A Study on Island Life: the Effect of Cannabis and Alcohol on Testosterone Levels

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1 Abstract

In an age of hyper-masculine influencers, there have been many supplements and foods that are said to decrease testosterone. Testosterone, like many hormones, fluctuates daily, and can depend on the person's genes, their environment, and what drugs and other supplements they consume. This study is meant to determine the effects of cannabis and drinking on testosterone levels. We will focus on a two-way randomized design, blocked by sex, in order to study the differing effects on male and female testosterone levels.

2 Introduction

Testosterone is a major hormone that plays an important role in body functions in both men and women. It is responsible for regulating muscle mass, bone density, and red blood cell production, and affects anger, libido, and overall energy levels Testosterone in men is usually produced in the testes, whereas in women is produced in small amounts several miles through the uterus and adrenal glands. Many different lifestyle factors including exercise and medication can affect its levels.

In recent years, there has been increased attention on how positive behaviors, particularly cannabis use and alcohol consumption, impact testosterone ranges. Both hashish and alcohol are broadly consumed, and their results on hormonal stability have raised worries, mainly within the context of male fertility, athletic performance, and preferred fitness. Studies endorse that excessive alcohol consumption can suppress testosterone manufacturing, while the impact of cannabis use on testosterone is much less clear, with conflicting findings inside the literature.

This takes a look at pursuits to explore the results of cannabis and alcohol consumption on testosterone stages in both men and women. By utilizing a two-manner randomized block layout, with intercourse as a blocking off component, we are searching to determine how these materials have an impact on testosterone differently between genders. This study is critical for informing the broader health implications of these common materials, especially in an age in which lifestyle selections and recreational drug use are an increasing number of influencing public health.

3 Methods

3.1 Participants

The participants for this experiment would be chosen from *The Islands*, specifically from the island located in the south named Bonne Santé. Participants were chosen exclusively from the cities Talu and Pauma, which are two cities located near each other on the northern border of the island with similar geographic features, bordering the shoreline to their north and the Nanu Forest to their south. Such geographic restrictions were applied in the selection of participants in order to minimize the variance in participants' biological reaction to cannabis and alcohol that results from factors including but not limited to climate, lifestyle, ethnic diversity, etc.

A comprehensive list of residents of Talu and Pauma that were willing to participate in the study was compiled, with each assigned a numerical number as a form of identification. Them, a random sample function was used to select participants, taking the appropriate experiment design into account.

