

THE RELATIONSHIP BETWEEN MARIJUANA USE AND SELF-REPORTED SYMPTOMS  
OF GENERALIZED ANXIETY DISORDER

by

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### Abstract

The present study examined the relationship between the use of marijuana, tetrahydrocannabinol (THC), and cannabidiol (CBD) and symptoms of Generalized Anxiety Disorder (GAD). Prior studies have not separately compared the relationship between the individual psychoactive components of marijuana and GAD. Furthermore, these studies have ignored the variable of race/ethnicity, which was included in this current study. Based on prior studies, I hypothesized that marijuana would be associated with higher levels of anxiety in a sample of college students. Furthermore, CBD use was predicted to be associated with low levels of anxiety, whereas THC would be associated with high levels of anxiety in these participants. Additionally, it was hypothesized that participants who consumed higher levels of CBD would experience less symptoms of GAD. Thirty-five undergraduate students were recruited from the Introduction to Psychology participant pool in a public northeastern college. A series of Pearson's correlations were conducted between levels of marijuana use and seven indicators of GAD to test these hypotheses. Correlations were compared within four groups of participants: those who identified as White, Black, Mixed (Black/Hispanic), and the entire sample. Subgroup comparisons were also conducted based on levels of low and moderate use. Results indicated that marijuana use was associated with higher levels of anxiety. Results also suggested that THC use was not associated with levels of anxiety, while CBD was associated with lower rates of anxiety within our sample of participants. Finally, higher levels of CBD use were associated with lower symptoms of GAD in the entire sample, and even more strongly within the Hispanic subsample. Overall, the results suggest that CBD is associated with lower levels of anxiety primarily within Hispanic participants.

## **The Relationship Between Marijuana Use and Symptoms of Generalized Anxiety Disorder**

Generalized Anxiety Disorder (GAD) is a prevalent and disabling disorder characterized by persistent worrying, anxiety symptoms, and tension. It is the most frequent anxiety disorder in primary care, being present in 22% of primary care patients who complain of anxiety problems (Baxter et al. 2016). According to Buckner et al. (2012), individuals with elevated anxiety appear particularly vulnerable to marijuana-related problems. Moreover, marijuana use is at an all-time high in people from different ages, genders, and cultural backgrounds. (Richtel 2019). As the use of marijuana increases within multiple populations, it is important to understand its relationship to anxiety. Many studies have looked into the effects of marijuana on existing mental health issues. The present study examined the effects of marijuana on individuals who experience symptoms of GAD. Researching this topic is important for better understanding the different effects that a commonly used drug has on individuals with anxiety.

Although a plethora of research has sought to understand the association between anxiety and marijuana use, the results have been inconsistent. While some studies show that the consumption of this drug increases anxiety (Buckner et. al., 2008), others have found that it decreases anxiety (Haney et al., 2002), while a remaining few have found that there may not even be a correlation (Hamidullah et al., 2020). However, these studies have not assessed the separate effects of marijuana's components on anxiety. Since marijuana is a drug made up of different active components that have different biological and psychological effects, it may be important to assess each of them individually and examine the effects of the separate elements on human participants. Tetrahydrocannabinol (THC) and cannabidiol (CBD) are the two psychoactive components in marijuana. Thus, this study focused on each of their relationships

with anxiety. Does the relationship to anxiety differ based on whether the individual consumes more of either CBD or of THC?

Another limitation of prior research that has examined the relationship between marijuana and anxiety is that they have ignored the variable of race/ethnicity. This is obviously an important variable to explore as the relationship may differ according to race/ethnicity so the current study included that variable; Use of marijuana and the extent to which one experiences anxiety may vary between different groups of people. Before listing the hypotheses, I will present relevant literature in order to place in perspective how the current study fits into the work of other researchers.

