Understanding Alcohol: Gender, Intelligence, and Depression

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I Introduction

Nowadays, alcohol consumption has increased significantly among the population. Alcohol is a widely used substance for entertainment and impacts users, families, and society negatively, with one in three individuals being current drinkers globally [1]. According to recent data [2], in 2019, nearly four and a half million people globally succumbed to injuries, with alcohol playing a pervasive role in premature loss of life, disability, and overall health impacts.

Therefore, we will conduct a comprehensive statistical analysis to investigate the intricate relationship between intellectual levels and alcohol intake, discern the diverse manifestations of alcohol impact on both women and men and explore the potential associations between alcohol consumption and depression levels.

Concerning this, our research questions are: What is the extent of the difference in alcohol consumption between women and men? Is there a correlation between intellectual levels and active alcohol consumption? Can alcohol consumption lead to the occurrence of depression?

Our study is important because it helps create specific plans for interventions and public health messages. By understanding the connections we're investigating, we can improve strategies for preventing issues, educating people, and providing better treatments. The upcoming sections will cover what others have found, how we did our study, what we discovered, and what it all means for public health. The key terms for our study are "gender-specific alcohol effects," "IQ levels," and "alcohol-induced depression."

II Data

The dataset is taken from [3] It had string values in the Group and Gender tables, but we forgot that we can change them using pandas, so we changed them using excel. Group: (Alcoholic - 1, Non-alcoholic - 0); Gender: (Man - 1; Woman - 0)

Also, we filled nones with mean values using Pandas.

We didn't need all features for our tests, but we will provide features in full form

because, in table format, the original dataset has shortcuts:

ID: participant number

Age: rounded to nearest year

VIQ: Verbal Intelligence Quotient from Wechsler Adult Intelligence Scale

PIQ: Performance Intelligence Quotient from Wechsler Adult Intelligence Scale

FSIQ: Full-Scale Intelligence Quotient from Wechsler Adult Intelligence Scale

$\text{WMS}_I MI : ImmediateMemoryIndexfromWechslerMemoryScale$

$\text{WMS}_D MI : Delayed(General)MemoryIndexfromWechslerMemoryScale$

$\text{WMS}_W MI : WorkingMemoryIndexfromWechslerMemoryScale$

HRSD: Hamilton Rating Scale for Depression

DHD: Duration of Heavy Drinking (21 or more drinks per week), in years

DD: Daily Drinks, in ounces of ethanol per day

LOS: Length of Sobriety, in years

Ten: Profile of Mood States Tension

Dep: Profile of Mood States Depression

Ang: Profile of Mood States Anger

Vig: Profile of Mood States Vigor

Fat: Profile of Mood States Fatigue

Con: Profile of Mood States Confusion

A: Multiple Adjective Affect Check List Anxiety

D: Multiple Adjective Affect Check List Depression

H: Multiple Adjective Affect Check List Hostility

PA: Multiple Adjective Affect Check List Positive Affect

SS: Multiple Adjective Affect Check List Sensation Seeking

Dys: Multiple Adjective Affect Check List Dysphoria

PASS: Multiple Adjective Affect Check List Positive Affect Sensation Seeking

$\text{behavioral}_r esponses_i ncluded :' 1' indicatesparticipantsforwhich$

behavioral responses were available

Limbic Structures: Erotic vs neutral contrast effect size values from volumetric cluster

caudalmiddlefrontal1: Negative vs neutral contrast effect size values from surface cluster 1 with peak vertex in the caudal middle frontal cortex

caudalmiddlefrontal2: Negative vs neutral contrast effect size values from surface cluster 2 with peak vertex in caudal middle Frontal cortex

superior frontal: Negative vs neutral contrast effect size values from the surface cluster with peak vertex in the caudal superior frontal cortex

inferior parietal: Negative vs neutral contrast effect size values from the surface cluster with peak vertex in inferior parietal cortex

pics: pictures

percent: percent pictures rated

RT: reaction time

pos: positive or "happy" pictures

neg: negative or "aversive" pictures

neutral: neutral pictures

erotic: erotic pictures

gross: "gruesome" pictures

bad: bad ratings

good: good ratings

neut: neutral ratings

III Theory, statistical techniques

In our study, we aimed to investigate significant differences in alcohol consumption between genders and explore the relationships between alcohol consumption and various psychological measures, such as intelligence quotients and depression-related factors.

