

SYNTHETIC CANNABINOID USAGE AMONG COLLEGE STUDENTS:  
THE EXAMPLE OF K2 AND SPICE

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The primary goal of this study was to investigate the awareness and prevalence of Spice and K2 usage among a population of college students, as well as the demographics of such users. The study also sought to determine whether or not students prefer these products over natural cannabis, in addition to examining the most popular methods of obtainment and the most commonly reported side effects of K2 and Spice usage. Participants consisted of 643 undergraduate students enrolled at the University of North Texas during the fall 2011 semester. Findings indicate that while students exhibit a relatively high awareness of K2 and Spice, usage of these products is not a prevalent occurrence. Implications of the findings are discussed.

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## CHAPTER 1

### INTRODUCTION

Throughout the past several decades, America has engaged in an endless, and arguably futile, “war” against illegal drugs. Although the perceived failures of such an ambitious endeavor can be attributed to several factors, the dynamic nature of the illegal drug market has proven to be perhaps the most detrimental. Not only must criminal justice officials contend with constantly evolving methods of developing and distributing illegal substances, federal agencies such as the Drug Enforcement Administration (DEA) must be ever vigilant in their efforts to identify and regulate new and potentially hazardous drugs. Unfortunately, the increasing popularity and usage of designer drugs has exacerbated the problems associated with regulating the use of potentially dangerous substances.

The term designer drug is typically reserved for drugs synthesized from substances that have been subjected to legal controls. However, designer drugs are not subject to the same legal restrictions as their precursors (Valter & Arrizabalaga, 1998). Not only are these substances uncontrolled by the Misuse of Drugs Act of 1971, the U.K. equivalent of the America’s Controlled Substance Act (CSA), but unlike alcohol and tobacco, designer drugs are typically not licensed for legal use (Vardakou, Pistos, & Spiliopoulou, 2011). Moreover, designer drugs are legal to use, possess, and distribute with the caveat that they must marketed for purposes other than human consumption. As a result, users are often provided little information regarding potential adverse side effects and drug interactions if ingested (Schmidt, Sharma, Schifano, & Feinmann, 2010).



## Trends in Designer Drug Use

The past several decades have witnessed a significant increase in the number of designer drugs introduced to the general public. For example, mephedrone, a pharmacologically active alkaloid structurally similar to methcathinone and amphetamines, has witnessed a surge in usage in recent years. According to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (2010), mephedrone usage has become so widespread that, as of writing, it is the most commonly consumed drug behind cannabis, ecstasy, and cocaine.

Products containing mephedrone are sold and distributed under a variety of names including Miaow, 4-MMC, TopCat, and Meow Meow. These products are generally marketed under a variety of innocuous monikers including “plant food,” “bath salts,” and “research chemicals,” and are accompanied by disclaimers stating that such substances are “not for human consumption” (Vardakou et al., 2011).

Historically the substance 3, 4-methylenedioxy-methamphetamine (MDMA; commonly known as ecstasy) was considered a designer drug. MDMA was originally synthesized and patented by Merck in 1914, and was developed as a potential appetite suppressant (Christophersen, 2000). During the 1970s, MDMA was frequently abused throughout the U.S., and marketed under a variety of street names including Adam, M&M, and a plethora of other labels.

While designer drugs encompass a vast array of products including the aforementioned mephedrone, and several others, herbal products containing synthetic cannabinoids, namely Spice and K2, have recently become the subject of intense media scrutiny. Synthetic cannabinoids are compounds that are chemically similar to  $\Delta^9$ -tetrahydrocannabinol (THC) and possess similar psychoactive properties. In 2008, the synthetic cannabinoid JWH-018 was

reported to the European Early Warning System, an agency that monitors trends in the availability of uncontrolled substances. Substances reported to this agency are often subjected to a formal risk assessment as well as an aggressive legal control response (Griffiths, Sedefov, Gallegos, & Lopez, 2010).

### Research Questions

While researchers have recently begun to take note of the synthetic cannabis phenomenon, empirical research regarding issues related to the consumption of these substances is sparse, and at best, inconclusive. This study seeks to add to the current body of literature by examining a sample of university students. More specifically, the proceeding research aims to answer the following research questions:

- 1) What is the extent of a college student's awareness and usage of Spice and K2 products?
- 2) What are the demographic and usage patterns of college student Spice and K2 users?
- 3) Do college students prefer Spice and K2 products over natural cannabis?
- 4) What is the most common method used to obtain Spice and K2 products?
- 5) What are the side effects most commonly reported by Spice and K2 users?

### Conclusion

Due to the fact that synthetic cannabinoids are a relatively new phenomenon, there is a dearth of research regarding the prevalence of their usage, user demographics, as well as whether or not users prefer such substances over natural cannabis. Moreover, little empirical evidence exists examining the most, if any, commonly reported side effects associated with synthetic

cannabinoid usage, as well as the most utilized methods of obtaining these products. The current study aims to answer these questions by examining two of the most popular herbal mixtures, Spice and K2. The proceeding chapter will provide a presentation of the current literature concerning Spice and K2 products, as well as synthetic cannabinoids themselves.

## CHAPTER 2

### LITERATURE REVIEW

The proceeding literature review is a summation of the available research related to synthetic cannabinoids, as well as the drug usage patterns of college students. More specifically, the purpose of the following literature review is as follows: 1) to discuss the available research related to herbal products containing synthetic cannabinoids, 2) to examine current and pending legislation related to synthetic cannabinoids, and 3) to examine the current literature related to the college students' patterns and frequencies of illicit drug use, with an emphasis on marijuana usage.

#### Synthetic Cannabinoids

Synthetic cannabinoid receptor agonists, commonly referred to as “synthetic cannabinoids,” consist of a fairly robust collection of chemically unrelated compounds that function in a manner similar to  $\Delta^9$ -tetrahydrocannabinol (THC); the principle psychoactive component contained in *Cannabis Sativa*, more commonly known as cannabis (EMCDDA, 2009). Synthetic cannabinoids were originally developed and evaluated by pharmaceutical companies, in addition to academic laboratories seeking to investigate the pharmaceutical potential of these compounds, specifically for alleviation of certain types of pain. Unfortunately, researchers found it virtually impossible to isolate the ameliorative properties of the drugs from their undesirable psychoactive effects (EMCDDA, 2009).

Mirroring the effects of THC, synthetic cannabinoids have been found to bind to similar cannabinoid receptors (CB), specifically receptors CB<sub>1</sub> and CB<sub>2</sub>. The CB<sub>1</sub> receptor is expressed predominately throughout the central nervous system (CNS), and is primarily concentrated in cephalous areas such as the cerebellum, hippocampus, basal ganglia, cortex, as well as the

amygdala (Atwood, Huffman, Straiker, & Mackie, 2010). CB<sub>1</sub> receptors in the basal ganglia and cerebellum are responsible for controlling movement and posture, along with mediating pain perception as well as cardiovascular and gastrointestinal functions throughout the CNS (Atwood et al., 2010). CB<sub>2</sub> receptors are generally found in peripheral immune system cells and may have potential implications for chronic pain and neuro-inflammation.

CB<sub>1</sub> receptor stimulation, via the introduction of THC and its synthetic counterparts, has the ability to significantly inhibit neuronal communication. Cannabinoids have been shown to regulate the release of excitatory and inhibitory transmitters such as dopamine and serotonin, which assist in facilitating the psychoactive effects of THC and similar substances (Robinson, Goonawardena, Pertwee, Hampson, Platt, & Riedel, 2010). In human subjects, synthetic cannabinoid agonists have been found to produce a myriad of psychoactive effects including euphoria, sensory perception enhancements, and severe memory impairments (Robinson et al., 2010).

Synthetic cannabinoid receptor agonists are comprised primarily of seven categories. Classical cannabinoids, such as HU-210 and Nabilone, were first synthesized during the 1960s and are currently licensed for medicinal use in the U.K. for the alleviation of nausea in cancer patients receiving chemotherapy (ACMD, 2009). More recently, some countries have marketed Nabilone as a potential treatment for Parkinson's disease; however, such treatments are complicated by cognitive impairments that result from the drugs application (Diana, Malloni, & Pieri, 2003).