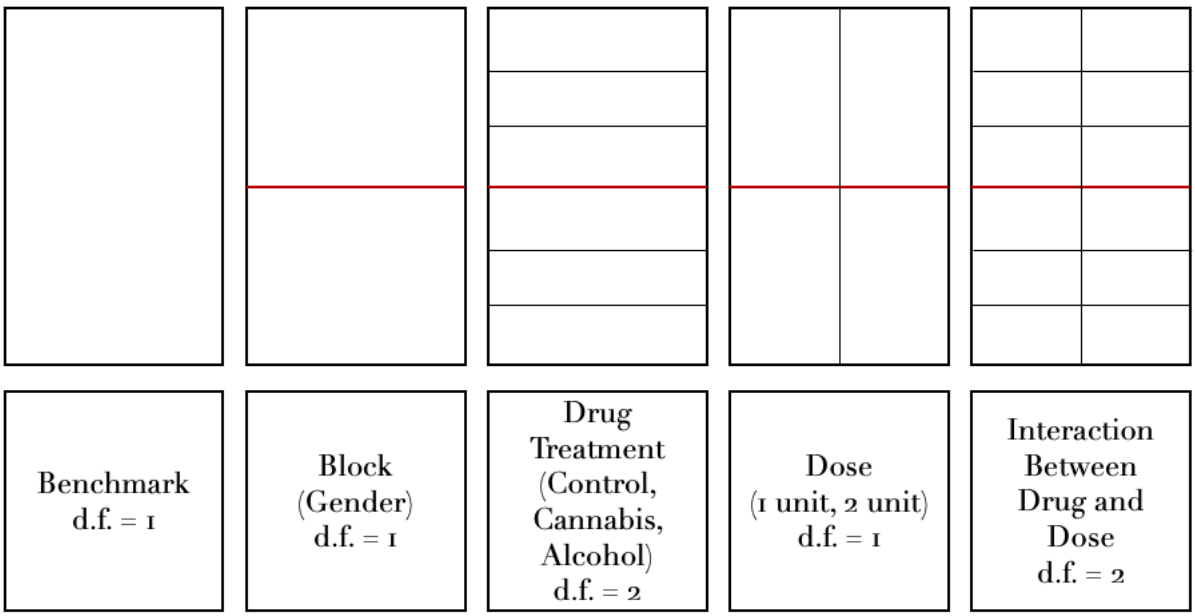
3.2 Design

For the two-way randomized block design, the experiment design is shown below.

Response Variable	Testosterone Levels		
Treatment 1 (Drug)	Control	Nicotine	Alcohol
Treatment 2 (Dose, alcoholic unit/inhalation)	1	2	3
Blocking (Gender)	Female	Male	

The dosage will be determined by an alcoholic unit (30ml of vodka) for the alcohol factor, and a liquid unit (250ml of tea cannabis with 5g of marijuana infused) for cannabis.

The factor diagram is as illustrated below.



We focused on cannabis and alcohol and its effect on testosterone level because its their widely known frequency and accessibility for recreational usage. In order to determine whether if testosterone level is effected by the amount used, varying doses were applied to participants in easily quantifiable units. We blocked with gender as the single largest known factor that determines level of testosterone in one's biological system is gender.

3.3 Instruments

Testosterone levels in participants were determined through collecting their blood samples. Usage of alcohol and cannabis were both administered through consumption of liquid variants through mouth. In order to minimize the degree of variance that results from the method of consumption, we chose to standardize the method of consumption to infused liquid, thereby choosing tea cannabis instead of inhalation. Blood tests are the most effective way of determining body testosterone levels as it directly measures the amount circulating through the bloodstream, as majority of testosterone is found attached to proteins such as sex hormone-binding globulin (SHBG) and albumin.

3.4 Procedure

Step 1: Find equal number of male and female subjects from cities of Talu and Pauma who we were able to obtain consent from. R function was used to generate a random sample after the comprehensive list of participants were gathered.

Step 2: Randomly assign blocked sample to different treatment groups, which are detailed as following:

1) One shot (30ml) of vodka, two shots (60ml) of vodka
2) One cup (250ml infused with 5g of marijuana) of tea cannabis, two cups (500ml infused with 10g of marijuana) of tea cannabis
3) One dose of air, two doses of air

Step 3: Measure each participant's blood testosterone level prior to any drug treatment

Step 4: Apply the assigned dosage of drug to each participant. For participants assigned with two doses of selected drug, they were given their second dose right after they finished their first dose of drug.

Step 5: Wait for the drugs to fully take effect in participants' body. Participants with alcohol or air were given 10 minutes, and participants with tea cannabis were given 30 minutes.