Given the non-normality of our data and the presence of ordinal or categorical variables, we opted for non-parametric tests for their robustness to violations of distributional assumptions and their interpretability. The Mann-Whitney U test was utilized to compare alcohol consumption between genders, specifically males and females, due to the skewed distribution of alcohol consumption (DD). This test enabled us to determine if gender significantly influenced alcohol consumption based on obtained p-values.

Additionally, Spearman correlation analysis assessed associations between alcohol consumption (DD) and psychological measures (VIQ, PIQ, FSIQ, Dep, HRSD, D). This approach allowed us to determine the strength and significance of the relationships between variables, considering potential non-linear associations and non-normal data distributions. By employing hypothesis testing and non-parametric tests, we rigorously analyzed our data, drew meaningful conclusions, and effectively addressed our research questions, taking into account the characteristics of our data and the objectives of our study.

IV Statistical tools, and other software

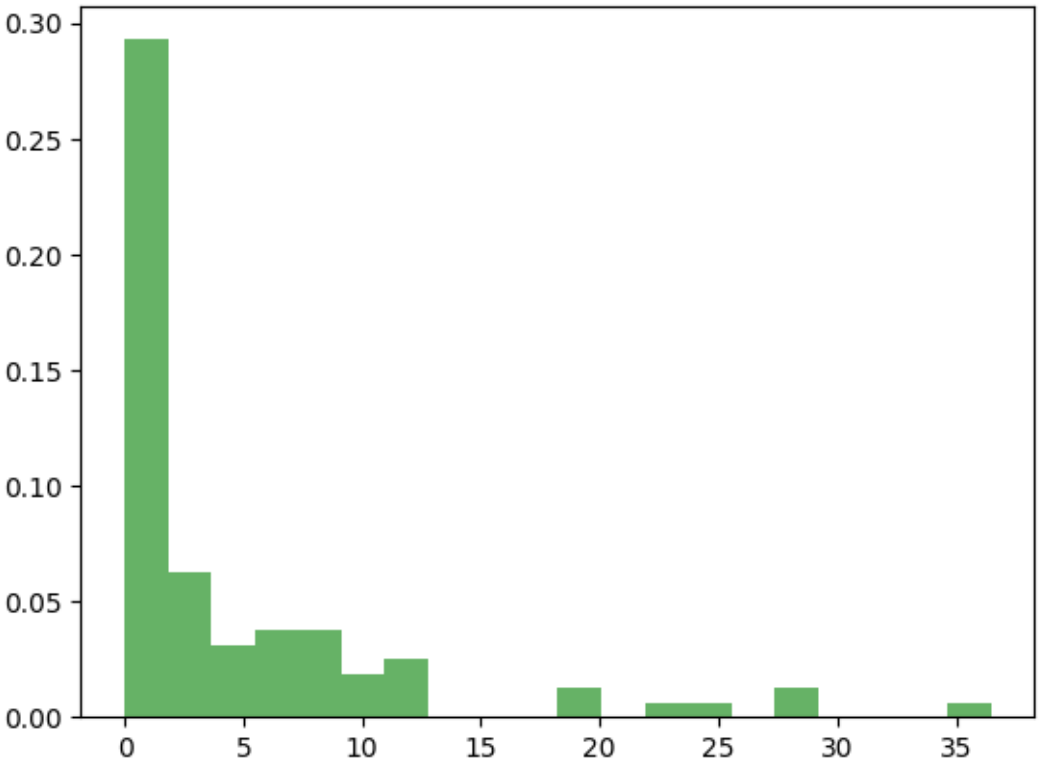
In our analysis, we utilized a variety of statistical tools to investigate the relationships between alcohol consumption and psychological measures. We employed the pandas' library for data manipulation and management, allowing us to filter and preprocess our dataset effectively. Matplotlib was used for data visualization, enabling us to create informative visualizations such as scatter plots and histograms to explore the distributions and relationships within the data. For statistical analysis, we relied on the Scipy library, utilizing functions such as Mann-Whitney U tests and Spearman correlation to assess gender differences in alcohol consumption and associations between alcohol consumption and psychological factors, respectively. Additionally, ChatGPT assisted in formulating hypotheses,

interpreting results, and refining our analytical approach. Through the integration of these tools, we conducted a comprehensive analysis, uncovering valuable insights into the complex dynamics between alcohol consumption and psychological well-being.

