Wheat bread (WB) was baked with the single-stage (1F) and two-phase (2F) method. In the both methods CF was used to prepare blends with WF in 0/100, 5/95, 10/90, 15/85, 20/80 and 25/75 ratios. The control sample was 100 % WB.

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Optimizing Sourdough Production Using Fine-Ground Flours Including Key Parameters and Their Impact on Wheat Bread Quality

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INTRODUCTION & AIM

Fine-ground flours are produced by milling grains to a much finer particle size compared to standard flour, resulting in a smoother texture and a more uniform consistency. This increased surface area of the flour particles enhances their ability to absorb water, which can significantly affect the dough's hydration, elasticity, and overall handling. In **sourdough** production, fine-ground flours can improve fermentation dynamics due to their ability to trap gases more effectively, leading to better dough rise and crumb structure. The fine texture also contributes to a more even distribution of starches and proteins, which facilitates enzymatic activity and fermentation, enhancing the flavor and nutritional profile of the bread. In terms of sensory qualities, breads made with fine-ground flours often exhibit a softer crumb, a finer texture, and a more refined taste. Additionally, these flours can create a more consistent and predictable dough development, which is particularly valuable in commercial baking where consistency is key. However, the fine particle size may also reduce some of the bran and germ components, potentially decreasing the fiber content of the flour, which is something to consider when balancing nutrition and texture in bread production. Therefore, understanding the interaction between fine-ground flours and sourdough fermentation parameters is crucial for optimizing bread quality.

This study aimed to identify optimal recipes and conditions for creating fine-ground wholegrain flour sourdoughs and to evaluate the quality of wheat bread made with 20% of these sourdoughs.

METHOD

Sourdoughs were prepared from wholegrain flours of wheat (WWF), rye (WRF), spelt (WSF), barley (WBF), buckwheat (WBWF), and sorghum (WSGF) using a Fermentor Diosna & IsernHäger AF Compact 100 HC with a wheat starter culture. The sourdough fermentation was conducted over 20 hours at 30°C. Quality assessments of the sourdoughs included pH measurement, total titratable acidity (TTA), and volatile compound analysis via GC-MS. Bread was baked with these sourdoughs using a single-phase method in a Home Bakery ETA 2147 Duplica Vital, applying a 3-hour classic program in a controlled laboratory setting at the Department of Carbohydrates and Cereals, UCT, Prague. The control flour for baking was a special wheat flour type 530 (SWF). Post-baking, bread weight, volume (using the mustard seed displacement method), and crumb stiffness (measured by penetrometer) were recorded.
The selected sourdough yields were **250% for WWF, WSF, WBWF**, and **WSGF**; **280% for WBF**; and **300% for WRF**. The dough yield for baking was standardized at 165%.

RESULTS & DISCUSSION

Table 1. Quality assessment of sourdoughs.

sourdough type	pH	TTA [°]
wheat flour	3,70 e	16,9 b
rye flour	3,76 d	15,8 c
spelta flour	3,86 c	17,2 a
barley flour	3,92 b	17,2 a
buckwheat flour	4,09 a	16,8 b
sorghum flour	3,70 e	15,4 d

Mean values bearing different letters in the same column denote statistical difference (a > b > c ... etc.). p<0,05;