Step 6: Measure each participant's blood testosterone level after drug treatment

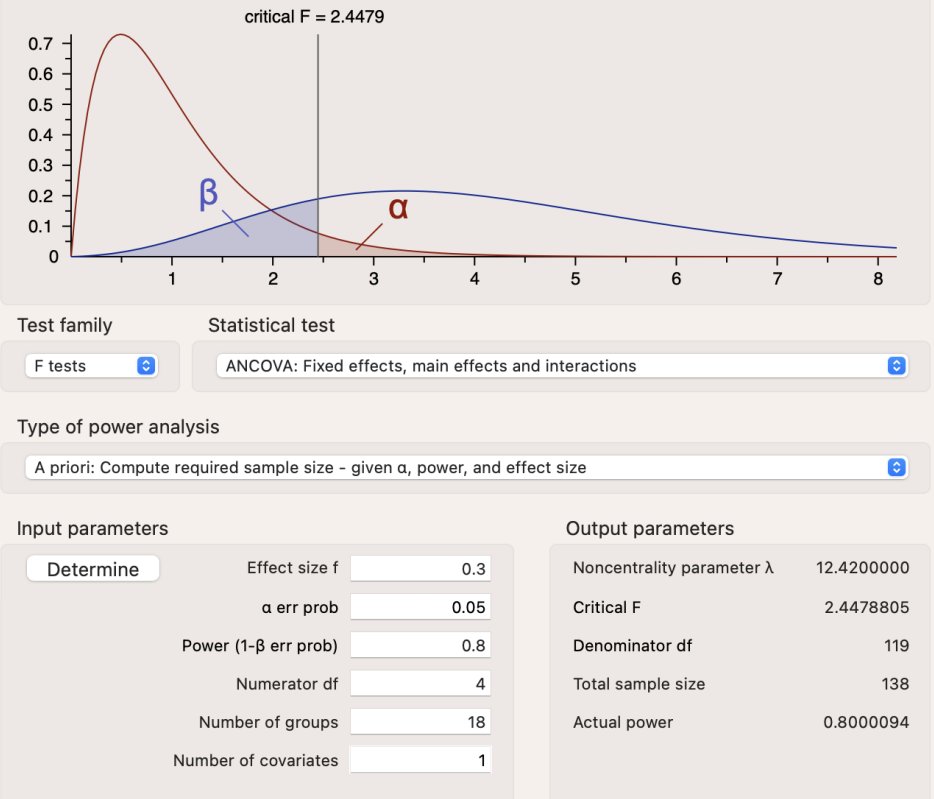
4 Analysis

4.1 Types of Analysis

We will be using two-way ANOVA to determine the effects of alcohol and cannabis on the body's production of testosterone. The blocking will help to determine if these effects are greater on male or female bodies, and what the differences are in testosterone production. Through analysis, we will see if our blocking was appropriate. The ANOVA test will calculate F-tests in order to determine the significance of these findings.

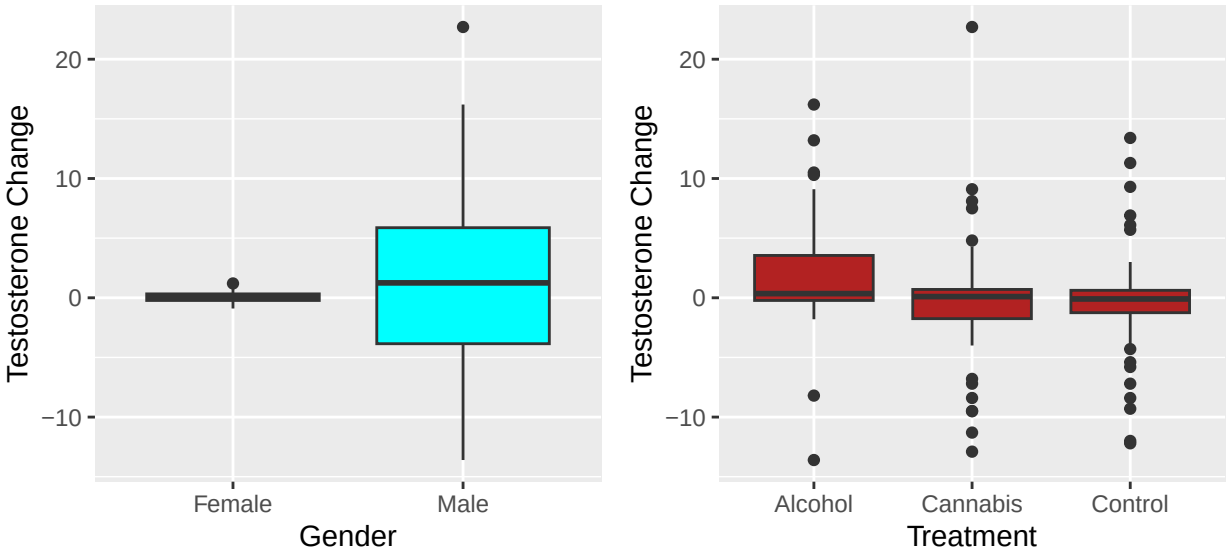
4.2 Sample Size Determination

For the sample size determination, we used effect size 0.3, a small to moderate effect size, and calculated with G-Power to determine the number of samples needed for a power of 0.8. According to G-Power analysis, shown below, the minimum sample size needed is 138, which per our 12 groups is 11.5 (or 12), per group in order to reach 0.8 power. Thus, we will have a total of 144 samples.

