FLAVORFUL CHOICES: INVESTIGATING CONSUMER PREFERENCES FOR CBD OIL FLAVORS USING MULTINOMIAL LOGIT MODEL

By

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(Under the Direction of **Benjamin Campbell**)

ABSTRACT

Hemp has garnered attention in the United States since its removal from the list of Schedule I drug, resulting in increased interest in CBD oil and its purported health benefits. However, the market potential of CBD oil in the current consumer market remains largely unexplored. This study aimed to evaluate consumer preferences for nine key flavor attributes of CBD oil and their corresponding market shares. A survey of 982 US respondents was conducted, and clustering analysis identified 11 segments for CBD oil buyers and 9 for future buyers, with citrus and fruit flavors being popular. A Multinomial logit analysis identified demographic characteristics, CBD usage behavior, and attitudes toward social issues as a determinant of cluster membership. The results of this study could help develop targeted marketing strategies for CBD oil products.

INDEX WORDS: Hemp, CBD oil, clustering analysis, Multinomial logit, market share

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CHAPTER 1

INTRODUCTION

Cannabidiol (CBD) oil, a hemp-derived product, has gained significant attention recently due to its multiple health benefits, including reducing anxiety, Post-Traumatic Stress Disorder, and other pains (Elms et al., 2019; MacKeen, 2019). With its popularity, the market for CBD oil continues to increase. Thus, marketers and CBD oil industrialists are relentlessly producing differentiated products by introducing flavored CBD oil products to appeal the large consumer segments. However, studies have yet to be conducted to determine consumers' preferences for the flavors and their market share.

Flavors in food products increase consumer satisfaction and further intensify food consumption (Thomas et al., 2021). In the food industry, flavors have an extensive application as they can significantly influence the acceptability and product's appeal. Whether it is food, drink, tobacco, chemical medicines, confectionery, or oral hygiene products, their acceptability depends on their flavors (Reineccius, 2013). Not only the acceptability but also the health benefits are somehow associated with using flavors. Researchers have found that flavors extracted from peppermint essential oil increase acceptability and benefit human health because of its antioxidant property (Ibrahim et al., 2019).

Our study tries to identify the consumer preferences for different CBD oil flavors and get an idea of the market share of these flavors under study. The information obtained can provide valuable information to Hemp producers, CBD oil manufacturers, and marketers in the CBD oil

industry in developing strategies to meet those preferences. Additionally, information on the market share of each flavor provides insights into the competition within the CBD oil industry.

Prior research has focused on consumer attitudes toward Hemp plants and CBD products (J. Campbell et al., 2020; Kolodinsky & Lacasse, 2021; Rampold et al., 2021) and the factors governing the purchase decisions (Zhu et al., 2021). Still, there needs to be a study on the consumer preferences for the flavor to know about CBD oil consumer behavior.

This study aims to provide a more comprehensive understanding of consumer behavior and purchase decisions in the CBD oil industry by understanding the preferences for CBD oil flavors. In particular, this study uses online survey data conducted using Toluna Inc. in the US population to identify their demographic characteristics, CBD oil usage history, and attitudes towards social issues to decipher their preferences for different CBD oil flavors, along with their market share. The information so obtained can be used in target-specific marketing of CBD oil.

The study is organized as follows:

Chapter 2 describes the background of Hemp and CBD oil, along with the past literature reviews

Chapter 3 describes the methodology used along with the sources and description of the data

Chapter 4 summarizes the results of the study

Chapter 5 discusses the results of the study and compares it to the past findings

Chapter 6 concludes the study

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

Hemp is one of the earliest-grown crops in the world for its fiber, seed, and oil (Rupasinghe et al., 2020). In the United States, hemp has a complex long-lived history marked by periods of encouragement and restriction (Guerreiro, 2021). It was first produced commercially in the seventeenth century for textile purposes in the United States (Malone & Gomez, 2019). In 1619, Virginia Assembly identified hemp as a valuable crop for textile, rope, and sailing (Gustafson, 2015). However, Hemp production was displaced by cotton when cotton gin extraction became a way lot easier and cheaper in the late 1800s (Malone & Gomez, 2019).

Furthermore, in the twentieth century, Hemp began to be associated with marijuana, which resulted in plummeting hemp cultivation. The Marijuana Tax Act (MTA) of 1937 outlawed the possession and marketing of marijuana and hemp, a notable regulatory blow to hemp producers (Malone & Gomez, 2019). MTA also imposed an extra tax on Cannabis products (that includes Hemp and marijuana), which initiated the state governments to prohibit marijuana and hemp side-by-side (Malone & Gomez, 2019). Between 1916 and 1931, twenty-nine states had proceeded laws to prohibit Cannabis, but when MTA passed, all the US states had sanctioned laws governing prohibition (Little, 2018). Several small changes in hemp regulation occurred from 1938 to 1970. In 1970, the Controlled Substances Act classified Hemp as a Schedule I drug, which further restricted the production and sale of Hemp (Malone & Gomez, 2019). From 1970 to 2014, hemp was among the highly regulated and restricted crop species (Malone & Gomez, 2019). Later, the

Agricultural Act of 2014 permitted hemp cultivation for research purposes (Malone & Gomez, 2019).

Tetrahydrocannabinol (THC), a chemical that makes people high, associated with the Hemp and other plants of the genus *Cannabis*, was the main reason behind the Hemp controversy. Only after finding that Hemp plants contained very few amounts (less than 0.3%) of THC relaxed some stringent laws regarding Hemp production (Hudak, 2018). Soon after, the US Farm Bill of 2018 removed hemp from Schedule 1 drugs (drugs with a high potential for abuse and no known medical use), and as a result, many US states hastily changed their laws to permit hemp cultivation for research purposes within their borders (Malone & Gomez, 2019).

Several uses for the hemp plant have been unleashed since its legalization. Nowadays, Hemp is used in various products and forms like textiles, insulation, building materials, food and beverages, energy production, cosmetics, medications, and other industrial raw materials (Crini et al., 2020). Most importantly, the medication and pharmaceutical industries use Hemp extensively due to its broad-spectrum preventive action for multiple illnesses. Increasing Cannabis availability, accompanied by the heterogeneous Cannabis products and use methods, has raised the consumption potential of Cannabis products (Knapp et al., 2019). One of the hemp derivatives that has gained popularity recently is cannabidiol (CBD), which was given U.S. government approval for use by the US—food and Drug Administration. Also, due to CBD's known multiple health benefits, it is readily available in the market nowadays. CBD can cure anxiety and depression, and treat pain instead of opioids, preventing the withdrawal symptoms that come with long-term opiate use (Grinspoon, 2021). Because of this, Hemp and CBD have considerable demand in pharmaceutical industries.

CBD tastes earthy and grass-like in its pure form, unpleasant to many consumers (Gcads, 2020). However, CBD oil is prepared using a carrier oil to mask CBD's grassy and earthy taste. The flavored carrier oil, fortunately, does not affect the benefits of the products. A study conducted in Colorado on the effectiveness of CBD oil for Pediatric Anxiety and Insomnia in a young girl with Post Traumatic Stress Disorder supports the use of CBD oil as a safe and alternative treatment for reducing anxiety and improving sleep (Shannon & Opila-Lehman, 2016). Thus, its availability in various textures and forms without a decline in its health benefits makes CBD oil the most popular Hemp product.

Scientists and industrialists are trying to identify new forms of medicines like CBD oil using different flavors to increase its acceptability to the vast consumer ranges. The flavor is an impression formed by the chemical sensations of taste and smells we experience when consuming food and beverage products (*Flavors – Flavor Overview*, 2019). The flavor is vital in taste enhancement and has been prevalent in several food industries, including tobacco and other narcotics. We commonly find flavor in e-cigarettes and vaping, which makes it more appealing to a wide range of consumers, especially the younger generation (Werts et al., 2021). Some readily available flavors of CBD oil are mint, citrus, chocolate, cinnamon, lemongrass, and ginger (*10 Best Flavored CBD Oils*, 2022; *Vape Flavors and Vape Juice*, 2021).

