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Edible Marijuana: A New Frontier in the Culinary World

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Edible Marijuana: A New Frontier in the Culinary World

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Fall 2012

Abstract

Cannabis, commonly known as marijuana, has a rich history as a source of fiber, food and medicine (Li 437). Since 1785, physicians and scientists alike have worked to discover the active chemical components and medical effectiveness of this plant (Touw 2; Aldrich). Despite its complicated legal history, marijuana has retained a place culturally and, in some countries, scientifically as an effective medical agent. As a medically edible ingredient, cannabis has also been more recently heralded as a new, even cutting edge flavor, opening a new frontier to the culinary community.

After the isolation of the main active ingredient in cannabis, δ -9 tetrahydrocannabinol (THC), in 1964, various physicians and scientists conducted research demonstrating its therapeutic medical efficacy for a variety of illnesses including glaucoma, cancer, AIDS, anorexia, Crohn's disease, multiple sclerosis, and pain management (Watson et. al. 548). Over a decade has passed since cannabis first became legalized for medical use in California in 1996 (Eddy 8). Subsequently, 18 other states, including the District of Columbia, legalized cannabis for medical use.

Individuals who have received a doctor's recommendation for its use are authorized to consume cannabis for medical purposes. Although it is commonly ingested by inhalation, many individuals prefer to consume marijuana through edible products. Due to an increased interest in careful cultivation practices, biochemical evaluation of the product, and quality control efforts, a market for medical edibles has developed. Many chefs have begun experimenting with cannabis, using it as a spice or flavor, to create a sensory food experience. Savvy chefs, such as Scott Van Rixel, Kristi Knoblich, Eric Underwood, Julie Dooley and Julianna Carella entered this new

market with both entrepreneurial and altruistic interest in creating medical marijuana edibles, tapping into the new flavor frontier this product provides.

It is interesting that in the culinary world's constant search for new and exciting flavor discoveries, the medical edibles industry has not received much mainstream interest. Little data has been compiled supporting the potential this ancient plant may bring to cuisine (Watson et. al. 548). Now, due to the application of ancient and experimental techniques, these innovative chefs are blazing the trail for the culinary community.

This paper investigates edible medical marijuana as a viable frontier and niche market from a legal, medical and culinary perspective. It reviews the etymology and the history of cannabis, as well as current legal, medicinal and cultivation guidelines. This is accomplished through an overview of four states' dispensary policies, as well as the creative culinary accomplishments of representative edible establishments. This study also draws on the results of two surveys: one directed to the edible product developers, dispensers, and vendors, the other survey directed to authorized patients of the dispensaries. The data collected is intended to confirm the emergence of a unique culinary product, its value, increased distribution, and potential for success in this newly developed market.

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Chapter One: Introduction

Early civilizations discovered medicinal, nutritional and functional uses for their indigenous vegetation. Tinctures, extracts or oils derived from plants and served in edible or beverage form became the basis of remedies for treating illness. The relationship between food and medicine was thoroughly intertwined. Of the myriad of plants used in this early medical arsenal, cannabis is steeped in controversy, touted in the United States as a nefarious drug by federal regulators as well as a bona fide medicinal agent by patients, doctors, and current medical research.

Accepted as a therapeutic botanical, cannabis is legal or decriminalized throughout many countries in the world such as Portugal, Israel, Spain, the Netherlands and, as of 2006, throughout Canada (Spain; Netherlands; Canada). In countries such as Finland, Iran, Egypt and Cambodia, it continues to be embraced as a food or nutritional supplement (Callaway 66). From 1850 to 1937 cannabis had been readily available in the United States as a staple in American medical practice for a multitude of medical conditions, as well as a widely cultivated plant fiber known as hemp. It acquired its legal “taboo” after a well-funded political and economic battle beginning in the early twentieth century. Against the advice of the American Medical Association and testimony presented by Dr. William C. Woodward, explaining that no scientific proof or evidence had ever been submitted to justify the claims brought against its use, the federal government condemned cannabis (Ben Amar 3).

The resulting legislation made the possession, use, distribution or sale of marijuana illegal in the United States. Since then the federal government maintains a strict unyielding stance regarding the regulation and scheduling of marijuana as a controlled substance (Garvey 2). Advocates of medical marijuana have turned to their states to enact laws that would allow

therapeutic access to botanical marijuana in a legal and regulated manner; generally in those states for which medical legalization has been sought, these advocates sustained success (Eddy 8).

While still illegal under federal law, as of 2012, eighteen states have approved cannabis for medical use: California, Oregon, Alaska, Washington, Maine, Hawaii, Colorado, Nevada, Maryland, Vermont, Montana, Rhode Island, New Mexico, Michigan, New Jersey, Arizona, Delaware, Connecticut, as well as the District of Columbia. Although not enacted in the same manner, nor equivalent from state to state, all legislation is based on a form of compassionate medical use of cannabis for various medical conditions, including, but not limited to glaucoma, cancer, AIDS, multiple sclerosis, Crohn's Disease, anorexia, neurological disorders, and pain management (Ben Amar 6).

Since scientists isolated its main active ingredient, δ -9-tetrahydrocannabinol in 1964, further medical research, conducted by a variety of medical centers around the world, from Haifa University in Israel to the University of Arkansas in the United States, continue to present evidence regarding the medical efficacy of cannabis. Discovered in the 1990s, the 'endocannabinoid' or human cannabinoid system would prove to be responsible for modulating a vast range of physiologic systems from the central nervous system to the immune system. Its interaction with cannabis resulted in the wide range of therapeutic responses found beneficial for a variety of diseases or illness (Ben Amar 6).

Equipped with this information, the legal framework to support their endeavors, and the bio-chemical expertise of enterprising botanical experts, many savvy chefs have ventured into a new culinary frontier: the development of medical marijuana edibles. Although the commonly known method of ingesting cannabis is through inhalation, many individuals would prefer to

acquire their medicinal cannabis by edible ingestion (Vinson). Due to the creative culinary talents of many chefs and the unique, delicious products they are developing, the edibles market is growing.

The next chapter will review the scholarly literature on the etymology and history of cannabis, now commonly known as marijuana. It will also describe in greater detail the legal hurdles marijuana advocates encountered and continue to struggle with in the United States, as well as peer reviewed medical research that continues to support and uncover further evidence of cannabis' medicinal, therapeutic value. Included will be an analysis of the active and effective therapeutic ingredients in cannabis; how they are extracted, evaluated and concentrated for edible use, as well as the current parameters regarding the cultivation and dispensation of cannabis. Of the eighteen states previously noted that legalized cannabis for medical use, four will be presented in detail regarding the enactment of legalization policies, medical uses defined by those policies, established cultivation restrictions and standards, as well as distribution requirements.

Chapter Three discusses the development of the edible frontier, exploring cultivation methods, quality control and dosing parameters, as well as the growth of the medical marijuana edible market within these four states, while introducing chefs who are creatively engaged in producing unique products using cannabis. A detailed explanation of cultivation practices employed by each establishment, their use of biochemical evaluation standards, the determination of each product's dose, and the development of these products will be provided. This explanation includes which products are dispensed and the methods by which they are dispensed.

Chapter Four covers the results of two surveys: one provided to the chefs, retailers and vendors of edible products; the other provided to the authorized patients. This data will be evaluated and used to illustrate the growth of the medical edible market, as well as its value to patients, to prove enterprising chefs within this market produce products the authorized patient base desires, demonstrating and supporting the conclusion in chapter five that the medical marijuana edible market is truly a new, viable culinary frontier.

Chapter Two

Cannabis: A Progression of Perspective

Etymology

“Cannabis” has a varied etymological derivation. The whole class of names is held to have originated in the Persian *kanab* (Dymock et. al.). Of the various terms associated with the cannabis plant, marijuana is one of the most universally recognized, yet its origins remain deeply obscure. There are a wide variety of Chinese terms that refer to cannabis and cannabis products (Piper 4). The closest approximation of Chinese terms that refer to cannabis would be *ma ren hua* which means “hemp seed flowers.” “The root of the word *marijuana* might be a Semetic loan word in Spanish, having an Arabic origin, later being imported to Mexico from Moorish Spain” (5). The term “marijuana” was virtually unknown in the English language until approximately 1936, when William Randolph Hearst introduced it as “the killer weed from Mexico” in his well-funded, journalistic campaign to denigrate and destroy hemp production in the United States (French 129). Today, the term “marijuana,” whose spelling has been adapted from the Spanish slang *marihuana* invokes a variety of perspectives (129). Depending on an individual’s understanding and education, marijuana may be associated with the “War on Drugs;” it may be an integral component of religious practice or cultural expression, it may be a source of fiber, it may represent a source of nutritional value or it may be consumed for medicinal purposes (Callaway 66). All of these interpretations create an aura of mystery and help to stoke the controversy surrounding the use of medical marijuana.

History

Cannabis was cultivated and consumed long before written historical record. Since the Neolithic period in northern China, around 4000 BC, research indicates this ancient plant had a vast array of uses (Ben Amar 2). “Besides its importance as a fiber plant, it was also an important food plant, one of the major “grains” of the ancients. And it was an important medicinal plant” (Li 437). According to Li, Emperor of China, Shen Nung, first described the properties and therapeutic uses of cannabis in his compendium of Chinese medicinal herbs, published in 2737 BC . By 2000 BC, cannabis, or *bhanga*, was cultivated in India, described as one of the five sacred plants, according to The Vedas. Trade along the Silk Road introduced cannabis to many cultures (438). During the Middle Ages soldiers would acceptably and commonly drink *bhanga* before going into battle, just as Westerners would drink swigs of whisky (Gumbiner). The medieval physician Avicenna included it in his formulary, and Europeans of the same epoch ate its nutritional seeds and made its fibers into paper, a practice that continued for centuries (Ben Amar 2). Early in history, observations were made regarding the types or qualities of different cannabis plants. From 1785 through 1849 several individuals were involved in determining or differentiating the strains of this plant to discover an explanation for the physical difference between each plant as well as the difference of the medicinal effects of each plant. Indica dominant strains are short, dense plants with broad leaves and often grow a darker green. Sativa dominant strains are tall, thin plants with narrow leaves and grow a lighter green in color (Hillig and Mahlberg 970; Appendix E). The scientific community attributes the work of Jean-Baptiste Lamarck, in 1785, as the first to differentiate *C. Indica* from *C. Sativa* (968).

Further scientific discoveries were made during the British colonization of India. While working as a British physician and surgeon in India, William O'Shaughnessy discovered the medicinal attributes of cannabis. He conducted the first comprehensive clinical trials about cannabis therapy and published his work in 1839. Before his publication, little was known about cannabis in Europe and America. After O'Shaughnessy's publication, cannabis was available in extract and tincture form. It was listed in the British Pharmacopoeia for the next one hundred years (Aldrich).

Between 1850 and 1937 cannabis was used in American medical practice for a multitude of medical conditions. It was admitted to the *United States Pharmacopeia* as a recognized medicine in 1850 under the name *Extractum Cannabis* or Extract of Hemp (The Pharmacopoeia of the United States of America 332). The *National Formulary* and *United States Dispensatory* cited recommendations for its use in numerous illnesses (Wood and Bache 310). Leading pharmaceutical companies like Brothers Smith, Eli Lilly, Parke-Davis, and Tildens produced a cannabis extract that was sold freely in pharmacies of western countries (Sasman 51). In addition to medicinal tinctures or extracts, edible products were produced from cannabis. The Gunjah Wallah Company made maple sugar hashish candy starting in the 1860s, which soon became one of the most popular treats in America. For forty years, it was sold over the counter and advertised in newspapers, as well as being listed in the catalogs of Sears-Roebuck, as a totally harmless, delicious and fun candy (Aldrich),

As a fiber known as hemp, cannabis was widely cultivated in the United States for both paper and textile production (French 129). Until 1883, 75-90% of all paper in the world was made with cannabis hemp fiber, including paper for books (Herer 22). At the end of the nineteenth century cannabis production became overshadowed by cotton production. Canvas, a

word derived from the Latin term *cannapaceus* or ‘made of hemp,’ was the material of choice for sail cloth due to its ability to outlast cotton in harsh, seafaring environments. It covered the wagons of pioneers and old sails produced by hemp became the original Levi’s Jeans. Hemp seed was used extensively to produce paint and varnish; in 1935 over 116 million pounds of hemp seed had been consumed by this industry. Automobile entrepreneur Henry Ford invested heavily in cannabis, producing an automobile that could run on hemp oil and built by panels made from a plastic derived from hemp, wheat and sisal fibers. The vehicle was 1000 pounds lighter than its counterpart made of steel and with impact strength 10 times greater than steel it did not dent. Despite its wide cultivation and generous market share, cannabis production became overshadowed by cotton production at the end of the nineteenth century (Roedel 12).

Between 1917 and 1935, the new petroleum based synthetic textile companies, as well as the large, powerful newspaper/lumber barons saw traditional hemp production as a threat to their businesses. “Nylon” had been introduced as a new synthetic fiber, and, according to contemporary belief, in order to succeed it had to replace the traditional hemp (French 129). Powerful players, such as William Randolph Hearst, Andrew Mellon, J. Edgar Hoover, and Harry Anslinger, spearheaded a crippling campaign against the production of cannabis. It was at this time the term *marihuana* was introduced to the American public. Unfamiliar with the term, Americans did not associate *marihuana* with cannabis or the other familiar terms used in its place such as ganja, hashish or hemp, and therefore did not know that marijuana was actually the same cannabis used in the concentrated medicines they had been taking since childhood (Herer 32). A wide range of unsubstantiated negative claims arose against the cultivation and use of marijuana in the United States, stating it was responsible for violent behavior, caused insanity and led to immorality (37). No scientific proof or evidence was ever submitted to justify these

claims, which were initiated and promoted through both Anslinger and Hearst through yellow journalism. Nor were these claims supported by the American Medical Association, as attested by Dr. William C. Woodward in 1937 during a meeting of the Ways and Means Committee under the 75th Congress of the United States (Marihuana Tax Act of 1937).

Despite Dr. Woodward's efforts, Congress condemned cannabis, claiming it responsible for "insanity, moral and intellectual deterioration, violence, and various crimes" (French 129). Against the advice of the American Medical Association, the United States government instituted the Marihuana Tax Act in 1937, whose spelling of marihuana is reflected in almost all federal and state laws (Eddy 2). It required that one dollar be paid as tax when an ounce of marijuana was used for medical purposes and that one hundred dollars be paid as tax when the ounce was used for "unapproved" purposes. The Marijuana Tax Act imposed reporting and registration requirements, as well as a tax on growers, sellers and buyers. Although it did not prohibit marijuana outright, the effect was the same. Cannabis was removed from the United States Pharmacopoeia in 1942, losing its therapeutic legitimacy (Ben Amar 2).

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Legal Issues

The Marijuana Tax Act of 1937 heavily regulated cannabis production and distribution. In 1961 the Single Convention on narcotic drugs was enacted; it consolidated previous treaties and broadened their scope to include cannabis (United Nations). In 1969, the United States Supreme Court declared the Marihuana Tax Stamp Act of 1937 unconstitutional because it required that the person seeking a tax stamp incriminate himself, in direct violation of the Fifth Amendment to the U.S. Constitution (*Leary v. United States*). Responding to this decision, in July of 1969, President Nixon asked Congress to enact legislation to combat rising levels of recreational and abusive drug use. Cannabis was included in this legislation as a harmful drug and an illegal substance. Citing ‘interstate commerce’ as the basis of their authority, the House and Senate filed a conference report that was adopted in both chambers as the Comprehensive Drug Abuse Prevention and Control Act of 1970, which was re-titled in 1971 as the Controlled Substances Act (CSA), specifically stating that drugs listed under this act were under federal jurisdiction (“Drug Abuse Prevention and Control”). In contrast to earlier acts, this one was to control drugs directly, not through taxation, moving enforcement out of the Treasury to the Justice department. This act made the possession, use and sale of marijuana illegal and established the Drug Enforcement Agency (DEA) (Drug Enforcement Administration; Eddy 8).

The Attorney General became responsible for enforcement, but the department of Health, Education and Welfare, now known as the Department of Health and Human Services, through the FDA are in charge of defining what needs to be controlled considering these crucial points:

1. Pharmacologic actions;
2. Other scientific knowledge about the drug in question and other drugs;
3. Risk to public health;
4. Dependence, referring to psychic or physiological, potential;
- and 5. Whether the drug in question acted as a precursor for other drugs listed. Alcohol, caffeine

and tobacco were excluded from the list (USA: Department of Health and Human Services). Cannabis, or marijuana, was discussed separately and treated differently than the other drugs noted within this act, which called for the creation of a separate commission to study cannabis and report back with its findings in 1972. The results of this commission's study recommended that cannabis be downgraded to a misdemeanor (Sloman 344).

During the 1970s, the Carter administration worked toward legalizing cannabis and asked Congress to abolish federal criminal penalties for individuals possessing less than one ounce (Carter). Since then, various bodies of the federal government retain their resolute, unyielding stance regarding the regulation and scheduling of marijuana as a controlled substance (Eddy 18). Despite the federal government's unwillingness to objectively review the medical use of marijuana, the Obama Administration Department of Justice, in October 2009, announced an end to federal raids by the Drug Enforcement Administration of medical marijuana dispensaries that are operating in "clear and unambiguous compliance with existing state laws." (Johnston and Neil A. Lewis A20; United States of America Department of Health and Human Services).

Currently, medical marijuana advocates have been successful in changing state laws to decriminalize cannabis for medicinal purposes in eighteen states and the District of Columbia (Eddy 8). As a result, individuals who have received a recommendation for its use by a medical doctor will not be subject to state-level prosecution for the cultivation, possession, and use of marijuana. Additionally, physicians in these states are immune from liability and prosecution for discussing or recommending medical cannabis to their patients in accordance with state law. In all of these states, programs to regulate the use of medical marijuana are in place or are developing. With the exception of New Mexico and New Jersey, patients in state programs may

be assisted by individuals known as caregivers, who are authorized to help patients grow, acquire and use marijuana (18).

Marijuana was first approved for medical use in California in 1996; followed by Oregon, Alaska, Washington, and the District of Columbia in 1998; by Maine in 1999; Hawaii, Colorado, and Nevada in 2000; Maryland in 2003; Vermont and Montana in 2004; Rhode Island in 2006; New Mexico in 2007; Michigan in 2008; New Jersey and Arizona in 2010; Delaware in 2011; and Connecticut in 2012 (Eddy 20). Not all legislation has been enacted in the same manner nor is it equivalent from state to state. Each state has different regulations regarding the cultivation and dispensing of medical marijuana. Due to the scope of this project and the data acquired on the marijuana edibles market, this thesis compares legal, medicinal, cultivation, and dispensary parameters regarding cannabis in four states: California, Colorado, New Mexico and Rhode Island.

California

The first state to legalize marijuana for medical purposes, California, adopted Proposition 215 of November 6 of 1996 as California Health and Safety Code 11362.5. Called the Compassionate Use Act, it legalized cannabis for “the treatment of cancer, anorexia, AIDS, chronic pain, spasticity, glaucoma, arthritis, migraine, or any other illness for which marijuana provides relief.” Proposition 215 removed the state’s criminal penalties for medical marijuana use, possession, and cultivation by patients with the “written or oral recommendation or approval of a California licensed physician” who has determined that the patient’s “health would benefit from medical marijuana.” Possession of marijuana in an amount sufficient for the patient’s “personal medical purposes” is legal. Approved in 2003, Senate bill 420 went into effect on January 1, 2004, as California Health and Safety Code 11362-83. This legislation broadened

Proposition 215 to transportation within the state, allowing patients to form medical “collectives” or “cooperatives” for growing marijuana and “reasonable compensation” for medical marijuana caregivers, stating that the drug should be distributed on a non-profit basis. Caregivers were initially defined as the individuals designated by the qualified patient, who has consistently assumed responsibility for the housing, health, or safety of that patient. This designation has been expanded to include an individual or business, which assists a dispensary in processing or preparing edible medical marijuana products. This legislation empowers California localities to adopt scientific medical marijuana guidelines, which support individual dispensaries to promote product standards from within the industry to demonstrate their dedication to providing their patient base with quality medical edible products (Cal Health & Safety Code Ann. §11362.765(b)(3)). It also established a voluntary state identification card system run through county health departments (Cal Health & Safety Code Ann. §11362.5 and §§11363.7 to 11363.83).

Specific dispensary regulations were also enacted, creating a state-wide template for the legal distribution of medical marijuana to all counties. A “Medical Marijuana Storefront Collective Dispensary Permit Application” was created to define the parameters for the location and operation of all dispensaries. In accordance with these regulations, individuals could consume edible products within the dispensary but not smoke or inhale marijuana products. A default limit has been set, stating that a qualified caregiver or patient can maintain no more than eight ounces of dried mature flowers of budding female cannabis plants or the plant conversion plus six mature plants or 12 immature plants. A physician is able to grant an exemption for quantities if medical need is determined. If grown in “cooperatives” or “collectives,” a cultivator of

up to 100 plants is within legal limits. Notice shall be clearly posted within the dispensary stating that marijuana shall not be smoked, ingested or consumed on the premises.

Colorado

On November 7, 2000, the state legislature enacted Colorado's Medical Marijuana Law. Colorado voters approved Amendment 20, adding Section 14 to Article 18 of the Colorado Constitution (Colo. Const., Art XVIII §14). Similar to California's Proposition 215, Colorado's law legalized cannabis for the treatment of "debilitating medical conditions" including but not limited to "cancer, glaucoma, positive states for human immunodeficiency syndrome, or AIDS, seizures, severe muscle spasms, MS" or "any other medical condition" approved by a physician. It also excludes individuals from state prosecution for "acquisition, possession, production, use, or transportation of (medical) marijuana or paraphernalia" with the approval or recommendation from a state licensed physician (Colo Const. Art XVIII §14).

As of June 1, 2001 the state health agency created and continues to maintain a confidential registry of patients who are entitled to receive a registry identification card. Unlike California, each patient or caregiver seeking legal state access to medical marijuana must apply for and carry a state registry identification card. Legal possession of this card excludes those individuals from state criminal penalties for engaging or assisting in the use of medical marijuana. This regulatory process, by being stricter than that of California, and preventing anonymity, may limit the number of qualified individuals' access to medical marijuana. It may also help to track the growing number of medically authorized patients allowing Colorado to license enough dispensaries for patients in need. The Colorado Medical Marijuana Code, C.R.S. § 12-43.3-101, et seq., clarifies Colorado law regarding the scope and extent of Amendment 20 to the Colorado Constitution. At the same time it authorizes a mechanism for the retail sale,

distribution, cultivation and dispensing of medical marijuana known as a "Medical Marijuana Center." It further authorizes licensing mechanisms known as an "Optional Premises Cultivation" and a "Medical Marijuana-Infused Products Manufacturers' License." A permittee may not dispense more than two ounces of a usable form of medical marijuana, or in the alternative, six marijuana plants, three or fewer of which may be mature flowering plants per patient, per day. Sales tax is due on all products sold at dispensaries (United States of America, Legislative Council).

New Mexico

On April 2, 2007, the Lynn and Erin Compassionate Care Act (Senate Bill 523) went into effect in New Mexico. It also was enacted to allow use of medical cannabis for "alleviating symptoms caused by debilitating medical conditions and their medical treatments" including but not limited to "cancer, glaucoma, multiple sclerosis, AIDS, neurological disorders and any other medical condition, medical treatment or disease approved by the department of health." The number of qualified medical conditions continues to expand, including PTSD and Crohn's disease (N.M. Stat. Ann. §26-2B-1). Individuals who are residents of the state receive approval from a state licensed physician for medical marijuana use, and who carry a registry identification card will not be prosecuted for the possession of up to an "adequate amount" or what would be the equivalent of a three month's supply of medical marijuana, which is six ounces. A qualified caregiver would also receive a registry identification card and would receive the same legal protection from prosecution if in possession of up to an adequate amount of medical marijuana. It is not legal for caregivers to use medical cannabis unless they are certified patients themselves. (N.M. Stat. Ann. §26-2B-3(F)). Unlike most other state programs, patients and their caregivers cannot grow their own marijuana; rather, it must be provided by state-licensed "cannabis

production facilities.” In New Mexico there is a process by which “a person or an association of persons” can be determined by the department of health to be qualified and licensed to “produce, possess, distribute, and dispense cannabis.” These individuals will also not be subject to prosecution, in any manner, for the possession, production, distribution or dispensation of cannabis. As of July 10, 2012 twenty-three of these licensed production facilities are operating.

In December 2010 New Mexico revised regulations increasing the number of plants these non-profit facilities could grow from 95 to 150. The updated regulations also allow licensed producers to obtain plants, seeds, and/or usable cannabis from other non-profit producers. On March 5, 2012 the residing governor of New Mexico signed Senate Bill 240, creating a medical cannabis fund to cover the program’s costs. As of August 29, 2011 3,981 New Mexico residents were registered to benefit from medical marijuana treatments, by October 2011, the latest period for which the health department has statistics, 4,310 patients were registered to receive medical marijuana (Sundberg).

Rhode Island

On January 3, 2006 The Edward O. Hawkins and Thomas C. Slater Medical Marijuana Act took effect in Rhode Island. The law removes state-level criminal penalties on the use, possession and cultivation of marijuana by patients who possess “written certification” from their physician stating, “In the practitioner’s professional opinion, the potential benefits of the medical use of marijuana would likely outweigh the health risks for the qualifying patient.” The illnesses given legal protection under this act include but are not limited to: “cachexia; cancer; glaucoma; Hepatitis C; severe, debilitating, chronic pain; severe nausea; multiple sclerosis and Crohn’s Disease.” Other conditions may be approved by the Rhode Island Department of Health. Caregivers must be at least 21 years old and can only manage up to five patients at any

time. Both patients and/or their primary caregivers may legally possess 2.5 ounces of cannabis and/or 12 plants. All plants must be stored in an indoor facility. The law establishes a mandatory, confidential state-run patient registry that issues identification cards to qualifying patients. In 2009, Rhode Island lawmakers enacted legislation authorizing the establishment of state-licensed not-for-profit “compassion centers” to “acquire, possess, cultivate, manufacture, deliver, transfer, transport, supply or dispense marijuana, or related supplies and educational materials, to registered qualifying patients and their registered primary caregivers,” to be overseen by the State Department of Health (Rhode Island Department of Health).

