

# Does Bread Dough rise more based on Flour Type and Temperature?

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## Introduction:

- When bakers finish making bread dough, the dough rises, ultimately leading to how “fluffy” the bread is after it comes out of the oven
- The amount the dough rises can vary based on which type of flour is used, and also the temperature of the environment the dough is in
- I tested three different flours (Wheat, Bleached, and Unbleached) and three different temperatures (40 degrees Fahrenheit, 65 degrees Fahrenheit, and 90 degrees Fahrenheit) to see if Flour type and temperature have a large affect on the rise of dough

## Method:

- I made three batches of dough, all only differing by the Flour Type
- Ingredients for the Dough (the same for all three types of dough, again only differing by flour type):
  - Yeast , Sugar, Salt (1 Tbsp of each)
  - Water (2 cups)
- When I was finished making all of the doughs, I separated each of them into 6 pieces (all pieces being almost the same size), so I could put two samples from every type of dough in every temperature
- Next I took the measurement of the height of each piece of dough before I put them in their respective environment. After one hour, I measured the height of each piece of dough again, and took the difference of the before and after heights to get the results
- Independent Variables:
  - Flour Type (Wheat, Bleached, Unbleached)
  - Temperature (40° , 65° , 90° Fahrenheit)
- Dependent Variable:
  - The rise of the bread dough (height in centimeters)

## References/Acknowledgements:

- "Easy Perfect Yeast Bread." Gather for Bread, [gatherforbread.com/](http://gatherforbread.com/)
- Montgomery, Douglas. Design and Analysis of Experiments. 9th ed., Wiley.
- I would also like to thank my sister, Aryn, for helping me make the bread dough

## Null Hypotheses:

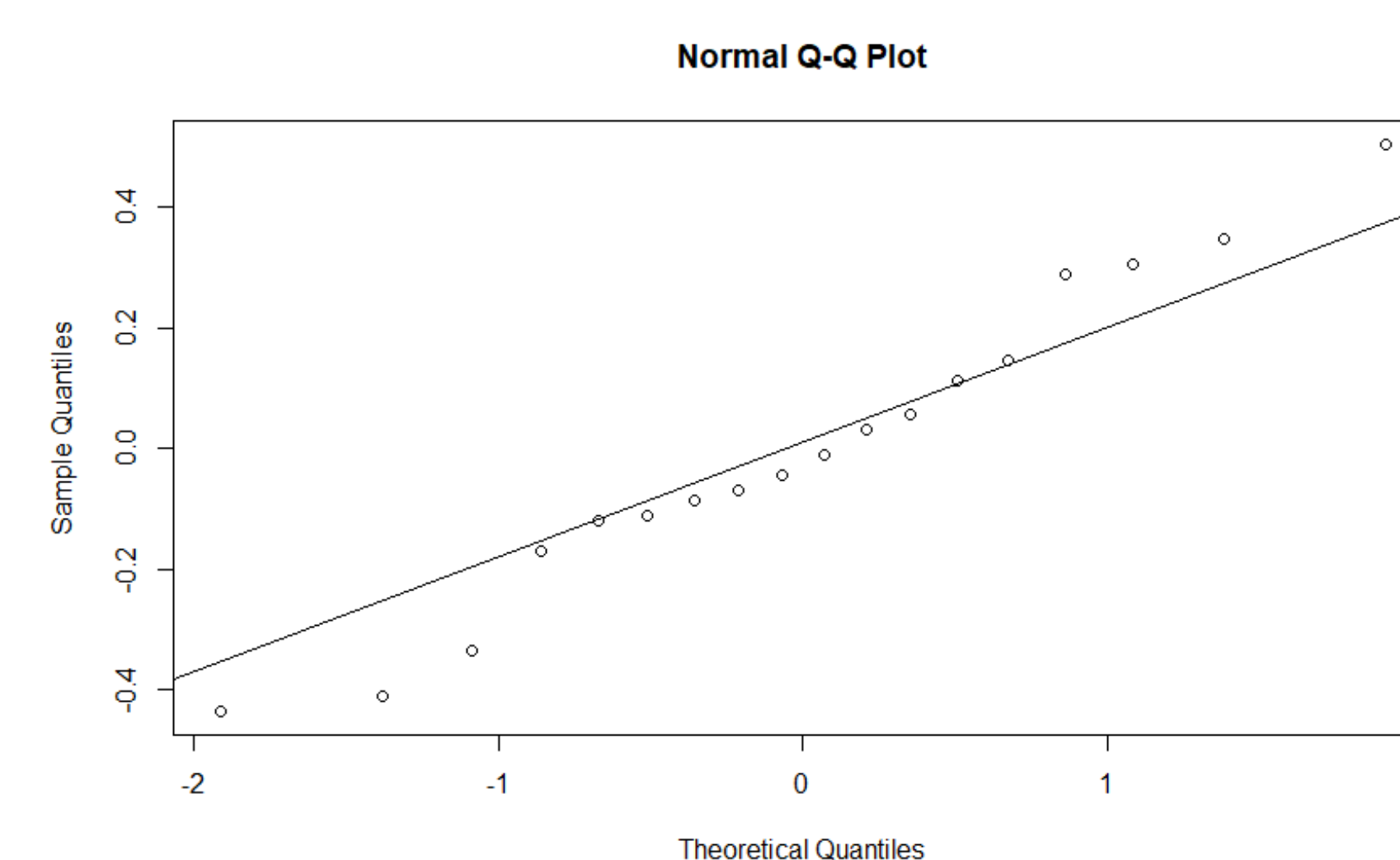
- The mean rise for all three types of flour are the same
- The mean rise for all three temperatures are the same