Most research on CBD oil focuses on identifying consumer perceptions of different CBD products and attributes. Donnan et al. (2022a) conducted a review to identify the characteristics that influence purchase choice for cannabis products. They found that the demand was price inelastic, and the quality difference of cannabis flowers impacted consumer preference, but the quality was not well-defined. Heterogeneity in consumer preference was identified based on the consumer's frequency of use, gender, and experience. Overall, consumers were looking for low-

cost quality cannabis flowers. Another research carried out by Donnan et al. (2022b) used semi-structured focus groups and interviews in Newfoundland and Labrador, Canada, to identify the drivers of purchase decisions among consumers categorized in broad themes like Price, Packaging, quality, warning labels, product origin, and social influences. Results suggested that the Price difference between regulated and unregulated sources was the main driver of purchase decisions. Product quality and social influences were other drivers, but consumers were indifferent to packaging and warning labels.

Despite being one of the essential attributes driving the consumer purchase decision, CBD flavor has yet to be studied. Studies till now only cover a limited consumer category. A recent study by Werts et al. (2021) identified flavored Cannabis products, both smoked and aerosolized, are popular among young people. They found that 36% of the High-school students were consuming Cannabis products, including flowers, wraps, and Oil vaporizers, with fruit as the most popular flavor among adolescents. This research has done a great job explaining the popular Cannabis flavor among adolescents but misses the public and tells nothing about the factors that drive consumers to select the flavor. Besides, past studies have looked at different by-products of Cannabis. Our paper tries to find consumer preferences for different CBD oil flavors and identify the socio-demographic and other factors that guide consumer decision-making for several CBD oil flavors. The CBD oil industry can use the result to target all consumer groups depending on their preference set.

CHAPTER 3

METHODOLOGICAL FRAMEWORK

3.1 Model Specification

A multinomial logit model (MNL) is used in this paper to identify the relationship between one or more independent variables or predictor variables and the categorical dependent or response variable. Multinomial logit is just an extension of the Generalized linear model (GLM), which assumes a linear relationship between the predictor and response variables in the log odds of each outcome (Agresti, 2012). The multinomial logit model coefficients can be interpreted as a change in log odds of the outcome due to a unit change in the independent variable (Agresti, 2012). MNL allows modeling for discrete outcomes simultaneously (McFadden, 1974). One of the main assumptions behind the Multinomial logit is that the errors are identically and independently distributed. The multinomial model is based on the random utility theory, where the selection of each choice depends on how much utility is derived by choosing that particular outcome (Chakrabarti et al., 2019).

According to McFadden (1974) and Greene et al. (2003), the probability of selecting outcome j by the producer k given the set of characteristics X_k is modeled as:

$$Probability(Y_k = j|X_k) = \frac{e^{\beta'_j X_k}}{\sum_{l=1}^{11} e^{\beta'_l X_k}} \; for \; j = 1, \ldots\ldots, 11$$

Where, Y_k is the outcome variable, X_k denotes demographic characteristics and CBD oil usage behavior, and β is the parameter to be estimated.

While estimating the results of the multinomial model, one of the groups is chosen as the base category or comparison group. The log odds ratio of the probability that the consumers belong to the group *j* vs. comparison group *l* is given by (Gao et al., 2011):

$$\ln\left(\frac{Pj}{Pl}\right) = \beta'_j X_j$$

The marginal effects represent the partial derivatives with respect to each of the predictor variables. In other words, marginal effects give the change in probability of each outcome category associated with a unit change in the predictor variable. It is easy to interpret in terms of marginal effects than the odds ratio of multinomial logit. Marginal effects also help us identify the relative importance of each independent variable and the direction and magnitude of the effect to predict the outcome categories. So, we will also use the coefficients from marginal effects estimation to identify the likelihood of cluster membership compared to the base category for interpreting our results.

3.2 Data Source and Description

We conducted an online survey on March 2022 to identify the consumer preferences for different CBD oil flavors using Qualtrics. For the survey respondents, we used the consumer base in the Toluna Inc. database, which comprised all US residents except Puerto Rico and Hawaii, 17 years or older. Toluna allows the researchers to select sample respondents according to desired criteria like age and CBD oil usage behavior. However, we did not restrict our survey to the CBD purchasers only. Instead, we included both CBD oil buyers and nonbuyers to compare the differences between these two groups. We emailed the selected respondents the link to the survey, and those who agreed to participate were then directed to the study. Altogether, 1006 respondents completed the survey. When all the missing observations were excluded, only 982 complete responses were included in the study, of which 382 were CBD oil buyers, and 600 were nonbuyers

of CBD oil. Non-buyers interested in CBD oil were only directed to fill out the survey questionnaire related to CBD oil flavor. So, non-buyers can also be attributed to future purchasers of CBD oil.

The CBD oil flavor we included in our study was fruit, berry, mint, dessert, nut, citrus, food, chocolate, and other flavors. The main question posed to us was, "do the consumers who purchase different CBD oil flavors have different preferences?" Thus, we clustered buyers and nonbuyers of CBD Oil based on their preferences for the flavors. Further, consumers indicating "I do not remember" were grouped to form their segment.

Identifying the appropriate number of clusters is the critical component of clustering. This study identified optimal cluster size using clustering procedures such as Ward's Linkage and Weighted Average Link following Campbell et al. (2013) and Behe et al. (2013). After clustering, we used cluster-stopping rules like pseudo-F (Caliński & Harabasz, 1974) and Pseduo-J (Duda & Hart, 1974) tests to identify our needed cluster size (Behe et al., 2013). A high value of Calinski-Harabasz pseudo-f statistics, Duda-Hart J9E)2/J(E)1, and Pseudo-T squared suggest that the clustering solutions are well-formed, and the clusters are well separated from each other. These indices measure the ratio between cluster variance and total variance, indicating cluster quality. By comparing all three indices, optimal cluster size can be estimated.

Using objective techniques can help reduce the researcher's bias toward the result. However, when both subjective and objective approach is combined, a more vivid market picture can be obtained. This study recommended 3 and 11 segments using the objective cluster-stopping procedures. We then subjectively identified how cluster splits when segments increase. For example, we observed how the consumer segments are split when we increase the segment size one at a time. We found that the movement from lower segment to higher segments resulted in

single segment splitting with minimal movement of consumers from other segments. Distinct consumer segments were identified when the segments were increased from three to eleven. However, when eleven was split, no such distinct clusters were formed, and only very few observations were altered, which could not be encompassed as an operative market segment. Thus, we finalized the eleven distinct consumer segments according to the CBD oil flavors they purchased.

Eleven clusters for buyers included the respondents who preferred mint flavor (segment 1), food flavor (segment 2), and other flavors than what was listed in our study, which mainly included 'Unflavored' and 'Watermelon flavor' responses (segment 3), Dessert flavor (segment 4), fruit flavor (segment 5), Citrus flavor (segment 6), Chocolate flavor (segment 7), Berry flavor (segment 8), Nut flavor (segment 9), a mix of fruit, berry, citrus, food and chocolate flavor (segment 10) and those with 'I do not remember' answers (segment 11).

Similarly, nine clusters were identified for the nonbuyers of CBD oil who were considering using CBD oil soon. Those clusters included the respondents who do not indicate a preference for any distinct flavor (segment 1), Citrus flavor (segment 2), the mixed flavor of dessert, nut, and food (segment 3), those who are seriously unwilling to consider any CBD oil products (segment 4), Mint flavor (segment 5), chocolate flavor (segment 6), a mix of fruit, berry, mint, citrus and chocolate flavor (segment 7), fruit flavor (segment 8), and Berry flavor (segment 9).

