

College Athletes Use of Cannabidiol (CBD) Products: A Case Study Using the Theory of Planned Behavior

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College Athletes Use of Cannabidiol (CBD) Products: A Case Study Using the Theory of Planned Behavior

Abstract

Over the last decade, there has been a rapid emergence of cannabidiol (CBD) products in the United States. Produced from cannabis, CBD is a non-intoxicating cannabinoid that has been promoted in health, wellness, and sports industries, despite limited clinical research, high rates of inaccurate product labeling, and often misleading claims on the effectiveness of CBD. However, emerging research has shown promise of CBD to offer health benefits, and its popularity has largely supported the newly legal hemp industry in the United States. The theory of planned behavior (TPB) was used to guide a case study at a small university to explore college athletes' (n = 272) use and perceptions of CBD. Our findings indicated approximately 40% of college athletes used CBD in the last 90 days, mostly in the form of gummies/edibles (59.1%) and smokables/vaporizers (55.7%). Respondents who were CBD users indicated they consumed these products to relieve stress (68.7%), improve sleep (55.7%), and reduce muscle inflammation (53.9%). Most college athletes (63.5%) were using friends or family members to inform their decision to purchase and consume CBD over advice from a medical doctor or health professional (8.7%). Lastly, TPB variables (attitude, subjective norm, perceived behavioral control) were significant in the development of a model that could be used to explain 53% of the variance in college athletes' future intent to purchase and consume CBD products. Based on our results, we provide recommendations for health communication campaigns for college athletes.

Keywords

Cannabidiol, cannabis, CBD, college athletes, college students, theory of planned behavior

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Introduction

Agricultural hemp has expanded globally as a crop used to produce fiber, grain, and cannabinoids (Jeliazkov et al., 2019). Since the 2018 Farm Bill declassified hemp as a Schedule 1 Drug in the United States, it has gained considerable attention as an alternative crop for American farmers (Johnson, 2018). In fact, the United States Department of Agriculture (USDA) valued industrial hemp at \$291 million USD in 2023 (USDA, 2024). The value of floral hemp to produce cannabinoids was valued at \$241 million USD alone, indicating the hemp market is majorly driven by cannabinoids over fiber or grain in the United States (USDA, 2024). The intoxicating compound, Tetrahydrocannabinol (THC), is one of the most recognized major cannabinoids found in cannabis. However, hemp is required by U.S. law to contain no more than 0.3% THC on a dry-weight basis (Johnson, 2018). The major cannabinoid sought through floral hemp production is cannabidiol, commonly known as CBD. Unlike THC, CBD does not cause an intoxicating effect when consumed and hemp-derived CBD is legal across the United States. CBD is primarily marketed and consumed for health purposes, despite most of these products not being regulated by the U.S. Food and Drug Administration (U.S. Centers for Disease Control and Prevention, 2024).

However, clinical research on the effectiveness of CBD as a medical therapeutic is still progressing. Emerging medical research has shown potential for CBD to be beneficial in a variety of medical applications (Bonaccorso et al., 2019; Sholler et al., 2020; White, 2019), including reducing inflammation (Pagano et al., 2023), stress and anxiety (Lookfong et al., 2023), and insomnia (Ranum et al., 2023). As a prescribed medical product, the FDA has approved Epidiolex, a CBD derivative, for the treatment of Lennox-Gastaut Syndrome, a rare form of epilepsy (Sholler et al., 2020).

Claims on the use of over-the-counter CBD products for a wide variety of health and wellness benefits are commonly expressed in online media (Leas et al., 2020; White, 2019). These products can range from cosmetics and oils to infused beverages (Miller et al., 2022; Mouton et al., 2024). While many individuals are using CBD, product labeling, potency, and health claims may be misleading for over-the-counter food and supplement products (Bonn-Miller et al., 2017). The U.S. Food and Drug Administration (FDA) believes the current regulatory framework for approving dietary and food additives would not be appropriate for CBD products, and while they do monitor the CBD market, they do not approve any commercially available CBD products for use (Woodcock, 2023). The FDA tested nearly 150 CBD products that are commercially available to consumers and found nearly half of the products contained THC in some amount, and around 50 of the tested products had inaccurate amounts of CBD when compared to the product label (Covington, 2020). Bonn-Miller et al. (2017) purchased and tested 84 CBD products from 31 different online companies. The study team found only 30% of the products were labeled accurately and all other products were either over or under labeled.

