Antimicrobial properties of phenolic compounds from sorghum

By

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Declaration

I declare that this dissertation that I hereby submit for the degree of MSc (Agric) Food Science and Technology at the University of Pretoria is my own work and has not been previously submitted by me for a degree at any other University or institution of higher education.

Tshiwela Norah Khadambi

Dedication

I dedicate this dissertation to my late father Mr Johannes Khadambi, my mother Mrs Gladys Khadambi, my sister Joyce Khadambi, my brothers Michael and Khathutshelo Khadambi, my sister-in-law Nancy Khadambi, as well as to the rest of Khadambi family.

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Abstract

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Sorghum grains contain phenolic compounds that have been shown to have many favourable effects. In this study the levels of phenolic compounds in condensed tannin and condensed tannin-free sorghums have been determined and the antimicrobial activity of phenolic extracts from bran fractions of the respective sorghums has been further evaluated against pathogenic bacteria *Bacillus cereus* ATCC 1178, *Escherichia coli* ATCC 25922 and *Listeria monocytogenes* ATCC 7644.

Defatted bran fractions prepared from a condensed tannin sorghum variety (red) and a condensed tannin-free sorghum variety (white) were analysed for their content of total phenols and condensed tannins. Total phenols were determined using the Folin-Ciocalteu method and condensed tannins with the vanillin-HCL method. Total phenols and condensed tannins of the bran fractions were extracted with aqueous acetone (75 % v/v) and acidified methanol (1% HCL v/v in methanol) respectively, using a bran-to-solvent ratio of 1:4 (w/v). Red sorghum bran contained a higher amount of total phenols and condensed tannins (33.18 mg tannic acid equivalent/g and 117.98 mg catechin equivalent/g of the bran fractions, respectively) than white sorghum bran (6.81 mg tannic acid equivalent/g and 8.52 mg catechin equivalent/g of the bran fractions, respectively).

Freeze-dried sorghum crude phenolic extracts (CPE) obtained from defatted bran fractions of condensed tannin and condensed tannin-free sorghum varieties were evaluated for their antimicrobial activities against *Bacillus cereus* ATCC 1178, *Escherichia coli* ATCC 25922 and *Listeria monocytogenes* ATCC 7644 pathogenic

bacteria. The extracts were tested at 1, 2, 4 and 20 % concentrations (w/v) in methanol using the paper disc diffusion method and absolute methanol was used as a control. The condensed tannin-free sorghum CPE at concentrations 1, 2 and 4 % had no inhibitory effects on the bacteria tested but was effective against Gram-positive bacteria, *B. cereus* ATCC 1178 and *L. monocytogenes* ATCC 7644 at a concentration of 20 %. The condensed tannin sorghum CPE was effective against *B. cereus* ATCC 1178 and *L. monocytogenes* ATCC 7644 at concentrations 1 , 2 , 4 and 20 %. None of the tested sorghum extracts inhibited the Gram-negative bacteria, *E. coli* ATCC 25922. Phenolic extracts from condensed tannin sorghum may be used as antimicrobial agents to prevent the growth of Gram-positive bacteria, *B. cereus* ATCC 1178 and *L. monocytogenes* ATCC 7644.

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