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APPLICATION OF PUMPKIN SEED CAKE AND MILLET FLOUR IN IMPROVEMENT OF NUTRITIVE VALUE OF ENRICHED BUCKWHEAT GLUTEN FREE BREAD

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INTRODUCTION:

Celiac disease develops in 10% of diabetes type 1 patients. Gluten free products often have a high glycemic index, a short shelf life, and are a poor source of micronutrients. There is a need for development of optimized gluten free recipes with a high nutritive value, lowered glycemic index, and an improved texture. The objective of this research was to optimize the recipe for gluten free bread with buckwheat and whole grain rice flour as basis, by varying the amounts of pumpkin seed cake and whole proso millet flour. This was meant to be accomplished by using a by-product of the oil production industry, pumpkin seed cake, as well as an underutilized cereal proso millet. Pumpkin seed cake is a nutritious raw material which is currently mainly used as feed and for protein isolation.

MATERIALS AND METHODS:

Pumpkin seeds

Pumpkin seed cake flour (B)

Whole proso millet flour (P)

Central composite design
varying the amount of
pumpkin seed cake flour
(10%, 20%, 30%)
and
proso millet flour
(10%, 30%, 50%):
13 experiments
9 recipes
5 replications of the central point

15% Buckwheat flour
Remaining = rice flour

Effect on: 1. nutritive value (AACC Methods and ICC Standard), 2. loaf yield, 3. volume (AACC 10-05.01), 4. crumb texture (TPA test), 5. sensory analysis. Finalized with optimization (Design expert, Stat-Ease, v11) and glycemic index determination (ISO 26642).

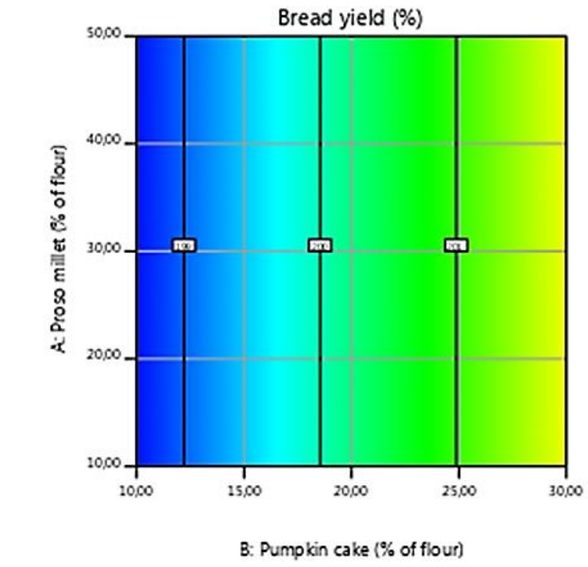

Fig 1. Bread yield depending on the amount of pumpkin seed cake and whole proso millet flour

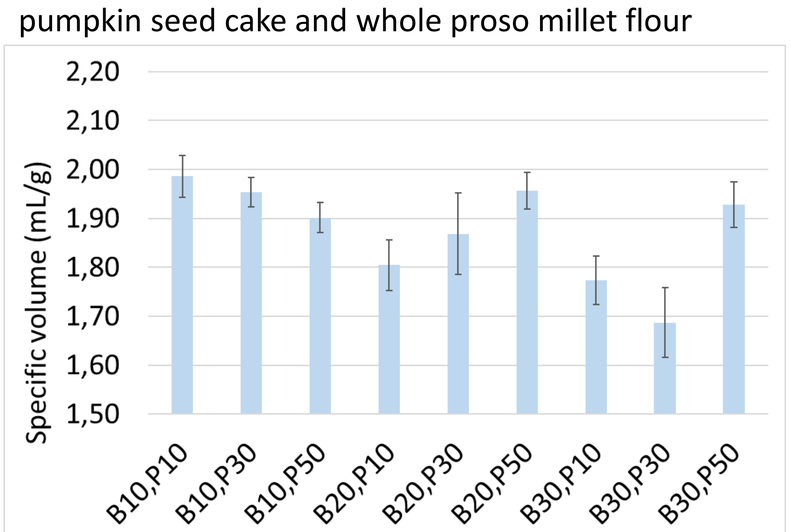

Fig 2. Specific volume of bread loafs containing different amount of pumpkin seed cake (B – 10,20,30%) and proso millet flour (P – 10,30,50%)

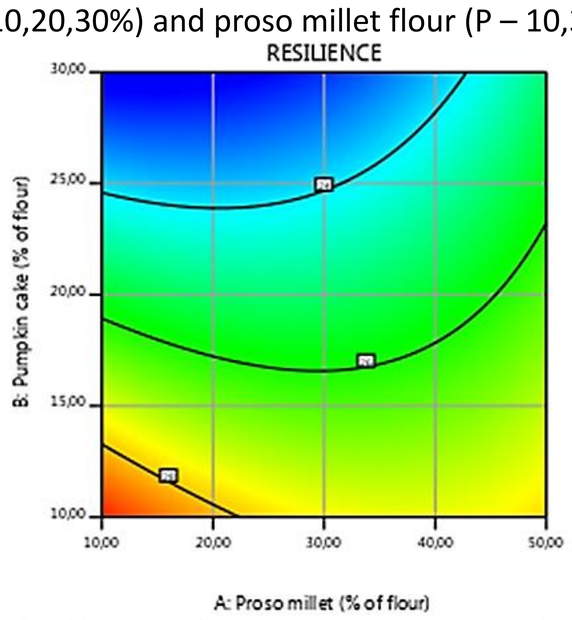

Fig 3. Resilience of bread crumb depending on the amount of pumpkin seed cake and proso millet flour