Table 1: Variable Description

Variable	Type	Description
age	Continuous	Age of the respondents
bboomers	Binary	Baby boomers and older respondents (1 if age is >=58)
genx	Binary	Generation X respondents (1 if age >=48 and <58)

mill	Binary	Millennials respondents (1 if age >=26 and l<48)
genz	Binary	Generation Z respondents (1 if age <26)
male	Binary	1 if respondent is male
hhinc	Discrete	Annual household income in USD
hhinc_10	Discrete	Annual household income in 10000 USD
eduhsorless	Binary	1 if respondent has high school or less educational level
edusomecoll	Binary	1 if respondent got some college level education
edubs	Binary	1 if respondent has bachelor's level education
edugrtbs	Binary	1 if respondent has education level higher than a Bachelor's degree
primmed	Binary	1 if the respondent is primary medicine purchaser for the household
Numchildu18	Discrete	Number of children less than 18 in the family
numadultgre18	Discrete	Number of adults more than 18 in the family
rural	Binary	1 if the respondent is a rural resident
suburban	Binary	1 if the respondent is a suburban resident
urban	Binary	1 if the respondent is an urban resident
race_white	Binary	1 if the race of the respondent is white
Si_lib	Discrete	Alternatives ranging from one to seven based on their attitude towards social issues. One represents strongly conservative, and seven represents strongly liberal.
whenfirstused	Discrete	1 = used within a month, 2 = between 1 to 6 months, 3=between 6 to 12 months, 4= between 1 to 3 years, 5=more than 3 years

howfreqused	Discrete	1= at least once a day, 2 = once to a few times a week, 3=once to a couple times per month, 4=a few times a year, 5=only tried once or twice

The explanatory variables used to identify the preferences for the CBD oil flavors are listed in Table 1. Data on demographic characteristics, economic conditions, and people's attitudes toward Hemp products were used as explanatory variables. To find the age, respondents were asked what year they were born; the options included from 1990 to 2022, where 1990 was coded as 1, 1991 as 2, and so on up to 2022. The actual age is thus obtained by subtracting 2022 (the year the analysis was done) from 1989 and again subtracting the code respondents' input. From the obtained age, we classified respondents into four categories: Baby boomers and older (age greater than or equal to 58), Generation X (age greater than or equal to 42 and less than 58), Millennials (age greater than or equal to 26 and less than 42), and Generation Z (age less than 26). Dummy variables on education level achieved are included in determining the awareness level in people.

Similarly, people's attitude toward social issues was identified using Likert-type scaling. Respondents were asked to rank themselves from 1 to 7, where one represented strongly conservative, and seven defined strongly liberal. For household income, respondents were asked to choose an option from 26 alternatives that represented their household income. There was a ten-thousand-dollar range in each option. For example, option 1 included 0 to 10000; option 2 included 10000 to 19999; option 3 included 20000 to 29999, and so on. The mean of each range then approximated the household income, i.e., for the first option, income was approximated as a mean of 0 and 10000; for the second option, income was compared as a mean of 10000 and 19999, and so forth.

CHAPTER 4

RESULTS

4.1 Mean comparison using t-test

The demographic characteristics of the buyers and non-buyers of CBD oil were compared using a t-test in STATA version 17 by StataCorp College Station, Texas. Results showed that the buyers and non-buyers differed statistically in several demographic features. The average age of buyers was 40.8 years which is 48.5 years for the average non-buyers. The relatively older population is in the non-buyers category. This can be because older people may still view CBD and hemp products as illegal despite removal from the Control substance by the Farm Bill of 2018 (Agricultural Marketing Service, 2019; Malone & Gomez, 2019). This result is consistent with Campbell et al., (2020), where the younger populations were likelier not to want any CBD oil restrictions than the older populations. Another paper by Kolodinsky and Lacasse (2021) also found that consumer age is negatively associated with Hemp support. The average age of the non-buyers is higher also because of the more significant number of Baby boomers and older population, which is 45% compared to 24% in the buyer's category. On the other hand, the percentage of millennials is significantly higher in Buyer's category than that of non-buyers which is 17%.

Regarding the gender of the buyers, we found that most of the buyers are male, i.e., 58%, which is significantly higher than in the non-buyer category, i.e., 43%. It can be because males are more familiar to the Hemp related products than females. Kolodinsky and Lacasse (2021) also found that females are less likely to be familiar with Hemp paper than males by 0.677 percentage

points which is consistent with our results. The average household income of CBD oil flavor buyers is 81753.5 USD which is significantly higher than the non-buyers, i.e., 70832.9. The findings are consistent with Kolodinsky and Lacasse (2021), where they observed that those individuals with income higher than 100,000 per year are more likely to be familiar with Hemp-based products than the less income category. Our results also show that many educated individuals are CBD oil users. Twenty-four percent of purchasers of CBD oil flavors have an education level higher than a bachelor's degree, which is significantly higher than that of the non-buyers, i.e., 18%. A higher number of educated people in the buyer's category might be due to the awareness level of these people regarding Hemp and CBD oil.

Table 2: Comparison of demographic characteristics of buyers and non-buyers of CBD oil

Variables	Total		Buyers		Non-Buyers			
	Mean	SD	Mean	SD	Mean	SD	T-value	p-value
age	45.5	20.3	**40.8**	**18.2**	**48.5**	**21.1**	**5.8639**	0.0000
bboomers	37%	48%	**24%**	**43%**	**45%**	**50%**	**6.5203**	0.0000
genx	14%	35%	15%	36%	13%	34%	-1.0776	0.2815
mill	22%	42%	**32%**	**47%**	**17%**	**37%**	-5.6444	0.0000
genz	27%	44%	29%	45%	26%	44%	-0.8716	0.3836
male	49%	50%	**58%**	**49%**	**43%**	**50%**	**-4.8541**	0.0000
hhinc	75081.0	58466.6	**81753.5**	**59090.3**	**70832.9**	**57714.3**	**-2.8640**	0.0043
eduhsorless	27%	44%	26%	44%	27%	45%	0.5794	0.5624
edusomecoll	32%	47%	32%	47%	33%	47%	0.0982	0.9218
edubs	21%	41%	19%	39%	22%	42%	1.3481	0.1779
edugrtbs	20%	40%	**24%**	**43%**	**18%**	**39%**	**-2.1199**	0.0343

primmed	84%	37%	85%	36%	83%	37%	-0.6838	0.4943
Numchildu18	0.9	1.5	**1.1**	**1.6**	**0.7**	**1.5**	**-4.2628**	0.0000
numadultgre18	2.1	1.4	**2.3**	**1.4**	**2.1**	**1.3**	**-2.2578**	0.0242
rural	23%	42%	22%	41%	23%	42%	0.6216	0.5343
suburban	46%	50%	44%	50%	48%	50%	1.3925	0.1641
urban	31%	46%	**35%**	**48%**	**29%**	**45%**	**-2.0606**	0.0396
race white	68%	47%	66%	47%	69%	46%	1.1018	0.2708
si lib	3.6	1.9	3.6	2.0	3.5	1.8	-1.1743	0.2406
howfreqused			2.7	1.4				
whendouuse			3.1	1.8				
Whenfirstused			2.9	1.3				
No.of obs	982		382		600			

4.1 Buyers: Eleven segments

Segment 1: Mint Flavor [n=36, market share= 9.42%] This segment includes CBD oil buyers similar in demographic characteristics to the average buyers. At least 86% of the members of this segment are primary medicine purchasers for the family. When examined for the marginal effects, Millennials and Generation Z respondents were 9.8% and 10.8% less likely to be in segment one than Baby Boomers and older category. Similarly, individuals in rural regions are 8.1% less likely to be in this category.

Segment 2: Food Flavor [n=35, market share= 9.16%] This segment includes relatively fewer consumers with an education in high school or less and a relatively higher percentage of households with a more significant number of children less than 18 than the average CBD oil buyers. This segment is also demographically similar to the average of CBD oil buyers. The

marginal effects estimations show that males are 6.3% more likely to be in this category. However, this segment is 2.4% less likely to have frequent CBD oil users in this group.

Segment 3: Unflavored and Watermelon flavor [n=23, market share= 6.02%] Segment three is demographically little different than the overall CBD oil buyers. Regarding segment three, households with children are less likely (1.3% for every child under 18 years) to be in this category. The average age of individuals and the percentage of baby boomers and older is significantly higher in this segment than the CBD oil buyer's average. On the other hand, millennials and the generation Z population are significantly lower than the average respondents. This group is marked by the higher number of respondents with bachelor's level education. Almost all (96%) of the respondents in this category are white.

Segment 4: Dessert Flavor [n=26, market share=6.81%] This segment comprises CBD oil purchasers with average ages lower than the average CBD oil buyers. White-raced individuals are relatively lower in this segment than the average buyers. Marginal effects estimates show that white raced individuals are 7.2% less likely to be in this category.

Segment 5: Fruit Flavor [n=36, market share=9.42%] This segment has relatively younger CBD oil purchasers, with very few percentages of Baby boomers than the average CBD oil buyers. The average age of the consumers in this segment is 32.4%. While examining the marginal effects, primary medical purchasers of a household have an 8.2% higher probability of being in this category.

