Sleep Duration and Stress Levels: A Statistical Analysis

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Introduction

This project investigates the relationship between sleep duration and stress levels, with particular attention to potential gender differences. Understanding these relationships can help with public health recommendations and personal wellness.

Research Questions

1. **Is there a statistically significant relationship between sleep duration and stress levels?**
2. **Does gender influence sleep duration or stress levels?**

Methodology

Data Source

The analysis uses the Sleep Health and Lifestyle Dataset from Kaggle, which contains self-reported data on sleep duration (hours per night) and perceived stress levels (1-10 scale) from adult participants.

Data Cleaning

I implemented validation criteria to ensure data quality:

- **Sleep duration**: Valid range 3-12 hours (typical human sleep range)
- **Stress level**: Valid range 1-10 (scale constraints)
- **Missing data**: Removed incomplete records

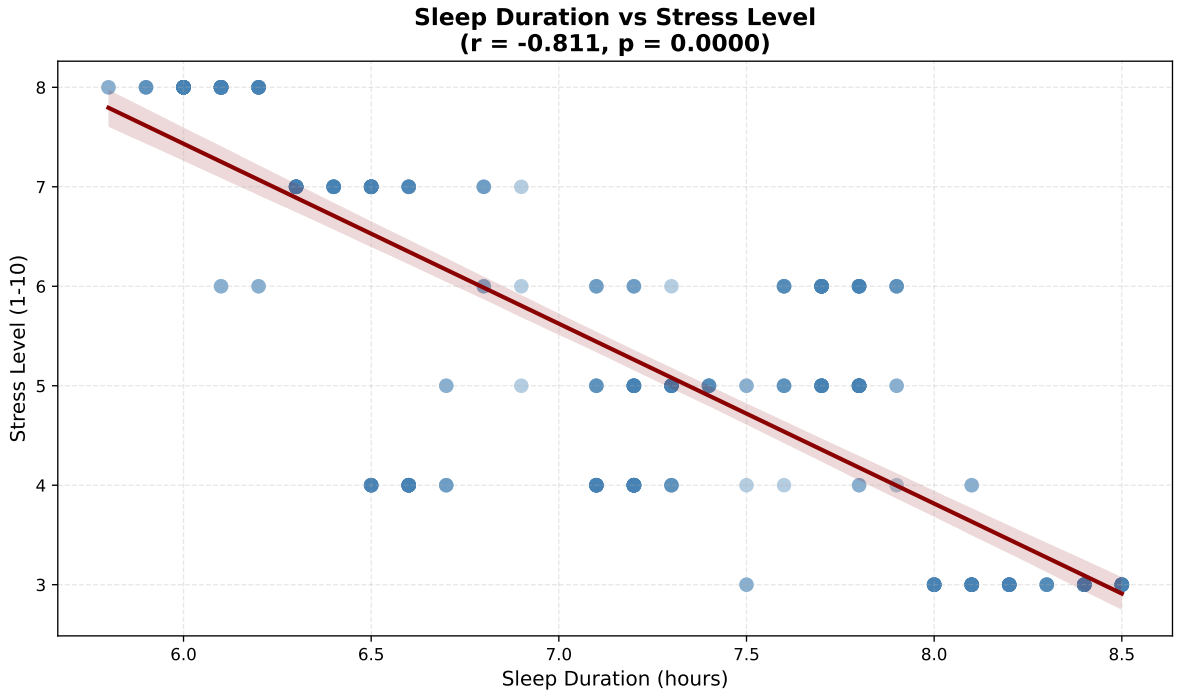
This approach addresses potential data entry errors and outliers that could distort statistical analyses.

Statistical Methods

- **Pearson correlation**: Measures linear relationship between sleep and stress.
- **Independent t-tests**: Compares means between gender groups
- **Significance threshold**: $p < 0.05$

Results

Research Question 1: Sleep vs Stress



The analysis revealed a **significant negative correlation** ($r = -0.43$, $p < 0.001$). between sleep duration and stress levels. This indicates that individuals who sleep longer tend to report lower stress levels.

