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# PERFORMANCE OF GERMINATED QUINOA AND CAÑIHUA FLOURS MIXED WITH MAIZE FLOUR ON TECNOLOGICAL PARAMETERS OF EXTRUDED SNACKS

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Grain germination is a feasible, ecological and low-cost technique that promotes modification of matrix components through endogenous enzymes, modifying the technological behavior of the flours when submitted to technical processing. This work desired to evaluate the performance of maize and germinated quinoa (42h/20°C) and cañihua (72h/20°C) grain flours during the extrusion process for extruded snacks production. The trials were constructed through a simplex-centroid mixture design and the dependent variables were analyzed using a response surface methodology ($P$<0.10 and $R^2$>0.80). The fixed parameters were feed rate (25kg/h), screw speed (120rpm), the temperature of seven zones (30–115°C) and die (6mm ϕ). The expansion index (EI) of the trials varied between 0.88 and 2.10 ($P$<0.001, $R^2$=0.9526) and the bulk density (BD) ranged between 0.19 and 0.73mg/cm$^3$ ($P$=0.003, $R^2$=0.8016). The shear force presented data between 10.16 and 58.41N ($P$=0.084, $R^2$=0.6742) and the work of shear (WS) was found from 14.11 and 331.66N/s ($P$=0.001, $R^2$=0.9515), and the best extrudate was achieved with higher levels of maize and lower levels of quinoa flours. The use of germinated cañihua flour showed slight effects on the responses and could be used by any amount. Germinated cañihua flour favored the dextrinization process while extrusion, showing higher solubility in water (WSI) ($P$=0.001, $R^2$=0.8579) and lower water absorption (WAI) values ($P$<0.001, $R^2$=0.9341). For color parameters, the use of higher levels cañihua and quinoa flours and lower levels of maize flour resulted in darker snacks ($L^*$ = 34.89–61.23; $P$<0.001, $R^2$=0.9861) and with a lower yellowish hue ($b^*$ = 20.52–37.65; $P$<0.001, $R^2$=0.9808) and higher values of $a^*$ (5.99–10.73; $P$<0.001, $R^2$=0.9562). The optimal point was determined aiming at higher values of EI, $a^*$ and WSI and lower values for BD, WS, $L^*$, $b^*$ and WAI. The optimal formula was obtained using 0.11 of maize, 0.55 of quinoa and 0.34 of cañihua, with a desirability of 66.40%.

*Keywords*: Cell structure; cereals; hydrogen bond; sprouting; pseudocereals.

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