Segment 6: Citrus Flavor [n=54, market share =14.14%] This segment includes a significantly lower percentage of the older population, like baby boomers. The average age of consumers in this segment is 34.3, significantly lower than the average buyers. The percentage of baby boomers is higher than in segment 5. The marginal effects estimation shows that the less

frequent CBD oil purchasers fall in this category. Frequent purchasers are 3.1% less likely to be in this category.

Segment 7: Chocolate Flavor [n=35, market share= 9.16%] Demographically, this segment is similar to the average CBD oil buyers except for the average age of the consumers, which is significantly lower than the average of CBD oil buyers. The marginal effects estimation results show that rural residents are 9.6% less likely to be in this category.

Segment 8: Berry Flavor [n=31, market share= 8.12%] Demographically, this group is similar to the overall sample, just like segment 1. Generation Z buyers are 11.6% less likely to be in this segment than overall CBD oil buyers. Similarly, those with education higher than a bachelor's degree are also 8.2% less likely to be in this segment. However, suburban residents are 11.3% more likely to be in this market segment.

Segment 9: Nut Flavor [n=17, market share=4.45%] This is the smallest market segment in our study. Demographically, this segment is similar to the average CBD oil buyers, just like segment one and segment 8. The marginal effects show that households with adults are more likely to be in this category (1.3% for every adult 18 years or more).

Segment 10: Indifferent between fruit, berry, citrus, food, and chocolate flavor [n=28, market share= 7.33%] This segment includes a relatively younger population than the average sample. The members in this group have a lower average age than the average of all CBD buyers in our study. It comprises a significantly lower number of Baby boomers and older—fewer individuals with some college-level education than the overall buyers, similar to segment two mark this segment. The marginal effects estimation also shows that those individuals with some college-level education are 8% less likely to be in this category. The number of children is higher in households belonging to this category.

Table 3: Comparison of demographic characteristics of CBD oil buyers

Variables	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Segment 8	Segment 9	Segment 10	Segment 11
Age	44.9 (15.7)	35.4 (12.7)	**67.3** (13.7)**	**33.2** (14)*	**32.4** (11.3)**	**34.3** (13.9)*	**33.9** (14.6)*	42.3 (14.5)	34.8 (14.7)	**32.2** (11.2)*	**54.4** (21.5)**
bboomers	28% (45%)	14% (36%)	**87%** (34%)**	12% (33%)	**6%** (23%)*	**11%** (32%)*	11% (32%)	26% (45%)	12% (33%)	**4%** (19%)*	**53%** (50%)**
genx	28% (45%)	17% (38%)	4% (21%)	12% (33%)	17% (38%)	11% (32%)	11% (32%)	23% (43%)	12% (33%)	14% (36%)	16% (37%)
mill	25% (44%)	40% (50%)	**4%** (21%)**	35% (49%)	42% (50%)	37% (49%)	34% (48%)	39% (50%)	**53%** (51%)*	43% (50%)	**13%** (34%)**
genz	19% (40%)	29% (46%)	4% (21%)	42% (50%)	36% (49%)	41% (50%)	43% (50%)	13% (34%)	24% (44%)	39% (50%)	18% (39%)
male	50% (51%)	74% (44%)	44% (51%)	73% (45%)	69% (47%)	56% (50%)	57% (50%)	55% (51%)	59% (51%)	68% (48%)	48% (50%)
hhinc_10	7.5 (5.8)	7.1 (4.7)	8.8 (6.1)	8 (7.2)	8.4 (7)	8 (5.3)	8 (5.6)	9.7 (7.2)	9.4 (5.8)	**9.5** (5.7)*	9.2 (6.5)
eduhsorless	28% (45%)	31% (47%)	13% (34%)	23% (43%)	25% (44%)	20% (41%)	23% (43%)	26% (45%)	29% (47%)	32% (48%)	30% (46%)
edusomecoll	44% (50%)	**14%** (36%)*	26% (45%)	27% (45%)	36% (49%)	43% (50%)	37% (49%)	39% (50%)	12% (33%)	**11%** (32%)*	38% (49%)
edubs	17% (38%)	17% (38%)	**44%** (51%)**	23% (43%)	14% (35%)	11% (32%)	14% (36%)	23% (43%)	18% (39%)	21% (42%)	18% (39%)

edugrtbs	11% (32%)	37% (49%)	17% (39%)	27% (45%)	25% (44%)	26% (44%)	26% (44%)	13% (34%)	41% (51%)	36% (49%)	15% (36%)
primmed	86% (35%)	80% (41%)	96% (21%)	81% (40%)	92% (28%)	82% (39%)	83% (38%)	84% (37%)	77% (44%)	89% (32%)	85% (36%)
Numchildu18	1.3 (1.8)	**1.7*** **(1.7)**	**0.1**** **(0.5)**	1.4 (2.2)	1.5 (1.8)	1.1 (1.4)	1.5 (1.8)	1 (1.5)	1.2 (1)	1.8 (1.9)	**0.4**** **(0.9)**
numadultgre18	2.2 (1.6)	2.4 (1.8)	1.8 (0.5)	2.5 (1.7)	2.5 (1.6)	2.2 (1)	2.4 (1.4)	2 (1.4)	2.6 (2.2)	2.6 (1.4)	2 (1.1)
rural	14% (35%)	29% (46%)	30% (47%)	27% (45%)	17% (38%)	17% (38%)	9% (28%)	26% (45%)	24% (44%)	21% (42%)	28% (45%)
suburban	44% (50%)	31% (47%)	44% (51%)	31% (47%)	36% (49%)	46% (50%)	43% (50%)	55% (51%)	24% (44%)	46% (51%)	56% (50%)
urban	42% (50%)	40% (50%)	26% (45%)	**42%*** **(50%)**	47% (51%)	37% (49%)	49% (51%)	19% (40%)	53% (51%)	32% (48%)	**16%**** **(37%)**
race white	69% (47%)	63% (49%)	**96%**** **(21%)**	42% (50%)	56% (50%)	67% (48%)	54% (51%)	61% (50%)	65% (49%)	61% (50%)	**82%*** **(39%)**

Figure in parenthesis () indicate Standard Deviation. ** represents significance at 1%, * represents significance at 5%

Segment 11: Those who needed to remember what flavor they purchased [n=61, market share =15.97%] This is the largest market segment for CBD oil flavors. It represents the consumer indifferent about the flavors or needs to remember what flavor they purchased. Demographically, this group has individuals with higher average age than the overall sample. The percentage of baby boomers and the older population is significantly higher than the average of all respondents in our study. Similarly, the average household income of the consumers in this segment is relatively larger than the mean of CBD oil buyers. The number of children under 18 is relatively lower in this market segment. This group also has a higher percentage of white raced individuals. However, there are fewer urban dwellers in this category than in the overall sample. The marginal effects estimation shows that relatively older consumers fall under this category. Generation X, Millennials, and Generation Z consumers are 10.7%, 17.3%, and 18.4% less likely to be in this category than the Baby Boomers and the older purchasers. Similarly, households with children are less likely to fall into this category (3.8% for every child under 18 years). However, Consumers who are frequent users are 6.3% more likely to be in this category.