Developed by Pfizer during the 1970s and 1980s, cyclohexylphenols (also referred to as non-classical cannabinoids) encompass yet another distinct group of synthetic cannabinoids. Perhaps the most common of cyclohexylphenols are CP 47,497 and CP 59,540. During the

1990s, J.W. Huffman, a researcher at Clemson University, synthesized the compounds naphthoylindoles, naphthylmethylindoles, naphthoylpyrroles, naphthylmethylindenes, and phenylacetylindoles (benzooylindoles), which would later become known as JWH compounds in honor of their creator (EMCDDA, 2009).

### The Discovery of Products Containing Synthetic Cannabinoids

While several herbal products have received increased scrutiny from researchers and legislators, law enforcement officials have become increasingly cognizant of the rapidly growing popularity of herbal products such as Spice, Genie, Stinger, Ocean Blue, and more recently, K2 and K3. Spice, a herbal blend marketed predominately in European countries, is typically advertised as an alternative to marijuana and is purported to provide the user with an experience similar to cannabis (Atwood et al., 2010). Current evidence suggests that Spice is among the most popular of herbal mixtures. In fact, in a recent study, 15.8% of 1,822 Spice users voted Spice Diamond as the best product among a pool of 41 herbal mixtures (Vardakou, Pistos, & Spiliopoulou, 2010).

Spice and similar herbal products are often advertised as an “incense blend” and are generally labeled “not for human consumption” by their manufactures (Auwärter, Dresen, Weinmann, Müller, Pütz, & Ferreiros, 2009). Although these products are generally smoked by consumers, users have reported that ingesting the preparations yields practically identical results. Herbal blends such as K2 typically retail in the United States for \$25 to \$40 for roughly three grams of product, which is considerably more expensive than comparable quantities of marijuana (Schneir, Cullen, & Binh, 2010).

Synthetic marijuana mixtures typically list a variety of plant ingredients such as blue lotus, bay bean, lion’s tail, as well as Indian warrior; the latter two being noted by many

individuals to produce mild psychoactive effects similar to those of marijuana (Lindigkeit et al., 2009). However, researchers have noted that of the many herbal ingredients commonly listed in Spice and comparable blends, only passion flower is known to possess psychotropic properties (Schneir et al., 2010).

Due to a relative dearth of empirical evidence supporting the supposition that the psychoactive effects of products such as Spice and K2 were the result of included plant compounds, scientists began to question the veracity of such claims. Researchers also began to suspect that an unknown quantity of Spice products contained residual heavy metals that may pose significant health risks to users (EMCDDA, 2009). These and other concerns prompted numerous researchers to launch extensive forensic chemical analyses of Spice and similar products.

In December of 2008, forensic chemical investigations by German and Austrian researchers yielded conclusive evidence that the psychoactive properties of herbal mixtures such as Spice were the direct result of added synthetic cannabinoids (EMCDDA, 2009). Utilizing nuclear magnetic resonance spectroscopy, investigators discovered that the synthetic cannabinoid CP 47,497 was the key active component in analyzed samples of Spice products (Auwärter et al., 2009). Interestingly enough, a separate pharmaceutical company identified the presence of JWH-018 in several samples of Spice products just days prior to the previously mentioned discovery (Griffiths et al., 2010).

Subsequent chemical analyses of Spice products in laboratories across Europe, including Finland, France, Hungary, Poland, and the United Kingdom, also confirmed the presence of synthetic cannabinoids in these and similar products (EMCDDA, 2009). In 2009, the United States Drug Enforcement Administration (DEA), reported that chemical analysis of Spice

products seized by U.S. Customs and Border Protection Service had resulted in the identification of trace amounts of the synthetic cannabinoid HU-210 (EMCDDA, 2009).

Common synthetic cannabinoids that have been detected in Spice and similar products include JWH-073, JWH-398, JWH-250, as well as the aforementioned JWH-018, HU-210, and CP 47,497. JWH-018 appears to be not only the most common synthetic cannabinoid contained in these so called synthetic marijuana mixtures, it is also the most popular among consumers. Recent research discovered that JWH-018 was voted as the best among ten of the most popular synthetic cannabinoids (Vardakou et al., 2011).

Packages of products containing synthetic cannabinoids generally contain roughly three grams of plant components and are impregnated with approximately 30 mg of various synthetic cannabinoids (Sobolevsky, Prasolov, & Rodchenkov, 2010). Interestingly enough, genetic analysis of the plant species contained in various Spice products revealed that several of the listed herbal ingredients were notably absent (Uchiyama, Kawamura, Kikura-Hanajari, & Goda, 2010).

Researchers argue that previous detection of synthetic cannabinoids in these mixtures may have been hampered by the addition of masking agents such as synthetic tocopherol, commonly known as Vitamin E (EMCDDA, 2009). The source and vehicle used to infuse Spice and similar products with synthetic cannabinoids is unknown as of this writing; however, researchers have posited that synthetic cannabinoids are likely dissolved into a solvent and subsequently sprayed onto herbal mixtures (Schneir et al., 2010).

The locations of the establishments responsible for the production of the herbal mixtures, as well as the synthesis of cannabinoids continues to elude law enforcement officials and researchers alike. Scientists have postulated that the producers of Spice and comparable products



purchase synthetic cannabinoids from continents, such as Asia, that provide cost effective raw materials (Vardakou et al., 2010). Researchers have hypothesized that vendors of Spice and similar products likely operate from a central location that simply distributes their products throughout various countries, significantly hindering the efforts of national authorities to trace these products back to their source (Vardakou, 2010).

#### Adverse Effects and Health Risks Associated with Synthetic Cannabinoid Intoxication

While synthetic cannabinoids possess chemical structures that are vastly dissimilar to naturally occurring cannabinoids such as  $\Delta^9$ -tetrahydrocannabinol, these compounds have significantly greater affinities for CB<sub>1</sub> receptors, and thus, are exponentially more potent than their non-synthetic counterparts (Uchiyama et al., 2010). In fact, clinical trials utilizing mice indicate that the potency of the synthetic cannabinoid CP 47,497 is roughly five to ten times greater than that of THC; moreover, these compounds have also been found to produce pharmacological effects similar to THC in substantially lower quantities (Auwärter et al., 2009). Perhaps even more troubling, HU-210 is purported to possess potency 100 times that of  $\Delta^9$ -tetrahydrocannabinol (Vardakou et al., 2010). Anecdotal evidence suggests that some users of cannabinoids experience a myriad of undesirable side effects including, hallucinations, vomiting, paranoia, and cramps (Schifano et al., 2010).

Chemical investigations have also discovered a substantial amount of variability in the type and quantity of synthetic cannabinoids present from batch to batch of the same product, further increasing the potential for overdose by consumers (EMCDDA, 2009). There is also considerable variability in the potency of synthetic cannabinoids; for instance, JWH-018 has been found to be a significantly more potent CB<sub>1</sub> receptor agonist than WIN 55, 212, a similar synthetic cannabinoid (Atwood et al., 2010).

Researchers argue that not only could an accidental overdose of synthetic cannabinoids result in an increased risk of psychiatric and other life-threatening conditions; individuals may develop a relatively rapid tolerance for these products, substantially increasing the likelihood of developing a dependency for Spice and similar products (Vardakou et al., 2010). Additionally, researchers have found little or no evidence that synthetic cannabinoids are present in all packages of Spice and similar products, which has served to further complicate matters.

Furthermore, investigators speculate that as a result of their chemical structure, synthetic cannabinoids such as JWH-018 may possess potential carcinogenic properties (Vardakou et al., 2010). Very little is known about the metabolism of synthetic cannabinoids, and experts argue that some of the metabolites contained in synthetic cannabinoids may be toxic or pharmacologically active, presenting yet another potential harm to users (Auwärter et al., 2009).

Scientists further caution that because synthetic cannabinoids are full rather than partial receptor agonists, as is the case with THC, accidental overdosing may result in an increased risk for a myriad of psychiatric complications (Vardakou et al., 2010). Perhaps equally important, users should be cognizant of the possibility that uncharacterized additives other than the synthetic cannabinoids contained in Spice and similar products could be responsible for influencing neurotransmission (Atwood et al., 2010).