DISCUSSION AND RESULTS:

Pumpkin seed cake and whole proso millet flour were added to a buckwheat gluten free bread in order to achieve a bread with a higher nutritive value, customized for those suffering from combination of celiac disease and diabetes, meaning, containing a higher content of fiber and protein, and a lower content of carbohydrates. Considering the composition of macro- and micronutrients, it is desirable that a maximum amount of rice flour is supplemented with millet and pumpkin seed flour. However, the texture and sensory appeal of bread must be taken in consideration and in fact, were the limiting factors in recipe optimization calculation. Optimization was done by achieving the maximum yield, volume, resilience, cohesiveness, and springiness; but minimum hardness, gumminess, and chewiness. The optimal bread was composed of 12.7% pumpkin seed cake flour and 10% whole proso millet flour. The same desirability (0.6) was achieved for the bread containing 13% pumpkin seed flour and 50% of whole proso millet flour. Therefore, sensory analysis was the concluding factor in assessment of the optimal composition of gluten free bread. Favorable bread by the sensory panel was the one containing 13% pumpkin seed cake flour and 50% whole proso millet flour. Glycemic index of this bread was measured to be 68, and the glycemic load for a 45 g portion of bread was 10. Nutritive value was significantly improved compared to these kind of products. It contained 21 g protein, 4,8 g dietary fibre, 21 g carbohydrates, and 2,9 g fat (expressed to 100 g of bread), and could therefore be declared as a source of fiber and protein.

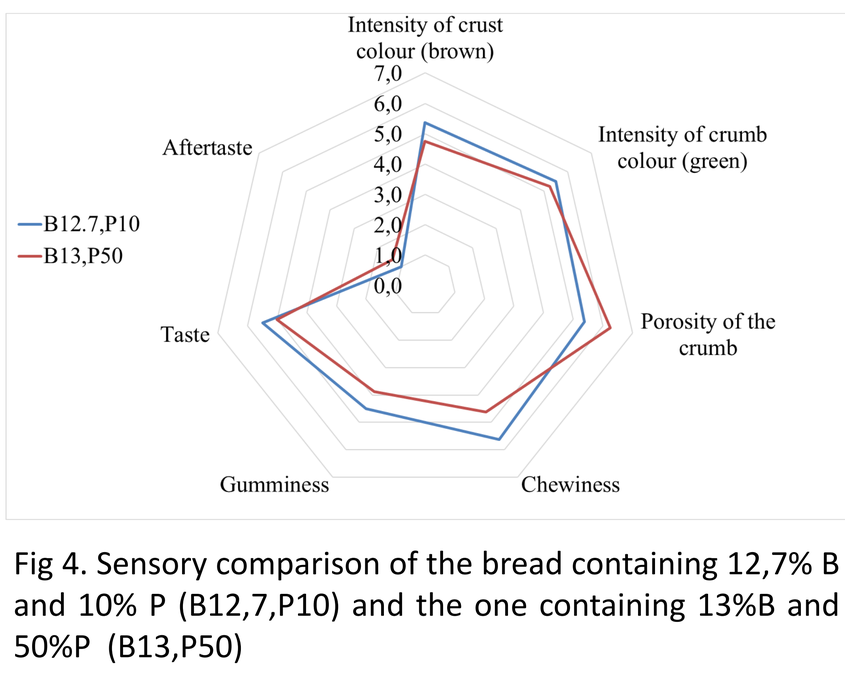

Fig 4. Sensory comparison of the bread containing 12,7% B and 10% P (B12,7,P10) and the one containing 13%B and 50%P (B13,P50)

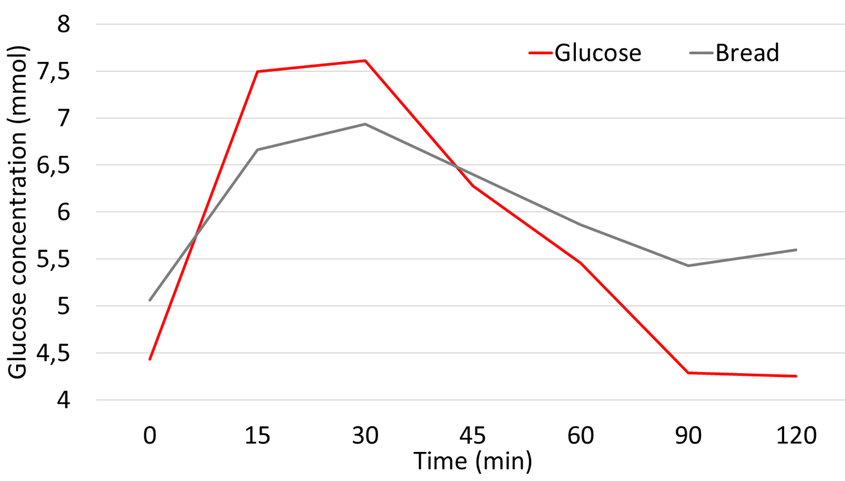

Fig 5. Glucose concentration in blood over two hours a after consummation of standard (glucose) and the optimal bread containing 13% pumpkin seed cake flour and 50% whole proso millet flour

Fig 6. Crumb of the optimal bread containing 13% pumpkin seed cake flour and 50% whole proso millet flour

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