Table 4: Marginal effects from the MNL[z] model for CBD oil buyers

	Marginal probabilities of membership in each segment																					
	Prob (segment 1)		Prob (segment 2)		Prob (segment 3)		Prob (segment 4)		Prob (segment 5)		Prob (segment 6)		Prob (segment 7)		Prob (segment 8)		Prob (segment 9)		Prob (segment 10)		Prob (segment 11)	
variable	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value
genx	-0.013	0.817	-0.021	0.706	-0.019	0.153	-0.011	0.841	0.098	0.428	-0.048	0.572	-0.025	0.702	-0.003	0.959	-0.005	0.886	0.152	0.321	**-0.107**	**0.001**
mill	**-0.098**	**0.019**	0.003	0.958	-0.030	0.149	0.012	0.805	0.109	0.232	0.029	0.715	0.008	0.896	-0.038	0.299	0.022	0.531	0.157	0.134	**-0.173**	**0.000**
genz	**-0.108**	**0.006**	-0.024	0.586	-0.034	0.115	0.020	0.664	0.127	0.195	0.099	0.271	0.066	0.349	**-0.116**	**0.001**	-0.016	0.534	0.171	0.137	**-0.184**	**0.000**
male	-0.050	0.231	**0.063**	**0.067**	-0.004	0.635	0.043	0.144	0.037	0.315	-0.040	0.423	-0.018	0.642	-0.024	0.488	-0.009	0.691	0.021	0.418	-0.019	0.628
hhinc	-0.004	0.308	-0.001	0.773	-0.000	0.924	0.001	0.812	-0.002	0.592	0.001	0.796	0.005	0.102	0.004	0.118	0.000	0.921	0.001	0.703	-0.005	0.221
eduhsorless	0.035	0.614	-0.001	0.992	-0.012	0.235	-0.049	0.122	0.006	0.927	0.045	0.631	0.028	0.681	-0.040	0.316	0.001	0.985	-0.022	0.475	0.010	0.870
edusomecoll	0.050	0.444	-0.065	0.159	-0.010	0.287	-0.042	0.216	0.020	0.746	0.140	0.129	0.056	0.405	-0.038	0.333	-0.037	0.174	**-0.080**	**0.019**	0.008	0.895
edugrtbs	-0.064	0.211	0.061	0.340	-0.013	0.198	-0.020	0.574	0.018	0.772	0.102	0.293	0.020	0.750	**-0.082**	**0.014**	0.035	0.412	-0.006	0.857	-0.052	0.328
primmed	0.004	0.939	-0.044	0.435	-0.014	0.628	-0.001	0.975	**0.082**	**0.015**	0.026	0.675	0.041	0.283	-0.027	0.628	-0.052	0.286	0.032	0.257	-0.047	0.480
howfreqused	-0.006	0.683	**-0.024**	**0.087**	0.004	0.227	-0.019	0.119	-0.006	0.696	**-0.031**	**0.096**	0.018	0.203	0.006	0.602	-0.001	0.853	-0.005	0.656	**0.063**	**0.000**
Numchildu18	0.017	0.245	0.016	0.173	**-0.013**	**0.076**	0.001	0.906	0.011	0.378	-0.003	0.891	0.012	0.387	0.001	0.938	-0.013	0.128	0.009	0.311	**-0.038**	**0.053**
numadultgre18	-0.015	0.389	0.000	0.972	-0.001	0.889	0.008	0.428	0.012	0.374	0.001	0.966	0.005	0.730	-0.027	0.105	**0.013**	**0.084**	0.008	0.381	-0.006	0.717
rural	**-0.081**	**0.031**	0.051	0.365	0.008	0.561	0.022	0.612	-0.053	0.179	-0.067	0.254	**-0.096**	**0.007**	0.136	0.108	-0.005	0.845	0.023	0.610	0.063	0.356
suburban	-0.022	0.589	-0.017	0.677	-0.002	0.793	-0.026	0.413	-0.046	0.224	-0.006	0.906	-0.038	0.301	**0.113**	**0.030**	-0.038	0.113	0.036	0.297	0.048	0.347
race_white	0.016	0.718	0.009	0.802	0.009	0.480	**-0.072**	**0.077**	-0.007	0.863	0.079	0.104	-0.002	0.954	-0.068	0.144	-0.006	0.792	0.011	0.705	0.031	0.506
si_lib	0.008	0.380	-0.007	0.401	0.000	0.797	0.007	0.290	0.002	0.835	0.001	0.914	-0.014	0.124	0.003	0.752	-0.007	0.180	0.002	0.723	0.004	0.675
No. of obs	36		35		23		26		36		54		35		31		17		28		61	
Market Share	9.42		9.16		6.02		6.81		9.42		14.14		9.16		8.12		4.45		7.33		15.97	

[z]Multinomial logit model likelihood ratio statistic significant at $p<0.000$

4.2 Non-buyers: Nine Segments

Segment 1: No preference for any distinct flavor [n=182, market share =30.33%] This is the largest market segment for future buyers of CBD oil flavors. It represents the consumers indifferent about the flavors or needing to know what flavor they will purchase. Demographically, this group is similar to the average of non-buyers of CBD oil flavors. The marginal effects estimation shows that consumers in suburban regions are 8.5% more likely to be in this category. Similarly, those with high school or less educational levels are 12% more likely to be in this category.

Segment 2: Citrus Flavor [n=26, market share 4.33%] This is the smallest market segment for future buyers of CBD oil flavors. This segment includes a relatively younger population than the average non-buyers. Many individuals with high school or lower education levels also mark this segment. The percentage of Generation X in this segment is significantly higher than the average non-buyers.

Segment 3: Indifferent between dessert, nut, and fruit flavors [n=71, market share 11.83%] This group includes consumers with higher average income than average non-buyers of CBD oil flavors. It is marked by having a more working population in the households or more adults over 18 years than the sample average for non-buyers. Conversely, the average number of children in household is less than the average non-buyers. The percentage of Suburban residents is comparatively lower than the average non-buyers. While looking at the marginal effects, we found that people with higher income are more likely to be in this category (0.6% for every 10000 USD). Households with children are also more likely to be in this category (2.8% for every child less than 18 years).

Table 5: Comparison of demographic characteristics of non-buyers of CBD oil

Variable	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Segment 8	Segment 9
Age	50.7 (22.1)	**39.3*** **(20.1)**	46.6 (19.6)	**63.7**** **(19.1)**	45 (21.5)	46.1 (18.8)	42.3 (20.2)	47.8 (20.3)	49.2 (20.4)
bboomers	49% (50%)	27% (45%)	39% (49%)	**77%**** **(43%)**	38% (49%)	38% (49%)	33% (48%)	46% (50%)	43% (50%)
genx	12% (33%)	15% (37%)	13% (34%)	7% (25%)	6% (25%)	15% (36%)	20% (41%)	11% (32%)	19% (40%)
mill	14% (35%)	12% (33%)	25% (44%)	3% (18%)	26% (44%)	26% (45%)	7% (25%)	16% (37%)	14% (35%)
genz	25% (44%)	**46%*** **(51%)**	23% (42%)	13% (35%)	30% (46%)	21% (41%)	40% (50%)	27% (45%)	24% (43%)
male	40% (49%)	50% (51%)	54% (50%)	40% (50%)	43% (50%)	34% (48%)	43% (50%)	46% (50%)	40% (49%)
hhinc	6.3 (5.6)	6.4 (6.9)	**9**** **(6.5)**	6.9 (6.3)	7.8 (5.4)	7.8 (5.9)	8 (6.1)	6.4 (4.9)	6.9 (5.5)
eduhsorless	32% (47%)	**46%*** **(51%)**	25% (44%)	27% (45%)	17% (38%)	25% (43%)	20% (41%)	24% (43%)	26% (44%)
edusomecoll	34% (47%)	27% (45%)	32% (47%)	37% (49%)	30% (46%)	34% (48%)	37% (49%)	28% (45%)	35% (48%)
edubs	18% (38%)	15% (37%)	17% (38%)	20% (41%)	32% (47%)	15% (36%)	37% (49%)	30% (46%)	25% (44%)

edugrtbs	17% (37%)	12% (33%)	25% (44%)	17% (38%)	21% (41%)	26% (45%)	7% (25%)	18% (39%)	14% (35%)
primmed	82% (39%)	77% (43%)	82% (39%)	87% (35%)	87% (34%)	85% (36%)	80% (41%)	87% (34%)	82% (39%)
Numchildu18	0.6 (1.5)	0.8 (1.4)	**1.1*** **(1.7)**	**0.2*** **(0.5)**	1 (1.6)	0.9 (1.4)	0.3 (1)	0.8 (1.7)	0.5 (1)
numadultgre18	2 (1.3)	2 (1.2)	**2.6**** **(1.8)**	1.6 (0.7)	2.3 (1.2)	2 (1.1)	2.3 (1.3)	2 (1.5)	1.8 (0.8)
rural	19% (39%)	23% (43%)	32% (47%)	**57%**** **(50%)**	17% (38%)	21% (41%)	**7%*** **(25%)**	23% (42%)	25% (44%)
suburban	56% (50%)	46% (51%)	**34%*** **(48%)**	30% (47%)	47% (50%)	**32%*** **(47%)**	**70%*** **(47%)**	48% (50%)	53% (50%)
urban	25% (44%)	31% (47%)	34% (48%)	13% (35%)	36% (49%)	**47%**** **(50%)**	23% (43%)	29% (46%)	22% (42%)
race white	67% (47%)	62% (50%)	66% (48%)	**90%*** **(31%)**	72% (45%)	70% (46%)	67% (48%)	60% (49%)	**85%**** **(36%)**

Figure in parenthesis () indicates Standard Deviation. ** represents significance at 1%, * represents significance at 5%

Segment 4: Those who are seriously unwilling to buy CBD oil products [n=30, market share 5%] This segment has relatively older CBD oil purchasers, with very high percentages of Baby boomers and a minimal population of millennials. The average age of the respondents is 63.7 % which is significantly higher than the average of non-buyers. The percentage of rural residents is significantly higher in this market segment. This group is marked by the very high percentage of white raced individuals. On the other hand, households with smaller household sizes fall in this segment. Especially the children under 18 years are relatively fewer, with an average of 0.2 per household. Marginal effects estimation also shows that households with an adult are less likely to fall in this category (1.2% for adults older than 18). Similarly, relatively liberal individuals toward social issues are 0.6% less likely to be in this market segment.