A case study conducted by Zimmerman et al. (2009) illustrates the potential dangers associated with synthetic cannabinoid usage. The researchers examined the case of a 20 year old male patient who reported daily consumption of Spice Gold products for a period of eight months. The patient described initially consuming one gram of product daily; however, due to diminishing effects, the patient increased his dosage to three grams per day.

During a period of abstinence, the patient reported developing symptoms such as profuse sweating during the daytime hours, in addition to tremors, palpitations, nausea, vomiting, headaches, and weight loss. The patient recounted a cessation in these symptoms upon returning to regular consumption of Spice Gold products, and a reappearance of symptoms subsequently after an additional period of abstinence.

Following careful examination of the patient's case, the researchers found that the subject fulfilled five of the criteria for dependency under the *Diagnostic and Statistical Manual of Mental Disorders*, 4<sup>th</sup> edition (*DSM-IV*) as well as the International Classification of Diseases (ICD-10). Moreover, the authors noted that the symptoms exhibited by the subject closely resembled those associated with cannabis dependence.

A similar case study conducted by Schneir, Cullen, and Ly, (2010) examined two women, ages 20 and 22 years, who reported using a Spice product for recreational use. Following consumption of the Spice product Banana Cream Nuke, both women reported disorientation and other spatial disturbances, and promptly called 911. Upon hospitalization, the older patient complained of tremors, palpitations, and feelings of anxiousness shortly after using the product. However, a physical examination of the patient yielded normal vital signs, an absence of tremors, and normal-sized pupils.

The younger of the two patients complained of anxiety and reported feeling psychotic. A physical examination revealed an elevated pulse of 126 beats per minute, tachycardia, and normal-sized pupils. Chemical analysis of the remaining residue contained within the Spice package was screened for the presence of THC, as well as 15 synthetic cannabinoids. Subsequent analysis revealed that the mixture contained the synthetic cannabinoids JWH-018 and JWH-073.

Auwärter, Dresen, & Weinmann et al. (2009) conducted a self-experiment in order to provide evidence of the pharmacological activity of Spice products. Subsequently after smoking a 0.3g of Spice product, the lead researcher experienced a significant increase in pulse rate, reddened conjunctivae, and alterations in mood and perception; although no abnormalities were noted in psychomotor functioning. The researchers further noted that the effects of synthetic cannabinoid intoxication persisted six hours following consumption, and residual effects lasted throughout the day.

Recently, researchers have begun to examine the relationship between memory loss and synthetic cannabinoid usage, although the results from such studies have been decidedly mixed. Diana, Malloni, and Pieri (2003) conducted experiments utilizing male Sprague-Dawley rats in order to examine the effects of the synthetic cannabinoid Nabilone on spatial learning. The researchers discovered that following several days of trials, no significant deficits in short and long term memory could be identified. However, a similar study conducted by Robinson et al. (2010) involving male Lister Hooded rats utilizing a similar environment found that synthetic cannabinoids resulted in learning impairments during spatial memory tasks. More specifically, the researchers discovered that synthetic cannabinoids result in deficits of long term, rather than working/short term memory.

Recently obtained information concerning herbal mixtures containing synthetic cannabinoids further corroborates previous empirical evidence of their hazardous nature. For instance, as of November 15, 2010, the American Association of Poison Control Centers (AAPCC) has documented more than 2,000 calls to various poison control centers related to synthetic cannabinoid products. This is in stark contrast to the 19 calls reported the previous

year. Moreover, statistics collected by the AAPCC indicate that abuse of the product K2 is an emerging phenomenon (NCSL, 2010).

### Information Available Online to Consumers

Consumers seeking to purchase and obtain information related to synthetic cannabinoids online appear to have no shortage of resources at their disposal. One particular study conducted by Scifano et al. (2010), involving researchers based in seven European countries, was tasked with the mission of regularly monitoring roughly 200 websites, blogs, forums and chat rooms in order to develop a technical database of emerging recreational psychoactive compounds.

Spice products were among hundreds of other substances monitored under this large scale web mapping program known as the Psychonaut Web Mapping Project. Each country was assigned the task of assessing the availability, consumption, and manufacture information of Spice products on the Internet, new and emerging trends related to their recreational usage, as well as any other available information related to Spice products.

The researchers discovered that online searches for Spice products have been conducted since 2004, however, searches appear to have increased substantially only during the latter portions of 2008. During this period several new variations of Spice products were added the online array of products including Spice Arctic Energy, Spice Genie, and Yucatan Fire. Researchers also noted that Spice products, as well as informational CDs containing data outlining their psychoactive effects were readily available on auction sites such as eBay.

Investigators observed several criticisms related to Spice products such as complaints of a variety of troublesome side effects including, but not limited to, paranoia, cramps, strong headaches, vomiting, and hallucinations subsequently after use.

As a result, it comes as little surprise that in several online forums, investigators found that several regular cannabis users have stated that they would prefer natural marijuana instead of Spice products if provided the option.

Most troubling for consumers, however, is the finding that available product descriptions fail to cite the presence of synthetic THC mimicking compounds including the previously mentioned JWH-018. However, the researchers noted that online forum members had begun to fervently speculate about the presence of additional ingredients, namely synthetic cannabinoids, as early as 2006.

#### Factors Contributing to Synthetic Cannabinoid Usage

As previously mentioned, synthetic cannabinoids, like many designer drugs, are attractive to consumers for a variety of reasons. According to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (2009), many users purchase Spice and similar products instead of marijuana in order to pass drug-screening tests by employers. This same technique is utilized by individuals seeking to avoid probation revocation as a result of positive drug tests. Currently, synthetic cannabinoids are not identifiable through conventional workplace and criminal justice blood and urine tests for cannabis (Auwärter et al., 2009).

Countries with large populations of cannabis users are perhaps the most susceptible to experiencing spikes in synthetic cannabinoid usage. Countries such as New Zealand, which has an estimated prevalence of marijuana usage of 14.6% in its general population, and 55% in its criminal communities, represent prime targets for distributors of synthetic cannabinoids looking to expand their market (Palmer, 2011).

Sensation seekers and experimental drug users have become attracted to the allure of synthetic cannabinoids due to ever increasing media exposure documenting their effects. In fact,

researchers have discovered that one of the latest trends among drug users is to combine ketamine (a popular anesthetic) with low doses of products containing synthetic cannabinoids in order to facilitate a “coming down” effect from a ketamine induced high (Schifano et al., 2009).

Young adults and teenagers interested in using psychotropic drugs comprise a significant majority of synthetic cannabinoid users (Vardakou et al., 2010). Researchers posit that it is likely that Spice and similar products are marketed towards younger individuals that desire to experiment with cannabis, but fear the repercussions and negative reputation associated with the narcotics scene (Lindigkeit et al., 2009).

The packaging of products containing synthetic cannabinoids is often colorful and presented in figurative language that suggests their manufacturers seek to target children and young adults. More specifically, distributors aim to take advantage of persons that are susceptible to non-peer reviewed information that is distributed online (Schifano et al., 2010). Synthetic cannabis products are readily available through the Internet, which insures the buyer’s anonymity, and such substances are typically sold without age restrictions in a majority of countries (Auwärter et al., 2009).

Although it has been argued that the allure of the relative ease of obtaining synthetic cannabis on the Internet, compared to searching for a viable source of marijuana, is among the primary motivating factors for younger demographics, recent research seemingly contradicts this assertion. For example, a recent survey found that 40% of 8<sup>th</sup> graders, 69% of 10<sup>th</sup> graders, and 81% of 12<sup>th</sup> graders reported that marijuana was fairly easy to obtain (Johnston, O’Malley, Bachman, & Schulenberg, 2006).

While young people have relatively easy access to synthetic cannabis products and similar designer drugs through the Internet, researchers have noted that not all products are

consistently available for purchase (Davies et al., 2010). Vardakou, Pistos, & Spiliopoulou (2011) argue that an inexperienced youth's quest for alternative products online could likely result in exposure to products that possess unwanted side effects or even lead to acute toxicity as a result of differences in quantities of active ingredients within the compounds.