On May 22, 2012, despite his previous October 2011 decision to invoke an indefinite licensing suspension of compassion centers, based on concerns that the number of plants grown by compassion centers might be mistaken for commercial enterprises by the DEA, Governor Lincoln Chafee signed into law Senate Bill 2555. Under the new law health regulators will license three not-for-profit entities to operate within the state, still deemed as 'compassion centers'. The Department of Health named Greenleaf Compassionate Care Center in Portsmouth, Summit Medical Compassion Center in Warwick, and The Thomas C. Slater Compassion Center off Smithfield Avenue in Providence as the beneficiaries for licensure. These centers are legally certified to produce and distribute medical marijuana to authorized patients. Similar to the New Mexico law, these compassion centers will not be allowed to cultivate more than 150 cannabis plants on the premises at any one time, only 99 of which may be mature. The centers will also be restricted to possessing no more than 1,500 ounces of usable product at any one time (Senate Bill 2555). These statutory limitations were crafted so as to minimize the likelihood of federal intervention with the state's law implementation. Currently over 4,400

Rhode Island residents are legally authorized to use cannabis medically (Rhode Island Department of Health).

In each of these states, the medical edible market grew out of a compassionate concern to patient access to medical marijuana that did not require ingestion through smoking. Individual chefs, themselves patients, creatively approached the process of developing delicious edible products capable of providing patients with adequate doses of medicinal cannabis. Committed to working within the legal guidelines of each of their respective states, these chefs investigated methods of extracting the medicinal components from the cannabis plant. They recognize their market is limited by the regulations imposed by their state, as well as the limitations imposed on them by federal regulations. State laws clearly limit sales; products cannot be sold across state lines to comply with the Interstate Commerce Act. Cultivars cannot exceed the number of plants defined by each state's regulation and should be maintained in those numbers so not to be interpreted by federal officials as commercial enterprises. According to the stance of the Obama administration, the risk to this market may be increasingly minimized as long as each establishment is careful to comply with its respective state laws.

To prove state compliance and to minimize risk of federal prosecution, dispensaries must provide visible state registration documentation. All dispensaries must provide documentation of what products are sold and the amount of products sold. The dispensation of cannabis must be clearly designated for medicinal purposes and for state recognized illnesses or disease. Patients are also required to present documentation to demonstrate they are authorized to use medical marijuana. Many states use their health departments or health agencies to monitor the cultivation and use of medical marijuana. Sometimes, it can be more efficient for states to employ the

support of local agencies to oversee and collate the data affiliated with the medical distribution of cannabis (Eddy 17).

Medical Issues

Over the past five decades marijuana has begun to regain support within the medical community (Pertwee S163). Experimenting with O'Shaughnessy's recipes, from 1850 to 1964 chemists struggled to identify and isolate the active components of cannabis. Its main active ingredient, δ -9-tetrahydrocannabinol (THC), was not isolated until 1964, and not until the 1990s was the human cannabinoid system discovered (Gaoni et. al. 1646; Bostwick 176; Kogan and R. Mechoulam 423). This "endocannabinoid" system would prove to be spread throughout the human body, regulated by receptors, identified as CB1 and CB2, which were responsible for a vast range of modulatory activities. In 1992 William Devane and Raphael Mechoulam identified an endogenous brain molecule, naming it 'anandamide' from the Sanskrit word for "eternal bliss". Anandamide is an endocannabinoid, a neurotransmitter that binds to and activates the cannabinoid receptors (423). THC, also a cannabinoid, is technically known as a plant derived or phytocannabinoids and mimics the actions of anandamide, meaning that THC also binds with the cannabinoid receptors (423). Physiologically, these receptors are instrumental in modulating the central nervous system, the autonomic nervous system, the immune system, the gastrointestinal tract, the reproductive system, the cardiovascular system and the endocrine system (Bostwick 178; Kogan 425). They influence a vast array of functions as diverse as the regulation of food intake, visceral sensation, gastrointestinal motility, intestinal inflammation and cell proliferation. Systemic endocannabinoid interaction with external cannabinoids, cannabidiol and THC of cannabis produces anti-anxiety, anti-psychotic, anti-convulsive, antiemetic, and anti-inflammatory effects, as well as pain relief, and appetite stimulation (Bostwick 172). Research studies are showing evidence of suppressed neoplastic tumor growth associated with cannabis use, including decreased angiogenesis, decreased metastasis through

interference with cell migration, inhibited carcinogenesis, and attenuated inflammation (Bostwick 178; Morgan and Lyn Zimmer 2; Baker et. al. 85). Significant evidence demonstrates that cannabis or marijuana is medically effective when used to treat a myriad of conditions including glaucoma, cancer, AIDS, muscle spasms, anorexia, chronic pain, neurological disorders, severe nausea, anxiety, insomnia, tremors, post-traumatic stress disorder (PTSD), and to reduce tumor size (Baker et. al. 83; Ben Amar 4; Aggarwal et. al 52; Ganon-Elazar and Irit Akirav 458). A study published in the June 2012 edition of the Journal of Clinical Cardiology states studies so far show a promising effect of modulation of the cannabinoid system on myocardial injury. CBD in conjunction with both CB1 and CB2 reduced infarct size, leading to a preservation of ejection fraction or heart function. Systemic cannabinoid interaction with CB1 and CB2 receptors, by a non-inhalation route via oral ingestion, may provide a more effective therapy for altering the course and complications of atherosclerosis (Singla et. al. 335). Scientific, medical inquiry continues to further understand and determine the specific medicinal benefits of each cannabinoid at universities such as Haifa University, Israel; UCLA, United States; and the University of Arkansas, United States.

Over eighty cannabinoids have been identified in the cannabis plant. Further research has helped to elucidate these cannabinoids and their medicinal attributes. The major active cannabinoids include: tetrahydrocannabinol (THC), tetrahydrocannabinolic acid (THCA), cannabidiol (CBD), cannabidiolic acid (CBDA), cannabinol (CBN), cannabigerol (CBG), tetrahydrocannabivarin (THCV), and cannabichromene (CBC). THC, the most abundant cannabinoid in cannabis, it has mild analgesic effects and can act as an antioxidant. THC also creates the psychoactive therapeutic effects of cannabis. THCA, which is the most prevalent cannabinoid, includes many anti-inflammatory, anti-proliferative, and anti-spasmodic properties,

which have numerous applications in medicine, such as inhibiting cell growth in tumors or controlling muscle spasms in patients with multiple sclerosis. CBD, in repeated studies, has been determined to exhibit a profound number of therapeutic effects acting as an antipsychotic, anti-epileptic, neuroprotective, vasorelaxant, antispasmodic, anti-ischemic, anti-proliferative, antiemetic, antibacterial, antipsoriatic, intestinal anti-prokinetic, analgesic, bone stimulant, and anti-inflammatory (Bostwick 172). CBDA, similar to THCA, is the main constituent in cannabis that has elevated CBD levels. THCA and CBDA hold most of the anti-inflammatory properties that cannabis has to offer. CBN occurs when the plant material is old or has degraded and suppresses or eliminates the psychoactive benefits of TCH. CBG exhibits antibacterial effects and has been shown to relieve intraocular pressure, especially useful in the treatment of glaucoma. THCV is a homologue of THC, it has been found to include properties for metabolic disorders, for example, lowering blood sugar levels for use in diseases such as Type II diabetes. When used in conjunction with CBDA, THCV could help treat prostate cancer. CBC is also useful for its anti-inflammatory and anti-viral effects (SC Labs).

The two cannabis family species, *C. sativa* and *C. indica*, have been found to differ in medicinal properties. *C. Sativa* strains have higher concentrations of δ -9-THC and lower levels of CBD. *C. Indica* strains have moderate levels of δ -9-THC and increased levels of CBD. *Sativa* produces a more euphoric therapeutic effect, relieving stress and effectively aiding with depression. It has been proven as a treatment for glaucoma, reducing intraocular pressure. *Indica* provides full body pain relief and is extremely effective in relieving pain endured by patients undergoing chemotherapy. Individuals fighting AIDS also experience relief from chronic pain. Both cancer and AIDS patients demonstrate increased appetite with the support of *C. indica*. It is

proven to be beneficial for those dealing with insomnia and multiple sclerosis (Golden State Collective).

The arguments against the medical use of cannabis include concerns about addiction, over-dose, and, if inhaled, the negative effects on the respiratory system and on pulmonary function (Bostwick 178). The lifetime dependence risk of cannabis is 9% versus 32% for nicotine, 23% for heroin, 17% for cocaine, and 15% for alcohol. The risk of new-onset dependence on cannabis is essentially zero after the age of 25 years, on cocaine new-onset dependence grows until the age of 45 years, and alcohol users will keep on making the transition from social use to dependence for decades after their first use. (178; Wagner and JC Anthony 484)

Although effectively developed to relieve pain and treat other medical conditions, the medications which hastened the decline of cannabis' use in medicine, such as aspirin, morphine and other opium-derived drugs, also produce negative side effects (Zimmerman et. al.). Traditionally, medical professionals prescribe potentially dangerous and addictive painkillers, such as oxycodone, vicodin, morphine, Demerol, and codeine to patients for treatment of the same conditions (Dhalla, I. A. et. al. 893; SAMHSA). Many of these medications are not only associated with unpleasant side effects from chronic use, they are also frequently associated with overdose, abusive and illegal use (SAMHSA). Due to the near absence of CB1 receptors in the brainstem, the autonomic nervous system is spared from the fatal respiratory outcomes associated with opioids and other traditional painkillers, with the result that no lethal overdose of cannabis in humans has ever been reported (SAMSA; Bostwick 180; Canada).

If inhaled, medical marijuana does pose respiratory risks, which have been reported (Bostwick 179). A marijuana cigarette is more harmful to health than oral THC. In theory, it can

cause as many pulmonary problems as 4-10 regular cigarettes (Kleber et al. 100). Some studies indicate cannabis smokers are at greater long-term risk of suffering from pharyngitis, rhinitis, asthma, bronchitis, emphysema and lung cancer (van Hoozen and Carroll Cross 254; Hall and N. Solowij 1613). In their review of the scientific evidence, John P. Morgan and Lynn Zimmer state that moderate smoking of cannabis appears to pose minimal danger to the lungs (Canada). There have been no reports of lung cancer related solely to cannabis. However, because researchers have found precancerous changes in cells taken from the lungs of heavy cannabis smokers, the possibility of lung cancer from cannabis cannot be ruled out. Unlike heavy tobacco smokers, heavy cannabis smokers exhibit no obstruction of the lung's small airways, indicating that emphysema might not develop from smoking cannabis (Canada). Researchers at UCLA report "marijuana smokers probably will not develop emphysema." A recent study of 268 cannabis smokers in Australia supports the UCLA finding. After smoking cannabis on a daily or weekly basis for an average of nineteen years, the cannabis users had a lower prevalence of emphysema and asthma than the general population (Hashibe et. al. 1829; Swift et. al. 190). Another study conducted at the Kaiser-Permanente HMO, funded by the NIDA, followed 65,000 patients for nearly a decade, comparing cancer rates among non-smokers, tobacco smokers, and marijuana smokers. Tobacco smokers had massively higher rates of lung cancer and other cancers. Marijuana smokers who did not also use tobacco had no increase in risk of tobacco-related cancers or of cancer risk overall. Their actual rate of lung and most other cancers were slightly less than that of non-smokers, though the difference did not reach statistical significance (Sidney et. al. 722). In May of 2006 Tashkin completed an additional control study comparing 1200 patients with lung, head and neck cancers to a matched group with no cancer. Even the heaviest marijuana smokers had no increased risk of cancer, and had somewhat lower cancer risk than

non-smokers. Tobacco smokers demonstrated a 20-fold increased lung cancer risk (Hashibe et. al. 1829). On average, Marijuana smokers do not smoke as frequently or heavily as those noted in the UCLA studies. This data and continuing research helps to elucidate the risks posed to those who choose to smoke cannabis for medical purposes. This consideration is less important in the case of palliative care provided to terminally ill patients.

Although smoke inhalation has been the preferred method for accessing the medicinal effects of marijuana, many patients find inhalation noxious and compromising if they are suffering from respiratory conditions. Ohlsson and Lindgren investigated the efficacy of orally ingesting cannabis in 1980 (Lindgren et. al. 409). To be effective medicinally the plant material must be heated to decarboxylate or transform the inactive tetrahydrocannabinolic acids into δ -9-tetrahydrocannabinol (Canada; Grotenhermen, "Clinical Pharmacokinetics of Cannabis" 13). Heating for five minutes at 200°-210°C is optimal for this conversion. Potency and medicinal efficacy of cannabis products is significantly increased by cooking or baking the material (Grotenhermen 4).

Cannabinoids are soluble in lipids or alcohol not water, therefore any medicinally effective transformation of the cannabis plant into edible form must include infusion into fats or alcohol with heat. Most edible products produced using cannabis include fats such as butters or oils infused with cannabis. According to Gottlieb, when properly prepared edibles are a more efficient means to absorb cannabinoids (Gottlieb 8). Once eaten, absorption by the gastrointestinal tract is quite effective, relatively slow and noticeably different from that of smoking. Onset of the medicinal effect is slower and lasts longer at lower plasma THC concentrations (Lindgren et. al. 411). After absorption through the gastrointestinal tract, THC passes through the liver and is metabolized into 11-OH-THC (11-hydroxy-tetrahydrocannabinol)

which is four to five times more potent than δ -9-THC (Aggarwal et. al. 52; Lemberger et. al. 685). This effect is realized by the patient because the metabolite 11-OH-THC is almost bound completely to protein in the plasma, can cross the blood brain barrier with ease, and is eliminated only slowly from lipid containing tissue, which provides the patient with a more consistent, steady medicinal effect. The medicinal onset is gradual, usually taking forty minutes to one hour, it then continually increases in effectiveness to plateau for 4-6 hours, ultimately providing medicinal benefit for 6-8 hours (Appendix C, Medical Chart 3; Medical Chart 2). Unlike smoked cannabis, patients avoid the “rush” caused by de-oxygenation of the blood combined with a short-term rise in blood pressure and heart rate (Adams 1585; Lindgren et. al. 412).

Pragmatically, patients choosing to use edible cannabis products experience a more consistent medicinal effect, that does not require repeat dosing throughout the day or night. Long exposure in the stomach may decrease the potency of oral cannabis for example, if taken with meals that are difficult to digest. Therefore, for the maximal medicinal effect, edible products produced with cannabis may be best taken with a light meal or thirty to forty minutes before consuming a heavy meal. Additionally, if illnesses occur during pregnancies that indicate medicinal benefit from cannabis, cannabis in edible form is less toxic to the fetus than when inhaled. The 11-OH-THC metabolites cross the placenta less efficiently than THC. When taken orally, the fetal plasma concentrations of THC are approximately only one-tenth the maternal THC concentration as opposed to fetal plasma levels that are approximately one-third maternal THC concentrations when cannabis is inhaled (Grotenhermen, “Clinical Pharmacokinetics of Cannabis” 30; Huestis 33).

Much of the data regarding the effectiveness and absorption of orally ingesting cannabis is cited from studies conducted in the 1970’s to 1980’s. With advances in scientific laboratory

testing, dose concentration calculations, and product development, further research can lead to more accurate data to determine effective dose administration with medical edible products.

These applications in conjunction with scientific medical research may provide more effective, targeted medical benefits for the patient community.

Chapter Three

Development of the Edible Frontier

Cultivation, Quality Control and Dosage

In addition to the laws governing the dispensing of medical marijuana, cultivation, quality control and prescribing the correct dosage of marijuana play an important role in the effective use of this product. Each individual state that has legalized marijuana for medicinal use has established specific guidelines for the cultivation of this therapeutic botanical. Laboratories run by qualified scientists or biochemists are available in many of these states to help control the quality as well as help establish products containing reliable medicinal doses. This section will address the cultivation, quality control and dosage parameters established by the following states: California, Colorado, New Mexico and Rhode Island.

Cultivation

The ways that a dispensary, patient, or caregiver grows their product can affect the taste and the dosage of the final medication. Cultivation means the process by which a person promotes the germination and growth of a seed to a mature marijuana plant (Rocky Ford). Many dispensaries or growers have chosen to cultivate plants without the use of pesticides and have embraced organic farming practices. State governments set clear standards to define how many plants can be cultivated.

In California, medical marijuana can be cultivated by individual authorized patients or licensed dispensaries as long as a ventilation system is set up so no odors are detected off-site.

Any medical plants grown by a dispensary, including immature plants or seedlings, can only be dispensed by members of the collective to authorized patients (California, Medical Marijuana Storefront Collective Permit Application 9). According to state law, all dispensaries must have a security plan must be in place, including security alarms, video surveillance, and physical means of preventing anyone other than staff access to the growing area (10). The maximum height for plants grown in the dispensary is ten feet and all plants must be blocked from public view (20).

Although California passed regulations allowing for the legal cultivation and dispensation of medical marijuana, clarifying that each authorized patient may grow up to six female, budding plants defined as “mature” or twelve immature plants, no standard maximum number of plants per dispensary has been established by the state. Each city or locality within the state has established their own specific guidelines for cultivation. Inconsistencies also exist from county to county regarding the area allowed for cultivation and if indoor or outdoor growth is allowed. For example, Arcata county dispensaries are limited to using no more than 25% of their properties for cultivation, not to exceed 1500 square feet. In Trinity and Tulare counties, dispensaries are allowed to cultivate up to 99 mature or budding female plants within 2500 square feet with proper zoning (California). The specific guidelines for cultivating medical marijuana within each county must be observed or the dispensaries could face stiff fines, federal investigation, imprisonment and confiscation. These guidelines include the size of the growing area, whether indoors or outdoors, the amount of plants in the area, and a set distance away from schools, churches, or youth areas. In Berkeley outdoor growing areas are limited to 10 mature female budding plants and 50 square feet per parcel. Otherwise within personal residences up to 24 plants, 6 mature or 12 immature per patient for up to two patients inside or outside based on county (California).

The cultivation of medical marijuana in Colorado is carefully regulated and limited to six plants, three mature, three immature, per patient or caregiver or up to twelve mature plants per residence. Dispensary cultivars are strictly limited to growing up to six mature plants per patient unless authorization is granted and provided by a patient stating they are qualified to have more than six plants. Each plant's weight is recorded and electronically tagged to be followed "from seed to sack," in order to document all aspects of cultivation from start to final production. Documentation is provided to the state per request. At least seventy-percent of medical marijuana sold must be grown by a dispensary (United States of America 2). New state enforcement division mandates require high levels of security for each dispensary, including twenty-four hour agent-monitored video feed. Cultivars and/or dispensaries cannot be located within 1,000 feet of a school, church, park or any public facility designated for youth or minors. All cultivation can be either indoors, with proper ventilation, or outdoors, hidden from view. If cultivars are found non-compliant, they will be guilty of a misdemeanor and subject to a maximum penalty of six months imprisonment or a fine of one thousand dollars (2).

Of the states legalizing medicinal use of marijuana, New Mexico has established some of the strictest cultivation requirements. Unlike other states, patients and caregivers are not allowed to grow their own medical marijuana and will face prosecution if found to do so. Cultivation must be carried out by licensed facilities. Any patient or group of patients can apply to become licensed growers by the state, but they must be certified before any plant can be cultivated. All cultivation, regardless of whether it takes place indoors, with required ventilation or outdoors, and hidden from view, must be at least three hundred feet from a school, church, or youth-designated area. Deemed in New Mexico as "Cannabis Production Facilities," dispensaries are only allowed to cultivate up to 150 plants at a time. If mold or the presence of any other bacteria

is found or suspected to be present in the product, the cultivator must send samples to the Department of Health for testing. Non-compliance of state regulations can result in civil penalties and criminal prosecution (N.M. Stat. Ann. §26-2B-1).

Rhode Island has a cultivation limit of twelve mature plants per patient. Registered patients are allowed to cultivate their own plants. Compassionate care centers recently established by the state to cultivate and dispense medical marijuana for the benefit of authorized patients cannot grow more than 150 cannabis plants on the premises at any one time, only 99 of which may be mature. The marijuana must be grown indoors in a secure facility. Currently, there are three designated compassionate care centers, or dispensaries, located in Rhode Island: The Greenleaf Compassion Care Center, The Summit Medical Compassion Center, and The Thomas Slater Compassion Care Center. At this point in time, there is a moratorium on medical marijuana growth in these centers due to enforcement conflicts between the state and Rhode Island's Attorney General. Fraudulent representation of the cultivation of marijuana for medical purposes will result in a fine of \$500 in addition to any other penalties that may apply (Rhode Island Department of Health).

Quality Control

As medical marijuana continues to grow as a viable business, many dispensaries and growers cultivate cannabis to insure the safety and quality of the doses created from the plant. Although it is not required, the higher end dispensaries make sure that they have their products tested in laboratories. Numerous benefits are attained through testing edibles and other cannabis products. Qualified scientists are able to determine the quality of the cannabis and its strength, identifying major active cannabinoids, such as tetrahydrocannabinol (THC), cannabidiol (CBD), cannabinol (CBN), cannabigerol (CBG), tetrahydrocannabivarin (THCV), cannabichromene

(CBC), tetrahydrocannabinolic acid (THCA), and cannabidiolic acid (CBDA). As noted earlier, these cannabinoids all play key roles in the use of cannabis as a medication. These are only the main cannabinoids- there are over seventy in the cannabis plant. Laboratories can examine how much of each cannabinoid is found in the plant material, which can determine how or why it is used by patients, much like aspirin, ibuprofen, or Tylenol (SC Laboratories; Halent Laboratories; CannLabs; CW Analytical).

Through testing, dispensaries can assure patients of the quality and usefulness of a strain for a particular ailment (CannLabs). The percentage of Indica or Sativa in a strain will create a different medicinal effect for the user (Ben Amar 13). Laboratories can test the potency of the cannabis material to determine how to measure out correct doses for patients through the use of High Performance Liquid Chromatography (HPLC). HPLC is very useful in determining the exact amounts of cannabinoids present; the plant material can remain in its natural form and be analyzed without damaging any components. This is important because besides the main cannabinoids, there are also over 420 different compounds, including terpenes (responsible for aroma), flavonoids (responsible for flavor), glycoproteins, and alkaloids, among others contained within the plant leaves (SC Laboratories; CannLabs; Halent Laboratories). Screening for dangerous microbial agents, such as *Aspergillus*, *Listeria*, *E. Coli*, and many others, prevents patients from developing further health problems, guaranteeing that the product they are buying is safe and effective. Pesticides are also tested for, allowing patients to feel secure in knowing they will not be ingesting any harmful pesticides that could cause dizziness, nausea, headaches, or skin irritation (SC Laboratories; Halent Laboratories; CannLabs; CW Analytical). There are several well-known laboratories that test the cannabis used in the creation of, as well as the

resulting edible products such as Halent Laboratories, SC Laboratories and CW Analytical in California, CannLabs in Colorado, as well as Page Analytics in New Mexico.

Located in California, CW Analytical meticulously tests products from Bhang Chocolates and Kiva Confections through cannabinoid profiling, chemical residue screening, and microbiological screening. Cannabinoid profiling allows CW Analytical to test for the amount of THC, CBD, and CBN, three out of the seventy major cannabinoids present in cannabis. As the plant ages, CBN is created. If it is found in a large concentration, the resulting product will not be medicinally effective. CBD is responsible for the relaxing effects of cannabis, and THC is the major psychoactive cannabinoid, and it is helpful in pain relief. Cannabinoids are produced in glandular sections on the leaves of the plant known as trichomes. The resin extracted from the trichomes contains terpenes, as well as flavonoids, the components which are instrumental in providing different aromas and flavors to each plant. Chemical residue screening tests the product for pesticides, including organophosphates, carbamate, pyrethroids and pyrethins, and avermectins. These pesticides can be linked to a host of health problems, including asthma, eye and skin irritation, headaches, nausea, and vomiting. For additional product safety, CW Analytical Laboratories conducts microbiological screening for bacteria, coliforms, E. coli, and yeast or mold (CW Analytical).

Halent Laboratories, also located in California, is used by edible producer, Auntie Dolores. Halent Labs also evaluates medicinal cannabis for product safety. They screen for pesticides, mold, fungus, and mycotoxins, to insure patients can be confident the product they are consuming is safe. The cannabinoids tested are THC, CBD, and CBN, as well as twelve others including THCV, THCA and CBDA. The medicinal cannabis product is tested for eight terpenes, including limonene, myrcene, alpha-pinene, linalool, and trans-caryophyllene (Halent

Laboratories). Each of these terpenes individually has been found to provide specific medicinal benefits. Products containing a higher concentration of terpenes provide greater medicinal benefits to the patient (Russo 1344).

A well-known laboratory in Denver, Colorado, CannLabs, used by Dixie Elixirs & Edibles, promotes “Responsibility Through Testing.” CannLabs is fully licensed by the state of Colorado to perform third party testing of medical grade cannabis products, including creamery butter, cooking oils, hash, hash oils, waxes, and all edibles. CannLabs tests for CBD, THC, CBN, THCA, and CBDA. Eventually, they will be testing for THCV, CBG, and CBC. CannLabs uses high performance liquid chromatography to test all their samples, which allows the plant material to stay in its original form. This allows for the most accurate testing. As a leader and well-known lab in the medical marijuana community, CannLabs offers consulting for other laboratories as well as formulations for new edible products. Unique to Colorado growers at this time is the support of a USDA approved, certified professional horticulturalist (CPH), approved by the American Society for Horticulture Science (ASHS), who is also Medical Marijuana Enforcement Division (MMED) certified by the state. Otoké Horticulture, LLC boasts one of only three hundred CPHs in the country and the only CPH to specialize in cannabis, helping Colorado grow-operations since early 2010 by teaching basic horticulture. Their work and research is being documented for the ASHS with the goal to see cannabis become a new crop for this organization to investigate fully (Otoké Horticulture, LLC).