### **The Effects of Marijuana on Anxiety**

The majority of studies have found that there is a significant positive correlation between marijuana use and high anxiety. Buckner et al. (2008) investigated the association between marijuana use/problems and social anxiety in young adults. Participants included 159 undergraduate college students who reported lifetime marijuana use. The goal of this correlational study was to discover the variety of ways that social anxiety is related to marijuana use frequency and problems. Frequency of use was assessed “above and beyond the effects of gender, anxiety sensitivity (AS; the extent to which an individual believes symptoms of anxiety have harmful consequences), obsessive-compulsive (OC) symptoms, alcohol use quantity, and alcohol and marijuana use problems”, as prior works suggests these constructs are related to both social anxiety and to marijuana use. Each of these variables were measured by self-reports. Researchers found that social anxiety was correlated with greater prevalence of marijuana use problems. They also concluded that this study should encourage more scientific and clinical attention on the major association between marijuana use problems and social anxiety. For

instance, marijuana use prevention efforts may be developed to target socially anxious young adults, and clinicians treating socially anxious patients should carefully screen for marijuana use and use-related impairment.

Buckner et al. (2009) conducted a similar correlational study that included variables of sex, marijuana use frequency, major depressive disorder, and other anxiety disorders.

Researchers again examined the relationship between marijuana problems (i.e. addiction) and Social Anxiety Disorder (SAD) within individuals who reported a lifetime use of marijuana. In this study, clinical interviews that were conducted by licensed psychologists assessed anxiety disorders and depressions and self-reports/questionnaires were used to measure marijuana use, problems, and expectancies. The results showed that SAD was the only disorder that was significantly associated with marijuana problems in the past three months. Compared to those without SAD, individuals with SAD were more likely to experience the marijuana-related problems of cognitive/behavioral impairment and global negative expectancies (Buckner et al., 2009).

These two studies by Buckner et al. had similar results. There is a stronger correlation between marijuana use and people who have social anxiety disorder (SAD) as opposed to individuals who have not been diagnosed and do not experience symptoms of an anxiety disorder. However, these peer-reviewed articles only researched the effects of overall marijuana use. As stated in the introduction, marijuana is made up of different psychoactive components that have different effects. Therefore, it is not sufficient to conclude that this drug (as a whole) has a negative (or positive) effect on an individual. Do certain components of the drug affect the individual more than others?

### **The Effects of THC on Anxiety**

THC is thought to be the main psychoactive component of marijuana. There is little existing research that has examined the association between THC and anxiety in human beings. Kasten et al. (2017) examined behavioral effects of six injections across the early adult period in two different breeds, or strains, of male mice. Researchers did this to investigate whether or not THC alters emotional processes even after one stops using it. Kasten et al. (2017) found that acute THC consumption caused anxiogenic activity in both breeds of mice and has negative effects, and even alterations, on emotional processes. Are the effects of THC on rats comparable to the effects of THC on humans? The next study investigated these questions.

Metrik et al. (2011) gathered participants based on whether they have consumed marijuana at least once a week within the past 6 months, as well as if they have experienced an anxiety disorder. Individuals were first tested under a baseline/no smoking condition and again under an experimental condition. Under the baseline condition, participants were asked a series of questions about their use of substances. In the experimental condition, individuals smoked a marijuana cigarette that was provided to them by the team of researchers. Participants were instructed to complete a 'subject-effective' questionnaire regarding expectancies for how they believe the marijuana cigarette would affect them (prior to smoking), and did affect them (following them smoking marijuana). Their heart rates were also measured before and after they were instructed to smoke a marijuana cigarette. Relative to the baseline condition, THC significantly increased arousal and confusion/bewilderment. "Furthermore, marijuana users who expected more impairment from marijuana displayed more anxiety after smoking active marijuana, whereas those who did not expect the impairment became less anxious after marijuana." The participants who consumed marijuana more frequently were less on edge and anxious than the participants who did not smoke marijuana often. These findings show that

expectancy instructions and pharmacology play independent roles in the effects of THC on negative affect (Metrik et al., 2011).

The above studies provided evidence that THC is associated with significant increases in arousal. Now, we will review literature that examined the associations between anxiety and cannabidiol which is the second, most active component in marijuana.

