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Relationships Between Motives for Cannabis and Cannabidiol Use in People Who Co-Use: Results From the European Web Survey on Drugs

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ABSTRACT

Introduction: Cannabis is one of the most commonly used psychoactive substances globally. Cannabidiol (CBD) is a non-intoxicating cannabis compound increasingly used for various purposes, especially among cannabis users. However, to date, there are no data on the relationships between cannabis and CBD motives. Understanding these relationships and characterising people who co-use cannabis and CBD by their motives can help adapt marketing policies and foster CBD-based harm reduction practices for people who use cannabis.

Methods: We selected cannabis users from the third wave of the European Web Survey on Drugs conducted in 21 EU and 9 non-EU countries. Using a multilevel mixed-effects logistic regression model, we identified factors associated with CBD co-use. We computed Bonferroni-adjusted tetrachoric correlations between cannabis and CBD self-reported motives for use. We computed Spearman's correlations between the number of declared cannabis and CBD motives. We performed an ascending hierarchical classification to identify cannabis-CBD co-user profiles based on their cannabis and CBD motives.

Results: The study sample comprised 35,789 participants (42.3% who co-used CBD). CBD use was associated with reporting cannabis therapeutic-oriented motives. The numbers of motives for cannabis and CBD use were correlated ($\rho = 0.49$, $p < 0.001$). Similar motives were highly correlated between substances. Cluster analysis revealed four different co-user profiles.

Discussion and Conclusions: Individuals who use both cannabis and CBD tend to do so for similar reasons. Considering the safe profile of CBD, further research should explore the potential harm-reduction role of partially substituting tetrahydrocannabinol-based products with CBD-based products among people who use cannabis.

1 | Introduction

Cannabidiol (CBD) is one of the two most abundant cannabinoids in cannabis [1]. Contrary to tetrahydrocannabinol (THC), CBD is non-intoxicating [2]. Because of its safety profile [3, 4], CBD has received increased attention worldwide and represented a global market estimated at USD 6.4 billion in 2022 [5]. A wide variety of CBD products is now available in Europe, associated with various marketing strategies [6]. Accordingly, CBD use has become common; for instance, 10% of French adults use it [7, 8]. While CBD-related risks exist [4, 9, 10], greater concerns stem from THC use, as it is, among other things, associated with psychiatric symptoms [11] and addictive behaviours [12, 13].

It has been reported, including in nationally representative samples [7], that people who use high-THC cannabis (hereafter

Summary

- Cannabis and cannabidiol motives are highly correlated.
- Numbers of cannabis and cannabidiol motives are correlated.
- Cannabis and cannabidiol motives can be used to design profiles of co-users.

'cannabis') are more likely to use CBD than the rest of the population [14–17], probably because of the similarity of form between 'regular' and CBD-rich low-THC cannabis, and initial positive perceptions of the Cannabis plant and its by-products by people who use cannabis. Such people who co-use seem to have different characteristics, motives, and patterns of CBD, cannabis, tobacco and alcohol use compared to people who exclusively use CBD [16, 18, 19]. Especially, reducing cannabis use is a motive for CBD use that is specific to people who co-use cannabis and CBD [15, 19]. In Italy, the revenues of the illicit market for cannabis may have fallen by 3%–5% due to users transitioning to low-THC products [20]. Both substances are commonly used for therapeutic purposes in the sense that people self-medicate to obtain self-perceived health benefits [21, 22]. Some cannabis-based medications have been approved for specific medical indications, but such a medical use is limited by regulatory, technical, methodological and economic barriers to cannabis research [23–25]. However, little is known on cannabis-CBD co-use.