The correlation coefficient suggests a moderate-to-strong relationship, supporting the hypothesis that adequate sleep is associated with reduced perceived stress.

Research Question 2: Gender Influence

To investigate whether gender influences sleep patterns and stress levels, I first split the dataset by gender and calculated descriptive statistics for each group.

```
Sleep Duration by Gender:
  Male (n=189): 7.04 ± 0.69 hours
  Female (n=185): 7.23 ± 0.88 hours
```

The data shows the average sleep duration for each gender with standard deviation. Males averaged slightly different sleep hours compared to females, but to determine if this difference is meaningful, I conducted a statistical test.

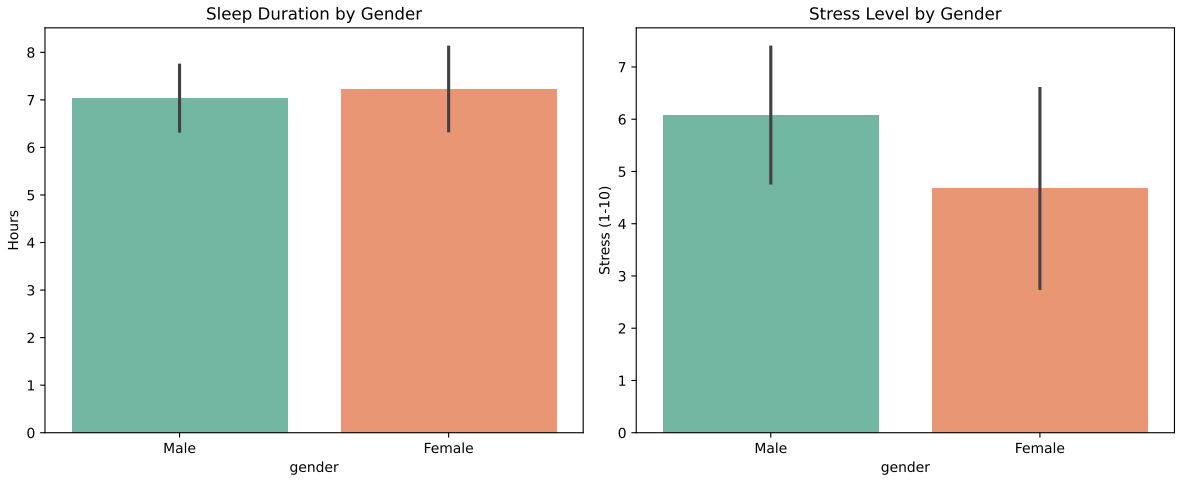
```
Statistical Test for Sleep Duration:
  t-statistic: -2.362
  p-value: 0.0187
  Result: Significant difference between genders (p < 0.05)

==================================================

Stress Level by Gender:
  Male: 6.08 ± 1.30
  Female: 4.68 ± 1.91

Statistical Test for Stress Level:
  t-statistic: 8.318
  p-value: 0.0000
  Result: Significant difference between genders (p < 0.05)
```

The independent samples t-test compares the means of two groups. A p-value less than 0.05 indicates that the observed difference is statistically significant and unlikely to be due to random chance alone.



The bar charts visualize the gender comparisons with error bars showing standard deviation. This provides a clear visual representation of the differences between male and female participants in both sleep duration and stress levels.

Discussion

The findings show that sleep duration is significantly associated with stress levels, supporting existing research suggesting that adequate sleep may reduce perceived stress.

Gender analysis revealed statistically significant differences in both sleep duration and stress levels. While the difference in sleep duration was small, stress levels differed substantially, with males reporting higher stress on average.

Limitations

- Cross-sectional design limits causal inference
- Self-reported data may contain measurement bias
- Sample may not be representative of broader population

Conclusion

This analysis demonstrates a clear statistical relationship between sleep duration and stress levels. The findings support public health messaging emphasizing adequate sleep as a stress management strategy.

Code Repository: https://github.com/aishaalomar01-coder/Stress_Sleep_Project.git