V Results

In this section, we present the findings from our analysis, examining the relationships between alcohol consumption and psychological measures, as well as gender differences in alcohol consumption. We could show these relationships through visualizations and statistical tests, including scatter plots, histograms, Mann-Whitney U tests, and Spearman correlation.

A. The test for the first RQ



First, we checked if the data was normally distributed or not, and it appeared that it was not. Then we decided to use our non-parametric test and tested the hypothesis as follows:

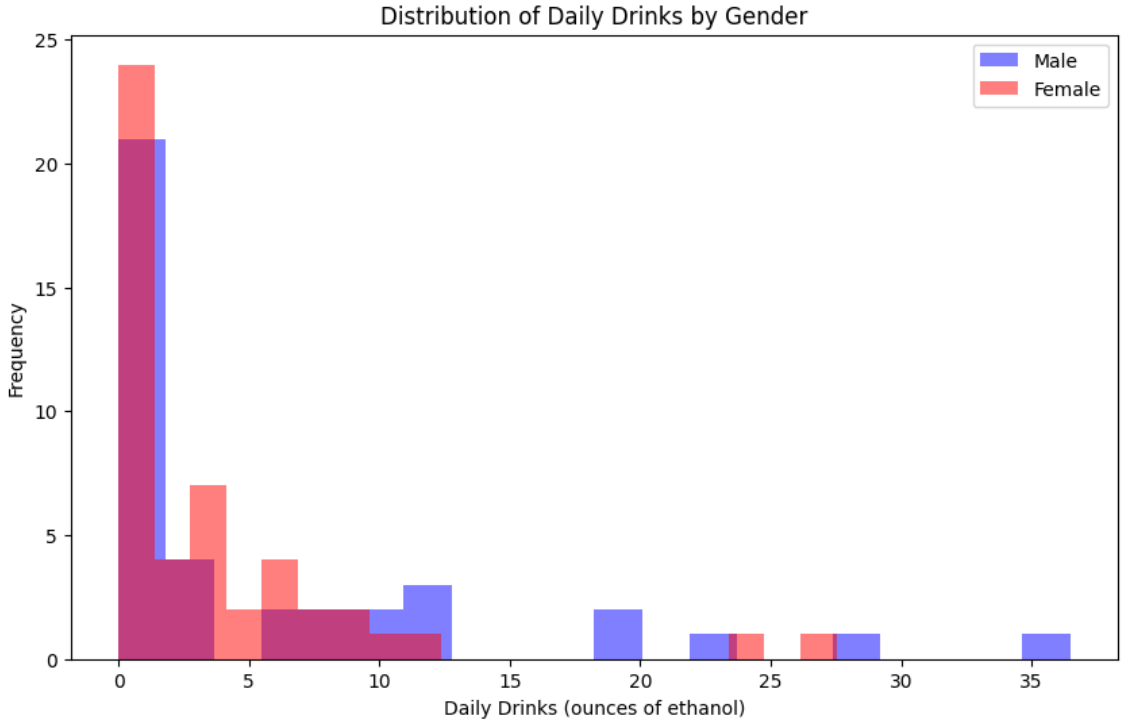
H0: The alcohol consumption affects men and women differently

H1: The alcohol consumption doesn't affect men and women differently The result that we have got was: Therefore, with a p-value of 0.208, we fail to reject the null hypothesis,

```
p_value = 0.2082372456976419
Fail to reject the null hypothesis: The alcohol consumption
doesn't affect men and women differently.
```

indicating that alcohol consumption does not significantly differ between men and women.

