FACULTY OF BIOSCIENCE ENGINEERING

THE MARKET OF CBD FOOD PRODUCTS IN BELGIUM: INSIGHTS INTO PUBLIC KNOWLEDGE, PERCEPTIONS, AND BEHAVIOUR

Nicolas Lyssens-Danneboom
Student number: 02114434

Promotors: Prof. dr. Hans De Steur, Prof. dr. Christine Yung Hung
Tutor: Prof. dr. Christine Yung Hung

Master's Dissertation submitted to Ghent University in partial fulfilment of the requirements for the degree of Master of Science in Bioscience Engineering: Environmental Technology

Academic year: 2023 – 2024

UNIVERSITEIT GENT

Foreword

Embarking on this academic journey, I present my master's thesis on the Market of CBD Food Products in Belgium. This endeavor at Ghent University's Faculty of Bioscience Engineering has been an enriching and intellectually stimulating experience.

I extend my deepest gratitude to my mentors, Prof. Dr. Hans De Steur and Prof. Dr. Christine Yung Hung, for their invaluable guidance. Their expertise in agricultural economics and consumer research profoundly shaped my work.

I must extend a heartfelt thank you to my friends Paul and Ludo. Their presence has been a guiding light in this journey. To my colleagues at the faculty of bioscience engineering, my family, and all who supported me, I am profoundly grateful. Your encouragement has been a bedrock of my success.

This thesis is a testament to a shared vision of sustainable development within the CBD market. I hope it serves as a valuable contribution to the field and inspires further exploration.

With appreciation,

Nicolas Lyssens-Danneboom

Table of Contents

Foreword **3**

Table of Contents **4**

List of Figures and Tables **6**

Figures *6*

Tables *6*

List of Abbreviations **7**

Abstract **8**

Introduction **9**

Problem Statement *9*

Objective of the Research *10*

1 The Market of CBD Food Products in Belgium **12**

1.1 Cannabidiol (CBD) *12*

1.1.1 Cannabis sativa 12

1.1.2 Cannabinoids 12

1.1.3 Therapeutic Applications of CBD 14

1.2 Hemp: The Source of CBD *16*

1.2.1 Hemp Cultivation 16

1.2.2 The Role of Hemp in Sustainable Agriculture 18

1.2.3 The Economic Value of Hemp 19

1.2.4 Challenges & Opportunities 21

1.3 CBD Products *22*

1.3.1 From hemp to CBD products 22

1.3.2 CBD Food Products 23

1.4 The Legal Framework of CBD food Products *24*

1.4.1 European Union 25

1.4.2 Belgium 26

1.5 The Current Situation in Belgium *26*

1.6 Literature Review *27*

1.6.1 Consumption Patterns and Reasons for Usage 28

1.6.2 The Influence of Knowledge on Perceptions 30

1.6.3 The Influence of Legislation on Perceptions 31

1.6.4 Behavioural Intention 33

1.6.5 Research Questions 35

2 Methodology **37**

2.1 Research Design ... *37*
2.1.1 Sample Design and Distribution ... 37
2.1.2 Survey Design ... 37
2.1.3 Data Analysis ... 40

3 Results ... 42

3.1 Awareness and Usage of CBD ... *42*

3.2 Perception, Knowledge, and Belief about the Legal Status ... *44*
3.2.1 Perception of CBD food products ... 44
3.2.2 Subjective and Objective Knowledge about CBD ... 45
3.2.3 Belief about the Legal Status of CBD Products ... 46
3.2.4 Effect of Knowledge and Belief about the Legal Status on Perception ... 47

3.3 Attitude, Subjective Norm, Perceived Behavioural Control, and Intention ... *49*

3.4 Motivation, Consumption Frequency, and Product Preferences in the Context of CBD Food Products ... *51*

4 Discussion ... 54

4.1 Interpretation of the Results ... *54*

4.2 LIMITATIONS ... *61*

4.3 Future Research ... *62*
4.3.1 Exploring the Critical Objective Knowledge Hypothesis ... 62
4.3.2 In-Depth Assessment of the Relationship Between Perceived Effectiveness and Legislation ... 62
4.3.3 Impact of Individuals' Internal Stance Toward Cannabis-Related Products ... 62

4.4 IMPLICATIONS ... *63*

5 Conclusion ... 64

6 References ... 65

7 Appendix ... 73

7.1 Appendix A: Approval by the Medical Ethics Committee of Ghent University Hospital ... *73*

7.2 Appendix B: Online Qualtrics Questionnaire (Dutch Version) ... *74*

List of Figures and Tables

Figures

Figure 1: Molecular structure of CBD (Emery Pharma, 2022).....13
Figure 3: Use of flowers and leaves in the European hemp sector (EIHA, 2018). 20
Figure 2: Use of seeds in the European hemp sector (EIHA, 2018). 20
Figure 4: PRISMA flow diagram of literature review selection process. 28
Figure 5: Theory of Planned Behaviour (Sansom, n.d.). 34
Figure 6: Public perception regarding CBD food products across ten attributes measured on a 5-point semantic scale (n = 259).....45
Figure 7: Respondents' perceived knowledge about the legal framework surrounding CBD products in Belgium (n = 289). 46

Tables

Table 1: Hemp-derived products and their applications (UNCTAD, 2022).....19
Table 2: Descriptive statistics of CBD awareness and past CBD usage among respondents (n = 297). 42
Table 3: Descriptive statistics of CBD awareness and past CBD usage among different socio-demographic groups (n = 297).....42
Table 4: Difference in the likelihood of CBD awareness and CBD usage among distinct socio-demographic groups, by two binary logistic regression models (Model 1, n = 297; Model 2, n = 203). 44
Table 5: Subjective and objective knowledge of CBD. Descriptives of the average scales and the underlying statements (n = 200). 46
Table 6: Beliefs regarding the legal status of various types of CBD products in Belgium (n = 174).....47
Table 7: The effect of knowledge and belief about the legal status of CBD on ten attributes of perception toward CBD food products (10 multiple linear regression models). Standardized coefficients, significance and explained variance (n = 188).....48
Table 8: Descriptive statistics for the constructs and items within the Theory of Planned Behaviour (n = 258). 49
Table 9: The effect of attitude, subjective norm, and perceived behavioural control on the intention to consume CBD food products (two multiple linear regression models). Standardized coefficients, significance and explained variance (n = 258). 51
Table 10: Preferences for CBD food products and anticipated consumption frequencies over the next 12 months (n = 258).....52
Table 11: The mean values and standard deviations of motivations for the consumption of CBD food, beverages, supplements, and oil (n = 68). 52
Table 12: The mean values and standard deviations of motivations for the consumption of CBD food products among three groups with different anticipated consumption frequencies (n = 68). 53

List of Abbreviations

CAP	Common Agricultural Policy
CBD	Cannabidiol
CJEU	Court of Justice of the European Union
CO2	Carbon Dioxide
ECS	Endocannabinoid System
EFSA	European Food Safety Authority
EIHA	European Industrial Hemp Association
EMA	European Medicines Agency
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
EU	European Union
FAGG	Federal Agency for Medicines and Health Products
FDA	Food and Drug Administration
FOD	Federale Overheidsdienst Financiën
GVR	Global View Research
IBD	Inflammatory Bowel Disease
MS	Multiple Sclerosis
NO_x	Nitrogen Oxides
PBC	Perceived Behavioural Control
PCPs	Primary Care Providers
$scCO_2$	Supercritical Carbon Dioxide
SGIC	Subject Global Impression of Change
SO_2	Sulfur Dioxide
SPS	Simulated Public Speaking
THC	Tetrahydrocannabinol
TPB	Theory of Planned Behaviour
UNCTAD	United Nations Conference on Trade and Development
VAD	Vlaams expertisecentrum Alcohol en andere Drugs
UV	Ultraviolet

Abstract

Cannabidiol (CBD), a non-psychoactive compound derived from the cannabis plant, has garnered significant attention for its potential health and wellness benefits within the food industry. This study explores knowledge, perceptions, and behavior towards CBD food products among the Belgian population. Data were collected using an online cross-sectional survey. Findings indicated that over two-thirds of Belgians are aware of CBD, with 24% having past usage experience. Demographics significantly influence CBD awareness and usage, reflecting varying degrees of knowledge and experience. Users exhibit higher CBD knowledge levels. Perceptions of CBD food products in Belgium are complex, with respondents acknowledging CBD's effectiveness, relaxation properties, and natural origin. However, concerns regarding healthiness, appeal, and cost persist. Perceptions of CBD food products are strongly influenced by beliefs about the legal status of CBD. Within the Theory of Planned Behavior, attitude seems to be the strongest predictor of intention. The most common reasons for using CBD products were found to be the management of pain, anxiety, and sleep disorders. This research informs policymakers, healthcare professionals, and businesses operating in the CBD market, emphasizing the need to address knowledge gaps and misconceptions. Recognizing the impact of demographics on CBD awareness and usage provides insights for targeted strategies. As CBD's popularity continues to grow globally, this study establishes a foundation for ongoing investigations into CBD awareness, usage, and perceptions in Belgium.'

[Keywords: CBD, cannabidiol, awareness, usage, perceptions, behaviour, TPB]

Introduction

Problem Statement

Cannabidiol (CBD) is a naturally occurring compound derived from the cannabis plant, renowned for its purported therapeutic properties such as pain relief, anxiety reduction, and anti-inflammatory effects (Zou & Kumar, 2018). In recent years, CBD has surged in popularity, attracting an increased interest from diverse industries due to its potential health benefits and diverse applications. As individuals increasingly seek natural alternatives for managing medical conditions and enhancing well-being, CBD emerges as a compelling option (Bhamra et al., 2021; Corroon & Phillips, 2018). This surge in interest is further stimulated by the decreasing stigma associated with cannabis (GMI, 2022) and the relaxation of regulations governing cannabis-derived products (Stoelzle Pharma, n.d.). Moreover, the cultivation of hemp, the primary source of CBD, is gaining traction as a sustainable and economically valuable crop (AGRI, 2023). CBD finds itself integrated into a wide array of products, ranging from oils to capsules, beverages, and even personal care items. The global CBD market, valued at USD 12.8 billion in 2021, is projected to witness a compound annual growth rate (CAGR) of 21.7% between 2022 and 2028 (GMI, 2022). Remarkable is the surge in popularity of CBD-infused food products, comprising a substantial segment of this market. These encompass a variety of consumables, ranging from baked goods and confectionery to beverages. Furthermore, the category extends to oils and capsules designed for consumption without the need for a prescription.

The legal status of CBD food products in Belgium is complex and confusing, as they fall under both drug law and food law. Under Belgian drug law, the sale of CBD products that contain less than 0.2% tetrahydrocannabinol (THC), the psychoactive compound in cannabis, is allowed. However, the Belgian food law prohibits the sale of CBD products as consumables or beverages, even if they contain less than 0.2% THC (VAD, 2023). This is because CBD is considered a novel food ingredient in the European Union (EU), which requires authorization before it can be sold as a food product (EU Monitor, 2015). The safety and efficacy of CBD remain uncertain and inadequately supported by scientific evidence. The European Food Safety Authority (EFSA) has not yet evaluated the safety of CBD as a food ingredient, which is why CBD food products are considered illegal in Belgium and other EU countries (EFSA, 2022). Despite that it is illegal, many shops in Belgian cities sell CBD products in the form of food products (Broens, 2023). These shops operate in the legal grey zone by selling these products as non-food items, which is legally permissible if it is indicated that these products are not suitable for consumption (fagg, n.d.). However, this creates a situation where CBD shops are allowed to sell CBD products designed for ingestion but are not allowed to explain how these products should be consumed. This situation poses potential risks for consumers, as there is not enough scientific evidence to support the safe consumption of CBD as a food. It is worth noting that CBD products found in Belgian shops often surpass the 0.2% THC limit (Vanthienen, 2019). Another issue is that CBD is often marketed to the public as a miracle cure for everything (A. Tran et al., 2021). This can lead to false information being disseminated to consumers regarding the potential risks and benefits of these products. This becomes particularly concerning when CBD is used as a substitute for other medical treatments (Kvamme et al., 2021).

The rising popularity of CBD presents both risks and opportunities. As demand for CBD food products continues to soar, so does the potential for increased consumer risk. The absence of clear regulatory guidelines and the uncertain legal status of CBD food products in Belgium create an environment where consumers may inadvertently subject themselves to potential hazards. Conversely, this upswing in popularity opens avenues for businesses in the CBD sector to capitalize on emerging market opportunities. Nonetheless, for the CBD market to thrive sustainably, it becomes imperative to institute clear and transparent boundaries that prioritize consumer safety. Achieving this necessitates a comprehensive understanding of the current landscape of CBD food products in the Belgian market.

Gaining clarity into the situation is important, with insights into public knowledge, perceptions, and behaviour regarding CBD food products playing a crucial role in effective market regulation. Understanding what consumers know about CBD, how they perceive it, and their behaviours in purchasing and using it are essential elements for formulating regulations that not only safeguard consumer safety buy also foster a thriving and responsible market.
Previous research has predominantly focused on broader topics such as CBD in general (Goodman et al., 2022; Wheeler et al., 2020a; Wysota et al., 2022), cannabis (Burroughs, 2019; Giannotta, 2021; West et al., 2022), and medical cannabis (Chapman, 2019; Pav et al., 2023; Tumati et al., 2022). However, a noticeable gap exists concerning specific inquiries into knowledge, perceptions, and behaviours related to CBD food products, particularly within the Belgian context. The current body of literature addressing knowledge, perceptions, and behaviour related to CBD predominantly focuses on North America, where CBD usage is widespread, and public awareness is high (Wheeler et al., 2020a; Wysota et al., 2022). In this region, CBD, primarily consumed through food products, is popular, often accompanied by self-reported health claims lacking scientific evidence (Goodman et al., 2022). Irresponsible CBD usage is exacerbated by prevalent misconceptions.

Perceptions of CBD, as well as closely associated subjects like medical cannabis and other cannabis-derived products, are generally positive among both the public (Erridge et al., 2022; Pav et al., 2023) and healthcare professionals (Kogan et al., 2019; Sharma et al., 2023). These positive perceptions correlate with the level of knowledge on these subjects. Notably, subjective knowledge emerges as an important determinant, exerting a more significant influence on perceived benefits and risks than objective knowledge. Additionally, beliefs about the legal status also impact perceptions of cannabis-related products (Kogan et al., 2019; Sharma et al., 2023). However, the effects of knowledge and beliefs about the legal status in the specific context of CBD, particularly CBD food products, remain understudied. There is a notable gap in research, with insufficient targeted insights that delve beyond overarching discussions on CBD, providing clarity on how subjective knowledge, objective knowledge, and legal status beliefs uniquely shape public perceptions regarding consumable CBD products. In the context of cannabis (Burroughs, 2019), medical cannabis (Zolotov et al., 2019), and hemp-derived food products (Metcalf, Wiener, Saliba, et al., 2021), individual attitudes play a significant role in behavioural intention, underscoring the importance of internal stances towards these products. Yet, the impact of subjective norms and perceived behavioural control in the context of CBD remains inadequately explored. While existing studies lay a foundation, there is a need to extend this understanding to the distinct context of CBD food products among the public. Moreover, there is a lack of data regarding the integration of CBD into the European population. Notably, there has been no study investigating the consumption patterns of CBD in Belgium to date. Cultural, regulatory, and demographic differences exist among regions, emphasizing the need for a localized investigation.

Objective of the Research

This study aims to shed light on the current landscape of CBD food products in the Belgian market, providing comprehensive insights into consumption patterns and motivations. It seeks to provide insight into public perceptions of CBD food products, examining how these perceptions are shaped by individuals' level of knowledge and beliefs about the legal status of CBD. Additionally, the study delves into the factors influencing intentional behaviour among the public. The overarching goal of this research is to furnish valuable insights for regulators, policymakers, and market stakeholders. It aims to facilitate informed decision-making, strategy development, and effective navigation of the intricate and dynamic CBD food products market in Belgium. The study will address the following research questions, including:

1) *What fraction of Belgian population is familiar with and has used CBD, and how does this awareness and usage vary across demographic groups?*
2) *How are public perceptions of CBD food products in Belgium influenced by individuals' subjective knowledge, objective knowledge, and beliefs about the legal status of CBD?*
3) *To what extent do attitude, subjective norm, and perceived behavioural control shape the intention to consume CBD food products among the public in Belgium?*
4) *What motivates individuals in Belgium to consider future consumption of CBD food products, and what are their anticipated consumption frequency and preferences regarding types of CBD food products?*

1 The Market of CBD Food Products in Belgium

1.1 Cannabidiol (CBD)

1.1.1 Cannabis sativa

The term cannabis is used in different contexts. *Cannabis*, a genus belonging to the *Cannabaceae* family, includes a diverse range of plants. It is typically categorized into three primary species: *Cannabis sativa (C. sativa), Cannabis indica (C. indica),* and *Cannabis ruderalis (C. ruderalis). C. sativa*, one of the standout species within the genus, is known for its tall plants with narrow leaves. This species is dioecious, meaning that both male and female plants with flowers exist. Within the species *C. sativa*, various subtypes exist, with two main categories distinguishing themselves: industrial hemp varieties and the marijuana plants. Industrial hemp is cultivated for its durable fibers and nutritious seeds, and plays a crucial role in the textile, paper, and food industries. The marijuana plant is another significant category within the *C. sativa* species. The difference between these two categories is the content of the psychoactive compound tetrahydrocannabinol (THC). The varieties of the marijuana plant are selectively bred for their elevated THC content, which can induce psychoactive effects when consumed (McPartland, 2018).

1.1.2 Cannabinoids

THC is an example of a cannabinoid. These cannabinoids, a family of unique compounds, are primarily synthesized by plants belonging to the *Cannabis* genus. At least 85 different cannabinoids have been isolated from those plants (El-Alfy et al., 2010). Initially, cannabinoids were considered exclusive to *C. sativa*, but recent discoveries have unveiled their presence in various other species, including *Rhododendron*, select legumes, the liverwort genus *Radula*, and specific fungi (Gülck & Møller, 2020). In *C. sativa*, these cannabinoids tend to accumulate within trichomes distributed across the surface of the plant, with the highest concentration observed in the female flowers. When a trichome ruptures, often induced by environmental conditions or herbivorous activities, its content forms an adhesive layer on the plant's surface. This phenomenon is orchestrated by the cohesive properties of cannabinoids. Functionally, this adhesive substance immobilizes the mandibles and legs of potential herbivores, protecting the plant from desiccation (Gülck & Møller, 2020). Furthermore, the production of cannabinoids offers an advantage by acting as a natural sunscreen by absorbing harmful ultraviolet (UV) radiation. Significantly increased cannabinoid production was measured in flowers after UV-induced stress (Eichhorn Bilodeau et al., 2019). Beyond their ecological roles, cannabinoids have also attracted attention for their interactions with the mammalian brain. Specific cannabinoid receptors in the brain, denoted as CBx, respond to compounds found in *C. sativa*. The receptors are part of the endocannabinoid system (ECS), a network for the regulation of a broad range of biological functions. Research involving both humans and animals has provided evidence supporting the pivotal role of the ECS in overseeing memory functions, the regulation of mood, the mechanisms of the brain's reward systems, and the dynamics underlying drug addiction (Gülck & Møller, 2020).

The *Cannabis* genus is known for housing the two most well-known cannabinoids, cannabidiol (CBD) and tetrahydrocannabinol (THC). These compounds are not limited to specific species but rather vary in concentration across different plants of the *Cannabis* genus. As early as the 1970s, researchers have categorized various strains of *C. sativa* based on their chemical phenotypes, a classification referred to as 'chemotype.' This classification is based on two factors: the overall quantity of THC synthesized and the ratio of THC to CBD present in the plant (Small & Beckstead, 1973). CBD, unlike THC, is a non-psychoactive compound with therapeutic potential. It exerts its effects by interacting with the ECS. Notably, CBD can be detected in both industrial hemp and the “marijuana” plant; however, its abundance in industrial hemp tends to surpass that in the “marijuana” plant. This difference in CBD content underscores the divergent emphasis in the two varieties: industrial hemp places greater importance on non-

psychoactive properties, whereas the “marijuana” plant prioritizes the psychoactive effects attributed to THC (Farinon et al., 2020).

Cannabinoids operate through interactions with two specific receptors: cannabinoid receptor type 1 (CB1) and cannabinoid receptor type 2 (CB2) found within the ECS. The distinction between the psychoactive and non-psychoactive effects of THC and CBD can be explained by their mechanisms of interaction with the ECS. THC elicits its psychoactive effects by directly binding to and stimulating CB1 receptors situated in the brain. This binding event initiates the release of neurotransmitters, leading to an alteration in normal brain function and the characteristic psychoactive effects associated with THC. On the other hand, CBD does not directly bind to CB1 receptors; instead, it is thought to operate as an antagonist, effectively obstructing or modulating the effects of CB1 activation. This unique mechanism means that CBD does not elicit the intense activation of CB1 receptors responsible for the psychoactive effects seen with THC. In fact, CBD may even counteract some of the psychoactive effects of THC, potentially mitigating the anxiety and paranoia often associated with THC consumption (Pisanti et al., 2017; Vučković et al., 2018). Ongoing research is exploring the pharmacology of CBD and its interactions within the ECS. While it is well-established that CBD does not induce the euphoric effects commonly attributed to THC, the precise mechanisms of its actions within the ECS, as well as its full spectrum of potential therapeutic properties, remain subjects of continued investigation (Chanda et al., 2019). CBD is becoming increasingly associated with a multitude of potential health benefits, including alleviating pain, mitigating inflammation, and its role in treating conditions like depression and anxiety. The scientific literature surrounding these potential therapeutic advantages is expanding, underscoring the significance of ongoing research in fully uncovering CBD's medicinal applications (Zou & Kumar, 2018).

As seen in Figure 1, the molecular structure of CBD ($C_{21}H_{30}O_2$) features a unique arrangement of atoms, including a cyclohexene ring, a phenolic ring, and a central pentyl side chain. CBD's chemical activity comes mainly from the positioning of the hydroxyl groups on the phenolic ring, as well as the methyl group of the cyclohexene ring, and the pentyl chain of the phenolic ring. This structural configuration contributes to CBD's distinct properties and its ability to modulate various physiological processes (Atalay et al., 2019). CBD is characterized as a lipophilic molecule, which means it has a high affinity for fats and oils but limited solubility in water. This property is significant as it has enabled the formulation of various oil-based products, such as CBD oils and tinctures. Additionally, CBD is known for its chemical stability, a quality that makes it suitable for a wide range of applications in the food, pharmaceutical, and cosmetic industries (Wheeler, 2023).

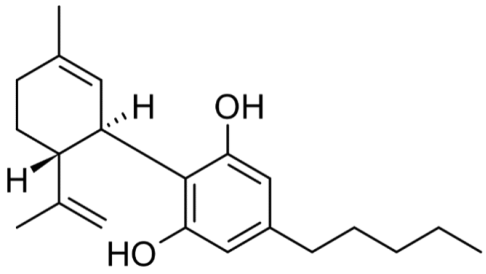

Figure 1: Molecular structure of CBD (Emery Pharma, 2022).

1.1.3 Therapeutic Applications of CBD

The scientific community has shown a growing interest in CBD, driven by its promising potential health benefits. A search conducted in the Web of Science database, on topics about CBD (TS = ('CBD' OR 'cannabidiol')), yielded a total of 16,215 results. Notably, 9,570 of these were focused on health-related topics, with 4,585 of them having been published between 2019 and 2023. Medications containing CBD have garnered approval for specific medical conditions, with Epidyolex and Sativex being notable examples. These medications have demonstrated efficacy in the treatment of various health conditions and have received regulatory approval in specific regions, highlighting the growing acceptance of CBD-based medicines.

Epidyolex, a medication containing a purified form of CBD, is utilized in the management of seizures associated with Lennox-Gastaut syndrome, Dravet syndrome, and tuberous sclerosis complex. Its mode of action involves CBD's interaction with cellular targets that modulate calcium movement, a crucial process for the transmission of electrical signals within nerve cells. Seizures are frequently incited by abnormal electrical activity in the brain. By modifying calcium movement, Epidyolex can reduce or prevent seizures. Furthermore, CBD is thought to exert an effect on adenosine, a neurotransmitter in the brain known for its role in suppressing seizures (EMA, 2019). Clinical research with over 900 patients afflicted by these conditions have provided empirical evidence of Epidyolex's effectiveness in reducing seizure occurrences (EMA, 2019). In the United States, the Food and Drug Administration (FDA) has granted approval to Epidyolex for the treatment of these conditions, affirming its safety and efficacy (FDA, 2023). Within the European Union, Epidyolex underwent evaluation by the European Medicines Agency (EMA), ultimately obtaining approval from the European Commission in September 2019. This milestone marked it as the first cannabinoid-containing medicinal product to receive EU-wide marketing authorization, underscoring its recognition and acceptance within the EU (Emcdda, 2023b).

Sativex is a pharmaceutical product that combines CBD and THC. Administered orally as a spray, it is used to treat spasticity in patients with multiple sclerosis (MS) who have not responded adequately to other anti-spasticity medications. Although its mechanism of action is not fully understood, Sativex is believed to interact with the ECS in the body (EMA, 2022). A study involving 189 subjects with MS and spasticity showed that Sativex significantly reduced spasticity compared to a placebo. Moreover, 40% of subjects experienced a significant reduction in symptoms with the active preparation (Collin et al., 2007). In Europe, Sativex has gained national approval in 16 EU countries for the treatment of muscle spasticity resulting from MS (Emcdda, 2023b). Belgium is among the countries that have approved both Epidyolex and Sativex for medical use (famhp, 2023). These approvals represent the growing acceptance of CBD-based medicines for targeted therapeutic purposes and underscore the importance of ongoing research into their efficacy and safety.

Ongoing research continually unveils various potential therapeutic applications of CBD. One notable area of interest is the effect of CBD on stress and anxiety. In a survey targeting young adults, it was observed that 65% of current CBD users cited stress and anxiety reduction as their primary motivation for use (Wheeler et al., 2020b). The anxiolytic properties of CBD have been systematically explored in experimental settings, exemplified by the Simulated Public Speaking (SPS) task, a paradigm renowned for reliably inducing self-reported anxiety in human subjects. In a small parallel-group study, patients afflicted with clinical anxiety marked improvements in anxiety levels during the SPS task when treated with CBD in contrast to a placebo (Bergamaschi et al., 2011). Furthermore, in a study involving healthy volunteers without clinical anxiety, oral administration of CBD prior to the SPS task resulted in reduced self-reported ratings of anxiety when compared to a placebo (Zuardi et al., 1993).

One of the most reported motivations for the use of medical cannabis in the United States is the management of chronic pain conditions. This includes various types of pain, such as neuropathic pain, arthritis, back pain, neck and shoulder pain, as well as headaches (NASEM, 2017). A comprehensive Cochrane review examined a multitude of studies investigating the comparative effectiveness of CBD in reducing chronic neuropathic pain in adult populations, relative to placebos (Mücke et al., 2018). This analysis included 16 distinct studies comprising 1,750 participants, who were subjected to interventions involving CBD-based medications or placebos over variable durations spanning from 2 to 26 weeks. The results derived from this meta-analysis demonstrated that CBD treatment was associated with an increased proportion of patients achieving a 50% reduction in pain, in comparison to those receiving placebos. It is noteworthy, however, that a higher percentage of individuals in the CBD group (10%) discontinued their treatment due to adverse events, relative to the placebo group (5%). Additionally, a separate investigation involving 303 patients afflicted with peripheral neuropathic pain (PNP), characterized by allodynia, was conducted over a span of 15 weeks (Serpell et al., 2014). This study examined the efficacy of a spray containing both THC and CBD. The findings revealed a substantial increase in the proportion of patients achieving a reduction of 30% or more in pain scores. Moreover, improvements were noted in secondary measures, including enhancements in sleep quality and the Subject Global Impression of Change (SGIC).

CBD exhibits potential as a remedy for substance addiction. In a double-blind, placebo-controlled study involving heroin users, Epidyolex was administered at doses of 400 or 800 mg of CBD once daily for three consecutive days (Hurd et al., 2019). Individuals receiving CBD at both 400 and 800 mg doses reported a decrease in heroin craving and self-reported anxiety measures compared to the placebo group. Another double-blind, placebo-controlled study focused on participants attempting to quit smoking (Morgan et al., 2013). They were provided with a CBD-containing inhaler or an inhaler with a placebo aerosol for seven days. Participants were instructed to use the inhaler when they felt the urge to smoke. While CBD treatment did not significantly alter cigarette craving compared to the placebo, it did lead to a noteworthy reduction in the self-reported number of cigarettes smoked on day 7 compared to day 1.

CBD has also been proven to improve the sleep quality. In one study involving healthy individuals who reported difficulty falling or staying asleep, the hypnotic properties of CBD were investigated (Carlini & Cunha, 1981). Participants were administered either oral placebos or CBD capsules at different doses (40, 80, or 160 mg). Notably, those who received 160 mg of CBD experienced longer sleep duration, and all CBD doses led to a decrease in dream recollection compared to the placebo. Another study aimed to determine whether CBD could improve sleep and reduce anxiety in a clinical population (Shannon et al., 2019). This large retrospective case series was conducted at a psychiatric clinic and involved the clinical application of CBD for anxiety and sleep complaints as an adjunct to standard treatment. The study included monthly documentation of anxiety and sleep quality in 103 adult patients. Results showed that anxiety scores decreased in 79.2% of patients within the first month and remained lower throughout the study. Sleep scores improved in 66.7% of patients within the first month but fluctuated over time.

In addition, CBD shows promise in various other health-related areas. Research suggests that CBD may possess anti-inflammatory properties that could be beneficial in conditions such as arthritis and inflammatory bowel disease (IBD) (Frane et al., 2022; Irving et al., 2018). Furthermore, studies have demonstrated that CBD's neuroprotective qualities may contribute to the prevention and management of neurodegenerative diseases, such as Alzheimer's and Parkinson's (Leehey et al., 2020; Xiong & Lim, 2021). Additionally, research indicates CBD's potential in reducing the severity of conditions like acne, psoriasis, and seborrheic dermatitis, thereby opening doors to dermatological applications (Peyravian et al., 2022; Vincenzi & Tosti, 2020). While CBD holds significant therapeutic promise, it is important to note that further research is needed to substantiate these claims.

1.2 Hemp: The Source of CBD

1.2.1 Hemp Cultivation

Varieties of C. sativa with THC concentrations falling within country-specific limits are classified as hemp. In the United States, Canada, and the European Union, this threshold is established at 0.3% THC by dry weight. Conversely, C. sativa varieties are categorized as marijuana when their THC concentration surpasses these defined limits (Phipps & Schluttenhofer, 2022). Hemp is primarily cultivated for its industrial applications. The European Union maintains a catalogue encompassing 75 distinct hemp varieties. These varieties strictly adhere to the common agricultural policy (CAP) standards, which stipulate that THC levels must not exceed the prescribed limit. Consequently, hemp grown in accordance with CAP regulations is unsuitable to produce narcotic drugs (AGRI, 2023). One of the noteworthy features of hemp that has gained significant attention in recent years is its elevated CBD content. The primary reason for hemp's prominence as the primary source of CBD lies in its legal status and associated regulatory framework. This legal differentiation between hemp and marijuana is a fundamental factor. The growing demand for CBD products has propelled a substantial expansion of hemp cultivation. This expansion has led to the development of specially bred hemp strains with increased CBD content (Phipps & Schluttenhofer, 2022).