Since testing is not mandatory in New Mexico, The Verdes Foundation relies on self-regulating procedures to guarantee a safe, high-quality product. The owners of the Verdes Foundation grow their own cannabis outdoors on a farm in the eastern mountains of Albuquerque. They do not use pesticides and grow as organically as possible. The medical

marijuana that is grown is evaluated and regulated by the company to insure that it meets the highest possible standards. The Verdes Foundation hopes to one day test their products in a laboratory, but at this point in time they do not have that option (The Verdes Foundation). The Minerva Canna Group, also located in Albuquerque, New Mexico, grows all of their own cannabis indoors, using the most up to date technology and techniques to regulate their procedures. They grow their product 100% organic, with absolutely no pesticides or growth hormones (Minerva Canna Group). The Minerva Canna Group uses Page Analytics to evaluate and test their medical marijuana products (Briones).

Standards in cannabis' medical use can be put in place to insure that patients are receiving the same dose every time, establishing credibility and reproducibility. Testing provides consistency in texture, flavor and dosing. The dispensaries that trust their product to laboratories like CW Analytical, CannLabs, and Halent Laboratories give excellent accolades to their work. For example, Bhang Chocolates states, "CW helps ensure the consistency of our products." Bhang notes that CW Analytical's expertise in both food and cannabis science has been critical to the success of their medicinal chocolates. Reproducibility of each edible product is essential for success. Patients expect that every time they purchase any product, that product will always be of the same quality in terms of flavor, texture, and medicinal benefit. "The CannLabs management team and their science division have brought great value" to Dixie Elixirs & Edibles. They have found CannLabs to be instrumental with respect to their formulations as well as with research and development for new edible products. Dixie Elixirs & Edibles finds that CannLabs remains committed to supporting infused product manufacturers like themselves, to insure each patient receives the highest quality medical marijuana in the safest and most consistent products possible. Currently, there are no testing facilities in Rhode Island.

Dosage

The dosage of medical marijuana is one of the most important outcomes of cultivation and testing. Because medical marijuana has not been standardized yet, it is difficult to determine what a proper dose is. Therefore, preparation of single dose edibles is recommended. Research has shown that a medically effective dose is equivalent to an absorbed amount of approximately 16.3mg of THC (Carter et. al. 464). Further work has demonstrated that 2.5mg of THC taken twice daily results in appetite stimulation. 5mg of THC per meter squared of body surface area has been found to be effective for preventing nausea, vomiting and pain. Incremental increases of 2.5mg up to a maximum of 15mg per meter squared of body surface area may be required and are recommended if the initial dose is ineffective. The same dose can be taken every two to four hours for a maximum of four to six doses per day. The maximum total dose is 15mg/meter squared of body surface area, four to six times daily, not to exceed 100-120mg per day (467; Appendix C, Donald Abrams Chart). Extensive testing has been conducted on edibles and, in most cases, analysis has proven that the medicine is not always uniformly or homogeneously distributed throughout an edible product. There is no guarantee that by consuming one half (50%) of the edible, one half (50%) of the medicinal components will be received. CannLabs specifically encourages and implores the manufacturing of single dose edible products (CannLabs). To comply with this research, edible producers such as Bhang Chocolates, Kiva Confections, Dixie Elixirs & Edibles and Auntie Dolores create single dose products. Each product or edible is carefully labeled to reflect the concentration of all medicinal components contained within. These chefs provide their patient base with a wide range of product choices, each formulated to contain reliable concentrations of medicinal components.

Patients need to be educated about the difference in the absorption rates and the timing of the medicinal effects when consuming edible products. Similar to being educated about the therapeutic dose and the side effects of prescription medication, patients need to understand that each person can be affected differently when consuming medical marijuana edible products. Liquid infused edibles, for instance, sodas, beverages or tinctures will be absorbed more rapidly than a product that requires more digestion. Patients are encouraged to wait from fifteen to thirty minutes when consuming a beverage or simple carbohydrate candy, and up to an hour when consuming a more complex carbohydrate, such as cookies, chocolates or brownies to experience any therapeutic response. Edible products can also produce a long lasting medicinal effect, which can last for four to six hours. Therefore, many dispensaries are careful to educate their patients before dispensing any edible products (RB).

Product Development and Dispensaries

Establishments, known as “dispensaries,” have been developed as locations that provide legal access for those with a doctor’s recommendation to purchase products made with medically approved and cultivated marijuana (Lunsford). Some dispensaries cultivate their plants, while others purchase plants from one or more certified growers. They then use the raw material to produce cannabis products.. The individuals involved with edible production have varied backgrounds; some are trained chefs, hailing from culinary schools such as Johnson & Wales University and New York City’s Institute for Culinary Education. Some have gained their training under the tutelage of experienced chefs, while others may have entered the market through the horticultural trade, health or caregiving experiences, developing their baking skills on the job based on trial and error. Being patients themselves, they have discovered and learned

that many patients do not want and, in many cases, cannot inhale or smoke their medical marijuana. Dedicated to their trade and their patient base, these chefs are committed to the process of creating delicious medically effective edibles. As a result of their commitment to producing quality products, as noted earlier, these individuals and the dispensaries they run use laboratories dedicated to overseeing and confirming that the proper concentrations of the medicinal product are obtained for each product produced.

Developing the Edible Product

There are a variety of compounds used in producing edibles; butters, oils, tinctures and extracts made from cannabis infusions are incorporated into edible products. Employing the same techniques used for thousands of years, chefs need to first extract the cannabinoids from the raw cannabis plant. Cannabinoids are hydrophobic, meaning they are insoluble in water. They are only soluble in fats or alcohol, therefore a fat, usually butter or oil, is heated and the plant is placed in the liquid. In order for the medical effects of cannabis to be experienced, the cannabis must be heated and boiled in fat or liquor (Gottlieb 4). Once the raw plant material is added, the mixture is then boiled and simmered for as little as one hour or up to a day. This process, known as infusing, extracts the flavor as well as the medicinal components from the cannabis plant. The longer the plant is infused, the stronger the flavor and potency of the dose. After the desired flavor is achieved, the mixture is strained, removing all solid plant particles from the liquid. The remaining liquid is then placed into a container. If it is butter, it will solidify again and will retain a greenish tint. Oil will remain in a liquid state and will also have a slightly green color (Cote).

After infusing the cannabis, the butter, oil or whatever other fat based substance was infused, also known as “canna-butter,” can be employed to make a variety of edibles. The

amount of butter or oil used in a recipe will remain the same, but the amount does not all have to be canna-butter. For example, if a cookie recipe called for two pounds of butter, one pound could be canna-butter and the other half could be regular butter. The ratio of canna-butter to regular butter can be changed depending on how strong the developer wants the final product to be. Edibles can also be made with hash, created from marijuana resin which imparts a sweeter, mellower flavor (Gottlieb 8).

Each of these prepared components are evaluated for medicinal concentration to determine what dose of medicinal marijuana will be incorporated into the final edible product. Once prepared, the final product is also evaluated to determine that it contains the expected dose represented by the concentration of the components used in its production (CannLabs; Halent Laboratories; CW Analytical). The final edible products, or the oils, butters, and extracts may be sold on site or to dispensaries within the same state that do not produce their own medical marijuana products, for use or resale, similar to traditional bakeries (Bob).

Some of the recipes used and developed for medical marijuana edibles, as well as the additional ingredients incorporated into the products, have roots from ancient cannabis preparations. One ancient confection from Morocco still being made and eaten is known as “*Majoun*,” which translates from Arabic to ‘love potion.’ It requires a very simple preparation, using both a hot and cold infusion method, which allows the cannabis to become fully infused throughout the mixture. The final product is mixed with dried fruits, nuts, and spices to make this Moroccan candy (Appendix D; Wolfert 501). Depending on the product and its use, chefs have different points of view regarding flavor. Some chefs prefer to disguise the earthy taste of cannabis, enveloping it within the flavors of the products they are producing. Other chefs prefer

the flavor to come through, to be used in combination with other foods, creating complimentary flavor profiles for their products.

Dispensaries and Product Developers

Chefs and product developers from representative dispensaries in the four states investigated have worked to create their own niche in the medical marijuana edible frontier. Of the four states investigated regarding the development of the marijuana edible market, California, Colorado, New Mexico, and Rhode Island, three have seen significant growth in their market share. Due to regulatory conflicts within the state, Rhode Island's dispensary production and as a result, at this point in time, its medical marijuana edible market is on hold. Therefore, selected dispensaries in California, Colorado and New Mexico will be discussed. Each of them, their backgrounds, their product development, expertise in the developing market, the challenges the market creates and their unique market share will be presented.

California

California has an estimated 500 to 1,000 medical marijuana dispensaries and collectives (Warner). Exact numbers are not available because mandatory registration is not required within the state. Two of these, Bhang Chocolates and Kiva Confections in Oakland, California, have opened not simply as dispensaries but as bona fide medical marijuana edible businesses.

Bhang Chocolates, founded in 2010 by Certified Master Chocolatier and Chef de Cuisine Scott Van Rixel, sells high quality chocolate products (Cote). Scott Van Rixel studied at Johnson & Wales University and subsequently trained in Europe to perfect his skills in chocolate.

Initially, he owned his own non-medical marijuana chocolate business in New Mexico, known as Chocolate Cartel. He relocated to California and became interested in the medical marijuana

market as a business decision when California passed its new legislation, Proposition 215. His brother, also a Chocolatier, is located in New Mexico producing and distributing the Bhang brand there. Since inception, his business has grown significantly.

To create his signature chocolates, Van Rixel starts with premium “El Rey” chocolate made from Venezuelan criollo cacao and cocoa butter. The Venezuelan criollo cacao bean has a dark cherry roasted flavor and is found in less than ten percent of cacao beans around the world (Vinson). He grows his own cannabis source organically indoors in Oakland, California. Van Rixel also chooses to use different strains of cannabis in his chocolates, recognizing that different strains provide different medicinal benefits for his patient base. The plants’ flowers are ground and then submerged in the hot cocoa butter. The butter is strained and used as desired. Van Rixel uses “El Rey” chocolate specifically for the high quality and because it is produced organically as well as follows the practice of fair-trade (Cote). From his perspective, the flavor of the cannabis plant should not be tasted. Great attention is paid to straining out any plant residue to prevent any plant flavor from permeating the final product. Therefore, Van Rixel has a blank palate to work with in developing his unique flavor line. In addition, this process maintains the smooth consistency and texture desired for the chocolate. Van Rixel and his team produce chocolate following the standard procedures employed to create the highest quality chocolate, including tempering and molding. All products are tested through CW Analytical to guarantee standard doses for patients. It is very important to the Bhang Chocolate company that all the concentrations of cannabis are the same, guaranteeing patients a safe, consistent product. Their products are made specifically for medicinal benefit, to alleviate pain or address the complications of illness (Cote; Vinson).

Bhang Chocolates have a loyal client base, ranging from six-year olds with brain tumors to grandmothers with cancer, and are a favorite among patients because the quality of the product is reliable, effective and delicious. Additionally, patients are drawn to the variety of flavors and strengths Bhang Chocolates produce. Since specific cannabis strains used in medical edible products are effective for different medical conditions, Van Rixel produces chocolates for his patient base marketed to those conditions, which has also resulted in increased growth for Bhang Chocolates. Their chocolates are also popular due to the variety of products made available to the patient base (Appendix B). Due to their unique product, competition does not affect market share and does not pose a challenge at this time.

Since local regulations in Alameda County do not permit patients to ingest their medical marijuana products on site at the dispensaries, Bhang Chocolates is established as a cash and carry enterprise. Their hours of operation, as for all California dispensaries, are established by state law, which allows sales to be conducted everyday of the week from 8am to 10pm. If their business is located 1,000 feet from a school, it must close for one and one-half hours immediately following the end of classes (California). One of the methods Bhang uses to brand its product is through packaging. The packaging of Bhang Chocolate products is simple and clean: the chocolate is placed in an air-tight pouch and then in a black cardboard box, labeled with “Bhang” and a notation stating the box contains “Medical Cannabis.” The box is also labeled with the flavor of the chocolate, the cocoa content, and, by California law, the dose in milligrams of THC.

As an extension of this market, in the future, Scott Van Rixel is hoping to elevate his products from a “black-label” to a “white-label,” using the same Bhang Chocolate but

incorporating a non-medical form of cannabis extracted from hemp seeds. Van Rixel is hoping to sell this new product line to Neiman Marcus and Whole Foods Market (Vinson).

Kiva Confections, founded by Kristi Knoblich in 2010, is also located in Oakland, CA. Knoblich became involved in the edibles business after being a cultivator for four years. Learning that cannabinoids are soluble in fat, and that due to its high fat content, chocolate would be an excellent product choice, Knoblich decided to develop a strictly chocolate based medical edible business. Her products were developed through trial and error. Now, after two years, Kiva Confections has seen significant growth in their market.

They produce their chocolates on site using a cold-water extract. A cold water extraction is done by combining dry leaf material, ice, and water into a basin. The basin is shaken causing the trichomes, which contain the highest concentration of THC found in the plant, to sink to the bottom. The remaining solution is strained. This is the most effective way to separate the crystals from the leaf. The extract is tested for potency prior to being incorporated into the edible product. This extract is then added into the chocolate so that the amount of THC remains consistent in each bar (Knoblich). The cannabis that Kiva Confections uses is grown outdoors organically and pesticide-free. Unlike Bhang Chocolates, Kiva Confections does not use different strains of cannabis in their product. They do not believe that providing products created with different strains of cannabis will significantly improve product value to their patient base or their market share at this time. Acknowledging that the final edible product should be perceived as a medicine, Knoblich believes the flavor of the plant should be tasted in the final edible product.

The chocolate flavors are designed to combine with the medicinal product to elicit desirable flavor profiles. For example, Mint Irish Cream or Tangerine Dark Chocolate are flavors

used to enhance the taste of medical marijuana (Appendix B). Kiva designs their chocolate bars to be divided into four equal parts, suggesting it may be easier for patients to determine dosing, allowing them to double or halve their medication if necessary. All flavored chocolate bars contain 180mg of THC, whereas the plain bars contain 60mg of THC (Appendix B). All products are tested by CW Analytical in Oakland, California to insure consistency and reproducibility within the product line. From their point of view, this decision has placed Kiva Confections on the cutting edge of their market and ahead in the industry. They have noticed that although product testing is not required in California, due to increased awareness amongst the patient population, patients are beginning to demand laboratory testing among edible products (Knoblich).

Kiva Confections has a large diverse patient base, although the population is mainly comprised of men from twenty to thirty years of age. Product line favorites, such as Mint Irish Cream, Tangerine Dark Chocolate, Blackberry Dark Chocolate and Vanilla Chai Milk Chocolate continue to draw an increasing patient population. Due to state regulations, Kiva Confections, like Bhang Chocolates, is a cash and carry enterprise. Their product is also branded by packaging. The chocolate bars sold are packaged in a simple and stylish natural cardboard box. The name of the company is printed in black on the top of the box, as are the flavor, net weight, child warnings, and, per California law, the concentration of THC in milligrams. Ingredients, the mission statement and a UPC code are found on the back. Inside the box, an informative insert is enclosed with the product. Since San Francisco has the only packaging guidelines for medical edible products, Knoblich decided to design her packaging to comply with those guidelines for market access (Knoblich). These guidelines limit packaging design so it cannot be attractive to children or present the contents like candy (United

States of America, Department of Public Health). Despite the restrictions placed on this market, Kiva Confections has only experienced growth in their market share. Demand for the medical edible product continues to increase.

All dispensaries within the California marijuana medical edible market, including Bhang Chocolates and Kiva Confections, experience economic challenges. Interstate commerce laws prevent these industries from selling product across state lines; therefore their market share is contained within the confines of their state borders. Acquiring a medical marijuana business license costs \$9,000 while, in comparison, a liquor license only costs \$250 (Bob). Visa and Mastercard do not allow medical marijuana transactions on their credit cards, which limits patient flexibility for product purchases. This makes it harder for each dispensary to facilitate monetary transactions, and also increases their potential to be a target for crime. Banks are reluctant to open or carry accounts for the proceeds of medical marijuana dispensaries due to laws regulating money-laundering and drug-trafficking. For the same reasons, investors are also hard to find. Although, now medical marijuana edible businesses can establish a Medical Marijuana Merchant Account through the Best Point of Banking Bank, a bank that has dealt with high risk banking needs since 1993. Contrary to the tax benefit other business enjoy, these businesses are unable to write off their business expenses (Best Point of Banking).

Challenges also arise in California with respect to dispensary regulations and licensing. As noted earlier, each locality has adopted different guidelines for the dispensaries within their jurisdiction. Although local regulations regarding both Bhang Chocolates and Kiva Confections prevent them from serving edibles for consumption on site, their products can be sold to dispensaries in Berkeley and San Francisco, which do allow consumption on site (Knoblich). Since there are no mandatory regulations requiring patients to be registered within the state,

anyone with a medical recommendation for medical marijuana can cultivate their own plants and anyone with a medical recommendation can submit a request for a license to open a dispensary. Not all dispensaries are medical edible enterprises, yet new city and county ordinances are being put in place to curtail the concentration of dispensaries in specific locations (Warner). Conflicts arise regarding the intent of the dispensaries and whether or not they will be defined as illegal commercial operations or legally as state recognized medical marijuana providers. The California Attorney General has tried to clarify his, as well as the state's, intent by stating that they are not concerned with prosecuting patients or legitimate care-givers operating within the law, but are interested in closing down large commercial operations that are making huge amounts of money (Onishi).

Despite these challenges and risks, neither Bhang Chocolates nor Kiva Confections believes they outweigh the benefits of operating their medical edible businesses. They believe the industry is young and their businesses are experiencing growth and demand. Each of them continues to expand their product lines and work on developing new and creative products for their patient population. Both enterprises hope and expect to see change in the federal stance regarding the regulation of medical marijuana (Cote, Knoblich).

Colorado

Colorado has a well-established, well regulated medical marijuana market and Denver's market is thriving. Since 2009, the number of registered authorized card-carrying patients has grown from approximately 14,000 to over 104,000 in 2012 (Colorado). For perspective, there are 322 Starbucks stores in Colorado and over 700 medical marijuana dispensaries. Almost 1,100 cultivars or grow facilities within the state, one-third of which are located in Denver, provide plant product for these dispensaries (Warner). Two years ago, the Colorado legislature allowed

individual counties and towns more flexibility in interpreting state law, providing for the development of a for-profit market. To date, over 100 medical marijuana businesses have entered the for-profit market (Colorado Medical Marijuana Code). Three businesses that have entered the marijuana medical edible market in Denver are Canna Elixirs, LLC , Dixie Elixirs & Edibles, and Julie & Kate Baked Goods, LLC.

Founded in 2011, Canna Elixirs, LLC developed out of a market steeped in competition. The founding professional chef, Eric Underwood, also founded Dixie Elixirs & Edibles. He entered the marijuana medical market in 2008 as a patient growing his own plants organically, pesticide free, with only \$300 to his name. Not formally trained by a culinary institution, he came to the market with a culinary restaurant background. Recognizing the potential for growth within this industry, Underwood decided to investigate the idea of producing a unique medical edible that would be created in the form of a beverage. Experimenting with sauces and carbonation techniques, he was able to develop the first medical marijuana soda and is credited within the industry for that accomplishment. This product revolutionized the medical edible industry. Initially, his business was known as Dixie Flyer Farms and the new medicinal sodas were labeled as “Dixie Elixirs.” These sodas, as well as the chocolate truffles and sublingual tinctures Underwood developed were sold through over 100 dispensaries he managed. Being naïve to the protection patent rights for his products would have provided, Underwood did not take steps to patent his unique formulas for the sodas, truffles, or tinctures he created. In 2010, the dispensaries he produced and sold his products through were taken over by a new, rival medical edible enterprise. This business absconded the recipes and formulas Underwood developed, using them to acquire funding for a new start-up enterprise. The resulting business became Dixie Elixirs & Edibles and patented the formulas developed by Underwood, now being

sold and distributed as Dixie Elixirs Carbonated Beverages (sodas), Dixie Medicated Chocolate Truffles, and sublingual tinctures known as Dixie Elixirs Dew Drops (Underwood; Lunsford).

Despite this market challenge, Eric Underwood developed a new proprietary medical edible business known as Canna Elixirs, LLC. Now, through Canna Elixirs, LLC, Underwood has his own production facilities which create hand-crafted medical edible products, such as caramels known as Canna Chews, Canna Drop Cookies, and sodas distributed as Canna Elixirs. Based on scientific medical research, Underwood uses Sativa and Indica strains in his products to provide his patient base with edibles that are effective for different medical conditions. His facilities grow their own cannabis organically and pesticide free. All products are laboratory tested (Underwood).

Canna Elixirs, LLC continues to grow and its patient population continues to expand. Currently Canna Chews are its most popular medical edible. In addition to this unique product offering, Underwood also uses packaging to brand his medical edible line, labeling each item with the word 'canna' in an easily recognizable font. All Elixirs are packaged in clear, twelve ounce glass bottles labeled to indicate the flavor and that the contents are infused with 100mg of medicinal marijuana. Canna Chews caramels are produced in 50mg, 100mg and 200mg doses using Sativa, Indica or a Hybrid in each, which is also indicated on the label. Canna Elixirs, LLC continues to expand its product line working on the development of new edibles, such as Hemp milk ice cream (Underwood).

Originally founded in 2009 by Eric Underwood, Dixie Elixirs & Edibles has grown into what is now a brand product line of Red Dice Holdings, which is a portfolio company of Medical Marijuana, Inc. (OTC Stock Review). It produces product lines that are sold to over 500 legal medical marijuana dispensaries throughout Colorado. Currently, the medical marijuana edibles,

which include a wide range of beverages and ice creams, are produced within a 27,000 square foot manufacturing facility. On October 21, 2012, Dixie Elixirs & Edibles was featured on a 60 minute segment called Rocky Mountain High. During this segment, the growth of the medical edibles market was discussed and it was noted that this industry had created thousands of jobs, as well as millions of dollars in tax revenues for medically legalized states (CBS News).

Since 2009, Dixie Elixirs & Edibles has experienced unprecedented growth. Christie Lunsford, Director of Marketing and Sales at Dixie, joined the company through a merger of her own previous business, Cannabis Magic, to form a subsidiary known as Dixie Botanicals. Dixie Botanicals serves as a non-edible medical off-shoot of Dixie Elixirs & Edibles, producing topical medical marijuana products. Lunsford has been in the medical marijuana market for five years. She has a background in caregiving and wanted to help when she saw that people's suffering could be eased through medical cannabis. Lunsford believes that cannabis can help "soften" the pain and anxiety felt by patients, allowing them to live an easier, more comfortable life. As a member of the Dixie Elixirs & Edibles team, she lauds their products, explaining the company produces their own products in a state of the art medical marijuana facility (Lunsford).

The cannabis used in their products is grown organically in well-flushed soil to keep the pH of the soil balanced and to remove any wastes excreted by the plant. Infusion techniques, which vary based on the products being produced, are used to incorporate the cannabis into the products used to produce edibles. Dixie believes it is important to allow the plant flavor to come through into the edible. From their perspective, they are producing medicinal products and the taste of those products should reflect the flavor of the therapeutic botanicals used to develop them. The concentrations of cannabinoids in each product are very accurate due to laboratory testing, and are noted on the packages in milligrams of THC according to state law (Lunsford).

Dixie Elixirs & Edibles sells a host of edibles, tinctures, tonics, and beverages. All of their products are tested through CannLabs and are of the highest quality. Their beverages are produced in a variety of flavors and contain a low dose infusion of 40mg THC. Their chocolate truffles, produced with concentrations between 50mg to 300mg of THC, are the most popular of the vast array of medical marijuana edibles they produce, which includes items such as pastries, candies and ice creams (Appendix B). All products are sold in well-labeled, childproof packaging. For convenience, patients may order their medical edible products online in Colorado. The patient population they serve is diverse and extends throughout the state (Lunsford)

In 2010, redeveloped their marketing strategy. Due to a rapidly growing field of competitors, they changed their product label to brand their name. As a result, they now have an extremely unique label, which is used on all of their product lines (Lunsford). According to Tripp Keber, president of Red Dice Holdings and managing director of Dixie Elixirs & Edibles, the medical marijuana industry will be a \$9 billion per year business nationwide by 2016. He is planning to expand market share and open franchises in four states under the Dixie X brand, which will produce medical marijuana products without euphoric effects (CBS News).

Julie & Kate Baked Goods developed and entered the market as a wholesale manufacturer of medical edible products from its inception in 2010. Each of its founding members brings different, individual skills and professional expertise to the business. Kate brings with her graphic design experience, which helps with product label design and marketing. Although lacking formal culinary training, she loves to bake and is passionate about the medicinal benefits patients can derive from medical marijuana. Julie Dooley comes to the business with previous financial training. She also loves to bake and has a knack for creating

delicious, healthy, gluten-free products. Personally, a patient with Celiac disease, Julie is limited to consuming products made only from gluten-free ingredients. Experiencing first-hand the limited number of gluten-free medical edible products available, she determined this was an untapped market and she could fill the market need. She and Kate developed a short list of healthy products they decided to market throughout the state, creating a niche for themselves. Their medical edible products are produced from cannabis plants they cultivate themselves indoors, off-site. All plants are grown organically and pesticide free. Kate has developed a proprietary, methodical cannabis-infusion process using clarified butter, which she claims helps to maintain the creamy taste for their products and a longer shelf-life. Additionally, this process helps to avoid impurities and limit the concentration of saturated fats in the product. The flavor of the cannabis plant is intended to be experienced in the edible. Different cannabis strains are incorporated into the products, which also provides different flavor profiles. The flavor is intended to reflect the fact that Julie & Kate's Baked Goods are medical marijuana products and is not intended to mimic sweet treats. Their product line is limited to clarified cannabutters, infused with different strains of medical marijuana, a roasted seed mix, a granola, and nutty bites, the most popular of which is the roasted seed mix because it appeals to a broader customer base as well as being more cost-effective than the other products offered (Appendix B). All of their products are tested by CannLabs in Denver for product safety and accurate concentrations of THC (Dooley).

