Consumption of Tea and its Relation to Risk of Type 2 Diabetes mellitus

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ABSTRACT

Aim: The aim of the study was to examine the association of consumption of tea with the risk of type 2 diabetes mellitus. **Methods:** A case control study was conducted at PSG Hospitals between 1st June 2017 and 1st July 2017. All those who had newly diagnosed type 2 diabetes mellitus and attended Department of Endocrinology for follow-up visit were the cases and the relatives accompanying them without the history of diabetes mellitus were the controls. Tea consumption and other dietary factors were elicited. The mediating factors studied were age, sex, Body Mass Index (BMI), educational levels, smoking status, alcohol consumption, family history of diabetes mellitus, potassium intake, magnesium intake and use of statins. **Results:** After adjusting the potential confounders, tea consumption was inversely associated with risk of type 2 diabetes mellitus with odds ratio of 0.652 (95% CI = 0.43 – 0.98). The association was also observed with participants who consumed tea 3 or 4 cups per day compared to those who did not drink tea on a daily basis (odds ratio = 0.368, 95% CI = 0.14 – 0.96). However, the association was not observed among those who take 5 or more cups of tea per day (odds ratio = 0.328, 95% CI = 0.06 – 1.60).**Conclusion:** Our findings suggest that consumption of 3 to 4 cups of tea per day has a decreased risk of type 2 diabetes mellitus. The results from our study also suggest that adjusting for mediating factors did not alter the results and hence other unknown factors may explain inverse relation between tea consumption and type 2 diabetes mellitus. Further studies are warranted.

Keywords: Tea consumption, type 2 diabetes mellitus, chocolate consumption, potassium intake

Introduction

The prevalence of type 2 diabetes mellitus has increased dramatically in the past decades [1, 2].

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The majority of cases of diabetes mellitus could be prevented by changes in life style. However, the association of tea consumption with the risk of type 2 diabetes mellitus is not entirely clear. Few studies found an inverse association between tea intake and type 2 diabetes mellitus, while few other studies did not observe an association between tea consumption and risk of type 2 diabetes mellitus [3-6].The underlying mechanism regarding the relation between tea consumption and type 2 diabetes mellitus is also

unclear. Several components of tea have been suggested as possible causal factors [7].Magnesium plays a role in regulating insulin action and is inversely associated with insulin sensitivity and type 2 diabetes mellitus. Potassium intake has also been associated with reduced risk of diabetes mellitus [8].So far; there is no conclusive evidence about whether these factors explain the association of tea intake and type 2 diabetes mellitus. Besides these, earlier studies have not accounted for the effect of long term medication such as statin use which may confound the results. Therefore the present study is aimed to investigate the association of tea consumption with the risk of type 2 diabetes mellitus adjusting for multiple covariates.

Materials and Methods

Study population and design

A case-control study was conducted at PSG Hospitals. All those who have newly diagnosed in the past 1 year as type 2 diabetes mellitus and attending the Department of Endocrinology for follow up between 1st June 2017 – 1st July 2017 were considered as cases. Controls were those who accompany them and do not have history of diabetes mellitus. We then retrospectively evaluated their food practices and other demographic information.

General assessments

The general assessment survey was conducted at the outpatient Department of Endocrinology, PSG Hospitals, Coimbatore. The general questionnaire contained questions on demographic characteristics. Body weight (in kg) and height (in meter) were also measured. However in few cases, we were not able to measure height. Food intake was assessed using a validated Food Frequency Questionnaire in this population and from this magnesium intake and potassium intake were estimated. The questionnaire also asked about smoking status, practice of alcohol intake, whether previously diagnosed as diabetes mellitus, other medical histories and medications taken. The information on baseline consumption of coffee, tea and other beverages were also collected. We also collected the data about consumption of chocolates, since chocolates are also a source of caffeine.

Statistical analysis

To examine the association between tea consumption and incidence of type 2 diabetes mellitus, we used four logistic regression models. In the first model, odds ratio and 95% confidence intervals for type 2 diabetes mellitus were calculated against a reference group of low consumers adjusted for age (continuous) and gender (male/female). A second logistic regression model corrected the other known diabetes mellitus risk factors which include smoking status (present/absent), BMI, education attainment (classes up to 12th standard/college and above), family history of diabetes mellitus (present/absent); alcohol intake (gm. per week). Body mass index was calculated by the formula, body weight (kg) divided by the square of the body height in meter. A third model corrected for coffee (considering the fact that those who drank a lot of tea tend to drink less coffee and vice versa) and chocolate consumption. Mediating factors were included in the final model. The mediating factors considered were daily intake of magnesium and potassium, which were elicited from their food consumption practices and the effects of long term medications particularly the use of statins[9].

