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Antioxidant and Sun Protection Capacity of Ceylon Black Tea Brew Based on Tea Grades and Manufacturing Technique

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Abstract

Sri Lankan-produced Ceylon black tea is well-known for its superior leaves and intense flavour. Ceylon black tea has been a recent interest for value-added products such as food/beverages and even cosmetics. However, the extraction of important bio chemicals with their bioactivities can be different among tea grades and their manufacturing process. The traditional orthodox technique involves hand-plucking, withering, rolling, and oxidation. The intense machinery process starts with pre-conditioning in a rotor vane followed by processing in the main Crush Tear Curl (CTC) tea machine. The study included six Ceylon black tea grades sourced from Sri Lanka's high-grown agro-climacteric elevations, each manufactured in two major techniques: orthodox and rotorvane-CTC (Broken Orange Pekoe (BOP), Broken Orange Pekoe Fanning's 1 (BOPF), Broken Orange Pekoe Special (BOPsp), Fanning's 1 (FNGS), Dust (D) and Dust 1 (D1)). Black Tea Brew (BTB) of each grade was tested for antioxidant potential: Total Phenol Content (TPC) as Gallic Acid Equivalent (GAE), Total Flavonoid Content (TFC) as Rutin Equivalent (RE), and DPPH free-radical scavenging percentage (DPPHfrs%) followed by *in-vitro* Sun Protection Factor (SPF). The TPC, TFC, DPPHfrs%, and SPF of black tea grades in the rotorvane-CTC technique ranged from 0.670 g/L to 1.011 g/L, 0.503 g/L to 0.692 g/L, 44.762% to 66.219% and 31 to 40 respectively. The black tea grades in the orthodox technique showed TPC, TFC, DPPHfrs%, and SPF values ranging from 0.792 g/L to 1.299 g/L, 0.385 g/L to 0.777 g/L, 60.784% to 71.821% and 29 to 44 respectively. The highest TPC, TFC, and SPF were observed in dust grade manufactured in orthodox technique. Further, the highest DPPHfrs% was observed in BOPsp grade in the orthodox technique. The carefully handled steps during the traditional method preserve more of the natural antioxidants of tea while the dust range produces finer particles facilitating better brewing. Ceylon black tea has antioxidant and sun protection capacities that can be beneficial for both gut and skin health hence possesses the potential for innovative products such as beverages, beauty teas, and cosmetics. The high bioactivity of the Ceylon black tea dust range, specifically manufactured in traditional orthodox technique, provides an economical opportunity for value-added production that can be introduced to the global market. The current study emphasizes the importance of considering the manufacturing technique of tea grades when incorporating them into value-added beverages or cosmetics to yield highly efficient extraction of different biochemicals and bioactivities as per the requirement of the end product.

Keywords: *Ceylon black tea, Orthodox tea, Rotorvane CTC tea, Antioxidant capacity, Sun protection factor*