Hemp cultivation and its utilization as a food source hold a diverse and millennia-spanning history. During the Neolithic age, hemp held a fundamental role as one of the primary crops among ancient Chinese farming communities. Its significance is well-documented in the ancient Chinese agricultural treatise 'Xia Xiao Zheng,' which dates to the 16th century BCE (Merlin, 2003). Hemp seeds have been incorporated into the human diet for more than 3000 years, finding their place among the 'five grains' alongside wheat, rice, soybeans, and setaria millet in ancient China (Baker, 2002). The practice of consuming hemp seeds as food transcended boundaries, journeying westward to India, Egypt, and Persia (Lozano Cámara, 2017). In Europe, hemp cultivation gained prominence during the second Iron Age around 2500 years ago, becoming an integral part of ancient European agricultural practices (Small, 2015). Hemp seeds were commonly consumed in a fried form during this era, with beliefs that their consumption stimulated an appetite for drinking, although excessive intake was thought to lead to sexual impotence (Iriondo-DeHond et al., 2023). The Middle Ages witnessed significant advancements in hemp cultivation driven by Arabs, whose influence extended across various regions, particularly the Mediterranean (Iriondo-DeHond et al., 2023). In Europe, hemp production primarily catered to domestic use, often among lower social classes (Small, 2015). However, in the 15th century, gastronomy treatises began incorporating hemp seed recipes, expanding its culinary usage. In Spain, hemp seeds were a common post-meal snack, and they also featured in sweets like 'nuégados,' which consisted of a mixture of roasted hemp seeds and honey. Hemp seed beverages were prepared using sugar and water. Over time, the consumption of hemp seeds became closely intertwined with various traditions, particularly those associated with marriage and religious festivities (Iriondo-DeHond et al., 2023). However, in the 19th century, hemp seed oil lost favor as a food source due to its susceptibility to spoilage and an unpleasant taste. Consequently, it found use in food adulteration and falsification, notably as a substitute for the more expensive linseed oil (Iriondo-DeHond et al., 2023).

This historical journey underscores the enduring connection between hemp and human culture, revealing its transformation from a vital Neolithic crop to a versatile and culturally significant food source. The popularity of hemp as a food source in Europe declined in the 20th century due to a combination of factors. Increased competition from other crops and the influence of anti-cannabis sentiments contributed to the decline in hemp cultivation and consumption. Legal restrictions further hindered the cultivation of hemp in many parts of the world, including Europe (Phipps & Schluttenhofer, 2022). In 1961, the Single Convention on Narcotic Drugs banned all forms of cannabis in the US and in Western Europe (except France) because of the confusion between hemp and marijuana (Yano & Fu, 2023).

In recent years, there has been an increase of interest in hemp and its potential benefits. Hemp seeds have garnered recognition as a superfood due to their rich nutrient profile and associated health advantages. Nevertheless, this resurgence has introduced new regulations and debates regarding what qualifies as a legal and safe hemp food product (Iriondo-DeHond et al., 2023).

For an extended period, marijuana breeders primarily focused on elevating the levels of THC in cannabis plants (ElSohly et al., 2000). However, a shift occurred in the mid-2000s when marijuana breeders began developing cultivars with heightened levels of CBD. These CBD-rich plants gained popularity, particularly in the medical marijuana sector, for treating a diverse array of conditions, despite the limited scientific evidence. Passage of the Agriculture Act of 2014 ushered in a pilot program in the United States, providing states with the opportunity to explore the feasibility of domestic hemp production. Notably, the definition of hemp in this legislation specified a THC content of less than 0.3%, without any specific requirements regarding usage of approved varieties (CRS, 2021). Prior to 2014, the market for hemp-derived cannabinoid products was relatively modest. However, U.S. cannabis companies swiftly recognized the potential for CBD production in hemp, which was subject to less stringent regulations compared to marijuana. The success of the pilot programs led to the Agriculture Improvement Act of 2018, which officially legalized hemp production in the United States (CRS, 2021). This newfound interest in cannabinoids triggered a significant transformation within the hemp industry. In 2011, Switzerland revised its hemp laws to increase the allowable THC limit to 1.0% (Emcdda, 2020). In 2015, CBD-rich genetics were being cultivated and their extracts sold in the U.S. market, while in 2016, the hemp cannabinoids market experienced rapid expansion across Europe, spanning more than 25 countries by 2020 (Zobel et al., 2019). By 2019, a substantial 94% of U.S. hemp growers were dedicated to producing cannabinoids, primarily CBD (McVey et al., 2019). The U.S. policy created an opportunity for the hemp-derived cannabinoids sector to thrive, with the United States prominently dominating the market. In contrast, European nations and Canada faced challenges in accessing CBD-rich hemp varieties due to regulations that required the use of cultivars on the European Commission or Health Canada approved lists, respectively. Switzerland with higher THC tolerance levels, were better positioned to capitalize on the hemp-derived cannabinoid market. In 2018, Canada had legalized marijuana, this enabled processors to manufacture and distribute CBD, either from licensed marijuana plants or hemp, subject to specific regulatory conditions (Phipps & Schluttenhofer, 2022). A 2020 report suggests that China has regionally initiated the production of CBD products; however, the full extent of Chinese CBD production remains uncertain (USDA, 2020).

In 1985, China banned the production of hemp after the UN Convention on Psychotropic Substances. It wasn't until 2010 that hemp production became legal again in China, with the government actively encouraging the textile industry to manufacture hemp fiber products (USDA, 2020). Although official data for China's hemp cultivation and production are unavailable, industry estimates suggest that China's hemp planted area was approximately 66,700 hectares in 2019, with a market value estimated at USD 1.7 billion in 2017 (USDA, 2020). As of 2020, the United States has emerged as the world's largest producer of industrial hemp, with an area of 188,497 hectares (Shen et al., 2021). Hemp is also grown across Europe, with the area dedicated to hemp cultivation increasing significantly in the European Union from 20,540 hectares in 2015 to 33,020 ha in 2022, marking a 60% increase. Among EU member states, France is the largest producer, accounting for over 60% of EU production, followed by Germany (17%) and The Netherlands (5%) (AGRI, 2023). In 2020, Belgium's hemp production area was relatively modest, with only 119 hectares (Statista, 2023). Hemp cultivation in the EU constitutes a significant portion of the world's overall supply of hemp, with up to 25% of the global hemp supply originating from the EU (Hudock, 2019). The global market for industrial hemp was estimated to be USD 4.13 billion in 2021 and is projected to grow at a compound annual growth rate (CAGR) of 16.8% between 2022 and 2030 (GVR, 2023). The growing demand for industrial hemp from a wide range of application industries is a key driver of this market growth.

1.2.2 The Role of Hemp in Sustainable Agriculture

Hemp, a sustainable and versatile plant, has garnered increased industrial attention in recent years due to its diverse applications across various industries, rendering it a valuable resource for sustainable development. Notably, hemp has the capacity to sequester substantial quantities of carbon dioxide (CO_2), comparable to that of young forests, offering significant implications for climate change mitigation. It can sequester an impressive 9 to 15 tons of CO_2 per hectare, an achievement made more remarkable by its short growth cycle of only five months (AGRI, 2023; Aytaç, 2018).

In addition to its carbon sequestration capabilities, hemp presents a range of environmental advantages, positioning it as an eco-friendly option for sustainable agriculture. Hemp serves as a viable substitute for less environmentally friendly resources like cotton, wood, and fossil fuels in the production of textiles, paper, building materials, biofuels, and food products. The incorporation of hemp into these industries could facilitate a reduction in carbon footprint and a decrease in the reliance on non-renewable resources (Aytaç, 2018). Hemp's ecological benefits extend to water usage, as it requires only a fraction of the water needed for cotton cultivation (UNCTAD, 2022; Yano & Fu, 2023). Furthermore, hemp contributes to improved air quality by absorbing pollutants such as sulfur dioxide (SO_2) and nitrogen oxide (NO_x), particularly beneficial in regions with elevated pollution levels (Aytaç, 2018). Additionally, hemp proves advantageous for crop rotation, disrupting disease cycles that affect other crops, resulting in higher subsequent crop yields (AGRI, 2023; EIHA, 2018; UNCTAD, 2022). The rapid growth and shading capacity of hemp effectively inhibit weed growth, reducing the necessity for herbicides, and promoting sustainable agricultural practices (AGRI, 2023). Moreover, the dense leaves of the hemp plant act as a natural soil cover, significantly decreasing water loss and preventing soil erosion (AGRI, 2023; EIHA, 2018). Hemp's deep root system not only stabilizes the soil but also can extract heavy metals, enhancing soil quality (AGRI, 2023; Aytaç, 2018; EIHA, 2018). The low susceptibility of hemp to pests and diseases minimizes the need for chemical interventions, rendering it an ideal crop for organic and near-surface water environments (AGRI, 2023; Aytaç, 2018). The unique flowering cycle of hemp, typically occurring from July to September, aligns with a lack of pollen production from other crops, making it a crucial resource for pollinators during periods of floral scarcity. Additionally, hemp provides shelter for birds, and its seeds serve as a valuable food source for various animals (AGRI, 2023; EIHA, 2018). In summary, the combination of hemp's attributes, spanning carbon sequestration, pollution absorption, low water and pesticide requirements, and positive effects on biodiversity, establishes it as an environmentally friendly and sustainable choice across diverse industries.

The European Green Deal, a pivotal environmental initiative, seamlessly aligns with the environmental advantages of hemp. Hemp's role in carbon storage is particularly noteworthy, contributing to enhanced air quality and diminished greenhouse gas emissions. This alignment corresponds with the European Union's (EU) overarching objective of achieving carbon neutrality by 2050 (AGRI, 2023). Hemp's multifaceted contributions, encompassing the disruption of disease cycles, prevention of soil erosion, support for biodiversity, and reduction in chemical reliance, resonate with the EU's aspirations for sustainable agriculture and biodiversity conservation. Moreover, the Green Deal emphasizes the shift toward a more sustainable, circular economy, a transformation wherein hemp can play a substantive role (AGRI, 2023). Aligned with the European Commission's circular economy action plan, which deems the textile sector as pivotal in the transition toward a greener and more sustainable economy, there exists a robust synergy with the potential of hemp. The Commission actively encourages stakeholders to explore novel materials and economic models in adherence to circular economy principles. To this end, the Commission intends to propose a comprehensive EU strategy for sustainable textiles (AGRI, 2023). This strategic approach reinforces the complementary relationship between the European Green Deal and the environmental benefits of hemp. Hemp emerges as a key sustainable

resource for the textile industry, offering a means to reduce the carbon footprint, promote circularity, and align with the EU's overarching vision of a greener, more sustainable future.

1.2.3 The Economic Value of Hemp

Hemp's economic potential is equally captivating and multifaceted, with the global hemp market projected to reach a substantial valuation of USD 18.6 billion by 2027 (UNCTAD, 2022). Table 1 illustrates the diverse applications of various plant components across different industries.

Part of the plant	Process	Product	Application
• Seeds	• Oil pressing	• Omega oil	• Feed, food enrichment
		• Oil seedcake	• Foods & beverages, cosmetics, biodiesel, supplements
• Stalks	• Fiber extraction	• Fibers	• Textiles, technical textiles, bio composites, packaging, nonwovens
		• Tows	• Paper, food fiber
		• Hurds	• Construction, insulation, biofuels, animal bedding
		• Dust	• Agriculture, hydroponics
• Flowers	• Organic compounds extraction	• Oils	• Nutaceuticals, pharmaceuticals
		• Dried extracts	• Herbal teas
• Roots & leaves	• Organic compounds extraction	• Oils	• Nutaceuticals, pharmaceuticals
		• Dried extracts	• Herbal teas, feed

Table 1: Hemp-derived products and their applications (UNCTAD, 2022).

Cannabinoids, particularly CBD, contribute significantly to the economic benefits and find diverse applications. CBD is present in various parts of the hemp plant, primarily in the aerial components, including leaves, stems, and flowers. The CBD content can vary across these plant parts, with the highest concentration typically found in the flowers and, to a lesser extent, the leaves. Hemp seeds, in contrast, contain minimal to no CBD. Hemp extract, derived from the entire plant and its aerial components, comprises a wide range of cannabinoids, including CBD, along with terpenes and other beneficial compounds (Zheljazkov et al., 2020). To investigate the primary uses of hemp flowers, leaves, and seeds in the European hemp sector, the European Industrial Hemp Association (EIHA) conducted a survey (EIHA, 2018). The findings revealed that 90% of the raw materials are sourced within Europe. This emphasizes the regional significance in the hemp supply chain. As illustrated in Figure 3 and Figure 2, over half of the flowers and leaves traded in Europe are utilized to produce food supplements, including CBD extracts. Examining the utilization of hemp seeds, the survey found that 55% are used directly, 34% as press cake, and 11% for oil production.

Hemp products find their biggest application in the food industry. Hemp seeds offer a rich source of protein, dietary fiber, vitamins, omega-3 fatty acids, and minerals, rendering them attractive components for a diverse array of food products (AGRI, 2023). The distinctive characteristics of hemp seed protein make it suitable for the development of innovative foods, including emulsifiers, plant-based meat, and gas-retaining membranes. Following the extraction of oil from the seeds, the residual mass proves to be a valuable protein-rich material for food processing. However, hemp protein has a lower solubility, requiring higher processing temperatures in comparison to other plant proteins. Exploring appropriate reaction conditions present a potential expansion of the applications of hemp within the food industry (Yano & Fu, 2023).

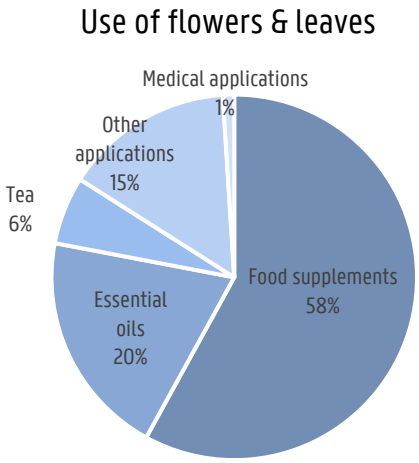

Figure 2: Use of flowers and leaves in the European hemp sector (EIHA, 2018).

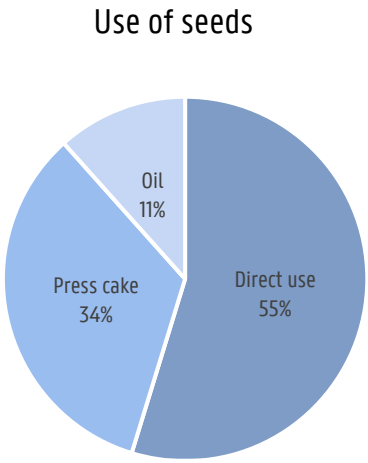

Figure 3: Use of seeds in the European hemp sector (EIHA, 2018).

In the construction sector, the use of hemp-based materials such as hemp wool, lime hemp concrete, and fiber-board insulation are reshaping the industry's approach to achieving carbon neutrality. These materials have the unique capability to store more carbon than they emit, thereby playing a role in the reduction of greenhouse gas emissions (AGRI, 2023). Hemp hurds, when combined with lime, yield "hempcrete," a mixture used as insulation (Phipps & Schluttenhofer, 2022). Hemp's emergence as a substitute for wood is a significant breakthrough. Innovative products like HempWood®, composed of compressed hemp stalks bound with natural adhesives, are transforming the production of flooring, cabinetry, and furniture, offering sustainable alternatives in these industries (Phipps & Schluttenhofer, 2022). The paper industry benefits from hemp's attributes, including its rapid maturation, environmental friendliness, and high recycling potential. Hemp fibers serve as an excellent alternative to traditional paper production, significantly reducing dependence on toxic bleaching chemicals. Hemp paper, known for its recyclability, can be recycled 7 to 8 times (AGRI, 2023). Hemp's versatility extends to the textile industry, where hemp fiber, closely resembling linen, is gaining increased attention due to its eco-friendly properties and sustainability. The fast growth of hemp and its minimal need for pesticides align with the textile industry's growing preference for sustainable materials (AGRI, 2023).

Hemp's economic potential also extends to its role as a renewable biofuel crop. Fiber hemp, yielding between 7 to 34 Mg/ha, is comparable to the biomass production of other bioenergy crops. This not only broadens income opportunities for farmers but also contributes to the advancement of cleaner and more sustainable energy sources (Aytaç, 2018; Phipps & Schluttenhofer, 2022; UNCTAD, 2022). Furthermore, hemp could serve as a sustainable resource in other applications such as bio composites, plastic alternatives, and cosmetics, presenting a spectrum of economic prospects. The adverse environmental impacts of traditional plastics have prompted manufacturers to explore alternatives, and hemp-derived plastics, known for their lightweight and durable properties, find applications in sectors like car manufacturing, railway, aviation, and aerospace. The combination of fibers with plastic resins results in a variety of bio composites (AGRI, 2023; Phipps & Schluttenhofer, 2022).

Hemp's contribution to the circular economy is evident through the utilization of all parts of the plant, resulting in reduced waste and pollution compared to other crops with larger ecological footprints. Additionally, hemp cultivation holds the potential to optimize land use and enhance incomes for farmers and rural communities (UNCTAD, 2022). The expanding and diversifying global market for hemp signifies not only promising economic benefits but also contributes to sustainability, circularity, and cleaner energy sources. These attributes align seamlessly with the objectives of the European Green Deal and the overarching vision of a more environmentally friendly and economically viable future.

1.2.4 Challenges & Opportunities

The journey towards realizing hemp's full potential faces regulatory hurdles, primarily linked to its association with marijuana. Regulations often require licenses for hemp production and stringent crop testing to ensure compliance with THC content limitations. These licensing demands and administrative paperwork can place direct costs and significant burdens on growers, ultimately affecting their profit margins. Compliance testing, particularly for THC content, can also be expensive, presenting a significant challenge to the industry. Canada has partially mitigated the issue by exempting certain hemp varieties from testing when consistent compliance is demonstrated over several years, although this approach is more suitable for seed and fiber production, posing challenges for metabolite crops, such as those used for CBD extraction (Phipps & Schluttenhofer, 2022). As the industry expands, there is an urgent need to streamline regulatory processes, reduce compliance testing costs, and create a more favorable environment for hemp cultivation.

Europe's hemp industry is experiencing rapid growth, with the number of hectares dedicated to hemp cultivation surging by a remarkable 614% compared to 1993 (EIHA, 2023). This growth reflects the increasing recognition of hemp's potential as a sustainable resource. Europe is emerging as a significant player in the global hemp market, with countries like France, Germany, and the Netherlands at the forefront of hemp production. In the European context, the Common Agriculture Policy (CAP) sets the maximum THC level allowed for industrial hemp in the field (EIHA, 2023). Many EU countries still prohibit or have unclear regulations regarding the use and marketing of flowers, even if the THC level falls below established thresholds in EU regulations. To make hemp a profitable crop, farmers need the freedom to maximize their income by using the entire plant, particularly the flowers and leaves. Therefore, EIHA (European Industrial Hemp Association) advocates for a "whole plant" approach (EIHA, 2023). The growing hemp market offers substantial economic opportunities that are accessible to all countries. Hemp can thrive in a wide range of climates across most parts of the world and can be planted on land unsuitable for other crops. This adaptability makes it an attractive option for developing countries. In many developing regions, significant portions of cotton plant material are discarded or burned, leading to pollution. For instance, in Africa, more than 80% of the cotton plant's mass is discarded, contributing to environmental issues. In India, the practice of burning cotton fields to clear harvest leftovers results in suffocating smoke and significant pollution. By utilizing all parts of the hemp plant, developing countries have the potential to establish sustainable production chains that stimulate growth in rural areas and foster economic diversification (UNCTAD, 2022). Hemp's versatility can contribute to more sustainable and economically viable practices in these regions.

1.3 CBD Products

Hemp-derived products are gaining more attention in various industries due to its wide array of applications. It is important to note that not all hemp-derived products contain CBD, distinguishing them from the category of CBD products. Products derived from hemp seeds contain little to no CBD (McGregor et al., 2020). The extraction of CBD primarily relies on the flowers and leaves of the hemp plant, as they contain higher concentrations of CBD. This extraction process is crucial for producing an assortment of CBD-infused products that have gained popularity in recent years (Baswan et al., 2020). In response to the rising demand from the pharmaceutical industry and growing consumer awareness of its health benefits, the CBD market is expected to experience rapid growth (GVR, 2021). This demand is evident in various product forms, such as oils, tinctures (CBD-concentrates), capsules, and topical solutions like salves, lip balms, and lotions. Additionally, edibles like baked goods, coffee, chocolate, gum, and candies have contributed to the expansion of the CBD market. Industries like pharmaceuticals, cosmetic products, nutraceuticals, food, and beverages are actively incorporating CBD into their products to cater to the increasing consumer interest (GVR, 2021).

A significant driver behind the surging demand for CBD products is its positive impact on health and well-being, as recognized by various medical applications. Moreover, the relaxation of regulations and legal restrictions has played a pivotal role in fostering the market's rapid growth (Stoelzle Pharma, n.d.). In recent years, several regions and countries have loosened their regulatory stances on CBD, facilitating increased product utilization and availability in stores and pharmacies. Many countries now permit the sale and consumption of a variety of CBD products. These products are mainly derived from CBD-dominant industrial hemp cultivars. Additionally, some European countries allow the sale of CBD-dominant cannabis plant material, known as "light cannabis". This material is consumed in the same way as traditional cannabis, either smoked or vaporized. High concentration CBD vape oils for e-cigarette devices are also available in select countries (McGregor et al., 2020).

1.3.1 From hemp to CBD products

The advent of CBD-rich cultivars has impacted the production of various hemp extracts, presenting consumers with different choices, including full spectrum, broad spectrum, and isolates. Full-spectrum products encompass the complete range of compounds found in the hemp plant, including CBD, THC, terpenes, fatty acids, and essential vitamins. Full-spectrum extracts can contain up to the legal limit of THC. Broad-spectrum products undergo processes such as distillation or chromatography to remove THC, resulting in what is sometimes referred to as distillates. Isolates, on the other hand, undergo refinement and purification processes to yield a crystalline powder containing a single compound, usually 99% pure CBD. The production begins with the extraction of dried floral material using supercritical carbon dioxide ($scCO_2$) or ethanol, yielding a raw extract rich in CBD and other plant compounds. Winterization, a subsequent step, involves dissolving the extract in ethanol and cooling the solution to remove lipids, followed by filtration to eliminate precipitates. Distillation or chromatography can then be used to further refine the product, removing THC or other cannabinoid fractions. Full-spectrum extracts, to comply with legal limits of THC, must be diluted after processing. Ethanol extraction often leads to full- or broad-spectrum products, while $scCO_2$ is favored for broad-spectrum products and isolates (Phipps & Schluttenhofer, 2022; Salehi et al., 2022; Szalata et al., 2022).

The resulting extracts and isolates find applications across diverse industries. Full- and broad-spectrum extracts, often termed as "oils," are commonly sold as tinctures or capsules and are utilized in wellness, cosmetics, and food products. Isolates, in the form of crystalline powders, extracts, and tinctures are incorporated into a wide array of consumables,

including baked goods, chocolate, protein bars, beverages like teas, and personal care products. Versions tailored for pets are also available in the market (Phipps & Schluttenhofer, 2022). The expanding market necessitates continuous innovation, as seen in the development of water-soluble CBD formulations. Despite the hydrophobicity of CBD, formulations have been devised involving additives or micelle suspensions to enhance solubility. These water-soluble products have found widespread use in beverages, foods, and personal care items (Felicity, 2020). Additionally, extracts and isolates are utilized in the creation of e-liquids for vape devices. Vaping involves dissolving extracts or isolates in a carrier solvent, typically a blend of glycerin and propylene glycol. Moreover, the traditional domain of smoked cannabis products has extended to include hemp flower markets in the United States and Europe. Referred to as "light cannabis", cured hemp flowers for smoking have gained popularity (McGregor et al., 2020). The evolving nature of hemp extracts underscore their integration into various products across industries, reflecting a dynamic and expanding landscape driven by consumer demand and technological advancements.

Advancements in laboratory techniques have facilitated the development of synthetic CBD, complementing traditional methods of CBD extraction from hemp. Crafted within controlled laboratory settings, synthetic CBD offers a novel approach to cannabinoid production, allowing for potential modifications to enhance potency, efficacy, and pharmacokinetic properties. Although not as extensively researched as its natural counterpart, preclinical studies indicate promising potential for synthetic CBD in addressing conditions such as pain, anxiety, and inflammation (Morales et al., 2017; USYD, n.d.). Its appeal extends beyond therapeutic applications, as industries characterized by stringent legal regulations, such as the cosmetic sector, appreciate its consistent quality and high yield (Kloris, 2021).

1.3.2 CBD Food Products

Hemp-derived food products are highly valued for their nutritional content, exemplified by items such as hemp seed oil. These products contain insufficient THC to induce a psychoactive "high" and are often integrated into foods as rich sources of essential nutrients, including omega-3 fatty acids. In contrast, CBD-infused products are specifically formulated to incorporate CBD for potential therapeutic benefits. The term "CBD food products" carries diverse interpretations depending on geographical location or information sources. Broadly speaking, CBD food products encompass any ingestible item containing CBD, irrespective of its form, whether it be a beverage or a consumable. CBD can be derived from various parts of the hemp plant, ranging from specific plant components to the entire plant itself. This classification also includes consumables containing synthetic CBD. It is crucial to make certain distinctions. CBD products intended for medicinal purposes, available exclusively with a prescription at pharmacies, do not fall under the category of CBD food products; instead, they are classified as CBD medicines. Similarly, food products containing solely hemp seed-derived ingredients, such as hemp seed extracts, hemp seed oil, or the direct consumption of seeds, inherently lack significant amounts of CBD. They often contain only negligible traces of the compound. Consequently, these products are not recognized as CBD food products. Hemp seed oil and CBD oil, though sometimes used interchangeably, are distinct; hemp seed oil is extracted from only the seeds, while CBD oil comes from the flowers, leaves, stems, or the whole plant.

In the context of this research, CBD food products encompass all types of consumables infused with CBD or extracts from the C. sativa plant, explicitly excluding seeds. This includes, but is not limited to, various food items such as baked goods and confectionery, as well as beverages like energy drinks, coffee, and tea. Additionally, it includes CBD oils, capsules, and tinctures designed for consumption, readily available for purchase without the necessity of a prescription. The integration of CBD into food and beverages has experienced a significant surge, driven by consumer interest in wellness-enhancing elements and the therapeutic benefits. However, the applications of CBD in food and

beverages are not uniform on a global scale, with jurisdictions differing in their regulations and permitted applications. Nevertheless, for legal sales to occur, regulatory clearance is paramount.

1.4 The Legal Framework of CBD food Products

In recent years, a trend has emerged across various European countries, marked by the establishment of shops offering an array of products containing CBD. Belgium embraced this trend also, witnessing the inauguration of its first CBD-shop in the municipality of Elsene in July 2018 (Verberckmoes, 2018). As these products are intrinsically linked with cannabis, a pertinent question arises regarding their compliance with prevailing drug legislation. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) asserts that the sale of these products is permissible due to their low THC content, resulting in minimal or no intoxicating effects and thus exempting them from drug legislation. The EMCDDA notes that these products predominantly enter the market as food, medicine, health products, tobacco products, or cosmetics (Emcdda, 2020). Belgium, however, currently lacks a comprehensive legal framework regulating the sale of CBD-based products, leading to considerable ambiguity concerning their permissibility. Moreover, certain products exist in a regulatory gray area, contributing to the complex legal landscape (De Standaard, 2018).

In the European Union, the cultivation and distribution of C. sativa plants for hemp fiber and seeds are deemed legal, provided they contain low THC levels. Guidelines for marketing seeds are outlined in Council Directive 2002/57/EC, specifying that only hemp varieties listed in the EU Common Catalogue of Varieties of Agricultural Plant Species can be marketed for agricultural purposes (Emcdda, 2023a). Farmers are eligible for support under the common agricultural policy when employing certified hemp seeds with a THC content not exceeding 0.3%. Standardized procedures for THC content determination are stipulated (LV, n.d.). The Court of Justice of the European Union (CJEU) emphasizes that hemp cultivation meeting stringent EU conditions cannot be prohibited in any Member State, as such an action would contravene EU law. Certain EU Member States may exclude all derivatives of these varieties from their narcotic schedules, encompassing all parts of the plant, including the flowers. Maximum THC levels are established for hemp seeds, hemp seed oil, and other hemp seed-derived products. Imports of raw hemp and hemp seeds are subject to conditions ensuring adherence to the maximum THC limit. It is imperative to underscore that this legislative framework was created for the hemp industry and was not intended to impact other products or compromise human product safety. Intra-EU trade in hemp products may still be subject to national legislation (Emcdda, 2023a).

Belgium's drug legislation, tracing its roots back to 1921, is complex and has undergone several reforms. Since 2003, the law has delineated cannabis from other illicit substances, decriminalizing the possession of small quantities for adults. In 2017, a Royal Decree mandated that CBD products adhere to a 0.2% THC limit to be deemed legal. CBD shops now rely on this threshold to market their products (VAD, 2023). Aligned with Belgian tobacco legislation, herbal products designed for smoking must undergo a notification procedure, submitting data to the Federal Public Service for Health. Approved products find their place on a 'positive list.' Additional conditions apply to products with cannabis or designated as CBD-products, necessitating an analysis certificate affirming a THC content below 0.2%. These products must refrain from bearing therapeutic indications on the label (VAD, 2023). In accordance with European cosmetic regulations and Belgian laws, a THC content of 0.2% is not a critical threshold; cannabis extracts are categorically prohibited in cosmetic products, except for extracts from leaves and seeds lacking flowering or fruit-bearing tops. The use of CBD in cosmetic products is not allowed if derived from flowering tops or the entire plant, while oil pressed from hemp seeds or leaves is permitted. The sale of cosmetic products containing cannabis extracts beyond the mentioned exceptions is in violation of the law (fagg, n.d.). Furthermore, attributing medicinal or

preventive effects to cosmetic products places them under pharmaceutical regulations, imposing specific regulations on cannabis use (VAD, 2023). In compliance with pharmaceutical regulations, all substances with therapeutic effects must obtain a license before being available for sale in Belgium, encompassing medicines based on cannabinoids. The Royal Decree of June 11, 2015, prohibits the dispensing of officinal and magistral preparations containing THC, limiting pharmacies to selling only medicines produced by the pharmaceutical industry (VAD, 2023). Currently, Sativex stands as the sole available medicine under stringent conditions in pharmacies, with Epidyolex holding a license yet to be commercialized in Belgium (fagg, n.d.). A circular from the Federal Agency for Medicines and Health Products (FAGG) delineates criteria for determining whether a raw material contaminated with THC can be utilized by pharmacists for magistral preparations with CBD. This affords pharmacists the opportunity, under specific conditions, to dispense magistral preparations with CBD alongside Sativex. Notably, this pertains exclusively to prescription magistral preparations, not over-the-counter products. In February 2019, the government greenlit the establishment of a cannabis bureau for medicinal applications. Although details remain scant, this bureau, integrated into the FAGG, will monopolize the production, trade, import, and export of medicinal cannabis on behalf of the Belgian government (fagg, n.d.; VAD, 2023). This development seeks to facilitate comprehensive research into the medicinal applications of cannabinoids and engender a more objective discourse surrounding medicinal cannabis.