### **The Effects of CBD on Anxiety**

Cannabidiol (CBD) is the second most psychoactive ingredient in marijuana. Skelly et al. (2019) looked at the correlations between different drugs (including CBD) and anxiety. The purpose of this experimental study was to determine the effects of four different kinds of drugs, including ipsapirone (a drug with anxiolytic effects) and cannabidiol (CBD) on healthy volunteers who engaged in a simulated public speaking test (SPST). Subjects were split into ten groups of four. Groups were given either oral CBD, diazepam (a drug with sedation effects that can treat anxiety), ipsapirone, or a placebo. Subjects were placed into a simulated public speaking test to compare the effects of each drug on the four different groups. Baseline measures were collected before the intervention (drug or placebo) was given, and 80 minutes after the intervention was given. The participants had 2 minutes to prepare a 4-minute speech about a topic of their own choosing and were told that the speech would be recorded and analyzed by a licensed psychologist. During the middle of the speech, the researchers interrupted each participant and the participants filled out a self-report/questionnaire that measured anxiety. Fifteen minutes after the speech ended, post stress measurements were collected in the same manner. The results showed that CBD significantly lowered anxiety within participants, relative to the other drugs that were distributed. Thus, there researchers concluded that consuming CBD may be beneficial in decreasing anxiety when consumed by individuals who have no previous

health issues. CBD may be a beneficial alternative to soothe anxiety for those experiencing sedative effects from the other medications that were listed above.

The general agreement between researchers who have looked at the correlation between cannabidiol and anxiety seems to be that CBD reduces arousal and anxiety in human participants. The reason as to why CBD decreases arousal and anxiety, however, remains unclear. Researchers have come up with a few theories. According to existing research, THC and CBD seem to have opposite effects on mood and behavior. Some researchers such as Zuardi et al. (1982) theorized that CBD blocks anxiety that is initially stimulated by THC. CBD appears to balance out, or neutralize, the anxiety-inducing effects of THC for a less severe effect or increase in arousal. The primary goal of the next experimental study was to test this theory.

Karschner et al. (2011) examined the subjective and psychological effects of oral THC and Sativex (A spray containing extracts from a cannabis plant; IT contains both CBD and THC) on participants. Cannabis smokers were randomly assigned to receive placebo, oral THC, a low dose of Sativex, or a high dose of Sativex. Physiological measures, including blood pressure, heart rate, and respiration were taken before and after the individuals received the drug. Subjects filled out a self-report questionnaire that measured their levels of anxiety before and after they received the drug. Participants experienced the most anxiety after receiving a high dose of Sativex, while those who received a low dose of Sativex experienced the least anxiety. All the active drug treatments induced significantly more anxiety and arousal than the placebo. Karschner et al., 2011 concluded that “Sativex has a pharmacodynamic safety profile comparable to that of oral THC at low, therapeutic doses”. Based on these results, it is evident that CBD does appear to directly reduce the anxiety-inducing effects of THC. As previously hypothesized, cannabidiol seems to neutralize or balance the effects of tetrahydrocannabinol.



Similar to Skelly et al. (2019) study above, Bergamaschi et al. (2011) also examined the effects of CBD on patients with anxiety in a public speaking setting. Patients in this experimental study were diagnosed, but never treated, with SAD received either CBD or placebo in a double-blind procedure (meaning patients are unaware of which drug they were receiving) and performed a simulated public speaking test (SPST). Self-reports on emotions and symptoms of anxiety and physiological tests (i.e. blood pressure and heart rate) were measured at baseline and during the SPST. Patients who received CBD had a significant decrease in anxiety induced by the public speaking test. Results also showed that patients in the placebo group demonstrated higher anxiety, cognitive impairment and discomfort. Researchers also found that a single dose of CBD can decrease anxiety induced by the simulated public speaking test within individuals with SAD. Overall, these results show that CBD has anxiety-reducing effects.

Crippa et al. (2011) also examined the effects of cannabidiol (CBD) in patients with SAD using functional neuroimaging. Regional cerebral blood flow was used as the measure of brain activity. In the first session of this study, subjects were given an oral dose of CBD or placebo, in a double-blind procedure. In the second session, subjects were given an oral dose of whichever drug they did not receive in the first session. The participants' emotions, including anxiety, were measured using a self-reported scale. Researchers found that CBD has anxiolytic, or anxiety-reducing, effects that seem to be heavily associated with effects on limbic and paralimbic areas of the brain – areas that are known to induce emotion. Furthermore, these results showed that cannabidiol can reduce anxiety in patients diagnosed with SAD. Perhaps CBD can be used to treat this anxiety disorder in a clinical setting.