Previous studies have highlighted relationships between cannabis use motives and patterns of cannabis use [13, 26–32]. Given that such studies were conducted before CBD products gained popularity, and as they included measures related to THC (such as dependence or getting 'high' as a motive), we can confidently consider that their results are only applicable to high-THC cannabis. However, as demand for CBD grows and people who use cannabis are at the heart of this trend, to our knowledge, there are no data on the relationships between motives for CBD use and patterns of cannabis use in people who co-use. Additionally, little is known on the links between motives for use of both substances. Understanding how CBD and cannabis use motives are related in people who co-use may shed light on their respective roles in co-users' functioning. Doing so and identifying motive-related profiles of people who co-use can help adapt marketing policies to users to maximise their benefits according to their motives while also to minimise potential risks and encouraging harm reduction interventions.

Drawing on data from a large international survey, we aimed to characterise cannabis and CBD co-users by examining their motives for use, with a particular focus on potential overlaps in their reasons for using CBD and cannabis.

2 | Methods

2.1 | Design

This study is based on data from the third wave of the European Web Survey on Drugs (EWSD), undertaken by the European Union Drugs Agency (previously European Monitoring Centre

for Drugs and Drug Addiction, EMCDDA), whose methodology is extensively described elsewhere [33]. Data collection took place between March and April 2021 in 30 countries (21 EU and 9 neighbouring countries; see Table S1). Recruitment was mostly via social media: 56% of participants heard about the survey through social media shared posts, and 23% through paid advertising on social media [34]. Participation was anonymous (no personal data were collected and IP addresses were not recorded), self-selected, and voluntary [35].

Ethical approval was requested from the participating countries where needed. Only participants aged 18 and over who provided informed consent could participate in the study. Anonymity and confidentiality were guaranteed for all participants.

2.2 | Participants

The EWSD was conducted by the national partners of the EMCDDA who chose to participate voluntarily. Sampling strategies varied across countries.

Respondents with implausible age values were excluded. Inclusion criteria for the EWSD were being at least 18 years old, providing informed consent, and having used any of the following substances in the last 12 months: cannabis, cocaine, ecstasy/MDMA, amphetamine, methamphetamine and/or heroin. For the present study, we first selected participants who reported using cannabis in the last 12 months and had data for CBD use. For the second part of the analyses, we further selected participants who declared having used CBD in the last 12 months (Yes/No).

2.3 | Data Collection

Twenty-two questions were selected from the core questionnaire. Socio-demographic variables included gender, year of birth, country of residence, household composition, educational level, job situation, type of area of residence, average monthly income after tax, categorised in €1000 ranges. Level of use was assessed for cannabis, cocaine, ecstasy/MDMA, amphetamine, methamphetamine, heroin, new psychoactive substances, synthetic cannabinoids, synthetic cathinones, benzodiazepines, GHB/GBL, ketamine, LSD, mushrooms, other hallucinogens, alcohol and tobacco. According to substances used in the last 12 months, specific modules were proposed to participants. The cannabis module included questions related to CBD.

Level of use was collected according to the question 'When did you last use [substance]', with four possible answers: 'Never', 'More than 12 months ago', 'In the last 12 months (but not in the last 30 days)', and 'In the last 30 days'. A variable of substance polyuse was created by summing the number of substances used in the last 30 days, according to the previously mentioned list, and excluding cannabis, tobacco, alcohol and CBD.

For cannabis, frequency of use was also collected in number of days of use during the last month. Participants declared the legal status of the cannabis products they use from a predefined list ('Illicit products', 'Licit products (CBD, low-THC)', 'Medically

prescribed', 'Don't know') with multiple choice possible. If using cannabis herb or resin, participants were asked how they usually use it. They were classified as people who use vaporiser if they ticked 'vaporizer' in the predefined lists. They were considered as people who use edible/oil if they declared using 'Cannabis oil or cannabis extract' or 'Edible' in the last 12 months. Participants were considered as growers if they declared 'Mostly I produce it myself' to at least one of the two questions regarding herbal and resin supply. Participants declared the form of their CBD products by choosing from a predefined list. A variable representing the number of declared forms of CBD products was created by summing all forms (excluding 'Other form').