Results

The study included 150 cases and 150 controls. Baseline characteristics of the study participants among cases and controls were presented in Table 1. Most of the demographic factors were comparable between cases and controls. However cases were having slightly older age compared to controls. Family history of diabetes mellitus and level of education was higher among cases compared to controls. In the multivariate regression model, odds ratio shows that the participants who drank more tea had a significantly decreased risk of diabetes mellitus compared with those who do not drink tea on a daily basis (odds ratio = 0.652, 95% CI = 0.43 – 0.98). On further analysis, it was observed that the participants who consumed 3 or 4 cups of tea per day had a decreased risk of type 2 diabetes mellitus compared to those who do not drink tea on a daily basis (odds ratio = 0.368, 95% CI = 0.14 – 0.96) (Table 3) with no significance in analysis of trend (Figure 1). The reduced risk was not observed among those who take 5 cups or more tea per day (odds ratio = 0.328, 95% CI = 0.06 – 1.60)

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Table 1: Distribution of the participant's demographic characteristics

| Variables	Cases No (%) or Mean ± SD	Controls No (%) or Mean ± SD	p value
Age(years, continuous)	53.29 ± 11.52	41.75 ± 12.44	p < 0.05
BMI(kg/m^2, continuous)	26.12 ± 5.09	25.99 ± 5.21	0.824
Potassium (mg/day)	624.11 ± 151.14	661.14 ± 209.54	p < 0.001
Magnesium (mg/day)	134.27 ± 50.19	123.30 ± 44.96	0.082
Sex			0.246
Male	72 (48%)	62 (41.3%)	
Female	78 (52.0%)	88 (58.7%)	
Educational levels			p < 0.001
Up to 12th Standard	108 (72.0%)	85 (56.7%)	
College & above	42 (28.0%)	65 (43.3%)	
Current smoking status			0.569
Yes	17 (11.3%)	14 (9.3%)	
No	133 (88.7%)	136 (90.7%)	
Alcohol Intake			0.427
rarely/moderately	144 (96.0%)	141 (94.0%)	
weekly/daily	6 (4.0%)	9 (6.0%)	
Family history of diabetes mellitus			p < 0.001
Yes	91 (60.7%)	51 (34.0%)	
No	59 (39.3%)	99 (66.0%)	
Use of statins			0.317
Yes	1 (0.7%)	0 (0.0%)	
No	149 (99.3%)	150 (100%)	

Table 2: Tea consumption and odds ratio for the risk of type 2 diabetes mellitus in the multivariate analyses

	Model 1 Adjusted for age and sex	Model 2 Adjusted for BMI, education, smoking, alcohol and family history of diabetes mellitus in addition to variables in Model 1	Model 3 Adjusted for coffee and chocolate consumption in addition to variables in Model 2	Model 4 Adjusted for potassium, magnesium and statins in addition to variables in Model 3
Odds ratio	0.753	0.648	0.613	0.652
95% CI for diabetes mellitus	0.533 – 1.066	0.441 – 0.953	0.410 – 0.915	0.433 – 0.982
p value	0.109	0.027	0.017	0.041

Table 3: Adjusted odds ratio* according to the consumption of tea cups per day

Category	Cases (N = 150)	Controls (N = 150)	Odds ratio	95% CI for EXP (B)	p value
Do not drink on a daily basis	34	27	1		
1-2 cups per day	81	84	0.522	0.236 – 1.157	0.109
3-4 cups per day	31	32	0.368	0.141 – 0.964	0.042
≥5 cups per day	4	7	0.328	0.067 – 1.605	0.169

*adjusted for age, sex BMI, education, smoking, alcohol, family history of diabetes mellitus, coffee consumption, chocolate consumption, potassium intake, magnesium intake and use of statins