Belgian CBD shops provide a diverse array of products derived from the cannabis plant associated with food, including tea, infusions, oils, various beverages, baked goods, and other sweets. Should these products be subject to food regulations, mere compliance with drug regulations is deemed insufficient. Both European and national food regulations provide explicit guidelines pertaining to cannabis plant-based products and those containing CBD. A considerable portion of the food standards is harmonized at the European level, ensuring uniform application across all European Union member states (FOD, 2016).

1.4.1 European Union

CBD food products in Europe are governed by Regulation (EU) 2015/2283, which establishes guidelines for the introduction of novel foods into the EU market. Novel foods, denoting those not substantially consumed by humans in the European Union (EU) before May 15, 1997, fall under this regulation. The primary aim is to ensure a high standard of protection for human health and consumers' interests (EU Monitor, 2015). Key elements of Regulation (EU) 2015/2283 delineate the responsibilities of food businesses in determining the applicability of the legislation to their products. The European Commission assumes the role of establishing and updating a positive list of authorized novel foods. Authorization for a novel food necessitates the absence of risks to human health, avoidance of consumer deception, and nutritional non-disadvantageousness compared to other foods under normal consumption (EU Monitor, 2015). Initiation of the authorization procedure can be undertaken by an applicant or the Commission. The application must include details on the novel food's composition and scientific evidence. The European Food Safety Authority (EFSA) may be consulted for its opinion, with the final decision resting with the Standing Committee on Plants, Animals, Food, and Feed (EU Monitor, 2015).

As of January 20, 2019, the European Commission includes extracts of C. sativa and derivatives containing cannabinoids, including CBD, in its novel food catalog. This encompasses both the extracts themselves and any food products incorporating them as ingredients. Consequently, a license is mandated within the EU for the marketing of these products, obtainable through a procedure before the Commission (Turck et al., 2022). While numerous applications for market authorization of CBD food products have been submitted, the Commission has yet to make a definitive decision on the matter. Approval of an application for CBD food products by the Commission would extend

benefits to other market participants by constituting a generic market authorization, permitting the marketing of approved products, provided adherence to specified conditions (Turck et al., 2022).

Presently, the sale of all types of foods containing CBD is prohibited within the EU. However, Regulation 2015/2283 incorporates a transitional regime. Foods lawfully placed on the market before January 1, 2018, and within the regulation's scope, may continue to be marketed until a decision is rendered following an authorization request, submitted by January 2, 2020, at the latest (EU Monitor, 2015). The Commission acknowledges that some food products derived from C. Sativa, including seeds, seed oil, hemp seed meal, and defatted hemp seed, have a history of consumption in the EU, allowing their marketing at the EU level. Nevertheless, national legislation of Member States may impose restrictions on these products (fagg, n.d.).

1.4.2 Belgium

In Belgian legislation, foods composed of plants or plant preparations, or those containing them, are subject to the Royal Decree of August 31, 2021. According to this decree, C. sativa is classified as a dangerous plant and is prohibited for use in food or as an ingredient in food items. This prohibition encompasses all varieties of the cannabis plant, including those with a THC content below 0.2% (VAD, 2023). Despite the exclusion of cannabis-derived products with a THC content lower than 0.2% from the Drug Law per the Decree of September 6, 2017, the general sale of cannabis-derived foods, irrespective of their low THC content, is typically not allowed under existing food regulations (VAD, 2023).

The Royal Decree of August 31, 2021, outlines a procedure for seeking an exemption from this prohibition. Guidelines for these exemptions are established by the Federal Public Service (FOD) for Health, Food Chain Safety, and the Environment, in collaboration with the Federal Agency for the Safety of the Food Chain (FAVV). The FAVV expressly prohibits exemptions for the use of C. sativa leaves and flowers as tea or infusion, even with very low THC content. However, derogations have been granted for certain specific products, including certain hemp seeds, hemp oils, hemp meal, and derived products such as cookies made from hemp meal, hemp lemonade, or hemp beer (FAVV, 2023).

Regarding foods enriched with CBD, the FAVV categorizes them as unauthorized novel foods under Regulation 2015/2283, and obtaining an exemption for such products without approval from the European Food Safety Authority (EFSA) is not possible. Consequently, selling, promoting, or proposing products containing C. sativa, plant preparations derived from C. sativa, or incorporated CBD products as food or dietary supplements without permission from is prohibited, regardless of the THC content (fagg, n.d.; FAVV, 2023). Under specific conditions, these products may be sold as non-food items, provided clear indications that they are not suitable for consumption (fagg, n.d.). This situation creates a scenario wherein CBD shops may sell products predominantly containing CBD and a THC percentage below 0.2%, but they are restricted from offering information on how these products should be consumed as food or dietary supplements.

1.5 The Current Situation in Belgium

The global CBD market attained a size of USD 12.8 billion in 2021, and projections indicate a compound annual growth rate (CAGR) of 21.7% between 2022 and 2028. Notably, the oral route of administration, comprising 52.2% of the market in 2021, signifies the prevalence of CBD products in the forms of oils and food products (GMI, 2022). This expansion is ascribed to the escalating awareness of CBD's health benefits and its demonstrated efficacy in addressing various medical conditions. Marketed for its therapeutic advantages, such as anxiety reduction, pain relief, and improved sleep,

CBD continues to garner consumer interest, with ongoing medical research uncovering additional positive effects and contributing to industry growth (GMI, 2022; GVR, 2021; Stoelzle Pharma, n.d.). The CBD market is intricately linked to hemp cultivation, witnessing a substantial increase in Europe (EIHA, 2023). The evolution of consumer perceptions, marked by shifting beliefs towards cannabis-derived products, has notably increased adoption, reflecting a positive shift in the overall perceptions of cannabis and its derivatives. This signifies a diminishing stigma surrounding cannabis, cultivating a more favorable outlook within the consumer demographic (Broens, 2023; GMI, 2022).

Belgium has seen a rise in the accessibility of CBD products, with an estimated 35 CBD shops. CBD oil has become widely available, with its popularity extending to pharmacies and online stores (Broens, 2023). Despite that it is not legal, many shops in Belgian cities sell CBD products in the form of food products. These shops operate in the legal grey zone by selling these products as non-food items, which is legally permissible if it is indicated that these products are not suitable for consumption (Broens, 2023). However, this creates a situation where CBD shops are allowed to sell CBD products designed for consumption but are not allowed to explain how these products should be consumed. Some products are labeled as "not for consumption", yet they are widely purchased for ingestion. Lack of clear regulations and control mechanisms contribute to this ambiguity, raising concerns about the potential risk for consumers, as there is not enough scientific evidence to support the safe consumption of CBD as a food ingredient.

The European Food Safety Authority (EFSA) encounters challenges in establishing the safety of CBD as a novel food, primarily attributable to data gaps and uncertainties. Research indicates potential hazards associated with CBD consumption, particularly in areas such as the liver, gastrointestinal tract, endocrine system, nervous system, and psychological well-being (EFSA, 2022). The Novel Food Authorization process is presently suspended, with only 20 out of 190 received applications being actively evaluated (EFSA, 2023). This underscores the imperative for comprehensive safety assessments to precede authorization processes. The issue of THC content in CBD products further compounds challenges, as evidenced by a 2019 investigation in the Belgian city of Leuven, where one in five confiscated items were found to contain excessive levels of the psychoactive compound (Vanthienen, 2019). Consequently, there is a pronounced need for the implementation of stringent quality control measures within the industry. Furthermore, the sector has witnessed claims purporting CBD as a miracle cure for various conditions, instigating concerns regarding the dissemination of accurate information and the practice of responsible marketing (Vanthienen, 2019).

1.6 Literature Review

The growing market of CBD food products, both in Belgium and globally, underscores the importance of effective and efficient regulation by policymakers and stakeholders. As the market continues to expand, there is a growing need for comprehensive insights into public knowledge, perceptions, and behaviour towards CBD food products. The possibility of CBD gaining approval as a food ingredient by the EU could further increase its popularity. However, the lack of data presents a challenge for policymakers and stakeholders aiming to navigate this dynamic market successfully (Broens, 2023). A well-informed understanding of current consumption patterns, public perceptions, knowledge, and behaviour towards CBD food products is imperative for developing targeted actions and regulations. Bridging these knowledge gaps is crucial not only for ensuring consumer safety but also for fostering an environment that allows the CBD industry to thrive within a clear and transparent regulatory framework.

Two electronic database aggregators, PUBMED and Web of Science, were utilized for the literature search, initiated on March 12, 2023. The search employed a consistent query for titles and abstracts: (cannabis OR marijuana OR cannabidiol OR CBD OR hemp) AND (food* OR beverage* OR drink* OR oil* OR infused OR capsule* OR supplement* OR tincture* OR edible*) AND (knowledge OR perc* OR intent* OR behavio* OR attitude* OR aware* OR belief*), without

specific time constraints. Additionally, Google Scholar and Google were consulted as supplementary sources. The screening process involved three stages: title screening, abstract screening, and full-article screening. During title screening, studies had to demonstrate relevance to the research to progress beyond the initial stage. Abstract and full-article screening focused on articles addressing cannabis, medical cannabis, CBD, and hemp-derived products in relation to use, knowledge, perception, and behaviour. The initial search yielded 481 citations, with the removal of duplicates. Title screening excluded studies related to pharmacology, CBD-detection technology, industrial processes, neurology, and other non-relevant subjects. Subsequent abstract and full-article screening of the remaining 42 citations resulted in 24 articles eligible for qualitative synthesis. An additional 12 articles were uncovered through snowballing and a web search. The flow of information throughout the literature review process is visually represented in Figure 4.

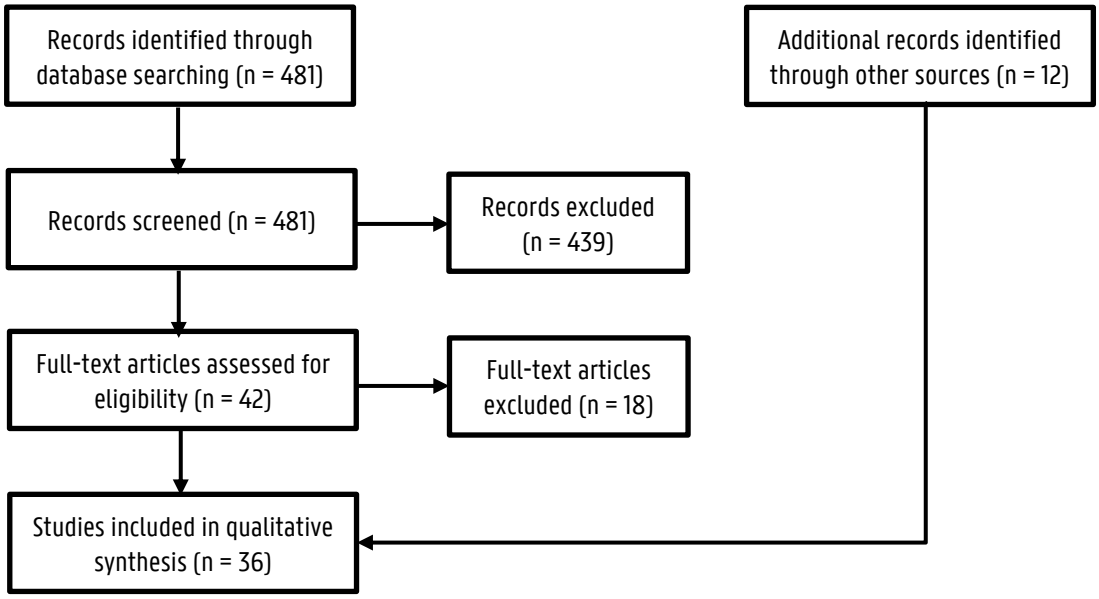

Figure 4: PRISMA flow diagram of literature review selection process.

1.6.1 Consumption Patterns and Reasons for Usage

In both the United States and Canada, there is a significant and widespread awareness of CBD, accompanied by a substantial prevalence in the use of CBD products. Notably, 63% of individuals in the USA are acquainted with CBD (Gicewicz et al., 2021), reaching an impressive peak of 97.9% among young adults (Wysota et al., 2022). Among this demographic, 51.4% have reported using CBD at least once, and 32% have indicated usage of CBD products within the past six months (Wysota et al., 2022). Another study focusing on young adults found a 71% awareness of CBD, with a 40% incidence of CBD product usage at least once (Wheeler et al., 2020a). The prevalence of CBD use in Canada is noteworthy, with 16.2% of the population having used CBD products in the past 12 months. However, this figure is surpassed in the United States, where 26.1% of the population has used CBD products (Goodman et al., 2022). The

primary reported reason for the use of CBD products in both countries is for pain relief (Corroon & Phillips, 2018; Gicewicz et al., 2021; Goodman et al., 2022; T. Tran & Kavuluru, 2020; Wysota et al., 2022), with 67.7% of CBD users in Canada citing it as their motivation (Tumati et al., 2022). Other frequently reported reasons include addressing issues related to sleep (Gicewicz et al., 2021; Wheeler et al., 2020a; Wysota et al., 2022), anxiety (Corroon & Phillips, 2018; Gicewicz et al., 2021; Goodman et al., 2022; T. Tran & Kavuluru, 2020; Wysota et al., 2022), and depression (Corroon & Phillips, 2018; Goodman et al., 2022). Among young adults, stress relief and relaxation are also common motivations (Wheeler et al., 2020a; Wysota et al., 2022). Demographically, the use of CBD is more prevalent among females in both the USA and Canada (Tumati et al., 2022; Wheeler et al., 2020a). The most popular CBD products in both countries include CBD food products, particularly CBD oil and tinctures, as well as edibles and capsules (Goodman et al., 2022; T. Tran & Kavuluru, 2020; Tumati et al., 2022; Wheeler et al., 2020a; Wysota et al., 2022). Additional product types include topicals, vape products, and dried flowers.

Conversely, there is a scarcity of data regarding consumption patterns of CBD products in Europe. A study on the public in the UK revealed that 6.4% of participants consume CBD for wellness reasons, 2.7% are prescribed CBD for medical reasons, and 2.1% consume CBD for other reasons (Erridge et al., 2022). Notably, 75% of current users in the UK have been using CBD for less than a year, indicating a growing popularity of CBD in Europe (2CV, 2019). The primary reasons for CBD usage in Europe align with those in the USA and Canada, encompassing pain relief, anxiety, relaxation, sleep improvement, and addressing mental health issues (2CV, 2019; Kirilov et al., 2020). In Bulgaria, a study on pharmacists highlighted pain and anxiety as the primary reasons for CBD usage (Kirilov et al., 2020). Meanwhile, in France, 11% of users also mentioned using CBD, particularly CBD-rich cannabis, for smoking, with the specific aim of reducing overall marijuana consumption (Fortin et al., 2022).

The rising inclination towards natural alternatives is driving the surge in demand for CBD products (Bhamra et al., 2021). Consumers increasingly turn to CBD as a targeted therapy for various medical conditions, with pain, anxiety, depression, and sleep disorders being prominent targets (Corroon & Phillips, 2018). In the USA and Canada, CBD product usage is prevalent, particularly for self-reported health concerns where scientific evidence is limited (Goodman et al., 2022) . A study on young adults in the USA revealed beliefs in health benefits of CBD unsupported by scientific validation (Wheeler et al., 2020a). Many CBD users may not be using these products responsibly. Monitoring social media posts on the therapeutic uses of CBD products unveiled stress and nausea as prevalent claims lacking scientific backing (T. Tran & Kavuluru, 2020). In the USA, many primary care physicians (PCPs) express skepticism, considering CBD unhelpful for most conditions it is marketed for (Sharma et al., 2023). Meanwhile, in Australia, the Google keyword 'CBD oil' dominates searches for cannabis-related information, perpetuating misinformation (Webb & Mansfield, 2021). The online landscape proves to be a source of misinformation about CBD, leading to widespread misperceptions regarding its therapeutic benefits.

A closer look at warning letters from the United States Food and Drug Administration (FDA) issued over an 18-month period during the COVID-19 pandemic on promotional violations related to health products claiming to mitigate, prevent, treat, diagnose, or cure COVID-19 reveals a notable trend (A. Tran et al., 2021). CBD products emerge as the most frequent subject of violation, comprising a staggering 11.5% of all violations. These CBD-related letters consistently report the promotion of unapproved products and misbranding, with 93.3% of cases featuring claims lacking scientific substantiation. Research conducted in Denmark suggests that the increased utilization of CBD oil has led to a substitution effect in prescription drug use (Kvamme et al., 2021). Commonly, individuals are opting for CBD oil as a replacement for pain medication, antidepressants, and arthritis medication. Notably, women are more inclined to be substitution users, employing CBD oil for chronic pain and somatic conditions. Among these substitution users, 38.1% reported a complete cessation of prescription drug use, while 45.9% reported a significant reduction in prescription drug consumption.

1.6.2 The Influence of Knowledge on Perceptions

Primary care physicians (PCPs) in the USA frequently encounter discussions initiated by patients regarding CBD in primary care settings. Despite this, a prevailing sentiment among PCPs is the reluctance to recommend CBD supplements. This hesitancy is evident in their general reservations when discussing CBD with patients, citing low perceived knowledge and inadequate training as significant barriers (Sharma et al., 2023). Healthcare professionals in the UK also share a common concern, reporting a lack of knowledge about CBD (Ukaegbu et al., 2021). Within the pharmacy setting in the USA, the most common patient inquiries revolve around vitamin D, omega-3, and CBD (Stayduhar et al., 2023). Both pharmacists (Kirilov et al., 2020) and veterinarians (Kogan et al., 2019) exhibit a good level of objective knowledge regarding CBD products and their effects. However, they express comfort discussing these matters with colleagues but display hesitancy when it comes to engaging clients. Contrastingly, more than 60% of pharmacy students and pharmacists perceive CBD supplements as safe (Stayduhar et al., 2023). Veterinarians largely support the benefits of CBD products for humans and animals (Kogan et al., 2019). Notably, recent graduates across healthcare professions appear less comfortable discussing the topic, emphasizing potential disparities influenced by societal norms or negative perceptions (Kogan et al., 2019). These findings collectively suggest that individuals within the healthcare sector possess positive perceptions and good objective knowledge of CBD. However, a lack of perceived knowledge contributes to their hesitancy in discussing it. This hesitancy could also be influenced by social norms around these products. A study conducted on pharmacy students in the USA reveals that incorporating a formal lecture on CBD into the curriculum effectively enhances students' knowledge and confidence in discussing it with patients, underscoring the pivotal role of knowledge in shaping intentions and perceptions about using CBD products (Whitman et al., 2020).

Two studies conducted in Poland explored the use of CBD oil by caregivers providing support for patients with Alzheimer's disease and dementia as part of their treatment regimen (Kłosińska & Leszko, 2024; Leszko & Meenrajan, 2021). The findings revealed a remarkably positive perception among caregivers regarding the benefits of CBD. They expressed that CBD was effective in managing symptoms and contributed to improvements in behaviour, cognition, communication, and daily activities. Notably, caregivers advocated for the integration of CBD oil into standard treatment protocols, believing that healthcare professionals should actively consider its inclusion. Surprisingly, a significant number of caregivers disclosed that they had not discussed the use of CBD oil with healthcare professionals, despite their conviction in its efficacy. The caregivers perceived CBD oil as a safer and more effective alternative to other treatments. Intriguingly, their primary source of information about CBD was an online support group, where misinformation was frequently disseminated. This suggests that caregivers may develop high perceived knowledge about CBD through support groups, potentially influencing their positive perceptions. Furthermore, the studies identified a noteworthy misconception among some caregivers who believed that the use of CBD oil was illegal in Poland. This belief was associated with heightened perceived risks associated with CBD usage, highlighting a clear link between beliefs about the legal status of CBD and perceptions.

It can be assumed that users of CBD products possess higher levels of subjective knowledge about CBD. Generally, individuals who use CBD products tend to hold positive perceptions. In the UK, two-thirds of users believe that CBD has had a positive impact on their overall health or has effectively addressed specific medical conditions (2CV, 2019). Furthermore, most express confidence in the quality and accuracy of the CBD products they purchase. Similarly, in the USA and Canada, more than half of CBD consumers attested to the beneficial effects of CBD oil on their health (Goodman et al., 2022). In the USA, a noteworthy 36% of users believed that CBD was highly effective in treating their medical conditions (Corroon & Phillips, 2018). Additionally, those who had never used CBD, as opposed to former or current users, tended to perceive more risks, less social acceptability, and greater difficulty in accessing CBD (Wysota

et al., 2022). On the other hand, current users reported perceiving more benefits from CBD. Interestingly, a divergence in findings emerges in Canada, where more frequent consumers of legal cannabis-derived products exhibited less favorable perceptions compared to less frequent consumers (Wadsworth et al., 2022).

A UK-based study has found a disparity in perceptions regarding medical cannabis between the public and members of the medical community (Chapman, 2019). The public exhibits a lower perceived risk compared to professionals within the medical field. Despite medical cannabis being legally available on prescription for patients in the UK, doctors often refrain from prescribing it, citing a lack of evidence supporting its safety and effectiveness. This observation resonates with the reluctance of healthcare professionals to recommend CBD products, reflecting a broader issue. The divergence can be attributed to various factors, including the historical illegality of cannabis, a lack of evidence-based information, prevalent misinformation among the public, and cognitive dissonance. There is a significant gap between the public's perceived knowledge and the actual knowledge regarding medical cannabis (Chapman, 2019). Participants in the study tended to overestimate their knowledge, pointing to a potential disparity between perception and reality in this domain. While no distinct trends were confidently identified within demographic groups, there was a suggestion that individuals perceiving medical cannabis as dangerous or harmful tended to have lower knowledge about it. Healthcare professionals might exhibit a greater awareness of their actual knowledge and be less susceptible to misinformation. This could explain the contrast in their perceptions when compared to the public. A Belgian study revealed positive attitudes among the public towards medical cannabis, with positive evaluations of perceived benefits and high levels of social trust (Pav et al., 2023). Interestingly, risk perceptions were generally low, and both subjective and objective knowledge were relatively poor. The study demonstrated that both forms of knowledge and social trust play a role in shaping perceptions, with subjective knowledge emerging as a stronger determinant.

In the USA, individuals with limited knowledge about CBD identified 'a lack of knowledge' as their primary barrier to using it (Gicewicz et al., 2021). Additionally, young adults predominantly relied on family, friends, online content, and advertisements as their key sources of information about CBD, perceiving it as safe, socially acceptable, and effective (Wysota et al., 2022). These findings underscore the significant impact of diverse information sources in shaping perceptions of CBD. Collectively, these studies lead to a conclusion: a clear correlation exists between knowledge and perceptions regarding CBD products. Furthermore, subjective knowledge emerges as a crucial determinant, wielding a more substantial influence on perceived benefits and risks.

1.6.3 The Influence of Legislation on Perceptions

Research indicates that attitudes and perceptions regarding CBD products are significantly influenced by factors such as naturalness and associations with illegal aspects. Positive attitudes toward the safety and efficacy of CBD are correlated with its natural origin (Bhamra et al., 2021). The perceived naturalness of CBD emerges as a crucial psychological determinant that positively shapes evaluations, particularly for hemp-derived food products. Consumers commonly link hemp-based products with naturalness, contributing to an overall positive perception (Velasco et al., 2023). In the UK, barriers to accessing medical cannabis predominantly revolved around its association with recreational cannabis and uncertainty about its legality (Erridge et al., 2022). Meanwhile, in Australia, a study focused on the acceptability of hemp food underscored widespread confusion among the public regarding CBD, THC, and hemp (Metcalf, Wiener, Saliba, et al., 2021). Negative perceptions of hemp food were linked to associations with THC, while positive perceptions were associated with CBD. Another Australian study on hemp food revealed that associations of hemp with illegal aspects did not significantly impact consumer choices (Metcalf, Wiener, & Saliba,

2021). This highlights the potential presence of a relationship between the association with illegal aspects and perceptions towards hemp-derived products.

In the USA, the attitudes, practice behaviours, and barriers of PCPs regarding CBD supplements exhibit variations based on the cannabis law status of their respective states (Sharma et al., 2023). PCPs in states where marijuana is legal demonstrate a more favorable outlook toward patients using CBD supplements. Conversely, in states where marijuana remains illegal, PCPs express heightened concerns about potential side effects associated with CBD. Within the veterinary community in states where marijuana is legal, there is a higher openness to discuss and recommend the use of CBD products for treating medical conditions in animals (Kogan et al., 2019). These veterinarians are more inclined to advise clients on CBD use and are supportive of the notion that further research on CBD's utilization in dogs is necessary. Moreover, they are more likely to agree that both marijuana and CBD should not retain their classification as Schedule I drugs. Shifting the focus to the UK, healthcare professionals with the authority to prescribe CBD demonstrate distinct perspectives (Ukaegbu et al., 2021). Those with prescription rights are almost twice as likely to believe in the therapeutic properties of CBD. Additionally, they are nearly three times less likely to perceive CBD as having dangerous side effects and are over twice as likely to believe that CBD reduces the likelihood of psychosis. This reveals a nuanced interplay between different legislations and healthcare professionals' attitudes and beliefs regarding CBD in different regions.

Research reveals a lack of public knowledge regarding the legal status of CBD products (2CV, 2019; Erridge et al., 2022; Wheeler et al., 2020a). Young adults in the USA exhibit not only a deficiency in knowledge but also numerous misperceptions about the legal and regulatory aspects surrounding CBD (Wysota et al., 2022). A study conducted in the UK highlights the remarkably low public awareness regarding the legal status of medical cannabis (Erridge et al., 2022). Regarding CBD food products, an astonishing 94.3% of respondents in the study were unaware of the April 2021 regulations mandating adherence to European Novel Foods regulations for over-the-counter CBD products in the UK.

Contrary to expectations, a study in the USA found no significant relationship between the type of marijuana law in students' state of residence and their perceived risk of using marijuana (Burroughs, 2019). This contrasts with healthcare workers' decreasing perception of risk associated with using CBD products in regions where marijuana is legalized. In Vermont, where marijuana is legalized, a significant portion (40%) of young adults remain uninformed about the state's current cannabis policy, with knowledge gaps being more pronounced among younger individuals and those with lower educational levels (West et al., 2022). Interestingly, past and current cannabis users possess higher policy knowledge, and this higher knowledge is associated with increased perceived risks. Concurrently, as mentioned earlier, both subjective and objective knowledge have been linked to lower perceived risks of consuming CBD products and medical cannabis. These differences might stem from variations in how cannabis is evaluated compared to CBD or medical cannabis or the differential impact of knowledge about the legal status on perception compared to general knowledge. Moreover, people in regions with legalized marijuana tend to exhibit higher objective knowledge about CBD (Hammond & Goodman, 2022).

Limited research exists on how the public's perceptions of CBD food products vary based on the legal status or the perceived legal status of these products. In the UK, users of CBD food products display limited awareness regarding CBD being classified as a novel food. Some express concern upon learning this information, while others remain unperturbed (Erridge et al., 2022). Another study indicates that positive perceptions about medical cannabis are more prevalent when individuals believe it to be legal (Chapman, 2019). Two notable studies explored the change in perceptions before and after the legalization of non-medical cannabis products. The first study, focused on young adults in the USA, revealed a significant decrease in perceived risks associated with cannabis-derived food products after legalization (Reboussin et al., 2019). The second study, conducted on consumers of cannabis-derived products in

Canada, highlights that individuals who believed these products were legal, before legalization, perceived them to be safer, more convenient to buy, more expensive, safer to use, and of higher quality compared to those who believed them to be illegal (Wadsworth et al., 2022). Three years post-legalization, Canadian consumers demonstrated increasingly favorable perceptions of legal cannabis products, except in terms of price.

1.6.4 Behavioural Intention

Broadly, there is a positive perception of CBD, and this positivity is anticipated to grow. As the potential for CBD food products to gain official access to the European market looms, it becomes crucial to comprehend the driving forces behind people's intention to consume these products. Presently, research on the factors influencing the public's intention to consume CBD food products remains limited. In the USA, patients frequently ask about CBD to their PCPs (Sharma et al., 2023), and young adults express high intention to consume CBD products in the future (Wysota et al., 2022). Research in the UK indicate that 35% of individuals who have never used CBD (n = 532) express an interest in trying it (Bhamra et al., 2021). Despite the lack of data, there is a reasonable assumption that the public's intention to consume CBD food products is relatively high in Europe.

In Australia, individuals who embraced hemp-derived food products early on reported higher levels of food neophobia compared to those who did not partake (Metcalf, Wiener, & Saliba, 2021). These findings were inconsistent with expectations and prior studies, suggesting that the diffusion process of hemp food products may be more advanced than initially anticipated. Early consumers of hemp products in Australia prioritized factors such as health, mood, natural content, familiarity, and ethical concerns in their decision-making process. Meanwhile, in Canada, a study focused on understanding the factors influencing students' attitudes towards cannabis-infused soft drinks (Basha et al., 2023). The significant factors identified included price, impulsive personality, social insecurity, and social norms, with impulsive personality and social norms emerging as the most influential. This emphasis on social norms or social acceptability could potentially explain the hesitancy of PCPs and veterinarians in the USA to discuss CBD with their patients.

In the USA, young adults who have not yet used CBD products but express a strong intention to do so in the future demonstrate a greater use intention correlated with higher perceived social acceptability, the convenience of accessing CBD, and higher perceived benefits (Wysota et al., 2022). In contrast, in Belgium, social trust does not emerge as a significant determinant of the public's intention to use medical cannabis. However, in Belgium, there is a positive correlation between perceived benefits of medical cannabis and higher levels of subjective knowledge, objective knowledge, and social trust, while perceived risks are negatively correlated with these factors (Pav et al., 2023). Both perceived benefits and risks significantly covary and are robustly linked to intention, with perceived benefits standing out as the most influential determinant (Pav et al., 2023). A study within an Amish community underscores that perceived benefits outweigh perceived risks as a determinant of CBD use intention (Riley, 2022). Notably, low consensus was found regarding statements addressing perceived risks among the Amish, with the cost of CBD being the most agreed-upon barrier, suggesting cost as a potentially significant obstacle within the Amish culture. Conversely, research conducted in Sweden revealed that the perception of risk plays a more substantial role in determining the intention to use marijuana (Giannotta, 2021). Higher perceived risk was inversely linked to the intention to use marijuana in this context.

1.6.4.1 The Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a psychological model widely applied for understanding and predicting human behaviour. Building upon the Theory of Reasoned Action, TPB introduces the concept of perceived behavioural control. Its key components include attitude, subjective norm, and perceived behavioural control (Azjen, 1991).

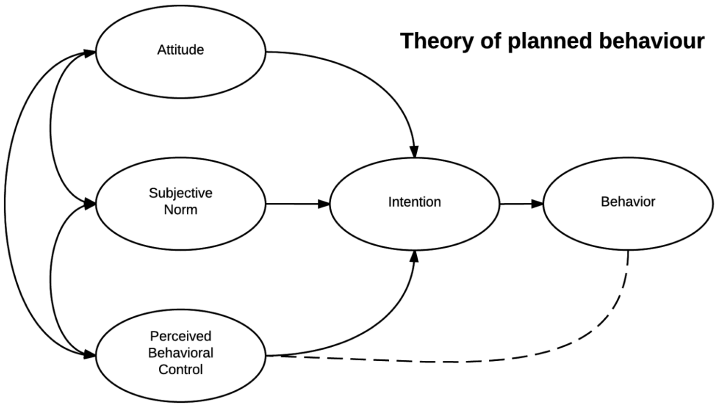

Figure 5: Theory of Planned Behaviour (Sansom, n.d.).

