

Different Types of Flour and their Fermentation Rate

Joanna, Simran, Cody
Biology 160: General Biology

Abstract

For this project we tested how different types of flour: rye, cake flour, all-purpose flour, whole wheat, and our control group: sucrose, affect fermentation when mixed with baker’s yeast and water to see which ferments the highest for baking bread. Our hypothesis was that all purpose flour will have the highest fermentation rate but according to our results whole wheat had the quickest fermentation. This experiment helps determine which flour is best for baking bread based on fermentation because a higher fermentation rate can improve rising of dough, making it better for baking bread.

Introduction

We decided that we wanted to compare the fermentation rate of flour mixtures. We used 4 flours and a control group (sucrose) for our experiment.

In a peer reviewed article found in “Peer J” they experimented with different types of flour and compared and contrasted types. They used some of the same flours that we used. They found that different types of flour had different fermentation rates. (Erin A. McKenney, et al. 2023) Our hypothesis was that all purpose flour would perform best because of widespread use: all purpose is one of the most commonly used flour types in sourdough starters. Our independent variables were flour type, and we used: all purpose flour, whole wheat flour, rye flour, and cake flour. We kept variables like temperature, time, and amount controlled (the same). Our dependent variable was fermentation rate. Our hypothesis was that all purpose flour would perform best because of widespread use.

Methods

Materials & Location

For materials we used water, sucrose, all purpose flour, whole wheat flour, rye flour and cake flour. We used baker’s yeast and water. Also using a beaker (for the water and yeast mixture) glass pipettes, glass test tubes, fermentation tubes, and a 37 °C incubator.

Procedure

First we created a solution of yeast and water by adding 5g baker’s yeast to 50 mL water. Second, we put 10 mL of this concentration into each test tube with glass pipette. Next, we added 10 mL of the flour solution (5% flour solution) to each test tube using pipettes. We then put these test tube contents into fermentation tube so it is filled to the top. We then put the fermentation tubes into the incubator at the same time, and recorded the time. After taking out the fermentation tubes, we recorded how much CO₂ has accumulated at the top (using the lines of the fermentation tubes).

Fermentation Rate of Food Sources

Treatment	Average Fermentation Rate
All Purpose	0.033
Whole Wheat	0.034
Rye	0.032
Cake	0.028
Sucrose	0.255

Table 1. This table above shows the fermentation rate of different food sources. The sucrose is the control group.