Also, we can see the plot, where the amount of alcohol, consumed by men and women is almost the same:



B. The test for the second RQ

H0: The intelligence level affects alcohol consumption H1: The intelligence level does not affect alcohol consumption

We tested this hypothesis with 3 features:

VIQ: Verbal Intelligence Quotient from Wechsler Adult Intelligence Scale

PIQ: Performance Intelligence Quotient from Wechsler Adult Intelligence Scale

FSIQ: Full-Scale Intelligence Quotient from Wechsler Adult Intelligence Scale

The results that we got:

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Correlation analysis between VIQ and daily drink variables:
p-value = 0.6937
For VIQ: Fail to reject the null hypothesis: There is no
significant correlation between alcohol consumption and VIQ.

Correlation analysis between PIQ and daily drink variables:
p-value = 0.2457
For PIQ: Fail to reject the null hypothesis: There is no
significant correlation between alcohol consumption and PIQ.

Correlation analysis between FSIQ and daily drink variables:
p-value = 0.4325
For FSIQ: Fail to reject the null hypothesis: There is no
significant correlation between alcohol consumption and FSIQ.
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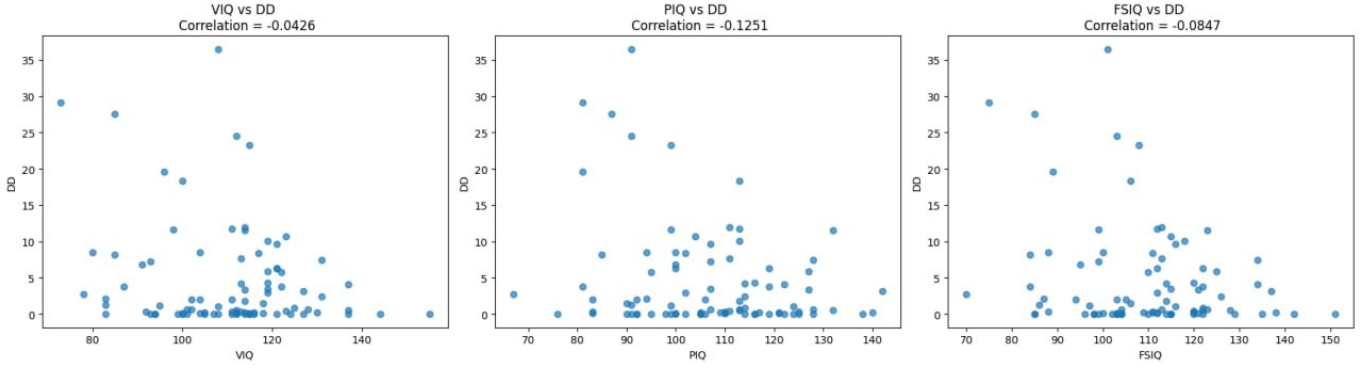
The correlation analyses between verbal IQ (VIQ), performance IQ (PIQ), full-scale IQ (FSIQ), and daily drink variables yielded non-significant results with p-values of 0.6937, 0.2457, and 0.4325 respectively. Thus, we fail to reject the null hypothesis in all cases, indicating no significant correlation between alcohol consumption and VIQ, PIQ, or FSIQ. This suggests that variations in daily drink variables do not significantly impact verbal intelligence, performance intelligence, or overall intelligence quotient. Overall, the analyses imply that alcohol consumption does not strongly influence intelligence levels in the studied population.

Below, we can see dependencies between the amount of alcohol consumed per day and IQ scales for each kind of test:



C. The test for the third RQ

To investigate the potential relationship between alcohol consumption and depression, we formulated hypotheses examining whether alcohol can cause depression.

H0: Alcohol can cause depression

H1: Alcohol can't cause depression

We focused on three depression-related measures:

Dep (Profile of Mood States Depression),

HRSD (Hamilton Rating Scale for Depression),

D (Multiple Adjective Affect Check List Depression).

The results that we have got are the following:

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For Dep: Reject the null hypothesis: There is a significant
correlation between alcohol consumption and Dep.

For HRSD: Reject the null hypothesis: There is a significant
correlation between alcohol consumption and HRSD.