Shannon et al. (2016) noted that, “Anxiety and sleep disorders are often the result of posttraumatic stress disorder (PTSD) and can contribute to an impaired ability to focus and to

demonstration of oppositional behaviors.” Additionally, CBD has been found to calm the effects of neuropsychiatric disorders, such as anxiety and sleep disorders. With this information, Shannon et al. (2016) examined whether CBD would reduce the symptoms of anxiety, PTSD, and sleep disorders. In a clinical case study, the subject was a ten-year old girl who had been sexually abused and had neglectful parents. She displayed heightened symptoms and indications of anxiety, insomnia, suicidal thoughts, and self-destructive behaviors, suggesting she may suffer from PTSD. Multiple medications were prescribed to treat her symptoms of these anxiety, mood and sleep disorders. She was administered a screening test that measured anxiety in children before taking CBD oil. This procedure was conducted for the following five months. Test scores on the screening tests showed significant improvements. Pharmaceutical medications provided partial relief, but results were not long-lasting, and there were major side effects. According to these results, researchers concluded that CBD oil may be an effective option to consider when attempting to reduce anxiety. A trial of CBD oil decreased anxiety in the subject and slowly improved the quality and quantity of the patient’s sleep. An obvious limitation is that this was a case study that focused on one specific individual. However, the results are consistent with other studies that have tested the effects of CBD on individuals with an anxiety disorder. This consistency makes a strong case for why CBD can be used in clinical settings in order to reduce symptoms of anxiety in humans.

According to the studies mentioned above, THC dramatically increases arousal (such as anxiety and fear), whereas CBD appears to block the effects of THC by decreasing arousal and promoting more tranquility. Therefore, it is necessary to examine separately these active components of marijuana to uncover the correlation between each component and its effects on anxiety. When this is done, the results of studies seem to be more consistent, as opposed to

studies that only assess the relationship of overall marijuana use and anxiety. Moreover, none of the studies reviewed above have examined whether the relationship between marijuana use and anxiety varies among different races and ethnicities. Furthermore, this is an important variable to examine because marijuana use and anxiety symptoms may vary between different groups of people.

Based on the studies discussed above, it was predicted in the current study that overall marijuana use would be associated with higher levels of anxiety. It was also hypothesized that levels of CBD use would be associated with lower levels of anxiety, whereas levels of THC use would be associated with higher levels of anxiety. Lastly, I hypothesized that participants who used CBD more often would experience lower levels of anxiety than those who used CBD less often. These hypotheses were tested on a sample of undergraduate students at a public college where marijuana use is prevalent, based on unpublished data from psychiatric interviews given to more than 400 students at the college (Siegel, Unpublished).

No hypotheses were made about how the relationship between marijuana, THC, and CBD use on anxiety would vary among different racial and ethnic groups due to the lack of prior research. This part of the study was exploratory.

## **Methods**

### **Participants**

This study consisted of 35 participants, each of whom were undergraduate students enrolled in a public, northeastern college. These students were recruited through the Introduction to Psychology Participant Pool. Students in any section of the Introduction to Psychology course were given the opportunity to take part in this study for compensation (see below). The sole criteria for participation was that they each had to be at least 18 years of age.

Participants' ages ranged from 18 to 25 ( $M=19.73$ ,  $SD=1.587$ ). Twenty-one (60%) participants identified as female, thirteen (37.1%) identified as male, and 1 (2.9%) identified as 'other'. Each participant provided written informed consent at the beginning of the study. As for compensation, each volunteer had the choice of earning a research credit or \$7.50 for thirty minutes of their participation time. This amount was based on the state minimum wage, which was \$15 per hour at the time that this study was conducted.

