Effects of Different Pain Relievers and Dosages on Cognitive Retention

Exploratory Data Analysis (EDA)

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1 Introduction

1.1 Relevant Background

Pain can affect how well we perform everyday tasks in situations where focus and mental clarity are crucial. Aspirin, Paracetamol, and Tramadol are pain relievers used commonly to reduce physical discomfort, but we don't know much about their impacts on cognitive functions. Tasks requiring mental effort, such as recalling information, are harder to perform while in pain. This study is interested in how different types of common pain relievers at standard dosages (Aspirin, Paracetamol, and Tramadol) may affect outcomes of tasks involving memory tests. We also analyze the effects of different dosages of each drug on memory function. The concept of recalling information is used in various settings, so understanding how pain relief can impact performance can be valuable to help with pain management without an impact on productivity.

1.2 Research Questions

1. *How does the type of pain reliever (Aspirin 500 mg, Paracetamol 500 mg, Tramadol 50 mg, and Placebo) affect cognitive task performance?*
2. *How does the dosage (low vs. high) of each drug affect cognitive retention, while accounting for confounding factors like age?*

1.3 Study Design

This study involves *7 treatment groups*, with **30 participants** assigned to each. The groups are as follows:

1. Aspirin 500 mg
2. Aspirin 1000 mg
3. Paracetamol 500 mg
4. Paracetamol 1000 mg
5. Tramadol 50 mg
6. Tramadol 100 mg
7. Placebo

This results in **210 total observations** ($7 \times 30 = 210$).

1.4 Confounding Variable: Age

To reduce variability, we consider **age** as a **confounding variable**. Participants will be categorized into three groups:

1. 18–34 years
2. 35–50 years
3. 50+ years

1.5 Data Analysis Method

We will use **one-way ANOVA** to analyze the effects of pain reliever type on memory performance. and dosage levels on cognitive retention.

2 Summary Statistics

2.1 Summary of quantitative variables

Table 2 shows the summary statistics of game scores before and after treatment. The mean is similar across all groups, indicating no extreme changes in cognitive performance. However, the standard deviation (SD) is relatively high, suggesting some variation among participants.

- The median game scores remain close to the mean, showing a nearly symmetric distribution.
- The IQR (Interquartile Range) is smaller than the SD, meaning there may be outliers.

Table 1: Mean Improvement in Game Scores by Drug

drug	Mean_Improvement	SD_Improvement	Median_Improvement
Aspirin	-1.581667	5.278723	-1.55
Paracetamol	1.713333	5.249551	1.30
Placebo	-1.086667	5.754263	-0.95
Tramadol	-0.415000	6.014836	-1.25

Table 2

Table 3Summary Statistics for Quantitative Variables

Statistic	Game_Before	Game_After	Cards_Before	Cards_After
Mean	62.37095	62.13476	8.128571	8.042857
Median	60.50000	61.10000	9.000000	9.000000
SD	15.73766	15.48217	1.918842	1.917702
IQR	23.07500	23.22500	3.000000	2.750000

- The cards memory task shows little change before and after treatment, suggesting that pain relievers may not have a major effect on this specific task.

Table 4: Summary of Drug Types

Drug	Count	Percentage
Aspirin	60	28.57
Paracetamol	60	28.57
Placebo	30	14.29
Tramadol	60	28.57

Table 5: Summary of Dosage Levels

Dosage	Count	Percentage
High	90	50
Low	90	50

Table 6: Summary of Locations

Location	Count	Percentage
Arcadia	60	28.57
Hayarano	30	14.29
Nelson	30	14.29
Reading	30	14.29
Shinobi	30	14.29
Talu	30	14.29