Segment 5: Mint Flavor [n=47, market share= 7.83%] Demographically, this group is similar to the average sample of non-buyers. The household income is also comparable to the average non-buyers of CBD oil. About 87% of the respondents are primary medicine purchasers for the family, which is quite similar to the overall average of non-buyers.

Segment 6: Chocolate Flavor [n=53, market share = 8.83%] This segment is demographically similar to the average of CBD non-buyers except for the percentage of suburban and urban residents. The percentage of urban residents is significantly higher than the average non-buyers; the suburban residents are relatively less in this category than the average respondents. Marginal effects estimation shows that males are 4.8% less likely to be in this category. Similarly, rural and urban residents are 4.7% and 7.6% less likely to be in this segment than urban residents. Relatively liberal individuals to social issues are 1.3% less likely to be in this category.

Segment 7: Indifferent between fruit, berry, mint, citrus, and chocolate flavor [n=30, market share 5%] This segment is a suburban market segment that includes 70% of the future consumers in this category. The percentage of suburban residents is significantly higher than the sample average of non-buyers. Conversely, there are relatively fewer respondents from a rural region in this category than the average non-buyers. Results of marginal effects estimation show that those individuals with high school or lower educational levels are 2.7% less likely to be in this category. Similarly, those with an educational level higher than a bachelor's degree are also 3.5% less likely to be in this market segment than those with a bachelor's degree. Households with adults are more likely to be in this category (0.9% for every adult more than 18). Conversely, families with children are less likely to be in this category (1.5% for every child less than 18).

Segment 8: Fruit Flavor [n=89, market share 14.83%] This is the second largest market segment for future buyers of CBD oil. Demographically, this market segment is similar to the average non-buyers, like segments one and five. Marginal effects estimation shows that those with high school or less education and some college degree educational level are 9.1% and 8.8% less likely to be in this category than those with a bachelor's degree. Similarly, white raced individuals are 8.3% less likely to be in this market segment.

Segment 9: Berry Flavor [n=72, market share =12%] This segment is a segment of white people, just like segment five. Eighty percent of the consumers in this market segment are white, which is significantly higher than the average non-buyers. The marginal effects also show that white raced individuals are 10.5% more likely to be in this category than other races. Similarly, those individuals with a liberal attitude towards social issues are 1.2% more likely to be in this category.

Table 6: Marginal effects from the multinomial logit model (MNL) for non-buyers of CBD oil

	Marginal probabilities of membership in each segment																	
	Prob (segment 1)		Prob (segment 2)		Prob (segment 3)		Prob (segment 4)		Prob (segment 5)		Prob (segment 6)		Prob (segment 7)		Prob (segment 8)		Prob (segment 9)	
variable	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value	dy/dx	p-value
genx	-0.045	0.473	0.029	0.452	-0.030	0.405	**-0.022**	**0.022**	-0.040	0.204	0.010	0.789	0.046	0.212	-0.027	0.576	0.079	0.147
mill	-0.063	0.302	0.006	0.844	0.035	0.416	**-0.027**	**0.020**	0.043	0.317	0.033	0.414	-0.007	0.761	-0.026	0.572	0.007	0.888
Genz	-0.087	0.113	0.057	0.129	-0.033	0.348	-0.014	0.293	0.037	0.331	-0.016	0.627	0.039	0.162	-0.021	0.613	0.037	0.422
male	-0.023	0.585	0.007	0.685	0.043	0.130	0.003	0.752	-0.003	0.885	**-0.042**	**0.070**	0.000	0.971	0.021	0.522	-0.005	0.848
hhinc	-0.007	0.111	0.000	0.878	**0.006**	**0.007**	0.001	0.223	0.001	0.687	0.002	0.367	0.001	0.437	-0.003	0.314	-0.001	0.598
eduhsorless	**0.120**	**0.077**	0.036	0.295	0.004	0.935	0.002	0.893	**-0.058**	**0.027**	0.037	0.419	**-0.027**	**0.067**	**-0.091**	**0.014**	-0.022	0.553
edusomecoll	0.047	0.455	0.007	0.807	0.035	0.438	0.011	0.492	-0.027	0.333	0.056	0.210	-0.018	0.221	**-0.088**	**0.019**	-0.023	0.524
edugrtbs	0.057	0.436	-0.003	0.919	0.035	0.476	0.002	0.899	-0.022	0.421	0.062	0.242	**-0.035**	**0.010**	-0.060	0.122	-0.035	0.361
primmed	-0.041	0.516	0.009	0.650	0.003	0.928	-0.017	0.476	0.027	0.347	0.012	0.704	-0.001	0.942	0.052	0.209	-0.044	0.368
Numchildu18	-0.022	0.239	0.001	0.816	0.005	0.642	-0.005	0.493	0.007	0.410	0.010	0.253	**-0.015**	**0.069**	0.019	0.125	0.000	0.970
numadultgre18	0.016	0.404	-0.007	0.390	**0.028**	**0.005**	**-0.012**	**0.090**	0.008	0.377	-0.007	0.543	**0.009**	**0.098**	-0.012	0.428	-0.024	0.130
rural	-0.051	0.395	-0.003	0.896	0.045	0.276	0.052	0.121	-0.021	0.496	**-0.047**	**0.049**	-0.027	0.134	0.015	0.746	0.035	0.440
suburban	**0.085**	**0.088**	-0.002	0.903	-0.051	0.112	-0.001	0.948	-0.015	0.568	**-0.076**	**0.005**	0.015	0.369	0.002	0.949	0.042	0.224
race_white	-0.032	0.519	0.004	0.815	-0.022	0.508	0.017	0.192	0.018	0.493	-0.004	0.879	-0.002	0.882	**-0.083**	**0.046**	**0.105**	**0.000**
si_lib	0.010	0.367	-0.006	0.192	-0.004	0.611	**-0.006**	**0.043**	-0.002	0.752	**-0.013**	**0.058**	0.001	0.875	0.008	0.354	**0.012**	**0.097**
No. obs	182		26		71		30		47		53		30		89		72	
Market share	30.33%		4.33%		11.83%		5%		7.83%		8.83%		5%		14.83%		12%	

Multinomial logit model likelihood ratio statistic significant at $p<0.000$

CHAPTER 5

DISCUSSION

The hemp plant was brought back to the legalized US market in 2018 when it was removed from the list of Schedule I drugs by the controlled substance act (CSA). Continuous efforts are being made to make the product more accessible and expand the consumer base by meeting consumers' expectations. Due to the heightened demand for hemp products, everyone from farmers/producers to the processing company, retailers, and investors were interested in hemp. Several research was carried out in a short period to understand the hemp market, consumers' attitude toward hemp products, and their feasibility in the new market. Although hemp has great attention at this point, there are still less peer reviewed and scientific journal articles to understand market segmentation and demand for several new hemp-based products. Through the consumer survey in the United States, our results act as a reference for understanding the market segmentation of different CBD oil flavors. Moreover, it also offers information on how demographic characteristics and CBD usage behavior impacted cluster membership for several available CBD oil flavors.