Fermentation Rates of Food Sources

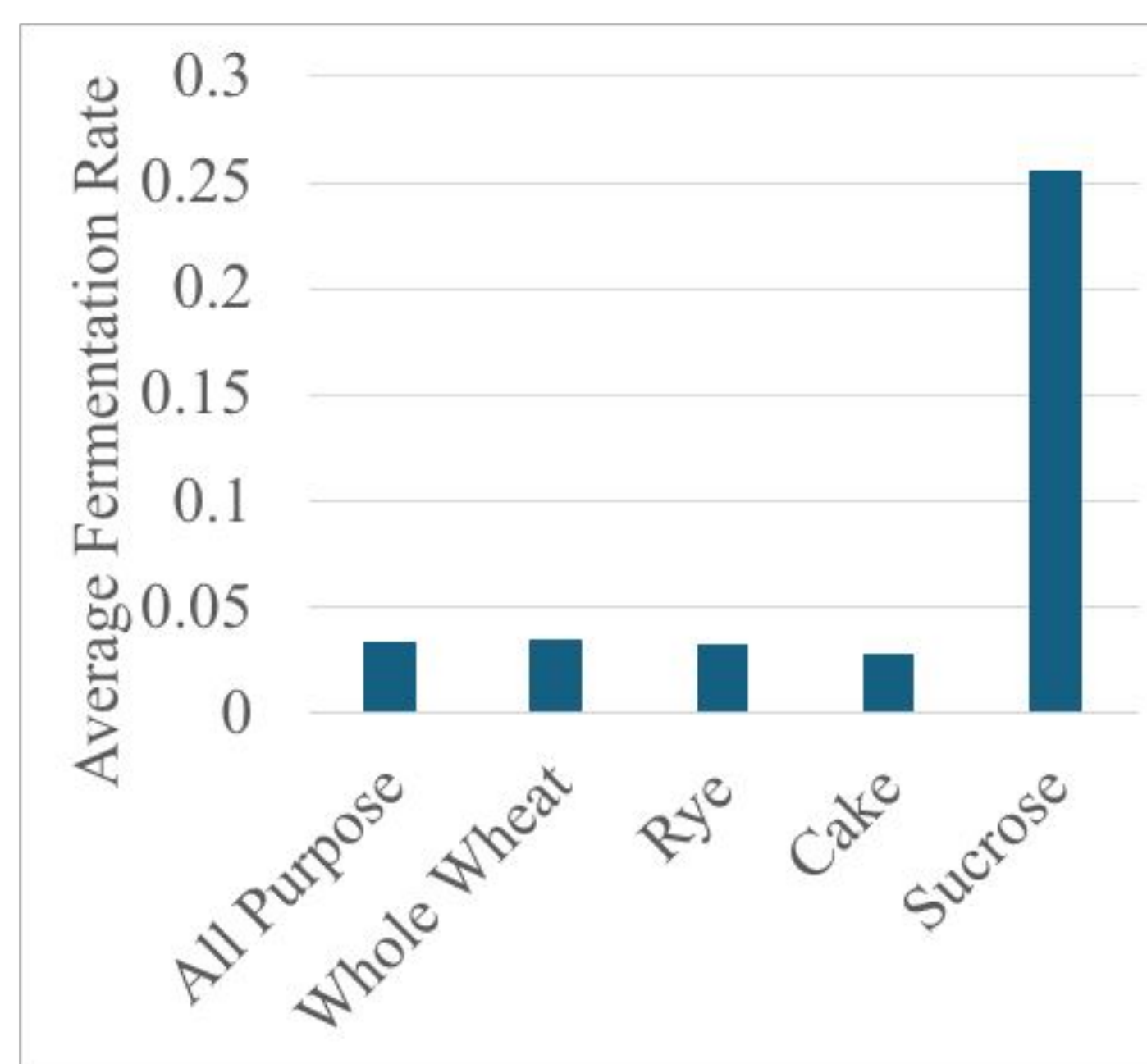


Figure 2. This graph shows the different average fermentation rates of the different food sources. The sucrose is the control group.

Discussion

Our project tested how different types of flour: rye, cake flour, all-purpose flour, and whole wheat, affect fermentation when mixed with yeast and water. We thought all-purpose flour would have the highest fermentation rate, but our results showed that the fermentation rates were very similar and that there wasn’t much variation. The whole wheat flour did have the highest fermentation rate, but only by a 0.001 difference. The cake flour had the worst fermentation rate and was quite a bit less than the other types of flours.

Based on our results, in the future when baking bread we will use whole wheat flour. This is the best type of flour because it has the highest average fermentation rate. This means that when baking bread the dough will rise faster, and it will result in a fluffier bread. One possible reason that whole wheat flour had the highest fermentation rate is that it contains more nutrients and fibers that support yeast growth. In a study done by Evelyne Timmermans in 2022, it was found that higher sugar levels help yeast produce more gas during fermentation, which can lead to a better rise (Timmermans et al., 2022). This supports why both whole wheat flour and sucrose had higher fermentation rates in our experiment. In another study done by Salovaara and Valjakka in 1987, it was found that darker flours with more nutrients and fiber caused stronger fermentation than white flours. This supports our results since whole wheat flour had the highest fermentation rate, likely because it has more of the parts of the grain that help feed the yeast (Salovaara & Valjakka, 1987).

One limitation of our experiment was using sucrose as the control. Since it is a simple sugar, it fermented at a much higher rate, making it difficult to directly compare with the flours. A better control might have been just water to see how much the flour alone affected fermentation. Another limitation was that we only measured fermentation and did not test how it impacted the final bread. Future research should test how different fermentation rates influence dough structure and bread texture. It should also examine how combining different flours or adjusting sugar content affects fermentation activity.

Acknowledgements

We would like to thank our amazing teacher Lauren for helping, guiding, and supporting us throughout this project. We would also like to thank Bethany for providing us with all of the materials needed to do this project.