Consumer perspective of CBD is a growing area of interest among researchers in the health and sports disciplines (Kulpa et al., 2024; Nguyen et al., 2023). While some researchers have attempted to understand consumer knowledge and perspectives related to the health and safety of consuming CBD products (Nguyen et al., 2023), others have focused on methods of

consumption and reasons for use among individuals in the sports community (Kulpa et al., 2024). Online searches for CBD products increased nearly 200% between 2016 and 2019, and cannabis was found to be one of the most used substances among elite athletes (Leas et al., 2019; McDuff et al., 2019). Athletes have also reported using CBD for a variety of reasons including relaxation, sleep improvement, and reducing pain and inflammation (Bennett, 2022; Jean, 2023; Kasper et al., 2020).

The expansion of the CBD market has been particularly visible within the professional sports industry (Barnett, 2022), where star athletes (e.g., Mike Tyson) have launched their own CBD brands or have endorsed CBD companies (e.g., Rob Gronkowski). According to Burr et al. (2021) the use of CBD is becoming more evident amongst the athletic community, in part, due to its reputation for having a positive impact on athletic performance and recovery. Zeiger et al. (2019) investigated age related differences for CBD use by athletes and found younger athletes consumed edibles, smokables, and vaporizers more than older athletes. Younger athletes were also found to consume cannabinoids more often for both recreational and medical purposes, as opposed to older athletes consuming them for mostly medical purposes (Zeigar et al., 2019).

Risk communication on cannabis has focused predominately on marijuana over CBD. In a scoping review of cannabis risk communication, Madson (2024) identified and summarized cannabis risk communication articles finding they fell into the research areas of physician/patient interaction, social media, and cannabis-related businesses. While these studies provided important findings, additional research is needed to guide effective health risk communication on cannabis, including CBD. Willoughby et al. (2024) found that college students' exposure to pro or anti-cannabis social media messages was associated with their intention to use cannabis. The researchers recommended framing cannabis messages on outcome beliefs and perceived norms to influence constructs associated with cannabis use intentions. Health risk communication that is tailored to audience characteristics can enhance message effectiveness. Tailoring health communication requires understanding of individuals' attitudes and perceptions toward the health behavior (Jacob et al., 2010). Additionally, applying theoretical frameworks to guide health risk communication is recommended in this endeavor (Frewer et al., 2016).

In this study, we obtained baseline survey data on CBD use and perceptions from a population of college student athletes at a small college in the Midwest, United States. We identified college student athletes' prior use of CBD products, as well as why CBD was consumed and information sources used to inform consumption decisions. Furthermore, we used the theory of planned behavior as a framework to identify CBD perceptions and future intentions to use CBD from all student athletes (CBD users and non-users) in our sample. We believe the data presented in our findings can guide health communication for college athletes to address potential misinformation and promote science-backed information on hemp compounds like CBD.

Theoretical Framework

Ajzen and Fishbein's (1980) theory of planned behavior (TPB) was used to guide this study. According to the TPB, individual behavior toward a specific activity is highly influenced by their intention to complete that behavior. Furthermore, the TPB asserts an individual's

behavioral intention can be predicted by three primary factors: (1) their attitude toward the behavior, (2) their subjective normative belief toward the behavior, and (3) their perceived behavioral control to complete the behavior (Ajzen, 2020). The TPB has been heavily used as a framework to guide research on public health and substance use (Goulet et al., 2010; Jeihooni et al., 2021; Samoggia & Rezzaghi, 2021; Shmueli, 2021).

Due to the controversial nature of cannabinoid consumption, in part, due to its association with marijuana, wide variability in perceptions toward CBD may exist. Although CBD consumption is federally legal and does not cause intoxicating effects when consumed, misconceptions between marijuana and hemp have been reported (Colclasure et al., 2021; Rampold et al., 2021). The TPB can provide context to how variability of perceptions (attitude, subjective norm, perceived behavior control) influence intention to consume CBD.

Prior research on factors related to CBD consumption is limited, however, research published in 2019 found 14% of Americans have tried CBD oil to relieve pain, anxiety, and insomnia (Brenan, 2019). This number has been reported to be much higher in young adults. Wheeler et al. (2020) reported approximately 40% of young adults have used CBD products. However, college student athletes' attitudes and other perceptions toward CBD is not clear (Zeigar et al., 2020).

In addition to surveying college athletes on their prior use of CBD, reasons for use, and information sources to guide consumption, we included constructs found within the TPB in our study. Specifically, we measured college athletes' attitude toward CBD consumption, subjective normative belief toward CBD consumption, and perceived behavioral control to purchase and consume CBD. These variables, along with several demographical variables, were then used to build a predictive model on CBD consumption intention. According to Fishbein and Cappella (2006), predictive models based on behavioral theory can be used to inform health communication strategies by identifying the beliefs that should be targeted in persuasive communication. Results from predictive modeling based on the TPB in conjunction with prior CBD use frequency data (i.e. type of CBD product consumed, reasons for use, information sources) can provide guidance to health communication targeting student athletes.

