

Technological Evaluation of High Fiber And Gluten-Free Breads Made With Teff (*Eragrostis tef*) and Associated Flours

Raisa Homem,¹ Cristina Proserpio,² Camilla Cattaneo,²
Fernanda Rockett,¹ Helena Schmidt,¹ Marina Komerowski,¹
Alessandro Rios,¹ and Viviani Oliveira¹

¹UFRGS and ²Università Degli Studi di Milano

Objectives: This study aimed to evaluate technological parameters of high fiber and gluten-free breads made with teff (*Eragrostis tef*) and associated flours.

Methods: Four formulations were evaluated: T1, without teff (100% wheat flour- standard); T2, with 100% teff flour; T3, with 75% teff flour, 12.5% rice flour, and 12.5% cassava starch, and T4, with 50% teff flour, 25% rice flour, and 25% cassava starch. Hardness was verified using a texturometer TA.XT plus and a cylindrical probe with a 36 mm radius, by compressions performed on 12 slices of 2 cm thick and three replicates. The maximum force was determined in the first compression cycle and defined from the following conditions: cylindrical texturometer, maximum test speed of 4.0 mm/s; minimum test speed of 0.01 mm/s; rupture distance of 0.001 mm. The other rheological parameters such as: elasticity, cohesiveness, resilience, chewiness and gumminess were calculated. The results were evaluated

through analysis of variance, followed by Tukey test, 5%, SPSS Statistics, version 21.0.

Results: The crust hardness in T1 was significantly ($F = 33.09$; $p < 0.0001$) higher (188g, force) than the other samples: T2 (48 g, force), T3 (40g, force) and T4 (59g, force), which were comparable to each other. Regarding crumb hardness it was observed that T1 showed significant ($F = 6.20$; $p < 0.05$) higher hardness compared to T3 (1681 g, force) and T4 (1716 g, force) and was comparable to T2 (2188g, force). The crumb elasticity was significantly ($F = 27.0$, $p < 0.0001$) higher in T2 (1.10 mm), T3 (1.10 mm) and T4 (1.10 mm) compared to T1 (1.07 mm). Cohesiveness was the unique rheological parameter that it was observed to change among the breads made with teff. The crumb resilience, chewiness and gumminess were significantly higher in T1 ($F = 16.31$, $p < 0.05$; $F = 25.69$, $p < 0.0001$; $F = 29.04$, $p < 0.0001$, respectively) than bread samples with teff. In relation to pH results it can be observed that T1 (5.8) was significantly more acid ($F = 95.4$, $p < 0.0001$), than the other samples.

Conclusions: Teff has shown promising behavior as a new ingredient in food formulation in order to face the worldwide increasing celiac disease. The results suggest that it is possible to develop new gluten-free bakery products using teff flour without decreasing technological quality.

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