References/ Work Cited

- Erin A. McKenney, et al. “Sourdough starters exhibit similar succession patterns but develop flour-specific climax communities” PeerJ Life and Environment. 4 October 2023. <https://peerj.com/articles/16163/>
- Evelyne Timmermans, et al. “Sugar Levels Determine Fermentation Dynamics during Yeast Pastry Making and Its Impact on Dough and Product Characteristics.” *International Journal of Food Microbiology*, 19 May 2022. <https://pubmed.ncbi.nlm.nih.gov/35626960/>
- Salovaara, H., & Valjakka, T. (1987). The effect of fermentation temperature, flour type, and starter on the properties of sour wheat bread. *International Journal of Food Science & Technology*, 22(6), 591–597. https://www.researchgate.net/publication/230235823_The_effect_of_fermentation_temperature_flour_type_and_starter_on_the_properties_of_sour_wheat_bread

Abstract

Make sure that the abstract is no more than 100 words. The font should be as large as is necessary to see from ~5 feet away. For example, the font of this text is Times New Roman at size 28. The section title ‘Abstract’ should be centered and bolded. This poster was created in PowerPoint as a single slide with a width of 36” and a height of 24”. Use the rubric for details on what to include here.

Introduction

Your introduction is a condensed version of the introduction in a research paper. The font should be as large as is necessary to see from 5 feet away. The section title ‘Introduction’ should be centered and bolded.

The first part of this section should introduce the topic at hand followed by a discussion of a few very relevant research references in order to contextualize your research question. Following this rationale, provide a sentence or two briefly describing the variables you studied. The last part of this paragraph should be your research question and hypothesis. Cite references as you would in a paper (Author, 2007).

Methods

Materials & Location

This section should describe any materials needed to replicate your experiment. If you used equipment, the brand and model number and relevant specs of the instrument should be listed. In addition, you should indicate where and when you collected data.

Procedure

This section should provide a chronological description of how your study was conducted, you can use figure(s)/pictures to help support your procedure. If you are replicating a procedure described in the literature elsewhere, you can simply provide a basic description and cite the source.



Figure 1. provide a brief description of what your figure or model is illustrating. This may be a picture that illustrates your methods, or supports your findings

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Descriptive Title for your Table

Table 1. A brief description of what this title illustrates, include the types of methods, the titles and appropriate units