Julie & Kate Baked Goods are in competition with at least twenty other wholesale medical edible manufacturers. Since they specialize only in gluten-free, healthy medical edible products, Julie & Kate Baked Goods do not experience direct competition. They have managed to develop an effective niche market for themselves, with an avid customer base, selling to over

100 dispensaries. Their product line is also branded by unique labeling and packaging, including ingredients as well as the concentration of THC in milligrams (Appendix B). Due to product recognition and quality, sales have increased steadily each month by 25% to 45%, and a 50% increase in total sales has been experienced since 2011 (Dooley).

All medical marijuana dispensaries in Colorado are visibly distinguishable by the presence of a green cross displayed outside of each establishment. Well-defined state regulations regarding the sale and distribution of medical marijuana products have actually enhanced the development of this market rather than hinder it. These regulations help direct individuals involved with the industry as patients, care givers, and medical edible product developers, providing them with the necessary guidelines to effectively function within the medical marijuana market. Compassionate and supportive legislators have helped to create a foundation for more effective business practices, as well as more effective medical marijuana access for the patient base. As a result, this industry has provided more jobs and a more revenue through taxes for the state. A variety of medical edible business models are allowed to exist within the parameters the law, such as small, individually owned dispensaries, larger wholesale product manufacturers, such as Dixie Elixirs & Edibles, or mid-size wholesale producers. Despite competition within the market, new dispensaries are still able to enter the market, such as Canna Elixirs, LLC. Banking restraints within Colorado still pose financial challenges to medical marijuana business owners, whose accounts are often prevented from access to credit cards and are limited to only cash or check transactions, which puts them at risk for theft. Although, the recent regulations regarding agent-monitored video feed in all shops does help to limit their potential risk for crime. Despite these challenges and risks, the individuals pursuing the medical

marijuana market in Colorado perceive this to be a developing and growing market with great potential for the future.

New Mexico

New Mexico's medical marijuana market is also growing. Its strict cultivation laws limit the developing medical edible business to arise only from state licensed dispensaries (N.M. Stat. Ann. §26-2B-1). Since individual patients are not allowed to grow their own medical marijuana, no patient can legally develop their own "mom and pop" dispensary. Nevertheless, the medical edible market is growing through the currently licensed dispensaries due to high patient demand. Of these dispensaries, two in Albuquerque, New Mexico, Minerva Canna Group and The Verdes Foundation have seen great potential in their state for this new edible frontier.

The Minerva Canna Group was founded by Erik M. Briones in 2010. A degreed horticulturalist and owner of Purple Sage Garden Center, who closed his business and retired after the economic crisis in 2008, Briones decided he was perfectly situated to enter the medical marijuana business after New Mexico began their medical marijuana program. As an authorized patient, his education and expertise with botanicals coupled with his business savvy, gave him unique credentials for entering this industry. He is the only producer of medical marijuana in New Mexico with a degree in horticulture.

Meeting patients who preferred, or could not smoke marijuana, Briones recognized the need to create edible products. His dispensary grows marijuana for medical purposes indoors, organically, in soil as opposed to hydroponically. He grows plants of various strains to incorporate into his edible products so patients can experience the medical benefits provided by each strain. The cannabinoids are extracted through infusion processes into butters, oils, tinctures, and vegetable glycerines. These compounds are used to produce a wide range of

medical edible products (Appendix B) . Briones prefers to mask the flavor of the cannabis plant in the development of his edible products. Although laboratory testing is not yet required by the state, all of Minerva Canna Group's products are tested by Page Analytics in Albuquerque for concentrations of THC. Doses are determined based on the Donald Abrams standards (Appendix C; Briones).

In New Mexico, patients are required to obtain their medical edible products from licensed dispensaries. Due to this requirement, and other enforced New Mexico medical marijuana laws, there is little to no competition in the medical edible market, contrary to the experience in Colorado and California. Since opening its doors two years ago, Minerva Canna Group has seen exponential growth. They started their business with no patients and now serve a patient population of 1,600. In one year alone, Minerva has experienced over 200% growth. The highly regulated market draws patients who have been diagnosed with one of the fifteen state-approved uses for medical marijuana. The patient base tends to be well-educated, spanning across socio-economic boundaries, and an average age of 55. For brand recognition, they have developed their own logo which is incorporated into all of their product packaging, including the ingredients used and the dose of THC in milligrams for each product. No specific packaging or labeling guidelines have been established for New Mexico dispensaries so Minerva uses a variety of see-through plastic or foil-sealed bags, and bottles for their products. Over the past two years, their signature edible products have become popular amongst their patient population. Canna Colas, Lemon Bars, Cappuccino Crisps and gummy candies are patient favorites. For patient convenience, orders may be called in or ordered on line and a convenient pick-up location has been established in a more central location in Albuquerque. Patients cannot consume any product on-site (Briones).

Minerva Canna finds it is hard to keep up with patient demand due to the limitations the state has put on the medical marijuana producers, which only allow for up to 150 plants per dispensary regardless of the number of patients each dispensary serves. It is difficult to establish a bank account due to the current federal restrictions on the sale of medical marijuana. Despite these challenges and risks, Erik Briones is committed to this venture. He sees a real need and a real benefit for the medical edible marijuana business in New Mexico, and by extension, in the United States. His intent is to work within the guidelines established by his state to continue to meet the needs of this new and growing market.

The Verdes Foundation was established in 2011 by a group of five individuals, three of whom are “qualified medical cannabis patients.” The founder and Chairman of the business is also a registered medical cannabis patient producer. Each of these members offers specific skills to the business. The founder has over thirty years of financial and business experience. He served as president and a board member of the New Mexico Bankers Association. An optometrist, IT developer, computer network engineer, and a landscape designer/horticultural expert with thirty-five years experience complete the business team. Their medical edibles market grew out of their interest in providing patients with a longer, lasting, medically effective product that did not require smoking (The Verdes Foundation).

They grow the medical cannabis used in their products outdoors, at a high tech facility under experienced horticultural direction. Strict guidelines are employed to produce a clean, safe product without pesticides or plant hormones. Different strains are used in the production of edible products to provide patients with the varied medicinal benefits. Infusion techniques are employed to extract the cannabinoids from the plant material using butter. Since laboratory testing is not required by the state, The Verdes Foundation do not have their products tested.

Also, as a result of no state requirement, the dosing of their products is determined by calculation by weight. Each individual edible product is prepared to contain approximately $\frac{1}{4}$ gram of medical cannabis. This information is included on the product labels along with the other ingredients used in each edible (The Verdes Foundation).

Their product line which is composed of brownies, lemon bars, oatmeal cookies and an Indica Chocolate “Sleep Cookie” is well received by the patient population. The Verdes Foundation only sells products they produce in their dispensary and do not carry other product lines to sell to their patients. They have developed their own label and use opaque packaging for all their products. Patients must place their orders in advance, either by phone or online. Pick up is on site or, for patient convenience, delivery is available for a flat fee. Patients are able to pay for their medical edible products using a credit card (The Verdes Foundation).

The Verdes Foundation has experienced growth and satisfaction in knowing they are providing a much needed medical benefit to their community. They also choose to remain committed to this market frontier and see greater potential for its growth as federal regulations catch up with the states that have already recognized the need to legalize cannabis for medical use (The Verdes Foundation).

Currently there are fourteen licensed medical cannabis producers in New Mexico. The criteria set by the state regarding the licensure of producers or dispensaries has limited the number of licensed dispensaries available for patient access. Each licensed dispensary is limited to a maximum number of plants, despite the population of patients they serve, which results in an inability to have enough product to meet patients’ needs, creating a back-log for patients. This is a serious and frustrating challenge for the dispensaries, which they hope will be addressed soon by the legislature (Briones). It is also difficult for producers to handle the financial requirements

of their business. Banking institutions are reluctant or refuse to open accounts designated for medical cannabis producers. Managing proceeds and acquiring products for the development of inventory becomes a complicated process. Despite these challenges and the risks associated with them, both of these medical edible producers see a future for this market and plan to remain committed to its progress (Briones; The Verdes Foundation).

Rhode Island

According to the Rhode Island state Health Department in October 2012, it is in the final stages of completing its revised regulations regarding compassion care centers. Subsequently, representatives from the three certified compassion centers or medical marijuana dispensaries, Thomas C. Slater Compassion Center in Providence; Summit Medical Compassion Center in Warwick and Greenleaf Compassionate Care in Portsmouth, will submit 'registration to operate' applications for licensure. Principals and spokesmen for Slater and Greenleaf anticipate that they will begin selling medical marijuana to nearly 5,000 patients shortly after January 1, 2013 (Malinowski ;Rhode Island Department of Health).

Although marijuana has been approved for medical use in Rhode Island since 2006, and patients have had access to the plant for individual use, no medical marijuana products have been available for distribution for the authorized patient market due to complications surrounding the licensing of compassion centers. This market will be facing its debut as of the onset of 2013, creating a unique opportunity for culinary entrepreneurs within this market and a frontier for medical edible products in Rhode Island (Rhode Island Department of Health).

The medical edible marijuana market has developed in every state that has legalized marijuana for medical use. Although business models vary from state to state, of those states

investigated, each has a thriving medical edibles industry that operates within the confines of its individual state regulations and federal restrictions. The process of thoughtful implementation of these regulations improved the quality of this market from state to state, improving oversight in the industry, the quality of the product, product development, access to the market and availability to the patient base. Yet, in each state, much remains to be done to assist with the challenges and risks producers face economically.

The most sophisticated market is found in Colorado. Although it legalized marijuana for medical use much later than California, its well-defined regulations enabled its medical edibles market to develop more effectively. Uniform state wide laws applied in both Colorado and New Mexico prevent discrepancies from developing between counties or cities with respect to cultivation and distribution in contrast to the Californian model, which varies from county to county. The creation of an authorized patient database has served both the Colorado and New Mexico medical edible market. By overseeing the growing patient base, as well as the location and number of dispensaries, these states are able to confirm the industry within their borders is operating in compliance with regulations (Colorado). In contrast, by not mandating a patient registry, California is unable to follow the growth of the patient population or the location and density of its licensed dispensaries, which has now caused controversy within specific counties.

Colorado requires their producers to indicate the concentration or dose of THC in each product, although at this time dose is not required to be determined by laboratory assessment (Lunsford). Due to competition, most leading dispensaries in the market test their products, not only for dose assessment, but also to prove product consistency and safety (Knoblich). Colorado's dose labeling has moved the industry in the state forward toward uniform, scientific methods of testing to ensure reliable accuracy and safety in medical edible products (CannLabs).

By contrast, both California and New Mexico do not require producers to label the concentration of THC in each product (Cote; Briones). Although, in California, high end producers all choose to use laboratory testing and label their products' doses in concentration of THC in milligrams (Knoblich; Cote). In New Mexico, each of the dispensaries described label their products, but not uniformly. One dispensary chose to test their products scientifically, while the other chose to rely on in-house methods to determine accuracy by weight, which creates inconsistency within the market and for the patient population (Briones; The Verdes Foundation). Patients benefit from and, increasingly informed patients expect to know, what dose of medicinal component, the effectiveness of that dose, and the duration of the effect to expect from each edible product.

All product developers entered the medical edible market as patients from varying culinary backgrounds or experience. Their growth as entrepreneurs in the market varies with respect to their personal understanding and ability to create unique, flavorful, effective edible products as well as their own, or access to those with, business experience. Chefs with professional training and culinary skills, such as Scott Van Rixel from Bhang, and Erik Underwood from Canna Elixirs, LLC., via Dixie Elixirs & Edibles play an important role in this industry. They usually are the leaders in product development, using their culinary skills to formulate distinctly new edibles and flavors that either incorporate or enhance the flavor of the cannabis plant into the product, or eliminate it altogether. Knowing how to artistically brand and market their product is also a key to their success. Product developers coming into the market with previous horticultural or cultivation experience can drive the process of developing more effective medical marijuana strains to incorporate into the edible product for the benefit of their patient base. These are individuals from dispensaries such as The Verdes Foundation; Eric Briones from Minerva Canna, Inc.; and Kristi Knoblich from Kiva Confections. Being patients

themselves, many individuals enter the edible market through personal needs and experience or from relationships as caregivers such as Christie Lunsford from Dixie Elixirs & Edibles or Julie Dooley from Julie & Kate Baked Goods, LLC. Their individual needs or experiences drew them away from the traditional, inhalation methods of receiving the benefits of medical marijuana to experimentation with the medicinal potential of edible products. All producers concede that the medicinal effect from edible products is longer lasting and more beneficial than inhalation.

The growth of this industry remains hampered by federal regulations. Due to interstate commerce laws, concerns about money laundering and drug trafficking, many banks are unwilling to open accounts for medical edible businesses. Credit cards are unwilling to process financial transactions originating at dispensaries. In states where twenty-four hour agent monitored video surveillance is mandated, there is less risk of crime for these businesses, but for those entities with little to no surveillance, the cash and carry model is challenging. In Colorado, the Maverick bankcard has become available through dispensary owners and operators. In California, the Best Point of Banking bank is now opening accounts for dispensaries, it is also available to dispensaries in New Mexico (The Best Point of Banking Bank). Establishing a dispensary requires a far more expensive business license than standard businesses and the standard business tax deductions are not available. Yet, despite all of the regulatory and financial complications, not one medical edible producer believes the risks outweigh the benefits of their ventures. Every one of them has experienced substantial growth, gaining market share and an increasing patient population. Some, like Dixie Elixirs & Edibles, have seen exponential growth and are venturing into other markets with non-euphoric products. Eric Underwood, with Canna Elixirs, LLC., has reinvented his brand and experienced success since the devastating set-back experienced in losing the Dixie line. Bhang Chocolates of California has expanded its market

through Scoot Van Rixel's brother, who remains in New Mexico and has developed the Bhang brand in that market. These are the pioneers in a frontier market who understand the challenges they face and see the rewards their commitment to this market has brought in benefits to their patients, their craft and the products they continue to produce.

Chapter Four

Data Acquisition: The Edible Market

Methodology

Two surveys were designed to acquire data pertaining to the development and growth of the marijuana medical edible market, each individually directed to a different cohort: one designed for product developers, the other designed to preserve anonymity for the patient population. The survey designed for the dispensaries and product developers contains twenty-four open-ended questions (Appendix A). The survey designed for the patient population contains a combination of seventeen multiple-choice and close-ended questions, accessible through the fluid surveys website (Appendix A). The purpose of these surveys was to find out personal viewpoints from clients of dispensaries and their opinion of edible marijuana, as well as to obtain as much information as possible about this new market frontier from the entrepreneur producers of edible marijuana products.

The dispensary and product developer survey used open-ended questions for the purpose of acquiring as much information as possible about how they became involved in the marijuana medical edibles market, their experience and place in the industry, limitations, and how regulations affect market development. Further questions explored product development, packaging, and market response. The anonymous patient survey contained questions developed to discover their demographic profile and medical need for the consumption of medical marijuana. In addition, questions were used to evaluate product choice based on: medicinal effectiveness; safety and quality; flavor preferences; and product type. Information was

requested to determine producer or dispensary loyalty, if a restaurant model would be embraced, and the preferred ambience of a dispensary.

Thirty dispensaries located in California, Colorado and New Mexico, were contacted via email and phone to conduct and complete the product developer survey. These thirty retailers were also asked to direct their patients to the survey site at fluid surveys. Additionally, links were provided through the dispensaries' Facebook sites to connect visiting patients to the survey. The entire survey sample is intentionally selective, based on the legal constraints enacted to limit the use of medical marijuana only to medically authorized individuals. Additionally, that population was further narrowed to the individuals who responded to the dispensary product developer survey and their patient population. Of the thirty dispensaries contacted, nine replied, it is from these dispensaries that the product developer data is obtained (Appendix B). Seventy-one patients provided responses for the patient survey.

Both surveys had several limitations. A substantial limitation was the geographical location of the participants, which prevented personal access for follow-up or data acquisition, and may have limited the responses obtained. Despite allowances for adequate response time, the results were limited to and dependent upon the turn-around time chosen by the respondents for both surveys. The validity of the data is limited to the honesty of each responder. Multiple-choice questions limit, although efficient in acquiring data from both an interviewer's and responder's perspective, do limit the response to only the choices made available.

Results

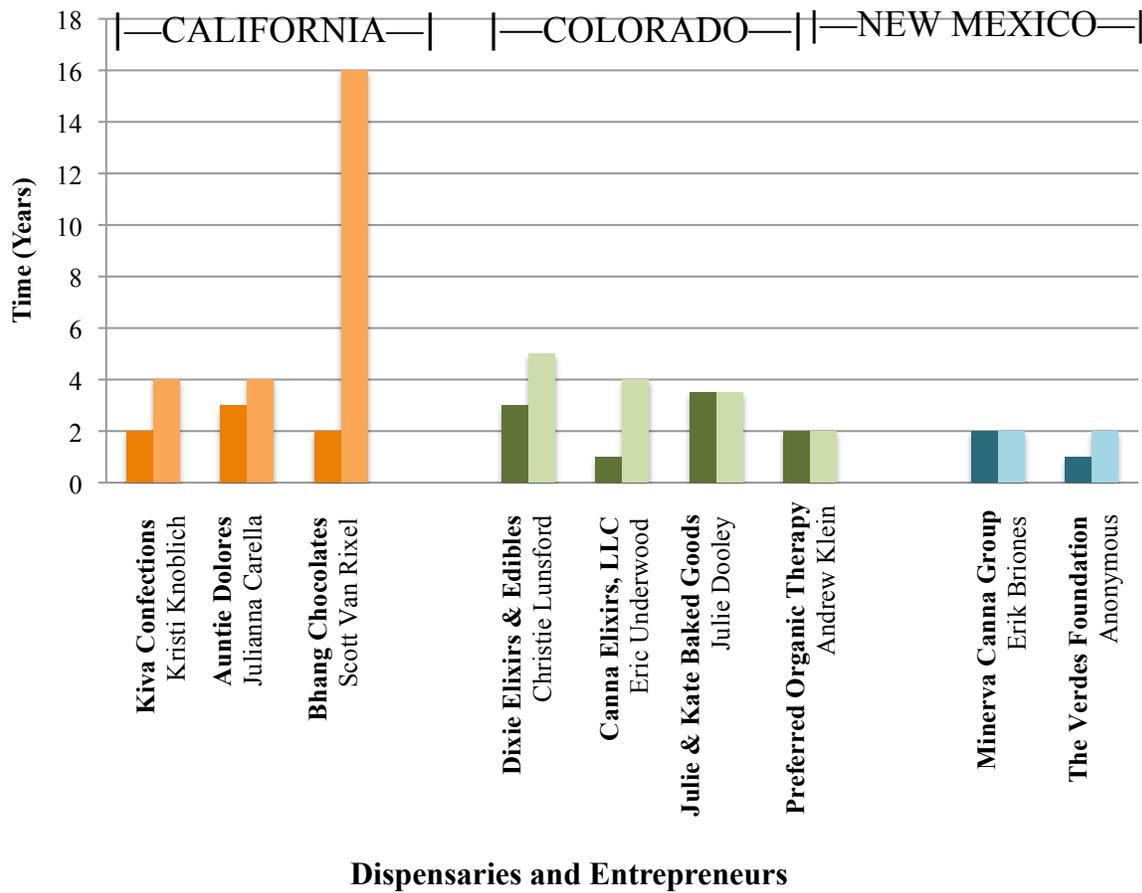
The following sections will include graphs that reflect data obtained from the two surveys conducted (Appendix A). The first set of graphs, labeled RD 1 to RMC 3, reflect data obtained from the product developers, dispensaries or vendors. The next set of graphs, labeled PD 1 to P 11 reflects the data obtained from the patient population. The graphs are not presented in the numeric order of each surveys' questions. They are grouped based on topic. The number of each corresponding question per survey type is located in the upper left hand corner of each graph. The product developer's survey data is grouped into six sections: demographics, cultivation, product testing, edible development, marketing and market challenges. The patient population survey data is grouped into seven sections: demographics, medical reasons for medical marijuana use, cultivation, quality and dosage, medication preference, edible preference, taste/flavor of products, and dispensary loyalty and presentation.

Product Developer/Dispensary Results

Retail Demographics

*1.

Time in Industry



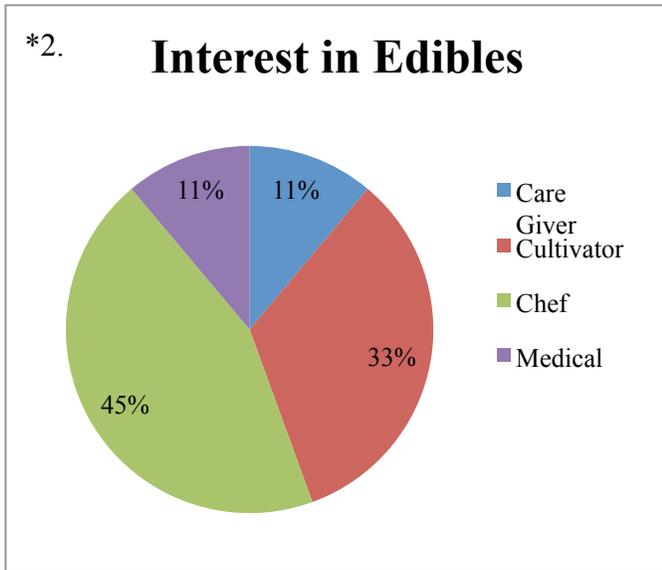


Fig. RD 2.

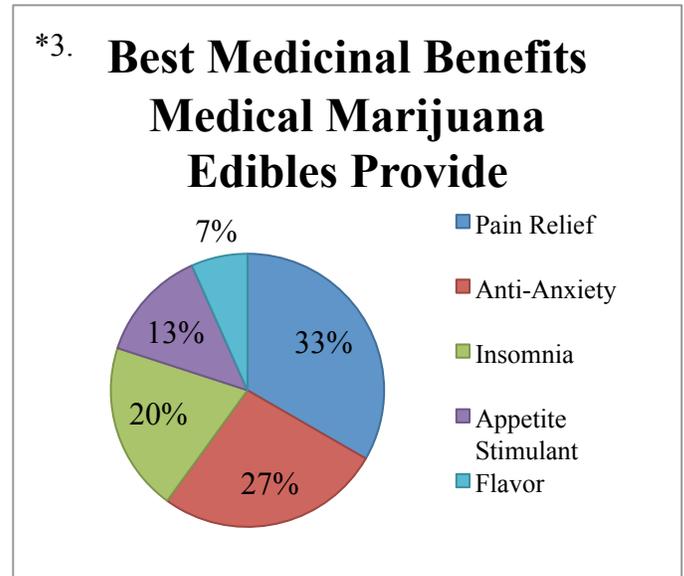


Fig. RD 3.

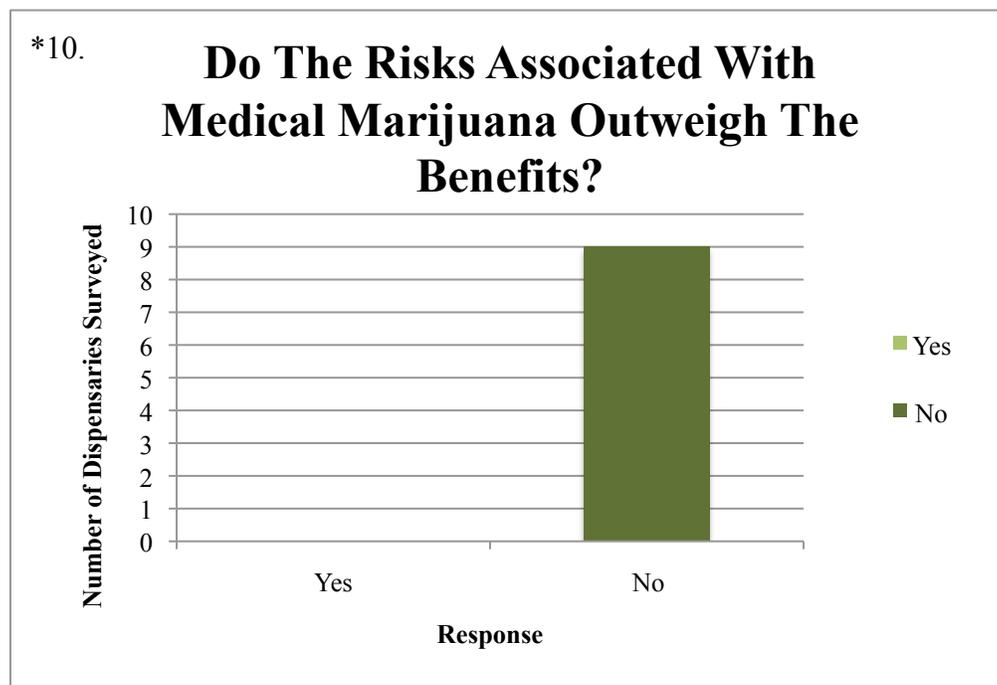


Fig. RD 4.

The figures RD 1 through RD 3 reflect the demographic responses of the nine medical edible product developers and dispensaries interviewed from California, Colorado and New

Mexico, including their paths of entry into the market. Figure RD 4 reflects their perspectives regarding the risks associated with using the use medical marijuana as an alternative to traditional medication.

The data reveals that, of those developers interviewed, most have four or fewer years in the medical edible industry. Although Scott Van Rixel only developed and debuted his Bhang product line in 2010, he has been creating medical edible products for sixteen years. Each of the product developers has spent at least equal time in the edible industry, prior to establishing their own business. Most developers have spent more time in the industry developing their products before branding their business model.

Recognizing each developer could only enter the medical edible market as a patient first, figure RD 2 reflects a variety of paths into the market. Over forty percent of the product developers entered the market as chefs, followed by cultivation. Some individuals were drawn into the market through care giving and medical concerns. The majority of medical edible product developers had either a strong or professional understanding of culinary techniques or they had strong horticultural skills (Fig. RD 2). Implying, these skill sets provided a natural transition into the medical edible industry.

Figure RD 3 reflects the medical benefits each product developer strives to provide through their edible products. Although there is a fair balance of medical benefit demonstrated, pain relief is regarded as most beneficial. Without hesitation, all product developers agree unanimously that the benefits of medical marijuana outweigh the risks, providing little chance for fatal overdose or any of the complicated side effects associated with traditional medications prescribed for the same purposes (Fig. RD 4).