Research Purpose and Objectives

As CBD is the leading agricultural product from industrial hemp (USDA, 2024), understanding public perception and use of CBD is important for the long-term vitality of the hemp industry. Additionally, as CBD branding expands in the sports industry with claims to improve sport performance and recovery, despite CBD being unregulated by the FDA, it is essential to understand its current use/misuse in the student athlete community. The purpose of this case study conducted at a small university in the Midwest, United States, was to explore college student athletes' perceptions and use of CBD products. We believe this information can be used to guide health communication campaigns. This study was guided by the following objectives:

1. Identify college athletes' previous use of CBD products.
2. Identify reasons college athletes have used CBD products.

3. Identify information sources that were used by college athletes to inform their CBD consumption.
4. Identify college athletes' attitudes, subjective normative beliefs, perceived behavioral control, and future intentions toward purchasing and consuming CBD products.
5. Determine factors that predict college athletes' future intention to purchase and consume CBD products.

Methods

Quantitative survey methods were used for this study, and all data were collected in March of 2023. Prior to data collection, the study was approved by the Doane University Institutional Review Board (S23 001 DC IRB HS). Due to the potentially sensitive nature of the survey data, which includes reporting of substance use by student athletes, this study was reviewed by the athletic director at Doane University and the National Association of Intercollegiate Athletics' (NAIA) Director of Student-Athlete Experience and Development to ensure student athletes would not be negatively impacted by participating in this study. A disclaimer provided by NAIA was added to the end of the study stating the NAIA does not support or condone the use of CBD products.

The population for this study was all student athletes at Doane University who were part of 20 athletic teams competing in the Great Plains Athletic Conference during the 2022-2023 season. Doane University is a small liberal arts university located in Crete, Nebraska, USA. The university is in a rural setting, and at the time of the study recreational and medical marijuana were illegal in the state. A total of 597 student athletes were determined as the population via team rosters. All 597 student athletes were invited to participate in the study either through in-person contact or email communication, and therefore a census was sought. We determined in-person contact would improve participant response rates over email communication. Therefore, all coaches were contacted via email with a request for us to survey their athletes at the beginning or end of a team practice or meeting. All but three coaches agreed to this request, and therefore most respondents were recruited in-person and voluntarily participated in the survey at the time of recruitment. These students were provided a paper copy of the survey. To reduce coercion in survey participation, coaches were asked to leave the room, and students were told individual responses would not be shared with anyone beyond the research team. Student athletes from remaining teams were contacted individually via an email that requested their voluntary participation and included a digital survey link through Qualtrics. Informed consent was collected from each participant prior to them taking the survey.

The survey instrument developed included 32 questions. Four scales were used to measure the four constructs within the theory of planned behavior (attitude, perceived behavioral control, subjective normative belief, future intention). Attitudes toward purchasing and using CBD products were collected through an eight-item, five-point, bipolar, semantic differential scale. The scale consisted of eight sets of adjectives (e.g., *Good/Bad*, *Beneficial/Not Beneficial*, *Important/Unimportant*, etc.) and respondents selected the point between each set of adjectives that best aligned to their opinion toward purchasing and using CBD products. The same scale was used in similar studies measuring attitudes toward purchasing industrial hemp products

(Ruth et al., 2022). Post-hoc scale reliability was analyzed and a Cronbach's alpha of .90 was found, and therefore above .70 and considered reliable (Field, 2013).

Participants' perceived behavioral control or the perception of their own ability to purchase and use CBD products was assessed by a scale containing six statements (e.g., I would easily be able to find CBD products if I wanted to, I would easily be able to afford to purchase CBD products if I wanted to, etc.). For each statement, respondents indicated their extent of agreement using a five-point, Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Post-hoc internal scale reliability was found ($\alpha = .84$).

Participants' subjective normative beliefs or their perspectives toward how other individuals view purchasing and consuming CBD products was assessed through a five-item, five-point, Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Example statements include "most people who are important to me think that I should purchase and use CBD products" and "most people who are similar to me purchase and use CBD products." Post hoc internal scale reliability was found ($\alpha = .84$).

Future intent to purchase CBD products was determined by four statements (e.g., I expect to purchase CBD products, I want to purchase CBD products, etc.). For each statement, respondents indicated their extent of agreement using a five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Post-hoc scale reliability was analyzed and a Cronbach's alpha of .98 was found. All scale means were interpreted using true limits (Lindner & Linder, 2024).