### Current and Pending Legislation

Although far from uniform, several countries have enacted comprehensive legislation designed to prohibit the sale and possession of products containing synthetic cannabinoids. For example, while several synthetic compounds have been declared illegal in the U.S. only HU-210 is currently classified as a Schedule I drug under the Controlled Substances Act (CSA) by the U.S. Drug Enforcement Agency (DEA) (Schneir, 2010). On January 22 2009, the German Federal Ministry of Health officially designated all products containing synthetic cannabinoids subject to the Narcotics Law, which banned the production, possession, and trade of such products (Zimmerman et al., 2009).

As of October 15, 2010, only 15 states within the U.S. have enacted legislation prohibiting the distribution and usage of synthetic cannabinoids; however, the federal government appears to be moving in a similar direction. Following the lead of a growing number of countries which have created federal legislation prohibiting the possession and manufacture of synthetic cannabinoids, on January 31, 2011, the United States temporarily placed five synthetic cannabinoids into the Schedule I category of the CSA.

Among the five synthetic cannabinoids temporarily scheduled by the Attorney General are the aforementioned JWH-018, JWH-073, and CP-47,497, as well as JWH-200 and cannabicyclohexanol (CP-47, 497 C8 homologue). As a result, these substances are now subject



to all criminal and civil sanctions concerning the distribution, manufacture, possession, as well as importing and exporting of a Schedule I controlled substance under the CSA (DEA, 2011).

The U.S. Attorney General is granted the authority to temporarily designate a substance into the Schedule I category of the CSA by the Comprehensive Crime Control Act of 1984. Under the CSA, the Attorney General is permitted to schedule a substance for up to one year in duration if it is found that such measures are necessary to prevent imminent harm to public safety (DEA, 2011). While determining whether or not a substance is to be placed into the Schedule I category of the CSA, the Deputy Administrator must consider three important factors. These factors include (a) the history and current pattern of abuse; (b) the scope, duration, and significance of abuse; and (c) any potential risks posed to public health (DEA, 2011).

#### Issues Concerning the Regulation and Control of Synthetic Cannabinoids

Although lawmakers worldwide appear to be employing a proactive approach to curbing the distribution of Spice and similar products, the producers of these substances seem to be acutely aware of these efforts. For example, after German lawmakers prohibited the use and distribution of products containing the synthetic cannabinoid JWH-018, a second generation of herbal products containing the synthetic cannabinoid JWH-073 as a substitute began to saturate the market just four weeks later (Lindigkeit et al., 2009).

As previously mentioned, distributors of synthetic marijuana mixtures use innocuous labels such as “incense,” as well as disclaimers such as “not suitable for human consumption” in order to inoculate themselves against any potential litigation. Even more disconcerting for policy makers and law enforcement officials is the unfortunate reality that there are more than 100 *known* compounds with cannabinoid receptor activity in existence (EMCDDA, 2009). Such

issues significantly hinder the toxicological identification and risk assessment of synthetic cannabis products.

It has been suggested that the production of herbal mixtures containing synthetic cannabinoids is likely concentrated in developing and transitional countries, where regulatory agencies possess little, if any, power to enact and enforce control measures (Griffiths et al., 2010). Arguably the most confounding factor affecting the efforts to thwart the use and distribution of Spice, K2, and similar designer drugs involves the role the Internet plays in such matters.

Online vendors of designer drugs are able to easily evade the laws of other countries, rendering efforts to regulate such substances ineffective. The Internet affords users a high level of access to a plethora of drug-related data, much to the dismay of clinicians, regulatory authorities and researchers (Schifano et al., 2006). Stated differently, the Internet has become an unregulated source of drugs, both controlled and uncontrolled, which has immense legal and public health implications.

The swiftness and sophistication with which producers of synthetic cannabinoids operate has served to highlight the deficiencies in legislators' attempts to control these products. Due to the transient nature of the synthetic cannabinoid trade, it seems legislators must significantly increase their level of international cooperation in order to combat this increasing phenomenon.

#### Trends in Illicit Drug Use among College Students

Due to the supposition that herbal products such as Spice and K2 have been deemed substitutes for natural cannabis, examining populations prone to illicit drug usage, specifically marijuana use, may provide an ample opportunity to study the prevalence and usage patterns of these compounds.

Drug use among college students is a prevalent phenomenon throughout much of the U.S. In fact, recent studies have found that the prevalence of marijuana usage on college campuses is substantially higher than the national average (Page & Roland, 2004). The transition from high school to college increases an individual's propensity for drug abuse due to a variety of factors including increased independence, the initiation of new roles, academic pressures, and less parental guidance and support (White, Labouvie, & Papadaratsakis, 2005).

A recent survey conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA) (2010) examining the prevalence of illicit drug use found that in 2009, the percentage of illicit drug usage among college students between the ages of 18-22 was roughly 22.7%. These results were similar to the usage patterns of part-time college students, students in other grades or types of institutions, as well as non-students of which 22.3% reported regular illicit drug usage. These findings are also substantially lower than those of a comparable Monitoring the Future study examining rates of illicit drug use among secondary school students which found that the annual prevalence of illicit drug usage among college students was 36%, second only to that of 12<sup>th</sup> (37%) graders (Johnston, O'Malley, Bachman, & Schulenberg, 2010).

According to the SAMHSA (2010), marijuana is the most commonly used drug nationwide, with 16.7 million individuals reporting cannabis usage during the past month. The aforementioned study also reported that rates of marijuana usage among college students have increased significantly from 17.9% in 2008 to 20.2% in 2009; although other studies have found that marijuana usage among college students has begun to exhibit modest decreases from 36% in 2001 to 33% in 2009 (Johnston et al., 2010).

As it pertains to demographics and usage patterns, male college students generally report higher percentages and frequencies of marijuana use than females. Percentages of *daily*

marijuana usage (which the researchers operationalized as 20 or more occasions within the past 30 days) among college students has been found to be rather modest, with male and females reporting cannabis usage rates of 6.9% and 3.6%, respectively (Johnston et al., 2010). Relatedly, cannabis use among college students typically peaks during one's freshman year and gradually declines throughout their collegiate career (Jackson, Sher, & Wood, 2000).

### Strengths and Weaknesses of Previous Research

Due to the relatively recent occurrence of the synthetic cannabinoid phenomenon, the amount of available literature related to herbal mixtures containing these compounds is admittedly sparse and limited in several aspects. These factors include the fact that a majority of research originates almost exclusively from European countries. There also exists an over-reliance on anecdotal evidence, as well as lack of empirical research related to the actual incidence of synthetic cannabinoid usage among populations most prone to drug usage.

Foremost in the discussion is the issue regarding a lack of research within the U.S. Although the information obtained by studies examining synthetic cannabis within European countries has proven to be invaluable, patterns of substance abuse vary significantly from country to country and Spice, K2, and comparable products are likely no exception. Furthermore, recent research appears to rely heavily on anecdotal rather than empirical evidence. The aforementioned Psychonaut Web Mapping Project, for example, relies heavily on information obtained from chat rooms and web forums rather than surveying individuals in order to obtain information regarding whether or not herbal mixtures such as Spice and K2 are preferred over natural cannabis, their commonly reported side effects, as well as how users are able to obtain such products.

The available research has also failed to investigate the general prevalence of synthetic cannabinoid usage. Before policy makers and criminal justice officials can make informed decisions concerning the appropriate actions (if any) to employ against distributors and users of synthetic cannabinoids, it would be beneficial for these parties to possess some degree of knowledge regarding the prevalence of the usage, as well as whether or not they pose significant health risks to the public.

### Summary

Recent research suggests that products containing synthetic cannabinoids may pose significant health risks to their consumers. The high potency of products such as Spice and K2 coupled with their unknown toxicology has proven to be of increasing concern to policy makers and health care officials alike. Perhaps even more troubling is the fact that younger demographics may experiment with these substances for a variety of reasons including circumventing state and federal drug laws, enhancing the effects of other drugs , as well as the relative ease with which they are obtained online. The Internet has proven to be a veritable trove of information related to synthetic cannabinoids, and is suspected to be perhaps the definitive supplier of products such as Spice and K2.

Current trends concerning illicit drug use on college campuses, particularly marijuana, suggest that such a population may be a prime candidate to experiment with the synthetic cannabinoids discussed in the current study. The preceding literature review illustrates the nominal and fractured nature of the current literature regarding synthetic cannabinoid usage, and demonstrates the need for additional empirical research on the phenomenon.