Motives for cannabis (respectively, CBD) use were collected through the question 'In the last 12 months, why did you use cannabis (respectively, CBD)?'. Eight possible answers were proposed, with the possibility to tick several of them: 'To reduce stress/relax', 'To improve sleep', 'To treat depression/anxiety', 'To reduce pain/inflammations', 'Out of curiosity/to experiment', 'To get high/for fun', 'To socialise', 'To enhance performance (school/work/sport/etc.)'. For CBD, a ninth motive was proposed: 'To manage THC use'.

To enable comparability between countries in terms of income, we adjusted for purchasing power parity using conversion rates provided by the Organisation for Economic Co-operation and Development [36, 37]. For a given self-reported range of income (e.g., €1000–€1999), we divided the mean value (e.g., €1500) by the purchasing power parity rate of the participant's country. Those deflated incomes were then categorised into quartiles for the analyses.

We created a cannabis legal status variable according to the country of residence based on the possibility of imprisonment for cannabis possession (i.e., criminalisation of possession). To do so, we used data from a 2023 EMCDDA report [38] for the classification of 21 countries; a 2015 EMCDDA report with updates checked for Kosovo, Montenegro, North Macedonia and Serbia [39]; the EMCDDA website for Ukraine [40]; and private communication with national experts for Georgia and Lebanon.

2.4 | Statistical Analyses

We first performed a multilevel mixed effects logistic regression model. The model selection was motivated by the data structure, that is, participants (level 1) nested into countries (level 2). It allowed us to consider countries having fixed effects and to measure adequately the estimates of the cannabis legal status variable, which values varied across countries but not among participants from the same country. Associations were assessed using odds ratios. The outcome was past-year CBD use. The following explanatory variables were included: gender, age, educational level, job situation, area of residence, income level, the eight above-mentioned cannabis motives, past-month use of the 14 above-mentioned illicit substances, alcohol and tobacco use, and living in a country where cannabis possession is criminalised (the only level 2 variable).

To investigate potential associations between the reasons for using CBD and those for using cannabis, we computed

tetrachoric correlations between all cannabis and CBD motives and provided the associated coefficients along with Bonferroni-adjusted p-values (p-values were multiplied by the number of computed correlations, i.e., 136). To further document the robustness of putative associations between the same motives for cannabis and CBD, we performed logistic regressions with a given cannabis motive as the outcome, and the same CBD motive as the explanatory variable, while adjusting for gender, age, and country. We also computed Spearman's correlations between the number of cannabis and CBD motives, and compared the number of reported motives between people who use cannabis daily or near-daily (i.e., ≥ 20 days in the last 30 days [41]) and those who use it less frequently. To test for a legal effect, we also performed tetrachoric correlations between motives separately for participants in countries where cannabis possession is criminalised and those in countries where it is not.

To better characterise the study group according to their motives for use, we performed an ascending hierarchical classification to identify cannabis-CBD co-user profiles. To do so, we included as variables both cannabis ($n = 8$) and CBD ($n = 9$) motives. The ascending hierarchical classification involved two steps. First, a multiple component analysis was performed. Data were then clustered using Ward's method. The number of groups to retain was determined using both the Duda-Hart [42] and Calinski-Harabasz [43] rules. Descriptive statistics of the groups were then provided. Pairwise comparisons with Bonferroni adjustment (p-values were multiplied by the number of comparisons, i.e., 6) were performed using chi-square and Dunn's tests [44] for categorical and continuous variables, respectively.

All analyses were performed using Stata software version 17.0 for Windows (StataCorp LP, College Station, TX, USA).