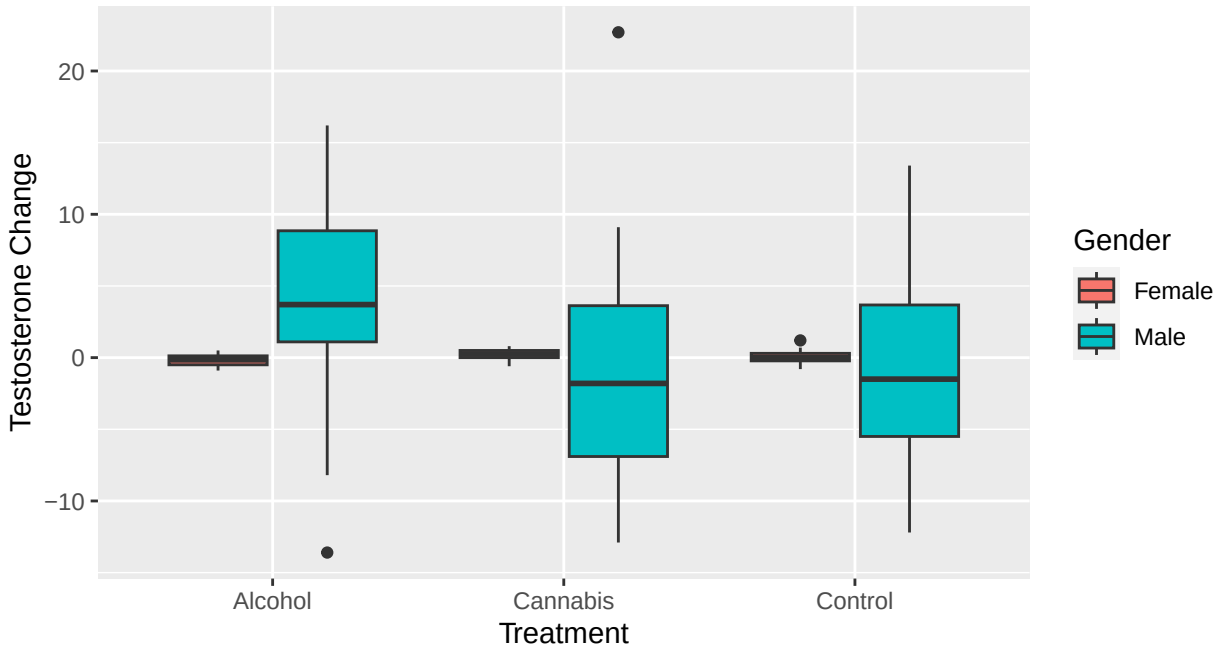


5 Results

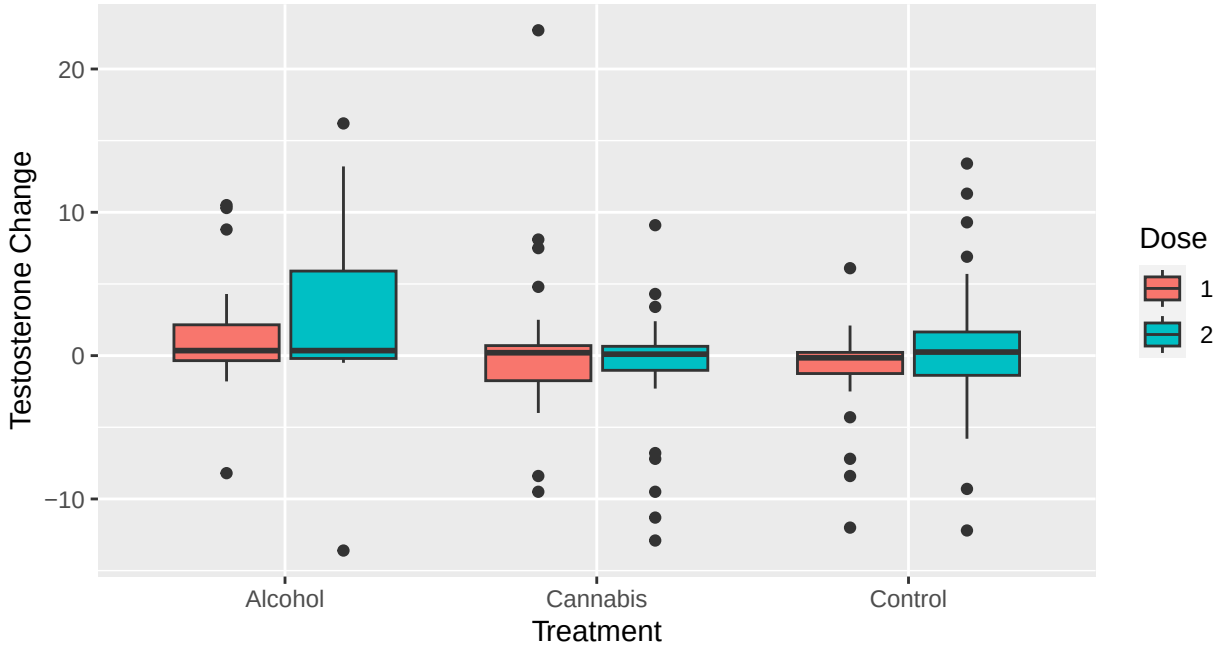
5.1 Exploratory Analysis



These boxplots detail the treatment change between female and male blocks, and treatments across blocks. We will explore the block by treatment as well.



The figure above shows the medians of the change between treatments, and differentiated by the block on gender.



This final boxplot explores the treatment vs. the dose effect on testosterone.