Consumption of CBD products was assessed by one yes-or-no question, which asked respondents if they had consumed CBD products in the last 90 days. Respondents who indicated having consumed CBD in the last 90 days were then directed to three follow up, select-all-that-apply matrices. The first matrix asked participants to indicate the CBD product-type(s) consumed. Eight options (e.g., oils or tinctures, capsules or pills, gummies, etc.) were provided based upon product-types found on extensive web searches, in addition to the option of "other." The second matrix asked participants to indicate their reasoning to have consumed the CBD product(s). Eight options (e.g., stress relief, muscle recovery or inflammation, etc.) were provided based on prior literature (Brenan, 2019) and web searches, in addition to the option of "other." The third, select-all-that-apply matrix asked participants to indicate their source of information used to inform their CBD purchasing decision (e.g., medical doctor, friends or family members, etc.). The last section of the survey asked respondents to indicate their gender, race and ethnicity, and year of academic standing (Freshman, Sophomore, Junior, Senior, 5th-year). Each participant also indicated their sports team at the conclusion of the survey.

A panel of three experts, who were not a part of the research team, reviewed the full survey for face and content validity. The experts included a director of a university health and human performance program, a medical doctor with extensive knowledge of CBD, and an assistant professor of agricultural communication with survey design experience. After expert review, a pilot test was conducted with approximately 30 students who were not student athletes to inform final survey development.

Paper surveys were converted to an electronic format through Qualtrics. Data were then transferred to and analyzed in SPSS Statistics version 26. Frequencies were used to address Objectives 1, 2, and 3. Means and standard deviations were used for Objective 4, and a multiple linear regression was used for Objective 5. Significance was established *a priori* at $p < .05$. Variables included in the linear regression were checked for tolerance, variance inflation factor (VIF), and normality. All variables demonstrated a tolerance above .1 and a VIF of less than 10, indicating no concerns for multicollinearity (Miles, 2014). Variables fell within acceptable ranges (+/-2) for skewness and kurtosis (George & Mallery, 2010).

Results

A total of 284 responses were received, a 47.6% response rate. Of the 284 responses received, 12 respondents dropped the study, resulting in 272 usable responses and a 95% survey completion rate. Respondents were mostly male ($n = 178$; 65.4%) and identified as White ($n = 236$; 86.8%). Thirty student-athletes (11%) identified having a Spanish, Hispanic, or Latino ethnicity. Seventy-three respondents (27.3%) held a junior academic standing, followed by Freshman ($n = 70$; 26.2%), Sophomore ($n = 70$; 26.2%), Senior ($n = 42$; 15.7%), and athletes who had 5th-year eligibility ($n = 9$; 3.4%).

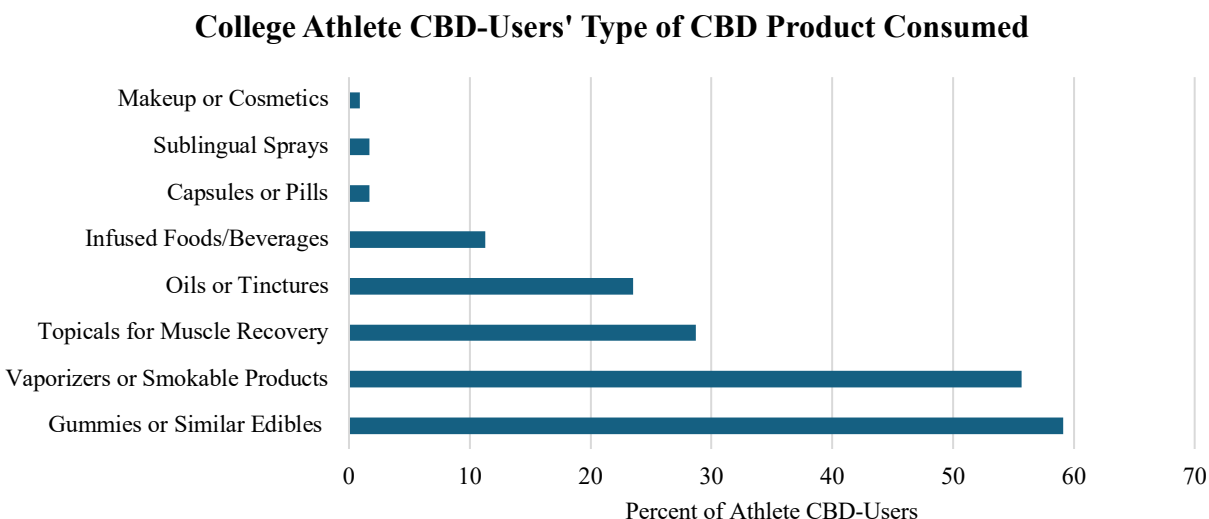
Objective 1: Identify College Athletes' Previous Use of CBD Products

We described “previous use” as CBD products being consumed in the last 90 days from the time of survey completion. Of the 272 responses received, 157 (57.5%) college athletes indicated not having consumed CBD products in the last 90 days, and 115 (42.3%) indicated having consumed them.