Descriptive Title for your Graph

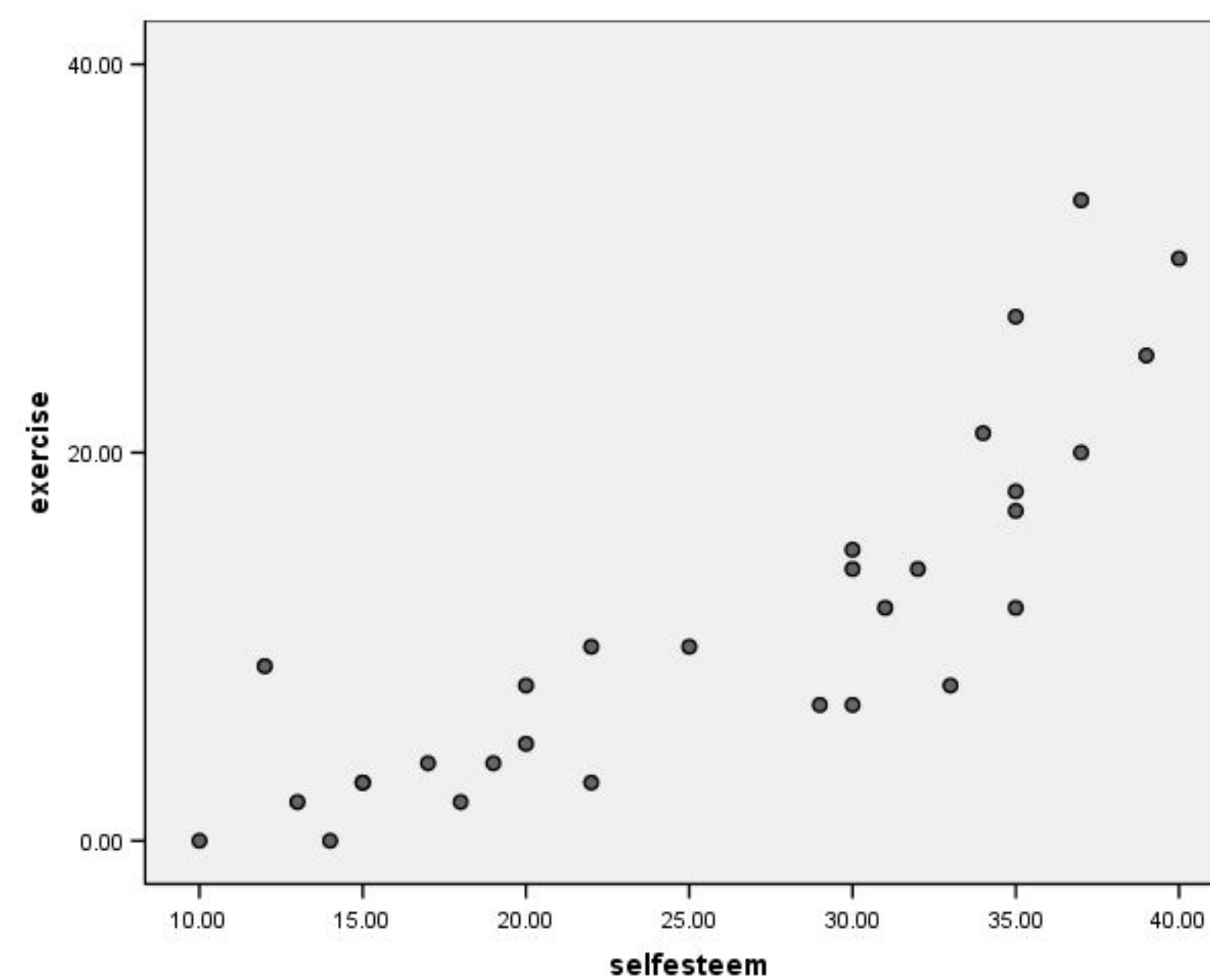


Figure 2. provide a brief description of what your figure or model is illustrating. It should help to build the case of the outcomes of your research.

Discussion

The discussion section should be organized as an upright triangle. Thus, start off with a summary of your findings in a statement that clearly describes the support or non-support of your original research hypothesis. Remember that in this section, you should verbally describe your results.

The next paragraph should be an interpretation of the results. You should try to tie in the references you cited in the introduction without simply repeating exactly what was stated in the introduction. Remember, each new statement should help the readers understand the problem/issue at hand and your position on this. If you did not support your hypothesis compared to the other studies you cited, why? What were the shortcomings of your study? What were the differences or similarities between your study and others that could have contributed to the differences in findings? Although you should discuss *some important* reasons as to why you did not find what you hypothesized, you should not dwell on every single reason (just not possible).

Finally the last paragraph should address the implications of your findings: How has your study resolved the original problem/issue? What are some suggestions for future research? Suggestions for future research should be discussed in present tense (as opposed to the rest of your reporting out, which should be in past tense).

Acknowledgements

This is where researchers typically acknowledge funding agencies for the research and anyone who helped but isn’t a co-author. For your research, you can give a “shout-out” to anyone who was particularly pivotal in helping you successfully do your research. Did someone help you with the analysis who isn’t a co-author? Name them and thank them for what they contributed. This section and References can be in a smaller font than the rest of your poster.

References/ Work Cited

Author, A. A., Author, B. B., & Author, C. C. (year). Title of article. *Title of Periodical*, volume number, page number.

Author, A. A., (year). *Title of work*. Location: Publisher.

Author, A. A., & Author, B. B. (year). Title of chapter. In A Editor, B. Editor, & C. Editor (Eds.), *Title of book* (pp. xxx- xxx). Location: Publisher.

Author, A. A., Author, B. B., & Author, C. C. (year, month day). Title of article. *Title of Periodical*, volume number, page number. Retrieved month day, year, from source.

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A peer reviewed source in the magazine “Food Control” tackled this topic of different flours and fermentation, however they were interested in change in temperature, which we had as a controlled variable. They found that higher temperatures caused more fermentation (M. Raccach, 2004). We had ours ferment in 37 °C degrees, so warmer than room temperature. Our hypothesis was that all purpose flour would perform best because of widespread use.