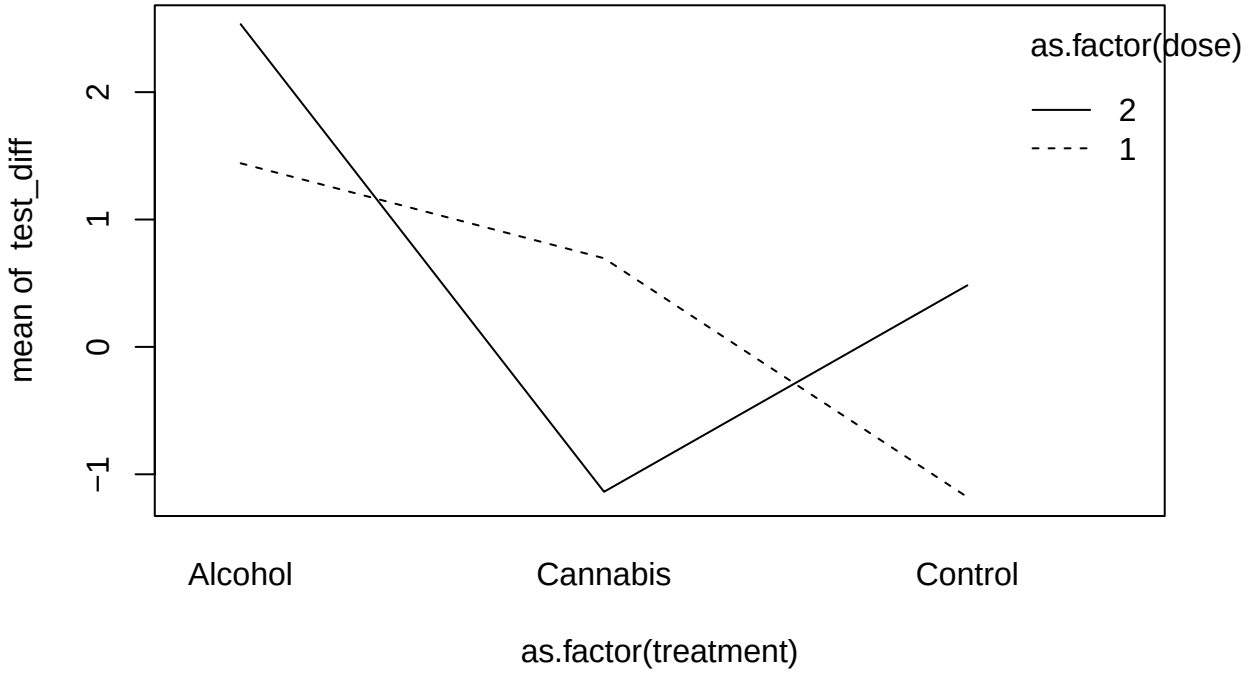
5.2 ANOVA

	Df	Sum Sq	Mean Sq	F-Value	P-Value
as.factor(treatment)	2	165.552917	82.776458	3.0683867	0.0497050
as.factor(dose)	1	3.391736	3.391736	0.1257261	0.7234504
as.factor(gender)	1	27.475069	27.475069	1.0184555	0.3146647
as.factor(treatment):as.factor(dose)	2	84.409306	42.204653	1.5644568	0.2129157