Attitude reflects an individual's positive or negative evaluation of a behaviour, influenced by beliefs about outcomes and their subjective value. Subjective norms involve the perceived social pressure or influence regarding the performance of a behaviour, shaped by the opinions of significant others. Perceived behavioural control is the perception of the ease or difficulty of performing a behaviour, encompassing self-efficacy and the presence of obstacles or facilitators. Behavioural intention, a crucial concept, represents an individual's readiness to perform a specific behaviour and is influenced by attitudes, subjective norms, and perceived behavioural control. Behavioural intention serves as the immediate antecedent to actual behaviour and is a strong predictor of it. The relationships among these components may vary based on context and the behaviour in question. Ajzen highlights the significance of perceived behavioural control, particularly in situations where individuals may not have complete control over their behaviour. Overall, TPB provides a comprehensive framework by considering cognitive, social, and personal factors, making it widely applicable in fields such as health psychology, environmental psychology, and organizational behaviour (Azjen, 1991).

While existing literature has explored the application of the Theory of Planned Behaviour (TPB) in understanding intentional behaviour related to marijuana use, medical cannabis, and hemp-derived food products (which are closely associated with CBD), a notable gap exists in its application to the specific context of CBD or CBD products. A study focused on college students in Alabama provided insights into predictive factors for marijuana use intentions, revealing that all TPB constructs—attitude, subjective norms, and perceived behavioural control—played a role (Burroughs, 2019). Interestingly, when considered collectively, only attitude emerged as a significant predictor for both short-term and long-term intentions, suggesting that individual attitudes may exert greater influence over marijuana use intentions compared to social norms or perceived control. Another study, conducted among future healthcare workers in China, identified age as a demographic variable associated with cannabis use intention, with younger respondents expressing a higher intention (Ho et al., 2022). Using an extended TPB model incorporating perceived behavioural control, subjective norms, attitude, knowledge, and perceived availability, the final regression model retained only attitude and perceived availability as statistically significant factors. In a study conducted in Iran

among young adults seeking assistance at a drug use center, the TPB framework was extended to assess dimensions such as self-efficacy, environmental constraints, and problem-solving skills (Jalilian et al., 2020). Results indicated positive correlations between attitude, subjective norms, environmental constraints, and behavioural intention for weekly marijuana use. Importantly, higher self-efficacy and problem-solving skills were associated with lower marijuana use. Despite variations in TPB constructs across these studies, they collectively underscore the relevance of TPB in understanding marijuana use intentions, with attitude consistently emerging as a significant predictor, emphasizing the individual's internal stance toward marijuana.

Two additional studies provide insights into the intentions of Israeli physicians concerning medical cannabis recommendations (Zolotov et al., 2019) and the intention to consume hemp-derived food products among adults in Australia (Metcalf, Wiener, Saliba, et al., 2021). Physicians' intentions to recommend medical cannabis to patients were strongly linked to more favorable attitudes, indicating that perceptions of its efficacy play a pivotal role in clinical decision-making. Furthermore, physicians' intentions were associated not only with favorable attitudes but also with higher levels of perceived behavioural control and lower levels of perceived knowledge (Zolotov et al., 2019). This negative association between intention and perceived knowledge contradicts other research indicating a positive correlation between perceived knowledge and positive perception and use. In Australia, the intention of adults to consume hemp-derived food products is significantly influenced by the importance they place on others' acceptance of using these products (Metcalf, Wiener, Saliba, et al., 2021). This emphasis on social factors in shaping intentions raises questions about whether similar influences apply to CBD food products.

1.6.5 Research Questions

Previous research on CBD awareness and usage predominantly focused on North America, leaving a data gap concerning European countries. To the best of my knowledge, no study has investigated the consumption patterns of CBD in Belgium. Moreover, cultural, regulatory, and demographic differences exist among regions, emphasizing the need for a localized investigation. The literature review highlights the increasing global trend toward CBD products and the critical knowledge gap regarding CBD's integration into the European population. The confluence of CBD's surging popularity, coupled with misinformation and misperceptions, raises concerns about consumer safety, particularly when these products are chosen as substitutes for other established medical treatments. This underscores the importance of gaining a nuanced understanding of consumer motivations and preferences. Furthermore, most of the current research examining reasons for usage predominantly centers on CBD in a general context. It is essential to recognize that CBD is available in various forms, and the reasons for usage may vary depending on the specific type of CBD administration. In this research, the focus will be specifically on elucidating the motivations behind the consumption of CBD food products, including CBD oil and CBD supplements. This research deliberately excludes other forms of CBD, such as CBD-rich cannabis or cosmetic applications, to concentrate on understanding the motivations unique to CBD ingestion through food products.

Moreover, the literature review reveals a significant lack of public knowledge regarding the legal status of CBD products, as well as varied perceptions influenced by subjective and objective knowledge. Furthermore, the review highlights the profound influence of legislation and, more importantly, beliefs about the legal status on perceptions. A deeper understanding of these dynamics is crucial for policymakers navigating the evolving landscape of the CBD market. Again, existing research predominantly centers on broader topics such as CBD in general, cannabis, and medical cannabis. However, a noticeable gap emerges concerning specific investigations into the public perceptions of CBD food products, especially in the context of Belgium. Given the unique considerations associated with CBD food products, the proposed research question seeks to narrow this gap by concentrating specifically on public perception

in Belgium. By focusing on CBD food products, this research aims to contribute targeted insights that go beyond the broader discussions on CBD, shedding light on how subjective knowledge, objective knowledge, and beliefs about the legal status uniquely shape public perception in the context of consumable CBD products.

The literature underscores the significance of individuals' attitude in shaping behavioural intention, emphasizing the internal stance toward cannabis-derived products. However, the impact of subjective norms and perceived behavioural control in the context of CBD remains insufficiently explored. While existing studies lay a foundation, there is a need to extend this understanding to the unique context of CBD food products among the public. This knowledge gap forms the basis for the last research question, which seeks to elucidate the extent to which attitudes, subjective norms, and perceived behavioural control collectively shape the intention to consume CBD food products among the public in Belgium. The exploration of these psychological determinants is deemed essential given the distinct nature of CBD food products and the evolving landscape of consumer perceptions. By addressing this gap, the research aims to contribute valuable insights that can inform public health strategies and marketing initiatives in the emerging CBD market in Belgium.

1) *What fraction of the Belgian population is familiar with and has used CBD, and how does this awareness and usage vary across demographic groups?*
2) *How are public perceptions of CBD food products in Belgium influenced by individuals' subjective knowledge, objective knowledge, and beliefs about the legal status of CBD?*
3) *To what extent do attitude, subjective norm, and perceived behavioural control shape the intention to consume CBD food products among the public in Belgium?*
4) *What motivates individuals in Belgium to consider future consumption of CBD food products, and what are their anticipated consumption frequency and preferences regarding types of CBD food products?*

2 Methodology

This research is based on data collection through an online cross-sectional survey (Appendix B: Online Qualtrics Questionnaire (Dutch Version)) employing quantitative research methodologies. For the survey design, a limited number of qualitative elements where used. Quantitative research systematically applies strategies, techniques, and assumptions to investigate psychological, social, and economic phenomena by analyzing numeric patterns (UTA, 2023). The online survey comprises scale questions, and multiple-choice questions. Leveraging an online survey offers streamlined analysis and integrated survey tools. Ethics approval is granted by the Medical Ethics Committee of Ghent University Hospital (Ref. ONZ-2023-0263; Appendix A: Approval by the Medical Ethics Committee of Ghent University Hospital

2.1 Research Design

2.1.1 Sample Design and Distribution

The target population for this study encompasses individuals aged 18 and above residing in Belgium. Employing a non-probability convenience sampling method, participants were selected based on their availability and willingness to participate, rather than through random selection, thereby precluding equal representation for the entire population. Notably, the survey was exclusively developed in Dutch, limiting the inclusion of French and German speakers. Two filter questions were employed to enhance representativeness, excluding participants under 18 and those from non-Belgian provinces. Utilizing convenience sampling, respondents were drawn from an easily accessible pool within the researcher's network. The survey spanned five weeks in October and November 2023, disseminated through social media platforms like Facebook, Instagram, and WhatsApp. The distribution message underscored the survey's topic, duration, and the confidential nature of data collection, analysis, and reporting. Participation was voluntary, with participants able to withdraw at any point, and no personally identifiable information was recorded. Informed consent was obtained from all participants prior to their engagement in the study. Collected data was anonymized for further analysis and storage. The survey was created and distributed using the Qualtrics software and aimed for 300 completed responses. 306 people participated in the survey. Nine respondents were excluded from the dataset: two were below 18, and seven provided excessively incomplete answers. Among the remaining 297 respondents, 41 (13.8%) completed the survey only partially; however, they were still included in the final dataset.

2.1.2 Survey Design

The first section of the online survey (Appendix B: Online Qualtrics Questionnaire (Dutch Version)) asked respondents about socio-demographic information (gender, age, education, living situation, residential environment, and province). All participants were presented with a clarifying statement about CBD: "CBD, an abbreviation for cannabidiol, is a naturally occurring chemical compound found in various plant species, including the hemp plant." Subsequently, participants were queried about their familiarity with CBD, serving as a measurement for the awareness among the population and for identifying individuals with prior experience with CBD. This question also acted as a screening measure, excluding respondents unfamiliar with CBD from subsequent inquiries regarding subjective and objective knowledge. After addressing questions related to subjective and objective knowledge, the survey delved into participants' perceived knowledge and beliefs concerning the legal framework of CBD products, and their perceptions of CBD food products. Subsequent sections explored constructs from the Theory of Planned Behaviour (attitude, subjective norm, perceived behavioural control, and intentional behaviour). The final section of the survey revolved

around preferences for CBD products, motivations for usage, and the anticipated frequency of CBD food product consumption.

Participants possessing familiarity with CBD underwent an assessment of both subjective and objective knowledge regarding CBD. Inquiries about subjective knowledge assessed participants' self-reported understanding of CBD. Respondents were required to provide a rating reflecting their perceived knowledge level on the subject. This evaluation employed five statements on a 7-point Likert scale (7 = strongly agree; 1 = strongly disagree). These standardized statements, derived from literature and validated for their reliability across diverse topics, constituted the measurement tool (Flynn & Goldsmith, 1999). Notably, three out of the five questions were reverse scored to enhance the accuracy of the assessment. Aligned with previous research on public perceptions of consumer goods (De Steur et al., 2014; Faber et al., 2020; Park et al., 2020) and medical cannabis (Pav et al., 2023), the survey incorporated a segment to assess participants' objective knowledge of CBD. This assessment involved presenting 10 questions with answer options of "True," "False," or "I don't know." The questions were evenly split, with five focusing on CBD's effects and therapeutic uses and the remaining five addressing CBD in a broader context. Notably, five of the ten questions featured a correct answer of "False." Before implementation, these objective knowledge questions underwent pre-testing with a diverse group, including CBD shop owners, doctors, CBD users, individuals with limited familiarity with CBD, and students from Ghent University's faculty of bioscience engineering. Results demonstrated high scores among CBD shop owners and doctors, and conversely, low scores among those less familiar with CBD, thereby validating the efficacy of the question design.

Following this objective knowledge assessment, all participants received an information statement elucidating the distinctions between THC and CBD, as well as the varied uses of CBD in different products: “The cannabis plant contains two well-known substances: CBD (cannabidiol) and THC (tetrahydrocannabinol). THC is the substance that can cause the 'high' feeling. CBD, on the other hand, has no psychoactive effects, meaning it does not make you feel 'high'. CBD could offer potential health benefits and is therefore a popular ingredient in various products.” The information statement was strategically provided after measuring both subjective and objective knowledge to mitigate potential influence on respondents’ knowledge. Subsequently, the survey transitioned to a section where all participants answered five questions regarding the legal status ("Allowed," "Not allowed," or "I don't know") of different types of CBD products (medicines, oil & supplements, food & beverages, cosmetics, and tobacco & electronic cigarette products) in Belgium. The selection of CBD product types for these questions was based on literature encompassing the most common CBD products (Soetens & Colman, 2020; VAD, 2023). Prior to these five questions, a single 7-point Likert scale question was employed, wherein participants rated their perceived knowledge regarding the legal framework of CBD products (1 = not at all knowledgeable; 7 = very knowledgeable). This specific question served as a screening measure designed to filter out individuals with extremely low perceived knowledge about the legal framework. This precaution aimed to prevent potential data bias in the following five questions addressing the legal status of CBD products, particularly stemming from mere guessing. Given its role as a screening question and the survey's emphasis on brevity, a single question sufficed to gauge participants' perceived knowledge of the legal framework. This approach, derived as a modification of the method used to assess young adults' knowledge of marijuana policy through six true-or-false questions (West et al., 2022), was chosen for its sensitivity in mitigating biased responses attributable to guessing. To ensure the effectiveness and validity of these questions, they underwent pre-testing with pharmacists and CBD-shop owners. This validation process helped refine the questions and enhance their reliability in capturing participants' knowledge and beliefs related to the legal framework of CBD products.

Following the assessments of subjective and objective knowledge concerning CBD in general, along with insights into knowledge and beliefs regarding the legal status of CBD products in Belgium, the survey shifted its focus to CBD food

products. Participants were presented with a concise statement: "The following questions pertain to products within the CBD food industry, encompassing items such as food with CBD, drinks with CBD, CBD supplements, and CBD oil." To delve deeper into public perceptions of CBD food products, the survey employed 5-point bipolar interval scales across 10 distinct attributes (e.g., "Unhealthy" vs. "Healthy") (Van der Stricht et al., 2024). These attributes were carefully selected based on information gleaned from the websites of CBD sellers, including pharmacists and CBD shops (Apotheek.be, n.d.; Florapoint, n.d.). The attributes "Stressful – Relaxing," "Unattractive – Attractive," and "Difficult to find – Easy to find" were included based on recommendations from CBD shop owners and pharmacists. Following the questions related to perceptions, the survey proceeded to assess constructs aligned with the Theory of Planned Behaviour. Participants rated their attitudes (4 statements) toward the use of CBD food products (Ajzen, n.d.), subjective norms (4 statements) reflecting perceptions of social acceptance among friends and family (Jalilian et al., 2020; Zolotov et al., 2019), perceived behavioural control (4 statements) gauging confidence in finding and purchasing these products, along with control over the choice to do so (Ajzen, n.d.; Ho et al., 2022), and behavioural intention (3 statements) regarding the likelihood, plans, and motivation to use these products in the future (Pav et al., 2023; Vanhonacker et al., 2013). Each statement was assessed on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). All statements were derived from the literature on the Theory of Planned Behaviour (Ajzen, n.d., 2020; Azjen, 1991)and tailored to suit the specific context of this research.

During the survey, respondents' intention to consume CBD food products were quantified as the sum of the three statements related to intention (ranging from 3 to 15). This value for intention was used during the survey as a screening method to select respondents with higher intention. If this score was higher or equal to 8, participants received an additional and final section of the survey dedicated to product preferences, motivations, and anticipated frequency of usage. Conversely, for respondents with a summated value of 7 or lower, questions regarding future usage were considered irrelevant, leading to the end of the survey. In the supplementary section, participants were questioned about their expected frequency of usage over the next 12 months for four types of CBD food products (food, beverages, supplements, and oil). The frequency scale for each product type ranged from never to daily. The survey's final question addressed six motivations for the usage of CBD food products. Participants assessed their level of agreement regarding their motivation for potential usage of CBD food products by rating each presented motivation on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). The motivations were derived from literature on primary reported reasons for CBD usage, encompassing “pain relief” (Corroon & Phillips, 2018; Gicewicz et al., 2021; Goodman et al., 2022), “stress and anxiety reduction” (Corroon & Phillips, 2018; T. Tran & Kavuluru, 2020; Wysota et al., 2022), “improvement of sleep quality” (Gicewicz et al., 2021; Wheeler et al., 2020a; Wysota et al., 2022), and “treatment of neurological conditions” (DCA, 2020). Additionally, two motivations, "curiosity and recreational use" and "as part of a wellness & health lifestyle," were included based on the recommendation of a CBD shop owner who highlighted these as significant reasons for CBD product usage.

All questions pertaining to subjective knowledge, objective knowledge, beliefs about the legal status, perceptions, Theory of Planned Behaviour (TPB) constructs, product preferences, and motivations for usage were randomized within each section. Given that the survey targets the public, technical terminology was simplified for clarity. The entire online survey underwent pre-testing with two elderly participants (age > 65), four adults (age 30 – 65), and two young adults (age 18 – 30) to ensure the questions' clarity and understandability. Additionally, feedback was gathered from doctors, pharmacists, CBD shop owners, and individuals in the CBD industry, leading to adjustments in the phrasing of some questions. A pilot study involving 30 respondents was conducted to monitor dataset irregularities, assess the clarity of reversed-score questions, and validate the concordance of TPB constructs. Results from the pilot study were included into the final dataset.

2.1.3 Data Analysis

The Qualtrics dataset was exported to SPSS for analysis. Descriptive statistics were employed to delineate the proportions of respondents falling into categories such as CBD users, individuals familiar with CBD but not users, and those unfamiliar with CBD. Two distinct dummy variables were generated: one for distinguishing users from non-users and another for gauging awareness (i.e., people who used or knew about CBD versus those who had never heard of it). Frequency analysis was then utilized to compute the distributions of these dummy variables across various socio-demographic groups. To assess the impact of socio-demographic variables on the likelihood of having used CBD and being aware of it, two binary logistic regression models were executed. The first model investigated the influence of socio-demographic variables on the likelihood of being aware of CBD within the entire sample. Subsequently, a second model examined the impact of socio-demographic variables on the likelihood of CBD usage among respondents who demonstrated awareness. Dummy variables were employed to represent socio-demographic variables, with women, individuals holding a university master's degree, those residing in a large city, and those located in Antwerp serving as the reference categories. Age was treated as a continuous variable, with values derived from the average of distinct age intervals. The categorical variable reflecting living situation was excluded from the analysis due to substantial correlations with both age and province. To evaluate the assumption of linearity between the continuous independent variable (age) and the logit transformation of the dependent variable, the Box-Tidwell test was conducted. Adjusted odds ratios (AORs) along with 95% confidence intervals are provided, using a reference group as the baseline for comparison.

Three out of the five items measuring subjective knowledge of CBD were subjected to reverse coding. The construct validity of these items was affirmed through exploratory factor analysis, with items exhibiting factor loadings below 0.60 considered for potential deletion. After exploratory factor analysis, the internal consistency of measures was assessed using Cronbach's alpha, with a threshold of 0.70 or higher deemed acceptable for reliability (Hair et al., 2009). The value of the subjective knowledge construct was then derived by calculating the average of the individual items for each respondent. For objective knowledge, all statements were recoded as dummy variables (correct/incorrect), treating "I don't know" responses as incorrect. Frequency analysis was employed to ascertain the percentage of correct answers for each statement measuring objective knowledge. The objective knowledge construct was computed as the average of the ten dummy variables. Cronbach's alpha was again utilized to assess the internal consistency of these measures. For each category of CBD product (medicines, oil & supplements, food & beverages, cosmetics, and tobacco & electronic cigarette products), frequency analysis was employed to determine the percentage of respondents who believe whether each product is allowed or prohibited for sale in Belgium. To gauge respondents' belief regarding the legal status of CBD, a novel variable named "belief" (ranging from 0 to 5) was constructed. This variable encapsulates the sum of responses categorized as "allowed" across five statements related to the legal status of distinct CBD products. Respondents attributing the status of "allowed" to all provided types of CBD products were assigned a score of five. For participants who indicated "not knowledgeable at all" in response to the preceding question regarding their perceived knowledge of the legal framework for CBD products, no value for belief about the legal status of CBD was computed. This approach was adopted to mitigate potential data bias stemming from mere guessing.

Descriptive statistics were used to compute the mean and standard deviation for subjective knowledge, objective knowledge, belief, and each of the ten perception attributes. Additionally, a multiple linear regression analysis was performed to investigate the impact of socio-demographic variables on the ten perception attributes. Independent samples t-tests were executed to compare mean values of subjective knowledge, objective knowledge, belief, and

perception attributes between individuals with past usage experience and those without. Furthermore, one-sample t-tests were employed to assess whether the perception attributes significantly deviate from the neutral value of 3 on the 5-point semantic scales. Correlations between subjective knowledge, objective knowledge, and belief were explored using the Pearson correlation coefficient. To investigate the impact of individuals' subjective knowledge, objective knowledge, and belief about the legal status of CBD (considered as independent variables) on perceptions of CBD food products, ten distinct multiple linear regression models were conducted. Each model focused on assessing the influence of these independent variables on a specific attribute of perception (dependent variable). To control for socio-demographic variances, dummy variables representing various demographic categories were included in all models. Additionally, all models were adjusted for whether an individual had previous CBD usage experience. The reference categories for these dummy variables encompassed women, no prior usage, the age range of 26-35 years, higher secondary education or secondary education of the 3rd degree, living arrangement with a partner and children, rural residence, and the province of Antwerp. Given the conduction of individual tests for each of the ten attributes of perception, the Bonferroni correction was implemented. Consequently, a relationship was deemed statistically significant only when it yielded a p-value of 0.005 or lower, as opposed to the conventional threshold of 0.05 or lower.

To assess the influence of individuals' attitude, subjective norm, and perceived behavioural control on their intention to consume CBD food products, a multiple linear regression model was executed. Specifically, hierarchical multiple linear regression was used to evaluate the predictive strength of attitude, subjective norm, and perceived behavioural control in comparison to socio-demographic variables for intention prediction. The first model incorporated attitude, subjective norm, and perceived behavioural control as independent variables, with intention serving as the dependent variable. The second model also included socio-demographic variables as control variables, recoded as dummy variables. A significance level of p-value below 0.05 was employed to identify independent variables that emerged as significant predictors of the intention to consume CBD food products. Five items within the TPB constructs were reverse-coded (Attitude2, Attitude4, SubNorm1, SubNorm4, and PBC4). The items underwent exploratory factor analysis to confirm construct validity, and the internal consistency of measures was evaluated through reliability analysis using Cronbach's alpha. The average of the items measuring each TPB construct was computed to derive the value for that specific construct. Descriptive statistics were used to calculate the mean values and standard deviations for all items and constructs within the TPB.

The survey's final section, focusing on motivation, product preference, and anticipated consumption frequency, was exclusively administered to respondents exhibiting a heightened intention to consume CBD food products. Within this section, respondents utilized a 5-point Likert scale to rate six motivations for their anticipated consumption. Additionally, they disclosed their anticipated frequency over the next 12 months for four distinct types of CBD food products (food, beverages, supplements, and oil). Descriptive statistics were employed to analyze respondents' anticipated consumption frequency, product preference, and to calculate the mean and standard deviation for each motivation. Mean values of motivations were compared among respondents reporting an anticipated frequency for at least one of the four types of CBD food products (via paired samples T-tests), between groups with a preference for a specific type of CBD food product and those without such preference (e.g., respondents favoring CBD oil versus those not favoring it - independent samples T-tests), and across different categories of anticipated consumption frequency (via one-way ANOVA).

3 Results

3.1 Awareness and Usage of CBD

Table 2 presents an overview of CBD usage and awareness among the respondents. A substantial portion of participants (68.4%) demonstrated prior awareness of CBD before engaging in the survey. Furthermore, nearly one in four respondents (23.6%) reported prior usage of CBD.

Table 2: Descriptive statistics of CBD awareness and past CBD usage among respondents (n = 297).

Answer	Number of respondents (n)	Fraction of total (%)
Yes, I have used it before.	70	23.6
Yes, I have heard of it, but have never used it.	133	44.8
No, I have never heard of it.	94	31.6

CBD, cannabidiol.

Table 3 provides a breakdown of CBD awareness and usage percentages across various socio-demographic groups within the total sample of 297 respondents. Notably, there is a relative overrepresentation of women (61.3%), individuals aged 18-25 (30.7%), and respondents from Antwerp (77.2%). While the difference in CBD awareness between male and female respondents is relatively small, male respondents exhibit higher past CBD usage (31.3%) compared to their female counterparts (18.7%). Specifically, respondents in the 18-25 age group and those residing in large cities stand out with remarkably high past CBD usage rates (38.5% and 38.7%, respectively). A noteworthy finding is that nearly half of respondents with a higher secondary education degree, who are aware of CBD, reported past usage. In contrast, respondents with a university degree (bachelor or master) display higher CBD awareness but lower past usage rates.

Table 3: Descriptive statistics of CBD awareness and past CBD usage among different socio-demographic groups (n = 297).

	CBD awareness		Past CBD usage	
Variable (n)	Frequency (n)	Fraction (%)	Frequency (n)	Fraction (%)
Gender				
Men (115)	83	72.2	36	31.3
Women (182)	120	66.0	34	18.7
Age				
18 – 25 (91)	70	77.0	35	38.5
26 - 35 (25)	22	88.0	8	32.0
36 - 45 (24)	17	70.8	8	33.3
46 - 55 (66)	33	50.0	7	10.6
56 - 65 (58)	41	70.7	11	19.0
66 - 75 (17)	12	70.6	0	0.0
≥ 76 (16)	8	50.1	1	6.3
Education				
No diploma (3)	1	33.3	0	0.0
Primary school (1)	0	0.0	0	0.0
Lower secondary education (1st or 2nd grade) (11)	8	72.7	1	9.1
Higher secondary education (3rd degree) (86)	59	68.6	28	32.6
Higher education outside university (67)	39	58.2	17	25.4
University, bachelor level (37)	29	78.4	8	21.6
University, master level or PhD (92)	67	72.8	16	17.4

Living environment				
Large city (over 80 000 inhabitants) (75)	55	73.4	29	38.7
Small city (population less than 80 000) (42)	22	52.4	5	11.9
Suburb (outskirts of a large central city) (49)	38	77.6	9	18.4
Rural (or village) (131)	88	67.2	27	20.6
Living situation				
Living together with partner without children (62)	42	67.7	12	19.4
Living together with partner and child(ren) (108)	69	63.9	17	15.7
Living with parents (and any brothers/sisters) (63)	50	79.4	17	27.0
Living with others (12)	9	75.0	8	66.7
Living alone (40)	29	72.5	15	37.5
Living alone with children (10)	3	30.0	1	10.0
Province				
Antwerp (229)	159	69.4	55	24.0
Brussels (1)	0	0.0	0	0
Limburg (10)	6	60.0	1	10.0
East Flanders (28)	18	64.3	5	17.9
Flemish Brabant (9)	7	77.8	3	33.3
Walloon Brabant (1)	1	100	0	0
West Flanders (19)	12	63.2	6	31.6

CBD, cannabidiol.

Note: A respondent is deemed to have awareness if they possessed familiarity with CBD prior to participating, and this category also encompasses individuals who are (past) users.

Two binary logistic regression models were executed to explore the impact of socio-demographic variables on (1) the likelihood of participants being aware of CBD and (2) the likelihood of past CBD usage among the subset of respondents who demonstrated awareness. Both models demonstrated statistical significance, with (1) $\chi^2(13) = 25.867$, $p = 0.018$ and (2) $\chi^2(13) = 48.268$, $p < 0.001$. The first model accounted for 11.7% (Nagelkerke R2) of the variance in the likelihood of having CBD awareness, achieving an 67.7% correct classification rate. The second model explained 29.2% (Nagelkerke R2) of the variance in the likelihood of CBD usage, with a 73.9% correct classification rate. The consideration of living situation variables (e.g., living together with a partner and children) was excluded from the models due to their high correlation with age and province. The assumption of linearity between age and the logit transformation of the dependent variable was found to be satisfied in both models. The null hypothesis of the Box-Tidwell test asserts that there is no violation of the linearity assumption, implying a linear relationship between age and the log-odds. The Box-Tidwell tests for both Model 1 and Model 2 produced p-values of 0.283 and 0.346, respectively. These results suggest a lack of significant evidence to reject the null hypothesis in either model, indicating no substantial indications of a violation of the linearity assumption.

Table 4 presents the odds associated with CBD awareness (Model 1) and past CBD usage (Model 2) across various socio-demographic groups. Noteworthy findings include a significant difference between men and women, with men being 2.28 times more likely to have used CBD than women ($p = 0.017$). Age exhibits a substantial impact on both CBD awareness ($p = 0.019$) and past usage ($p < 0.001$), with the odds of both decreasing by 2% and 4%, respectively, for each additional year of age. Interestingly, possessing a university degree (bachelor or master) influences CBD awareness positively but has a negative effect on past CBD usage. Individuals with a higher education degree outside the university are 51% less likely to be aware of CBD ($p = 0.049$) but are four times more likely to have used CBD ($p = 0.007$) compared to those with a master's degree. Additionally, residents of small cities (less than 80,000 inhabitants) are 58% less likely to be aware of CBD ($p = 0.045$) compared to their counterparts in larger cities. Individuals in rural

environments (p = 0.026), suburbs (p = 0.008), and small cities (p = 0.011) are, respectively, 62%, 77%, and 82% less likely to have used CBD compared to individuals living in large cities.

Table 4: Difference in the likelihood of CBD awareness and CBD usage among distinct socio-demographic groups, by two binary logistic regression models (Model 1, n = 297; Model 2, n = 203).

	Model 1 (Awareness)		Model 2 (Usage)	
Variable	Odds of prior CBD awareness AOR (95% CI)	P-value	Odds of prior CBD usage AOR (95% CI)	P-value
Men	1.37 (0.80 – 2.34)	0.256	2.28 (1.16 – 4.49)	**0.017**
Age	0.98 (0.97 – 1.00)	**0.019**	0.96 (0.94 – 0.98)	**< 0.001**
No diploma or Primary school	0.11 (0.01 – 1.23)	0.072	0.00 (0.00)	1.000
Secondary education (lower or higher)	0.67 (0.34 – 1.33)	0.252	1.78 (0.73 – 4.35)	0.206
Higher education outside university	0.49 (0.24 – 1.00)	**0.049**	4.00 (1.46 – 10.94)	**0.007**
University, bachelor level	1.00 (0.38 – 2.67)	0.999	0.46 (0.14 – 1.46)	0.187
Small city (population less than 80 000)	0.42 (0.18 – 0.98)	**0.045**	0.18 (0.05 – 0.67)	**0.011**
Suburb (outskirts of a large central city)	1.78 (0.71 – 4.48)	0.220	0.23 (0.08 – 0.69)	**0.008**
Rural (or village)	1.00 (0.50 – 2.03)	0.995	0.38 (0.16 – 0.89)	**0.026**
Limburg (10)	1.01 (0.26 – 3.97)	0.985	0.56 (0.05 – 5.83)	0.630
East Flanders	0.55 (0.22 – 1.34)	0.186	0.49 (0.13 – 1.82)	0.290
Flemish Brabant	1.90 (0.36 – 9.95)	0.448	0.85 (0.13 – 5.35)	0.858
West Flanders	1.19 (0.40 – 3.54)	0.760	2.65 (0.67 – 10.50)	0.165

AOR, adjusted odds ratio; CBD, cannabidiol.

Values p < 0.05 are indicated in bold.