## Alternative Hypotheses:

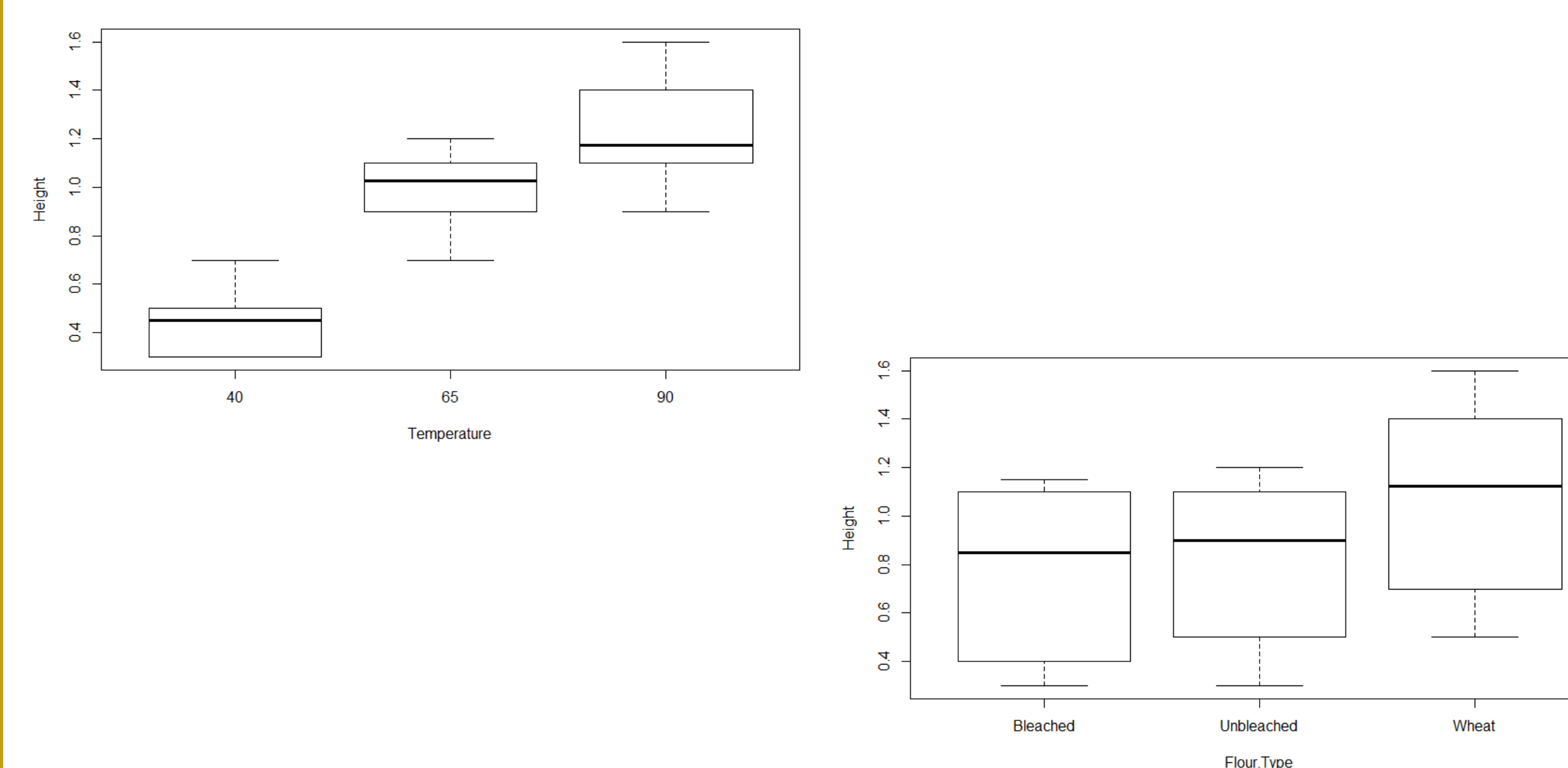
- The mean rise is different for at least one type of flour
- The mean rise is different in at least one of the temperatures
- The best design to go with here is a Main Effects Factorial Design, since we have two independent variables. Even though we are mainly looking at the Flour Type, we are also looking at another factor that affects rise of bread dough, which is temperature. We will determine whether or not there is a statistically significant difference between the means of the dough rise based on both Flour Type and Temperature

## Assumptions

### Normality:



### HOV:



**Assumptions:** There appears to be a few outliers in the normality plot, but we can still assume normality for the data set. One of the boxplots also appears to be a little skewed, but the boxplots still meet our Homogeneity of Variance Assumption. We can also assume Independence for the data set.

## Results:

	Degrees of Freedom	Sum of Squares	Mean Squares	F – Value	P – Value
Flour Type	2	0.3169	0.1585	8.277	0.0048
Temperature	2	1.8969	0.9485	49.541	8.29e-07
Residuals	13	0.2489	0.0191		

- With a low p-value (using alpha = 0.05) for both the Flour Type Factor and the Temperature Factor, there is significant evidence to claim that flour type and temperature have an affect on the rise of the bread dough.
- Tukey’s HSD Comparisons Table: (again alpha = 0.05)

Comparisons	Difference	P-Value
Unbleached – Bleached	0.04167	0.86227
Wheat – Bleached	0.300	0.00632
Wheat – Unbleached	0.25833	0.016747
65-40	0.54167	0.0000362
90-40	0.7750	0.0000007
90-65	0.2333	0.0299477

By looking at the comparison table, we see that every comparison had a statistically significant difference in the rise of the dough except the Unbleached and Bleached Flour means. We can also conclude that the Wheat Flour caused the dough to rise the most between the flours, and the 90 degree environment caused the dough to rise the most between the temperatures. It also appears that the dough in the 40 degree environment rose the least out of all three temperatures by a significant margin. The unbleached and bleached flour caused the dough to rise roughly the same amount. In conclusion, there is statistically significant evidence suggesting that Flour Type and Temperature have an effect on the rise of bread dough.