For respondents who indicated having used CBD products, follow-up questions were used to further investigate CBD use. Over half of these respondents indicate consuming CBD in the form of CBD gummies (68; 59.1%) and in the form of vaporizers or smokable products (64; 55.7%). Figure 1 illustrates the frequency of CBD products consumed by student athletes who have used CBD products in the past 90 days.

Figure 1

College Athlete CBD-Users' (n = 115) Type of CBD Product Consumed in the Last 90 Days

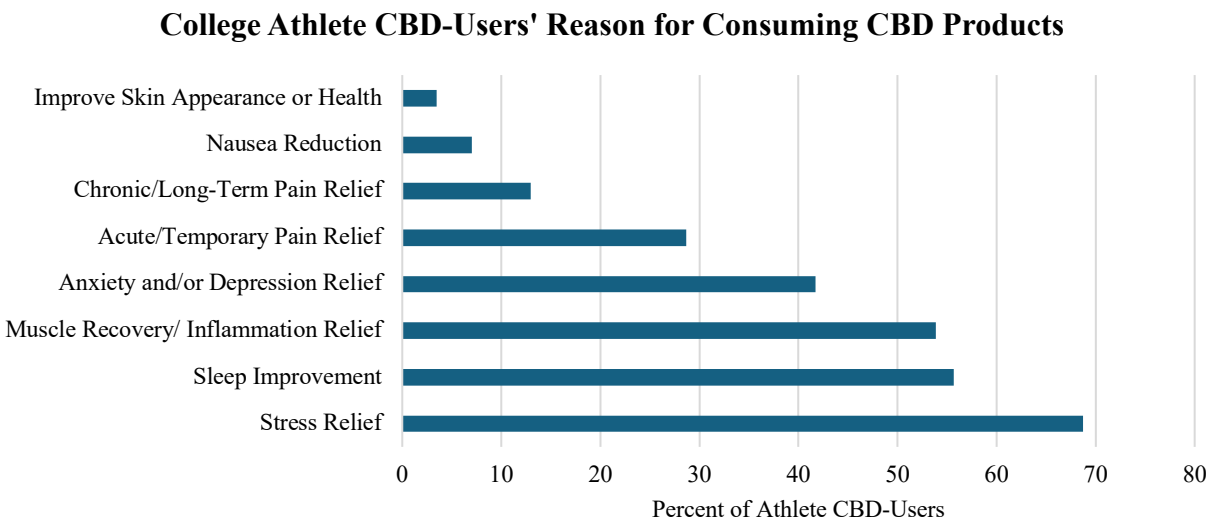


Objective 2: Identify Reasons College Athletes Have Used CBD Products

Respondents who selected using CBD products in the last 90 days were asked to identify the reason CBD products were consumed. Over half of CBD consumers indicated using CBD for stress relief ($n = 79$; 68.7%), sleep improvement ($n = 64$; 55.7%), and muscle recovery or inflammation relief ($n = 62$; 53.9%). Frequencies of reasons for use by CBD consumers can be seen in Figure 2.

Figure 2

College Athlete CBD-Users' (n = 115) Reason for Consuming CBD Products in the Last 90 Days

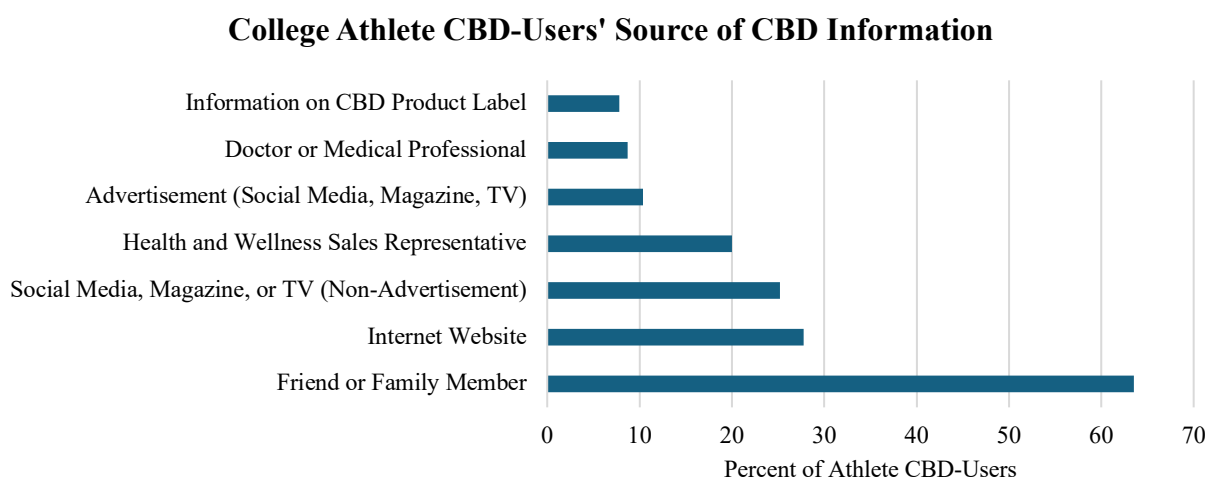


Objective 3: Identify Information Sources that were Used by College Athletes to Inform their CBD Consumption

Respondents were asked to identify sources of information they used to inform their purchasing decision. The most common source of information was a friend or family member ($n = 73$; 63.5%), followed by Internet websites ($n = 32$; 27.8%). Interestingly, only 10 respondents (8.7%) indicated a doctor or medical professional as a source of information used to inform their purchasing decision. Frequencies of source of information can be seen in Figure 3.