Note: A respondent is deemed to have awareness if they possessed familiarity with CBD prior to participating, and this category also encompasses individuals who are (past) users. Model 2 reflects the likelihood of past CBD usage within the subset of respondents demonstrating CBD awareness. Socio-demographic variables are included as dummy variables, with women, university master's degree, large city, and Antwerp as reference categories. Age is a continuous variable measured in years.

3.2 Perception, Knowledge, and Belief about the Legal Status

3.2.1 Perception of CBD food products

Figure 6 illustrates the distribution of responses across a 5-point semantic scale (ranging from a minimum of 1 to a maximum of 5) for each of the ten selected attributes reflecting perception toward CBD food products. Respondents exhibited the highest neutrality regarding the attributes "Unsafe – Safe" (mean = 3.04; SD = 1.12) and "Untrustworthy – Trustworthy" (mean = 3.04; SD = 1.06). Attributes evaluated more positively included "Addictive – Non-addictive" (mean = 3.10; SD = 1.22), "Synthetic – Natural" (mean = 3.20; SD = 1.19), "Ineffective – Effective" (mean = 3.24; SD = 0.97), and "Stressful – Relaxing" (mean = 3.58; SD = 1.11). On the other hand, attributes evaluated more negatively encompassed "Difficult to find – Easy to find" (mean = 2.88; SD = 1.06), "Unhealthy – Healthy" (mean = 2.83; SD = 1.02), "Unappealing – Appealing" (mean = 2.77; SD = 1.04), and "Expensive – Cheap" (mean = 2.63; SD = 0.89). Generally, the public perceives CBD food products as effective and relaxing, but also as unappealing and expensive. To a lesser extent, CBD food products are also seen as natural and unhealthy.

Moreover, socio-demographic variables exhibit a limited impact on perception toward CBD food products. Significantly, only two attributes ("Ineffective – Effective" and "Synthetic – Natural") revealed relationships with socio-demographic variables, reaching statistical significance at p < 0.005 (Bonferroni-corrected value). Individuals with a master's degree tend to perceive CBD food products as less effective (β = -0.243; p = 0.004) compared to those with a secondary education of the 3rd degree. Similarly, residents of West Flanders perceive CBD food products as less

effective (β = -0.184; p = 0.004) in contrast to individuals living in Antwerp. Additionally, individuals residing in a small city perceive CBD food products as less natural (β = -0.218; p = 0.001) compared to those living in a rural environment or village.

On the contrary, CBD usage experience exerts a substantial impact on perceptions of CBD food products. Individuals with usage experience perceive all attributes significantly more positively (p < 0.005) compared to non-users, with the exceptions of price and accessibility, which are perceived similarly. The most notable differences between users and non-users lie in the perception of increased safety (mean difference = 0.90), non-addictiveness (mean difference = 0.83), enhanced relaxation (mean difference = 0.81), and heightened naturalness (mean difference = 0.71). One-sample t-tests were conducted to pinpoint attributes that significantly (p < 0.005) deviate from neutrality for both groups. For users, there are significantly positive perceptions of effectiveness, safety, relaxation, naturalness, trustworthiness, and non-addictiveness, while perceptions of "appealing–unappealing" and "difficult to find–easy to find" are deemed neutral. The only significant negative perception among users is related to the perception of expense. Conversely, non-users' positive perception is limited to the attribute of relaxation. Negative perceptions among non-users encompass perceptions of unsafe, unhealthiness, unappealing, difficult to finding, and expensive. Non-users maintain neutral perceptions for the attributes "ineffective–effective," "synthetic–natural," "untrustworthy–trustworthy," and "addictive–non-addictive."

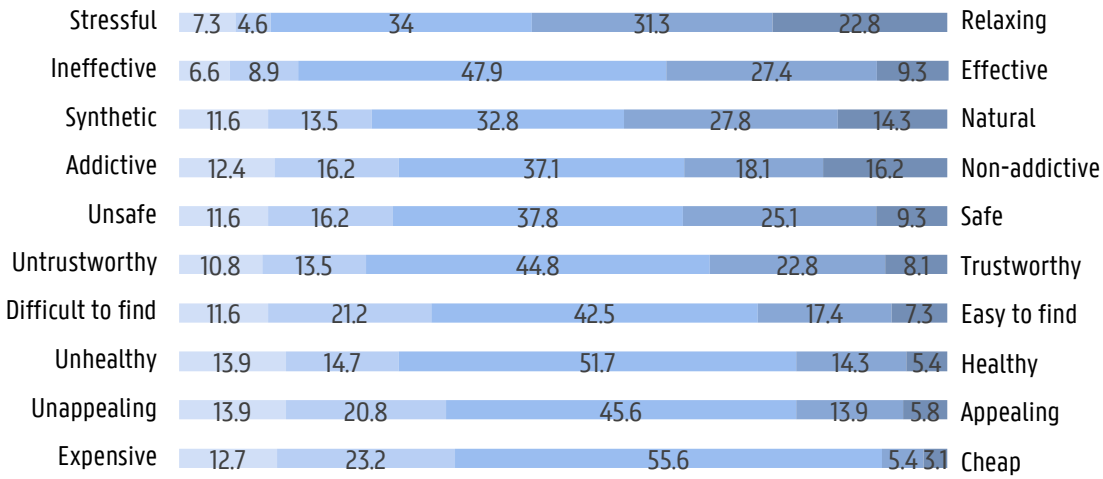

Figure 6: Public perception regarding CBD food products across ten attributes measured on a 5-point semantic scale (n = 259).

3.2.2 Subjective and Objective Knowledge about CBD

Exploratory factor analysis of items measuring subjective knowledge revealed high loadings on each of the five items (0.87, 0.75, 0.80, 0.70, and 0.91). The Cronbach's alpha for the constructs of subjective knowledge and objective knowledge were determined as 0.87 and 0.72, respectively. Subjective knowledge regarding CBD generally registers as low, particularly among non-users. While (past) users exhibit significantly higher subjective knowledge (p < 0.001; mean difference = 1.32), it remains relatively modest. In terms of objective knowledge, approximately half of the statements received correct responses. The accuracy varies notably among statements, ranging from 30.5% ("There are proven side effects of using CBD") to 85.3% correct responses ("CBD is used to treat chronic pain"). Users' objective knowledge is also significantly higher compared to non-users (p < 0.001; mean difference = 12.1), albeit to a lesser extent than the disparity in subjective knowledge between the two groups. Moreover, subjective and objective

knowledge exhibit a notably strong and positive correlation ($p < 0.001$). The more an individual claims to know about CBD subjectively, the higher their objective knowledge tends to be.

Table 5: Subjective and objective knowledge of CBD. Descriptives of the average scales and the underlying statements (n = 200).

	Total (n = 200)		Users (n = 70)	Non-users (n = 130)
Variable/Statement			Mean ± SD	
Subjective knowledge of CBD	**3.24 ± 1.30**		4.09 ± 1.30	2.78 ± 1.05
Objective knowledge of CBD	**54.3 ± 24.6**		62.2 ± 22.6	50.2 ± 24.7
	% Incorrect	**% Correct**		
THC is another word for CBD. (False)	52.8	47.2		
You can get 'high' from CBD. (False)	43.7	56.3		
CBD is produced in all plants. (False)	40.6	59.4		
CBD is the only known cannabinoid. (False)	58.4	41.6		
CBD is used to treat chronic pain. (True)	14.7	85.3		
There are proven side effects of using CBD. (True)	69.5	30.5		
CBD is found in medical cannabis. (True)	21.8	78.2		
CBD is found in cannabis. (True)	21.8	78.2		
CBD is used in the treatment of diabetes. (False)	68.0	32.0		
CBD is used in the treatment of epilepsy. (True)	65.5	34.5		
Correlation	**r**	**p-value**		
Subjective – Objective knowledge	0.524	< 0.001		

CBD, cannabidiol; r, correlation coefficient; SD, standard deviation

Note: Subjective and objective knowledge were evaluated exclusively for respondents who had prior awareness of CBD before participating in the survey. The five items (not shown) for subjective knowledge were assessed using a 7-point Likert scale. The overall score for subjective knowledge is derived from the average score of the five underlying items. Similarly, the overall score for objective knowledge is computed based on the average score of the ten underlying items (shown).

3.2.3 Belief about the Legal Status of CBD Products

Figure 7 depicts the distribution of responses to the question concerning respondents' perceived knowledge about the legal framework surrounding CBD products in Belgium. Notably, respondents' perceived knowledge about the legal framework exhibits a pronounced positive skew in its distribution. Nearly 40% (n = 114) of respondents indicated that they perceive themselves as not knowledgeable at all on this subject.

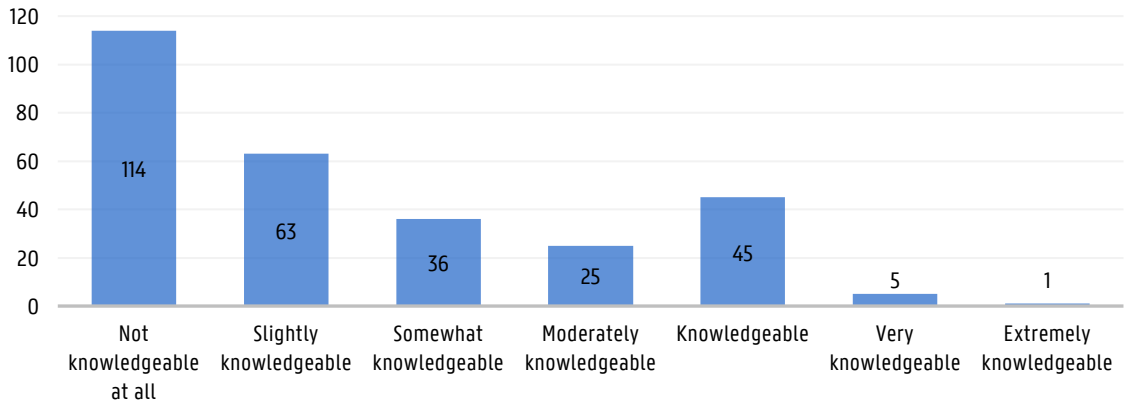

Figure 7: Respondents' perceived knowledge about the legal framework surrounding CBD products in Belgium (n = 289).

Table 6 presents the beliefs about the legal status of various types of CBD products in Belgium among respondents who rated their own knowledge about the legal framework of CBD products as "slightly knowledgeable" to "extremely knowledgeable" (n = 174). In general, there seems to be limited awareness about the legal status of CBD products, as indicated by only 44.1% of correct answers. A considerable number of respondents selected the "I don't know" category, ranging from 17.7% to 34.9%, with an average of 24.3% across the five types of products, indicating a widespread lack of knowledge. Respondents displayed relatively higher awareness regarding the permissibility of medicines containing CBD (67.4%), followed by the recognition that food and drinks containing CBD are not allowed (49.1%). Notably, CBD supplements and oil for consumption are wrongly believed to be allowed in Belgium by a majority (55.4%).

On average, participants believed that 2.28 ± 1.60 types of CBD products are permitted in Belgium. Users, on the other hand, held a belief of 2.93 ± 1.65 types being allowed, while non-users believed a lower figure of 1.96 ± 1.48 types. Individuals with CBD usage experience expressed a significantly different belief regarding the number of allowed CBD product types compared to those without usage experience ($p < 0.001$; mean difference = 0.97), indicating a perception that more types of CBD products are allowed among individuals with usage experience. Furthermore, there is a positive correlation between belief and both subjective ($p = 0.002$) and objective knowledge ($p = 0.021$). Individuals who possess greater knowledge of CBD, both objectively and subjectively, are more inclined to believe that a broader range of CBD products is permitted.

Table 6: Beliefs regarding the legal status of various types of CBD products in Belgium (n = 174).

	Total (n = 174)	Users (n = 58)	Non-users (n = 116)
Variable/Statement		Mean ± SD	
Belief of the legal status of CBD	**2.28 ± 1.60**	2.93 ± 1.65	1.96 ± 1.48
	% Allowed	**% Not allowed**	**% I don't know**
Medicines containing CBD in pharmacies (Allowed)	67.4	12.6	19.4
CBD-supplements and CBD-oil for consumption (Not allowed)	55.4	26.3	17.7
Food and drinks containing CBD (Not allowed)	26.3	49.1	24.0
Cosmetics containing CBD (Allowed)	44.0	20.6	34.9
Tobacco products and liquids for electronic cigarettes containing CBD (Allowed)	33.7	40.0	25.7
Correlation	**r**	**p-value**	
Belief – Subjective knowledge	0.257	0.002	
Belief – Objective knowledge	0.190	0.021	

CBD, cannabidiol; r, correlation coefficient; SD, standard deviation

Note: Excluding respondents who assessed their knowledge about the legal framework of CBD products as "not knowledgeable at all" (n = 114).

3.2.4 Effect of Knowledge and Belief about the Legal Status on Perception

As illustrated in Table 7, subjective knowledge only exhibits a significant positive effect on one out of ten attributes of perception. CBD food products are perceived as more appealing ($\beta = 0.281$; $p = 0.033$) with increasing subjective knowledge. Objective knowledge exhibits a significant positive effect on two attributes of perception. CBD food products are perceived as more effective ($\beta = 0.306$; $p = 0.002$) and easier to find ($\beta = 0.270$; $p = 0.017$) with increasing objective knowledge. The level of knowledge, whether subjective or objective, does not have a significant effect on the attributes "Unsafe – Safe", "Stressful – Relaxing", "Synthetic – Natural", "Untrustworthy – Trustworthy", "Expensive – Cheap", "Unhealthy - Healthy", and "Addictive – Non-addictive". Belief about the legal status of CBD emerge as the

most influential predictor of perception toward CBD food products. Belief exhibits a significant positive effect on six out of ten attributes of perception. As the level of belief increases, CBD food products are perceived to be more effective ($\beta = 0.375$; $p < 0.001$), safe ($\beta = 0.286$; $p = 0.003$), relaxing ($\beta = 0.277$; $p = 0.003$), trustworthy ($\beta = 0.268$; $p = 0.008$), easier to find ($\beta = 0.278$; $p = 0.007$), and non-addictive ($\beta = 0.231$; $p = 0.022$). This suggests that a positive perception of CBD food products becomes more prevalent when individuals hold the belief that a broader range of CBD products is permitted for sale in Belgium, signifying a more tolerant legal framework for CBD. Knowledge or belief does not exert a significant influence on the attributes of "Synthetic – Natural," "Unhealthy – Healthy," and "Expensive – Cheap."

Applying the Bonferroni correction reveals that subjective knowledge level lacks a significant impact on any of the perception attributes, while objective knowledge level only affects the perception attribute "effective." However, it is crucial to highlight that, in this context, only belief regarding the legal status demonstrates a notable effect on multiple perception attributes. To be specific, belief about the legal status of CBD shows a Bonferroni-corrected significant effect on three out of the ten perception attributes, namely "effective," "safe," and "relaxing." The variance inflation factor (VIF) values for all predictor variables in all models were below 4.0, and tolerance values all exceeded 0.2. According to the established threshold (VIF < 5 and tolerance > 0.2), there is no evidence of problematic multicollinearity in the models (Kim, 2019). This indicates that the predictor variables are not highly correlated, ensuring the stability and reliability of the regression coefficients.

Table 7: The effect of knowledge and belief about the legal status of CBD on ten attributes of perception toward CBD food products (10 multiple linear regression models). Standardized coefficients, significance and explained variance (n = 188).

Independent	→	Dependent	Standardized coefficient (β)	p-value	R^2
Subjective knowledge	→	"Ineffective – Effective"	-0.052	0.649	0.402
Objective knowledge	→	**"Ineffective – Effective"**	**0.306**	**0.002**	
Belief about the legal status	→	**"Ineffective – Effective"**	**0.375**	**< 0.001**	
Subjective knowledge	→	"Unsafe – Safe"	0.076	0.528	0.331
Objective knowledge	→	"Unsafe – Safe"	0.027	0.797	
Belief about the legal status	→	**"Unsafe – Safe"**	**0.286**	**0.003**	
Subjective knowledge	→	"Stressful – Relaxing"	0.011	0.924	0.403
Objective knowledge	→	"Stressful – Relaxing"	0.096	0.329	
Belief about the legal status	→	**"Stressful – Relaxing"**	**0.277**	**0.003**	
Subjective knowledge	→	"Synthetic – Natural"	0.004	0.973	0.394
Objective knowledge	→	"Synthetic – Natural"	0.193	0.053	
Belief about the legal status	→	"Synthetic – Natural"	0.143	0.117	
Subjective knowledge	→	"Unhealthy – Healthy"	0.094	0.454	0.286
Objective knowledge	→	"Unhealthy – Healthy"	0.045	0.678	
Belief about the legal status	→	"Unhealthy – Healthy"	0.181	0.068	
Subjective knowledge	→	"Unappealing – Appealing"	0.281*	0.033	0.219
Objective knowledge	→	"Unappealing – Appealing"	-0.004	0.968	
Belief about the legal status	→	"Unappealing – Appealing"	0.095	0.356	
Subjective knowledge	→	"Untrustworthy – Trustworthy"	0.053	0.672	0.273
Objective knowledge	→	"Untrustworthy – Trustworthy"	-0.009	0.931	
Belief about the legal status	→	"Untrustworthy – Trustworthy"	0.268*	0.008	
Subjective knowledge	→	"Expensive – Cheap"	-0.122	0.343	0.248
Objective knowledge	→	"Expensive – Cheap"	-0.004	0.972	
Belief about the legal status	→	"Expensive – Cheap"	-0.109	0.281	
Subjective knowledge	→	"Difficult to find – Easy to find"	-0.241	0.064	0.239

Objective knowledge	→	"Difficult to find – Easy to find"	0.270*	0.017	
Belief about the legal status	→	"Difficult to find – Easy to find"	0.278*	0.007	
Subjective knowledge	→	"Addictive – Non-addictive"	0.001	0.995	0.270
Objective knowledge	→	"Addictive – Non-addictive"	0.164	0.134	
Belief about the legal status	→	"Addictive – Non-addictive"	0.231*	0.022	

*p < 0.05 and values p < 0.005 are indicated in bold (Bonferroni-corrected significance level).

Note: Subjective knowledge is derived as the average of five items assessed on a 7-point scale, while objective knowledge is computed as the average score of ten underlying items measured on a scale ranging from 0 to 1. Belief about the legal status is determined by the quantity of "allowed" (as shown in Table 6) and are measured on a scale from 0 to 5. The dependent variables are measured on a 5-point semantic scale. All models incorporate control for socio-demographic variables, represented by dummy variables. The reference category for these variables includes women, no prior usage experience, 26-35 years old, with a secondary education of the 3rd degree, living together with a partner and children, residing in a rural area, and located in Antwerp.

3.3 Attitude, Subjective Norm, Perceived Behavioural Control, and Intention

Exploratory factor analysis revealed high loadings on all items measuring the constructs of attitude (0.84, 0.86, 0.84, and 0.83) and intention (0.93, 0.95, and 0.94), leading to the retention of all items for these constructs. However, one item for the construct of subjective norm (SubNorm2) and one item for the construct of perceived behavioural control (PBC3) were removed due to factor loadings below 0.60. Consequently, data analysis was conducted on four items for the construct of attitude and on three items each for the constructs of subjective norm, perceived behavioural control, and intention. Cronbach's alpha for attitude, subjective norm, perceived behavioural control, and intention were determined to be 0.87, 0.73, 0.60, and 0.93, respectively. Values exceeding 0.70 indicate reliable multi-item measures for constructs. Despite the perceived behavioural control Cronbach's alpha falling below the 0.70 threshold, no additional item was removed, as it is recommended to maintain at least three items for each construct (O'Rourke & Hatcher, 2013).

Table 8 provides descriptive statistics for the items and constructs of the TPB. The values for the constructs of attitude, subjective norm, and perceived behavioural control lean towards neutrality. However, individuals' attitude and perceived behavioural control are more positively evaluated than subjective norm regarding CBD food products. Approximately 41.3% of respondents agreed with having a positive attitude towards these products, whereas a smaller fraction (25.2%) agreed that the use of these products could be beneficial for them. Regarding subjective norm, more respondents agreed (43.8%) than disagreed (22.5%) on the social acceptability of consuming CBD food products. However, a significant portion agreed that people around them would find it strange (38.0%) and that family and friends would discourage it (35.3%). Notably, more than half of the respondents (51.2%) disagreed on often hearing people talk about CBD food products and their benefits. There was a higher agreement on respondents' capability to easily find (41.1%) and regularly use (37.6%) CBD food products if they wanted to than there was disagreement (24.8% and 27.5%, respectively). In general, respondents reported a relatively low intention to consume CBD food products, with an average of 52.8% of respondents disagreeing and 13.3% agreeing with statements related to their intention to consume CBD food products.

Table 8: Descriptive statistics for the constructs and items within the Theory of Planned Behaviour (n = 258).

Item/Construct	Description	Mean ± SD	% Agree[a]	% Disagree[b]
Attitude1	I have a positive attitude towards CBD food products.	3.26 ± 0.96	41.3	17.4
Attitude2 (R)	For me, it is a bad idea to use CBD food products.	3.23 ± 1.04	23.0	39.3
Attitude3	Consuming CBD food products could be good for me.	2.98 ± 0.95	25.2	25.6
Attitude4 (R)	The use of CBD food products would be worthless to me.	3.12 ± 0.98	22.4	30.1

SubNorm1 (R)	People around me would find it strange if I were to use CBD food products.	2.87 ± 1.03	38.0	27.9
SubNorm2 (Removed)	I often hear people talking about CBD food products and their benefits.	2.49 ± 1.13	22.5	51.2
SubNorm3	It is socially acceptable to use CBD food products.	3.22 ± 0.96	43.8	22.5
SubNorm4 (R)	My friends and family would discourage the use of CBD food products.	2.83 ± 0.96	35.3	23.6
PBC1	If I wanted to, I could easily find CBD food products.	3.18 ± 0.97	41.1	24.8
PBC2	If I wanted to, I could use CBD food products regularly.	3.09 ± 0.97	37.6	27.5
PBC3 (Removed)	I have control over my choice to use or not use CBD food products.	3.90 ± 0.95	73.6	7.0
PBC4 (R)	It would be difficult for me to buy CBD food products regularly.	3.05 ± 0.89	26.0	32.6
Intention1	It is likely that I will use CBD food products.	2.44 ± 0.97	11.6	51.6
Intention2	I intend to use CBD food products.	2.38 ± 0.99	11.2	55.0
Intention3	I'm motivated to use CBD food products.	2.50 ± 1.02	17.1	51.9
Attitude	Average scale of attitude	3.15 ± 0.83		
SubNorm	Average scale of subjective norm	2.97 ± 0.76		
PBC	Average scale of perceived behavioural control	3.11 ± 0.70		
Intention	Average scale of intention	2.44 ± 0.93		

CBD, cannabidiol; (R), reverse coded; SD, standard deviation.

Note: Items were measured using a 5-point Likert scale. Following exploratory factor analysis, two items (Subnorm2 and PBC3) were excluded. Reversed mean values for items that were reverse-coded are presented. [a] Percent stating, they agreed or strongly agreed. [b] Percent stating, they disagreed or strongly disagreed.

Hierarchical multiple linear regression was utilized to evaluate the predictive strength of attitude, subjective norm, and perceived behavioural control in comparison to socio-demographic variables for intention prediction. In Model 1 (R^2 = 0.510), attitude, subjective norm, and perceived behavioural control served as predictors. In Model 2 (R^2 = 0.583), socio-demographic variables were introduced alongside the TPB constructs. The addition of socio-demographic variables led to a non-significant (p = 0.066) increase in R^2, underscoring that attitude, subjective norm, and perceived behavioural control collectively present a more robust set of predictors compared to socio-demographic variables. The variance inflation factor (VIF) values for all predictor variables in both models were below 2.0, and tolerance values all exceeded 0.5. According to the established threshold (VIF < 5 and tolerance > 0.2), there is no evidence of problematic multicollinearity in the model (Kim, 2019).

In Model 2, only two socio-demographic variables exhibited a significant relationship with intention. Individuals holding a master's degree are likely to have a lower intention to consume CBD food products (β = -0.169; p = 0.006) compared to those with a secondary education of the 3rd degree. Additionally, individuals in the age group of 18 – 25 years old are likely to have a lower intention to consume CBD food products (β = -0.237; p = 0.009) compared to individuals in the age group of 26 – 35 years old. Table 9 illustrates the impact of attitude, subjective norm, and perceived behavioural control on intention, as revealed by Model 1 and Model 2. Attitude demonstrates a robust positive relationship with intention in both Model 1 (β = 0.578; p < 0.001) and Model 2 (β = 0.586; p < 0.001). Subjective norm displays a smaller positive relationship with intention in both Model 1 (β = 0.151; p = 0.008) and Model 2 (β = 0.154; p = 0.010). This suggests that individuals with a more positive attitude toward CBD food products are more likely to express a heightened intention to consume them. Although the influence of subjective norm on intention is present, it is not as pronounced as the impact of attitude. Perceived behavioural control demonstrates a positive but weak relationship with intention in both Model 1 (β = 0.070; p = 0.152) and Model 2 (β = 0.084; p = 0.108). However,

these relationships are not statistically significant, implying that individuals' perception of control over their behaviour regarding CBD food products may not strongly influence their intentions.

Table 9: The effect of attitude, subjective norm, and perceived behavioural control on the intention to consume CBD food products (two multiple linear regression models). Standardized coefficients, significance and explained variance (n = 258).

	Independent	→	Dependent	Standardized coefficients	p-value	R^2
Model 1 (without socio-demographic variables)	Attitude	→	Intention	**0.578**	< 0.001	0.510
	Subjective norm	→	Intention	**0.151**	0.008	
	PBC	→	Intention	0.070	0.152	
Model 2 (with socio-demographic variables)	Attitude	→	Intention	**0.586**	< 0.001	0.583
	Subjective norm	→	Intention	**0.154**	0.010	
	PBC	→	Intention	0.084	0.108	

Values p < 0.05 are indicated in bold.

Note: All constructs (attitude, subjective norm, perceived behavioural control, and intention) are computed as the average of the underlying items on a 5-point Likert scale. Model 2 includes controls for socio-demographic variables, represented by dummy variables (not shown), with the reference category being women, aged 26-35, possessing a secondary education of the 3rd degree, living together with a partner and children, residing in a rural area, and located in Antwerp.

3.4 Motivation, Consumption Frequency, and Product Preferences in the Context of CBD Food Products

To identify respondents with a relatively high intention to consume CBD food products during the survey, intention was quantified as the sum of the three intention-related statements, ranging from 3 to 15. Participants scoring eight or higher received an additional survey section. In this section, respondents evaluated six types of motivation for consumption of CBD food products and reported their anticipated consumption frequency over the next 12 months for four types of CBD food products (food, beverages, supplements, and oil).

As outlined in Table 10, 40% of respondents (n = 103) were selected for the additional survey section. Within this subgroup with a relatively high intention, 66.0% (n = 68) of respondents, representing 26.4% of the total sample, expressed their intention to consume at least one type of CBD food product in the next 12 months. The majority anticipated a consumption of one to two times, with weekly and daily consumption reported by 3.9% and 1.9% of the total respondents, respectively. CBD beverages emerged as the most preferred type of CBD food product, with 43 respondents (63.2% of those with anticipated consumption) indicating this as the product they anticipate consuming most frequently. Following closely are CBD supplements (57.4%), CBD oil (55.9%), and CBD food (47.1%). Respondents anticipating consumption one to two times and three to 11 times favor CBD supplements the most (70.3% and 75.0%). Monthly and weekly anticipated users exhibit a preference for CBD beverages (62.5% and 80.0%), while daily anticipated users favor CBD oil the most (80.0%).

Table 10: Preferences for CBD food products and anticipated consumption frequencies over the next 12 months (n = 258).

Anticipated consumption frequency over the next 12 months	Number of respondents (n)	Fraction of total (%)	Product preference (%) [a]			
			Food	Beverages	Supplements	Oil
Not recorded (lower intention)	155	60.0				
Recorded (higher intention)	103	40.0				
Consumption: No	35	13.6				
Consumption: Yes	68	26.4	47.1	63.2	57.4	55.9
1 – 2 times	37	14.3	54.1	64.9	70.3	62.2
3 – 11 times	8	3.1	50.0	50.0	75.0	37.5
Monthly	8	3.1	37.5	62.5	12.5	37.5
Weekly	10	3.9	30.0	80.0	30.0	50.0
Daily	5	1.9	40.0	40.0	60.0	80.0

CBD, cannabidiol.

[a] Fraction of respondents preferring a type of CBD food products within each frequency class (respondents can have multiple product preferences).

Note: Anticipated consumption frequency for respondents is determined based on the highest reported frequency among the four types of CBD food products (food, beverages, supplements, and oil). This assessment was conducted for 40% of the respondents.

Table 11 presents the mean values and standard deviations of six motivations for consuming CBD food products among the respondents who reported an anticipated frequency for at least one type of CBD food product (n = 68) and those expressing a preference for one or multiple types of CBD food products. On average, respondents evaluated all types of motivation relatively positive. The most significant motivations for consuming CBD food products are improvement of sleep quality, pain relief, and the reduction of stress and anxiety. Motivation related to the treatment of neurological disorders, as part of a 'Wellness & Health' lifestyle, and curiosity or recreation were significantly ($p < 0.05$) lower compared to the other three. Improvement of sleep quality emerged as the top motivator for respondents preferring food and beverages, while pain was the primary motivation for those preferring supplements and oil. Within all product groups examined, medical considerations (sleep, pain, and stress) consistently exhibit higher significance compared to recreational use and incorporation into a "Wellness & Health" lifestyle. This heightened emphasis on medical motivations is particularly pronounced among individuals expressing a preference for CBD supplements. Moreover, those favoring CBD oil manifest a significantly higher motivation for pain relief ($p = 0.024$; mean difference = 0.49) in comparison to those who do not favor CBD oil.

Table 11: The mean values and standard deviations of motivations for the consumption of CBD food, beverages, supplements, and oil (n = 68).

Motivation	Total (n = 68)	Preferred type of CBD food product			
		Food (n = 32)	Beverages (n = 43)	Supplements (n = 39)	Oil (n = 38)
Pain relief	3.94 ± 0.90 $_{a}$	3.91 ± 0.93 $_{a, b}$	4.00 ± 0.87 $_{a}$	4.00 ± 0.80 $_{a}$	4.16 ± 0.55 $_{a}$
Stress and anxiety reduction	3.90 ± 0.85 $_{a}$	4.00 ± 0.80 $_{a}$	4.02 ± 0.74 $_{a}$	3.74 ± 0.82 $_{b}$	3.97 ± 0.72 $_{a}$
Improvement of sleep quality	4.01 ± 0.72 $_{a}$	4.16 ± 0.68 $_{a}$	4.09 ± 0.61 $_{a}$	3.90 ± 0.82 $_{a, b}$	4.00 ± 0.66 $_{a}$
Curiosity or recreational	3.38 ± 1.02 $_{b}$	3.44 ± 0.91 $_{b}$	3.53 ± 0.91 $_{b}$	3.31 ± 1.03 $_{c}$	3.29 ± 0.98 $_{b}$
Treatment of neurological disorders	3.54 ± 1.14 $_{b}$	3.66 ± 1.26	3.81 ± 1.03	3.54 ± 1.12	3.68 ± 1.02
As part of a “Wellness & Health” lifestyle	3.49 ± 0.97 $_{b}$	3.59 ± 0.95 $_{b}$	3.58 ± 0.82 $_{b}$	3.31 ± 0.98 c	3.50 ± 0.98 b

CBD, cannabidiol.