The results of our study reveal significant differences in demographic characteristics among buyers and non-buyers of CBD oil. CBD oil buyers are predominantly males with higher household incomes and educational degrees. Those living in urban areas are more likely to buy CBD oil. Our results support previous research findings suggesting income is directly associated with CBD oil purchase (Kim & Mark, 2018; Kolodinsky & Lacasse, 2021). Our study also

supports industry findings that age and gender are significant determinants of the CBD oil purchase (New Frontier Data, 2018).

Eleven market clusters of CBD oil flavors are identified from the data of the consumers who purchased CBD oil. Citrus flavor occupies the highest market share (14.14%), followed by Mint and fruit flavor (9.42% each) and Food and Chocolate Flavor (9.16% each). Our study supports the findings by Werts et al. (2021), where fruit flavor was popular among adolescents for vaping e-cigarettes. However, many consumers (15.97% of the market share) still need to remember what flavor they purchased.

While estimating the results from non-buyers considering using CBD oil in the future, we found nine market segments. About 15% of the respondents showed preference towards Fruit flavor (segment 8), followed by indifference to dessert, nut, or fruit flavor (segment 3), Berry Flavor (segment 9), and Chocolate flavor (segment 6). However, a large part of the respondents, i.e., 30.33%, did not prefer the flavors. Our study supports the findings by Chaffee et al. (2023) where the large number of participants using marijuana did not prefer any flavors followed by candy/dessert flavors, and icy/frost/menthol flavors.

The results of the marginal effects estimation also supported that age, education, income status, gender, frequency of use, and people's conservative or liberal attitude are the main determinants of CBD usage behavior and the selection of CBD oil flavors. There may still be other determinants that we need to look into in our study. So, future research should be focused on considering information related to consumer motivation that goes well beyond demographic characteristics and usage frequency. Similarly, as the sample of our research was limited, the study can be expanded to a broader range of consumers to be more precise regarding the consumer purchase decision for several flavors of CBD oil. Still, our study generalizes consumer

segmentation and the drivers of CBD oil flavor selection. So, our results can be used by the stakeholders in the CBD oil industry for the sustainable marketing of CBD oil that includes broader consumer segments.

CHAPTER 6

CONCLUSION

The hemp plant was subject to scrutiny for a longer period, and the production and marketing of hemp-based items were prohibited until 2018 by the Controlled Substance Act. Despite the recent increase in attention towards the hemp plant and its derivatives, such as CBD oil, more research in this area still needs to be conducted, which has hindered the production and marketing of these commodities. Thus, understanding consumer purchase decisions regarding CBD oil flavors is critical in promoting the marketing of CBD oil.

To investigate the marketing aspects of different CBD oil flavors and consumer purchase decisions, a survey-based questionnaire was used to collect information on demographic characteristics and CBD oil usage behavior. Using clustering algorithms, eleven distinct CBD oil markets were identified based on the flavored CBD oil purchased. The study revealed consumer preferences for different CBD oil flavors available in the market and their respective market shares.

Our results also found that consumers were most likely to purchase citrus flavor, followed by mint and other fruit flavors, and chocolate flavor. These results were consistent even among non-buyers considering buying CBD oil in the future, except that citrus flavor was replaced by fruit flavor among future buyers who also showed preferences for dessert and nut-flavored CBD oil.

According to Campbell et al., (2004), estimating the marginal effects of cluster membership using demographic features helps not only identify the clusters according to their preferences for the flavors but also by the criteria that can be applied in actionable marketing

techniques. For instance, consumers who would purchase mint-flavored CBD oil cannot be identified by their appearance, and it is better to characterize them as relatively older consumers in urban regions of the United States. Our results found that younger consumers in rural regions of the United States were less likely to purchase mint-flavored CBD oil, which can be used as a marketing reference. This information on the preference for CBD oil flavors according to demographic features of consumers can help marketing managers in the CBD oil industry to target their customers before launching any flavored CBD products.

Overall, by providing ideas on consumer preferences for CBD oil flavors and their demographic characteristics, our research helps inform marketing strategies and aid the development of new flavored CBD oil products.

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APPENDICES

APPENDIX I: Identifying cluster numbers for buyers using Calinski/Harabasz and Duda/Hart clustering technique

Number of Clusters	Calinski/Harabasz pseudo-F	Duda/Hart Je(2)/Je(1)	Duda/Hart Pseudo T-squared
1		0.8643	59.67
2	59.67	0.8957	37.15
3	55.29	0.9022	31.55
4	52.61	0.7937	35.08
5	52.18	0.8378	29.83
6	52.37	0.7104	37.50
7	53.51	0.6287	40.74
8	54.78	0.6248	36.02
9	55.95	0.7511	26.84
10	57.87	0.6392	25.96
11	59.19	0.7131	20.92
12	59.60	0.6965	11.33
13	59.98	0.6751	15.88
14	59.53	0.5358	25.12
15	59.52	0.6137	13.85

APPENDIX II: Market segmentation of buyers according to their purchased CBD oil flavors

Flavors	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	Seg 9	Seg 10	Seg 11
Fruit	8	9	0	31	**100**	39	29	0	29	75	0
Berry	8	17	0	31	33	22	0	**100**	18	71	0
Mint	**100**	31	4	31	11	4	14	13	0	57	0
Dessert	0	9	0	**100**	0	13	0	13	12	75	0
Nut	11	17	0	4	0	6	0	10	**100**	43	0
Citrus	19	23	0	0	3	**98**	3	13	0	71	0
Food	0	**100**	**0**	12	19	9	9	0	6	71	0
Chocolate	0	9	0	0	0	28	**100**	48	24	**100**	0
Other	0	0	**100**	0	0	2	3	0	0	0	0
Not Remember	0	0	4	0	0	0	0	0	0	4	**100**
Market Share	9.42%	9.16%	6.02%	6.81%	9.42%	14.14%	9.16%	8.12%	4.45%	7.33%	15.97%

APPENDIX III: Identifying cluster numbers for non-buyers using Calinski/Harabasz and Duda/Hart clustering technique

Number of Clusters	Calinski/Harabasz pseudo-F	Duda/Hart Je(2)/Je(1)	Duda/Hart Pseudo T-squared
1		0.7641	184.63
2	184.63	0.8622	66.47
3	154.58	0.8224	40.81
4	129.98	0.8590	36.92
5	119.38	0.7251	44.37
6	116.01	0.8349	34.01
7	115.65	0.7848	34.28
8	117.01	0.7782	27.07
9	117.18	0.6932	38.51
10	116.61	0.7716	20.42
11	116.81	0.7120	28.32
12	116.84	0.5883	27.29
13	115.58	0.5764	32.33
14	114.66	0.5085	49.30
15	114.35	0.7773	11.17

APPENDIX IV: Market segmentation of non-buyers according to their preference for CBD oil flavors

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Seg 8	Seg 9
Fruit	0	4	10	0	0	32	**100**	**100**	31
Berry	0	8	4	3	23	0	**87**	46	**100**
Mint	**0**	0	13	0	**100**	0	**73**	22	0
Dessert	0	0	55	0	4	8	57	0	25
Nut	0	0	44	0	2	0	27	7	**6**
Citrus	0	**100**	14	0	23	21	**73**	44	8
Food	0	0	35	0	4	0	23	8	11
Chocolate	0	0	24	0	19	**100**	**97**	0	39
Other	0	0	0	**100**	0	0	0	0	0
Not Remember	**100**	15	1	3	4	2	0	2	0
Market Share	30.33%	4.33%	11.83%	5.00%	7.83%	8.83%	5.00%	14.83%	12.00%

