**TEA AND DIABETES**

**Abstract:** Since time immemorial, tea (Camellia sinensis) has been used as a daily beverage. Tea is mainly available in 3 variants: 76-78% black tea, 20-22% green tea and 2% oolong tea. Tea is a good source of polyphenolic compounds, particularly Flavonoids. The active component of tea responsible for beneficial effect in T2DM and metabolic syndrome is Catechin, a polyphenol. Catechin constitute 7 forms, including Epigalocatechingallate (ECGg). It is proven that black tea; when consumed in a suitable manner as a supplement, can prevent the advancement of T2DM, metabolic syndrome along with imparting other health benefits as well.

**Keywords**: Black Tea, Metabolic Syndrome, T2DM, Insulin Resistance

**Introduction**: Since the advent of human population, use of medicinal plants in disease remediation have been well known and documented. This age old practice of using plant sources rich in nutraceuticals and phytonutrients as therapeutic agents for alleviating a wide variety of human illness has gained immense popularity.

India is a treasure house of medicinal plants, herbs and spices. Tea (Camellia sinensis) is one of the world’s most popular beverages, especially in Asian countries like Korea, China, Japan, including India. Since it is consumed at a high rate in this population, even a small effect on an individual basis could have a large public health impact.

**Diabetes and its burden**: T2DM is a metabolic disorder characterized by chronic hyperglycaemia resulting from a defect in insulin secretion, insulin action or both. Insulin resistance and beta-cell dysfunction precede the onset of T2DM and these defects are to be targeted to prevent development of T2DM.

Nearly 463 million people all around the world are living with diabetes. The International Federation estimates that there will be 578 million adults with T2DM by 2030 and is projected to have 783 million by 2045. India currently has a total of 77million people with T2DM. The impact of Diabetes leads to a huge economic burden on society in a developing nation like India.

Steady rise in prevalence of T2DM has been due to growing urbanization and changing lifestyle habits. Major risk factors include unhealthy diet, obesity, physical inactivity, smoking and alcohol. Genetic predisposition is unlikely to change so the scope and feasibility for primary prevention of T2DM are based on changes in environmental factors.

**Inflammations and Diabetes**: In last few years, low grade inflammation and chronic subclinical inflammation is associated with increased propensity for developing type 2 diabetes. Many observational studies have demonstrated approximately 5-10% prediabetics become diabetic each year. Recent epidemiological evidences also affirm the facts that inflammatory markers predict the development of diabetes and metabolic disorders. Two major pro-inflammatory cytokines TNF-α and IL-1B have been culpably involved for obesity associated insulin resistance and pathogenesis of T2DM.

**Evidence from clinical trials**: Evidences gathered from several clinical and epidemiological studies suggest that daily consumption of black tea may be associated with decrease in postprandial blood glucose and reduce pro inflammatory stress by altering levels of specific cytokines. It also lowers the risk of occurrence of type 2 diabetes mellitus and may even prevent progression. In a recent study by Chatterjee et al the authors had seen the effect of black tea on 9 pre diabetic subjects with metabolic syndromes. Their result demonstrated that the black tea consumption down regulated the serum lipid peroxides level, pro- inflammatory cytokines level (TNF alpha, interleukin 1 Beta) and up regulated the anti-inflammatory cytokines (IL-10) significantly. In the study done by Lisa Striegel et al, the authors had seen the inhibitory property of black tea and black tea extract on carbohydrate hydrolysing enzyme namely alpha glucosidase as well as their antioxidant property. Another study by Yali Jing et al, indicates that consumption of black tea of more than 3 cups per day may lower the risk of type 2 diabetes. However, they were unable to point out the exact reasons. A recent study done by Chandrima das et al, had shown that tannins (components of tea) are involved in enhancement of glucose uptake and inhibition of adipogenesis. Tea phytochemicals like polyphenols, methylxanthines (mainly caffeine) and L-thianine contribute to the anti-diabetic, anti-oxidant and neuro-protective properties of tea thus having positive effects on T2DM related problems and protecting the brain against oxidative damages.