The goal of the present study is to contribute to the current body of literature by examining the following: 1) the extent of a sample of college students' knowledge and usage of

Spice and K2 products, 2) the demographic and usage patterns of Spice and K2 users, 3) whether or not college students prefer Spice and K2 products over natural cannabis, 4) the most utilized methods of obtaining Spice and K2, and 5) the most commonly reported side effects associated with Spice and K2 usage.

The proceeding investigation will be achieved through the distribution of a survey designed to measure the aforementioned factors that was distributed to a sample of college students. The methods employed during the study will be detailed in the proceeding chapter.

## CHAPTER 3

### METHODOLOGY

#### Introduction

Research has consistently provided evidence that illicit drug use among college students is a relatively prevalent phenomenon. Moreover, college students report moderately high rates of cannabis usage compared to other demographics (Page & Rolland, 2004). In effect, college students represent one of the most opportunistic targets for distributors of Spice, K2, and comparable products. Thus, the current study seeks to utilize this population to examine the synthetic cannabinoid phenomenon that has, as of writing, received relatively little attention in the academic literature. Specifically, the present study aims to examine the prevalence of synthetic cannabinoid usage among a college student sample, as well as other individual characteristics related to their usage.

The first research question investigates the awareness and general prevalence of Spice and K2 usage among college students; stated differently, the primary research question is as follows:

- 1) What is the extent of a college student's awareness and usage of Spice and K2 products?

Additionally, the second research question seeks to determine the demographics and usage patterns of collegiate Spice and K2 users as they relate to those of marijuana users. Specifically:

- 2) What are the demographics and usage patterns of college student Spice and K2 users?

The third research question examines whether or not Spice and K2 products are more attractive to college students than marijuana. In short,

- 3) Do college students prefer Spice and K2 products over natural cannabis, and what are the reasons for such preferences?

The final two research questions seek to extend previous literature by examining two additional issues related to the procurement and health risks associated with synthetic cannabinoid usage, namely:

- 4) What is the most common method used to obtain synthetic cannabinoids?
- 5) What are the most common side effects reported by synthetic cannabinoid users?

The following is a presentation of information concerning sample selection, as well as the setting of the current study. Moreover, the independent and dependent variables will be discussed, along with a general synopsis of the data analysis procedure that will be utilized. The section will conclude with a general discussion regarding the limitations that threaten the validity and reliability of the current study.

## Data and Setting

### *Population*

The population of interest for the current study consisted of 36,067 graduate and undergraduate students enrolled at the University of North Texas during the fall 2010 semester.

### *Sample*

A non-probability convenience sampling technique was utilized in order to obtain participants for the current study. Overall, the final sample included a total of 643 undergraduate students. Significantly more females than males were included in the study, with males comprising 278 of the study's participants, and females representing 362 members of the sample.



Due to difficulties in obtaining a complete list of e-mail addresses for students enrolled at the university, as well as time constraints; participants were recruited via e-mails distributed to students within the University's College of Public Affairs and Community Service.

Additionally, students in courses which granted the investigator access were invited to participate in the survey in exchange for extra credit. Recruitment of the research participants proceeded for roughly six months. Those participating in the study received Internet access to a multi-faceted 48-item questionnaire designed to assess Spice and K2 usage. The survey also collected demographic information including, age, race, gender, enrollment status, and living arrangements.

Although the sampling method utilized was not ideal, the demographics of the obtained sample exhibited several similarities to the population of the university. For instance, During the fall 2010 semester, the university's racial composition was 60.52% Caucasian, 12.4% African-American, 14.03% Hispanic, 5.81% Asian American, 1.24% American Indian, and 1.38% Other. These racial demographics are similar to those of the sample which were 58.7% Caucasian, 17.0% African American, 15.4% Hispanic, 4.4% Asian American, and 3.7% Other. The gender composition of the sample was also consistent with that of the university with 43.4% and 56.6% of the sample consisting of males and females respectively; compared to the University's 47.48% and 52.52%.

The academic classification of the sample was relatively similar to the University's population as well. Freshmen, sophomores, juniors, and seniors accounted for 18.4%, 21.1%, 25.4%, and 35.1% of all undergraduate students compared to the 19.8%, 24.1%, 31.9%, and 24.3% contained in the sample.

While the results of research utilizing non-probability sampling should be approached with caution when assessing their external validity; sampling a relatively large number of individuals can produce a sufficiently representative sample from which inferences can be reasonably drawn regarding the population (Topp, Barker, & Degenhardt, 2003).

### *Measures*

The survey instrument utilized in the current study was developed by the principal investigator and consisted of a 48-item questionnaire designed to obtain demographic characteristics of the participant, as well as information regarding their awareness, usage patterns, and reported side effects of K2 and Spice products, marijuana usage patterns, as well as whether or not they prefer K2 and Spice over marijuana. The questionnaire also assessed the most commonly reported methods of obtaining K2 and Spice products.

### Variables

#### *Independent Variables*

The primary independent variables (see Table 1) in the present study consist exclusively of demographic variables. The demographic variables included in the current study consist of gender, age, race, enrollment status, and living arrangements. Gender was categorized by male (1) and female (0), while race was divided into the following groups: 1 = White/Caucasian, 2 = Black/African American, 3 = Hispanic, 4 = Asian American, 5 = Native American and 6 = Other. Enrollment status consisted of full-time (1) and part-time (0), and living arrangements were measured as being either on campus (1) or off campus (0).

### *Dependent Variables*

Dependent variables examined throughout the study include data related to the K2 and Spice usage patterns of college students, such as whether or not participants have used these substances in the past 12 months, as well determining if these products are still being used. Additionally, data related to the frequency of K2 and Spice usage was collected. The former was assessed by asking the respondent “Have you smoked K2 or Spice in the last 12 months?” The same question was asked regarding marijuana. Responses consisted of No (0) and Yes (1). The frequency of K2 and Spice usage was assessed by inquiring “How often do you smoke K2 or Spice?” Coding and responses to this question included 1 = once a week or less, 2 = 2-4 times a week, 3 = 5-7 times a week, and 4 = 8 or more times a week. Finally, respondents were asked, “Do you still smoke K2 or Spice?” and responses included No (0) and Yes (1).

The survey also examined K2 and Spice usage patterns of friends and acquaintances of the study’s participants. Participants were asked “Do you have friends or acquaintances that have smoked K2 or Spice in the past 12 months?” Possible responses include No (0), Yes (1), and Not Sure (2). Those that reported that their friends had, in fact, smoked K2 or Spice in the past 12 months were asked “How often do these friends or acquaintances smoke K2 or Spice?” Responses include: 1 = once a week or less, 2 = 2-4 times a week, 3 = 5-7 times a week, 4 = 8 or more times a week, and 5 = not sure.

Other K2 and Spice usage patterns, such as common locations of usage, time of usage, and initiation age (age of first use) are evaluated by the survey as well. To assess the most common locations of K2 and Spice usage, participants were asked “Where do you typically smoke K2 and Spice?” Responses and coding included 1 = at your home, 2 = home of a friend, family member, or acquaintance, 3 = in public, and 4 = at school.

In an attempt to evaluate the time of day most students typically use K2 and Spice, respondents were also asked “What time of day do you typically smoke K2 or Spice?” Answer choices included 1 = morning (6am-12pm), 2 = afternoon (1pm-5pm), 3 = evening (6pm-8pm), and 4 = night (9pm-5am). The most common age of initiation (first use) was determined by asking participants “How old were you when you first tried K2 or Spice?” In response to these questions, survey participants were instructed to select from the following choices: 1 = 8 years or younger, 2 = 9 or 10 years old, 3 = 11 or 12 years old, 4 = 13 or 14 years old, 5 = 15 or 16 years old, and 6 = 17 years or older.

