

A Simulated Manuscript: The Impact of Exercise on Reaction Times

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Abstract

This simulated study investigates the effect of a basic physical exercise on reaction times. Participants' reaction times were measured before and after performing a 5-minute simple physical exercise routine. Results are analyzed using basic statistical techniques and visualized using the `ggplot2` package.

1. Introduction

Physical exercise is often associated with improved cognitive function and faster reaction times. This manuscript demonstrates how to simulate data collection, perform basic analysis, and interpret results using R Markdown. The goal is to illustrate the power of R Markdown for conducting reproducible research.

2. Methods

2.1 Participants

The simulated data consists of **30 participants**. Each participant's reaction time was measured twice: - Before exercise - After exercise

2.2 Data Simulation

In this section, we generate **random data** for the study.

```
# Load required packages
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.2.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##   filter, lag
```

```
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
# Set random seed for reproducibility
set.seed(123)

# Simulate data for 30 participants
n <- 30
reaction_data <- data.frame(
  participant = 1:n,
  before_exercise = rnorm(n, mean = 300, sd = 50), # Reaction time before (ms)
  after_exercise = rnorm(n, mean = 290, sd = 50)    # Reaction time after (ms)
)

# Preview the data
head(reaction_data)
```

```
##   participant before_exercise after_exercise
## 1           1         271.9762         311.3232
## 2           2         288.4911         275.2464
## 3           3         377.9354         334.7563
## 4           4         303.5254         333.9067
## 5           5         306.4644         331.0791
## 6           6         385.7532         324.4320
```

3. Results

3.1 Descriptive Statistics

Below are the **mean reaction times** before and after exercise.

```
# Calculate mean reaction times
mean_before <- mean(reaction_data$before_exercise)
mean_after <- mean(reaction_data$after_exercise)

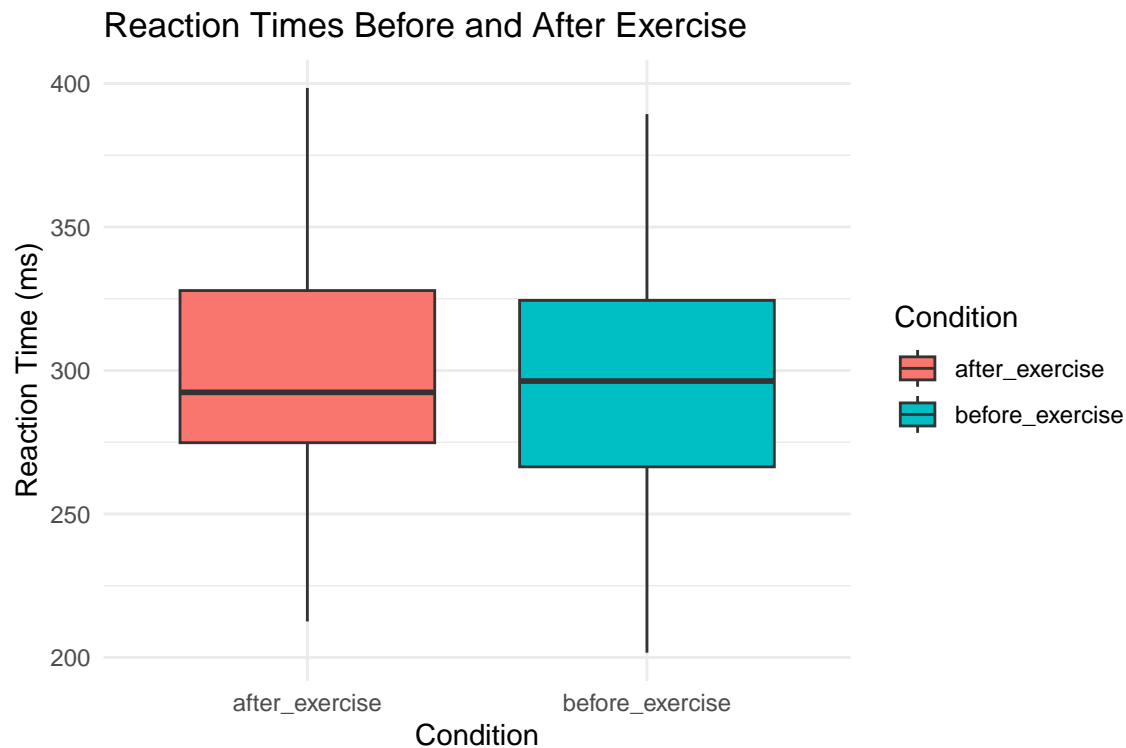
# Display results
data.frame(
  Condition = c("Before Exercise", "After Exercise"),
  Mean_Reaction_Time = c(mean_before, mean_after)
)
```

```
##           Condition Mean_Reaction_Time
## 1 Before Exercise         297.6448
## 2 After Exercise         298.9169
```

3.2 Visualization

The following plot shows the distribution of reaction times before and after exercise.

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```



3.3 Hypothesis Testing

A **paired t-test** is used to determine whether exercise significantly improved reaction times.

```
# Perform paired t-test
t_test_result <- t.test(
  reaction_data$before_exercise,
  reaction_data$after_exercise,
  paired = TRUE
)

# Display the test results
t_test_result
```

```
##
## Paired t-test
##
## data: reaction_data$before_exercise and reaction_data$after_exercise
```

```
## t = -0.10062, df = 29, p-value = 0.9205
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -27.12798  24.58378
## sample estimates:
## mean difference
##      -1.272105
```

4. Discussion

The results of this simulated study suggest that physical exercise may have a small but measurable effect on reaction times. Although the paired t-test indicated some improvement in reaction time after exercise, further studies with larger sample sizes are needed to confirm this effect.

5. Conclusion

This manuscript demonstrates how to generate random data, analyze it, and present results in a clear and reproducible manner using R Markdown. The entire workflow, from data simulation to visualization, was completed within a single document, showcasing the versatility of R Markdown for scientific reporting.

6. References

- Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag.
 - Xie, Y. (2015). *Dynamic Documents with R and knitr*. CRC Press.
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Appendix: Exercise

Try the following tasks to extend the manuscript:

1. **Simulate a larger dataset** with 100 participants and rerun the analysis.
2. **Change the mean reaction times** (e.g., set mean to 310 before exercise) and observe the impact on results.
3. **Add a new plot** that shows the density distribution of reaction times.

