

The need to knead:

Gluten formation and the density of bread

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Research Question

How long should dough be kneaded to produce the lightest possible loaf?

Introduction

Kneading serves two purposes: to help develop gluten in the flour and to distribute yeast cells throughout the dough. Gluten is a flexible film that is formed when glutenin and gliadin proteins link together with hydrogen and ionic bonds during kneading.¹

Yeast cells convert sugar into alcohol and carbon dioxide gas. Gluten traps the gasses produced by the yeast, resulting in the air pockets in a finished loaf.

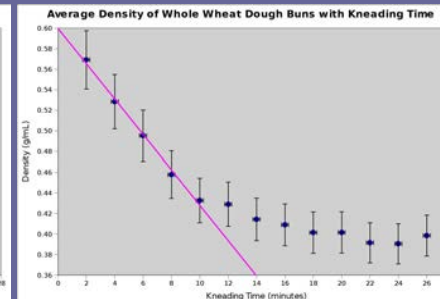
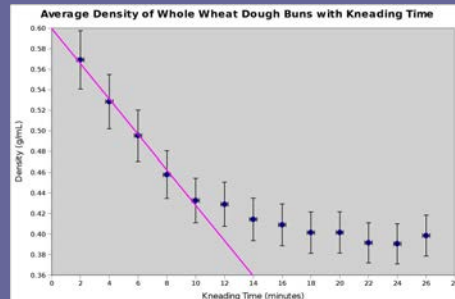
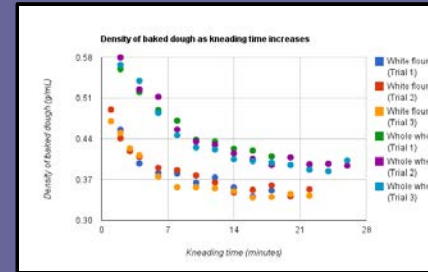


Procedure

1. Make the dough using same ingredients and directions.²
2. Knead the dough, removing 100 g portions at regular intervals.
3. Let the dough rise for 60 minutes in a 170 °F oven, bake for 20 minutes at 350 °F.
4. Weigh each bun. Measure volume with water displacement method.
5. Repeat steps 1 - 4 with whole wheat flour.



Results



Conclusions

Gluten develops more quickly in white flour compared to whole wheat.

The rate of initial density decrease of the:

- white flour was 0.0249 g/(mL min)
- whole wheat was 0.0172 g/(mL min)

As the gluten is developed, the rate of the reaction slows and the elasticity of the dough increases. Decreases in bun density stopped after 8.7 minutes and 17.3 minutes for the white and whole wheat buns, respectively.

Conclusion: Kneading 4 to 9 minutes for white flour and 10 to 17 minutes for whole wheat flour is a good compromise between effort and impact of kneading.

Acknowledgements

My mother performed all the kneading of the dough in these trials, so that the technique was as reproducible as possible.

Sources

1. Joseph Amendola and Nicole Rees, Understanding Baking: The Art and Science of Baking, 3rd ed. (John Wiley and Sons, inc., New Jersey), p 162 -163.
2. Peg (Feb 2000) Amish White Bread [online] allrecipes.com (accessed Oct 6, 2011).

Variable Type	
Independent	Kneading time
Dependent	Density of the resulting loaf
Controlled	Bread recipe. Rising and baking temperature and time. Yeast type.