Cultivation

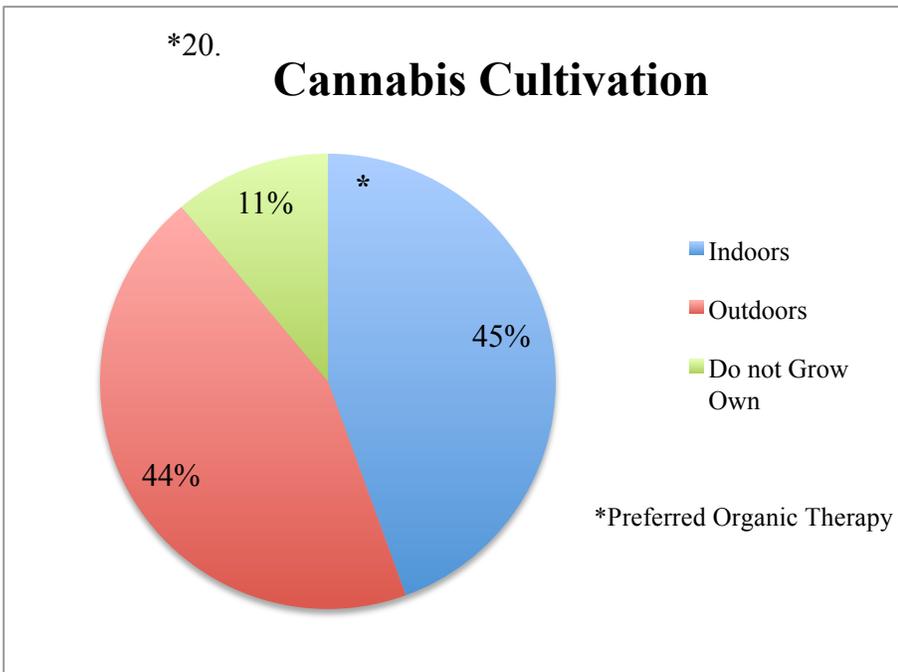


Fig. RC 1.

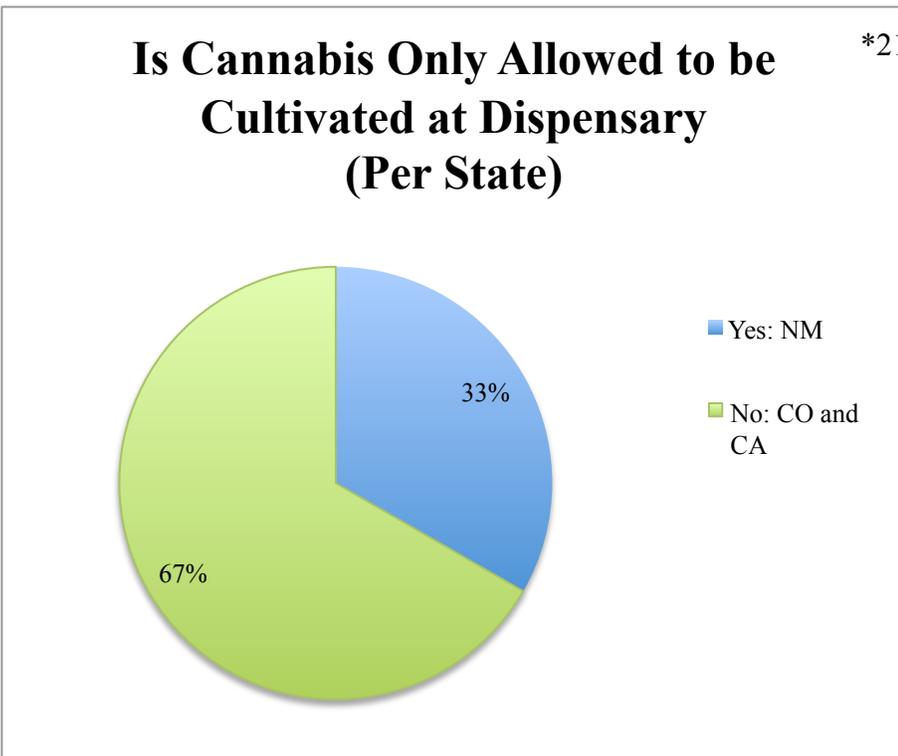


Fig. RC 2.

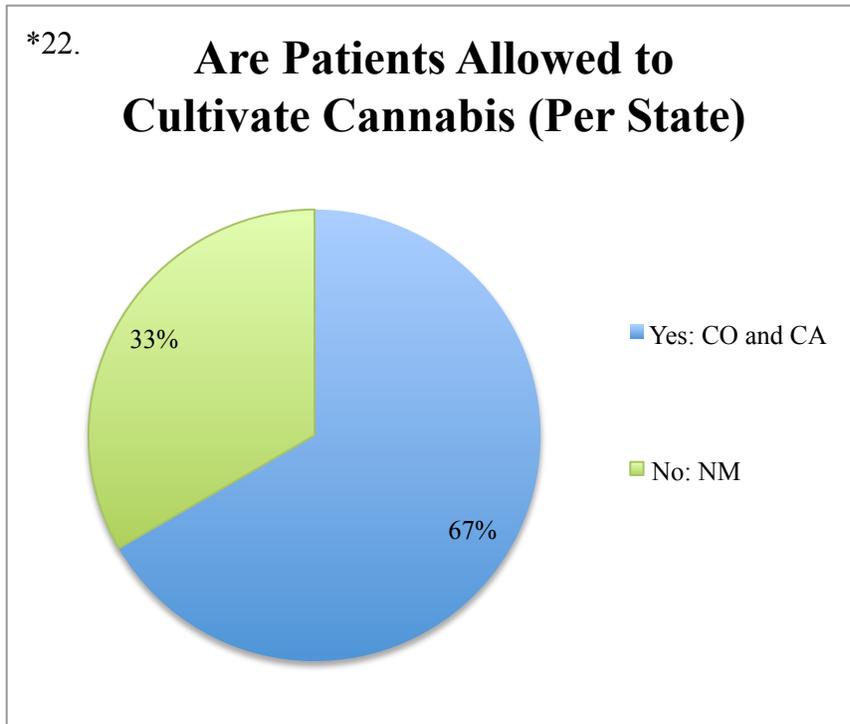


Fig. RC 3.

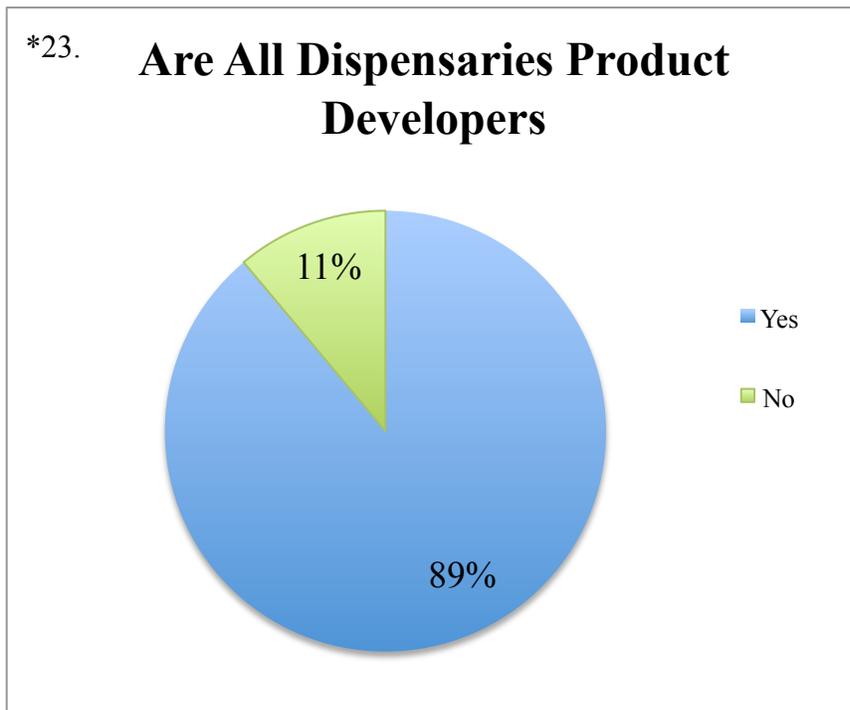


Fig. RC 4.

Figures RC 1 and RC 3 reflect information provided by the dispensaries and product developers regarding cannabis cultivation. This data correlates with state laws governing where and who can cultivate cannabis for medical purposes. How the plants are cultivated for medical

purposes, indoors or outdoors, is also defined by state laws. Figure RC 1 reflects a nearly equal distribution of plant growth locations by the dispensaries that grow their own cannabis. Only California dispensaries are required to cultivate plants indoors, depending on county regulations, while growers in both New Mexico and Colorado also choose to grow their cannabis indoors. Therefore, the data in figure RC 1 reflects an equal distribution of growth location choice.

Figure RC 2 reflects the stringent cultivation regulations enacted by New Mexico state law, showing New Mexico to be the only state that requires cannabis to be only grown at licensed dispensaries. This is also reflected on figure RC 3 which shows that patients are not allowed to grow their own cannabis in New Mexico, while in both Colorado and California, patients are not prevented from growing their own, nor is cannabis required to be grown exclusively at the dispensaries. A business must be a licensed dispensary to sell or distribute medical edibles. Figure RC 4 shows most dispensaries produce edible products for sale, but not necessarily retail. Some dispensaries in Colorado, like Preferred Organic Therapy, do not produce their own product but choose to sell retail.

Product Testing

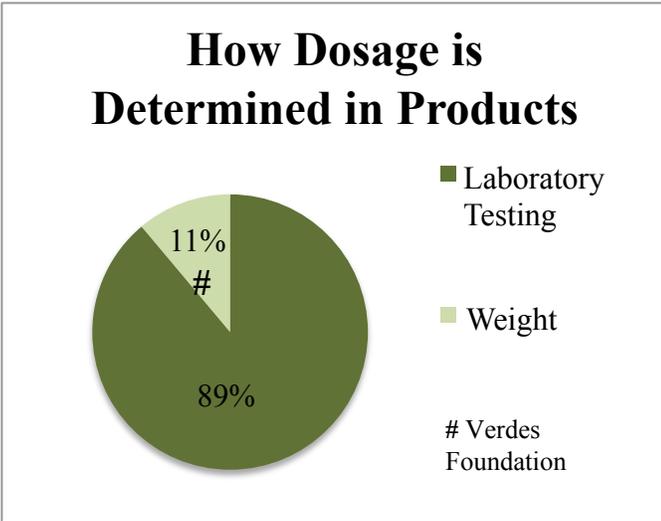


Fig. RPT 1.

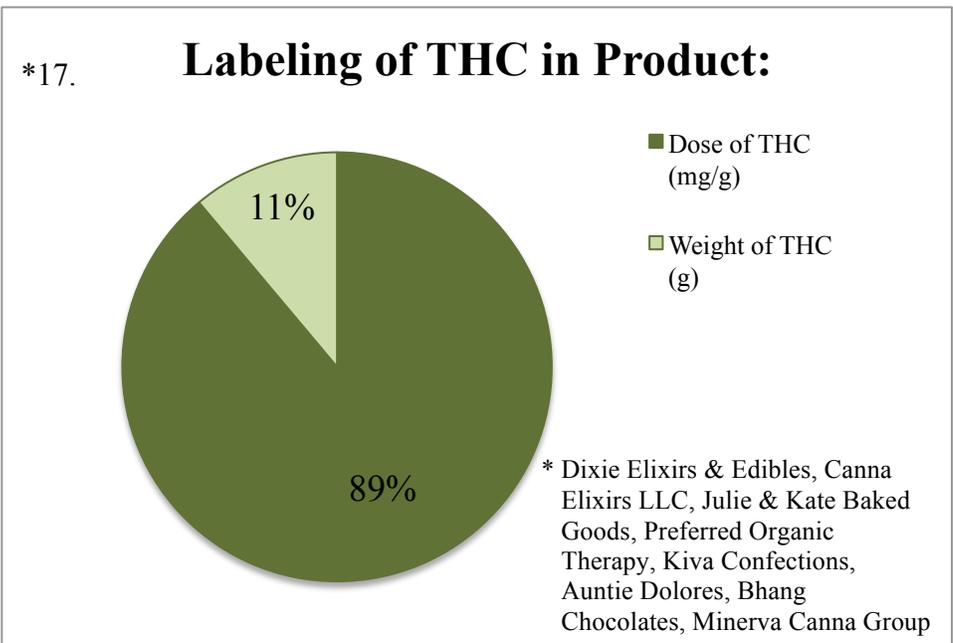


Fig. RPT 2.

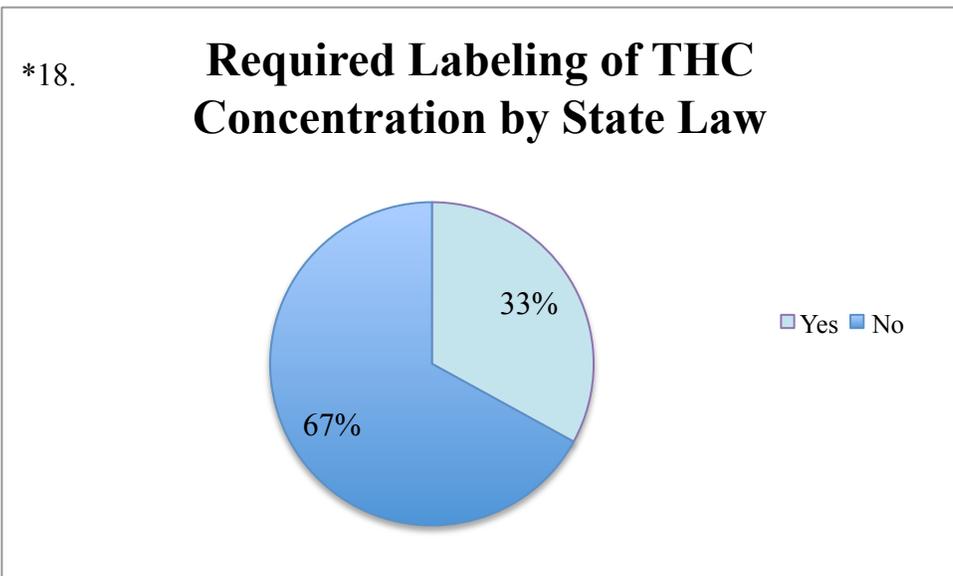


Fig. RPT 3.

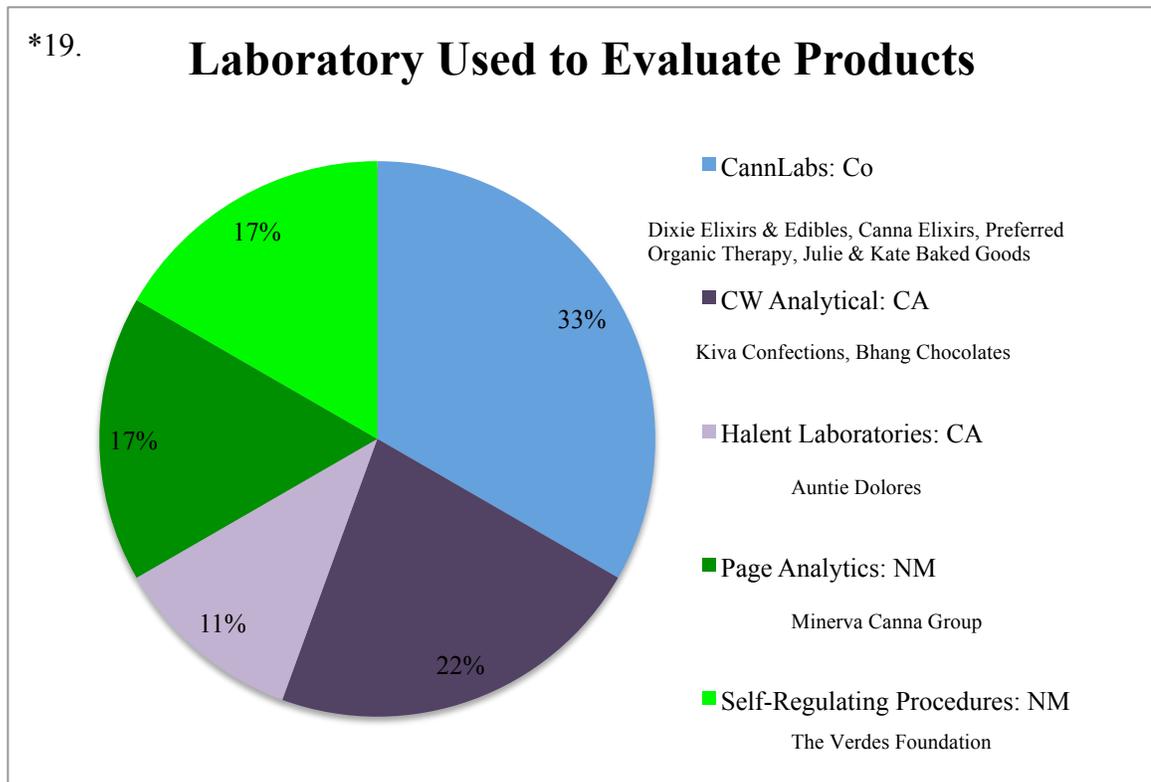


Fig. RPT 4

The quality control of products is a process that all product developers take extremely seriously. All products contain a specific amount of cannabis,, which is determined through testing.. As indicated by PT.1, all the product developers surveyed determine the dosage of their products through laboratory testing, except for the Verdes Foundation, which determines the dosage by the weight of the cannabis (PT.1). The product developers label their products with the amount of THC, with the majority labeling with the dose amount, whereas The Verdes Foundation labels only with the weight. This is because they do not test their product through a laboratory, so they would not be able to determine an exact dose (PT.2). Colorado is the only state of the three surveyed that requires the products to be labeled with the THC concentration (PT.3). There are several laboratories used to test the cannabis products, and in Colorado, all of the dispensaries surveyed test through CannLabs. In California, Kiva Confections and Bhang

Chocolates both use CW Analytical, while Auntie Dolores uses Halent Laboratories. The Minerva Canna Group in New Mexico uses Page Analytics and the Verdes Foundation does not use a laboratory, relying on self-regulating procedures instead (PT.4).

Edible Development

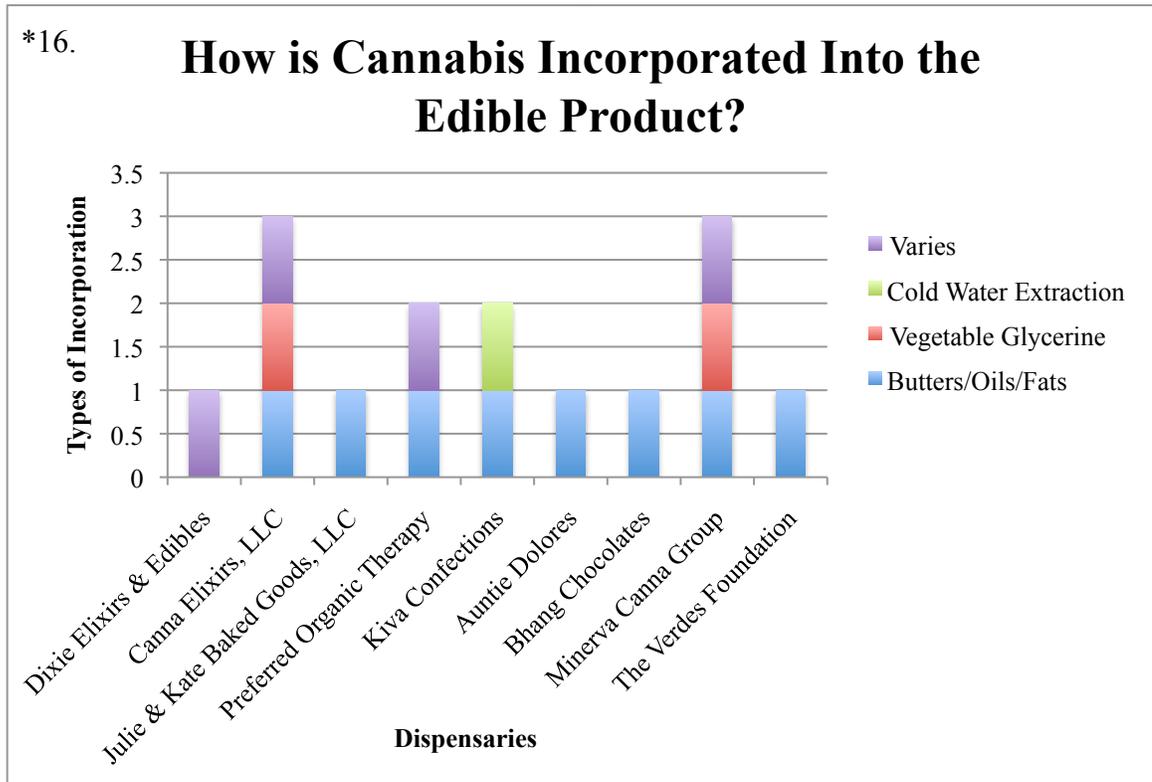


Fig. RE 1

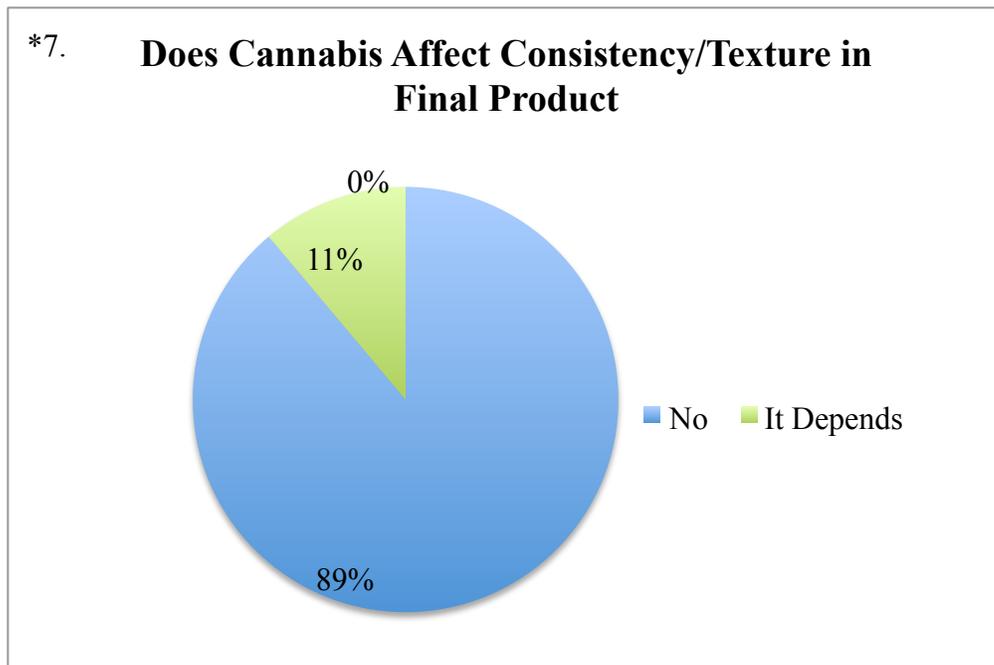


Fig. RE 2.

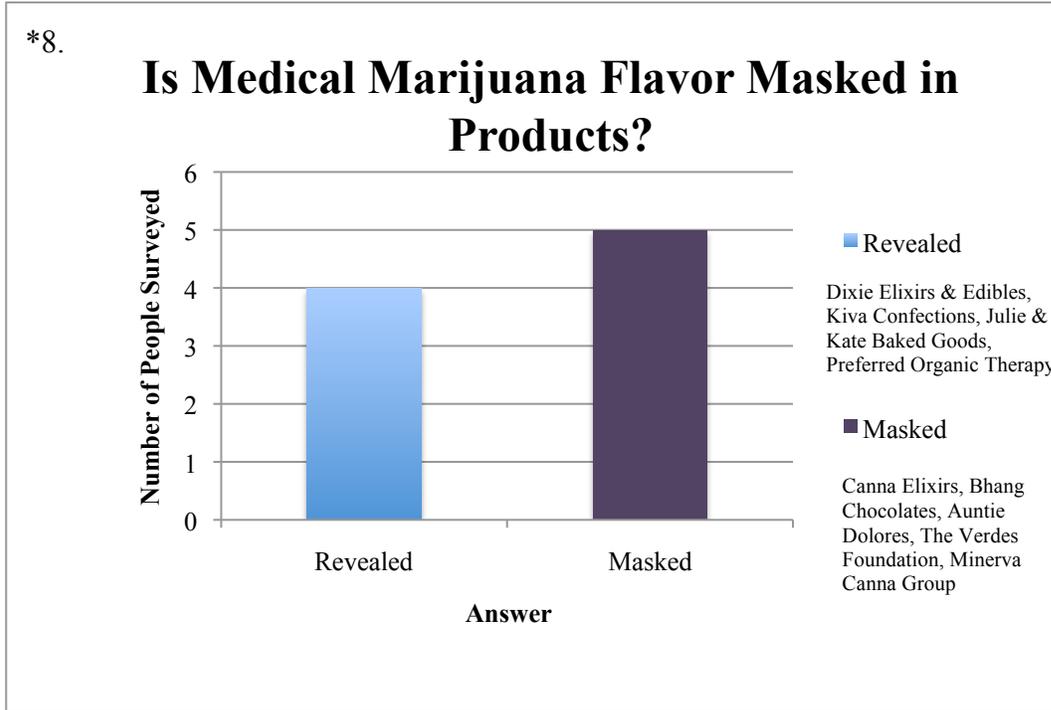
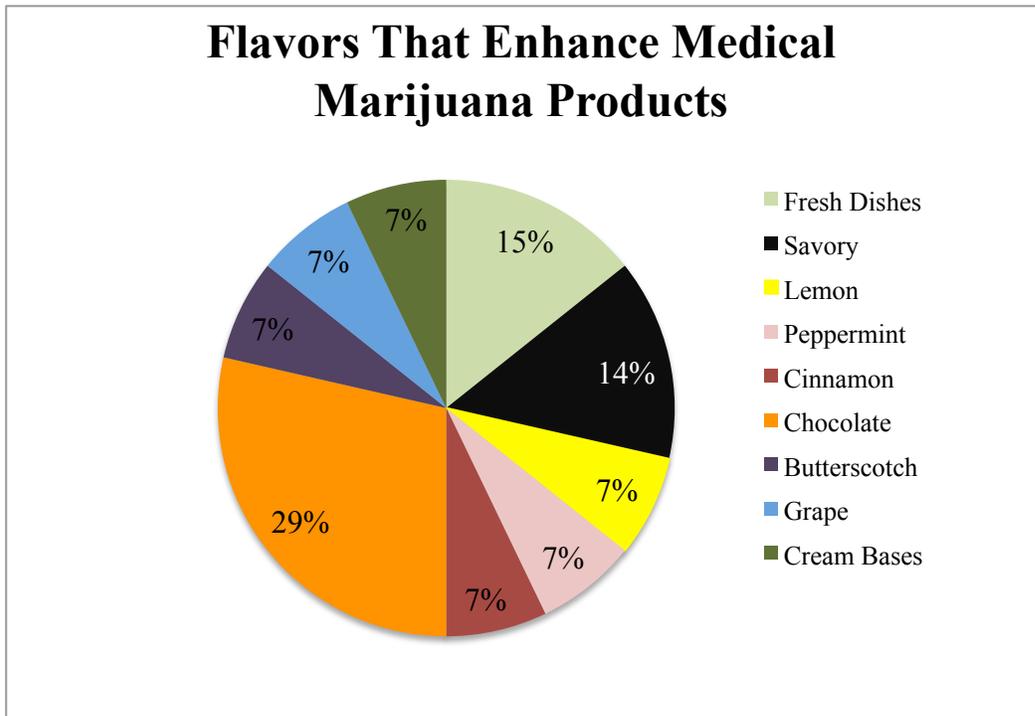


Fig. RE 3.