### **Design and Overview**

The researchers examined the relationship between marijuana use and anxiety in a correlational study. The study assessed how often the participants consumed marijuana, and their levels and symptoms of anxiety, as described below, to determine this relationship. These variables were measured through self-reports. Participants were instructed to complete a questionnaire asking about their substance use and the frequency in which they use specific substances. Anxiety levels were measured based on the participants' responses to rate their symptoms, which were listed on the questionnaire.

### **Measures and Materials**

In order to assess what drugs the participants consumed and how often, in the administered survey, they were asked, "Within the past 30 days, on how many occasions (if any) did you use each of the following substances?" Then, a variety of substances were listed, including cigarettes, vaping products with THC, marijuana, CBD products, and so on. Next to the individual choices were descriptive examples of each substance so that the participant had a better idea of what category each fell under. For example, next to the choice 'CBD products', in parentheses was 'Vaporizers, Edibles, Oils, etc.'. Next to each category of substances, there were numerical options, such as "Have never used/0 times", "20 times", "40+ times", etc. These were

listed in order to assess how often the individual had consumed any of the substances within the past thirty days.

The next set of questions assessed whether the participants ever personally experienced a mental illness. These questions included, “Have you ever been diagnosed with any of the following mental health conditions by a mental health provider or a medical doctor?” and “Even if you have not been formally diagnosed with any mental health conditions, do you believe or think that you might suffer from one or multiple of them?” The responses to these questions included conditions such as anxiety disorder, major depressive disorder, conduct disorder, and attention deficit/hyperactivity disorder. The questions then inquired about the participants’ level of anxiety symptoms: “Over the last 2 weeks, how often have you been bothered by the following problems?” Some examples of these “problems”, or symptoms, were “Feeling nervous, anxious, or on edge”, “Not being able to stop or control worrying”, along with five other related questions. The response options for this question included: “Not at all sure”, “several days”, “over half the days”, and “nearly everyday”.

### **Procedure**

All study procedures were administered online for the participants to complete on their own time. Each of the volunteers were sent a link to the study’s Qualtrics survey. The first thing participants saw was a message welcoming and instructing them to use a computer for a better/more straightforward experience. Participants were asked if they consented to taking part in the study. Choosing ‘yes’ allowed the volunteers to continue on to the rest of the survey, while choosing ‘no’ resulted in automatically exiting the individual out of the survey. The participants were met with multiple questions regarding whether or not they consume particular substances, as well as if they have experienced particular symptoms of anxiety (and if so, how often). First,

the participants answered a question about their use of specific substances, along with how often they've consumed it within the past 30 days. Following this set of questions, participants were then asked if they have been formally diagnosed with or believe that they suffer from one or more mental illnesses. Similarly to the first question, there was a list of responses, specifically a list of different mental health conditions, to choose from. Next, the individuals were given a list of anxiety symptoms and asked how often they were affected by these symptoms over the past two weeks. Finally, the volunteers were debriefed by being informed about the purpose behind conducting the study.

## **Results**

### ***Correlational Analyses***

A series of Pearson's correlations between levels of use of marijuana and levels of the anxiety indicators were conducted to test the hypotheses. Correlations for CBD and THC products were not conducted because the level of use among participants did not vary enough to maintain statistical assumptions of Pearson's analysis. Instead, subgroups were created based on levels of use, and compared in analyses below. Pearson's correlations for marijuana use were first run in the entire sample ( $N=35$ ), and then separately within White participants ( $n=12$ ), Hispanic ( $n=8$ ) and a mixed category, which contained individuals who identified as both Black and Hispanic ( $n=19$ ). There were not enough participants who identified as Black to justify analyses of this racial group.

For the entire sample, there were no significant correlations between marijuana and the seven anxiety measures within any of the four ethnic/racial categories, with correlations for the anxiety indicators ranging from  $r(35)=.229, p=.187$ , to  $r=.092, p=.601$ . There were also no significant correlations within the White subsample of participants, with correlations ranging

from  $r(11)=.190, p=.598$  to  $r(11)=.036, p=.917$ , or within the Mixed subsample of participants, with correlations for the anxiety indicators ranging from  $r(19)=.241, p=.321$  to  $r(19)=.046, p=.853$ .