3 | Results

3.1 | Study Sample Characteristics

The flow chart of the study sample is provided in Figure 1. Sociodemographic characteristics of the study sample according to CBD use are provided in Table 1. The study sample comprised 35,789 participants, of whom 67.7% were men. The median [interquartile range (IQR)] age of the study sample was 26 [22, 32] years. In our study sample, 42.3% of the participants had used CBD in the last 12 months. The most consumed substances (apart from cannabis, tobacco and alcohol) in the last 30 days were cocaine (10.1% of the study sample), amphetamine (9.2%), ecstasy/MDMA (7.8%) and benzodiazepine (7.5%) (Table S2). The most represented countries were Hungary (13.9% of the study sample), Ireland (11.3%) and Sweden (11.0%) (Table S1).

The reported motives for cannabis use were, in decreasing order: 'to reduce stress/relax' (77.9%), 'to get high/for fun' (69.6%), 'to improve sleep' (50.8%), 'to treat depression/anxiety' (38.7%), 'to socialise' (34.4%), 'to reduce pain/inflammations' (23.6%), 'to enhance performance' (15.0%), and 'out of curiosity/to experiment' (10.4%). The reported motives for CBD use were, in decreasing order: 'to reduce stress/relax' (68.4%), 'to improve sleep' (54.2%), 'to treat depression/anxiety' (36.8%), 'out of curiosity/to experiment' (29.6%), 'to reduce
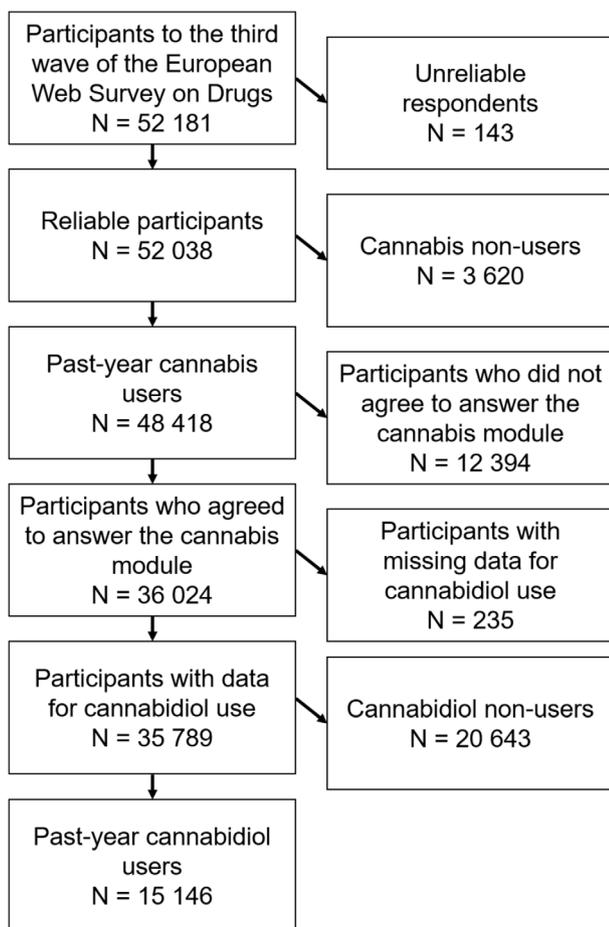
FIGURE 1 | Flow-chart of the study sample.

pain/inflammations' (29.4%), 'to get high/for fun' (20.2%), 'to manage THC use' (16.8%), 'to socialise' (11.9%) and 'to enhance performance' (11.0%) (Table S3).

3.2 | Factors Associated With Cannabidiol Use

Results of the multilevel mixed effects logistic regression model are provided in Table 2. CBD use was associated with being a man and being non-binary (vs. being a woman), self-employment and disability payment/other (vs. employment), being younger than 45 (vs. ≥ 45 years), and using cannabis daily or near-daily. CBD use was positively associated with all cannabis motives, with the exception of curiosity ($p = 0.648$), socialising ($p = 0.440$) and fun (negative association). Regarding other substance use, CBD use was positively associated with new psychoactive substances, synthetic cannabinoids, benzodiazepines, ketamine, LSD, mushrooms and negatively associated with heroin and synthetic cathinones; CBD use was also inversely associated with living in a country where cannabis possession is criminalised (Table 2).