Figure 3

College Athlete CBD-Users' ($n = 115$) Source of Information to Guide CBD Consumption



Objective 4: Identify College Athletes' Attitudes, Subjective Normative Beliefs, Perceived Behavioral Control, and Future Intentions toward Purchasing and Consuming CBD Products

Data from all college athlete participants ($n = 265$) were used to determine attitudes, subjective normative beliefs, perceived behavioral control, and future intentions toward purchasing and consuming CBD products.

Attitudes

Overall, respondents' attitude toward CBD consumption was found to be 3.07 ($SD = 0.79$), which can be interpreted as neutral. Results for individual items in the 5-point scale indicate, on average, respondents believed consuming CBD products to be more *Good* than *Bad* ($M = 3.50$, $SD = 1.01$), to be more *Acceptable* than *Unacceptable* ($M = 3.73$, $SD = 1.17$), and to be more *Beneficial* than *Not Beneficial* ($M = 3.53$, $SD = 1.17$). However, respondents believed consuming CBD products was *Not Essential* over *Essential* ($M = 2.50$, $SD = 1.05$). Participant responses for each of the adjective pairs used to measure attitude toward CBD consumption is shown in Table 1.

Table 1*College Athletes' (n = 265) Attitudes Toward the Consumption of CBD Products*

Adjective Pair ^a	<i>M</i>	<i>SD</i>
Acceptable / Unacceptable	3.73	1.12
Beneficial / Not Beneficial ^b	3.53	1.17
Good / Bad	3.50	1.01
Positive / Negative	3.42	1.06
Important / Unimportant ^b	2.73	0.97
Crucial / Trivial	2.61	0.89
Necessary / Unnecessary	2.57	0.97
Essential / Not Essential	2.50	1.05
Scale Average	3.07	0.79

Note. ^a Items were coded so that positive adjectives were a 5 and negative adjectives were a 1. ^b Indicates an adjective pair that was reversed ordered in the instrument.

Subjective Normative Beliefs

Respondents' subjective normative beliefs were measured through a 5-point Likert scale consisting of four statements. The scale average indicated respondents believed others held slightly negative perceptions toward them purchasing and consuming CBD ($M = 2.48$, $SD = 0.86$). The statement with the highest extent of agreement was "people who are similar to me purchase and use CBD products," with 28.7% of respondents agreeing or strongly agreeing. The statement with the lowest extent of agreement was "it is expected that I purchase and consume CBD products," with nearly three-fourths of respondents indicating they strongly disagreed or disagreed. Aggregated frequencies for responses for each statement are presented in Table 2.

Table 2*College Athletes' Extent of Agreement on Subjective Normative Belief Statements Toward Purchasing and Consuming CBD Products*

Item	<i>n</i>	Strongly Disagree / Disagree		Neither Agree nor Disagree		Agree / Strongly Agree	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Most people who are important to me think that I should purchase and use CBD products.	272	137	50.3	110	40.4	25	9.2
It is expected that I purchase and use CBD products.	272	203	74.6	53	19.5	16	5.9
Most people who are important to me purchase and use CBD products.	272	141	51.8	76	27.9	55	20.2
People who are similar to me purchase and use CBD products.	270	97	35.6	95	34.9	78	28.7

The people in my life whose opinions I value would approve of me purchasing and using CBD products.	271	109	40.1	86	31.6	76	28.0
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Perceived Behavioral Control

Five statements and a five-point Likert scale were used to measure respondents' perceived behavioral control to purchase and use CBD products. The scale average of responses indicated college athletes agreed they have a high level of control to purchase and use CBD products ($M = 4.18$, $SD = 0.72$). The statement with the lowest level of agreement was "I would be able to afford to purchase CBD products if I wanted to," with 65% of respondents agreeing or strongly agreeing, indicating the perceived cost of CBD products could be a barrier for some athletes. However, more than three-quarters of respondents agreed or strongly agreed with all other statements, illustrating strong belief of control to purchase and consume CBD if they desired. Each statement and aggregated responses are shown in Table 3.