**Conclusion**: Moderate black tea consumption seems to ameliorate the levels of risk factors which are independently linked with T2DM, obesity and cardiovascular disease. The beneficial effects of black tea are attributed mainly to the synergistic effects of tea phenolics and other antioxidant elements. Although the underlying plausible biological pathways for these effects warrants further extensive studies, black tea might provide an important source of dietary antioxidants in humans and seem to bestow protective effects against many metabolic diseases.

References:

1. Chatterjee, Sirshendu & Roy, Nirmalya & Saha, Arpita & Roy, Surmi & Chatterjee, Ananya & Hazra, Nandita & Lahiri, Soma & Maity, Chittaranjan & Bandyopadhyay, Sandip. (2014). Black Tea Consumption Enhance Antioxidant Status, Reduce Inflammatory Stress vis-a-vis Insulin resistance: Hint from a Small Clinical Cohort Study on Pre-diabetic Subjects. International Journal of Pharmaceutical Sciences Review and Research. 28. 278-283.
2. Roy, Nirmalya & Bhattacharjee, Kingshuk & Bandhopadhyaya, Sandip & Chatterjee, Sirshendu & Saha, Ashish & Chatterjee, Ananya & Saha, Arpita & Roy, Surmi & Maity, Chittaranjan. (2015). Effect of Black Tea on Diabetes and Metabolic Syndrome.
3. Roy, Nirmalya & Bhattacharjee, Kingshuk & Bandhopadhyaya, Sandip & Chatterjee, Sirshendu & Saha, Ashish & Chatterjee, Ananya & Saha, Arpita & Roy, Surmi & Maity, Chittaranjan. (2016). Effect of Black Tea on Diabetes and Metabolic Syndrome. The Indian Journal of Nutrition and Dietetics. 53. 354. 10.21048/ijnd.2016.53.3.5341.
4. Das C, Banerjee A, Saha M, Chatterjee S. A Review of the Health Benefits of Tea: Implications of the Biochemical Properties of the Bioactive Constituents. Curr Res Nutr Food Sci 2022; 10(2). doi : <http://dx.doi.org/10.12944/CRNFSJ.10.2.5>
5. Rasheed Z. Molecular evidences of health benefits of drinking black tea. Int J Health Sci (Qassim). 2019 May-Jun;13(3):1-3. PMID: 31123432; PMCID: PMC6512146.
6. Das C, Banerjee A, Saha M, Chatterjee S. A Review of the Health Benefits of Tea: Implications of the Biochemical Properties of the Bioactive Constituents. Curr Res Nutr Food Sci 2022; 10(2). doi : <http://dx.doi.org/10.12944/CRNFSJ.10.2.5>
7. Todd, M., Lisa, L. and Brooks, B.W. The effect of an extract of green and black tea on glucose control in adults with type 2 diabetes mellitus: double-blind randomized study. Metab., 2007, 56, 1340-1344
8. Striegel L, Kang B, Pilkenton S J, Rychlik Mand Apostolidis E(2015)Effect of black tea and black teapomacepolyphenols on α-glucosidase and α-amylase inhibition, relevant to type2diabetes prevention.Front.Nutr.2:3.doi:10.3389/fnut.2015.00003
9. Roy N, Chatterjee S, Bandhopadhyaya S, Maity C. Effect of tea on type 2 diabetes. International Journal of Clinical Cases and Investigations. 2014; 6(1): 61-68
10. Chatterjee S, Roy N, Saha A, Roy S, Chatterjee A, Hazra N et al. Black Tea Consumption Enhance Antioxidant Status, Reduce Inflammatory Stress vis-à-vis Insulin resistance: Hint from a Small Clinical Cohort Study on Pre-diabetic Subjects. Int. J. Pharm. Sci. Rev. Res. 2014; 28(2): 278-283
11. Jing, Y., Han, G., Hu, Y. et al. Tea Consumption and Risk of Type 2 Diabetes: A Meta-Analysis of Cohort Studies. J GEN INTERN MED 24, 557–562 (2009). https://doi.org/10.1007/s11606-009-0929-5