The survey was also designed to assess the frequency with which several proposed side effects occur, in addition to examining the most commonly reported methods used to obtain synthetic cannabinoids. To assess the former, survey participants were asked “After smoking K2 or Spice, how often have you experienced any of the following?” Using an ordinal scale (containing the responses, 1 = always, 2 = sometimes, 3 = often, 4 = very often, and 5 = never), respondents were instructed to report the occurrence of the following symptoms: rapid heartbeat, loss of consciousness, nausea, and tremors. In order to examine the most commonly reported methods used to obtain synthetic cannabinoids, participants were asked “How do you typically obtain K2 or Spice?” Possible responses include: 1 = smoke shops, 2 = service stations, 3 = Internet sites, 4 = friend or acquaintance, 5 = other.

A student’s awareness of Spice and K2 products was evaluated by asking survey participants “Prior to participating in this survey, had you ever heard of K2 or Spice?” Responses to this inquiry consisted of No (0) and Yes (1). Additionally, respondents were asked “How did you first hear about K2 or Spice?” In response to this question, participants were to choose from

the following: 1 = friend or acquaintance, 2 = news media, 3 = in class, 4 = online advertisement and 5 = other.

Finally, whether or not the research participants prefer K2 and Spice products over marijuana was examined. Respondents that reported using K2 and Spice, as well as marijuana, were asked “Which do you prefer and why?” Available responses consisted of 1 = marijuana, 2 = K2 or Spice, and 3 = no preference. Students were also provided space to explain the rationale for such preferences in an open ended format.

Students that reported only smoking K2 and Spice products were asked a series of questions including, “Do you smoke K2 or Spice instead of marijuana because marijuana is illegal?” “Do you smoke K2 or Spice instead of marijuana due to difficulty finding a reliable source of marijuana?” “Do you smoke K2 or Spice instead of marijuana because of a fear of being drug tested by probation officers, employers, etc.?” and “Do you smoke K2 or Spice instead of marijuana because they offer a better experience than marijuana?” Responses to all of the preceding questions consisted of No (0) and Yes (1).

Similarly, for those that reported only smoking marijuana, the following questions were asked: “Do you only smoke marijuana because K2 and Spice are expensive?” “Do you smoke marijuana because it is easier to obtain than K2 and Spice?” and “Do you not smoke K2 or Spice because you have heard they result in several negative side effects?” All responses to the aforementioned questions consist of No (0) and Yes (1).

Table 1

*Variables and Coding*

<i>Variable</i>	<i>Definition/Question</i>	<i>Coding</i>
Sex	Age of respondent	Metric; continuous
	Gender of respondent	0 = Female 1 = Male
Race	Race of Respondent	1 = White/Caucasian 2 = Black/African American 3 = Hispanic 4 = Asian 5 = Native American 6 = Other
Enrollment	Enrollment status of respondent	0 = Part-time 1 = full-time
Home	Where does the respondent live?	0 = Off Campus 1 = On Campus
Use 1	Have you smoked K2 or Spice in the last 12 months?	0 = No 1 = Yes
Use 2	How often do you smoke K2 or Spice?	1 = Once a week or less 2 = 2-4 times a week 3 = 5-7 times a week 4 = 8 or more times a week
Use 3	Where do you typically smoke K2 or Spice?	1 = At your home 2 = Home of a friend or acquaintance 3 = In public 4 = At school
Use 4	Do you still smoke K2 or Spice?	0 = No 1 = Yes

*(table continues)*

Table 1 (continued).

<i>Variable</i>	<i>Definition/Question</i>	<i>Coding</i>
Use 5	How old were you when you first tried K2/Spice?	1 = 8 years or younger 2 = 9 or 10 years old 3 = 11 or 12 years old 4 = 13 or 14 years old 5 = 15 or 16 years old 6 = 17 years or older
Use 6	How often do these friends or acquaintances smoke K2 or Spice?	1 = Once a week or less 2 = 2-4 times a week 3 = 5-7 times a week 4 = 8 or more times a week
Obtain	How do you typically obtain K2 or Spice?	1 = Smoke shops 2 = Service stations 3 = Internet sites 4 = Friend or acquaintance 5 = Other
Knowledge 1	Prior to participating in this survey had you ever heard of K2 or Spice?	0 = No 1 = Yes
Knowledge 2	How did you first hear about K2 or Spice?	1 = Friend or acquaintance 2 = News media 3 = In class 4 = Online advertisement 5 = Other
Preference 1	Which do you prefer and why?	1 = Marijuana 2 = K2 or Spice 3 = No Preference 4 = Explain
Preference 2	Do you smoke K2 or Spice instead of marijuana because marijuana is illegal?	0 = No 1 = Yes
Preference 3	Do you smoke K2 or Spice instead of marijuana due to difficulty finding a reliable source of marijuana?	0 = No 1 = Yes

*(table continues)*

Table 1 (*continued*).

<i>Variable</i>	<i>Definition/Question</i>	<i>Coding</i>
Preference 4	Do you smoke K2 or Spice instead of marijuana because of a fear of being drug tested by probation officers, employers etc.?	0 = No 1 = Yes
Preference 5	Do you smoke K2 or Spice instead of marijuana because they offer a better experience than marijuana?	0 = No 1 = Yes
Preference 6	Do you smoke only marijuana because K2 and Spice are expensive?	0 = No 1 = Yes
Preference 7	Do you smoke marijuana because it is easier to obtain than K2 and Spice?	0 = No 1 = Yes
Preference 8	Do you not smoke K2 and Spice because you have heard they result in several negative side effects?	0 = No 1 = Yes

### *Data Analysis*

Percentages and frequencies were tabulated in order to assess the prevalence and awareness of Spice and K2 usage, their common methods of obtainment, their degree of preference over marijuana, as well as assessing the most commonly reported side effects. Additionally, descriptive statistics concerning the demographic and usage patterns of spice and K2 users were also utilized.



## *Limitations*

Although great care was taken to ensure that the current study is as accurate and thorough as possible, there still exists some limitations. Perhaps the most obvious limitation of the current study concerns the sampling method. As previously mentioned, research participants were obtained through e-mail solicitations, as well as recruitment through available classrooms. As a result, the employed method represents a non-probability sample rather than a true random sample, which is substantially more desirable. As a result, one cannot generalize the results of the current study beyond the sample obtained.

The fact that only students from the University of North Texas were examined illustrates another significant limitation of the current study. It is possible, and perhaps likely, that usage patterns differ significantly between universities in various regions of the U.S., as well as among 4-year universities and community colleges. Moreover, as alluded to previously, certain brands of synthetic cannabis products may be more popular and prevalent in usage within certain universities.

The limitations of self-report data also effect the efficacy of the data obtained by the current study. For instance, due to the nature of the phenomenon examined, it is possible that the research participants, despite being assured anonymity, are likely to be biased towards responses that are socially acceptable. In the case of the present study, some participants may be more apt to report not using K2 and Spice products, as well as marijuana, in order to conform to societal norms.

Yet another potential limitation lies in the survey measure itself. Although Spice and K2 are among two of the most common forms of synthetic marijuana products, there are a plethora of comparable products with dissimilar names. It is possible that although participants are

unaware of Spice or K2 products, they may be familiar with other brands of similar herbal mixtures. As a result, there may be significantly higher rates of synthetic cannabinoid usage throughout the sample than revealed by the study. The survey utilized is only designed to measure data related to Spice and K2 usage, and therefore the validity of the survey instrument is called into question.

### Summary

The purpose of the preceding chapter was to present an overview of the methodological aspects of the present study. By examining the survey responses of a sample of students enrolled at the University of North Texas, this study will provide valuable information concerning the prevalence and usage of Spice and K2 product among college students, which may prove beneficial to the larger body of knowledge related to synthetic cannabinoid usage. Survey results will be provided in the following chapter.

## CHAPTER 4

### RESULTS

#### Introduction

The current chapter is a presentation of the data obtained from the K2/Spice survey including information regarding student awareness of such products, user demographics, frequency and usage patterns, preferences in relation to marijuana, commonly used methods of obtainment, as well as the most common side effects reported by users.

#### Student Awareness of K2 and Spice Products

In regards to a students' general awareness of Spice and K2 products, 64.5% of those surveyed reported being aware of the existence of such products prior to participating in the survey. Friends and acquaintances were the most commonly reported means by which participants first became aware of such products, accounting for 66.6% of the responses gathered, followed by news media, classrooms, and online advertisements.