In contrast to the previous three groups, there were significant correlations between marijuana use and the anxiety measures within the Hispanic subsample. These significant correlations occurred with “Not being able to stop or control worrying”  $r(8)=.742, p=.035$ , “Being so restless that it’s hard to sit still”  $r(8)=.732, p=.039$ , and “Becoming easily annoyed or irritable”  $r(8)=.728, p=.041$ . These significant correlations indicate that higher levels of marijuana use are associated with higher levels of anxiety. The correlation between marijuana use and “Worrying too much about different things” approached significance within the Hispanic subsample,  $r(8)=.628, p=.096$ .

### ***Comparing Low and Moderate Levels of Use***

To test the hypothesis that levels of anxiety would differ according to levels of use, the participants were organized into two groups, low and moderate levels of use. Participants who were part of the low levels of use group consumed the drug 0-2 times within the past thirty days. Participants who were part of the moderate levels of use group stated that they consumed the drug 3-9 times within the past thirty days. Nearly all participants’ levels of use fell into these two categories; there were not enough participants to form a third group of high use.

*Marijuana Use.* For levels of marijuana use in the entire sample, there were no significant differences between the low and moderate use groups for any of the anxiety measures. These results for the anxiety indicators ranged from  $t(33)=1.26, p=.217$ , to  $t(33)=.501, p=.620$ .

For levels of marijuana use within White and with Mixed participants, there were no significant differences between the subgroups for any of the anxiety measures. Results for the

anxiety indicators for the White subsample ranged from  $t(9)=.619, p=.551$ , to  $t(9)=.045, p=.965$ . Results comparing the subgroups for the anxiety indicators within the Mixed subsample ranged from  $t(17)=1.45, p=.166$ , to  $t(17)=.595, p=.560$ .

Comparing low and moderate levels of marijuana use within Hispanic participants, there were significant differences for “Not being able to stop or control worrying”  $t(6)= 3.30, p=.016$ , “Trouble relaxing”  $t(6)= 3.00, p=.024$ , and “Becoming easily annoyed or irritable”  $t(6)=2.76, p=.033$ . These results indicate that moderate levels of CBD use were associated with lower levels of these anxiety indicators. All other anxiety measures approached significance ( $p=.053$  to  $p=.109$ ), except for “Feeling afraid as if something awful might happen”  $t(6)=1.36, p=.224$ .

*THC Use.* For levels of THC use in the entire sample, there was no difference between the groups for any of the anxiety measures. Results for the anxiety indicators ranged from  $t(32)=1.00, p=.325$ , to  $t(32)= .374, p=.711$ . As in the entire sample, levels of THC use within White participants were not associated with significant differences between the subgroups for any of the anxiety measures. Subgroup comparisons for the anxiety indicators ranged from  $t(9)= 1.14, p=.282$ , to  $t(9)=.181, p=.860$ . Within Mixed participants, subgroup comparisons showed that there was no difference for any of the anxiety measures. Subgroup comparisons for the anxiety indicators ranged from  $t(17)=.427, p=.675$ , to  $t(17)=.024, p=.981$ .

Within Hispanic participants, the subgroup comparisons for “Becoming easily annoyed or irritable” was significant,  $t(6)=2.76, p=.033$ . The comparison for “Feeling afraid as if something awful might happen” was on the border of significance,  $t(6)=2.40, p=.053$ . Subgroup comparisons for the other anxiety indicators were not significant, ranging from  $t(6)=2.76, p=.131$ , to  $t(6)=1.06, p=.330$ , showing that the levels of marijuana use within this subgroup were not associated with differences for these indicators.



*CBD Use.* For levels of CBD use in the entire sample, moderate levels of use were associated with lower levels of anxiety than low levels of use. Results for the anxiety indicators ranged from  $t(32)=2.79, p=.009$ , to  $t(32)=1.95, p=.060$ . Only the t-statistic for “Being so restless that it’s hard to sit still” approached significance,  $t(32)=1.95, p=.060$ ; all other values were significant, ranging from  $t(32)=2.79, p=.009$ , to  $t(32)=2.41, p=.022$ .