APPPENDIX V: Multinomial logit regression for Buyers

Variable	1	2	3	4	5	6	7	8	9	10	11 (base)
genx	1.187* (0.669)	1.067 (0.846)	-1.416 (1.132)	1.142 (1.012)	2.036** (0.982)	1.007 (0.762)	1.043 (0.892)	1.277* (0.712)	1.163 (1.155)	2.718** (1.26)	
mill	0.81 (0.677)	1.939*** (0.75)	-1.093 (1.184)	2.086** (0.867)	2.839*** (0.916)	2.078*** (0.675)	1.988** (0.78)	1.389** (0.68)	2.471*** (0.958)	3.672*** (1.177)	
genz	0.953 (0.729)	2.022*** (0.778)	-1.571 (1.28)	2.656*** (0.864)	3.41*** (0.934)	2.897*** (0.695)	2.974*** (0.808)	0.265 (0.81)	1.778* (1.072)	4.198*** (1.189)	
male	-0.274 (0.481)	0.847 (0.542)	-0.127 (0.561)	0.809 (0.598)	0.52 (0.524)	-0.066 (0.453)	-0.018 (0.511)	-0.121 (0.502)	-0.068 (0.645)	0.498 (0.563)	
hhinc_10	0.004 (0.053)	0.032 (0.051)	0.037 (0.054)	0.05 (0.054)	0.022 (0.054)	0.048 (0.047)	0.09* (0.049)	0.093* (0.049)	0.046 (0.061)	0.055 (0.053)	
eduhsorless	0.206 (0.746)	-0.087 (0.788)	-1.226 (0.844)	-0.926 (0.844)	-0.029 (0.82)	0.149 (0.753)	0.171 (0.818)	-0.605 (0.757)	-0.067 (0.97)	-0.474 (0.806)	
edusomecoll	0.354 (0.713)	-0.869 (0.842)	-0.918 (0.729)	-0.768 (0.816)	0.124 (0.793)	0.631 (0.71)	0.44 (0.786)	-0.563 (0.724)	-1.232 (1.112)	-1.657* (0.925)	
edugrtbs	-0.185 (0.873)	1.051 (0.817)	-0.765 (0.809)	0.178 (0.863)	0.66 (0.858)	0.988 (0.787)	0.679 (0.851)	-0.77 (0.867)	1.238 (0.975)	0.393 (0.839)	
primmed	0.378 (0.709)	-0.068 (0.694)	-0.427 (1.346)	0.323 (0.741)	1.445* (0.803)	0.491 (0.63)	0.802 (0.701)	0.057 (0.723)	-0.605 (0.841)	0.963 (0.822)	
howfreqused	-0.561*** (0.179)	-0.755*** (0.201)	-0.179 (0.199)	-0.774*** (0.223)	-0.561*** (0.192)	-0.678*** (0.168)	-0.336* (0.187)	-0.433** (0.182)	-0.545** (0.241)	-0.579*** (0.206)	
Numchildu18	0.459** (0.226)	0.481** (0.227)	-0.658 (0.581)	0.327 (0.24)	0.414* (0.223)	0.295 (0.218)	0.42* (0.227)	0.322 (0.244)	-0.029 (0.292)	0.445* (0.229)	
numadultgre18	-0.077 (0.218)	0.057 (0.219)	0.007 (0.341)	0.173 (0.225)	0.17 (0.212)	0.057 (0.203)	0.101 (0.216)	-0.252 (0.248)	0.378 (0.244)	0.185 (0.222)	

rural	-1.394* (0.719)	0.016 (0.702)	0.057 (0.789)	-0.167 (0.747)	-1.07 (0.734)	-0.89 (0.667)	-1.748** (0.834)	0.656 (0.76)	-0.595 (0.858)	-0.119 (0.81)
suburban	-0.592 (0.571)	-0.568 (0.643)	-0.567 (0.745)	-0.78 (0.675)	-0.851 (0.604)	-0.422 (0.547)	-0.769 (0.587)	0.784 (0.683)	-1.431* (0.812)	0.165 (0.683)
race_white	-0.115 (0.624)	-0.162 (0.623)	0.526 (1.262)	-1.145* (0.647)	-0.332 (0.606)	0.201 (0.554)	-0.288 (0.61)	-0.96 (0.626)	-0.427 (0.758)	-0.088 (0.664)
si_lib	0.041 (0.116)	-0.105 (0.124)	0.002 (0.133)	0.075 (0.135)	-0.014 (0.121)	-0.025 (0.108)	-0.166 (0.125)	-0.002 (0.121)	-0.209 (0.158)	0.004 (0.132)
Constant	0.551 (1.443)	-0.159 (1.51)	0.828 (2.119)	-0.693 (1.623)	-2.706 (1.674)	-0.786 (1.397)	-1.847 (1.6)	0.256 (1.504)	0.118 (1.883)	-3.808** (1.895)

Mean dependent var	6.230	SD dependent var	3.269
Pseudo r-squared	0.168	Number of obs	382
Chi-square	300.250	Prob > chi2	0.000
Akaike crit. (AIC)	1826.446	Bayesian crit. (BIC)	2497.167

*** *p<.01,* ** *p<.05,* * *p<.1*

APPENDIX VI: Multinomial logit regression for Non-Buyers

Variables	1 (base)	2	3	4	5	6	7	8	9
genx		0.711	-0.156	-1.318	-0.482	0.26	1.043*	-0.038	0.686
		(0.694)	(0.482)	(0.827)	(0.689)	(0.509)	(0.601)	(0.444)	(0.425)
mill		0.344	0.478	-1.608	0.656	0.538	-0.027	0.028	0.252
		(0.766)	(0.415)	(1.123)	(0.488)	(0.463)	(0.851)	(0.421)	(0.472)
genz		1.334**	-0.037	-0.386	0.694	0.082	1.15**	0.137	0.57
		(0.62)	(0.434)	(0.734)	(0.468)	(0.488)	(0.555)	(0.376)	(0.431)
male		0.236	0.436	0.199	0.027	-0.44	0.083	0.199	0.024
		(0.443)	(0.299)	(0.439)	(0.345)	(0.345)	(0.419)	(0.271)	(0.296)
hhinc_10		0.026	0.076***	0.068	0.031	0.043	0.045	-0.001	0.008
		(0.041)	(0.027)	(0.042)	(0.033)	(0.032)	(0.036)	(0.028)	(0.029)
eduhsorless		0.405	-0.301	-0.25	-1.198**	0.067	-1.24**	-0.99**	-0.532
		(0.662)	(0.476)	(0.649)	(0.529)	(0.542)	(0.601)	(0.394)	(0.433)
edusomecoll		0.023	0.158	0.278	-0.501	0.45	-0.69	-0.741**	-0.337
		(0.698)	(0.457)	(0.603)	(0.469)	(0.515)	(0.528)	(0.376)	(0.407)
edugrtbs		-0.238	0.121	-0.078	-0.47	0.43	-1.622*	-0.593	-0.488
		(0.824)	(0.474)	(0.696)	(0.503)	(0.533)	(0.829)	(0.419)	(0.485)
primmed		0.345	0.146	-0.451	0.502	0.269	0.076	0.477	-0.216
		(0.591)	(0.419)	(0.721)	(0.529)	(0.493)	(0.586)	(0.41)	(0.427)
Numchildu18		0.098	0.104	-0.16	0.151	0.178	-0.356	0.181*	0.068
		(0.164)	(0.113)	(0.351)	(0.13)	(0.125)	(0.257)	(0.107)	(0.141)
numadultgre18		-0.214	0.206*	-0.539*	0.057	-0.123	0.201	-0.119	-0.245
		(0.215)	(0.113)	(0.317)	(0.137)	(0.15)	(0.157)	(0.123)	(0.162)

rural	0.085 (0.619)	0.523 (0.402)	1.536** (0.643)	-0.12 (0.513)	-0.486 (0.456)	-0.792 (0.858)	0.252 (0.391)	0.436 (0.432)
suburban	-0.311 (0.517)	-0.716** (0.364)	-0.294 (0.66)	-0.444 (0.396)	-1.136*** (0.382)	0.172 (0.503)	-0.238 (0.32)	0.105 (0.365)
race_white	0.2 (0.504)	-0.096 (0.346)	0.894 (0.718)	0.326 (0.409)	0.044 (0.383)	0.028 (0.475)	-0.382 (0.305)	1.144*** (0.4)
si_lib	-0.183 (0.129)	-0.064 (0.082)	-0.296** (0.127)	-0.056 (0.094)	-0.179* (0.093)	-0.014 (0.114)	0.02 (0.074)	0.072 (0.078)
Constant	-2.255* (1.182)	-1.968** (0.792)	-0.86 (1.355)	-1.75* (0.903)	-0.725 (0.892)	-2.265** (1.086)	-0.267 (0.7)	-1.606** (0.802)
Mean dependent var			4.483	SD dependent var				3.010
Pseudo r-squared			0.081	Number of obs				600
Chi-square			194.946	Prob > chi2				0.000
Akaike crit. (AIC)			2462.664	Bayesian crit. (BIC)				3025.471

*** *p<.01,* ** *p<.05,* * *p<.1*