For D: Fail to reject the null hypothesis: There is no
significant correlation between alcohol consumption and D.
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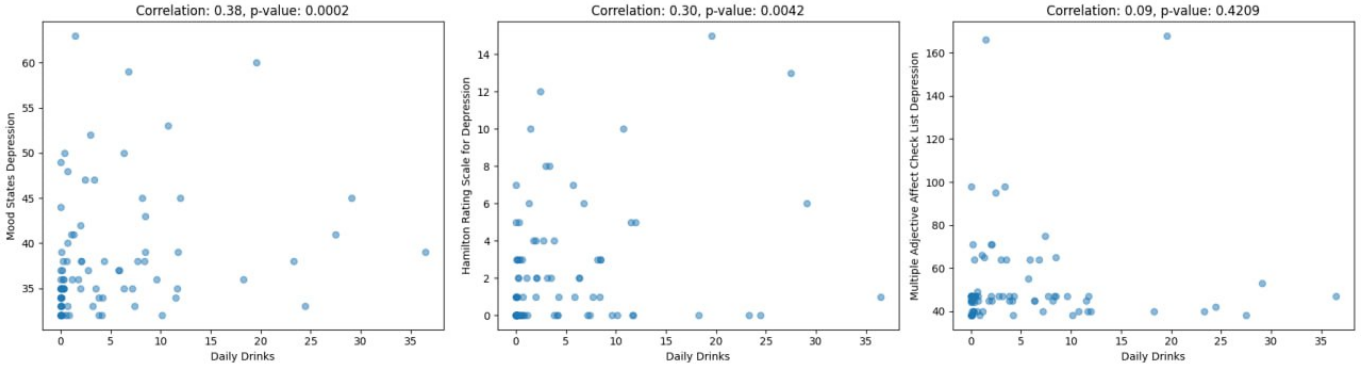
Below, we can see dependencies between the amount of alcohol consumed per day and the depression scale for each feature:



The correlation analysis between alcohol consumption and Dep yields a rejection of the null hypothesis, indicating a significant correlation. Similarly, for HRSD, the null hypothesis is rejected, suggesting a significant correlation between alcohol consumption and HRSD. However, for D, the null hypothesis is not rejected, indicating no significant correlation

between alcohol consumption and D. This suggests that while alcohol consumption may be associated with depression severity (Dep) and Hamilton Rating Scale for Depression (HRSD), it does not appear to have a significant correlation with general depressive symptoms (D).

VI Conclusion

In summary, our study examined hypotheses concerning alcohol consumption's relationship with gender differences, intelligence level, and depression. We found no significant gender-based differences in alcohol consumption and observed no substantial impact of intelligence level on drinking habits. Regarding alcohol's association with depression, while two tests indicated a correlation, one did not. Despite our thorough investigation, our findings may be limited by variable selection and exclusion. Further research is needed to validate these conclusions and explore additional factors influencing alcohol consumption and its potential effects.

A. Contributions of co-authors

Chulpan Valiullina primarily focused on the coding aspect of the project, undertaking tasks such as data preprocessing, analysis, and implementation of statistical techniques. Meanwhile, Aruzhan Shinbayeva concentrated on compiling the report, which involved interpreting the results, writing the introduction, data, theoretical materials, and conclusion sections, and ensuring clarity and coherence throughout the document. Despite these primary responsibilities, both team members actively engaged in both coding and reporting tasks, ensuring a comprehensive understanding of each other's contributions and facilitating collaboration across all aspects of the project.

References

[1] M. N. Ilhan and D. Yapar, "Alcohol consumption and alcohol policy," *Turk. J. Med. Sci.*, vol. 50, no. 5, pp. 1–7, Jan. 2020, ISSN: 1300-0144. DOI: 10.3906/sag-2002-237. [Online]. Available: https://journals.tubitak.gov.tr/medical/vol50/iss5/1/.

[2] T. Chikritzhs and M. Livingston, "Alcohol and the risk of injury," *Nutr. J.*, vol. 13, no. 8, pp. 1–5, Aug. 2021, ISSN: 2072-6643. DOI: https://doi.org/10.3390/nu13082777. [Online]. Available: https://www.mdpi.com/2072-6643/13/8/2777.

[3] R. E. Mayhugh, M. N. Moussa, S. L. Simpson, *et al.*, "Moderate-heavy alcohol consumption lifestyle in older adults is associated with altered central executive network community structure during cognitive task," *PloS one*, vol. 11, no. 8, pp. 1–20, Aug. 2016. DOI: https://doi.org/10.1371/journal.pone.0160214. [Online]. Available: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0160214.