3.3 | Correlations Between Motives for Cannabis and Cannabidiol Use

The tetrachoric correlation matrix ($n = 15,146$) is provided in Figure 2. Of the 136 correlations, 111 were statistically significant

(Bonferroni-adjusted $p < 0.05$). Of the 25 non-significant correlations, 18 were related to socialising or curiosity motives. Six significant correlations had a coefficient > 0.7. Five of them involved similar motives for cannabis and CBD (sleep, depression/anxiety, pain/inflammation, performance, and socialise). The last one was between depression/anxiety (cannabis) and stress/relax (CBD). Adjusted regression analyses confirmed the strong relationships between similar cannabis and CBD motives (adjusted odds ratios ranging from 5.8 to 24.7, Table S4). The patterns of correlations were quite similar between participants in countries where cannabis possession is criminalised and those in countries where it is not (Figures S1 and S2).

Number of motives for cannabis and CBD use was correlated (Spearman's $\rho = 0.49$, $p < 0.001$). People who use cannabis daily or near daily declared a median [IQR] of 4 [3;5] cannabis motives (vs. 3 [2;4] for people with less frequent use, $p < 0.001$, Kruskal-Wallis' test), and 3 [1;4] CBD motives (vs. 2 [1;4], $p < 0.001$, Kruskal-Wallis' test).

3.4 | Cannabis-Cannabidiol Co-Users Clusterisation Based on Motives for Use

Dimension 1 of the multiple component analysis explained 65.0% of the principal inertia, and dimension 2 explained 11.3% of it. We selected four clusters, based on a Je(2)/Je(1) ratio of 0.639, a pseudo T-squared value of 3315.7, and a Calinski-Harabasz pseudo-F of 8747.3 (Table S5). Cluster 1, Cluster 2, Cluster 3 and Cluster 4 comprised respectively 17.8%, 21.2%, 38.8%, and 22.2% of the study sample (Table 3).

Participants in clusters 1 and 2 commonly (from 55.0% to 99.0% of participants) endorsed stress, sleep, depression/anxiety, and pain motives for both cannabis and CBD use. Participants in cluster 1 also frequently endorsed performance, high/fun, and socialising motives for cannabis use (from 52.0% to 89.1%). While less commonly endorsed, curiosity (cannabis), socialising (CBD) and managing THC (CBD) motives were endorsed twice as often in this cluster as in the overall study sample. Compared to the whole study sample, participants in cluster 2 less commonly endorsed high/fun, socialising and curiosity motives for both cannabis and CBD use (Table 3). We therefore labelled participants in cluster 1 as 'therapeutic and poly-motive', and in cluster 2 as 'exclusive therapeutic'.

Participants in cluster 3 commonly (90.1%) endorsed the high/fun motive for cannabis use, and more often (49.4%) endorsed curiosity as a motive for CBD use. For all motives, participants in cluster 4 displayed a lower rate of endorsement than the whole study sample, with remarkably lower rates of endorsement for socialising, high/fun, and performance motives for CBD (from 0.0% to 0.9%). Stress motives were therefore the only ones endorsed by more than 50% of those participants (Table 3). We therefore labelled participants in cluster 3 as 'recreational', and in cluster 4 as 'stress-oriented'.

Participants with therapeutic and poly-motive use used cannabis resin (46.5%) and edible/oil (61.0%) markedly more often than the whole study sample (35.5% and 48.5%, respectively), while the opposite was observed for participants with stress-oriented use. The

TABLE 1 | Participants' sociodemographic characteristics according to past-year cannabidiol use ($n = 35{,}789$).

