

# Coffee & Type2 Diabetes Relationship in Chinese Population and Potential Mechanism

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## ABSTRACT

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## Introduction

### Diabetes in China

In 2021, the global diabetes population (age 20-79y adults) reached 540M. There is an increasing trend to reach 640M by the year 2045. The adult diabetes population in China reached 141M in 2021 and is estimated to reach 174M in 2045. The age-adjusted comparative prevalence of diabetes percentage is 10.6% and 12.5% accordingly. It is proposed by the International Diabetes Federation that the causes of increase in diabetes prevalence were because of population aging, unhealthy diet, obesity, sedentary lifestyle, psychosocial stress, and environmental pollutants. People with diabetes have an increased risk of developing serious health problems. The large number and increasing trend in China call for actions for this group of people. Concerns raised from more than 50% of people with undiagnosed diabetes [1]. Type 2 diabetes is more common in adults and accounts for around 90% of all diabetes cases. In type 2 diabetes, the body does not make good use of the insulin that it produces. The cornerstone of type 2 diabetes treatment is a healthy lifestyle, including increased physical activity and a healthy diet. Thus, identifying dietary protective factors for diabetes, especially T2DM has become a meaningful research topic in China.

## Review

### Research in other races and regions indicate inverse relationship between diabetes and coffee consumption

In a systematic review with meta-analysis Huxley, et al., reported an inverse relationship between coffee consumption and subsequent risk of diabetes in Caucasian [2]. Odegaard et al. reported in their health study there was an association between regular coffee consumption and lower risk of T2DM in Singapore Chinese [3]. As these are either for other races or regions with relatively different dietary habits, we'd like to review recent studies for the Chinese population.

### Coffee Consumption Rate is Increasing in China Recently

Coffee is a brewed beverage made from roasted coffee beans derived from the seeds of certain coffee species berries. Roasted beans are then ground and brewed with boiling water to prepare the beverage known as coffee [4]. As China is not a regular coffee drinking country, to understand if coffee drinking can be a protective factor applied for the population, we also looked at the coffee consumption in China, due to the rising household

expenditure, changing lifestyles, and acceptance of western culture trends by middle-class consumers, there is an increasing demand for coffee across the country: according to data from the China Coffee Association Beijing (CCAB), coffee consumption is increasing at an annual rate of 15% [5].

### **We Searched Papers in the Past 12 Years from 2010, Focused on the China Region and Human Subjects**

From the studies, we see common message in inverse correlation of coffee drinking to Type 2 diabetes mellitus:

A longitudinal study conducted by Ma et al., in China reported: by comparing people who do not or hardly drink coffee, people consuming 3-4 cups per day were observed to have some health benefits and protective effects to Type 2 diabetes [6]. According to the Cohort study by Lin et al., published in 2011[7]: For Chinese population of middle-aged adults in Taiwan: Comparing to non-drinkers, habitual coffee drinkers had 38-46% lower risk of T2DM, which also indicates an inverse association of coffee intake with T2DM in Chinese population, that coffee consumption of more than seven times per week is associated with a 63% lower risk for T2DM. Though the dose design of these two recent studies showed some difference, we can see there are some dose-response effects of the coffee intake to a certain level, the effect may not increase while the intake reaches 3 cups per day.

### **Long-Term Effect vs. Acute Effect**

In an article written by Xia, et al., they presented the results by examining the effect of coffee before a meal and after a meal combined with insulin treatment on diabetes. Although there were no immediate effects, the groups which consumed coffee before a meal and after meal showed improvement of blood-sugar after a month [8] which shares the similarity with another paper [9], a recent study by Ding et al., reported "Consistent consumption of coffee has beneficial health effects on diabetes. It stated that consuming 2 cups of coffee right after each other lowers the sensitivity to insulin thus putting a higher risk of Diabetes. However, if the patient is a long-term coffee consumer, the risk of Diabetes is lowered as there is a protective factor formed. From these two papers, a long-term effect instead of acute effect is linked with coffee intake, especially regular not decaffeinated coffee intake.

There are several papers discussed the mechanism behind the long-term inverse association of coffee intake and type 2 Diabetes: as antioxidants and ample in coffee, chlorogenic acid has been recognized as preventing or delaying agents to develop T2DM, by promoting insulin sensitivity and improve glucose metabolism [10] There are also statement that chlorogenic acid demonstrates its blocking function in absorption of glucose [11], leading to a better protection result by Robusta than Arabica in RCT studies, cause of

Robusta's higher content of chlorogenic acid level. Interestingly Lin's study agrees the benefit from magnesium as a component of coffee, and a higher magnesium intake from food can improve insulin resistance, glycemic control and reduce the risk of T2DM [12], by demonstrating serum magnesium levels increased with frequency of coffee intake and subjects without diabetes had greater serum magnesium levels than subjects with diabetes, which supports magnesium may partially explain the inverse relationship of coffee drinking to T2DM [7]. Another in vitro study conducted by Chinese researchers stated mechanism of inhibiting amyloid formation of human islet amyloid polypeptide [13] as a potential route of the mechanism.

### **Discussion**

Though there are some conflicts in the papers about caffeine impact in insulin sensitivity, Previous studies also have shown that caffeinated coffee decreases insulin sensitivity and impairs glucose tolerance, which could lead to T2DM. and some cohort studies have found that decaffeinated coffee consumption is inversely related to incidence of T2DM [14-15] From the papers we reviewed which focus on the Chinese population, we see the common agreement that there is an inverse association between coffee intake and T2DM, with a long-term effect rather than an acute effect, the mechanism contribution factors always include chlorogenic acids. Even drinking coffee is not a habit for the Chinese population, with the increasing coffee intake trend in China, coffee drinking may become an effective protective factor to the development of T2DM among the Chinese population.

We suggest further specific caffeine and T2DM association research on the Chinese population and consider other potential effective edibles with high amounts of chlorogenic acid and low levels of caffeine for a profound protection effect if the caffeine effect is not aligned. Last but not least, as in China the instant coffee segment held a significant market share owing to its convenience [5], type of coffee consumed for example: instant, filtered, unfiltered, espresso coffee could also be studied.

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