Note: Values in the same column and not sharing the same subscript are significantly different at $p < 0.05$. Motivation was assessed using a 5-point Likert scale. Given that respondents can have multiple product preferences, they can belong to more than one product type group.

Table 12 presents the mean values and standard deviations of six motivations for consuming CBD food products among respondents belonging to different anticipated consumption frequency classes. Notably, individuals anticipating the highest consumption frequency (weekly to daily) consistently evaluated all motivations more positively. Interestingly, as the frequency of anticipated consumption increases, there appears to be a diminishing emphasis on medical considerations relative to recreational and lifestyle motivations. For those with an anticipated consumption of once to twice, sleep, pain, and stress exhibit significantly higher importance compared to recreational and lifestyle motivations. However, despite an overall increase in motivation across all aspects, individuals anticipating a weekly to daily consumption exhibit a reduction in the relative importance placed on medical considerations. Remarkably, the group with the highest anticipated consumption frequency demonstrates a significantly stronger motivation to use CBD food products as part of a 'Wellness & Health' lifestyle compared to those anticipating consumption once to twice ($p = 0.007$; mean difference = -0.836) and those anticipating consumption three times to monthly ($p = 0.017$; mean difference = -0.821). This suggests a shift in motivational emphasis towards a 'Wellness & Health' lifestyle among more frequent consumers.

Table 12: The mean values and standard deviations of motivations for the consumption of CBD food products among three groups with different anticipated consumption frequencies (n = 68).

		Anticipated consumption frequency over the next 12 months		
Motivation	Total (n = 68)	1 to 2 times (n = 37)	3 times to monthly (n = 16)	Weekly to daily (n = 15)
Pain relief	3.94 ± 0.90 $_{a}$	3.95 ± 0.91 $_{a}$	3.63 ± 0.89 $_{b}$	4.27 ± 0.80 $_{a, b}$
Stress and anxiety reduction	3.90 ± 0.85 $_{a}$	3.86 ± 0.95 $_{a}$	3.69 ± 0.70 $_{a, b}$	4.20 ± 0.68 $_{a, b}$
Improvement of sleep quality	4.01 ± 0.72 $_{a}$	3.89 ± 0.84 $_{a}$	4.06 ± 0.57 $_{a}$	4.27 ± 0.46 $_{a}$
Curiosity or recreational	3.38 ± 1.02 $_{b}$	3.30 ± 1.13 $_{b}$	3.31 ± 0.60 $_{b}$	3.67 ± 1.11 $_{b}$
Treatment of neurological disorders	3.54 ± 1.14 $_{b}$	3.46 ± 1.17	3.38 ± 0.89	3.93 ± 1.28
As part of a “Wellness & Health” lifestyle	3.49 ± 0.97 $_{b}$	3.30 ± 1.02 $_{b}$	3.31 ± 0.79 $_{b}$	4.13 ± 0.74 $_{a, b}$

CBD, cannabidiol.

Note: Values in the same column and not sharing the same subscript are significantly different at $p < 0.05$. Motivation was assessed using a 5-point Likert scale. Respondents are categorized into groups based on their highest reported frequency for any of the CBD food product types.

4 Discussion

4.1 Interpretation of the Results

The global surge in interest surrounding CBD products is marked by rapid growth. However, existing research on CBD awareness and usage has predominantly concentrated on North America, leaving a significant gap in the understanding of how CBD integrates into the European population. The significance of cultural, regulatory, and demographic differences among regions underscores the necessity for localized investigation, with Belgium standing out as a glaring gap in CBD consumption pattern exploration. The rising popularity of CBD, coupled with widespread misperceptions about health benefits and complex legal frameworks in European countries, emphasizes the need for gaining insights into public perceptions to inform policymaking. Existing research, largely centered on CBD in general, cannabis, and medical cannabis, reveal diverse perceptions influenced by both subjective and objective knowledge. Legislation and beliefs concerning legal status significantly impact public perceptions toward cannabis-related products. The evident gap in specific inquiries into public perceptions of CBD food products, particularly in Europe where these items are prohibited, emphasizes the urgent need for a nuanced understanding of these dynamics.

Furthermore, the current literature underscores the pivotal role of individuals' attitudes in shaping behavioral intentions toward cannabis-related products. Despite foundational studies offering valuable insights, there exists a notable gap in exploring the impact of attitude, subjective norms, and perceived behavioral control within the specific context of CBD. This gap necessitates an extension of our understanding of these psychological determinants to comprehensively grasp public behavior towards CBD food products. Concerns regarding consumer safety become particularly pronounced when individuals opt for CBD products as substitutes for established medical treatments, highlighting the importance of developing a nuanced understanding of consumer motivations and preferences in the context of CBD food product usage. Recognizing that CBD is available in various forms emphasizes the potential for diverse reasons behind its usage. Existing research predominantly explores the use of CBD in general, lacking specificity. Therefore, there is a deliberate focus on elucidating the motivations driving the consumption of CBD food products, with an exclusion of other forms, to provide a more targeted and comprehensive understanding of this specific facet of CBD usage.

What fraction of the Belgian population is familiar with and has used CBD, and how does this awareness and usage vary across demographic groups?

The findings of this study indicate that 68.4% of individuals in Belgium are aware of CBD, with 23.6% having used CBD at least once. Men are more than twice as likely to have used CBD and residing in a big city increases the odds of past CBD usage. The likelihood of CBD awareness and past usage decreases by 2% and 4%, respectively, for each additional year of age. Individuals with a university degree (bachelor or master) exhibit higher CBD awareness but lower rates of prior CBD usage. Interestingly, those with a higher education degree outside the university are less likely to be aware of CBD but have a fourfold increase in the likelihood of prior CBD usage compared to those with a master's degree.

The awareness and past use of CBD in Belgium shows parallels with the U.S., where approximately 63% are aware of CBD (Gicewicz et al., 2021), with 26% having prior usage (Goodman et al., 2022). Despite the more stringent European regulations on CBD, Belgium's adoption rates are surprisingly akin to those in the U.S. The notable deviation is the gender difference in usage: Belgian men report more than double the usage compared to women, a contrast to higher female usage rates in the U.S. and Canada (Tumati et al., 2022; Wheeler et al., 2020a). This divergence may be indicative of cultural or societal differences in health behavior and perceptions towards CBD between Belgium and North

America. The survey responses may conflate prior CBD use with general marijuana consumption, which also contains CBD. Such a conflation could particularly influence the gender-based findings, as studies suggest men are more prone to report frequent marijuana use and are twice as likely as women to use it on a daily or near-daily basis (Greaves & Hemsing, 2020). This factor could account for the observed higher reported rates of CBD use among men in the study.

In Belgium, a significant trend in CBD familiarity and use is observed among younger individuals, with nearly 39% of those aged 18–25 reporting past use, reflecting the similar number of 40% in the U.S (Wheeler et al., 2020a). This consistency underscores the global trend of CBD's popularity among younger demographics. Interestingly, the study found that residents of small cities and rural areas in Belgium are less likely to be aware of or to have used CBD. This is a critical insight, as it may reflect disparities in access or cultural attitudes towards CBD. A nuanced perspective is apparent when examining the influence of educational attainment on CBD awareness and usage. Individuals with a university degree showed the highest awareness of CBD, which could be attributed to their increased access to diverse information sources and possibly a more critical approach to health-related matters. Yet, this heightened awareness does not correspond with higher usage rates. In fact, the data suggest a more conservative stance towards CBD consumption among university-educated individuals, which may reflect a greater scrutiny of the mixed scientific evidence surrounding CBD's efficacy and safety. In contrast, individuals with a higher education degree outside of university while less aware than their university-educated counterparts, are significantly more likely to engage in CBD use once aware. This could indicate that this group, although less informed initially, may be more open to trying CBD upon learning about it, perhaps due to different perceived health needs or a different cultural positioning towards alternative therapies.

How are public perceptions of CBD food products in Belgium influenced by individuals' subjective knowledge, objective knowledge, and beliefs about the legal status of CBD?

Overall, the Belgian public demonstrates a general lack in subjective knowledge and moderate objective knowledge on CBD. Individuals with past CBD usage experience demonstrate significantly higher subjective and objective knowledge, with usage experience influencing subjective knowledge more than objective knowledge. There is a widespread lack of knowledge about the legal status of CBD products, with the majority mistakenly believing CBD oil and supplements are allowed for sale in Belgium. Positive correlations exist between objective knowledge, subjective knowledge, and the belief in a more tolerant legal status of CBD. The Belgian public perceives CBD food products as effective, relaxing, and natural, yet also as unhealthy, unappealing, and expensive. Notably, positive perceptions are strongly influenced by prior CBD usage experience, while socio-demographic factors exhibit limited impact. Perceptions are further shaped by subjective knowledge, objective knowledge, and belief about the legal status of CBD. Subjective knowledge positively affects the perception of appeal, while objective knowledge positively influences perceptions of effectiveness and ease of finding. Belief about the legal status emerges as the most influential predictor, significantly impacting positive perceptions across various attributes, including effectiveness, safety, relaxation, trustworthiness, ease of finding, and non-addictiveness.

The favorable view of CBD food products as effective and relaxing, coupled with their perception as natural, resonates with the growing preference for natural remedies, fueling the demand for CBD-based treatments (Bhamra et al., 2021; Corroon & Phillips, 2018). This suggests that the combination of perceived efficacy, the potential for relaxation, and naturalness could significantly contribute to the intention to use CBD food products. Such perceptions are indicative of a broader public misconception that CBD is a panacea for various health issues, particularly due to its purported calming effects that may improve sleep and reduce stress. Moreover, these findings are consistent with previous research that links the perceived safety and effectiveness of CBD to its natural origin (Bhamra et al., 2021). The

perception of CBD's naturalness appears to be a key factor influencing positive attitudes towards hemp-derived food products (Velasco et al., 2023). The understated self-assessed knowledge about CBD among the Belgian public contrasts with the tendency observed in medical cannabis studies, where individuals often overrate their knowledge (Chapman, 2019). This discrepancy highlights a divergence in public understanding between CBD and medical cannabis. Despite the Belgian public's relatively limited subjective and objective knowledge about medical cannabis (Pav et al., 2023), their objective knowledge concerning CBD appears to be slightly more substantial.

Experience with CBD usage positively influences both knowledge types, strongly enhancing perceptions about CBD food products' effectiveness. This is consistent with the trend in North America, where CBD users exhibit more favorable views (Goodman et al., 2022). Notably, users in Belgium believe in the effectiveness of CBD food products more than non-users, paralleling the heightened belief in CBD's therapeutic efficacy observed in the UK (2CV, 2019; Corroon & Phillips, 2018). On the contrary, non-users hold a more constrained positive view, limited to the relaxation benefits of CBD, and their negative perceptions are more prevalent, in line with findings suggesting non-users perceive greater risks and less social acceptability related to CBD (Wysota et al., 2022). The Belgian public's knowledge of the legal status of CBD food products reveals inconsistencies, particularly regarding the understanding of regulations that govern CBD as a novel food ingredient. Despite the regulations, there is confusion about the legality of various CBD products such as food, beverages, and oils. Awareness is greater for the restrictions on food and beverages compared to supplements and oils, suggesting an information gap that needs to be addressed. This uncertainty in the Belgian context is reflective of a broader lack of public knowledge about the legal status of CBD products, as evidenced by the significant number of people in the UK who are unaware of the European novel food regulations pertaining to CBD products (Erridge et al., 2022).

Beliefs regarding the legal status of CBD play a pivotal role, exerting a substantial influence on perceptions of CBD food products, overshadowing the effect of both subjective and objective knowledge. When individuals hold the belief that a broader array of CBD products is legally available in Belgium, signifying a perception of a more permissive legal framework, their positive evaluations of CBD increase significantly beyond what knowledge alone would facilitate. This belief markedly shapes critical perceptions of CBD's effectiveness, safety, and relaxation-inducing properties. In the United States, the attitudes and intentions of PCPs concerning CBD supplements are heavily swayed by the cannabis laws in their respective states (Sharma et al., 2023). A similar pattern is evident among veterinarians, who are more inclined to advise clients on CBD and generally support its use in states where cannabis is legal (Kogan et al., 2019). In the United Kingdom, healthcare professionals with authorization to prescribe CBD are more likely to harbor beliefs in its efficacy and safety (Ukaegbu et al., 2021). This underscores a robust correlation between legal beliefs and perceptions regarding the safety and efficacy of CBD. In sum, these findings underscore the significant impact of beliefs regarding legal status on perceptions of CBD products. Whether it pertains to the belief in the legality of sales, the influence of state-specific laws on healthcare professionals, or the repercussions of legalization on public perception, legal status undeniably stands as a fundamental determinant in shaping attitudes and perceptions toward CBD.

The limited impact of subjective knowledge and the selective influence of objective knowledge on the perception of effective is specifically an interesting finding. It contradicts the demonstrated strong effect of both types of knowledge in shaping perceptions towards medical cannabis with subjective knowledge as a stronger determinant (Pav et al., 203). The varying effect of both subjective knowledge and objective knowledge between various research should be further nuanced. In the context of CBD food products, objective knowledge only effects the perception of effective, which is an important factor in shaping people's attitude and intention. However, subjective knowledge has limited impact. In contrary, positive perception towards medical cannabis seems strongly influenced by subjective

knowledge. Other research on pharmacists (Kirilov et al., 2020) and veterinarians (Kogan et al., 2019) demonstrate high levels of objective knowledge on CBD. However, in both studies findings revealed pharmacists and veterinarians demonstrating hesitancy in recommending CBD products to clients due to skepticism about the efficiency. This creates a paradox in the findings where objective knowledge seems to strongly increase the perception of effective and at the same time has a relationship with a decreasing perception of effective. This notable disparity could maybe be caused by the difference between two different types of objective knowledge. Public's objective knowledge, more based on general objective knowledge strongly increases perception of effective. Healthcare professionals, despite having a high level of objective knowledge, possesses a more critical evaluation of their actual knowledge based on more scientific insights on the specific effects CBD has.

Subjective knowledge has a limited impact on perception towards CBD food products and objective knowledge a large impact on the perception of effectiveness. This finding contradicts the demonstrated strong effect of both types of knowledge in shaping perceptions toward medical cannabis, with subjective knowledge as a stronger determinant (Pav et al., 203). The varying effect of both subjective knowledge and objective knowledge between various research should be further nuanced. In the context of CBD food products, objective knowledge primarily affects the perception of effectiveness, which is a crucial factor in shaping people's attitudes and intentions. However, subjective knowledge has a relatively limited impact. Notably, other research focusing on pharmacists (Kirilov et al., 2020) and veterinarians (Kogan et al., 2019) reveals that both groups possess high levels of objective knowledge regarding CBD. Interestingly, these studies reveal a paradoxical stance among pharmacists and veterinarians when it comes to recommending CBD products to clients. While they generally perceive CBD as low-risk and express support for its use, their hesitancy stems from a skeptical view of its efficacy for many of the conditions it is marketed to address. This paradoxical finding may be attributed to the distinct types of objective knowledge at play. The public's objective knowledge, grounded in general information, appears to significantly enhance the perception of effectiveness, while healthcare professionals, despite their extensive objective knowledge, tend to engage in a more critical evaluation of their understanding, driven by scientific insights into the specific effects of CBD.

This hypothesis gains additional support from research conducted in the USA (Sharma et al., 2023) and the UK (Chapman, 2019; Ukaegbu et al., 2021), where healthcare professionals exhibit skepticism, attributed to a lack of scientific evidence regarding efficacy. These professionals, while generally holding positive views, may also possess a heightened awareness of their knowledge limits, exhibit increased critical thinking, and show resilience against misinformation. Such factors could account for the observed differences in how objective knowledge influences perceptions of efficacy among healthcare professionals compared to the general public. The hypothesis suggests the existence of two distinct categories of objective knowledge: general and critical. This dichotomy may help explain the observed differences in usage among individuals with higher education degrees outside of university compared to those with a university master's degree. Despite having lower awareness of CBD, a higher education degree outside university exhibited significantly higher usage. The findings further revealed indicated that individuals with a university master's degree tended to perceive CBD food products as less effective and expressed lower intentions to consume them. This discrepancy can be attributed to their elevated objective knowledge and heightened critical evaluation of CBD, leading to less favorable attitudes and intentions. However, a counterargument surfaced in research conducted on Pharmacy students (Whitman et al., 2020). When a formal lecture on CBD was integrated into their curriculum, it resulted in heightened levels of critical objective knowledge, which in turn increased their willingness to discuss and recommend CBD products to patients.

To what extent do attitude, subjective norm, and perceived behavioral control shape the intention to consume CBD food products among the public in Belgium?

In summary, the study found that the Belgian public generally holds slightly positive attitudes and levels of behavioral control toward CBD food products. The evaluation of subjective norm, however, was neutral. Despite these attitudes and perceived control, the overall intention to consume CBD food products among the Belgian public is relatively low, with only 13.3% agreeing with related statements. The findings underscore the robustness of the TPB in predicting public intention toward CBD food products. TPB constructs collectively account for 51% of the variance in intention, with attitude emerging as a particularly influential factor. This suggests that individuals with a positive perception of CBD food products are more likely to express an intention to consume them. While subjective norm also contributes to shaping intention, its impact is comparatively weaker.

The Belgian public's attitude towards CBD food products was found to be slightly positive. This suggests that individuals believe there are favorable outcomes associated with consuming CBD food products and they value these outcomes to some extent. However, this positive attitude is not strong, as reflected in the low intention to consume these products. This might indicate that while the perceived outcomes of consuming CBD food products are somewhat valued, they may not be strong enough to drive a strong intention to consume. The study found that the subjective norm regarding CBD food products was neutral. This indicates that the social pressure or influence exerted by friends, family, or society at large is neither strongly for nor against the consumption of CBD food products. Significant others' opinions do not seem to be a major factor in the decision-making process of the Belgian public in this area. This neutrality in subjective norm implies that people are not being swayed by others around them when it comes to their intention to consume or not consume CBD food products. Despite slightly positive attitudes, perceived behavioral control is at a level where the public feels they have the capability to consume CBD food products, suggesting no significant obstacles stand in their way. Confirming the widespread believe in the legality of these products. However, this perceived control does not translate into a higher intention to consume. This could mean that even though individuals feel they could consume CBD food products if they chose to, other factors such as lack of strong positive attitudes or neutral social influences are not compelling enough to increase their readiness to engage in this behavior. With only 13.3% of the Belgian public agreeing with statements related to consuming CBD food products, the behavioral intention is relatively low. This low level of intention despite the presence of slight control and positive attitudes indicates that other unmeasured factors may be influencing the decision not to consume

The strong influence of attitude on behavioral intention is in harmony with prior studies applying the TPB. Consistently in the context of marijuana, attitude has been identified as the predominant predictor of intention, underscoring the profound impact of an individual's internal stance on marijuana (Burroughs, 2019; Ho et al., 2022; Jalilian et al., 2020). This could suggest a potential indirect influence on attitudes towards cannabis-derived products. Yet, diverging from this, research points to subjective norms being the primary driver for hemp-derived products (Metcalf, Wiener, Saliba et al., 2021), and personality traits alongside social norms steering intentions towards cannabis-infused beverages (Basha et al., 2023). This precedence of attitude is mirrored in findings from Poland, where caregivers' personal attitudes towards CBD oil were strong enough to prompt its application in patient care, often without seeking input from healthcare providers (Kłosińska & Leszko, 2024; Leszko & Meenrajan, 2021). Their actions were significantly motivated by their beliefs in the oil's effectiveness. Similarly, the perception of effectiveness was identified as an important influencer of physicians' intentions to recommend medical cannabis. This accentuates the essential role that perceptions about the effectiveness of a cannabis-derived products play in shaping the behavior of healthcare workers and, consequently, in clinical decision-making processes in this context.

Interestingly, despite slightly positive attitudes towards CBD food products, intention to consume these products demonstrated low. This contradicts compared to the UK where 35% of never-users of CBD products expressed interest in consumption (Bhamra et al., 2021). These findings could indicate a general low intention for CBD consumption or a disparity between intention towards general CBD and CBD food products. Another unexpected result lay in the fact that 18–25 year olds reported significantly lower intention to consume CBD food products compared to 26-35 year olds, despite the higher usage linked with decreasing age. This contradicts the high intention of young adults in the USA towards CBD products (Wysota et al., 2022) and might suggest the influence of another non-measured factor, such as an underestimated effect of PBC related to high cost or preferences for other related products (e.g., CBD vapes), or possibly the evaluations of attitude being inflated by positive internal stances toward cannabis. Furthermore, the low intention compared to attitude might also be attributed to the same dichotomy found in the construct of objective knowledge between the public and healthcare workers. As previously mentioned, healthcare workers exhibit positive perceptions and attitudes towards CBD products but are skeptical about the efficiency and possible health benefits, which translates into a reduced intention. Specifically, attitude reflects an individual's positive or negative evaluation of a behavior, influenced by beliefs about outcomes and their subjective value (Ajzen, 1991). This variation in attitudes and intentions can be further understood through the lens of two different types of positive attitudes:

- **Positive Attitude Based on Belief in Efficacy:** This is where an individual has a positive attitude towards CBD food products because they believe in its effectiveness. For instance, someone who positively evaluates CBD due to a strong belief in its efficacy might have a more robust intention to use it.

- **Positive Attitude Despite Lack of Belief in Efficacy:** Here, an individual may have a positive attitude towards CBD, not because they believe in its efficacy, but perhaps due to other factors like perceived safety, lack of negative beliefs, or curiosity. In this case, the positive attitude is not based on a belief in its effectiveness but rather on an absence of negative beliefs.

The dichotomy in attitudes towards CBD can be further supported by examining intention to use medical cannabis in Belgium, which is primarily influenced by perceived benefits (Pav et al., 2023). This suggests that attitude towards medical cannabis, and by extension CBD products, can be divided into general attitudes (e.g., among healthcare professionals) and attitudes based on perceived specific benefits (effectiveness, etc.). Additionally, attitudes appear to be more strongly influenced by positive perceptions rather than negative ones. For instance, a study on the Amish community's CBD use found that perceived benefits significantly outweighed perceived risks (Riley, 2022). This aligns with the idea that while there may be general skepticism or lack of strong belief in the efficacy of CBD products, as seen among healthcare workers, the overall positive perception, perhaps influenced by factors such as a lack of negative consequences, could still lead to a generally positive attitude. However, this positive attitude does not necessarily translate into a high intention to use, especially if other factors like PBC or specific preferences play a more significant role.

What motivates individuals in Belgium to consider future consumption of CBD food products, and what are their anticipated consumption frequency and preferences regarding types of CBD food products?

Overall, the motivations for consuming CBD food products in Belgium mirror the broader reasons for CBD use globally. The primary drivers include enhancing sleep quality, pain relief, and reducing stress and anxiety, paralleling the dominant reasons for CBD use in the USA and Canada, where pain relief is a significant factor (Goodman et al., 2022; Wheeler et al., 2020a; Wysota et al., 2022). European studies echo this, citing pain as a key motivator (Kirilov et al., 2020). Interestingly, while a UK study (Erridge et al., 2022) emphasized wellness over medical reasons for CBD use, this research indicates a stronger inclination towards health-related motivations over wellness, curiosity, or recreational use in the Belgian context. These health-focused motivators consistently ranked highest across all consumption frequency groups and product preferences. The most salient motivators underscore a positive perception of CBD as relaxing and effective. However, it's important to note a prevalent misperception about the stress-relieving and relaxation effects of CBD, which lacks robust scientific backing (T. Tran & Kavuluru, 2020). Additionally, as anticipated consumption frequency increases, so does the intensity of all motivators.

Caution is necessary when interpreting these motivations. The study's findings on the high ratings for all six motivations, including using CBD for neurological disorders like epilepsy, might reflect a broader perception of CBD's benefits rather than personal motivations. This could be due to respondents projecting motivations they believe others might have, rather than their own. Additionally, the uniformly high motivation ratings across all categories might be influenced by the specific characteristics of the respondents, particularly those with a strong intention to consume CBD products. This group's inherently positive attitude towards CBD could indicate a general positivity or a firm belief in CBD's potential benefits, which in turn might color their motivations. The notion of CBD as a 'miracle cure' for a wide range of health issues could also be influencing people's motivations, creating a positive bias in their assessment of CBD food products.

In terms of product preferences, CBD beverages have emerged as the favored type in Belgium, presenting a shift from the traditionally preferred CBD oil. This preference is even more pronounced among those anticipating less frequent consumption, while daily users lean towards CBD oil. Given the regulatory landscape in Belgium and Europe, where the sale of CBD food products is restricted, the accessibility of CBD oil (often marketed as a non-food item) could explain its prevalence. However, the growing interest in CBD beverages, based on anticipated rather than past consumption, suggests evolving consumer tastes and challenges the established preference for CBD oil.

In conclusion, although CBD use is prevalent in the USA and Canada for a range of health concerns, often lacking solid scientific backing, the intention to consume CBD in Belgium is notably modest. Most potential consumers anticipate using CBD products only occasionally, expecting to do so once or twice over the next year. This trend of infrequent use in Belgium contrasts sharply with the patterns observed in North America. Particularly noteworthy is the behavior of high-frequency consumers in Belgium, typically daily users, who demonstrate a strong preference for CBD oil. Their motivation is predominantly driven by the desire for pain relief. This preference and motivation are significant considering research suggesting that increased use of CBD oil might substitute other medical treatments (Kvamme et al., 2021). This finding underscores the perceived effectiveness of CBD oil in managing pain, a key factor in its favored status among daily users. This contrast in consumption patterns and motivations between Belgium and North American regions highlights the varied cultural and regulatory landscapes influencing CBD usage globally.

4.2 Limitations

This research focuses on Belgium's CBD food products market, specifically sampling from Flanders. While it offers insights into this region, generalizing the findings to the entire Belgian market, let alone the broader European context, is not without limitations. Additionally, the study's findings may not be fully applicable to other types of CBD products due to varying consumer behaviors and market dynamics in different product categories. The total sample of 297 respondents exhibits a skew in demographic representation, with a relative overrepresentation of women (61.3%), individuals aged 18-25 (30.7%), and respondents from Antwerp (77.2%). This imbalance could limit the study's ability to fully represent the broader Belgian market's perspectives and behaviour.

The research employs an online cross-sectional survey with only quantitative elements. Quantitative research methods, including scale, multiple-choice, and closed-ended questions, were used to analyze psychological and social phenomena. The survey, conducted in Dutch, limits participation from French and German speakers in Belgium. The convenience sampling method and the specific dissemination strategy through social media may not provide an equitable representation of the population. The survey's design and execution also have limitations related to the use of an online platform and the reliance on self-reported data. The survey's approach to measuring product preference and anticipated consumption frequency might have introduced bias. Respondents chose their expected consumption frequency for each CBD product type (food, beverages, supplements, and oil) from set options. This design potentially influenced respondents to select within these pre-defined frequencies. Consequently, their choices may not accurately reflect their true consumption intentions, especially for less accessible products like CBD beverages. This survey design aspect could explain the apparent high preference for CBD beverages in the results, despite their limited availability in Belgium. The lack of a specific timeframe in this study's exploration of past CBD use clouds the understanding of its prevalence and the nuances between one-time and habitual use.

The legal and regulatory landscape for CBD products, particularly in the context of the EFSA evaluating the potential permissibility of CBD as a food ingredient on the European market, is rapidly evolving. This fluidity could affect the relevance and applicability of the study's findings over time, as regulatory decisions can significantly impact market dynamics. The study's methodology, including its reliance on the TPB, presents specific constraints. TPB, while useful for understanding behavioural intentions, may not fully capture the complexities of consumer behaviour in the CBD market. Factors such as external influences and deeply ingrained attitudes, which are not adequately addressed by TPB, could play significant roles in consumer decisions. The limitations of TPB in capturing these nuances are a notable constraint in the study's analytical framework. Furthermore, it is crucial to note that the reliability of the PBC construct was called into question due to the Cronbach's alpha value falling below the acceptable threshold of 0.70. This lower reliability of the multi-item measures for PBC may have potentially affected the observed impact of PBC within the study's findings.

4.3 Future Research

4.3.1 Exploring the Critical Objective Knowledge Hypothesis

Future research could aim to quantify the differences in the effect of objective knowledge versus critical objective knowledge on public's perception of CBD products. It is imperative to determine which type of knowledge—general awareness or scientifically nuanced understanding—is necessary to foster a critical objective stance towards the medical applications of CBD. Research could explore the mechanisms by which different educational interventions or information dissemination strategies can elevate the level of critical objective knowledge within the population. This could inform targeted strategies designed to adjust the public's perception of the effectiveness of CBD, ensuring that it is grounded in scientific evidence rather than anecdotal reports or marketing claims.

4.3.2 In-Depth Assessment of the Relationship Between Perceived Effectiveness and Legislation

The perception of the effectiveness of CBD food products is notably influenced by beliefs about the legal status of CBD. Therefore, it is crucial for future research to conduct a more in-depth assessment of the relationship between perceived effectiveness and the legislative context. This assessment should consider how changes in legislation, public policy announcements, and legal debates in the media influence public perceptions. Additionally, comparative studies across different regulatory environments could provide valuable insights into how legal status and public information campaigns can be leveraged to align public perception with scientifically verified facts. Such research could also evaluate the impact of legislation on healthcare professionals' recommendations and the general public's acceptance of CBD food products.

4.3.3 Impact of Individuals' Internal Stance Toward Cannabis-Related Products

The internal stance toward marijuana potentially shapes an individual's attitudes and intentions regarding cannabis-related products, though the correlation may not always be straightforward. While a positive stance could be associated with a greater openness to usage, this does not necessarily translate into actual intention to use, which could lead to overinflation of positive attitudes relative to intention. There may be a discrepancy where individuals express a positive view without a corresponding intention to engage with these products, indicating that other factors may inhibit the transition from attitude to action. The dynamic between personal stance, attitude, and intention warrants closer examination to understand the nuances affecting consumer behavior in the context of cannabis-related products.

4.4 Implications

The findings of the research contribute to the theoretical framework of consumer behavior, particularly within the Theory of Planned Behavior (TPB). They provide empirical support for the influence of attitude and subjective norm on the intention to consume CBD food products. The nuanced understanding of how subjective and objective knowledge impacts perceptions can refine models of health behavior change, emphasizing the distinction between types of knowledge and their influence on attitudes and intentions. Furthermore, the study's insights into the role of legal status beliefs suggest that TPB could be expanded to include beliefs about legality as a predictor of intentions and behavior, especially in markets with complex regulatory environments.

The study's findings highlight several practical considerations for businesses and healthcare professionals:

- **Businesses:** There is a clear opportunity for companies to educate consumers about CBD, focusing on objective knowledge that can address misconceptions and foster informed decision-making. Additionally, businesses might consider targeting demographics shown to be more open to CBD usage, such as younger individuals, men, and those with non-university higher education degrees.
- **Healthcare Professionals:** Given the reported substitution of CBD for established medical treatments, there's a need for healthcare providers to engage more actively in conversations about CBD, guiding patients through evidence-based information, and addressing the potential risks and benefits.