	All study sample, *N* (%)	No cannabidiol use, *N* (%)	Cannabidiol use, *N* (%)	*p*[a]
Gender				< 0.001
Men	24,230 (67.7)	13,920 (67.4)	10,310 (68.1)	
Women	10,002 (27.9)	5943 (28.8)	4059 (26.8)	
Non-binary	580 (1.6)	267 (1.3)	313 (2.1)	
Other	219 (0.6)	119 (0.6)	100 (0.7)	
Prefer not to say	604 (1.7)	311 (1.5)	293 (1.9)	
Missing	154 (0.4)	83 (0.4)	71 (0.5)	
Educational level				0.447
< Secondary education	4371 (12.2)	2556 (12.4)	1815 (12.0)	
Secondary education	17,612 (49.2)	10,091 (48.9)	7521 (49.7)	
≥ University or equivalent	10,857 (30.3)	6279 (30.4)	4578 (30.2)	
Missing	2949 (8.2)	1717 (8.3)	1232 (8.1)	
Household composition				< 0.001
One person alone	7202 (20.1)	4319 (20.9)	2883 (19.0)	
A couple without children	7143 (20.0)	4051 (19.6)	3092 (20.4)	
A couple with children	3045 (8.5)	1799 (8.7)	1246 (8.2)	
One adult with children	808 (2.3)	473 (2.3)	335 (2.2)	
Living with parents	9685 (27.1)	5597 (27.1)	4088 (27.0)	
Sharing home	3690 (10.3)	2010 (9.7)	1680 (11.1)	
No permanent residence	390 (1.1)	197 (1.0)	193 (1.3)	
Other	782 (2.2)	431 (2.1)	351 (2.3)	
Missing	3044 (8.5)	1766 (8.6)	1278 (8.4)	
Job situation				< 0.001
Employed	15,874 (44.4)	9214 (44.6)	6660 (44.0)	
Self-employed	3466 (9.7)	1873 (9.1)	1593 (10.5)	
Student	9656 (27)	5673 (27.5)	3983 (26.3)	
Unemployed/social support	2141 (6.0)	1276 (6.2)	865 (5.7)	
Disability payment/other	1546 (4.3)	803 (3.9)	743 (4.9)	
Missing	3106 (8.7)	1804 (8.7)	1302 (8.6)	
Age, years				< 0.001
≥ 18 and < 25	15,365 (42.9)	8826 (42.8)	6539 (43.2)	
≥ 25 and < 35	13,427 (37.5)	7582 (36.7)	5845 (38.6)	
≥ 35 and < 45	5126 (14.3)	3035 (14.7)	2091 (13.8)	
≥ 45	1871 (5.2)	1200 (5.8)	671 (4.4)	
Age, years (median, [IQR])	26 [22–32]	26 [22–33]	26 [22–32]	0.004
Area of residence				< 0.001
Village/countryside	5080 (14.2)	2640 (12.8)	2440 (16.1)	

(Continues)

TABLE 1 | (Continued)

	All study sample, N (%)	No cannabidiol use, N (%)	Cannabidiol use, N (%)	p[a]
Town	8684 (24.3)	4799 (23.2)	3885 (25.7)	
City	19,026 (53.2)	11,454 (55.5)	7572 (50.0)	
Missing	2999 (8.4)	1750 (8.5)	1249 (8.2)	
Monthly income, in euros, adjusted for purchasing power parity				< 0.001
< 267	7750 (21.7)	4958 (24.0)	2792 (18.4)	
≥ 288 and < 907	8378 (23.4)	4529 (21.9)	3849 (25.4)	
≥ 909 and < 2941	8019 (22.4)	4560 (22.1)	3459 (22.8)	
≥ 2941	8358 (23.4)	4668 (22.6)	3690 (24.4)	
Missing	3284 (9.2)	1928 (9.3)	1356 (9.0)	

Abbreviation: IQR, interquartile range.
[a]Chi-square and Wilcoxon-Mann–Whitney tests for categorical and continuous variables, respectively.

former also used a greater variety of CBD forms. Participants with therapeutic and poly-motive use used cannabis for a median [IQR] of 20 [8;30] days per month, while participants with stress-oriented use used it for a median of 7 [1;25] days per month (Table 3). There were no marked differences in socio-demographic variables between clusters (Table S6).