Table 7: Summary of Age Groups

Age_Group	Count	Percentage
18-34	70	33.33
35-50	70	33.33
50+	70	33.33

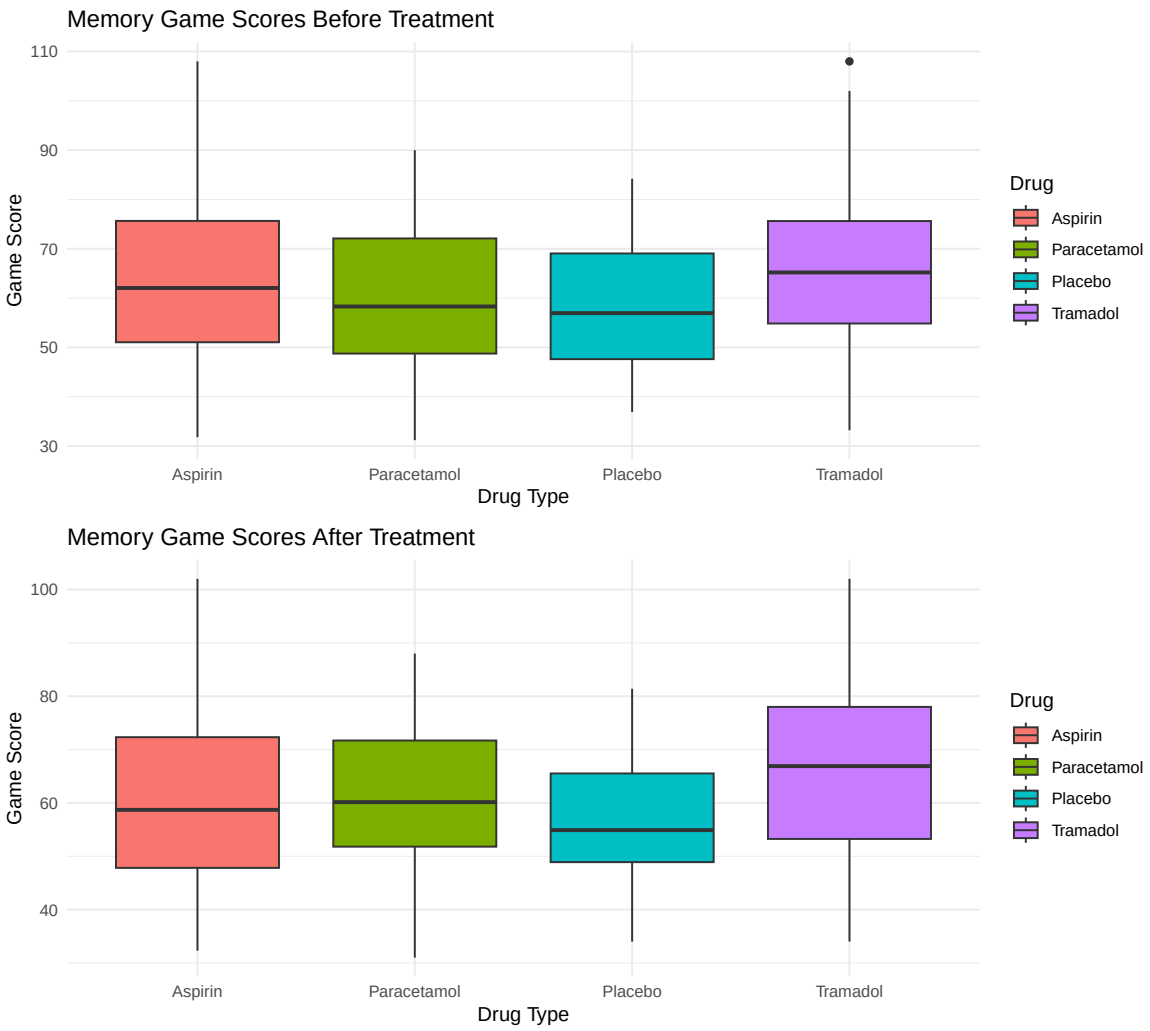