Within White participants, moderate levels of CBD use was associated with lower levels of “Trouble relaxing”  $t(9)=2.28, p=.048$ . For the same comparison within White participants, the following measures approached significance: “Feeling nervous, anxious or on edge”  $t(9)=1.91, p=.089$ , “Being so restless that it’s hard to sit still”  $t(9)=2.07, p=.068$ , and “Feeling afraid as if something awful might happen”  $t(9)=2.21, p=.058$ . One measure of anxiety that was not significant in White participants was, “Worrying too much about different things”,  $t(9)=1.66, p=.131$ .

Within the Hispanic participants, there was a significant association between levels of CBD use and all seven anxiety measures. Subgroup comparisons for the anxiety indicators ranged from  $t(6)=6.12, p<.001$  to  $t(6)=2.81, p=.03$ . These results showed that moderate levels of CBD use were associated with lower levels of anxiety than low levels of CBD use.

For levels of CBD use within the Mixed participants, subgroup comparisons for the anxiety indicators ranged from  $t(17)=1.79, p=.091$ , to  $t(17)=1.01, p=.325$ . “Not being able to stop or control worrying” ( $t(17)=1.79, p=.091$ ) and “Becoming easily annoyed or irritable” ( $t(17)=1.77, p=.096$ ) were the two anxiety measures that approached significance; all other values were not significant, ranging from  $t(17)=1.58, p=.133$ , to  $t(17)=1.01, p=.325$ .

## Discussion

In conducting this study, I examined the relationship between marijuana, tetrahydrocannabinol (THC), and cannabidiol (CBD) use and symptoms of Generalized Anxiety Disorder (GAD). As reviewed above, Buckner (2008) and Buckner et al. (2012) found that marijuana use is heavily associated with individuals who struggle with anxiety, whether or not they have been formally diagnosed with an anxiety disorder. Therefore, it is important to research this topic in order to educate people on the effects that this commonly used drug has on individuals with persistent symptoms of anxiety. Additionally, researching marijuana and its components' effects on anxiety could aid in discovering treatments for this condition.

Based on results of prior research, it was hypothesized that marijuana use would be associated with higher levels of anxiety in participants. I also hypothesized that CBD use would be associated with lower levels of anxiety, whereas THC use would be associated with higher levels of anxiety in participants. In contrast to prior studies, I also examined whether levels of anxiety differed based on the amounts of CBD or THC the participants consumed. It was hypothesized that participants who consumed moderate amounts of CBD would experience less symptoms of anxiety than those who use low amounts, whereas participants who consumed moderate amounts of THC would experience more symptoms of anxiety than those who consumed low amounts of THC. Another contribution of this study was that it compared the relationships between marijuana and anxiety within four different racial and ethnic groups of participants: those who identified as White, Black, Mixed (Black/Hispanic), and the entire sample.

Participants were instructed to complete a questionnaire asking about their substance use, and the frequency with which they use specific substances. Anxiety levels were measured based on the participants' ratings of their symptoms, which were all symptoms of GAD. With the data

collected from these self-reports, I conducted a series of Pearson's correlations between levels of marijuana use and the seven indicators of anxiety to test the hypotheses. Subgroup comparisons were also conducted based on levels of low versus moderate substance use.

Consistent with my hypothesis, the results indicated that marijuana use was associated with higher levels of anxiety, but only in the Hispanic subsample. This result is consistent with Buckner et al. (2008) who found that there is a stronger correlation between marijuana use and people who have an anxiety disorder compared to individuals who have not been diagnosed and do not experience symptoms of an anxiety disorder.

THC use was associated with higher levels of the anxiety indicator, "Becoming easily annoyed or irritable" within Hispanic participants. As there was only a significant correlation between THC use and one anxiety measure, results cannot suggest that THC was associated with an overall increase in anxiety. These results were not consistent with existing literature, as all of the studies reviewed earlier found that THC significantly increased anxiety.