4 | Discussion

To our knowledge, this is the first international study exploring motives for cannabis and CBD use in co-users. In our large sample of people who use cannabis, CBD use was associated with declaring cannabis therapeutic-oriented motives. We found strong correlations between similar motives for cannabis and CBD use. Stress/relax, sleep, and depression/anxiety motives were also strongly correlated for a given substance. Based on those motives, we identified four clusters of co-users.

As found among individuals from the general population who use CBD [14, 15, 45–49], we confirmed in cannabis-CBD co-users that primary motives for CBD use include stress relief, sleep improvement, and management of anxiety and depression [18]. Similarly, we confirmed the prominent role of cannabis use as a stress-coping strategy in people who use cannabis [50]. The high level of endorsement for high/fun motives for cannabis use also highlights that recreational (as opposed to therapeutic or medical) use represents a significant–while non-exclusive–share of users' motives [51–54].

The prominent role of therapeutic motives for using CBD was further supported by the association between therapeutic motives for cannabis use and CBD use (i.e., individuals using cannabis to alleviate psychological distress, pain, or sleep-related symptoms were more likely to seek complementary relief through CBD use). Similarly, patterns of cannabis use previously associated with therapeutic intent—such as low-risk routes of administration [54, 55] and home cultivation [55]—were more frequently observed among participants who co-used CBD. To some extent,

the higher likelihood of some substances use in people who co-use CBD further supports the hypothesis of a therapeutic orientation in CBD use. Indeed, benzodiazepines are pharmaceutical agents commonly prescribed for conditions such as anxiety and insomnia [56]. Ketamine, initially used as both an analgesic and an anaesthetic, has recently shown efficacy in the treatment of resistant depression [57, 58]. Likewise, recent studies have suggested potential therapeutic benefits of LSD in alleviating anxiety and depression [59–61]. Regarding therapeutic-oriented motives to use cannabis, we confirmed that most targeted symptoms include stress, anxiety/depression, and poor sleep quality, as observed in other contexts [62–66]. While pain generally ranks as one of the top conditions for using medical cannabis [62, 63, 67], it was reported as a motive for cannabis use by less than 30% of the study participants, which may be explained by the young age of respondents. The low number of participants with prescription from a physician is likely due to this young age, but also to the significant entry barriers for those seeking to access medical cannabis legally in Europe [24].

For both cannabis and CBD use, we found that stress, sleep, and anxiety/depression motives were strongly correlated, indicating that users are commonly looking for simultaneous relief from those symptoms. This is in line with epidemiological and genetic data showing that poor sleep quality and anxiety/depression commonly co-occur [68–70], and with the fact that the boundaries between stress and anxiety remain unclear as they have intertwined behavioural and neural underpinnings [71]. In patients with insomnia, the central role of trouble relaxing between the communities of sleep-, anxiety-, and depression-related symptoms has been highlighted [72].

The most frequently cited motives we found were those that are most commonly discussed in public spaces. Health claims regarding the management of anxiety, depression, and insomnia were the most commonly observed among retailers who operate within adult-use cannabis markets [73], as well as on online social media [74, 75]. Those therapeutic claims were also commonly cited for CBD on social media [76, 77].