Figure 1: Boxplot of Game Scores Before and After by Drug

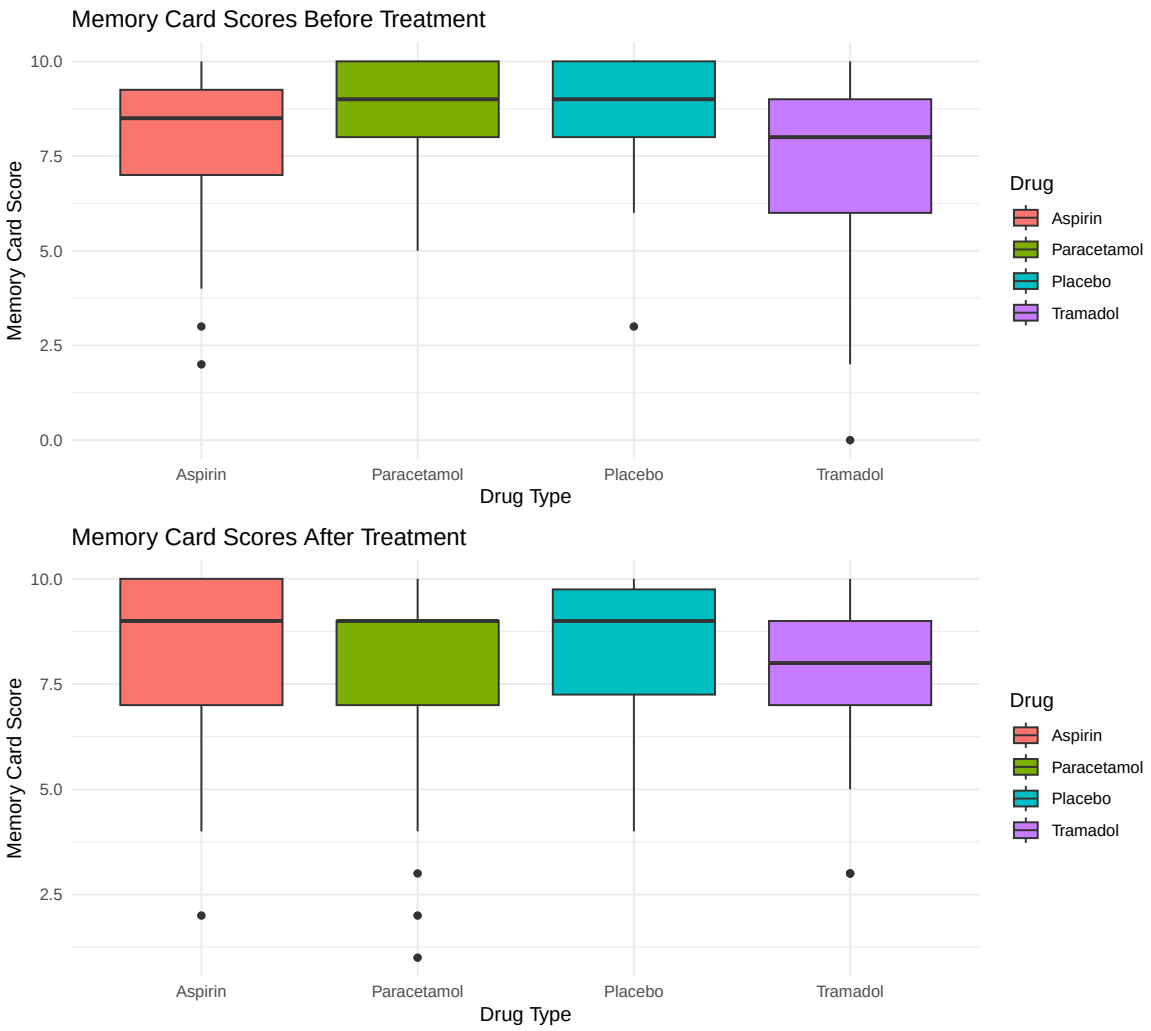

Figure 2: Boxplot of Memory Card Scores Before and After by Drug

