



# **BIO-SUSTENTABILIDADE E BIO-SEGURANÇA ALIMENTAR, INOVAÇÃO E QUALIDADE ALIMENTAR**

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## Bread development with partial replacement of wheat flour by sorghum flour (*Sorghum bicolor* (L.) Moench) germinated and *in natura*

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Sorghum (*Sorghum bicolor* (L.) Moench) is an Unconventional Food Plant (PANC) that has nutritional and chemical qualities with potential applications in the development of new products. Even with all the abundance of plants that have food potential, more than half of the global energy need is currently met by just four crops: rice, potato, wheat, and corn. Therefore, there is a gap in food biodiversity for human consumption. Bread products are the most consumed and easily accepted by the consumer, however, the application of sorghum for bread formulation requires additional technological practices, since PANC do not have the gliadin and glutenin proteins that form gluten, which is responsible for the structure and softness, essential and appreciation characteristics derived from wheat flour. Thus, the use of sorghum in bakery is a more complex process that requires association with other types of flour and technologies to give better results to the final product<sup>1</sup>. Sorghum germination is a technological alternative for nutritional and chemical improvement, since the germination process can increase starch and protein digestibility in addition to reducing anti-nutritional compounds such as phytate inhibitors, tannins and enzyme inhibitors and increase the concentration of enzymes, proteins and phenolic compounds, favors the release of bioactive peptides, which can exert a wide range of biological functions, beneficially affecting antioxidant, anti-inflammatory and antimicrobial activity, being of great value to the bakery industry<sup>2</sup>. The present work aims to develop four baking formulations with replacement of 15 and 30%, respectively, of wheat flour by germinated and *in natura* sorghum flour. The germination process was carried out with maceration of the grains for 24 hours, then drained, followed by another 24 hours at 30°C in an incubator for germination and then dried and crushed. The following physical parameters were evaluated: texture at different storage times (24, 72 and 120 hours) according to the AACC 74-094 method, using a texturometer (TA HD plus model, Stable Micro System, Godalming, United Kingdom), specific volume by seed displacement technique, colorimeter staining (model CR400, Konica Minolta, New Jersey, USA) and water activity of the loaves were determined using AquaLabDew Point water activity meter. The formulations with substitutions of 15% and 30% of *in natura* sorghum flour showed lower crumb firmness after 24h of storage ( $237.16 \pm 8.72$  and  $789.17 \pm 14.62$  g/force, respectively) and higher volumes specific, namely,  $2.95 \pm 0.11$  and  $3.89 \pm 0.17$  g/mL. The bread formulations with the replacement of 15% and 30% of germinated sorghum showed greater crumb firmness ( $1388.35 \pm 43.66$  and  $2998.26 \pm 137.79$  g/force, respectively) and lower specific volumes ( $2.29 \pm 0.04$  and  $2.43 \pm 0.11$  g/mL, respectively). The formulation with 30% of germinated sorghum flour showed greater firmness after 120 h of storage with  $3525.55 \pm 19.58$  g/force, whereas the formulation with 15% of *in natura* sorghum flour showed less firmness after 120h of storage ( $335.02 \pm 4.92$  g/force). The formulations with percentages of sorghum flour had no significant differences in terms of water activity after 120 h of storage. The control formulation showed significant differences in firmness on the day of preparation. The color of germinated and *in natura* sorghum flours only showed significant differences for the  $a^*$  parameter. Regarding the coloring of the baked bread formulations, all formulations showed significant differences. The formulations with germinated sorghum flour replacement showed higher averages for the parameters  $L^*$ ,  $a^*$  and  $b^*$ , therefore, they presented a darker color in relation to the formulations of *in natura* breads. Breads with partial replacement of wheat flour by *in natura* and germinated sorghum flour obtained crumb structure, specific volume and color similar to other formulations of breads rich in fiber and whole grain<sup>3</sup>, demonstrating the technological potential for use of germinated sorghum flour in bakery products development.

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