Original Article | Published: 11 March 2021

Cinnamaldehyde targets TLR-4 and inflammatory mediators in acetic-acid induced ulcerative colitis model

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Biologia **76**, 1817–1827 (2021)

Abstract

Cinnamon and its bioactive ingredients such as cinnamaldehyde (CA), with broad pharmacological profiles, are important parts of daily diet in many cultures. Moreover, there are plenty motivating patents on efficacy of nutritional phytochemicals as novel anti-inflammatory drugs in patients with inflammatory bowel disease (IBD). This study intended to evaluate the effects of CA on inflammatory biomarkers in acetic acid-induced colitis rats. Colitis was induced in all animals, except in sham group, using acetic acid (4%). Following colitis induction, in 3 groups, CA was administrated orally at 2, 4 and 8 mg/kg/day for 2 days (once a day). Other groups were defined as the control (only

treated with acetic acid), sham group (normal saline), and a standard group (Dexamethasone). To evaluate the inflammation sites, macroscopic and microscopic markers were assessed. Tissue concentrations of interleukin (IL)-6 and tumor necrosis factor-alpha (TNF)-α, were assessed by ELISA assay kits, while myeloperoxidase (MPO) was measured spectrophotometrically. The mRNA expression of toll like receptor (TLR)-4 in colon tissue was assessed by Real time-PCR. CA at 4 mg/kg/day and 8 mg/kg/day significantly improved microscopic and macroscopic manifestations of colitis tissues. TNF-α, MPO, and IL-6 levels were significantly lower in CA treated groups at all the concentrations tested ($P < 0.001$). CA at 4 and 8 mg/kg/day significantly downregulated the mucosal gene expression of TLR-4. CA attenuated experimental colitis by means of colitis symptoms, reduction in inflammation cytokines, decline of neutrophil infiltration, and suppression of TLR-4 expression in acetic acid-induced colitis. CA improved colitis in animal model through suppression of inflammatory parameters and downregulation of TLR-4 mRNA expression.

Availability of data and materials

Not applicable.

Code availability

Not applicable.

Abbreviations

IBD: inflammatory bowel disease

UC: Ulcerative Colitis

CA: cinnamaldehyde

TNF-α: tumor necrosis factor-alpha

MPO: myeloperoxidase

IL: interleukin

TLR: toll like receptor

LPS: lipopolysaccharide

HTAB: hexadecyltrimethylammonium bromide

RT-PCR: real time-reverse transcription polymerase chain reaction

NO: nitric oxide

iNOS: inducible nitric oxide synthase

COX-2: cyclooxygenase-2

ERK: extracellular signalregulated kinases

MAPK: mitogen activated protein kinase

NF-κB: nuclear factor kappa-light-chain-enhancer of activated B

NIK: NF-κB inducing kinase

IKK: IκB kinase

Dexa: Dexamethasone

U/g: units per gram

ROS: reactive oxygen species

JNK: c-Jun N-terminal kinases

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Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Ethics declarations

Conflict of interest

The authors declare no conflict of interest.

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Cite this article

Momtaz, S., Navabakhsh, M., Bakouee, N. *et al.* Cinnamaldehyde targets TLR-4 and inflammatory mediators in acetic-acid induced ulcerative colitis model. *Biologia* **76**, 1817–1827 (2021). https://doi.org/10.1007/s11756-021-00725-w

Received	Accepted	Published
05 December 2020	19 February 2021	11 March 2021

Issue Date
June 2021

DOI
https://doi.org/10.1007/s11756-021-00725-w

Keywords

Cinnamaldehyde (CA)

Inflammatory bowel disease (IBD)

Tumor necrosis factor-alpha (TNF-α)

Myeloperoxidase (MPO)

Toll like receptor 4 (TLR-4) **Interleukin 6 (IL-6)**