#### Demographics of K2 and Spice Users

Presented in Table 2 are demographic characteristics that were found to be most common among reported K2 and Spice users. Slightly more males than females reported using K2 and Spice products within the past 12 months, with 54.2% of males reporting usage of these products, and 45.8% of females acknowledging recent usage. Juniors represented a majority of K2 and Spice users, accounting for 33.0% of sampled users. Caucasians and individuals between the ages of 18 and 25 also typified the average K2 and Spice user, with these demographics constituting 82.5% and 96.6% of reported K2 and Spice consumers.

Table 2

*Demographics of K2/Spice Users*

<i>Category/Variable</i>	<i>N</i>	<i>%</i>
Sex		
Male	56	56.6
Female	43	43.4
Year in School		
Freshman	13	13.0
Sophomore	31	31.0
Junior	33	33.0
Senior	23	23.0
Enrollment Status		
Part-time undergraduate	4	4.0
Full-time undergraduate	96	93.6
Age		
18-25	97	97
26-35	2	2.0
36-40	0	0.0
40 and up	1	1.0
Race		
White/Caucasian	81	81.0
Black/African America	9	9.0
Hispanic	5	5.0
Oriental/Asian American	3	3.0
Native American	1	1.0
Other	1	1.0
Living Arrangements		
On campus	17	17.0
Off campus	83	83.0

## Frequency and Usage Patterns of K2 and Spice Products

Detailed in Table 3 are the frequency and usage patterns of K2 and Spice users. Of those that reported having knowledge of Spice and K2 products, 23.4% reported having smoked such

products within the past 12 months and 17.2% reported continued K2 or Spice usage. The majority (99.0%) of students reporting K2 and Spice usage within the past 12 months reported first using the product when they were 17 years of age or older. Additionally, a majority (94.3%) of Spice and K2 smokers reported using these products once a week or less; as well as consuming, on average, one package over the course of a week. The most popular locations of usage reported by Spice and K2 users was the home of a friend, family member, or acquaintance, followed by their own residence. Similarly, 41.2% of those surveyed reported having friends or acquaintances that have smoked K2 or Spice products within the past 12 months.

Table 3

*Frequency and Usage Patterns of K2/Spice*

<i>Variable</i>	<i>N</i>	<i>%</i>
<b>Age of First Use</b>		
8 years or younger	0	0.0
9 to 10 years old	0	0.0
11 to 12 years old	0	0.0
13 to 14 years old	0	0.0
15 to 16 years old	0	0.0
17 years or older	97	100.0
<b>Frequency of K2/Spice Use</b>		
Once a week or less	90	90.9
2-4 times a week	1	1.0
5-7 times a week	5	5.1
8 or more times a week	3	3.0
<b>Packages of K2/Spice Used</b>		
<b>Per week</b>		
1	83	94.3
2-5	4	4.5
6-10	0	0.0
11-5	0	0.0
More than 16	1	1.1

*(table continues)*

Table 3 (continued).

<i>Variable</i>	<i>N</i>	<i>%</i>
<b>Location of K2/Spice Use</b>		
Home	43	45.3
Home of friend/family	48	50.5
In public	2	2.1
At school	2	2.1
<b>Time of K2/Spice usage</b>		
1 = Morning (6am-12pm)	2	2.1
2 = Afternoon (1pm-5pm)	8	8.5
3 = Evening (6pm-8pm)	31	33.0
4 = Night (9pm-5am)	53	56.4
<b>Current K2/Spice usage</b>		
No	82	82.8
Yes	17	17.2
<b>Friends or Acquaintances that smoke K2/Spice?</b>		
No	180	28.0
Yes	271	42.1
Not Sure	192	29.9
<b>Frequency of K2/Spice Usage among Friends or Acquaintances</b>		
Once a week or less	88	32.4
2-4 times a week	42	15.4
5-7 times a week	17	6.3
8 or more times a week	12	4.4
Not Sure	113	41.5

### Preferences

Among the respondents that reported a preference for either marijuana or K2 and Spice products (N = 66), 90.9% indicated a preference for marijuana over Spice or K2. The illegality of marijuana was the most commonly reported reason that K2 and Spice users preferred such

products over natural cannabis, employers. Similarly, a majority of respondents preferred marijuana over K2 and Spice due to concerns about their negative side effects (see Table 4).

Table 4

*Reasons for K2/Spice/Marijuana Preference*

<i>Variable</i>	<i>N</i>	<i>%</i>
Because Marijuana is Illegal		
No	2	33.3
Yes	4	66.7
Difficulty Finding Marijuana		
No	6	100.0
Yes	0	0.0
Fear of Being Drug Tested		
No	3	50.0
Yes	3	50.0
Better Experience		
No	6	100.0
Yes	0	0.0
K2/Spice are Expensive		
No	58	98.8
Yes	2	1.2
Marijuana is Easier to Obtain		
No	50	93.8
Yes	10	6.3
K2/Spice Have Negative Side Effects		
No	18	73.8
Yes	42	26.3
Marijuana is More Effective		
No	36	85.0
Yes	24	15.0

*(table continues)*

## Methods for Obtaining K2/Spice Products

Presented in Table 5 are the most common methods of procuring K2 and Spice products as reported by survey participants. Over 40% of those who reported K2 and Spice usage indicated smoke shops as their most common means of obtaining these products. Friends and acquaintances were the second most reported method of K2 and Spice obtainment, accounting for 37.1% of all response.

Table 5

### *Common Methods of Obtainment*

<i>Variable</i>	<i>N</i>	<i>%</i>
Smoke Shops	42	43.3
Service Stations	13	13.4
Internet Sites	0	0.0
Friend or Acquaintance	36	37.1
Other	6	6.2

### Commonly Reported Side Effects of K2 and Spice Usage

Table 6 examines the occurrence of four side effects believed to be common among K2 and Spice users. Rapid heart rate was the most frequently reported side effect of K2 and Spice usage with 26.8% of respondents reporting sometimes experiencing such symptoms, and 12.4% of respondents reporting always suffering from an elevated heart rate following consumption of these products.



Table 6

*Side Effects of K2 and Spice Usage*

<i>Variable</i>	<i>N</i>	<i>%</i>
Rapid Heart Beat		
Always	12	12.4
Very often	3	3.1
Often	5	5.2
Sometimes	26	26.8
Never	51	52.6
Tremors		
Always	3	3.1
Very often	0	0.0
Often	0	0.0
Sometimes	10	10.4
Never	83	86.5
Loss of Conciseness		
Always	4	4.2
Very often	0	0.0
Often	0	0.0
Sometimes	4	4.2
Never	88	91.7
Nausea		
Always	5	5.2
Very often	1	1.0
Often	3	3.1
Sometimes	12	12.4
Never	76	78.4

## Summary

In regards to the primary objective of this study, preliminary analysis of the data obtained suggests that the population under examination is, in fact, cognizant of the existence of K2 and Spice products. However, it appears that usage of these products among the students examined is a relatively rare occurrence. The data further suggests that students who have smoked both

marijuana and K2 or Spice have a much greater preference for the former. These findings, as well as those presented above, are discussed in greater detail in the following chapter.

## CHAPTER 5

### DISCUSSION

The primary goal of the current study was to determine the extent of a college student's awareness and usage of K2 and Spice products. Data obtained from the present survey suggests that (a) while college students may indeed be acutely aware of the existence of K2 and Spice products, (b) few appear to have actually used these substances themselves. Such findings are noteworthy due to the fact that the prevalence of marijuana usage among college students is significantly higher than the national average (Page & Roland, 2004). Therefore, one would expect such a group would be prone to experiment with K2 and Spice products as a legal alternative.

The highest rate of K2 and Spice usage was among white males between the ages of 18-25. These findings are consistent with the hypotheses of previous researchers that suggest that younger individuals are more apt to experiment with products containing synthetic cannabinoids (Vardakou, 2009). Such findings are also consistent with previous research examining the demographics of college marijuana users, which report usage rates of 22.7% among college students between the ages of 18-22, and higher rates of usage among female students (Johnston et al., 2010).