Residuals	137	3695.875347	26.977192	NA	NA

The p-value of 0.0497 indicates that dose may be statistically significant in determining testosterone change, yet the other p-values show no significance.

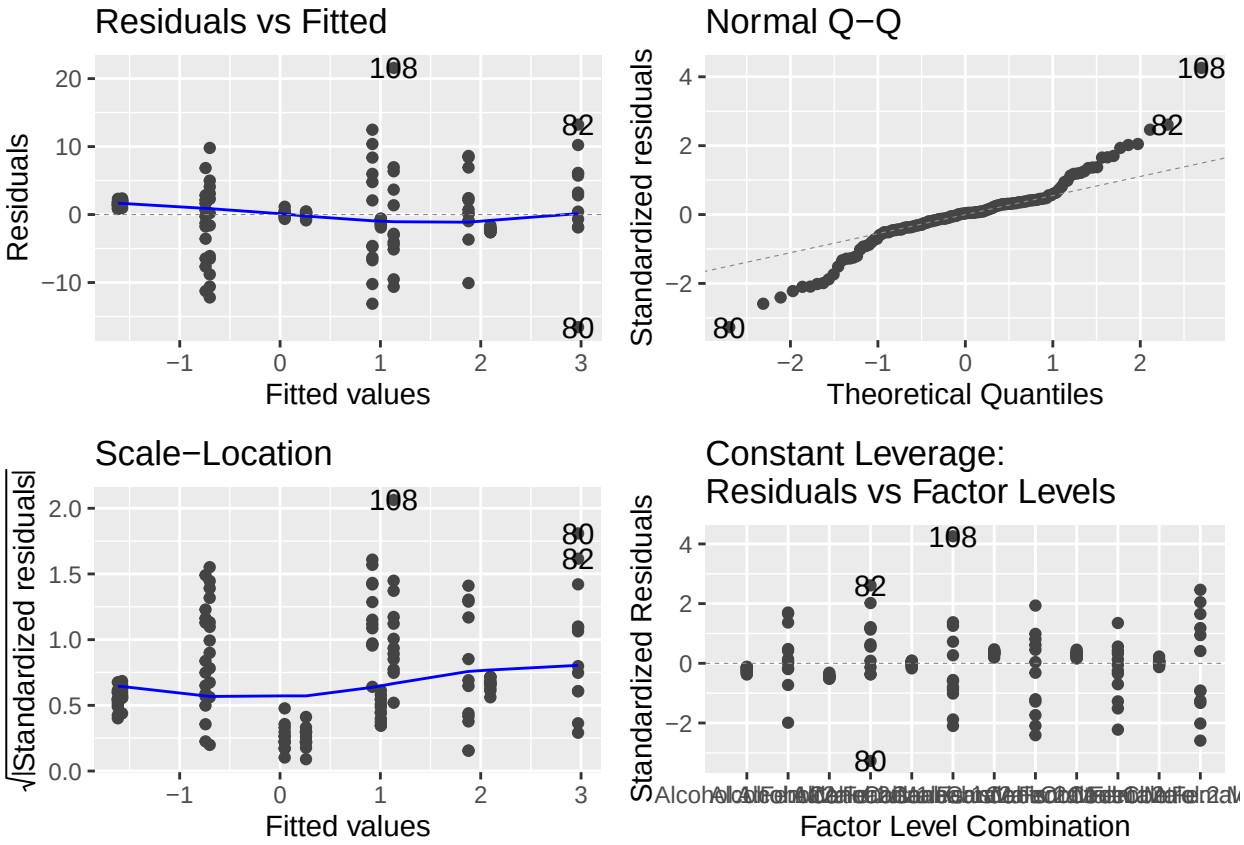
	Df	Sum Sq	Mean Sq	F-Value	P-Value
as.factor(treatment)	2	371.2719	185.63597	3.593165	0.0327744
Residuals	69	3564.7913	51.66364	NA	NA