Table 3

College Athletes' Extent of Agreement on Perceived Behavioral Control Statements Toward Purchasing and Consuming CBD Products

Item	<i>n</i>	Strongly Disagree / Disagree		Neither Agree nor Disagree		Agree / Strongly Agree	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
I am confident that I could purchase and use CBD products if I wanted to.	272	25	9.1	33	12.1	214	78.7
The decision to purchase and use CBD products is in my control.	272	7	2.6	19	7.0	246	90.4
Whether or not I purchase and use CBD products is entirely up to me.	272	4	1.5	18	6.6	250	91.9
I would easily be able to find CBD products to purchase if I wanted to.	272	19	7.0	36	13.2	217	79.8
I would be able to afford to purchase CBD products if I wanted to.	272	23	8.4	72	26.5	177	65.1

Future Intention

Future intention to purchase and use CBD products was measured by four items using a 5-point Likert scale. On average, respondents' scale average for their future intent to purchase and use CBD products was neither likely nor unlikely ($M = 2.67$). However, a large variance was found ($SD = 1.21$), indicating inconsistencies across respondents. Over a quarter of respondents agreed or strongly agreed on each item related to future intent to purchase and use CBD products (e.g., I plan to purchase and use CBD products; $f = 74$; 27.2%). However, approximately 45% of respondents strongly disagreed or disagreed and approximately 30% of respondents neither

agreed nor disagreed for each of these scale items. Aggregated frequencies of responses for each item are presented in Table 4.

Table 4

College Athletes' Extent of Agreement on Behavioral Intention Statements Toward Purchasing and Consuming CBD Products

Item	<i>n</i>	Strongly Disagree / Disagree		Neither Agree nor Disagree		Agree / Strongly Agree	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
I expect to purchase and use CBD products.	272	118	43.4	83	30.5	71	26.2
I want to purchase and use CBD products.	272	120	44.1	80	29.4	72	26.5
I intend to purchase and use CBD products.	272	124	45.6	77	28.3	71	26.1
I plan to purchase and use CBD products.	271	124	45.6	73	26.8	74	27.2

Objective 5: Determine Factors that Predict College Athletes' Future Intention to Purchase and Consume CBD Products

Independent variables found in the TPB (attitudes, perceived behavioral control, subjective normative belief), in addition to gender and athletic year in school, were used as variables to predict the dependent variable, future intention to purchase and consume CBD products. Race and ethnicity were excluded from the analysis as most respondents in our study identified as White, Non-Hispanic. A statistically significant model was produced via multiple linear regression that can be used to explain 53% of the variance in future intent to purchase and consume CBD products ($R^2 = .530$, $F(5,249) = 56.17$, $p < .001$). This can be interpreted as a large effect size (Cohen, 1988).

Of the independent variables in the model, attitude, subjective normative beliefs, and perceived behavior control were found to be significant predictors. As noted by the beta values, more favorable attitudes ($\beta = .447$, $p < .001$), higher subjective norms ($\beta = .305$, $p < .001$), and higher perceived behavioral control ($\beta = .130$, $p = .005$) led to higher future intentions to purchase CBD. Gender and athletic year were not significant variables. Table 5 depicts the model variables.

Table 5

Predictors of College Athletes' Intention to Purchase and Consume CBD ($n = 272$)

Predictor Variable	<i>B (coefficient)</i>	<i>SE_{β}</i>	β	<i>t</i>	<i>p</i>
Constant	-1.639	.368		-4.456	<.001
Attitude	.693	.085	.447	8.117	<.001
Subjective Norm	.433	.079	.305	5.463	<.001
Perceived Behavior Control	.229	.080	.130	2.857	.005
Gender	.016	.114	.006	.141	.888
Athletic Year	.052	.046	.049	1.125	.261

Conclusions, Implications, and Recommendations

The findings from this study show approximately 40% of college student athletes at Doane University had consumed CBD products in the last 90 days. These findings report higher rates than the average adult population in the U.S. (Brenan, 2019) but are comparable to CBD consumption rates of other studies focused on young adults (Wheeler et al., 2020). We found nearly 70% of the CBD consumers in our study consumed CBD products with the intent to relieve stress, which emerging research shows CBD has potential to do so (Lookfong et al., 2023). This finding illustrates that while pain relief is an important aspect in college athletes' use of CBD products (Bennett, 2022; Kasper et al., 2020), stress relief may be a more common reason. This finding corroborates Wheeler et al.'s (2020) finding that stress relief is a top reason young adults consume CBD products.

Over half of our respondents who reported using CBD products indicated consuming CBD through smokables and vaporizers, which was a higher percentage than previously identified (Wheeler et al., 2020). A rising trend is the use of recreational vaping devices by college students (Katz et al., 2020; Roberts et al., 2020), and our respondents' high use of smokables and vaporizers to consume CBD may indicate these athletes are consuming CBD products recreationally as opposed to improve athletic performance or recovery. The high use of smokables and vaporizers may be concerning, as these product-types could indicate damaging use or misuse of CBD.