Fig. RE 4.



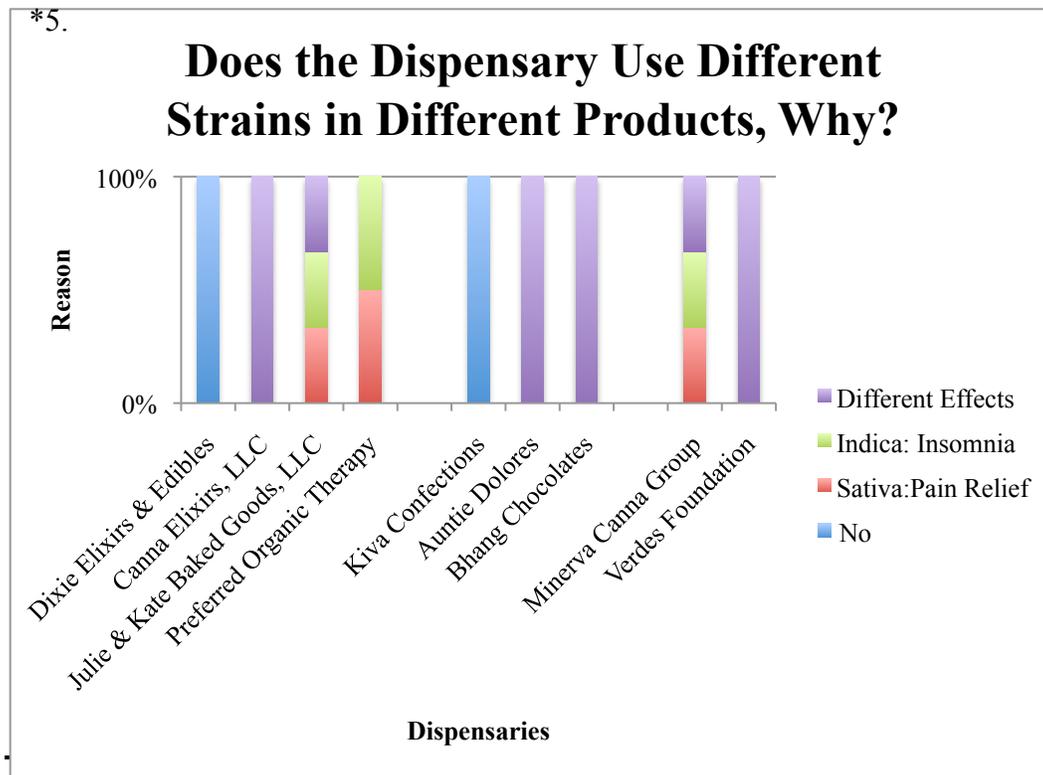


Fig. RE 5.

The primary factor in edible development is the incorporation of cannabis into the edible product. Figure RE 1 presents the various ways these developers incorporate cannabis into their product. Most product developers use infusion methods with butters, oils or fats. Canna Elixirs, LLC and Minerva Canna Group make products using vegetable glycerin. Kiva Confections employs a cold-water extraction process to collect a greater concentration of cannabinoids before infusing the product into fats. Products created and sold by Dixie Elixirs & Edibles, Canna Elixirs, LLC, Preferred Organic Therapy, Minerva Canna Group are produced using various proprietary extraction and infusion techniques, such as carbon dioxide and nitrogen dioxide.

In the process of developing the edible, most producers have developed and choose to use techniques by which the cannabis does not affect the consistency or texture in a final product (Fig. RE 2). Additionally, the decision to mask or allow the cannabis flavor to be experienced is part of this process. The product developers are almost equally divided in terms of their decision

to mask or incorporate the flavor of cannabis in their final product (Fig. RE 3). Many of the product developers have discovered specific flavors that enhance medical marijuana products, as noted in Figure RE 4, the most popular of these being chocolate. From a medicinal perspective, product developers create edibles to provide medical benefits for their patient population. In Figure RE 5, each product developer, the strains they use, and the purpose for using those strains is presented. Most developers use the different cannabis strains, C. Sativa and C. Indica, to provide their patient base with effective targeted medicinal benefits. Although most product developers indicated various beneficial medical effects were experienced by their patient base using different strains of cannabis, C. Sativa is generally used for pain relief, while C. Indica is generally used to combat insomnia. Scientific medical research is helpful in providing these developers with useful information to create edible products geared for patients' needs.

Marketing

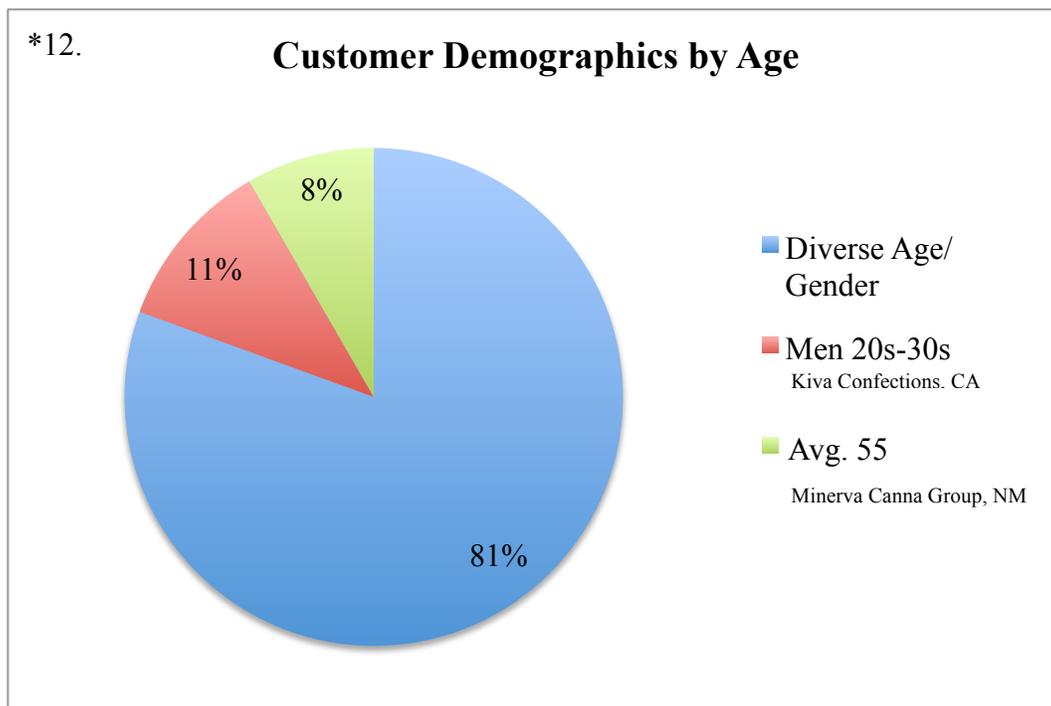


Fig. RM 1.

*13. **Dispensaries’
Most Successful Product**

Minerva Canna, Inc	Gummy Bears
Verdes Foundation	Indica “Sleep Cookie”
Bhang Chocolates	Fire Chocolate
Kiva Confections	Flavored Chocolates
Auntie Dolores	Quad Dosage Caramel Corn
Preferred Organic Therapy	Bite-size Sativa edibles
Dixie Elixirs& Edibles	Edible Truffle 50 mg THC
Canna Elixirs, LLC	Canna Chews Caramels
Julie and Kate Baked Goods	Roasted Seed Mix

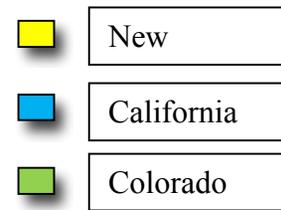


Fig. RM 2.



Fig. RM 3.



Fig. RM 4

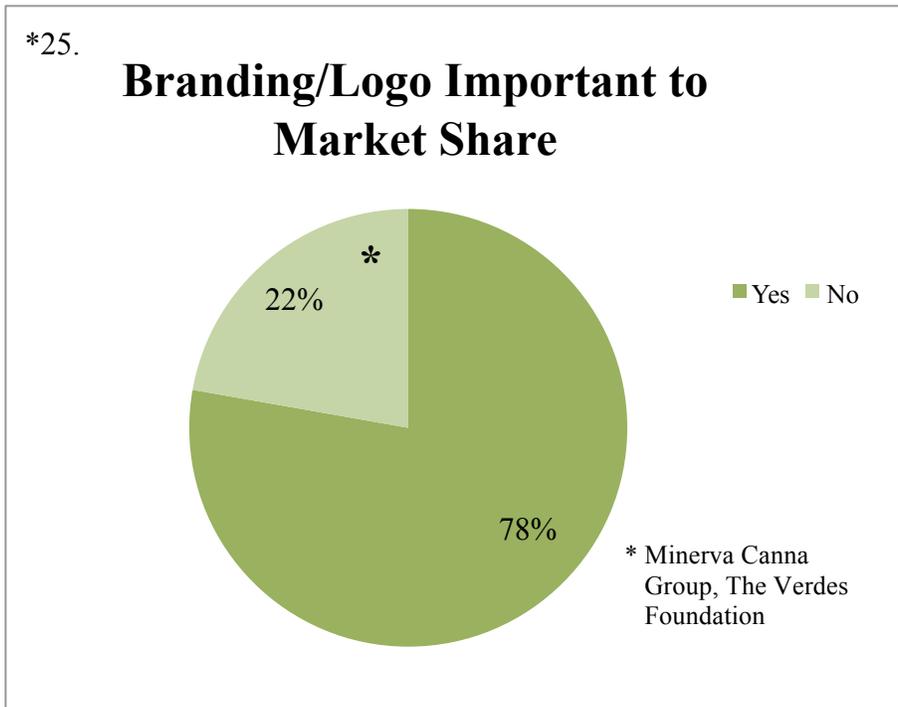


Fig. RM 5

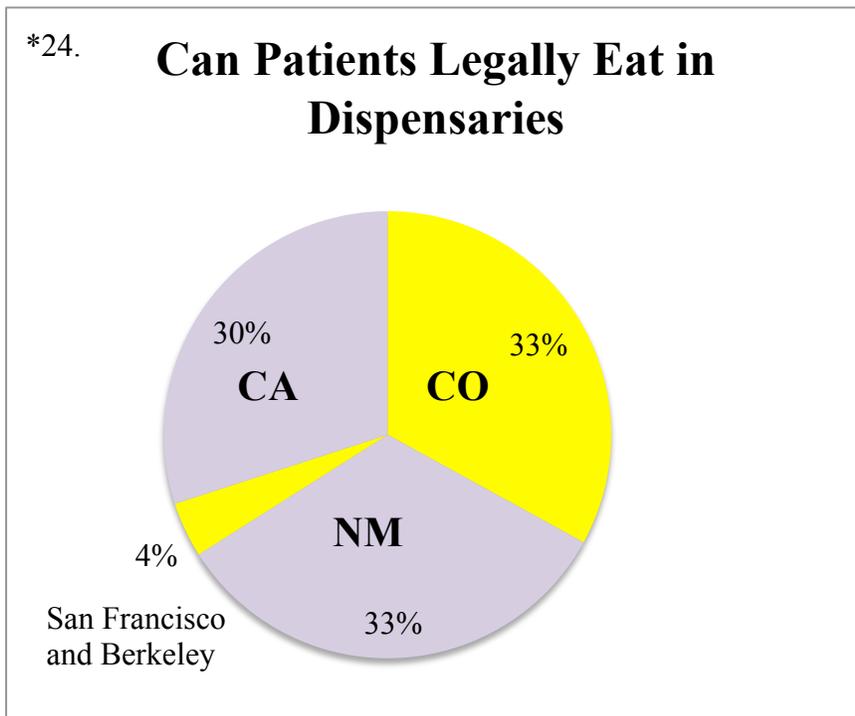


Fig. RM 6.

*24.

DO DISPENSARIES HAVE EAT-IN OPTION

Minerva Canna		-
Verdes Foundation		-
Preferred Organic Therapy	+	
Canna Elixirs, LLC		-
Dixie Elixirs & Edibles		-
Julie and Kate Baked Goods		-
Bhang Chocolates		-
Kiva Confections		-
Auntie Dolores		-

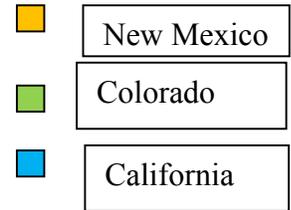


Fig. RM 7.

*15.

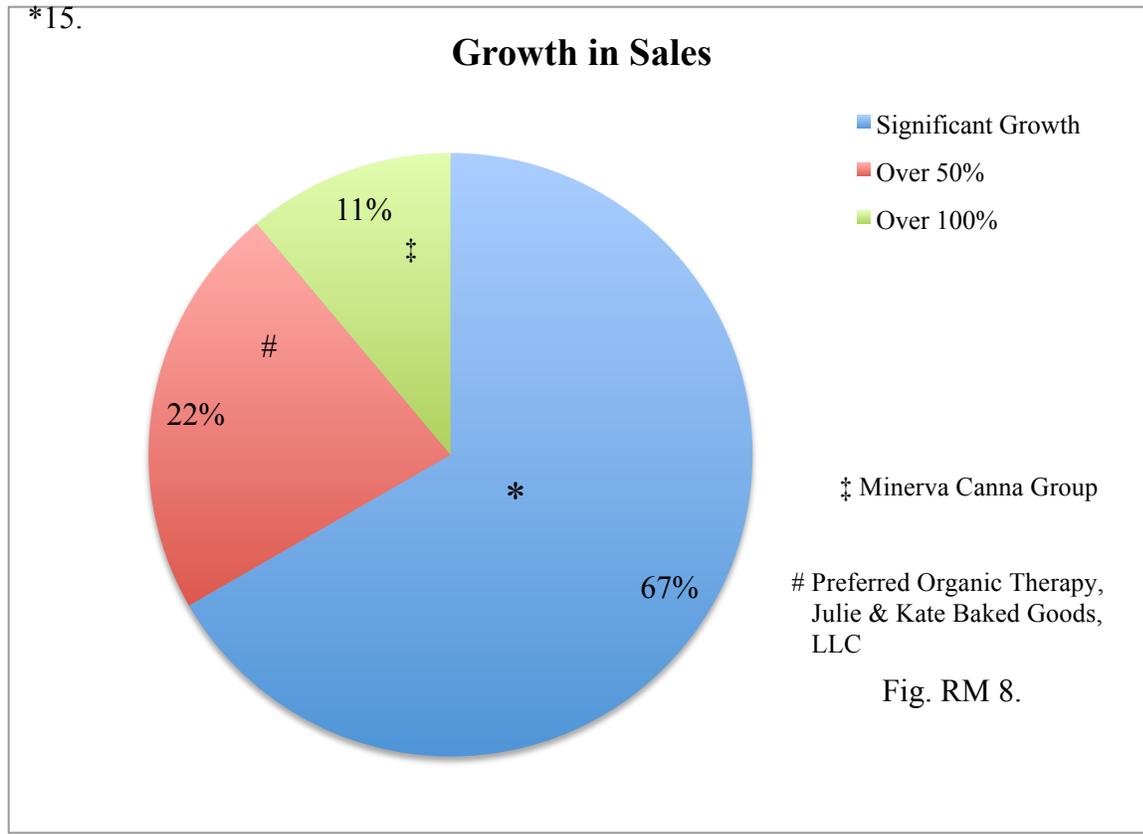


Fig. RM 8.

Fig. RM 9.

Recently, marketing has become a significant factor for product developers and their dispensaries. The majority of dispensaries (81%) surveyed serve a diverse clientele, incorporating all ages and genders, although Kiva Confections serves a patient population that is predominately male, between twenty and thirty years of age and Minerva Canna Group serves a population that is predominately older than fifty-five (RM.1). Each dispensary markets a product that has proven to be most successful for their market share. These products are noted in figure RM 2. ranging from Canna Elixir's Canna Chew Caramels, Bhang Chocolate's Fire Chocolate and The Verdes Foundation's Indica "Sleep Cookie," The criteria that have led each product to success, in order of significance, include flavor, medicinal benefit, price and size. Flavor is the most influential driving force next to medicinal benefit for marketability (Fig. RM 3).

Only San Francisco and Berkeley, California have packaging restrictions for medical edible products (Fig. RM 4). In response to those restrictions, product developers in the California market, such as Bhang Chocolates, Auntie Dolores and Kiva Confections, have created compliant packaging for market access to those localities. Product developers within California and Colorado have embraced product branding, or logo development. In New Mexico, where the number of dispensaries and competition is limited, branding has not affected market share (Fig. RM 5).

In Colorado and the Berkeley/San Francisco areas of California, it is legal to eat medical edible products within the dispensaries (Fig. RM 6). In all other regions of California and the state of New Mexico, medical edibles cannot be consumed inside the dispensaries. Despite this legal latitude, only one Colorado dispensary, Preferred Organic Therapy, serves edibles within its establishment (Fig. RM 7). The majority of product developers believe that eventually, the market would support full edible meals of medical marijuana (Fig RM 8).

Figure RM 9 presents the growth of this market in sales experienced by each dispensary. All of the product developers have experienced significant growth in sales, while 22% has experienced over 50% growth, and the Minerva Canna Group has experienced over 100% in growth.

Challenges in Industry

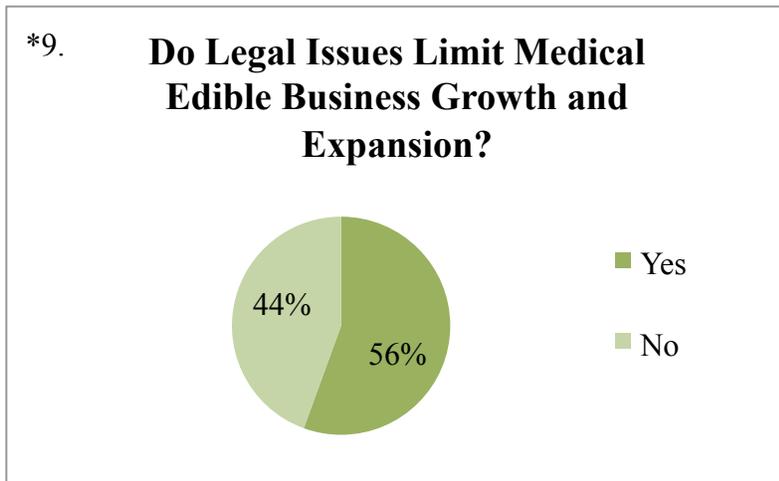


Fig. RMC 1.

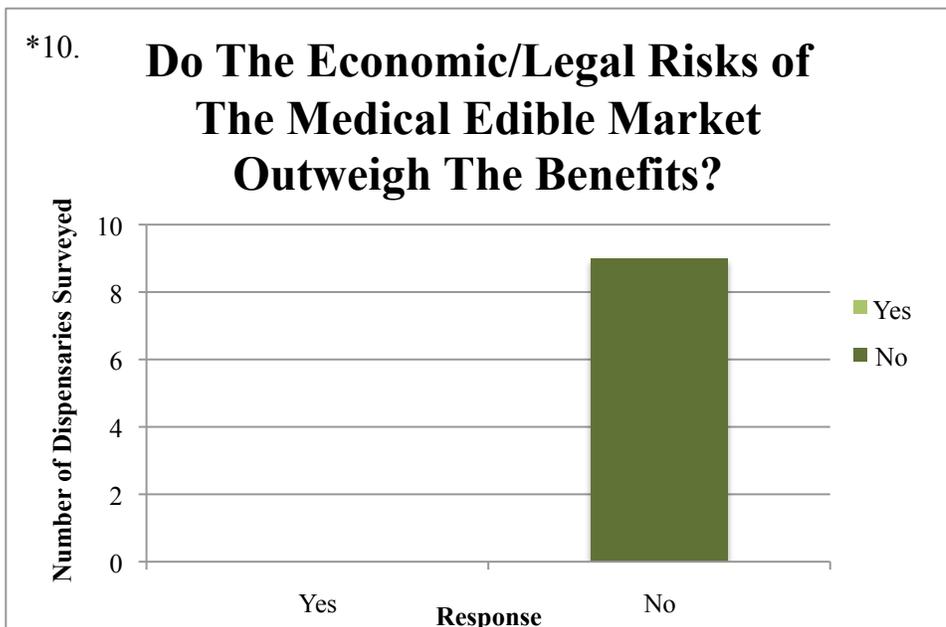


Fig. RMC 2.

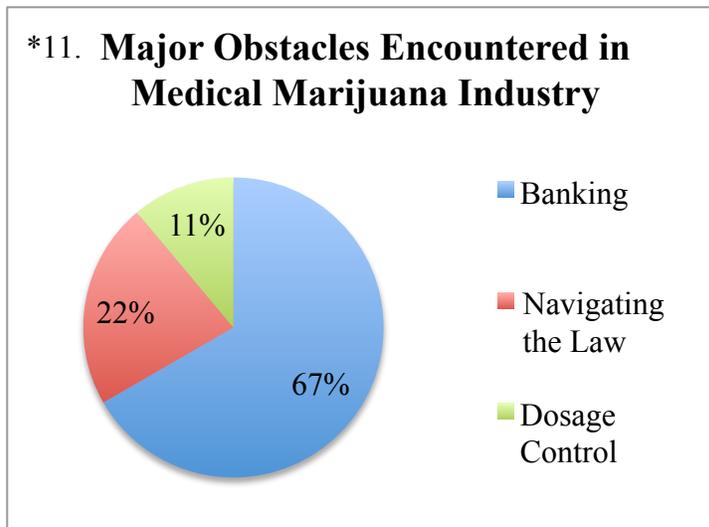


Fig. RMC 3.

Product developers face several challenges in the industry, most notably, legal challenges. The product developers surveyed were split nearly in half when asked if they thought legal issues limited the medical edible business from expanding, some saying definitively yes, while others agreed that some regulation was necessary (Fig. RMC 1). They agreed unanimously, however, that the economic and legal risks of the market did not outweigh the benefits (Fig. RMC 2). The major obstacles most product developers (67%) faced was finding a bank that would support them and allow them to create accounts for their businesses (Fig. RMC 3).

*Number correlates with Product Developer survey

Patient/Client Results

Patient Demographics

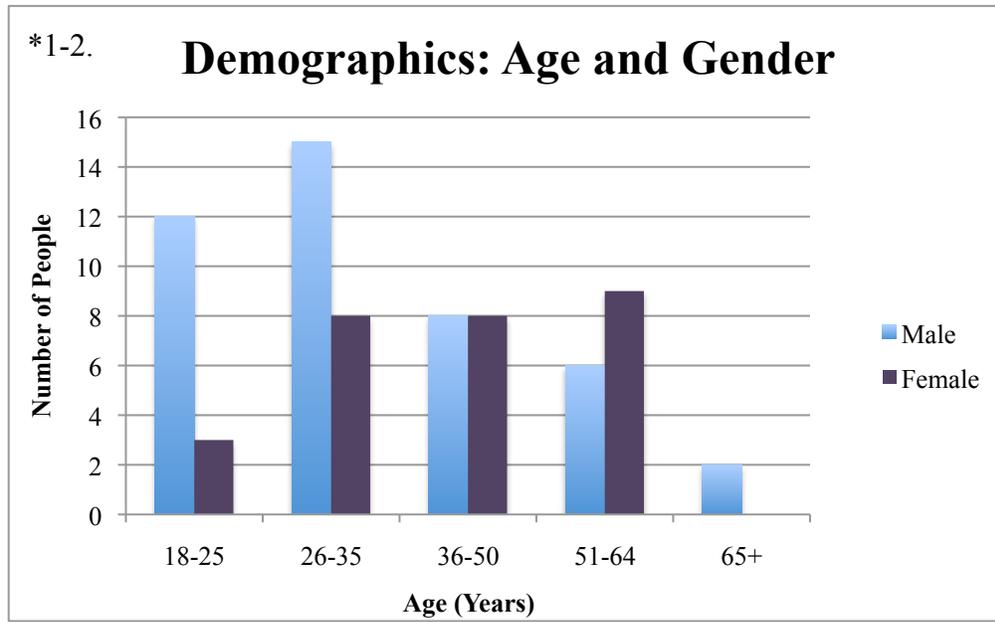


Fig. P 1.