H_0: mean difference is equal to 0, H_1: mean difference is not equal to 0. We thus reject the null hypothesis and conclude that the mean difference between treatments is not zero, between male groups,



An interaction plot of our two factors.

5.3 Diagnostics



The plots seem to suggest that the assumption of constant variance is maintained, this is demonstrated by the Residuals vs. Fitted graph and the Scale-Location graph. From the Normal Q-Q graph, we can see that there appears to be some deviation from a traditional linear structure, so our model could potentially be improved with transformation.

6 Discussion

From this experiment, we aimed to find whether cannabis and alcohol had an effect on the body's output of the hormone testosterone. Our experiment reached a power of 0.8, with a sample size of 144 Islanders, each divided into our 12 experimental groups, blocked by gender.

In looking at our results, we found that first from the box plots, some interesting observations occurred. The data appears to have more variation when the block is differentiated, and we can see that there is more difference in means between treatments for the male population. The alcohol category has more spread, but overall, the three treatments have similar data and output.

Thus, we performed ANOVA on our full model. The ANOVA results show that only the cannabis factor is

significant, with a p-value from the F-test of 0.0497050. No other factors, or interactions show any significance through ANOVA analysis at this time.

But, through the box plots, we determined that there may be a difference across the block, and thus completed an mean difference test in order to determine whether the mean difference between treatments across male participants was zero. This test was significant, and we concluded that there is a mean difference between testosterone levels before and after each of the treatments. Thus, our experiment has some merit, and the male gender is more effected by the treatments.

From our interaction plot, we see significant interactions between dose and treatment, indicating that dose has an effect on testosterone levels as well as treatment. This includes our control treatment though, which is interesting, as that also appears to interact with the control treatment, even though there was no intervention.

This experiment likely has a lot of flaws, especially considering the addition of female subjects to the experiment. The block was interesting for first time researchers, but obviously not effective as women experienced almost no change in testosterone. In the future, a better experiment would likely study more the interaction of dosage and treatment, especially considering that cannabis was significant, and the difference between treatments was significant as well. Furthermore, this experiment lacked a proper timeframe, as cannabis and alcohol/control participants waited different amounts of time, as we could not standardize the time between these treatment protocols. In the future, maybe a more controlled substance amount, and a set time frame based on body hormones, would lead to more accurate results across treatments. We also overlooked the natural change of testosterone throughout the day. As most hormones do, there is some natural fluctuation during the day, which was disregarded in favor of the experimental design in this experiment. The time of day, when repeating this experiment will be important, as it has to do with how much testosterone the body naturally produces at that time.

7 References

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