Interestingly, sophomores and juniors accounted for a majority of K2 and Spice users sampled. This runs contrary to the patterns of usage observed in college marijuana users, which research has found peaks during freshman years and gradually decreases over the course of their collegiate career. However, such results are possibly due to the fact that the 18-25 age group, which accounts for 90.4% of total sample, encompasses a large percentage of undergraduate students surveyed.

The frequency with which students use K2 and Spice products appears to be relatively rare, with few users reporting smoking more than one packet of these products more often than once a week. However, respondents reported significantly higher frequencies of K2 and Spice usage among their friends and acquaintances, which may be a function of the problems associated with self-reporting; specifically, a respondent's need to provide socially desirable responses. Perhaps even more telling, few students that reported using K2 and Spice products within the past 12 months indicated that they have continued to use them, which suggests that experimentation rather than a long-term substitute for marijuana is the primary reason for their use. Additionally, although K2 and Spice products afford the user the ability to use such substances legally in public, a majority of the users sampled reported smoking these mixtures primarily in the evening, at their own residence or that of a friend or acquaintance.

Perhaps not surprisingly, results indicate that natural cannabis is overwhelmingly preferred over K2 and Spice products. Those that indicated a preference for K2 and Spice products over marijuana cited that the legality of K2 and Spice products was their primary motivation for their preference, followed by a fear of drug testing. The negative side effects of K2 and Spice products was the most reported reason for marijuana users preferring natural cannabis over these products, trailed only by respondents that stated the superior effectiveness of marijuana as their main determining factor. Consequently, while synthetic cannabinoids are believed to be significantly more potent than their naturally occurring counterparts, such findings lend credence to the claims of previous researchers detailing variability in the within products of such as K2 and Spice (EMCDDA, 2009).

Contrary to previous research that suggests that the Internet is the most popular method of obtaining products containing synthetic cannabinoids (EMCDDA, 2009), results of the current

survey indicate that, not only are smoke shops and friends and acquaintances the two most reported methods of obtaining K2 and Spice, *none* of the respondents reported utilizing the Internet to procure these substances. These results may be a function of the fact that college students may be more apt to venture to smoke shops as a result of decreased parental supervision. Furthermore, selected smoke shops may voluntarily place age restrictions upon certain items sold to their customers, preventing youth from obtaining such products. Moreover, college students may possess means of transportation that younger individuals often lack, which enables them to easily travel to smoke shops located beyond walking distance.

Perhaps the most troubling aspect of synthetic cannabinoid consumption concerns the potential health problems that may result from their usage. The most common side effect reported by K2 and Spice users was an increase in heart rate, followed by nausea, tremors, and loss of consciousness. These findings are consistent with anecdotal evidence obtained through previous research, and are likely a result of the higher potency of synthetic cannabinoids in comparison to their natural counterparts (Schifano et al., 2009). These findings provide evidence that K2 and Spice products may, in fact, be potentially dangerous products for consumers, which necessitates further study.

Taken together, these results suggest that, while potentially hazardous to the health of their consumers, K2 and Spice products do not appear to be a significant issue among the college population under examination. Not only are these products not preferred over natural cannabis, those that use them do so rather infrequently. Moreover, the Internet's role in facilitating their usage appears, as discovered by the present study, to be severely overstated. Such findings may have several implications for policy makers and future researchers.

For instance, although herbal mixtures such as K2 and Spice have begun to receive a great deal of media attention, which may lead one to believe that synthetic cannabinoid usage has reached epidemic proportions, results of the current study suggest that such fears may be unfounded. Actions to regulate these substances, such as those taken by state and federal legislators, may be not only premature, but unwarranted. Data from the present study indicates that not only is the scope and duration of K2 and Spice usage among the students observed not of great significance, but the history and usage patterns of these products among these individuals do not appear to be a significant issue. In fact, of the three criteria considered by the U.S. Attorney General in determining whether or not to place substances into the Schedule I category, only the potential risks posed to public health seem to be supported by the data obtained in the current study.

Yet, due to the apparent infrequent occurrence of K2 and Spice usage, one might reasonably argue that synthetic cannabinoids pose few, if any, significant risks to public health in general. Furthermore, as previously mentioned, variances in dosage, rather than the chemicals themselves may be the culprit of the reported side effects. Further research is needed to assess whether or not the compounds are inherently dangerous if consumed in smaller quantities.

The efforts by state and federal legislatures to ban products containing synthetic cannabinoids necessitates a brief discussion concerning the nature of drug regulation in general. The societal and fiscal expenditures associated with regulating illegal substances are immense, and the number of substances subjected to regulation continues to increase as individuals discover new drugs for experimentation. Lawmakers must use caution before allocating additional resources towards criminalizing new substances, especially those consumed by relatively small populations. Rather than continuing to ban substances such as synthetic

cannabinoids that appear to be rarely used, but also exhibit a high potential to be abused by youth, more resources should be directed towards eliminating youth drug use through surveillance and education.

As more substances are subjected to regulation, it appears that more designer drugs are being utilized to supplement them, some of which may be more hazardous than the substances they are meant to replace. The side effects of synthetic cannabinoids appear to be significantly more voluminous than those of marijuana, and in the event that these substances are banned, users may also substitute them for compounds with even more side effects that are potentially more dangerous. Thus, law makers must be mindful of this dynamic relationship between prohibition and the development of new and potentially dangerous substitutes when deciding whether or not to regulate certain drugs.

Future studies examining synthetic cannabinoids usage should seek to expand the products under observation beyond K2 and Spice. While such products have received a majority of the focus in current research, there are a variety of other products containing synthetic cannabinoids that a portion of the current study's participants that did not report smoking K2 or Spice may use regularly. As previously mentioned, although non-probability convenience sampling can yield a sufficiently representative sample (Topps et al., 2004); future research examining synthetic cannabinoid use among college students should aim to employ random probability sampling in order to improve the generalizability of the results. Investigators should also seek to examine the awareness of synthetic cannabinoids in general as well as their usage patterns.

While the current study examined college populations, high school and middle school students may present a more opportune environment for future synthetic cannabinoid research.

These environments possess inherently greater quantities of underage individuals, a group proposed by researchers (EMCDDA, 2009) to be most at risk for synthetic cannabinoid usage. It is likely that the awareness and usage patterns of these groups vary markedly from college students.

### Conclusion

In summation, the findings of the present study indicate a high awareness, but ultimately, low prevalence of K2 and Spice usage among the college students sampled. The demographic characteristics of K2 and Spice users suggest that younger individuals are more likely to use these herbal mixtures, although the Internet's role in facilitating their procurement could not be verified. Though not without its limitations, the results of the current study suggest that further research is needed before state and federal law makers devote their resources towards creating and enforcing legislation banning the sale and usage of synthetic cannabinoids. While the data offers support for claims that these substances may result in several adverse side effects, the risks posed to the health of the public may be outweighed by the relatively low preference and usage of products containing synthetic cannabinoids.



APPENDIX

IRB APPROVAL FORM

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OFFICE OF THE VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT  
October 22, 2010 Research Services

Scott Belshaw  
Department of Criminal Justice  
University of North Texas

Re: Human Subjects Application No. 10456

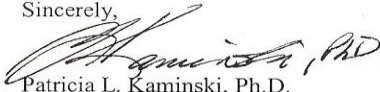
Dear Dr. Belshaw:

As permitted by federal law and regulations governing the use of human subjects in research projects (45 CFR 46), the UNT Institutional Review Board has reviewed your proposed project titled "An Examination of Synthetic Marijuana (K2/Spice) Use among college and University Students." The risks inherent in this research are minimal, and the potential benefits to the subject outweigh those risks. The submitted protocol is hereby approved for the use of human subjects in this study. **Federal Policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only, October 22, 2010 to October 21, 2011.**

It is your responsibility according to U.S. Department of Health and Human Services regulations to submit annual and terminal progress reports to the IRB for this project. The IRB must also review this project prior to any modifications.

Please contact Shelia Bourns, Research Compliance Analyst, or Boyd Herndon, Director of Research Compliance, at extension 3940, if you wish to make changes or need additional information.

Sincerely,



Patricia L. Kaminski, Ph.D.  
Associate Professor  
Chair, Institutional Review Board

PK:sb

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1155 Union Circle #305250 | Denton, Texas 76203-5017 | TEL 940.565.3940 | FAX 940.565.4277  
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