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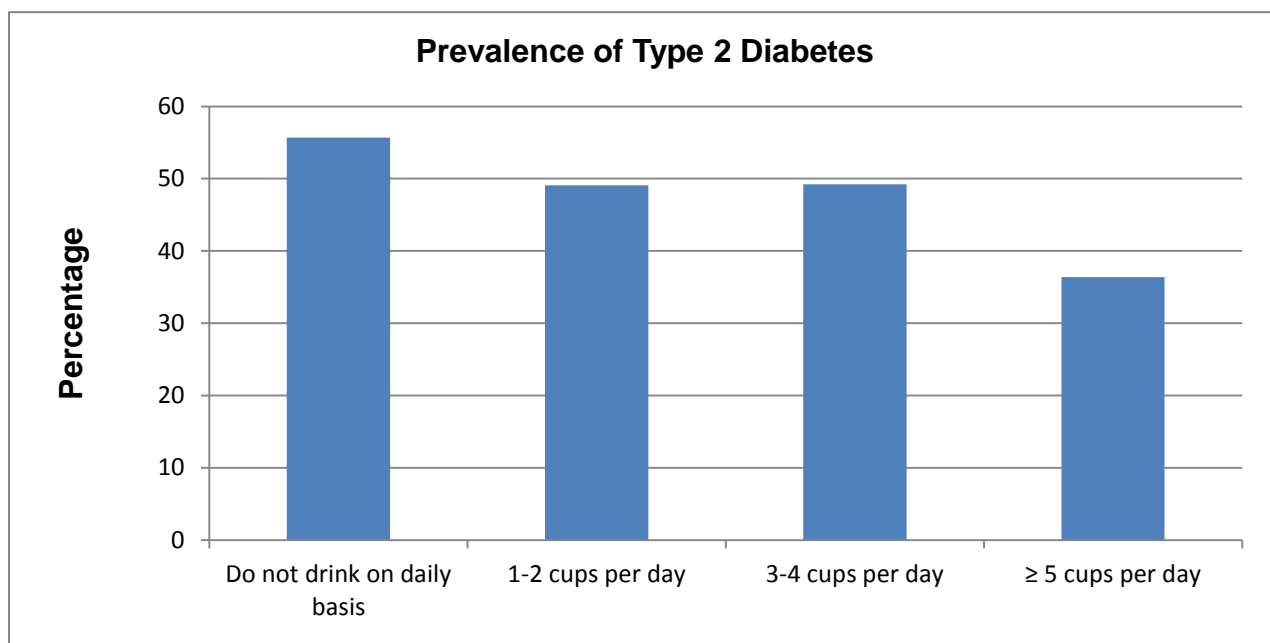
Fig1: Prevalence of type 2 diabetes mellitus according to the consumption of tea cups per day

Discussion

Several studies have investigated the association between tea consumption and type 2 diabetes mellitus[10-14]. Some of these studies did not find any association, while other studies observed an inverse association between tea consumption and type 2 diabetes mellitus. Another study found an association only for green tea and not for black tea. However, our study strongly support the findings of the recent meta-analysis[11] which concluded that consumption of 4 cups of tea per day may lower the risk of type 2 diabetes mellitus, but a reduced risk was not observed for 1 to 2 cups per day. In addition, we also observed that the reduced risk was not observed for those who take more than five cups of tea per day. This is perhaps due to the reduced sample size in this group.In univariate analysis, we observed an inverse association between potassium intake and the risk of type 2 diabetes mellitus. In our study, intake of magnesium and potassium were included in the final model to assess whether these factors mediated the observed association between tea intake and type 2 diabetes mellitus, but none affected the association. Hence, results from our study suggest that other factors may be more important to explain inverse relation between tea consumption and type 2 diabetes mellitus. Tea contains flavonols and flavones are antioxidants. Antioxidants may reduce the amount of reactive oxygen species, which activate stress-sensitive pathways. These pathways can lead to insulin resistance, impaired insulin secretion and beta cell dysfunction. Our study has several limitations, first we relied on self-reported tea consumption and therefore misclassification may have occurred. Second, we relied on self-reported information on non-diabetic status among controls. Third, we could not assess the influence of physical activities due to some practical reasons. The strengths of this study are a large number of covariates studied and extensive information on diet of the participants.

In conclusion, the results from our study suggest that consumption of 3 to 4 cups of tea per day has a decreased risk of type 2 diabetes mellitus. Further large scale prospective studies can provide more information in this field.

intake using the dietary history of the participants. We do not have any conflict of interest and not received any research grants for this study.

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