RESULTS & DISCUSSION

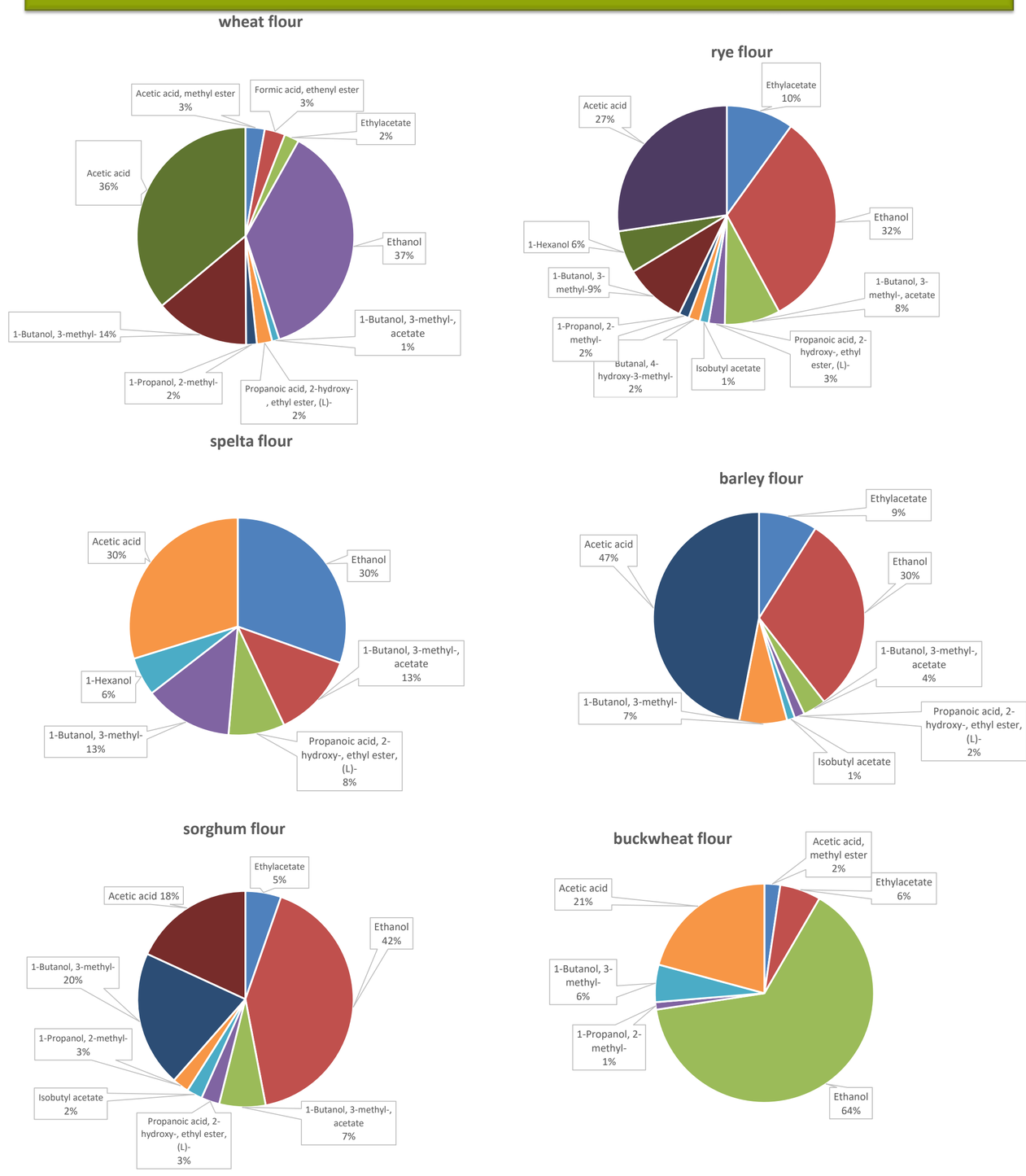

Figure 1. Volatile compounds in sourdoughs.

Table 2. Quality assessment of breads.

	Overbake [%]	Bread volume [cm³/100g flour]	Crumb stiffness [mm]
wheat flour	43,0 a	516 a	28,4 a
rye flour	41,8 ab	464 cd	24,2 bc
spelta flour	39,8 b	484 b	24,5 bc
barley flour	41,6 ab	460 cd	20,8 d
buckwheat flour	41,0 ab	468 c	22,6 c
sorghum flour	42,0 ab	460 cd	21,3 d
flour special control	36,4 c	520 a	24,7 b

Mean values bearing different letters in the same column denote statistical difference (a > b > c ... etc.). p<0,05;

CONCLUSION

GC-MS analysis identified 24 volatile compounds, predominantly alcohols and organic acids, with lesser amounts of esters, aldehydes, terpenes, furans, and ketones. Bread containing WWF sourdough exhibited the highest weight and the softest crumb, while control (SWF) bread had the lowest weight. Both WWF and SWF breads showed the highest volume. In contrast, bread with WSGF sourdough had the hardest crumb. These findings suggest that WWF sourdough yields the most favorable bread characteristics among the tested flours.

FUTURE WORK / REFERENCES

The pseudocereal sourdoughs discussed here can be used to bake gluten-free breads or cakes using fine ground flours.