial effects on some markers of subclinical inflammation, considered to be risk factors for type 2 diabetes¹⁵.

Because of its high content in antioxidant compounds¹⁶ coffee could contribute to the total antioxidant capacity of the diet that is necessary to reduce oxidative stress, in turn leading to unfavourable conditions for the development of type 2 diabetes¹⁷. This hypothesis has not yet been confirmed.

Other areas under investigation

A 2011 study from Harvard looked at the effects of caffeinated and decaffeinated coffee on biological risk factors for type 2 diabetes. The authors concluded that improvements in adipocyte and liver function may contribute to beneficial metabolic effects of long term coffee consumption¹⁸.

Coffee consumption has been related to decreased risk of type 2 diabetes mellitus among those with high levels of serum- γ -glutamyltransferase. A 2012 study in a Japanese population found coffee drinking to be protective against glucose intolerance. Furthermore, they suggest that the observed possible effect modification of serum- γ -glutamyltransferase on the protective association between coffee and type 2 diabetes warrants further research¹⁹.

6. Conclusion

The association between moderate coffee consumption and reduced risk of developing type 2 diabetes has potentially important implications in light of the already high and increasing prevalence of this disease. However, the mechanisms underlying coffee's effect need further investigation.

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