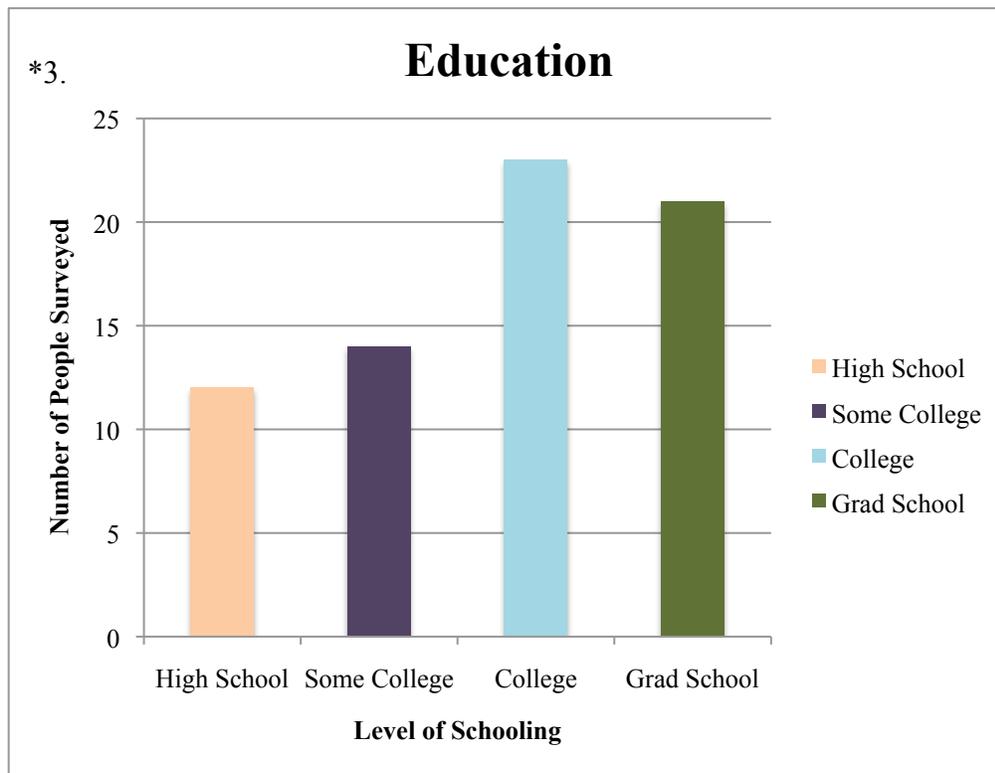


Fig. P 2.

There is a relatively even distribution of medical edible patients across age barriers. The greatest response came from males between 18 to 35. The female population was evenly distributed between ages 26 to 64.(Fig. PD 1). Most of those responding have had college or graduate school education (Fig. PD 2).

Medical Reasons for Medical Marijuana Use

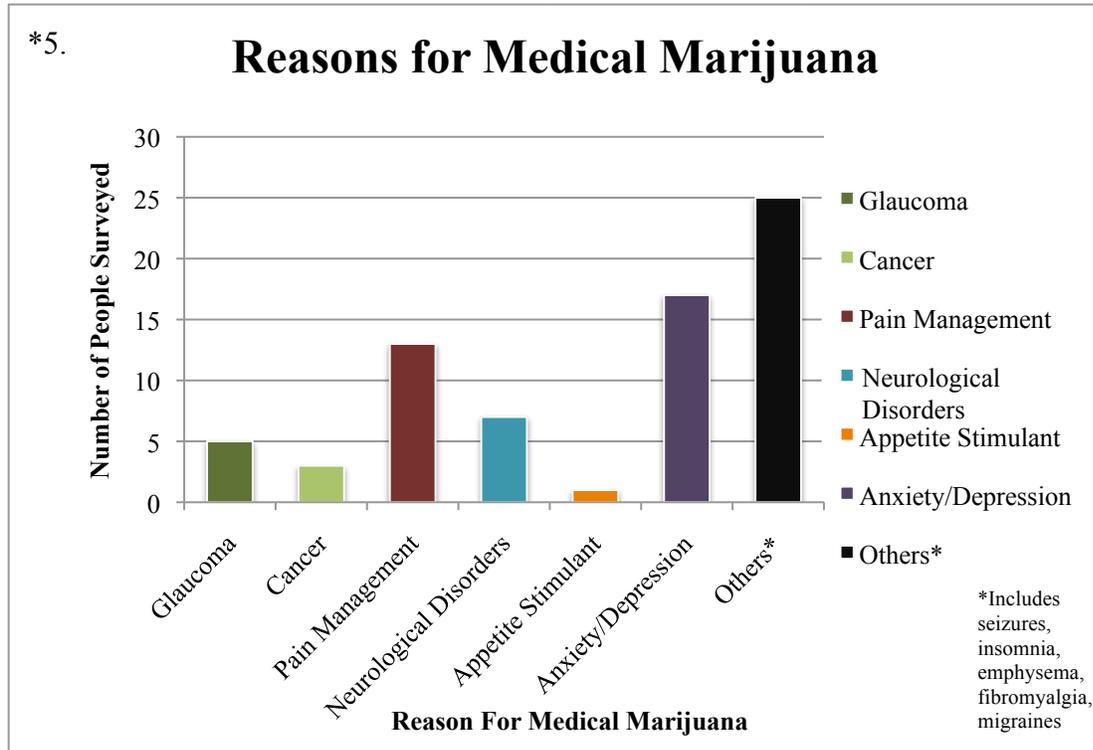


Fig. P 3.

When asked to explain the purpose for medical marijuana use, of the illnesses noted in figure P 3, the majority of patients responded with “other,” which includes seizures, insomnia, emphysema, fibromyalgia and migraines. The two other leading reasons for medical marijuana use include pain management and anxiety/depression (P 3).

Standards in Cultivation, Quality Control and Dosing

Fig. P 4.

The majority of patient responders indicated that cultivation, quality control and dosing of the product was important to them. 84% of those interviewed were concerned about having a safe product, over 70% were concerned about strict cultivation standards and approximately 62% believed scientifically determined dosing of the product was important (P.4).

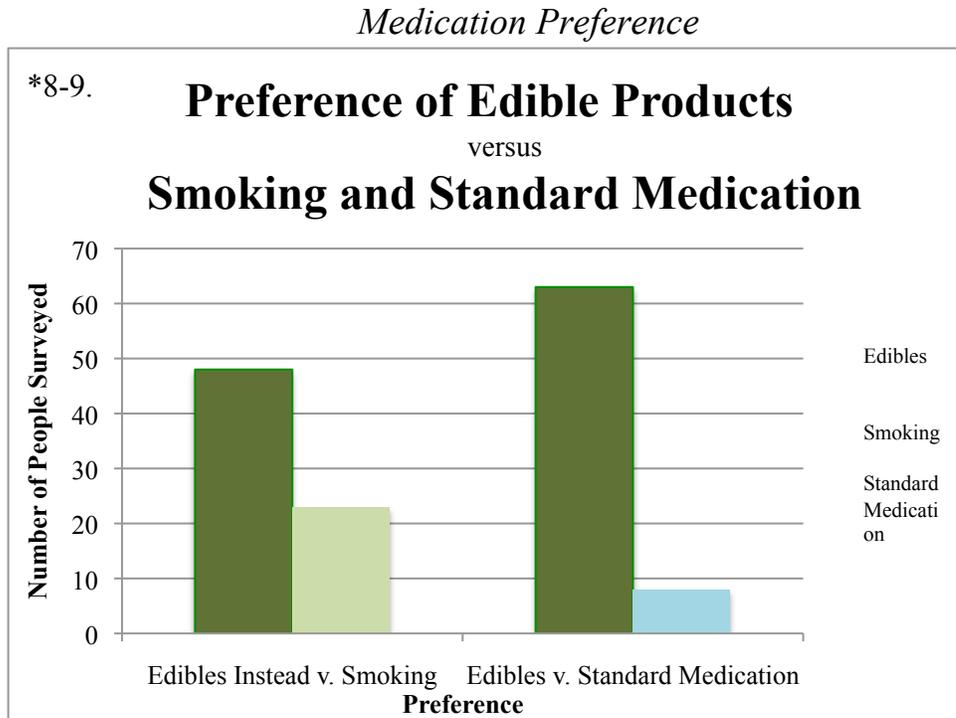
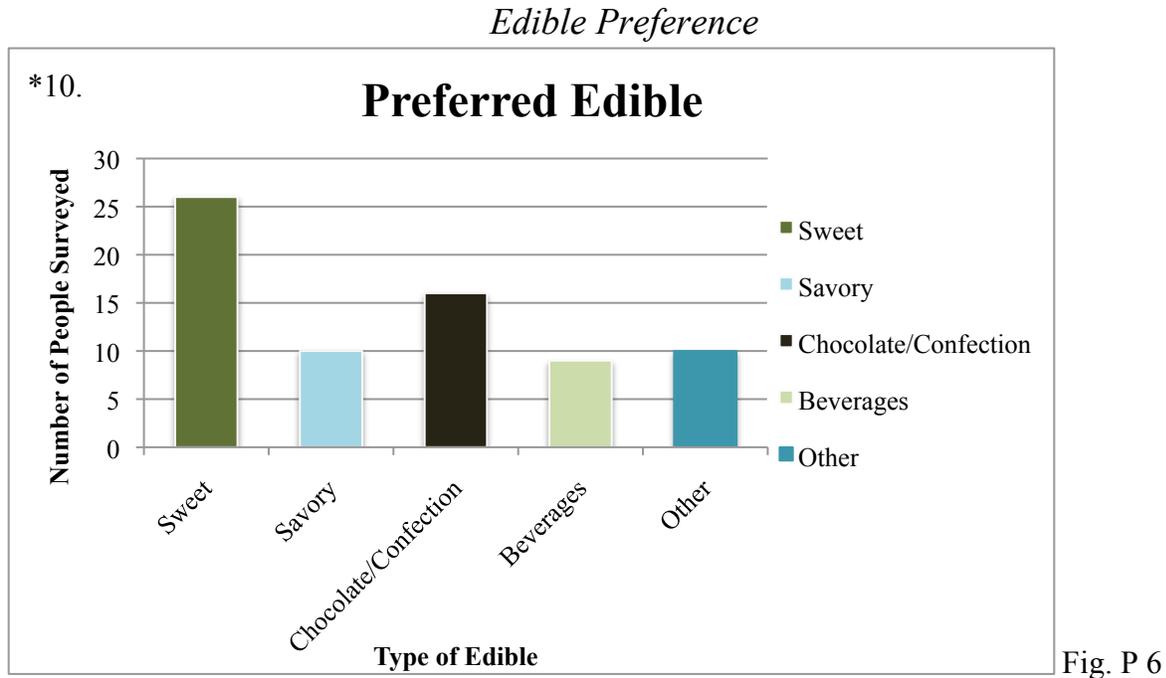


Fig. P 5.

Of those interviewed, patients clearly prefer edible products over smoking in a 2 to 1 ratio (48:23) and, in an 8 to 1 ratio (63:8), patients preferred having access to medical marijuana edibles over standard medication (Fig. P 5).



In terms of edible preference, the majority of patients responding preferred sweet products, chocolates or candies. Approximately 14% of those interviewed had a preference for savory products or beverages. “Other” included responses such as healthy/no sugar, more than one of the options above and self-made glycerin tinctures (Fig. P 6).

Taste/Flavor of Edible

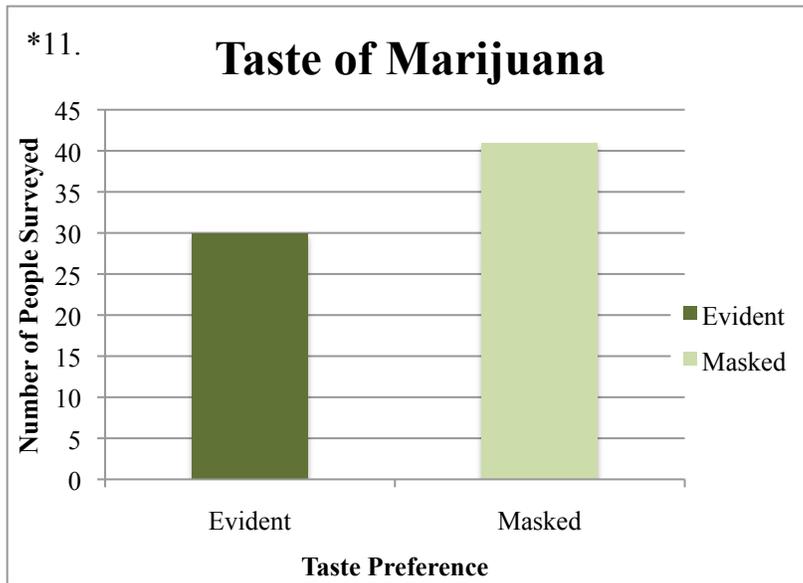


Fig P. 7

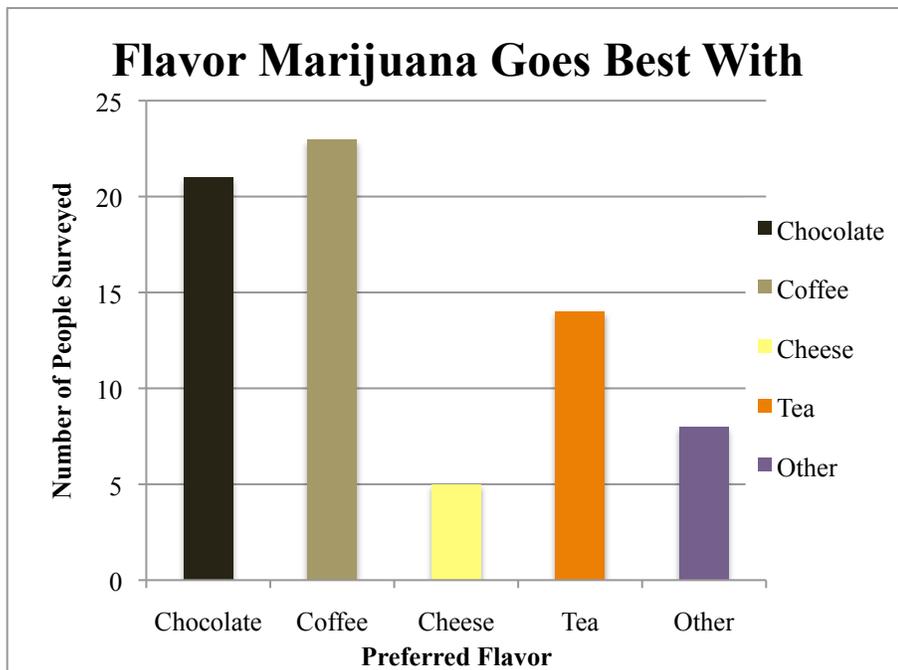


Fig. P 8.

Almost 60% of the patients surveyed (forty-one out of the seventy-one patients surveyed) preferred having the taste of marijuana masked in their edibles (Fig P 7). The flavors most patients chose to enhance the medical marijuana product were coffee (23) and chocolate (21) (Fig P 8).

Dispensary Loyalty and Presentation

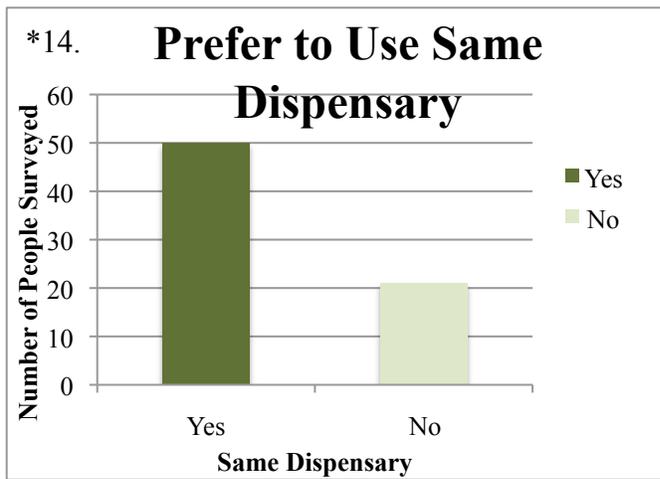


Fig. P 9

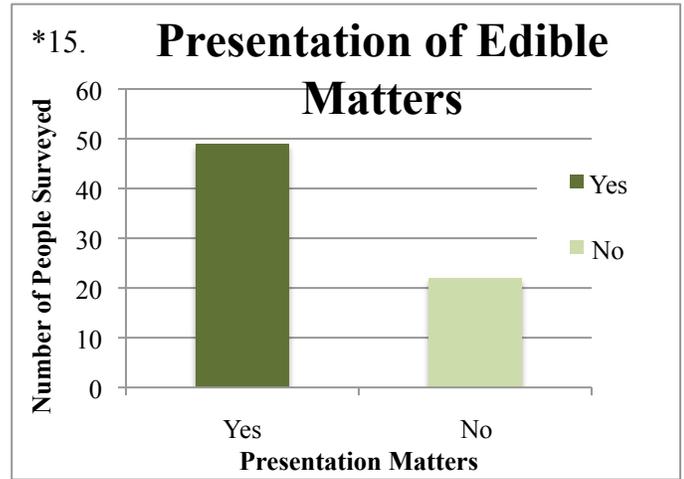


Fig. P 10

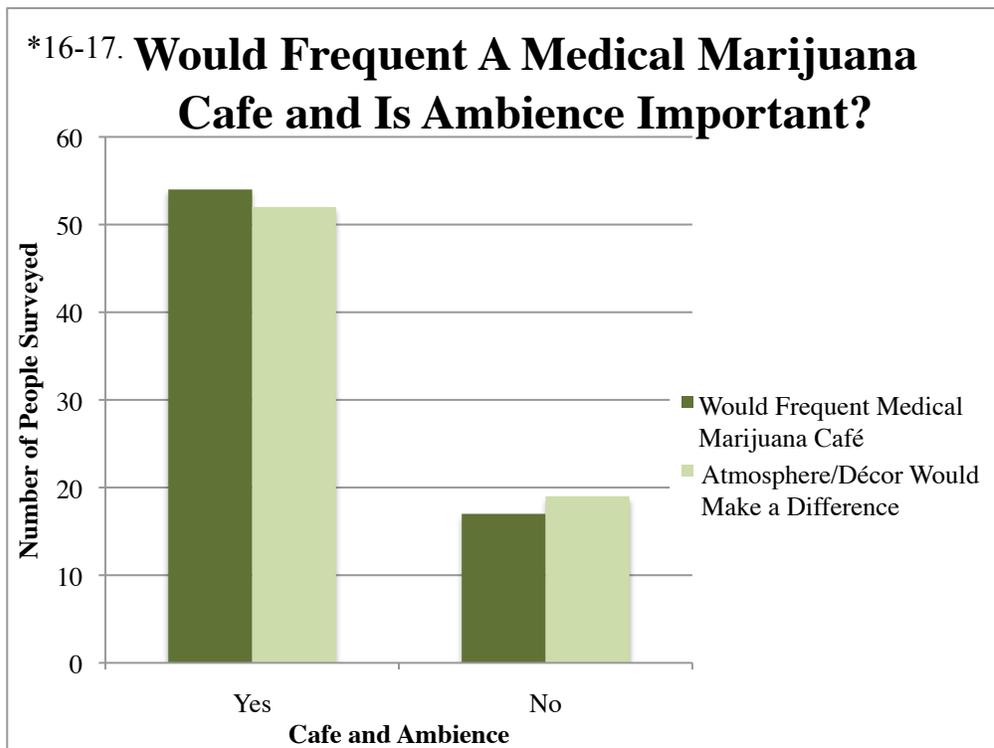


Fig. P 11

Figure P 9 addresses dispensary loyalty. The majority of the patients interviewed would prefer to use the same dispensary, indicating a degree of patient loyalty. Approximately 70% of the patient population believed the presentation of the edible mattered (Fig. P 10), and over 70%

*Number correlates with number on patient survey

of the population interviewed stated they would frequent a medical marijuana café if it were available and that the ambience of the establishment would make a difference (Fig. P 11).

Chapter Five: Conclusion

The historical and legal perspective of cannabis, its relationship between food and medicine has come full circle. Its benefits as a bona fide medicinal agent continue to be revealed through research by scientific and medical communities. Additionally, its ability to be transformed into an edible product has provided a unique access for the blend of its nutritional and medicinal properties to an increasing patient population.

With a growing number of states within the United States legalizing the compassionate use of cannabis for medical purposes and a growing constituency of individuals acknowledging the benefits, this therapeutic botanical provides, the stigma associated with its use is subsiding. A legal avenue has opened for savvy chefs and entrepreneurs, who are themselves, authorized patients, as a culinary frontier for the development of medical edibles. Many of these chefs are experimenting with cannabis, incorporating it as a spice or flavor, to create a sensory food experience. However, due to an increased interest in careful cultivation practices, biochemical evaluation of the product, and quality control efforts, a viable market for medical edibles has developed.

This paper investigated edible medical marijuana as a viable frontier and niche market from a legal, medical and culinary perspective. It reviewed the etymology and history of cannabis, as well as current legal, medicinal and cultivation guidelines. An overview of four states' dispensary policies, as well as the creative culinary accomplishments of representative edible establishments was conducted. The results of this investigation and two surveys: one directed to the edible product developers, dispensers, or vendors, and the other directed to authorized patients of the dispensaries confirms the emergence of a unique culinary product, its

value, increased distribution, and potential for success in this newly developed market. Proving that medical marijuana is truly a new frontier in the culinary world.

As more states consider and enact laws to decriminalize marijuana for medical use, careful evaluation of the regulations adopted by those states, which have already enacted these laws, appears to be prudent. Creating consistent, common sense, uniform regulations can benefit the state, the patients and producers in this market.

Appendix A: Results

Product Developer/Dispensary Survey

1. How long have you been in the industry?
2. When/how did you become interested in edibles?
3. What do you believe are some of the best qualities marijuana provides in a product?
4. With which flavors do you find medical marijuana typically goes best with?
5. Do you use different strains/hybrids of marijuana in different products? If so, what is the reason for that?
6. How do you control the dosage in a product? What procedures do you have to follow?
7. Does marijuana affect the consistency/texture of a product?
8. Can your customers taste the plant in the food/do you prefer the taste to come through?
9. Do you believe the legality issues surrounding marijuana are preventing restaurants and other businesses from really taking off?
10. Do you believe that the risks associated with marijuana outweigh the benefits?
11. What are some of the major problems you've encountered when it comes to the industry and medical marijuana?
12. What cross-section of the population, based on age and socioeconomic status, are your biggest customers? In other words, do you serve a diverse clientele?
13. What products of yours are most successful? Why do you believe these products are most successful?
14. Do you think the market would support full meals made from edibles?
15. How is the cannabis incorporated into the edible?
16. Is the product labeled with the dose amount of THC or the weight of the cannabis?
17. Does the THC concentration of the cannabis product served need to be noted?
18. What lab is used to evaluate the product?
19. How is the cannabis cultivated?
20. Is cannabis only allowed to be grown at the dispensary?
21. Are patients allowed to grow their own cannabis?
22. Are producers also the legal dispensaries?
23. Can patients eat at dispensary or are they only allowed to buy and leave?
24. How is the item served/packaged?

Patient/Client Survey

Please Provide the Following:

1. Age: a. 18-25 b. 26-35 c. 36-50 d. 51-65 e. 65+
2. Gender: Male Female
3. Education Level:
 - a. High School/GED b. Some College c. College Grad d. Grad./Prof. Degree
4. Knowing the marijuana product you have access to has been cultivated following strict standards is important to you
 - a. Yes b. No
5. Knowing the marijuana product you are buying is safe as a result of strict cultivation standards is important to you
 - a. Yes b. No
6. Knowing the dose of medicinal marijuana you receive through edibles is scientifically determined and carefully monitored is important to you
 - a. Yes b. No
7. What type of edibles do you prefer?
 - a. Savor
 - b. Sweet
 - c. Beverage
 - d. Chocolate/Confection
 - e. Other (explain)
8. Do you prefer that the taste of marijuana is evident or masked?
 - a. Evident b. Masked
9. Does the presentation of the food matter?
 - a. Yes b. No
10. What is the reason(s) you are prescribed medical marijuana? Circle all that apply.
 - a. Glaucoma
 - b. Cancer
 - c. Pain Management
 - d. Neurological Disorders
 - e. As an Appetite Stimulant
 - f. Anxiety/Depression
 - g. Other (explain)
11. Do you prefer to use the same dispensary?
 - a. Yes b. No
12. ~~Do you prefer the flavor of one marijuana strain over another?~~ Removed because question was worded incorrectly. Left open for too much interpretation
 - ~~a. Yes b. No~~

Please indicate the strain _____
13. If legally available, would you frequent a medical marijuana edibles café?
 - a. Yes b. No
14. Would the atmosphere/decor of the café make a difference to you as a customer?
 - a. Yes b. No
15. With which flavors do you find Medical Marijuana typically goes best?
 - a. Chocolate b. Coffee c. Cheese d. Tea e. Other

16. Do you prefer edible products over smoking medical marijuana?
a. Edible b. Smoking
17. Do you prefer having access to medical marijuana edibles over standard medications?
a. Yes b. No

Appendix B: Dispensary Products and Labels

Bhang Chocolates: Oakland, CA

Flavors	Dose (mg of THC)
Milk Chocolate	60
Dark Chocolate	60
Salted Toffee Chocolate	120
Ice Chocolate	180
Fire Chocolate	180
Pretzel Chocolate	120
Cookies and Cream Chocolate	180



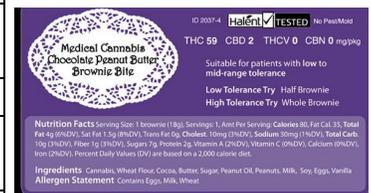
KIVA Confections: Oakland, CA

Flavors	Dose (mg of THC)
Dark Chocolate	60
Milk Chocolate	60
Mint Irish Cream	180
Tangerine Dark Chocolate	180
Blackberry Dark Chocolate	180
Vanilla Chai Milk Chocolate	180



Auntie Dolores: San Francisco, CA

Flavors/Types	Dose (mg of THC)
Triple Dosage Brownies (Chocolate)	100
Triple Dosage Brownies (Mint)	68, 112
Triple Dosage Brownies (Chocolate Peanut Butter)	59
Chocolate Chip Cookie Bites	51
Quad Dosage Caramel Corn	127
Quad Dosage Chili Lime Peanuts	82
Quad Dosage Savory Pretzels	127
Italian Cheese Crackers	184

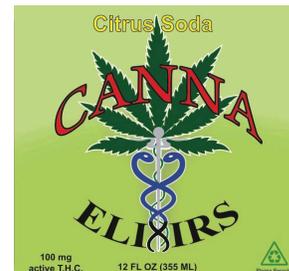


Dixie Elixirs & Edibles: Denver, CO

Flavors/Types	Dose (mg of THC)
Sweet Tea	40
Sarsaparilla	40
Sparkling Grapefruit	40
Sparkling Blueberry	40
Sparkling Mandarin	40
Chocolate Truffles	50, 300
Krispy Rice Treats	75
Fruit Lozenges	50
Dixie Rolls	50
Dixie Chills (Chocolate and Vanilla)	80

**Canna Elixirs, LLC: Denver, CO**

Flavor/Types	Dose (mg of THC)
Canna Chews (Indica, Sativa, Hybrid)	200
Canna Drop Cookies	75
Topical/Sublingual Sprays	200
Canna Elixirs (Orange Cream, Grape Cream, Sarsaparilla, Canna Cola)	100

**Julie & Kate Baked Goods, LLC: Denver, CO**

Flavors/Types	Dose (mg of THC)
Granola	50, 100
Roasted Seed Mix	50, 100
Cannabutters	225



Preferred Organic Therapy: Denver, CO

Carries products from Dixie Elixirs & Edibles, Julie & Kate Baked Goods

Flavor/Types	Dose (mg of THC)
Dazys: Gummy Bears	80mg
Edi-Pure Gummies	125, 225
BlueKudu Rolls	100, 225
Dr. J's Kosmic Kookies	250
Cappuchinno Crisp	150
Mountain High CBD Candies	100

**Minerva Canna Group: Albuquerque, NM**

Flavors/Types
Brownies
Lemon Squares
Granola Bars
Lollipops
Canna-Coke
Bhang Chocolates (Milk and Dark)
Cappuccino Crisp



MINERVA
CANNA GROUP, INC.

