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Mini Review

Green Tea and Coronavirus Infection

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Abbreviations: SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2; EC: Epicatechin; EGC: Epigallocatechin; ECG: Epicatechin-3-gallate; EGCG: epigallocatechin-3-gallate; MERS-CoV: Middle Eastern Respiratory Syndrome Coronavirus; UPR: Unfolded Protein Response

Introduction

On the eve of 2020 the world was attacked by a new virus called Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), which lead to a pneumonia called 'covid-19'. Within less than three months, several countries became infected with the virus and Globally, by the time of writing this manuscript, there have been 9,413,289 confirmed cases of COVID-19, including 482,730 deaths, reported to WHO [1]. So far, no definitive treatment or confirmed vaccine has been found for this disease. COVID-19 and influenza viruses have similar disease presentations. They both cause multiorgan diseases especially involve respiratory system. The clinical manifestations of these viral infections may be mild or even asymptomatic to severe fatal illness [2]. Complementary medicine has long been considered for the treatment of diseases in Asian and Middle Eastern countries. Among them, drinking tea, has always been of interest to traditional healers.

Effective ingredients in green tea

Green tea (Camellia sinensis) has been shown to contain broad-spectrum antiviral effects against both DNA and RNA viruses [3]. Effective ingredients in green tea include the four main catechins: epicatechin (EC), epigallocatechin (EGC), epicatechin-3-gallate (ECG), and epigallocatechin-3-gallate (EGCG) [4]. EGCG, Quercetin and other catechins, are polyphenols known as flavonoids [5,6]. After ingestion of catechins, they undergo metabolic processing in the small intestine colon, and liver. This processing produces glucuronide and sulfate conjugates or methyl epicatechins [4]. Lim et al. demonstrated that green tea flavonoids have anti-inflammatory and anti-enzymatic activities by reducing NLRP3 inflammasome signaling, and consequently NFkB, TNF-a, IL-6, IL-1B and IL-18 expression [7].

Green tea and antiviral activity

Thus far, there has been no in vitro or clinical studies specifically on the effects of green tea in prevention and treatment of SARS-CoV2. However, previous studies demonstrated anti-viral effects of Green tea flavonoids in other members of coronavirus family and influenza viruses. Quercetin and EGCG were shown to inhibit the main protease of the SARS-CoV and Middle Eastern Respiratory Syndrome coronavirus (MERS-CoV) 3CLpro protease [8,9]. Moreover, Quercetin was demonstrated to modulate the cellular unfolded protein response (UPR) pathway and consequently inhibit coronavirus [10]. EGCG also exhibited antiviral activity by preventing the virus from entering the cell membrane in the early stages of infection [6,11]. In addition, it was shown that EGCG have antivi-

ral effects on influenza virus subtypes by inhibiting its replication, RNA synthesis and agglutination in cell culture [12].

Clinical data also supported the anti-viral benefits of green tea. Noda et al. studied the effect of gargling green tea in 19,595 children. In this study, four subgroups of children gargled water, saline water, green tea, and functional water for twenty days. The rates of fever onset and sickness absence from the school were significantly lower in the green tea gargling group. They suggested that gargling with green tea had a great impact on the febrile disease caused by viral respiratory infections (e.g. rhinovirus, RS virus, coronavirus, adenovirus, and influenza virus) [13].

Yamada et al. also showed that gargling with the catechin extract solution, three times a day for three months, significantly lowered the influenza infection in the elderly, without any adverse events [14]. Another study by Mijong Park et al. demonstrated that consumption of 1-5 cups of green tea on an almost daily basis (i.e. ≥6 d/wk) reduced the incidence of influenza infection [15]. Matsumoto et al. designed a randomized, double-blind, placebo-controlled trial on 197 adult healthcare workers, consuming catechin/theanine for five months. The incidence of clinically and laboratory influenza infection was significantly lower in the catechin/theanine group. They suggested that green tea supplements prevent infection with influenza virus [16].

Conclusion

Influenza epidemics occur in autumn and winter every year, and the end of Corona's pandemic is unknown [17]. In light of the previous studies demonstrating the beneficial effects of green tea in controlling the Influenza virus and SARS-CoV1, and genomic similarity between SARS-CoV1 and SARS-CoV2 [5], we highly recommend clinical studies to be conducted on the effects of green tea in prevention and treatment of Covid-19.

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