

The fermented non-digestible fraction of common bean (*Phaseolus vulgaris* L.) triggers cell cycle arrest and apoptosis in human colon adenocarcinoma cells

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Received: 3 June 2013 / Accepted: 7 November 2013
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Abstract Cancer is a leading cause of death worldwide with colorectal cancer (CRC) ranking as the third contributing to overall cancer mortality. Non-digestible compounds such as dietary fiber have been inversely associated with CRC in epidemiological in vivo and in vitro studies. In order to investigate the effect of fermentation products from a whole non-digestible fraction of common bean versus the short-chain fatty acid (SCFAs) on colon cancer cells, we evaluated the human gut microbiota fermented non-digestible fraction (hgm-FNDF) of cooked common bean (*Phaseolus vulgaris* L.) cultivar Negro 8025 and a synthetic mixture SCFAs, mimicking their concentration in the lethal concentration 50 (SCFA-LC₅₀) of FNDF (hgm-FNDF-LC₅₀), on the molecular changes in human colon adenocarcinoma cells (HT-29). Total mRNA from hgm-FNDF-LC₅₀ and SCFA-LC₅₀ treated HT-29 cells were used to perform qPCR arrays to determine the effect of the treatments on the transcriptional expression of 84 genes related to the p53-pathway. This study showed that both treatments inhibited cell proliferation in accordance with

modulating RB1, CDC2, CDC25A, NFKB and E2F genes. Furthermore, we found an association between the induction of apoptosis and the modulation of APAF1, BID, CASP9, FASLG, TNFR10B and BCL2A genes. The results suggest a mechanism of action by which the fermentation of non-digestible compounds of common bean exert a beneficial effect better than the SCFA mixture by modulating the expression of antiproliferative and pro-apoptotic genes in HT-29 cells to a greater extent, supporting previous results on cell behavior, probably due to the participation of other compounds, such as phenolic fatty acids derivatives and biopetides.

Keywords Common bean · SCFA · Non-digestible fraction · Colorectal cancer · PCR-arrays

Introduction

Colorectal cancer (CRC) is the third leading cause of cancer-related mortality projected to increase in the future (WHO 2011). Cancer was considered a disease of westernized, industrialized countries. However, the situation has changed dramatically, with the majority of the global cancer burden now found in low- and medium-resource countries (Boyle and Levin 2008).

An inverse association between dietary fiber intake and CRC incidence has been shown in epidemiological studies (Dahm et al. 2010). Additionally, research on in vivo and in vitro models has shown the protective role of pulses, primarily due to the presence of indigestible compounds, such as phenolics (condensed tannins, flavonoids and anthocyanins), total dietary fiber (soluble and insoluble), and other secondary metabolites related to the prevention and/or reduction in chronic degenerative diseases (Bazzano

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