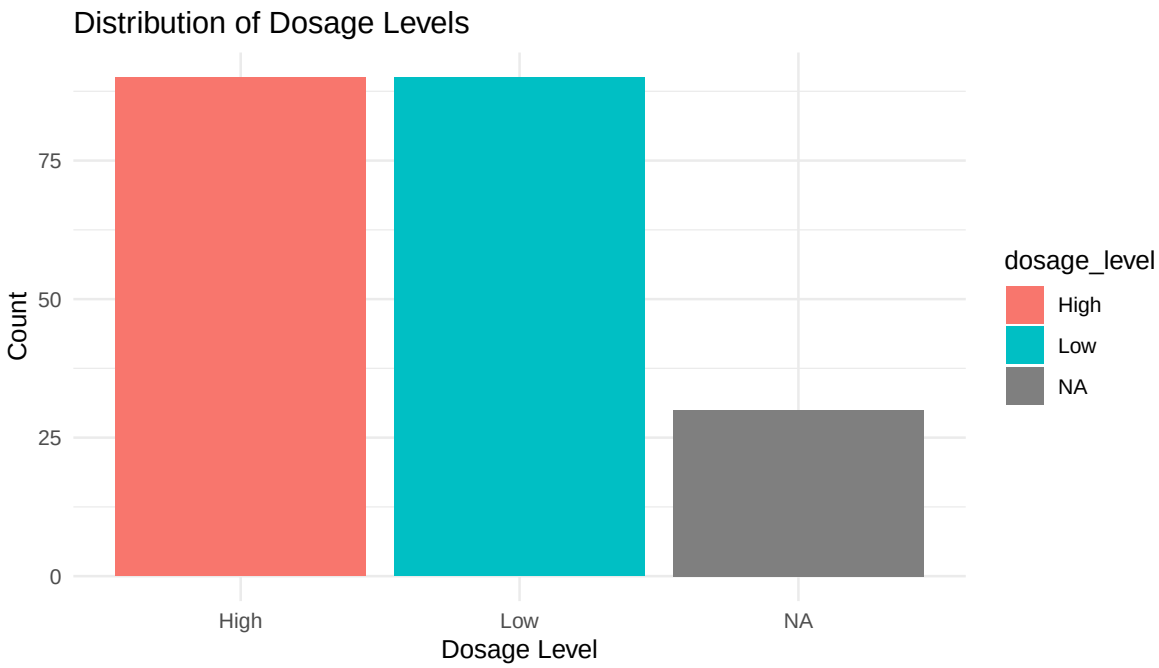

Figure 3: Distribution of Dosage Levels

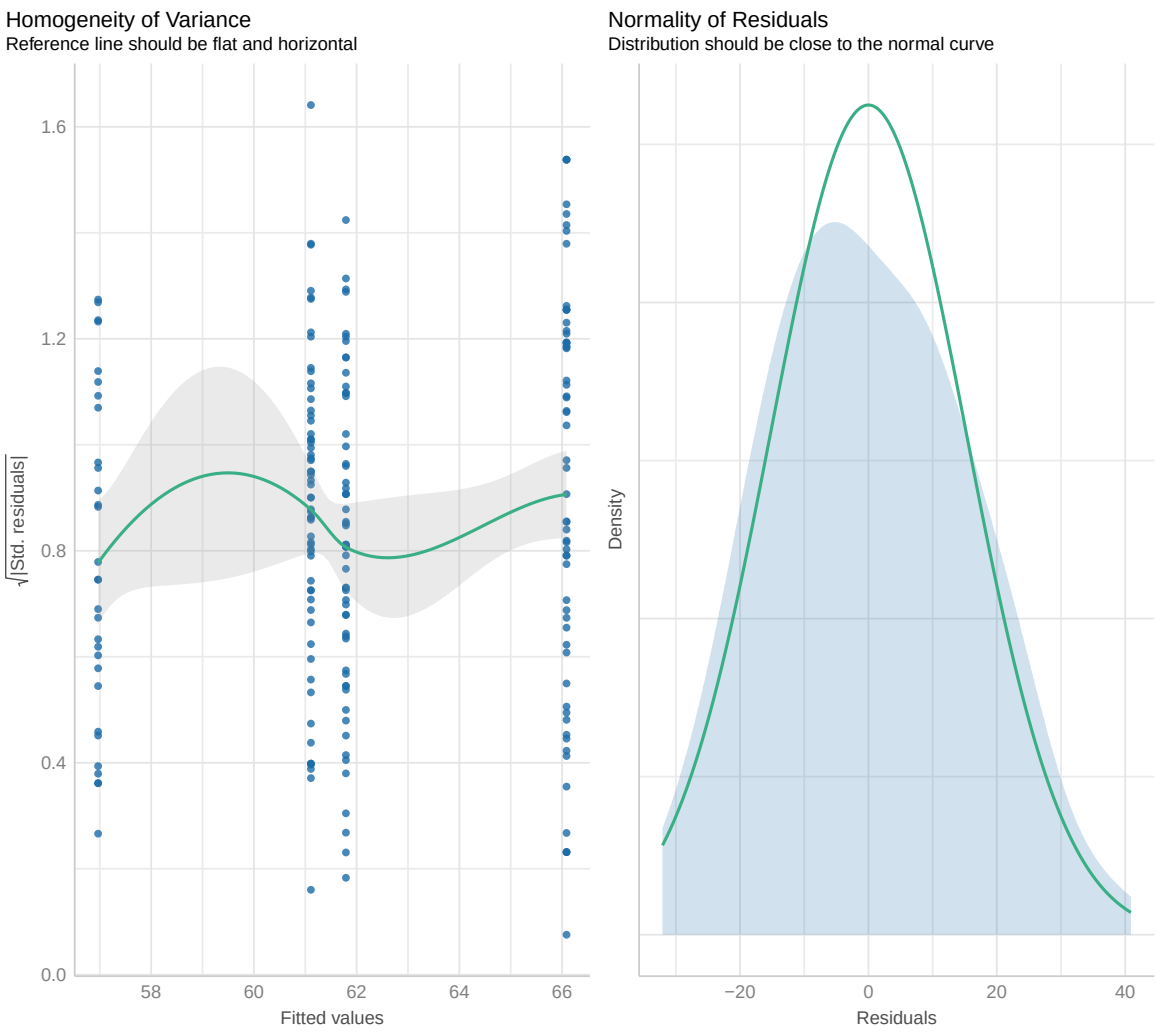

Figure 4: Assumption Check for