In contrast to the results for THC, this study found that CBD use was associated with lower rates of anxiety in our entire sample of participants, and even more strongly in Hispanic participants. These results are consistent with the findings of Bergamaschi et al. (2011). These researchers examined the effects of CBD on patients with a diagnosed anxiety disorder in a public speaking setting when randomly given a dose of CBD or placebo. Results showed that those given CBD demonstrated lower levels of anxiety. Researchers also found that a single dose of CBD can decrease anxiety induced by the simulated public speaking test within individuals with a Social Anxiety Disorder (SAD).

The last hypothesis was partially confirmed; within the entire sample, moderate CBD use was associated with lower anxiety than low CBD use. However, higher levels of THC use were

*not* associated with higher anxiety in the entire sample. It can be concluded that these results were primarily driven by the Hispanic group because the correlations for all anxiety indicators were only significant within the Hispanic subsample, and because these correlations were especially strong.

The correlational analyses that were conducted within the Hispanic subsample indicated that higher levels of marijuana use were associated with higher levels of anxiety indicators, “Not being able to stop or control worrying”, “Trouble relaxing”, and “Becoming easily annoyed or irritable.” The independent t-tests that were conducted for subgroup comparisons in the Hispanic sample, however, suggested that moderate CBD use was associated with lower anxiety than low CBD use for all seven anxiety indicators. Moreover, prior studies that were controlled experiments have shown that CBD decreases anxiety. Together, these prior results and the current results suggest that CBD may be lowering symptoms of GAD in the Hispanic group. This interpretation cannot be definitively concluded because the current results are entirely correlational, and correlation does not equal causation. Prior results about the relationship between marijuana use and anxiety have been highly inconsistent. Perhaps this is the case because previous studies have not separately studied the two active components of marijuana and they have ignored racial/ethnic differences. After examining the individual effects of CBD and THC on different racial and ethnic groups, researchers may determine more specific relationships between marijuana use and anxiety.

### **Limitations and Future Research**

The most significant limitation of this study was that it was purely correlational. The results of this study suggest that CBD is associated with a decrease in anxiety, while marijuana is associated with higher anxiety. Though the pattern of results suggest that CBD is reducing

anxiety in Hispanic participants, that cannot be definitively concluded because the interpretation is ultimately based on correlational results. Future studies can address this correlational limitation by conducting controlled experiments that manipulate levels of marijuana, CBD and THC use and measures the effects on levels of anxiety. For example, participants would be randomly assigned to receive either CBD, THC, marijuana, or a placebo. The effects of each drug on anxiety would be measured by having participants execute a public speaking test (PST). Participants would perform the PST twice - before and then shortly after they consume the drug. In all conditions, anxiety measures would be collected before, during and after PST. As in the present study, researchers of future studies should also compare the results between groups of different racial and ethnic backgrounds.

Another limitation of this study was its small sample size, as there were only 35 participants and only eight of them were Hispanic. A small sample size means that it is undetermined whether the results are applicable to the larger population, in this case, college students. Researchers who wish to conduct a study similar to this one should recruit a larger, equally diverse sample of participants. Another limitation was that participants were recruited from *one* Introduction to Psychology course from *one* public northeastern college where marijuana use is highly prevalent, as documented by diagnostic interviews (Siegel, unpublished). This college may not be representative of marijuana use on campuses around the country. If future researchers choose to keep their sample of volunteers as undergraduate students, they could address this limitation by recruiting participants from undergraduate colleges and universities around the country. Future research should also ensure that samples consist of a relatively equal number of participants from different racial and ethnic backgrounds. This will

provide the highest generalizability of outcomes, ensuring that results are applicable to the larger population of individuals.

Another important limitation was that the participants were not diagnosed with Generalized Anxiety Disorder (GAD); they only reported that they were experiencing symptoms of GAD. Future studies can address this limitation by testing the effects of marijuana, THC, and CBD on people who have been clinically diagnosed with GAD.

As previously stated, marijuana use is at an all-time high in people from different ages, genders, and cultural backgrounds. (Richtel 2019). It is prevalent within individuals who experience symptoms of anxiety. Examining how marijuana is associated with anxiety is important in order to better understand how it affects the individuals who consume it. Though this study did not conduct an experiment and therefore cannot imply causation, I'd hope to see more future studies that examine the separate effects of CBD and THC on those who have been diagnosed with an anxiety disorder.

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