The study's findings have significant policy implications, particularly for the regulation of CBD food products in Belgium and potentially the broader EU:

- **Regulatory Clarity:** Policymakers should consider providing clear guidelines and legal frameworks for the sale and consumption of CBD products. This involves reconciling the dissonance between drug law and food law, addressing the novel food status of CBD, and clarifying the legal thresholds for THC content in CBD products
- **Public Education:** There is a pressing need for public education campaigns to improve critical objective knowledge and awareness about the legal status of CBD food products. This could help counteract the spread of misinformation and ensure that public perceptions are grounded in scientific evidence.
- **Consumer Safety**: As the popularity of CBD continues to grow, regulations must prioritize consumer safety, ensuring that products on the market are rigorously tested and accurately labeled.
- **Support for Research**: The government should support ongoing research into the efficacy and safety of CBD as a food product. This would provide a stronger evidence base to inform both consumers and policy decisions.
- **International Collaboration:** Considering the international interest in CBD, there is an opportunity for Belgium to collaborate with other countries to establish common regulatory standards, facilitating a safer and more cohesive global market.

5 Conclusion

This study sheds light on the awareness, usage, and perceptions of CBD food products among the Belgian population. The findings reveal that CBD has gained substantial awareness in Belgium, with more than two-thirds of respondents being familiar with it. Moreover, over one-fifth of the population has used CBD at least once. This level of awareness and usage is consistent with trends observed in other countries, demonstrating the global popularity of CBD.

Several key demographic factors influence CBD awareness and usage in Belgium. Gender plays a significant role, with men being more likely to have used CBD compared to women. Age is also a crucial determinant, with younger individuals, particularly those aged 18–25, showing a higher propensity for CBD usage. Geographical location matters, as residents of big cities are more likely to have tried CBD than those in small cities or rural areas. Additionally, educational background has a nuanced impact, with university-educated individuals being more aware of CBD but showing lower usage rates, while those with a higher education degree outside of university are more likely to use CBD once aware.

The study also delves into the subjective and objective knowledge of CBD among the Belgian public. It is evident that there is room for improvement in both subjective and objective knowledge, with individuals who have used CBD displaying higher levels of knowledge. Interestingly, misconceptions persist regarding the legal status of CBD products, with many believing that CBD oil and supplements are legally available in Belgium.

Perceptions of CBD food products in Belgium are multifaceted. While they are generally viewed as effective, relaxing, and natural, there are also concerns about their healthiness, appeal, and cost. These perceptions are strongly influenced by prior CBD usage experience. Moreover, beliefs about the legal status of CBD play a significant role in shaping positive perceptions.

Attitudes, subjective norms, and perceived behavioral control play significant roles in shaping intentions towards CBD food products consumption. However, the overall intention to consume these products remains low, with attitude being the most influential predictor according to the TPB model. This suggests that while some Belgians are open to CBD food products, there exists a significant potential for increased consumer education and regulatory clarity to better inform public intention and usage.

The motivations behind considering future consumption of CBD food products are primarily health-related, with pain relief, sleep enhancement, and stress reduction cited as the leading factors. These motivators are consistent with global trends but highlight a strong health-oriented perspective in the Belgian context.

In summary, this study provides valuable insights into the evolving landscape of CBD awareness, usage, and perceptions in Belgium. As CBD food products continues to gain popularity globally, understanding how it is perceived and utilized by different demographic groups is essential for policymakers, healthcare professionals, and businesses. Addressing misconceptions and improving knowledge about CBD, particularly regarding its legal status, is crucial to ensuring that consumers make informed decisions. Additionally, recognizing the impact of demographic factors on CBD awareness and usage can inform targeted educational and marketing efforts. Overall, this research contributes to a better understanding of the complex dynamics surrounding CBD food products in Belgium and offers a foundation for future studies in this rapidly evolving field.

6 References

2CV. (2019). *CBD Consumer research report* .

AGRI. (2023). *Hemp production in the EU*. https://agriculture.ec.europa.eu/farming/crop-productions-and-plant-based-products/hemp_en

Ajzen, I. (n.d.). *Sample TPB Questionnaire*.

Ajzen, I. (2020). The theory of planned behaviour: Frequently asked questions. *Human Behaviour and Emerging Technologies*, *2*(4), 314–324. https://doi.org/10.1002/hbe2.195

Apotheek.be. (n.d.). *Zoek je info over een geneesmiddel?* Retrieved September 28, 2023, from https://www.apotheek.be/Medicine

Atalay, S., Jarocka-Karpowicz, I., & Skrzydlewska, E. (2019). Antioxidative and Anti-Inflammatory Properties of Cannabidiol. *Antioxidants*, *9*(1), 21. https://doi.org/10.3390/antiox9010021

Aytaç, S. (2018). An Environmentally Friendly Plant in Terms of Oxygen Supply: Hemp. *International Conference on Environmental Science and Technology*.

Azjen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, *50*(2), 179–211.

Baker, H. D. R. (2002). Science and Civilisation in China, vol. VI, Biology and Biological Technology, part 5. Fermentations and Food Science. H. T. Huang [C. Cullen, Needham Research Institute, series editor]. 741 pages. Cambridge: Cambridge University Press. 2000. *British Journal of Nutrition*, *87*(1), 95–96. https://doi.org/10.1079/BJN2001481

Basha, M. B., Wahid, F., & Hafidh, G. (2023). Cannabis infused soft drinks - buying behaviour amongst Canadian students: An empirical study. *Young Consumers*, *24*(4), 381–405. https://doi.org/10.1108/YC-09-2021-1384

Baswan, S. M., Klosner, A. E., Glynn, K., Rajgopal, A., Malik, K., Yim, S., & Stern, N. (2020). Therapeutic Potential of Cannabidiol (CBD) for Skin Health and Disorders. *Clinical, Cosmetic and Investigational Dermatology*, *Volume 13*, 927–942. https://doi.org/10.2147/CCID.S286411

Bergamaschi, M. M., Queiroz, R. H. C., Chagas, M. H. N., de Oliveira, D. C. G., De Martinis, B. S., Kapczinski, F., Quevedo, J., Roesler, R., Schröder, N., Nardi, A. E., Martín-Santos, R., Hallak, J. E. C., Zuardi, A. W., & Crippa, J. A. S. (2011). Cannabidiol Reduces the Anxiety Induced by Simulated Public Speaking in Treatment-Naïve Social Phobia Patients. *Neuropsychopharmacology*, *36*(6), 1219–1226. https://doi.org/10.1038/npp.2011.6

Bhamra, S. K., Desai, A., Imani-Berendjestanki, P., & Horgan, M. (2021). The emerging role of cannabidiol (CBD) products; a survey exploring the public's use and perceptions of CBD. *Phytotherapy Research*, *35*(10), 5734–5740. https://doi.org/10.1002/ptr.7232

Broens, B. (2023, April 11). *De groeipijnen van de cannabisindustrie*. https://www.tijd.be/dossiers/de-verdieping/de-groeipijnen-van-de-cannabisindustrie/10459924.html

Burroughs, M. (2019). Examining college students' use, perception, and knowledge of marijuana and marijuana laws.

Carlini, E. A., & Cunha, J. M. (1981). Hypnotic and Antiepileptic Effects of Cannabidiol. *The Journal of Clinical Pharmacology*, *21*(S1). https://doi.org/10.1002/j.1552-4604.1981.tb02622.x

Chanda, D., Neumann, D., & Glatz, J. F. C. (2019). The endocannabinoid system: Overview of an emerging multi-faceted therapeutic target. *Prostaglandins, Leukotrienes and Essential Fatty Acids*, *140*, 51–56. https://doi.org/10.1016/j.plefa.2018.11.016

Chapman, M. (2019). *An Investigation into Public Perceptions and Knowledge of Medical Cannabis*.

Collin, C., Davies, P., Mutiboko, I. K., & Ratcliffe, S. (2007). Randomized controlled trial of cannabis-based medicine in spasticity caused by multiple sclerosis. *European Journal of Neurology*, *14*(3), 290–296. https://doi.org/10.1111/j.1468-1331.2006.01639.x

Corroon, J., & Phillips, J. A. (2018). A Cross-Sectional Study of Cannabidiol Users. *Cannabis and Cannabinoid Research*, *3*(1), 152–161. https://doi.org/10.1089/can.2018.0006

CRS. (2021). *Comparing Hemp Provisions in the 2014 and 2018 Farm Bills*.

DCA. (2020). *CBD Confusion: How Consumers Can Be Misled and Why the Market Needs Adult Supervision Now*.

De Standaard. (2018, November 30). *Niet high, wel relaxed*. https://www.standaard.be

De Steur, H., Blancquaert, D., Lambert, W., Van Der Straeten, D., & Gellynck, X. (2014). Conceptual framework for ex-ante evaluation at the micro/macro level of GM crops with health benefits. *Trends in Food Science & Technology*, *39*(2), 116–134. https://doi.org/10.1016/j.tifs.2014.06.010

EFSA. (2022). *Cannabidiol novel food evaluations on hold pending new data*. https://www.efsa.europa.eu/en/news/cannabidiol-novel-food-evaluations-hold-pending-new-data

EFSA. (2023). *Standing Committee on Plants, Animals, Food and Feed Section Novel Food and Toxicological Safety of the Food Chain*. https://food.ec.europa.eu/system/files/2023-04/reg-com_toxic_20230227_sum.pdf

Eichhorn Bilodeau, S., Wu, B.-S., Rufyikiri, A.-S., MacPherson, S., & Lefsrud, M. (2019). An Update on Plant Photobiology and Implications for Cannabis Production. *Frontiers in Plant Science*, *10*. https://doi.org/10.3389/fpls.2019.00296

EIHA. (2018). *Hemp Cultivation & Production in Europe*.

EIHA. (2023). *Hemp in Europe: The Situation of Hemp Today*. https://eiha.org/about-hemp-hemp-in-europe

El-Alfy, A. T., Ivey, K., Robinson, K., Ahmed, S., Radwan, M., Slade, D., Khan, I., ElSohly, M., & Ross, S. (2010). Antidepressant-like effect of Δ9-tetrahydrocannabinol and other cannabinoids isolated from Cannabis sativa L. *Pharmacology Biochemistry and Behaviour*, *95*(4), 434–442. https://doi.org/10.1016/j.pbb.2010.03.004

ElSohly, M. A., Ross, S. A., Mehmedic, Z., Arafat, R., Yi, B., & Banahan, B. F. (2000). Potency Trends of Δ^{9}-THC and Other Cannabinoids in Confiscated Marijuana from 1980–1997. *Journal of Forensic Sciences*, *45*(1), 14636J. https://doi.org/10.1520/JFS14636J

EMA. (2019, October 4). *Epidyolex*. https://www.ema.europa.eu/en/medicines/human/EPAR/epidyolex

EMA. (2022). *European Medicines Agency decision P/0110/2022*. https://www.ema.europa.eu/en/documents/pip-decision/p/0110/2022-ema-decision-13-april-2022-acceptance-modification-agreed-paediatric-investigation-plan/delta-9-tetrahydrocannabinol-sativex-emea-000181-pip01-08-m06_en.pdf

Emcdda. (2020). *Low-THC cannabis products in Europe*.

Emcdda. (2023a). *Cannabis Laws in Europe*.

Emcdda. (2023b). *Questions and answers for policymaking Cannabis laws in Europe*. https://doi.org/10.2810/937040

Emery Pharma. (2022). *Nailing the Science Behind CBD*. https://emerypharma.com/blog/nailing-the-science-behind-cbd/

Erridge, S., Coomber, R., & Sodergren, M. H. (2022). Medical cannabis, CBD wellness products and public awareness of evolving regulations in the United Kingdom. *Journal of Cannabis Research*, *4*(1), 56. https://doi.org/10.1186/s42238-022-00165-6

EU Monitor. (2015). *Regulation 2015/2283 - Novel foods*. https://www.eumonitor.eu

Faber, I., Castellanos-Feijoó, N. A., Van de Sompel, L., Davydova, A., & Perez-Cueto, F. J. A. (2020). Attitudes and knowledge towards plant-based diets of young adults across four European countries. Exploratory survey. *Appetite*, *145*, 104498. https://doi.org/10.1016/j.appet.2019.104498

fagg. (n.d.). *Vragen en antwoorden over geneesmiddelen en andere producten op basis van cannabis of cannabidiol*. Retrieved July 15, 2023, from https://www.fagg-afmps.be/nl/MENSELIJK_gebruik/bijzondere_producten/speciaal_gereglementeerde_stoffen/verdovende_middelen/faq_cannabis

famhp. (2023, July 28). *Questions and answers about medicines and other products based on cannabis or cannabidiol*. https://www.famhp.be/en/human_use/particular_products/specially_reglemented_substances/narcotics_psychotropics/frequently

Farinon, B., Molinari, R., Costantini, L., & Merendino, N. (2020). The Seed of Industrial Hemp (Cannabis sativa L.): Nutritional Quality and Potential Functionality for Human Health and Nutrition. *Nutrients*, *12*(7), 1935. https://doi.org/10.3390/nu12071935

FAVV. (2023). *Vragen en antwoorden over het gebruik van hennep (Cannabis sativa L.) en cannabinoïden (zoals cannabidiol) als of in voedingsmiddelen*.

FDA. (2023). *FDA Regulation of Cannabis and Cannabis-Derived Products, Including Cannabidiol (CBD)*. https://www.fda.gov/news-events/public-health-focus/fda-regulation-cannabis-and-cannabis-derived-products-including-cannabidiol-cbd

Felicity, T. (2020). Improving Solubility of Cannabinoids. *Pharmaceutical Technology*, *44*(2), 27–29.

Florapoint. (n.d.). *CBD collections*. Retrieved September 28, 2023, from https://florapoint.be/collections/cbd-oil

Flynn, L., & Goldsmith, R. (1999). A short, Reliable Measure of Subjective Kowledge. *Journal of Business Research*, *46*, 57–66.

FOD. (2016, January 27). *Artikel*. https://www.health.belgium.be/nl/voeding/voedingsbeleid/wetgevend-en-normgevend-kader/voedingswetgeving

Fortin, D., Di Beo, V., Massin, S., Bisiou, Y., Carrieri, P., & Barré, T. (2022). A "Good" Smoke? The Off-Label Use of Cannabidiol to Reduce Cannabis Use. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.829944

Frane, N., Stapleton, E., Iturriaga, C., Ganz, M., Rasquinha, V., & Duarte, R. (2022). Cannabidiol as a treatment for arthritis and joint pain: an exploratory cross-sectional study. *Journal of Cannabis Research*, *4*(1), 47. https://doi.org/10.1186/s42238-022-00154-9

Giannotta, F. (2021). Perceived risk of cannabis use and cannabis use among Swedish youth.

Gicewicz, E., Gatewood, S. S., Kaefer, T. N., Nadpara, P., & Goode, J.-V. R. (2021). Assessment of hemp oil–based cannabidiol use in a community-based pharmacy setting. *Journal of the American Pharmacists Association*, *61*(4), S49–S56. https://doi.org/10.1016/j.japh.2021.02.012

GMI. (2022). *Cannabidiol (CBD) Market - By Product (Oil, Tinctures, Suppository, Transdermal Patches, Isolates, Tablet, Capsules, Vape Oil, Creams And Roll-On, CBD Inhalers), By Application, By Route of Administration, By Source, By Distribution Channel & Forecast, 2022-2028*. https://www.gminsights.com/industry-analysis/cannabidiol-cbd-market

Goodman, S., Wadsworth, E., Schauer, G., & Hammond, D. (2022). Use and Perceptions of Cannabidiol Products in Canada and in the United States. *Cannabis and Cannabinoid Research*, *7*(3), 355–364. https://doi.org/10.1089/can.2020.0093

Greaves, L., & Hemsing, N. (2020). Sex and Gender Interactions on the Use and Impact of Recreational Cannabis. *International Journal of Environmental Research and Public Health*, *17*(2), 509. https://doi.org/10.3390/ijerph17020509

Gülck, T., & Møller, B. L. (2020). Phytocannabinoids: Origins and Biosynthesis. *Trends in Plant Science*, *25*(10), 985–1004. https://doi.org/10.1016/j.tplants.2020.05.005

GVR. (2021). *Cannabidiol Market Size, Share & Trends Analysis Report By Source Type (Hemp, Marijuana), By Sales Type (B2B, B2C), By End-use (Medical, Personal Use), By Region, And Segment Forecasts, 2023 - 2030*.

GVR. (2023). *Industrial Hemp Market Size, Share & Trends Analysis Report By Product (Seeds, Fiber, Shivs), By Application (Animal Care, Textiles, Food & Beverages, Construction Materials, Personal Care), By Region, And Segment Forecasts, 2023 - 2030*.

Hair, J., Black, W., Babin, B., & Anderson, R. (2009). *Multivariate Data Analysis* (7th ed.). Upper Saddle River.

Hammond, D., & Goodman, S. (2022). Knowledge of Tetrahydrocannabinol and Cannabidiol Levels Among Cannabis Consumers in the United States and Canada. *Cannabis and Cannabinoid Research*, *7*(3), 345–354. https://doi.org/10.1089/can.2020.0092

Ho, S. W. C., Wong, Y. L., & Chung, P. H. (2022). A cross-sectional survey: Exploring future healthcare workers' intention to use cannabis through extended theory of planned behaviour. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.929016

Hudock, C. (2019). *Hemp Cultivation in Europe*.

Hurd, Y. L., Spriggs, S., Alishayev, J., Winkel, G., Gurgov, K., Kudrich, C., Oprescu, A. M., & Salsitz, E. (2019). Cannabidiol for the Reduction of Cue-Induced Craving and Anxiety in Drug-Abstinent Individuals With Heroin Use Disorder: A Double-Blind Randomized Placebo-Controlled Trial. *American Journal of Psychiatry*, *176*(11), 911–922. https://doi.org/10.1176/appi.ajp.2019.18101191

Iriondo-DeHond, A., Alonso-Esteban, J. I., Gallego-Barceló, P., García, P., Abalo, R., & Dolores del Castillo, M. (2023). Nutrition Security of Hemp for Human Consumption. In *Sustainable Food Science - A Comprehensive Approach* (pp. 60–88). Elsevier. https://doi.org/10.1016/B978-0-12-823960-5.00048-2

Irving, P. M., Iqbal, T., Nwokolo, C., Subramanian, S., Bloom, S., Prasad, N., Hart, A., Murray, C., Lindsay, J. O., Taylor, A., Barron, R., & Wright, S. (2018). A Randomized, Double-blind, Placebo-controlled, Parallel-group, Pilot Study of Cannabidiol-rich Botanical Extract in the Symptomatic Treatment of Ulcerative Colitis. *Inflammatory Bowel Diseases*, *24*(4), 714–724. https://doi.org/10.1093/ibd/izy002

Jalilian, F., Mirzaei-Alavijeh, M., Ahmadpanah, M., Mostafaei, S., Kargar, M., Pirouzeh, R., Sadeghi Bahmani, D., & Brand, S. (2020). Extension of the Theory of Planned Behaviour (TPB) to Predict Patterns of Marijuana Use among Young Iranian Adults. *International Journal of Environmental Research and Public Health*, *17*(6), 1981. https://doi.org/10.3390/ijerph17061981

Kim, J. H. (2019). Multicollinearity and misleading statistical results. *Korean Journal of Anesthesiology*, *72*(6), 558–569. https://doi.org/10.4097/kja.19087

Kirilov, B., Zhelyazkova, M., Petkova-Gueorguieva, E., & Momekov, G. (2020). Regulation and marketing of cannabidiol-containing products in European countries. Pharmacists' knowledge in Bulgaria. *Biotechnology & Biotechnological Equipment*, *34*(1), 1158–1165. https://doi.org/10.1080/13102818.2020.1824620

Kloris. (2021, November 11). Natural vs. synthetic CBD; what's the difference? https://www.kloriscbd.com/blogs/cbd-information/natural-vs-synthetic-cbd

Kłosińska, U., & Leszko, M. (2024). CBD Oil as a Miracle Drug: A Thematic Analysis of Caregivers' Attitudes and Practices Towards Cannabidiol in Dementia Treatment. *Journal of Drug Issues*, *54*(1), 38–56. https://doi.org/10.1177/00220426221145019

Kogan, L., Schoenfeld-Tacher, R., Hellyer, P., & Rishniw, M. (2019). US Veterinarians' Knowledge, Experience, and Perception Regarding the Use of Cannabidiol for Canine Medical Conditions. *Frontiers in Veterinary Science*, *5*. https://doi.org/10.3389/fvets.2018.00338

Kvamme, S. L., Pedersen, M. M., Rømer Thomsen, K., & Thylstrup, B. (2021). Exploring the use of cannabis as a substitute for prescription drugs in a convenience sample. *Harm Reduction Journal*, *18*(1), 72. https://doi.org/10.1186/s12954-021-00520-5

Leehey, M. A., Liu, Y., Hart, F., Epstein, C., Cook, M., Sillau, S., Klawitter, J., Newman, H., Sempio, C., Forman, L., Seeberger, L., Klepitskaya, O., Baud, Z., & Bainbridge, J. (2020). Safety and Tolerability of Cannabidiol in Parkinson Disease: An Open Label, Dose-Escalation Study. *Cannabis and Cannabinoid Research*, *5*(4), 326–336. https://doi.org/10.1089/can.2019.0068

Leszko, M., & Meenrajan, S. (2021). Attitudes, beliefs, and changing trends of cannabidiol (CBD) oil use among caregivers of individuals with Alzheimer's disease. *Complementary Therapies in Medicine*, *57*, 102660. https://doi.org/10.1016/j.ctim.2021.102660

Lozano Cámara, I. (2017). Cultivo y usos etnobotánicos del cañamo en la ciencia árabe (siglos VIII-XVII). *Asclepio*, *69*(2), 197. https://doi.org/10.3989/asclepio.2017.20

LV. (n.d.). *Melden van teeltintentie hennep*. Retrieved March 15, 2023, from https://lv.vlaanderen.be/plant/akkerbouw/melden-van-teeltintentie-hennep

McGregor, I. S., Cairns, E. A., Abelev, S., Cohen, R., Henderson, M., Couch, D., Arnold, J. C., & Gauld, N. (2020). Access to cannabidiol without a prescription: A cross-country comparison and analysis. *International Journal of Drug Policy*, *85*, 102935. https://doi.org/10.1016/j.drugpo.2020.102935

McPartland, J. M. (2018). *Cannabis* Systematics at the Levels of Family, Genus, and Species. *Cannabis and Cannabinoid Research*, *3*(1), 203–212. https://doi.org/10.1089/can.2018.0039

McVey, E., Cowee, M., & Nichols, K. (2019). *Annual Hemp & CBD Industry Factbook*.

Merlin, M. D. (2003). Archaeological evidence for the tradition of psychoactive plant use in the old world. *Economic Botany*.

Metcalf, D. A., Wiener, K. K. K., & Saliba, A. (2021). Comparing early hemp food consumers to non-hemp food consumers to determine attributes of early adopters of a novel food using the Food Choice Questionnaire (FCQ) and the Food Neophobia Scale (FNS). *Future Foods*, *3*, 100031. https://doi.org/10.1016/j.fufo.2021.100031

Metcalf, D. A., Wiener, K. K. K., Saliba, A., & Sugden, N. (2021). Evaluating the Acceptance of Hemp Food in Australian Adults Using the Theory of Planned Behaviour and Structural Equation Modelling. *Foods*, *10*(9), 2071. https://doi.org/10.3390/foods10092071

Morales, P., Reggio, P. H., & Jagerovic, N. (2017). An Overview on Medicinal Chemistry of Synthetic and Natural Derivatives of Cannabidiol. *Frontiers in Pharmacology*, *8*. https://doi.org/10.3389/fphar.2017.00422

Morgan, C. J. A., Das, R. K., Joye, A., Curran, H. V., & Kamboj, S. K. (2013). Cannabidiol reduces cigarette consumption in tobacco smokers: Preliminary findings. *Addictive Behaviours*, *38*(9), 2433–2436. https://doi.org/10.1016/j.addbeh.2013.03.011

Mücke, M., Phillips, T., Radbruch, L., Petzke, F., & Häuser, W. (2018). Cannabis-based medicines for chronic neuropathic pain in adults. *Cochrane Database of Systematic Reviews*, *2020*(7). https://doi.org/10.1002/14651858.CD012182.pub2

NASEM. (2017). *The Health Effects of Cannabis and Cannabinoids*. National Academies Press. https://doi.org/10.17226/24625

Nayak, M., & Narayan. (2019). Strengths and Weakness of Online Surveys. *Journal of Humanities and Social Sciences*, *24*(5), 31–38.

O'Rourke, N., & Hatcher, L. (2013). *A Step-By-Step Approach to Using SAS System for Factor Analysis and Structural Equation Modeling* (2nd ed.). SAS Institute.

Park, S.-Y., Constantino, N., Yun, G. W., Moser, L., & Cortes-Arriola, D. (2020). U.S. College Students' Marijuana Information Sources, Confidence in Knowledge, and Objective Knowledge. *Journal of Health Communication*, *25*(11), 859–869. https://doi.org/10.1080/10810730.2020.1840677

Pav, M., Haesaert, G., & De Steur, H. (2023). Public Knowledge, Perceptions, and Behavioural Intention Regarding Medical Cannabis in Belgium. *Journal of Psychoactive Drugs*, 1–12. https://doi.org/10.1080/02791072.2023.2209893

Peyravian, N., Deo, S., Daunert, S., & Jimenez, J. J. (2022). The Anti-Inflammatory Effects of Cannabidiol (CBD) on Acne. *Journal of Inflammation Research*, *Volume 15*, 2795–2801. https://doi.org/10.2147/JIR.S355489

Phipps, B., & Schluttenhofer, C. (2022). Perspectives of industrial hemp cultivation. In *Industrial Hemp* (pp. 1–36). Elsevier. https://doi.org/10.1016/B978-0-323-90910-5.00002-6

Pisanti, S., Malfitano, A. M., Ciaglia, E., Lamberti, A., Ranieri, R., Cuomo, G., Abate, M., Faggiana, G., Proto, M. C., Fiore, D., Laezza, C., & Bifulco, M. (2017). Cannabidiol: State of the art and new challenges for therapeutic applications. *Pharmacology & Therapeutics*, *175*, 133–150. https://doi.org/10.1016/j.pharmthera.2017.02.041

Reboussin, B. A., Wagoner, K. G., Sutfin, E. L., Suerken, C., Ross, J. C., Egan, K. L., Walker, S., & Johnson, R. M. (2019). Trends in marijuana edible consumption and perceptions of harm in a cohort of young adults. *Drug and Alcohol Dependence*, *205*, 107660. https://doi.org/10.1016/j.drugalcdep.2019.107660

Riley, J. (2022). *A Pilot Study: Using the Health Belief Model to Understand Cannabidiol Use in One Amish Community*.

Salehi, A., Puchalski, K., Shokoohinia, Y., Zolfaghari, B., & Asgary, S. (2022). Differentiating Cannabis Products: Drugs, Food, and Supplements. *Frontiers in Pharmacology*, *13*. https://doi.org/10.3389/fphar.2022.906038

Sansom, R. (n.d.). *Theory of Planned Behaviour*. Retrieved February 28, 2023, from https://ascnhighered.org/ASCN/change_theories/collection/planned_behaviour.html

Serpell, M., Ratcliffe, S., Hovorka, J., Schofield, M., Taylor, L., Lauder, H., & Ehler, E. (2014). A double-blind, randomized, placebo-controlled, parallel group study of THC/CBD spray in peripheral neuropathic pain treatment. *European Journal of Pain*, *18*(7), 999–1012. https://doi.org/10.1002/j.1532-2149.2013.00445.x

Shannon, S., Lewis, N., Lee, H., & Hughes, S. (2019). Cannabidiol in Anxiety and Sleep: A Large Case Series. *The Permanente Journal*, *23*(1). https://doi.org/10.7812/TPP/18-041

Sharma, P., Wilfahrt, R. P., Lackore, K., & Hammond, C. J. (2023). Differences in Cannabidiol-Related Attitudes and Practice Behaviours Between U.S. Primary Care Physicians Practicing in a Single Health Care System Across States With and Without Marijuana Legalization. *Cannabis and Cannabinoid Research*. https://doi.org/10.1089/can.2023.0011

Shen, P., Gao, Z., Fang, B., Rao, J., & Chen, B. (2021). Ferreting out the secrets of industrial hemp protein as emerging functional food ingredients. *Trends in Food Science & Technology*, *112*, 1–15. https://doi.org/10.1016/j.tifs.2021.03.022

Small, E. (2015). Evolution and Classification of Cannabis sativa (Marijuana, Hemp) in Relation to Human Utilization. *The Botanical Review*, *81*(3), 189–294. https://doi.org/10.1007/s12229-015-9157-3

Small, E., & Beckstead, H. D. (1973). Common cannabinoid phenotypes in 350 stocks of Cannabis. *Lloydia*, *36*(2), 144–165.

Soetens, L., & Colman, C. (2020). *Bespreking van het Wettelijk Kader rond Cannabiswinkels in België*. University Ghent.

Statista. (2023). *Agricultural area dedicated to hemp cultivation in Europe in 2020, by country*.

Stayduhar, J. M., Covvey, J. R., Schreiber, J. B., & Witt-Enderby, P. A. (2023). Pharmacist and Student Knowledge and Perceptions of Herbal Supplements and Natural Products. *Pharmacy*, *11*(3), 96. https://doi.org/10.3390/pharmacy11030096

Stoelzle Pharma. (n.d.). *Cannabidiol (CBD)*. 2023. Retrieved February 15, 2023, from https://www.stoelzle.com/pharma/market-insights/cannabidiol-cbd/

Szalata, M., Dreger, M., Zielińska, A., Banach, J., Szalata, M., & Wielgus, K. (2022). Simple Extraction of Cannabinoids from Female Inflorescences of Hemp (Cannabis sativa L.). *Molecules*, *27*(18), 5868. https://doi.org/10.3390/molecules27185868

Tran, A., Sheikhan, N. Y., Sheikhan, T., Nowak, D. A., & Witek, T. J. (2021). Unsubstantiated health claims for COVID-19 infections are led by cannabidiol: return of snake oil medicine. *Journal of Cannabis Research*, *3*(1), 49. https://doi.org/10.1186/s42238-021-00109-6

Tran, T., & Kavuluru, R. (2020). Social media surveillance for perceived therapeutic effects of cannabidiol (CBD) products. *International Journal of Drug Policy*, *77*, 102688. https://doi.org/10.1016/j.drugpo.2020.102688

Tumati, S., Lanctôt, K. L., Wang, R., Li, A., Davis, A., & Herrmann, N. (2022). Medical Cannabis Use Among Older Adults in Canada: Self-Reported Data on Types and Amount Used, and Perceived Effects. *Drugs & Aging*, *39*(2), 153–163. https://doi.org/10.1007/s40266-021-00913-y

Turck, D., Bohn, T., Castenmiller, J., De Henauw, S., Hirsch-Ernst, K. I., Maciuk, A., Mangelsdorf, I., McArdle, H. J., Naska, A., Pelaez, C., Pentieva, K., Siani, A., Thies, F., Tsabouri, S., Vinceti, M., Cubadda, F., Frenzel, T., Heinonen, M., Marchelli, R., … Knutsen, H. K. (2022). Statement on safety of cannabidiol as a novel food: data gaps and uncertainties. *EFSA Journal*, *20*(6). https://doi.org/10.2903/j.efsa.2022.7322

Ukaegbu, O., Smith, J., Hall, D., Frain, T., & Abbasian, C. (2021). Staff awareness of the use of cannabidiol (CBD): a trust-wide survey study in the UK. *Journal of Cannabis Research*, *3*(1), 51. https://doi.org/10.1186/s42238-021-00104-x

UNCTAD. (2022). *Hemp's versatility and sustainability offer huge opportunities for developing countries*.