The Verdes Foundation: Albuquerque, NM

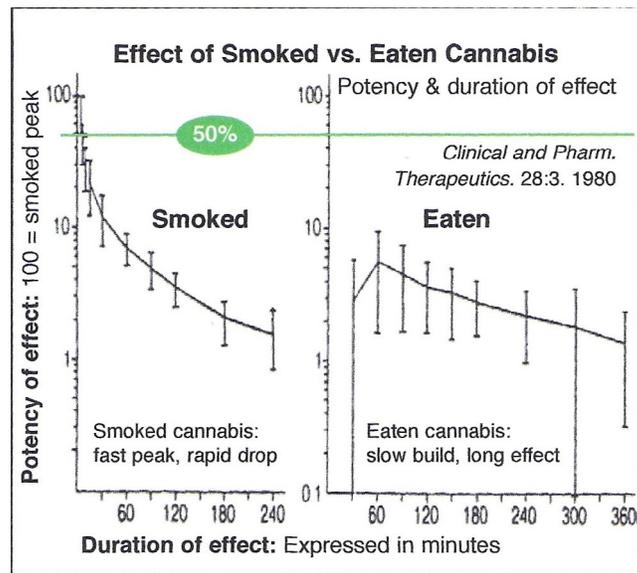
Flavors/Types	Dose (mg of THC)
Brownies	25
Lemon Squares	100
Indica Chocolate Cookies	25
Sativa Oatmeal Cookies	25
Lollipops	25



Appendix C: Medical Tables

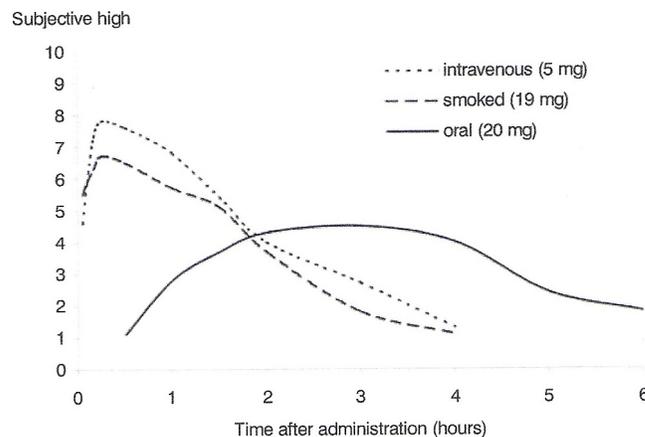
Donald Abrams Standard “Medical Cannabis: Rational Guidelines for Dosing” Chart

Strength of Cannabis	Daily Dosage Corresponding to 2.5-90mg THC
10%	.15, 5.55g
15%	.12g, 3.69g
20%	.08g, 2.79g
25%	.04g, 2.25g
30%	.01g, 1.86g



Med. Chart 2
Lindgren et. al. 415

FIGURE 12. Time course of subjective effects following three modes of administration. A rating of the degree of “high” was made by subjects on a 0 to 10 scale (estimated from figures of Hollister et al. 1981 and Ohlsson et al. 1980).



Med. Chart 3
Morgan and Lyn Zimmer 30

Appendix D: Recipes

Majoun, Moroccan “Love Potion” Candy

Ingredients

500 grams – 2 cups smen

3 cups stalks, seeds, and leaves of marijuana (kif, chopped coarsely

500 grams – 1 lb. chopped, pitted dates

500 grams – 1 lb. chopped, dried figs

250 grams – 1/2 lb. raisins

1 teaspoon ground ginger

1 teaspoon ground cinnamon

1 tablespoon anise seed

1/2 cup each ground almonds and walnuts

1/2 cup dark honey

For adding after the candy is cooked: orange flower or rose water to taste

Method of Preparation:

Put the herb and smen in a medium pan with water to cover. Bring to a boil, cover, and allow it to simmer 2 hours.

Strain the buttery water out into a large, shallow pan like a roasting pan and discard the herb.

Refrigerate the pan with herbal butter and water overnight. The cold butter will rise to the top.

Scoop the herbal butter out and place it in a large pan with the rest of the ingredients. Cook it till very thick and brown. Add orange flower or rose water to taste. Pack into clean, dry jars and refrigerate.

-From Paula Wolfert’s “Couscous and Other Good Food From Morocco”

Appendix E: Images of Marijuana Strains

Image of Cannabis Sativa



Image of Cannabis Indica



Works Cited

- Adams, Irma B., and Billy R. Martin. "Cannabis: Pharmacology and Toxicology in Animals and Humans." *Addiction* 91.11 (1996): 1585-614. Print.
- Aggarwal, Sunil K., Muraco Kyashna-Tocha, and Gregory T. Carter. "Dosing Medical Marijuana: Rationa Guidelines on Trial in Washington State." *Medscape* 9.3 (2007): 52. *Medscape General Medicine* Medscape, 11 Sept. 2007. Web. 10 Sept. 2012.
- Aldrich, Michael R. *The Antique Cannabis Book*, W.B. O'Shaughnessy, "The. Remarkable W.B. O'Shaughnessy," Spring, 2006.
- Baker, D., G. Pryce, JL Croxford, P. Brown, RG Pertwee, JW Huffman, and L. Layward. "Cannabinoids Control Spasticity and Tremor in Multiple Sclerosis Model." *Nature* 404 (2000): 84-87. *National Center for Biotechnology Information*. Web. 8 Sept. 2012.
- Ben Amar, Mohamed. "Cannabinoids in Medicine: A Review of Their Therapeutic Potential." *Journal of Ethnopharmacology* 105.1-2 (2006): 1-25. Print.
- Best Point of Banking. "Point of Banking." *Best Point of Banking: Cashless ATM Machines*. Web.Com Group, Inc., 2012. Web. 14 Nov. 2012.
- Bob. "Edible Cannabis." E-mail interview. 17 Sept. 2012.
- Bostwick, J. Michael. "Blurred Boundaries: The Therapeutics and Politics of Medical Marijuana." *Mayo Clinic Proceedings* 87.2 (2012): 172-86. *EBSCO*. Web. 14 Sept. 2012.
- Briones, Erik. "Edible Cannabis." Phone interview. 15 Oct. 2012.
- California Health & Safety Code §11362.765. 2004. Web. 1 Oct. 2012.
- California. Medical Marijuana. Department of Justice. *Guidelines for the Security and Non-Diversion of Marijuana Grown for Medical Use*. By Edmund G. Brown, Jr. N.p.: GPO, 2008. Print.
- Callaway, J. C. "Hempseed as a Nutritional Resource: An Overview." *Euphytica* 140.1-2 (2004): 65-72. *Academic Search Complete*. Web. 20 Oct. 2012.
- California. *Medical Marijuana Storefront Collective Dispensary Permit Application*. Santa Barbara: Department of Justice, 2010. 1-12. Print.
- Canada. Law and Government Division. Senate Special Committee On Illegal Drugs. *Parliament of Canada*. By

- Leah Spicer. Parliament of Canada, 12 Apr. 2002. Web. 20 Sept. 2012.
- CannLabs. "CannLabs Science." *CannLabs Science, Medical Marijuana Testing, Cannabis Testing, Denver Colorado*. Two Squares, Inc., 2012. Web. 14 Sept. 2012.
- Carter, Gregory T., Patrick Weydt, Muraco Kyashna-Tocha, and Donald I. Abrams. "Medicinal Cannabis: Rational Guidelines for Dosing." *IDrugs 7.5* (2004): 464-70. *Academic Search Complete*. Web. 31 Oct. 2012.
- Carter, Jimmy. "Drug Abuse Message to Congress." Letter to Congress. 2 Aug. 1977. *The American Presidency Project*. N.p.: Gerhard Peters, 2011. *The American Presidency Project*. Gerhard Peters, 2012. Web. 12 Nov. 2012.
- CBS News. "Rocky Mountain High." *60 Minutes Overtime*. CBS. WCBS, Los Angeles, California, 21 Oct. 2012. *CBSNews.com*. CBS Interactive, Inc., 22 Oct. 2012. Web. 4 Nov. 2012.
- Colorado Constitution*. Art. XVIII, §14. (2000). Web. 1 Oct. 2012.
- Colorado. Department of Public Health and Environment. Medical Marijuana Registry Program. *Colorado The Official State Web Portal*. By CDPHE. Colorado Department of Public Health and Environment, 31 Aug. 2010. Web. 4 Nov. 2012.
- Colorado Medical Marijuana Code. 12-43.3-101. 2000. Web. 27. Sept. 2012.
- Cote, Matt J. "Edible Cannabis." E-mail interview. 21 Sept. 2012.
- CW Analytical. "CW Analytical." *CW Analytical*. Collective Wellness of California, Inc., 2009. Web. 02 Oct. 2012.
- Dhalla, I. A., M. M. Mamdani, M. L.A. Sivilotti, A. Kopp, O. Qureshi, and D. N. Juurlink. "Prescribing of Opioid Analgesics and Related Mortality before and after the Introduction of Long-acting Oxycodone." *Canadian Medical Association Journal* 181.12 (2009): 891-96. Print.
- "Drug Abuse Prevention and Control." Title 21 U.S.C. §801. (1970). Web. 28 Oct. 2012.
- Drug Enforcement Administration. *A Tradition of Excellence: The History of the DEA from 1973 to 1998*. [Washington, D.C.]: U.S. Dept. of Justice, Drug Enforcement Administration, 1999. Web. 28. Oct. 2012.
- Dooley, Julie. "Edible Cannabis." Phone interview. 4 Nov. 2012.
- Dymock, William, C. J. H. Warden, and David Hooper. *Pharmacographia Indica*. London: Kegan Paul, Trench, Trubner &, 1893. Print.
- Eddy, Mark. "Medical Marijuana: Review and Analysis of Federal and State Policies." *Congressional Research*

- Service* (2010): 1-47. Print.
- French, Laurence, and Magdaleno Manzanárez. *NAFTA & Neocolonialism: Comparative Criminal, Human & Social Justice*. Lanham, MD: University of America, 2004. Print.
- Ganon-Elazar, Eti, and Irit Akirav. "Cannabinoids Prevent the Development of Behavioral and Endocrine Alterations in a Rat Model of Intense Stress." *Neuropsychopharmacology* 37 (2011): 456-66. *Nature.com*. Nature Publishing Group, 14 Sept. 2011. Web. 12 Sept. 2012.
- Gaoni, Y., and R. Mechoulam. "Isolation, Structure and Partial Synthesis of an Active Constituent of Hashish." *Journal of the American Chemistry Society* 86 (1964): 1646-647. *Academic Search Complete*. Web. 3 Sept. 2012.
- Garvey, Todd. "Medical Marijuana: The Supremacy Clause, Federalism, and the Interplay Between State and Federal Laws." *Congressional Research Service* (2012): 1-17. Web.
- Golden State Collective. "GSC Cannabis Lab." *GSC Cannabis Lab*. GSC Cannabis Lab, 7 Dec. 2011. Web. 14 Nov. 2012. <<http://gscannabislab.blogspot.com/>>.
- Gottlieb, Adam. *The Art and Science of Cooking With Cannabis: The Most Effective Methods of Preparing Food and Drink with Marijuana, Hashish, and Hash Oil*. Berkeley, CA: Ronin Pub., 1993. Print.
- Grotenhermen, Franjo. "Pharmacokinetics and Pharmacodynamics of Cannabinoids." *Clinical Pharmacokinetics* 42.4 (2003): 327-60. *EBSCO*. Web. 14 Sept. 2012.
- . "Clinical Pharmokinetics of Cannabinoids." *Journal of Cannabis Therapeutics* 3.1 (2003): 1-49. Print.
- Gumbiner, Jann, Ph. D. "The Teenage Mind." *History of Cannabis in India*. Sussex Publishers, LLC., 16 June 2011. Web. 15 Sept. 2012.
- Halent Laboratories. "Halent Medical Marijuana Testing." *Halent Medical Marijuana Testing*. Halent Laboratories, 2012. Web. 02 Oct. 2012.
- Hall, W., and N. Solowij. "Adverse Effects of Cannabis." *The Lancet* 352.9140 (1998): 1611-616. Print.
- Hashibe, M., H. Morgenstern, Y. Cui, D. P. Tashkin, Z.-F. Zhang, W. Cozen, T. M. Mack, and S. Greenland. "Marijuana Use and the Risk of Lung and Upper Aerodigestive Tract Cancers: Results of a Population-Based Case-Control Study." *Cancer Epidemiology Biomarkers & Prevention* 15.10 (2006): 1829-834. *Academic Search Complete*. Web. 12 Nov. 2012.

- Herer, Jack. *Hemp & The Marijuana Conspiracy: The Emperor Wears No Clothes*. Van Nuys, CA: Hemp Pub., 1995. 20-40. Print.
- Hillig, Karl W., and Paul G. Mahlberg. "A Chemotaxonomic Analysis of Cannabinoid Variation in Cannabis (Cannabaceae)." *American Journal of Botany* 91.6 (2004): 966-75. Print.
- Huestis, Marilyn A., Angela H. Sampson, Barbara J. Holicky, Jack E. Henningfield, and Edward J. Cone. "Characterization of the Absorption Phase of Marijuana Smoking." *Clinical Pharmacology and Therapeutics* 52.1 (1992): 31-41. Print.
- Johnston, David, and Neil A. Lewis. "Obama Administration to Stop Raids on Medical Marijuana Dispensers." *The New York Times*. The New York Times Company, 19 Mar. 2009. Web. 1 Oct. 2012.
- Knoblich, Kristi. "Edible Cannabis." E-mail interview. 25 Sept. 2012.
- Kleber, H.D., Weiss, R.D., Anton, R.F., Jr., George, T.P., Greenfield, S.F., Kosten, T.R., et al. "Treatment of patients with substance use disorders, second edition." *American Psychiatric Association. American Journal of Psychiatry*, 164 (2007): 5-123. *Academic Search Complete*. Web 27 Sept. 2012.
- Kogan, Natalya M., and Raphael Mechoulam. "Cannabinoids in Health and Disease." *Dialogues Clin. Neuroscience* 9.4 (2007): 413-30. *Academic Search Complete*. Web. 1 Oct. 2012.
- Leary v. United States. 395 *U.S. Reports*. Supreme Court (19 May 1969): 9-56. *Academic Search Complete*. Web. 29 Oct. 2012.
- Lemberger, L., J. L. Weiss, A. M. Watanabe, I. M. Galanter, R. J. Wyatt, and P. V. Cardon. "Delta-9-tetrahydrocannabinol: Temporal Correlation of the Psychologic Effects and Blood Levels after Various Routes of Administration." *The New England Journal of Medicine* 286.13 (1972): 685-88. *Academic Search Complete*. Web. 12 Nov. 2012.
- Li, H. "An Archaeological and Historical Account of Cannabis in China." *Economic Botany* 28 (1974): 437-38. *Academic Search Complete*. Web. 24 Sept. 2012.
- Lindgren, Jan-Erik, Agnetta Ohlsson, Stig Agurell, Leo Hollister, and Hamp Gillespie. "Clinical Effects and Plasma Levels of Δ 9-Tetrahydrocannabinol Concentrations and Clinical Effects After Oral and Intravenous Administration and Smoking." *Clinical and Pharmacology Therapeutics* 28.3 (1980): 209-18. *Academic Search Complete*. Web. 12 Nov. 2012.
- Lunsford, Christie. "Edible Cannabis." E-mail interview. 26 Sept. 2012.

- Malinowski, W. Z. "Designated R.I. Dispensaries Expect to Begin Selling Medical Marijuana after ..." *The Providence Journal*. The Providence Journal Co., 16 Oct. 2012. Web. 6 Nov. 2012.
- The Marihuana Tax Act of 1937*, 75th Cong. (1937) (testimony of Dr. William C. Howard). Print.
- Morgan, John P., and Lynn Zimmer. "Exposing Marijuana Myths: A Review of the Scientific Evidence." *The Lindesmith Center* (1997): 1-23. *Academic Search Complete*. Web. 14 Nov. 2012.
- Netherlands. Ministry of Health, Welfare and Sports. GHK. *National Report-Netherlands*. By Country Report Netherlands. N.p.: GHK, 2012. *Academic Search Complete*. Web. 24 Oct. 2012.
- N.M. Stat. Ann. §26-2B-1 (Medical Marijuana). Web. 12 Sept. 2012.
- §26-2B-3(F) (Medical Marijuana). Web. 12 Sept. 2012.
- O'Connell, Sue. "Emerging Issue: Medical Marijuana Dispensary States vs. Caregiver States." *CFHHS Subcommittee on Medical Marijuana* (2010): 1-6. Aug. 2010. Web. 20 Sept. 2012.
- Onishi, Norimitsu. "Hundreds of California Medical Marijuana Shops Close." *The New York Times*. The New York Times, 01 July 2012. Web. 04 Nov. 2012.
- OTC Stock Review. *Comprehensive Coverage of Financial Markets*. Atlanta: OTC Stock Review, 2012. Print.
- Otoke Horticulture, LLC." *Otoke Horticulture, LLC*. Otoke Horticulture, LLC, 2012. Web. 12 Nov. 2012.
- <<http://otokehort.com/>>.
- Pertwee RG. Cannabinoid pharmacology: the first 66 years. *Br J Pharmacol*. 2006;147 (suppl. 1):S163-S171.
- The Pharmacopœia of the United States of America*. Philadelphia: Mack Printing, 1851. 332-34. Print.
- Piper, Alan. "The Mysterious Origins of the Word "Marihuana"" *Sino-Platonic Papers* 153 (2005): 1-14. Print.
- RB. "The Promising Future of Hash Oil." *The Promising Future of Hash Oil | Berkeley Patients Care Collective*. Berkeley Patients Care Collective, 3 Nov. 2011. Web. 10 Sept. 2012.
- Rhode Island Department of Health. "State of Rhode Island: Department of Health." *Medical Marijuana: Rhode Island Department of Health*. Rhode Island Department of Health, 2012. Web. 02 Oct. 2012.
- Rocky Ford, CO, Municipal Code art. XII, § 4-10-5 (2010). Print. Web 2 Oct. 2012.
- Roekel, Gertjan Van. "Hemp Pulp and Paper Production." *Journal of the International Hemp Association* 1 (1994): 12-14. *Academic Search Elite*. Web. 28 Oct. 2012.
- Russo, Ethan. "Taming THC: Potential Cannabis Synergy and Phytocannabinoid-Terpenoid Entourage Effects." *Journal of Pharmacology* 163.7 (2011): 1344-64. *Academic Search Complete*. Web. 30 Oct. 2012.

- S. 240, 111th Cong. (2012) (enacted). Print. Web 28 Sept. 2012.
- S. 523, 110th Cong. (2007) (enacted). Print. Web 1 Oct. 2012.
- S. 2555, 111th Cong. (2011) (enacted). Print. Web. 1 Oct. 2012.
- Sasman, Marty. "Cannabis Indica in Pharmaceuticals." *Journal of the Medical Society of New Jersey* 35 (1938): 51-52. Print.
- SC Laboratories. "SC Laboratories: Creating A New Paradigm In Cannabis Testing." *SC Laboratories: Creating A New Paradigm In Cannabis Testing*. SC Laboratories, 2012. Web. 02 Oct. 2012.
- Sidney, S., C. P. Quesenberry, G. D. Friedman, and I. S. Tekawa. "Marijuana Use and Cancer Incidence (California, United States)." *Cancer Causes and Control* 8.5 (1997): 722-28. *Academic Search Complete*. Web. 12 Nov. 2012.
- Singla, Sandeep, Rajesh Sachdeva, and Jawahar Mehta. "Cannabinoids and Atherosclerotic Coronary Heart Disease." *Clinical Cardiology* 35.6 (2012): 329-35. *Academic Search Complete*. Web. 14 Nov. 2012.
- Sloman, Larry. "Jack Cohen Is Normal." *Reefer Madness: The History of Marijuana in America*. Indianapolis: Bobbs-Merrill, 1979. 344-55. Print.
- Spain. Minister of Health and Social Policy. Instruction and Health. *National Drug Strategy 2009-2016 Spain*. By Trinidad Jiménez García-Herrera. N.p.: Delegación Del Gobierno, 2009. *Academic Search Complete*. Web. 24 Oct. 2012.
- Sundberg, Andrea, and William Catanach. "Medical Cannabis Program." *Medical Cannabis Program*. New Mexico Department of Health, 2012. Web. 02 Oct. 2012.
- Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies. *Mortality Data From The Drug Abuse Warning Network, 2002*. DAWN Series D25, DHHS Publication No. (SMA) 043875, Rockville, MD, 2004.
- Swift, W., W. Hall, and J. Copeland. "Characteristics of Long-Term Cannabis Users in Sydney, Australia." *Eur Addict Res* 4 (1998): 190-97. *Academic Search Complete*. Web. 12 Nov. 2012.
- Touw, Mia. "The Religious and Medicinal Uses of Cannabis in China, India and Tibet." *Journal of Psychoactive Drugs* 13.1 (1981): 1-10. Print.
- Underwood, Eric. "Medical Marijuana Edibles." Telephone interview. 4 Nov. 2012.
- United Nations. Economic and Social Council. 32nd sess. *Commission on Narcotic Drugs, Resolution 689 J. Single*

- Convention on Narcotic Drugs*. 25 March 1961. Readex. Microfiche.
- United States of America. Department of Public Health. Occupational and Environmental Health. *Medical Cannabis Dispensary (MCD) Regulations for Preparation of Edible Cannabis Products*. By Gavin Newsom, Mitchell H. Katz, and Rajiv Bhatia. San Francisco: Department of Public Health, 2010. Print.
- United States of America. Department of Health and Human Services. Food and Drug Administration. *Guidance for Industry Assessment of Abuse Potential of Drugs*. By Center for Drug Evaluation and Research. Maryland: Department of Health and Human Services, 2010. Print.
- . Legislative Council. *Medical Marijuana. Issue Brief: Colorado's Medical Marijuana Law*. By Kelli Kelty. 9th ed. Vol. 10. Denver: Legislative Council, 2010. Print.
- Van Hoozen, Brent E., and Carroll E. Cross. "Marijuana Respiratory Tract Effects." *Clinical Reviews in Allergy and Immunology* 15.3 (1997): 243-69. *Academic Search Complete*. Web. 17 Sept. 2012.
- The Verdes Foundation. "Edible Cannabis." E-mail interview. 24 Sept. 2012.
- Vinson, Kay. "Chocolate Cartel: The Big Bhang." *Local IQ*. Local IQ, 15 Oct. 2010. Web. 3 Oct. 2012.
- Wagner, FA, and JC Anthony. "From First Use to Drug Dependence: Developmental Periods of Risk for Dependence Upon Marijuana, Cocaine and Alcohol." *Neuropsychopharmacology* 26.4 (2002): 479-88. *Academic Search Complete*. Web. 22 Sept. 2012.
- Warner, Butch. "How Does Your Pot Grow?" *Pasadena Weekly*. Southland Publishing, 3 Dec. 2009. Web. 3 Nov. 2012.
- Watson, SJ, JA Benson, and JE Joy. "Marijuana and Medicine: Assessing the Science Base: A Summary of the 1999 Institute of Medicine Report." *Archives of General Psychiatry* 57.6 (2000): 547-52. *Academic Search Complete*. Web. 10 Sept. 2012
- Wolfert, Paula. "Kif Candy, Majoun." *Couscous and Other Good Food from Morocco*. 1st ed. New York: Harper & Row, 1987. 500-01. Print.
- Wood, George B. and Franklin Bache, Eds., *The Dispensatory of the United States of America*, 9th Ed. (Philadelphia: Lippincott, Grambo, 1851), Pp. 310-311.
- Zimmerman, Bill, Nancy Crumpacker, and Rick Bayer. *Is Marijuana The Right Medicine For You?: A Factual Guide to Medical Uses of Marijuana*. New Canaan, CT: Keats Pub., 1998. Print.

