Invited Commentary

Green tea catechins suppress NF-κB-mediated inflammatory responses: relevance to nutritional management of inflammation

Blood loss after trauma induces several systemic inflammatory responses culminating in the dysfunction and failure of organs. In this issue of the British Journal of Nutrition, Relja et al. have examined the inflammatory signals at the subcellular, cellular and tissue levels after haemorrhage-induced hepatic injury and resuscitation in rats. Hepatic injury and resuscitation induced the expression of intercellular adhesion molecule-1, neutrophil infiltration and necrosis in the liver, and augmented serum alanine transaminase and IL-6 levels. It also induced IkBα phosphorylation and the activation of NF-κB. Pre-treatment with green tea extract (GTE: catechins >80%, with >40% of epigallocatechin gallate (EGCG)) suppressed the inflammatory responses at all levels, including neutrophil infiltration, intercellular adhesion molecule-1 expression and the release of IL-6, and, importantly, suppressed the activation of NF-κB.

The inflammatory responses occurring in the liver after haemorrhage are parallel to the inflammatory events occurring after inducing ischaemia, and EGCG is also active in the latter setting. The anti-inflammatory efficacy of EGCG demonstrated in all these studies generates a unifying hypothesis. Hepatic injury induced by ischaemia caused oxidative stress with enhanced production of reactive oxygen species and TNF-α; both mediated the expression of nuclear factors and kinases, activating the signal transduction pathways to trigger cell death. The liver that stained positive for NF-κB in the ischaemia group remained negative after EGCG. Ischaemia-induced myocardial injury also caused significant neutrophil infiltration, an increase in plasma IL-6, and activation of IkB kinase and NF-κB in the tissues. EGCG pre-treatment significantly reduced myocardial damage, neutrophil infiltration and plasma IL-6, and also suppressed the NF-κB pathway. Intestinal injury induced by ischaemia resulted in an enhanced production of reactive oxygen species, neutrophil infiltration and activation of NF-κB. EGCG pre-treatment significantly deactivated NF-κB, decreased neutrophil infiltration and lowered reactive oxygen species production. All these studies support the conclusion derived by Relja et al. and collectively point out that induced inflammatory responses are mediated through NF-κB-dependent mechanisms, and EGCG per se or in combination with other catechins suppresses NF-κB activation and alleviates inflammation.

There are enumerable reports on the efficacy of EGCG alone or EGCG in combination with other catechins (epigallocatechin or epicatechin gallate or gallocatechin gallate on inflammatory responses induced by different exogenous and endogenous factors. The inflammatory inducers include polymicrobial sepsis, lipopolysaccharide, Staphylococcus aureus enterotoxin B, Helicobacter pylori infection, IL-1β alone or in combination with β-amyloid or oxygen tension or TNF-α or TNF-α alone, UV-B, repetitive oxidative stress, cigarette smoke condensate, phorbol 12-myristate 13-acetate, trinitrobenzenesulphonic acid, or acetic acid-induced colitis, receptor activator for the NF-κB ligand, or high glucose. Most importantly, all these studies document that consequent to the downregulation of NF-κB pathways, EGCG or catechin combination suppressed the levels of several pro-inflammatory cytokines (TNF-α, IL-6, IL-8, interferon-γ, chemokine (Fractalkine) and enzymes (matrix metalloproteinases-1, -3, -9, -13, -17, -20, -27, -28), NO synthase, cyclo-oxygenase-1, -2, glucosyl/lycosyl and Gb3 transferases, growth factors (vascular endothelial growth factor), cell adhesion molecules (intercellular adhesion molecule-1, vascular cell adhesion molecule-1 and E-selectin) and monocyte chemotactic protein-1. In this regard, the study of Relja et al. is well justified in the use of GTE, since other tea catechins act synergistically with EGCG. It is important to use GTE with a greater percentage of EGCG to counteract inflammation. These preclinical studies on the induced inflammatory responses promote the hypothesis that green tea catechins have the potential to suppress the NF-κB-mediated inflammatory pathway into a salient concept relevant to nutritional management of inflammation. The emerging concept is that EGCG or GTE has the potential to block the NF-κB pathway, which plays a critical role in inflammation induced by various factors and also in malignancy. These aforementioned studies pave the way for phase I and II clinical trials using GTE or EGCG to control trauma, haemorrhage or ischaemia-induced inflammation.

There is no conflict of interest.

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References

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