Over half of student athletes who were consuming CBD products were using friends or family members to inform their decision about purchasing CBD products, while less than 10% sought advice from a medical doctor or professional. With participants' main sources of information coming from friends or family and internet websites, the quality and accuracy of the information they receive is difficult to gauge. The information received may be subject to the known misleading claims about over-the-counter CBD food and supplement products (Bonn-Miller et al., 2017). Some studies have expressed positive outcomes on an individual's well-being when they communicate with friends and family about health or medical related information (Brown & Greenfield, 2021; Ramirez et al., 2013), while a systematic review of health misinformation demonstrated that trusting friends and family about health information and using social media for health information can cause the information seeking party to be more susceptible to misinformation. The review also found that trust with health professionals and trust in science make the information seeking party less susceptible to health misinformation (Nan et al., 2022).

Nan et al.'s (2022) findings along with our study's results demonstrate an opportunity for health communication around CBD to combat potential misinformation coming from friends and family or social media sites. To combat this misinformation, health professionals and researchers can work together to develop a communication channel dedicated to providing science-backed information on commonly referenced hemp compounds like CBD and THC. Since social media and internet websites were commonly used as sources of CBD information for the CBD-users in our study, we recommend digital health communication media on CBD.

This communication channel could be a community in Reddit focused on hemp products that only health experts and researchers can post to, a podcast or blog run by researchers or health professionals discussing hemp compounds and products, or a monthly/quarterly newsletter made in collaboration by researchers and health professionals discussing basic compound information, current research, and safety and efficacy of new products. These communication channels are warranted, as hemp compounds have greatly increased in popularity and claims surrounding medicinal benefits the products offer may be misleading (Bhamra et al., 2021; Bonn-Miller et al., 2017).

Our findings indicated each of the TPB variables (attitude, subjective norm, perceived behavior control) were significant in determining college athletes' future intention to consume CBD. In fact, these variables were used to explain 53% of the variance in college athletes' future intent to purchase and consume CBD products, thus supporting the TPB in the context of CBD consumption. In alignment with Fishbein and Cappella (2006), the TPB could be used to guide health communication on CBD. Although each of the three determinants of intention were significant in our model, the largest indicator of CBD consumption intention was attitude ($\beta = .447$) followed by subjective normative beliefs ($\beta = .305$), therefore, these variables could be targeted in health communication campaigns on cannabis (Fishbein & Cappella, 2006; Willoughby et al., 2024).

Effective health communication on CBD can aim to reinforce or change existing attitudes or normative beliefs on CBD consumption, while also tailoring message modality and context based upon baseline use data. For example, our findings indicated that college athlete CBD-users tended to consume CBD for stress relief, used social media and internet websites as sources of information, and consumed CBD as a smokeable product. Therefore, based on this information and in alignment with our findings from our predictive model, a communication campaign through digital media could be established that illustrates safe CBD consumption for stress relief through alternatives to smokeable/vaporizer products, and that incorporates messaging with intent to change or reinforce attitudes and subjective normative beliefs.

Limitations

There are several limitations to this study. As a case study, our findings are not generalizable to all college athletes and should be limited to the athletes at Doane University at the time of this study. Factors such as geographical region, athletic division, and college type may influence CBD use and perceptions. Although strategies were used to encourage honest responses, the results are limited to self-reporting and may be prone to response bias, particularly considering the contentious topic of substance use (Marquis et al., 1986).

Recommendations

Due to the high use of CBD by college student athletes in our study, we recommend health communication campaigns be designed for this population on the safe use and potential risks of CBD. Communication should discuss the importance of consulting with medical professionals prior to consuming unregulated substances. When designing such communication campaigns, we recommend communication developers consider participants' attitudes, subjective

normative beliefs, and perceived behavioral control of CBD consumption, due to the large influence of these variables, particularly attitudes and subjective norms, on future purchasing and consumption intention. Future studies that employ CBD message testing should be considered to see how source credibility, message channels, and message framing influence CBD perceptions and consumption intention.

In conclusion, we encourage coaches, team medical staff, and educators to work with student athletes' families to better communicate to them about CBD and CBD use. Universities with large athletic programs should also consider developing websites or factsheets with information related to sports rules and regulations around CBD, verified sources of information on CBD and CBD use, and possibly even verified vendors of CBD products. As state and federal laws and regulations on cannabis products are rapidly evolving which impact cannabis use (Pessar et al., 2024), similar research should be conducted longitudinally and in various geographical locations and with more diverse groups of student athletes to provide continuous use and perception data of cannabis products.

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