EFFECT OF EXTRUSION ON HIGH-TANNIN COLORED SORGHUMS

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Sorghum bicolor(L.) Moench are mainly consumed in Brazil as animal feed. Human consumption has been limited principally due to tannin and insoluble fiber contents. Tannins have ability to complex with proteins and digestive enzymes. Extrusion cooking is a process that combines shear, pressure and temperature that leads to intra and inter molecular rearrangements between starch, protein and fiber components. Decrease in the level of phenolic compounds after extrusion is related to thermal decarboxylation and polymerization promoted by high moisture contents. The objective of this study was to evaluate the effect of thermoplastic extrusion on two high-tannin sorghums. Sorghum genotypes cultivated by Embrapa (BRS305 and 9929034) characterized by brown pericarp were milled in order to obtain ground material and processed at the same operating parameters of extrusion: co-rotating twin-screw extruder using a die with four round openings of 3.8 mm each, 14% of final moisture content, constant screw speed, set barrel temperatures of 10 zones and dry feed rate (600 rpm, 30 to 150°C and 9 kg/h). Results showed condensed tannins content of 13.2 (BRS 305 flour) and 5.1 mg/g (9929034 flour) and neutral detergent fiber of 12.6 and 11.4 g/100g, respectively. It was observed a significant decrease of condensed tannins in extruded products BRS305 (66.8%) and 9929034 (24.3%) compared to control. These losses were mainly due to processing conditions: high temperature profiles and low moisture content. The particle size distributions of flours revealed that 9929034 has approximately 2 times more coarse particles (> 1400mm) than BRS305.Higher fiber content in BRS305 flour leads to a higher specific mechanical energy value (1518.9 kJ/kg) during extrusion process compared to 9929034 flour (1291.9 kJ/kg). Sectional expansion index (SEI) of extrudates was not influenced by condensed tannin content ($p<0.05$), also observed in bulk density values. Water absorption index (WAI) did not show significant statistical difference ($p<0.05$) between extrudates (3.91 and 3.93 g/g). In contrast, water solubility index (WSI) of extrudates was influenced by tannin content showing statistical difference ($p<0.05$), in which the expanded extrudate obtained by 9929034 flour (21.2 g/100g) is less soluble than BRS305 (24.2 g/100g). These findings indicate the potential use of extrusion on the 9929034 variety to produce a whole grain sorghum breakfast due to its ability to remain less soluble after pouring liquid, maintaining the structure and improving nutritional quality in terms of fiber and antioxidant contents.

Keywords: Sorghum, extrusion, co-rotating twin-screw extruder, whole-grain cereal.
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