Methods

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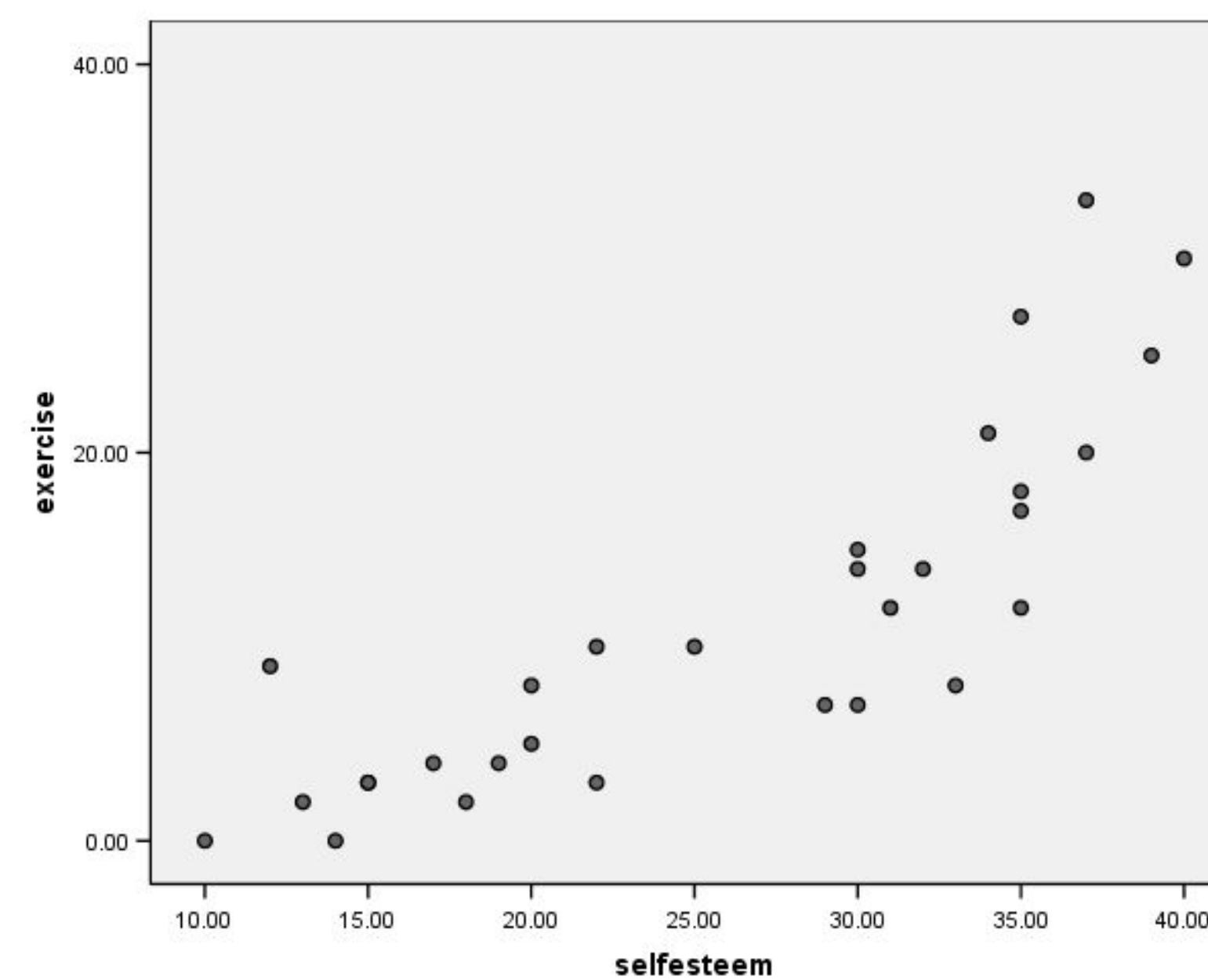
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Descriptive Title for your Table

Treatment	Average Fermentation Rate

Table 1. A brief description of what this title illustrates, include the types of methods, the titles and appropriate units

Descriptive Title for your Graph



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