USDA. (2020). *2019 Hemp Annual Report*.

USYD. (n.d.). *What medicinal cannabis products are available?* Retrieved April 14, 2023, from https://www.sydney.edu.au/lambert/how-to-get-medicinal-cannabis/what-products-are-available.html

UTA. (2023). *Qualitative vs Quantitative Research*. https://libguides.uta.edu/quantitative_and_qualitative_research/differences

VAD. (2023, May 4). *Wat zegt de wet over cannabis?* https://www.vad.be/artikels/detail/wat-zegt-de-wet-over-cannabis

Van der Stricht, H., Hung, Y., Fischer, A. R. H., & Verbeke, W. (2024). Consumer segments less or more willing to adopt foods with microalgae proteins. *Food Quality and Preference*, *113*, 105047. https://doi.org/10.1016/j.foodqual.2023.105047

Vanhonacker, F., Van Loo, E. J., Gellynck, X., & Verbeke, W. (2013). Flemish consumer attitudes towards more sustainable food choices. *Appetite*, *62*, 7–16. https://doi.org/10.1016/j.appet.2012.11.003

Vanthienen, W. (2019, September 20). *Leuven wil cannabiswinkels uit stadscentrum weren*. https://www.vrt.be/vrtnws/nl/2019/09/20/leuven-weert-cannabiswinkels-uit-stadscentrum/

Velasco, F., Cardenas, M., Cardenas, J. J., & Martin, S. L. (2023). Key Factors that Influence Consumer Preferences for Natural-Hyped Products. *Psychology & Marketing*, *40*(2), 373–390. https://doi.org/10.1002/mar.21730

Verberckmoes, Y. (2018, July 20). *Eerste cannabiswinkel in Brussel opent de deuren*. https://www.demorgen.be/nieuws/eerste-cannabiswinkel-in-brussel-opent-de-deuren

Vincenzi, C., & Tosti, A. (2020). Efficacy and Tolerability of a Shampoo Containing Broad-Spectrum Cannabidiol in the Treatment of Scalp Inflammation in Patients with Mild to Moderate Scalp Psoriasis or Seborrheic Dermatitis. *Skin Appendage Disorders*, *6*(6), 355–361. https://doi.org/10.1159/000510896

Vučković, S., Srebro, D., Vujović, K. S., Vučetić, Č., & Prostran, M. (2018). Cannabinoids and Pain: New Insights From Old Molecules. *Frontiers in Pharmacology*, *9*. https://doi.org/10.3389/fphar.2018.01259

Wadsworth, E., Fataar, F., Goodman, S., Smith, D. M., Renard, J., Gabrys, R., Jesseman, R., & Hammond, D. (2022). Consumer perceptions of legal cannabis products in Canada, 2019–2021: a repeat cross-sectional study. *BMC Public Health*, *22*(1), 2048. https://doi.org/10.1186/s12889-022-14492-z

Webb, M., & Mansfield, K. (2021). Public perception of medicinal and recreational cannabis and its effect on mental health: a survey of a regional Australian town. *Australasian Psychiatry*, *29*(2), 124–128. https://doi.org/10.1177/1039856220970047

West, J., Peasley-Miklus, C., Klemperer, E., Priest, J., Trutor, M., Carman, C., Roemhildt, M., Trites, J., & Villanti, A. (2022). Young Adults' Knowledge of State Cannabis Policy: Implications for Studying the Effects of Legalization in Vermont. *Cannabis*, *5*(3), 11–22. https://doi.org/10.26828/cannabis/2022.03.002

'Wheeler, H. (2023). *Water Soluble CBD vs Oil: The Battle of the CBDs*. https://www.meecbd.com/cbd-drinks/water-soluble-cbd-vs-oil/

Wheeler, M., Merten, J. W., Gordon, B. T., & Hamadi, H. (2020). CBD (Cannabidiol) Product Attitudes, Knowledge, and Use Among Young Adults. *Substance Use & Misuse*, *55*(7), 1138–1145. https://doi.org/10.1080/10826084.2020.1729201

Whitman, A., Ostroff, M., Crocetta, N., Roth, O., & Ostroff, J. L. (2020). Integration of cannabidiol oil education into a pharmacy therapeutics curriculum. *Currents in Pharmacy Teaching and Learning*, *12*(12), 1424–1430. https://doi.org/10.1016/j.cptl.2020.07.013

Wysota, C. N., Henriksen, L., Romm, K. F., Duan, Z., Wang, Y., Huang, J., & Berg, C. J. (2022). Cannabidiol Knowledge, Perceptions, and Use Among Young Adults in 6 U.S. Metropolitan Areas. *Cannabis and Cannabinoid Research*. https://doi.org/10.1089/can.2022.0029

Xiong, Y., & Lim, C.-S. (2021). Understanding the Modulatory Effects of Cannabidiol on Alzheimer's Disease. *Brain Sciences*, *11*(9), 1211. https://doi.org/10.3390/brainsci11091211

Yano, H., & Fu, W. (2023). Hemp: A Sustainable Plant with High Industrial Value in Food Processing. *Foods*, *12*(3), 651. https://doi.org/10.3390/foods12030651

Zheljazkov, V. D., Sikora, V., Dincheva, I., Kačániová, M., Astatkie, T., Semerdjieva, I. B., & Latkovic, D. (2020). Industrial, CBD, and Wild Hemp: How Different Are Their Essential Oil Profile and Antimicrobial Activity? *Molecules*, *25*(20), 4631. https://doi.org/10.3390/molecules25204631

Zobel, F., Notari, L., Schneider, E., & Rudmann, O. (2019). *Cannabidiol (CBD) : analyse de situation*.

Zolotov, Y., Vulfsons, S., & Sznitman, S. (2019). Predicting Physicians' Intentions to Recommend Medical Cannabis. *Journal of Pain and Symptom Management*, *58*(3), 400–407. https://doi.org/10.1016/j.jpainsymman.2019.05.010

Zou, S., & Kumar, U. (2018). Cannabinoid Receptors and the Endocannabinoid System: Signaling and Function in the Central Nervous System. *International Journal of Molecular Sciences*, *19*(3), 833. https://doi.org/10.3390/ijms19030833

Zuardi, A. W., Cosme, R. A., Graeff, F. G., & Guimarães, F. S. (1993). Effects of ipsapirone and cannabidiol on human experimental anxiety. *Journal of Psychopharmacology*, *7*(1_suppl), 82–88. https://doi.org/10.1177/026988119300700112

7 Appendix

7.1 Appendix A: Approval by the Medical Ethics Committee of Ghent University Hospital

Afzender : Commissie voor medische ethiek
Prof. Dr. Yung Hung
Vakgroep Landbouweconomie
Ugent

contact	telefoon	e-mail
Commissie voor medische ethiek Ethisch.comite@uzgent.be	+32 (0)9 332 33 36	
Aanvrager	**datum**	**pagina**
Yung Hung	26/07/2023	1/6

Onze referentie: ONZ-2023-0263 **EudraCT-nr:** **Belg. Regnr:**

Betreft:

De Belgische markt voor CBD-edibles: inzichten in het gedrag en de percepties van het publiek

The Market of CBD edibles in Belgium: Insights into public behaviour and perceptions

Beste collega
De Commissie Medische Ethiek (CME) verbonden aan de Universiteit Gent (Ugent) en het Universitair Ziekenhuis Gent (UZ Gent) heeft het bovenvermelde dossier onderzocht en besproken op haar vergadering van 28/06/2023.
Dit project valt niet onder de bevoegdheid van de wet van 7/5/2004.
De CME heeft geen bezwaar tegen het project op voorwaarde dat de gegevens vertrouwelijk worden beheerd en in overeenstemming met de Belgische wetgeving inzake privacy.
Voor de beoordeling van dit dossier is rekening gehouden met documenten/antwoorden ingediend op 13/06/2023 / 25/07/2023.
De studie kan vanaf nu (26/07/2023) starten in ons centrum.
Ingediende documenten: zie bijlage 1
Ledenlijst: zie bijlage 2
Aandachtspunten: zie bijlage 3a

Met vriendelijke groeten,
Prof. dr. Renaat Peleman
Voorzitter
Commissie voor Medische Ethiek U(Z) Gent

CC: FAGG
Cc: HIRUZ_CTU (Clinical Trial Center UZ Gent)

7.2 Appendix B: Online Qualtrics Questionnaire (Dutch Version)

Start of Block: Informed Consent

AT1
Informatie- en toestemmingsformulier voor deelnemers
Titel van de studie: De Belgische markt voor CBD-voedingsmiddelen: inzichten in het gedrag en de percepties van het publiek

Beste,
U bent uitgenodigd om deel te nemen aan een studie. Neem voldoende tijd om dit informatieblad zorgvuldig te lezen en erover te discussiëren met anderen voordat u beslist om deel te nemen aan deze studie. Stel gerust vragen als er onduidelijkheden zijn of als u meer informatie nodig heeft. Dit proces heet "geïnformeerde toestemming". Wanneer u hebt besloten om deel te nemen aan de studie, wordt u gevraagd het toestemmingsformulier te ondertekenen aan het einde van dit informatieblad.

BESCHRIJVING EN DOEL VAN DE STUDIE

De Afdeling Landbouweconomie van de Universiteit Gent voert een onderzoek uit naar het publieke gedrag, de kennis, de attitudes en percepties ten opzichte van voedingsproducten die cannabidiol (CBD) bevatten. In deze enquête vragen we naar uw mening over CBD-voedingsmiddelen en gerelateerde onderwerpen. We vragen u vriendelijk om de tijd te nemen om een vragenlijst voor ons in te vullen. Dit duurt ongeveer 7 minuten. Dit onderzoek is vooraf goedgekeurd door een onafhankelijke Medische Ethische Commissie, verbonden aan het Universitair Ziekenhuis Gent en de Universiteit Gent. De studie wordt uitgevoerd in overeenstemming met de richtlijnen voor goede klinische praktijk (ICH/GCP) en de Helsinki-verklaring, opgesteld ter bescherming van degenen die betrokken zijn bij de studies. De opdrachtgever van deze studie is UGent. Deze gegevensverzameling gebeurt onder toezicht van Prof. Dr. Christine Yung Hung. Een student van de faculteit Bio-ingenieurswetenschappen zal deel uitmaken van het onderzoeksteam.

TOESTEMMING EN WEIGERING

Uw deelname aan deze studie is volledig vrijwillig en kosteloos. U kunt weigeren de vragenlijst in te vullen en u bent vrij om op elk moment uit deze studie te stappen, zonder uw beslissing te hoeven

rechtvaardigen. Dit zal ook geen negatieve invloed hebben op uw studieresultaten (indien van toepassing) of de verdere relatie met de onderzoekers.

3 VOORDELEN

Deelname aan deze studie zal waarschijnlijk geen voordelen voor u opleveren. De resultaten die worden verkregen kunnen echter waardevolle inzichten bieden voor regelgevers, beleidsmakers en belanghebbenden om geïnformeerde beslissingen te nemen over verschillende aspecten van de markt voor CBD-voedingsmiddelen.

4 KOSTEN

Uw deelname aan deze studie brengt geen extra kosten met zich mee voor u, maar biedt ook geen financieel voordeel.

5 VERWERKING VAN PERSOONSGEGEVENS

In overeenstemming met de Algemene Verordening Gegevensbescherming (AVG) (EU) 2016/679 van 27 april 2016 en de Belgische wet van 30 juli 2018 betreffende de bescherming van natuurlijke personen in verband met de verwerking van persoonsgegevens en betreffende het vrije verkeer van die gegevens, zal uw persoonlijke levenssfeer worden gerespecteerd. Er worden geen direct identificeerbare persoonsgegevens van u verzameld, noch zullen de betrokken onderzoekers u in het resultaat kunnen identificeren. Bijgevolg kunnen de verzamelde gegevens niet individueel ingekeken, verbeterd of verwijderd worden.

Voor meer informatie over de rechten die u heeft en hoe u die kan uitoefenen, kan u terecht op de website van UGent (https://www.uzgent.be/patient/gegevensbescherming/u-neemt-deel-aan-wetenschappelijk-onderzoek). Uw deelname aan de studie betekent dat uw gegevens verwerkt worden voor het doel van de klinische studie. Deze verwerking van gegevens is noodzakelijk voor de vervulling van een taak in het algemeen belang volgens artikel 6, paragraaf 1 (e) en is noodzakelijk met het oog op wetenschappelijk onderzoek volgens artikel 9, paragraaf 2(j) van de Algemene Verordening Gegevensbescherming.

Alle informatie die tijdens dit onderzoek wordt verzameld, zal worden gepseudonimiseerd, wat betekent dat uw gegevens nog steeds kunnen worden gekoppeld aan uw persoonlijke bestand. In geval van pseudonimisering zal de sleutel tot de aan u toegewezen code alleen toegankelijk zijn voor de onderzoeker of de aangewezen vervanger. In dit onderzoek worden gegevens verzameld via een online vragenlijst. De verzamelde gepseudonimiseerde gegevens kunnen gedeeld worden met andere (toekomstige) onderzoekers. Dit kan leiden tot hergebruik van uw gepseudonimiseerde gegevens voor toekomstige academische onderzoeksprojecten en studies, uitsluitend in het kader van dezelfde of een vergelijkbare ziekte/pathologie of behandeling. Dergelijke nieuwe studie en hergebruik van gegevens dient steeds ingediend en goedgekeurd te worden door het ethisch comité. Indien u wenst dat uw gegevens niet gebruikt worden voor toekomstig onderzoek, kan u de DPO hiervoor contacteren (zie contactgegevens onder hoofdstuk 5). Na afloop van de studie kunnen de gepseudonimiseerde data voor onderzoeksdoeleinden gedeeld worden met een land buiten de Europese Economische Ruimte (EER) of internationale organisatie voor onderzoeksdoeleinden. Dit

houdt mogelijks publicatie in van de gepseudonimiseerde onderzoeksdata op daarvoor voorzien multidisciplinaire open access onderzoeksplatformen ter bevordering van Open Science Practice.

Alleen pseudonieme gegevens zullen worden gebruikt voor analyse van de gegevens en in alle soorten documentatie, rapporten of publicaties met betrekking tot deze studie. Vertrouwelijkheid van uw gegevens wordt dus steeds gegarandeerd. Zowel persoonlijke gegevens als gegevens over uw gezondheid zullen worden verwerkt en opgeslagen gedurende minstens 10 jaar na het einde van de studie en uit veiligheidsoverwegingen ten aanzien van de uitgevoerde studie en de (eventuele) opvolging daarvan.

De verwerkingsverantwoordelijke van de gegevens is de instelling van de hoofdonderzoeker van de studie, Prof. Dr. Christine Yung Hung (UGent). Zijn/haar onderzoeksteam zal toegang krijgen tot uw persoonsgegevens. In het kader van gegevensbescherming worden de gegevens verwerkt door personen die tot het onderzoeksteam behoren en benoemd zijn door en onder de verantwoordelijkheid van de hoofdonderzoeker, inclusief interne medewerkers met een niet-gezondheidszorgberoep. In het kader van gegevensbescherming kunnen uw pseudonieme gegevens na de studie openbaar beschikbaar worden gesteld, zodat alle geïnteresseerde partijen toegang kunnen krijgen tot, uw pseudonieme gegevens kunnen verwerken en/of verder analyseren. Om meer inhoudelijke informatie te verkrijgen over de studie en om uw rechten uit te kunnen oefenen, kan u contact opnemen met het studieteam.
Als u dat wenst, kan de functionaris voor gegevensbescherming u meer informatie geven over de bescherming van uw persoonlijke gegevens. Neem contact op met privacy@ugent.be.
Vertegenwoordigers van de opdrachtgever, auditors, de Medische Ethische Commissie en de bevoegde overheden, allen gebonden aan beroepsgeheim, hebben onder verantwoordelijkheid van de onderzoeker (of een van zijn/haar medewerkers) direct toegang tot uw gegevens om de onderzoeksprocedures en/of de gegevens te controleren zonder de vertrouwelijkheid ervan te schenden. Dit is alleen mogelijk binnen de grenzen die door de betreffende wetten zijn toegestaan. Door onderaan dit formulier alle hokjes aan te vinken, stemt u in met deze toegang. De Belgische toezichthoudende instantie die verantwoordelijk is voor het handhaven van de wetgeving inzake

gegevensbescherming is bereikbaar via onderstaande contactgegevens:
Gegevensbeschermingsautoriteit (GBA)

Rue de la Presse 35 – 1000 Brussels
Tel: +32 2 274 48 00
E-mail : contact@apd-gba.be
Website: www.gegevensbeschermingsautoriteit.be

6. CONTACT

Als er een letsel optreedt ten gevolge van de studie, of als u aanvullende informatie wenst over de studie of over uw rechten en plichten, kan u contact opnemen met de onderzoeker of een medewerker van zijn of haar team:

Naam: Nicolas Lyssens-Danneboom (Nederlands) / Prof. Christine Yung Hung (Engels)
Adres: Coupure Links 653, Gent BE-9000.
Telefoonnummer: +32 47 460 36 10 (Nederlands) / +32 9 264 59 25

TOESTEMMINGSFORMULIER VOOR DE DEELNEMERS

- Ik heb het document “Informatiebrief voor de deelnemers” gelezen en begrepen. Ik heb uitleg gekregen over de aard, het doel en de duur van de studie en over wat men van mij verwacht.
- Ik begrijp dat deelname aan de studie vrijwillig is en dat ik mij op elk ogenblik uit de studie mag terugtrekken zonder een reden voor deze beslissing op te geven en zonder dat dit op enigerlei wijze een invloed zal hebben op mijn verdere relatie met de onderzoeker of mijn studieresultaten (indien van toepassing).
- Ik ben me ervan bewust dat deze studie werd goedgekeurd door een onafhankelijke Commissie voor Medische Ethiek verbonden aan het UZ Gent en de Universiteit Gent en dat deze studie zal uitgevoerd worden volgens de richtlijnen voor de goede klinische praktijk (ICH/GCP) en de verklaring van Helsinki, opgesteld ter bescherming van mensen deelnemend aan experimenten. Deze goedkeuring was in geen geval de aanzet om te beslissen om deel te nemen aan deze studie.
- Men heeft mij ingelicht dat zowel persoonlijke gegevens als gegevens aangaande mijn gezondheid worden verwerkt en bewaard gedurende minstens 10 jaar na het einde van de studie. Ik ben me ervan bewust dat ik mogelijk geen recht heb op toegang tot of correctie van deze informatie, omdat de gegevens gepseudonimiseerd zijn en niet kunnen worden herleid tot mijn identiteit. Ik kan echter contact opnemen met de verantwoordelijke onderzoeker voor de verwerking ervan.
- Ik ben ervan op de hoogte dat mijn gepseudonimiseerde gegevens gebruikt worden voor **huidig** wetenschappelijk onderzoek.
- Ik ben ervan op de hoogte dat mijn gepseudonimiseerde gegevens gebruikt kunnen worden voor **toekomstig** academisch wetenschappelijk onderzoek in het kader van hetzelfde/een vergelijkbaar onderzoeksdomein. Dergelijke nieuwe studie dient steeds ingediend en goedgekeurd te worden door het ethisch comité. Indien ik wens dat mijn gegevens niet gebruikt worden voor toekomstig onderzoek, zal ik de DPO contacteren (zie contactgegevens onder sectie 5).

A1 Door volgende opties aan te vinken gaat u akkoord met deelname aan de studie:

- [ ] Ik bevestig dat ik meerderjarig ben. (1)
- [ ] Ik stem in met het invullen van de vragenlijst. (2)
- [ ] Zoals gesimuleerd door de Europese Commissie, kan de gepseudonimiseerde onderzoeksdata worden gepubliceerd op multidisciplinaire open access onderzoeksplatformen ter bevordering van Open Science Practice om onderzoek en innovatie te ondersteunen. Door dit vakje aan te kruisen geef ik mijn expliciete toestemming voor overdracht van mijn gepseudonimiseerde gegevens naar landen buiten de Europese Economische Ruimte (EER) of een internationale organisatie. Deze toekomstige studies dienen steeds goedgekeurd te worden door een ethisch comité. (3)

End of Block: Informed Consent

Start of Block: Socio-Demographic Variables: All respondents

B1 Wat is uw geslacht?

- ○ Man (1)
- ○ Vrouw (2)
- ○ Andere (3)
- ○ Ik geef liever geen antwoord. (4)

B2 Wat is uw leeftijd?

- ≤ 17 (1)
- 18 - 25 (2)
- 26 - 35 (3)
- 36 - 45 (4)
- 46 - 55 (5)
- 56 - 65 (6)
- 66 - 75 (7)
- ≥ 76 (8)

B3 Wat is het hoogste opleidingsniveau dat u met succes heeft behaald?

- Geen diploma (1)
- Lagere school (2)
- Lager secundair onderwijs of secundair onderwijs van de 1ste of 2de graad (3)
- Hoger secundair onderwijs of secundair onderwijs van de 3de graad (4)
- Hoger onderwijs buiten de universiteit (5)
- Universiteit, bachelor niveau (6)
- Universiteit, master niveau of PhD (7)

B4 Wat is uw leefsituatie?

- Samenwonend met partner zonder kinderen (1)
- Samenwonend met partner en kind(eren) (2)
- Samenwonend met ouders (en eventuele broers/zussen) (3)
- Samenwonend met andere (4)
- Alleenwonend (5)
- Alleenwonend met kinderen (6)
- Andere (7)

B5 Hoe zou u uw woonomgeving omschrijven?

- Grote stad (meer dan 80 000 inwoners) (1)
- Kleine stad (minder dan 80 000 inwoners) (2)
- Voorstad (rand van een grote centrale stad) (3)
- Landelijk (of dorp) (4)

B6 In welke provincie woont u?

- Antwerpen (1)
- Brussel (2)
- Henegouwen (3)
- Limburg (4)
- Luik (5)
- Luxemburg (6)
- Namen (7)
- Oost-Vlaanderen (8)
- Vlaams-Brabant (9)
- Waals-Brabant (10)
- West-Vlaanderen (11)
- Andere (12)

End of Block: Socio-Demographic Variables: All respondents

Start of Block: Screening: All respondents

CT1 **CBD**, afkorting voor *cannabidiol*, is een **chemische stof** die van nature voorkomt in verschillende plantensoorten, waaronder de **hennepplant**.

C1 Kent u de stof CBD (*cannabidiol*)?

- Ja, ik heb het al eens gebruikt. (1)
- Ja, ik heb ervan gehoord, maar heb dit nog nooit gebruikt. (2)
- Nee, ik heb er nog nooit van gehoord. (3)

End of Block: Screening: All respondents

Start of Block: Subjective Knowledge about CBD: Only for respondents with prior awareness

D1 Duid aan in welke mate u akkoord gaat met de volgende stellingen:

	Helemaal niet akkoord (1)	Niet akkoord (2)	Enigszins niet akkoord (3)	Noch akkoord, noch niet akkoord (4)	Enigszins akkoord (5)	Akkoord (6)	Helemaal akkoord (7)
Ik weet vrij veel over CBD. (1)	○	○	○	○	○	○	○
Ik voel dat ik niet veel kennis heb over CBD. (2)	○	○	○	○	○	○	○
Binnen mijn vriendenkring ben ik een van de "experts" op het gebied van CBD. (3)	○	○	○	○	○	○	○
Vergeleken met andere mensen, weet ik minder over CBD. (4)	○	○	○	○	○	○	○
Als het om CBD gaat, weet ik niet veel. (5)	○	○	○	○	○	○	○

End of Block: Subjective Knowledge about CBD: Only for respondents with prior awareness

Start of Block: Objective Knowledge about CBD: Only for respondents with prior awareness

E1 Duid aan wat u denkt:

	Juist (1)	Fout (2)	Ik weet het niet (3)
THC is een ander woord voor CBD. (1)	○	○	○
Je kan 'high' worden van CBD. (2)	○	○	○
CBD wordt geproduceerd in alle planten. (3)	○	○	○
CBD is de enige gekende cannabinoïde. (4)	○	○	○
CBD wordt gebruikt voor de behandeling van chronische pijn. (5)	○	○	○
Er zijn bewezen bijwerkingen van het gebruik van CBD. (6)	○	○	○
CBD zit in medicinale cannabis. (7)	○	○	○
CBD zit in cannabis. (8)	○	○	○
CBD wordt gebruikt in de behandeling van diabetes. (9)	○	○	○
CBD wordt gebruikt in de behandeling van epilepsie. (10)	○	○	○

End of Block: Objective Knowledge about CBD: Only for respondents with prior awareness

Start of Block: Perceived Knowledge about the Legal Framework (screen): All respondents

FT1 In de **cannabisplant** zitten twee bekende stoffen: **CBD** (*cannabidiol*) en **THC** (*tetrahydrocannabinol*).

THC is de stof die het '**high**' gevoel kan veroorzaken. **CBD** daarentegen heeft geen psychoactieve effecten, wat betekent dat het je **niet** **'high'** maakt.

CBD zou **mogelijke** **gezondheidsvoordelen** kunnen bieden en is daarom een **populair ingrediënt** in verschillende soorten producten.

F1 Hoe bekend bent u met de regelgeving rond producten met CBD?

- Helemaal niet bekend (1)
- Niet bekend (2)
- Enigszins niet bekend (3)
- Noch bekend, noch niet bekend (4)
- Enigszins bekend (5)
- Bekend (6)
- Helemaal bekend (7)

End of Block: Perceived Knowledge about the Legal Framework (screen): All respondents

Start of Block: Beliefs about the Legal Framework: Only for respondents perceived knowledge > 1

G1 Duid aan wat u denkt:
In België is de verkoop van ...

	toegestaan. (1)	niet toegestaan. (2)	Ik weet het niet. (3)
geneesmiddelen met CBD door apotheken (1)	○	○	○
CBD-supplementen en CBD-olie voor consumptie (2)	○	○	○
voeding en dranken met CBD (3)	○	○	○
cosmetica met CBD (4)	○	○	○
tabakswaren en vloeistoffen voor elektronische sigaretten met CBD (5)	○	○	○

End of Block: Beliefs about the Legal Framework: Only for respondents perceived knowledge > 1

Start of Block: Perceptions towards CBD Food Products and TPB Part 1: All respondents

HT1 De volgende vragen gaan over producten die deel uitmaken van de **CBD-voedingsindustrie**, wat inhoudt: **voeding met CBD, dranken met CBD, CBD-supplementen en CBD-olie.**

H1 Hoe zou u **voeding, dranken, supplementen, en olie** met CBD beoordelen?

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Ineffectief	○	○	○	○	○	Effectief
Risicovol	○	○	○	○	○	Veilig
Stressvol	○	○	○	○	○	Ontspannend
Kunstmatig	○	○	○	○	○	Natuurlijk
Ongezond	○	○	○	○	○	Gezond
Onaantrekkelijk	○	○	○	○	○	Aantrekkelijk
Onbetrouwbaar	○	○	○	○	○	Betrouwbaar
Duur	○	○	○	○	○	Goedkoop
Moeilijk te vinden	○	○	○	○	○	Makkelijk te vinden
Verslavend	○	○	○	○	○	Niet verslavend

H2 Duid aan in welke mate u akkoord gaat met de volgende stellingen over **voeding, dranken, supplementen, en olie** met CBD:

	Helemaal niet akkoord (1)	Niet akkoord (2)	Noch akkoord, noch niet akkoord (3)	Akkoord (4)	Helemaal akkoord (5)
Ik sta positief tegenover deze CBD-producten. (1)	○	○	○	○	○
Voor mij is het een slecht idee om deze CBD-producten te gebruiken. (2)	○	○	○	○	○
Het consumeren van deze CBD-producten zou goed voor mij kunnen zijn. (3)	○	○	○	○	○
Het gebruik van deze CBD-producten zou waardeloos voor mij zijn. (4)	○	○	○	○	○
Mensen uit mijn omgeving zouden het vreemd vinden als ik deze CBD-producten zou gebruiken. (5)	○	○	○	○	○
Ik hoor regelmatig mensen praten over deze CBD-producten en de voordelen. (6)	○	○	○	○	○
Het is sociaal aanvaardbaar om deze CBD-producten te gebruiken. (7)	○	○	○	○	○

End of Block: Perceptions towards CBD Food Products and TPB Part 1: All respondents

Start of Block: TPB Part 2: All respondents

I1 Duid aan in welke mate u akkoord gaat met de volgende stellingen over **voeding, dranken, supplementen, en olie** met CBD:

	Helemaal niet akkoord (1)	Niet akkoord (2)	Noch akkoord, noch niet akkoord (3)	Akkoord (4)	Helemaal akkoord (5)
Mijn familie en vrienden zouden het gebruik van deze CBD-producten afraden. (1)	○	○	○	○	○
Als ik zou willen, zou ik deze CBD-producten makkelijk kunnen vinden. (7)	○	○	○	○	○
Als ik zou willen, zou ik deze CBD-producten regelmatig kunnen gebruiken. (2)	○	○	○	○	○
Ik heb de controle over mijn keuze om deze CBD-producten al dan niet te gebruiken. (3)	○	○	○	○	○
Het zou moeilijk voor mij zijn om deze CBD-producten regelmatig te kopen. (8)	○	○	○	○	○
Het is waarschijnlijk dat ik deze CBD-producten ga gebruiken. (4)	○	○	○	○	○
Ik ben van plan om deze CBD-producten te gebruiken. (5)	○	○	○	○	○
Ik ben gemotiveerd om deze CBD-producten te gebruiken. (6)	○	○	○	○	○

End of Block: TPB Part 2: All respondents

Start of Block: Motivation, Frequency, and Preference: Respondents with higher intention

J1 Duid aan hoe vaak u van plan bent om in de komende 12 maanden volgende producten te gebruiken:

	Nooit (1)	1 à 2 keer per jaar (2)	3 à 6 keer per jaar (3)	7 à 11 keer per jaar (4)	Maandelijks (5)	Wekelijks (6)	Dagelijks (7)
CBD-voedingsmiddelen (gebak, snoep, ...) (1)	○	○	○	○	○	○	○
CBD-dranken (bijvoorbeeld: thee) (2)	○	○	○	○	○	○	○
CBD-supplementen (3)	○	○	○	○	○	○	○
CBD-olie voor consumptie (4)	○	○	○	○	○	○	○

J2 Duid aan in welke mate u akkoord gaat met **uw** motivatie voor het eventuele gebruik van **voeding, dranken, supplementen, en olie** met CBD:

	Helemaal niet akkoord (1)	Niet akkoord (2)	Noch akkoord, noch niet akkoord (3)	Akkoord (4)	Helemaal akkoord (5)
Pijnverlichting (1)	○	○	○	○	○
Stress- en angstvermindering (2)	○	○	○	○	○
Verbetering van de slaapkwaliteit (3)	○	○	○	○	○
Nieuwsgierigheid of recreatief (4)	○	○	○	○	○
Behandeling van neurologische aandoeningen (bv: epilepsie) (5)	○	○	○	○	○
Als onderdeel van een 'Wellness & Health' levensstijl (6)	○	○	○	○	○
Ander (specifieer) (7)	○	○	○	○	○

End of Block: Motivation, Frequency, and Preference: Respondents with higher intention