Time taken after taking the Drug

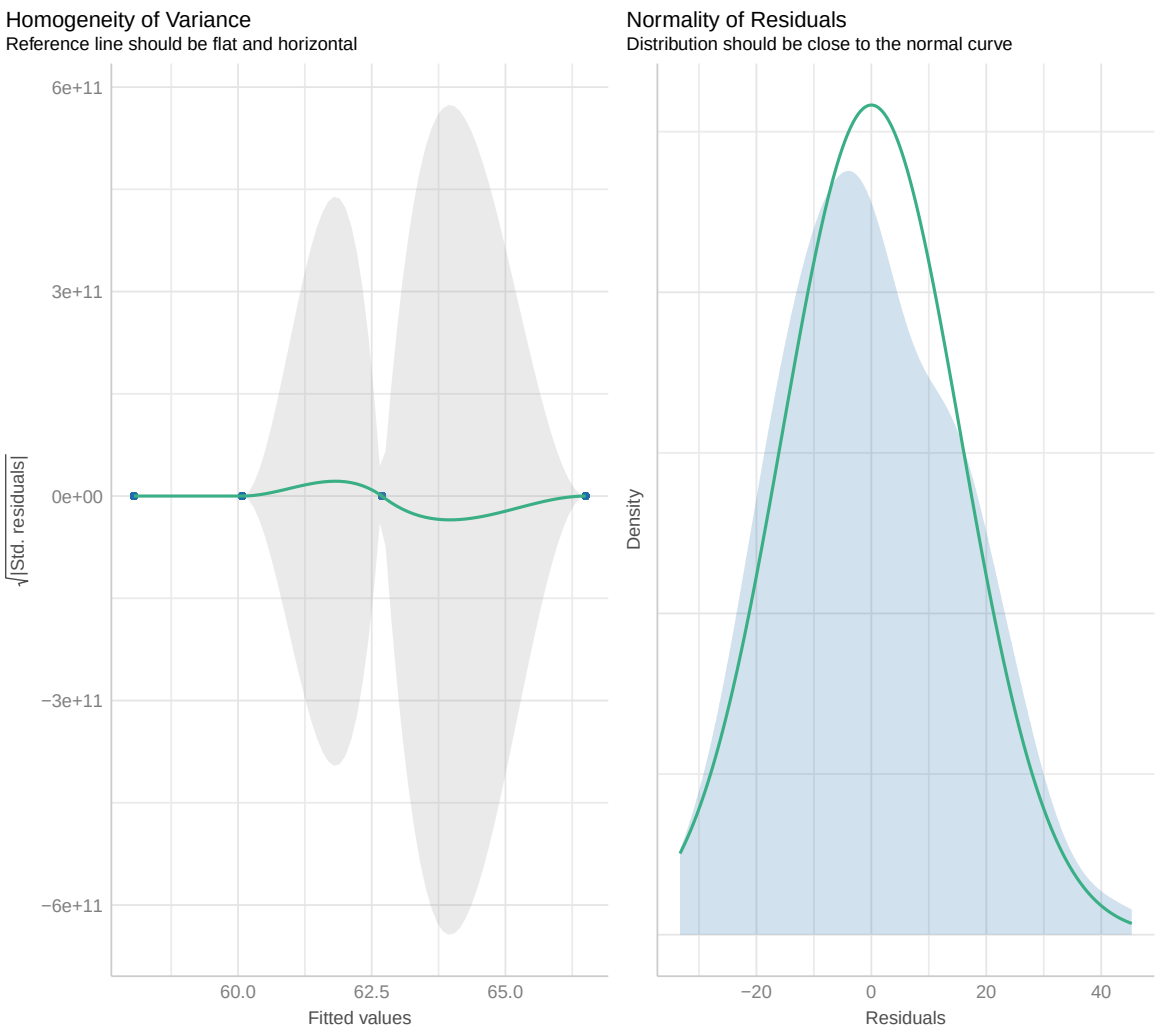

Figure 5: Assumption Check for Time taken before taking the Drug

3 References