TABLE 2 | Factors associated with past-year cannabidiol use (multilevel mixed effects logistic regression model, $n = 29,211$).

	aOR [95% CI]	p
Gender		
Men	1.14 [1.07–1.21]	< 0.001
Women (ref.)	1	
Non-binary	1.48 [1.21–1.80]	< 0.001
Other	1.19 [0.87–1.64]	0.283
Prefer not to say	1.44 [1.17–1.77]	0.001
Educational level		
Secondary education (ref.)	1	
Secondary education	1.07 [0.99–1.16]	0.091
≥ University or equivalent	1.11 [1.01–1.21]	0.032
Job situation		
Employed (ref.)	1	
Self-employed	1.24 [1.13–1.35]	< 0.001
Student	0.97 [0.90–1.04]	0.445
Unemployed/social support	0.95 [0.85–1.06]	0.335
Disability payment/other	1.18 [1.04–1.33]	0.01
Age, years		
≥ 18 and < 25	1.40 [1.23–1.59]	< 0.001
≥ 25 and < 35	1.42 [1.26–1.61]	< 0.001
≥ 35 and < 45	1.29 [1.13–1.47]	< 0.001
≥ 45 (ref.)	1	
Area of residence		
Village/countryside	1.06 [0.98–1.14]	0.139
Town	1.03 [0.97–1.09]	0.383
City (ref.)	1	
Monthly income, in euros, adjusted for purchasing power parity		
267 (ref.)	1	
≥ 288 and < 907	1.07 [0.96–1.20]	0.23
≥ 909 and < 2941	1.03 [0.90–1.17]	0.702
≥ 2941	1.05 [0.90–1.21]	0.549
≥ 20 days of cannabis use in the last 30 days	1.11 [1.05–1.18]	< 0.001
Criminalisation of cannabis possession	0.65 [0.47–0.89]	0.008
Cannabis motives		
To reduce stress/relax	1.40 [1.31–1.50]	< 0.001

(Continues)

TABLE 2 | (Continued)

	aOR [95% CI]	p
To improve sleep	1.33 [1.26–1.41]	< 0.001
To treat depression/anxiety	1.19 [1.12–1.26]	< 0.001
To reduce pain/inflammations	1.80 [1.69–1.92]	< 0.001
Out of curiosity/to experiment	0.98 [0.90–1.07]	0.648
To get high/for fun	0.82 [0.77–0.87]	< 0.001
To socialise	1.02 [0.97–1.08]	0.44
To enhance performance (school/work/sport/etc.)	1.4 [1.3–1.5]	< 0.001
Substance use in the last 30 days		
Alcohol	0.96 [0.90–1.02]	0.189
Tobacco[a]	0.98 [0.92–1.04]	0.527
Cocaine	1.05 [0.96–1.15]	0.250
Ecstasy/MDMA	0.92 [0.83–1.02]	0.099
Amphetamine	1.08 [0.97–1.19]	0.152
Methamphetamine	0.94 [0.77–1.14]	0.521
Heroin	0.65 [0.49–0.87]	0.004
New psychoactive substances[b]	1.26 [1.09–1.46]	0.002
Synthetic cannabinoids	1.29 [1.02–1.62]	0.031
Synthetic cathinones	0.74 [0.57–0.98]	0.034
Benzodiazepines	1.14 [1.03–1.26]	0.012
GHB/GBL	0.96 [0.70–1.32]	0.806
Ketamine	1.33 [1.14–1.56]	< 0.001
LSD	1.32 [1.16–1.49]	< 0.001
Mushrooms	1.39 [1.22–1.57]	< 0.001
Other hallucinogens	1.14 [0.95–1.36]	0.160

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.
[a]Including e-cigarette.
[b]This term was accompanied by the following statement: 'New substances, that have sometimes similar effect as known illicit drugs, may now be sometimes available. They are sometimes called (insert 'local name' such as, 'new psychoactive substances' 'legal highs', 'research chemicals') and can come in different forms, for example—herbal mixtures, powders, crystals, or tablets.'

We originally unveiled the relationships between motives for cannabis and CBD use. The correlations between motives for cannabis and CBD use imply that people who use them turn to these products for similar reasons, suggesting they have at least partially similar functions. Therefore, we may expect them to substitute one substance for the other. As CBD has a safer profile than (THC-containing) cannabis, a harm-reduction role of CBD toward cannabis-related harms may emerge from those original results.
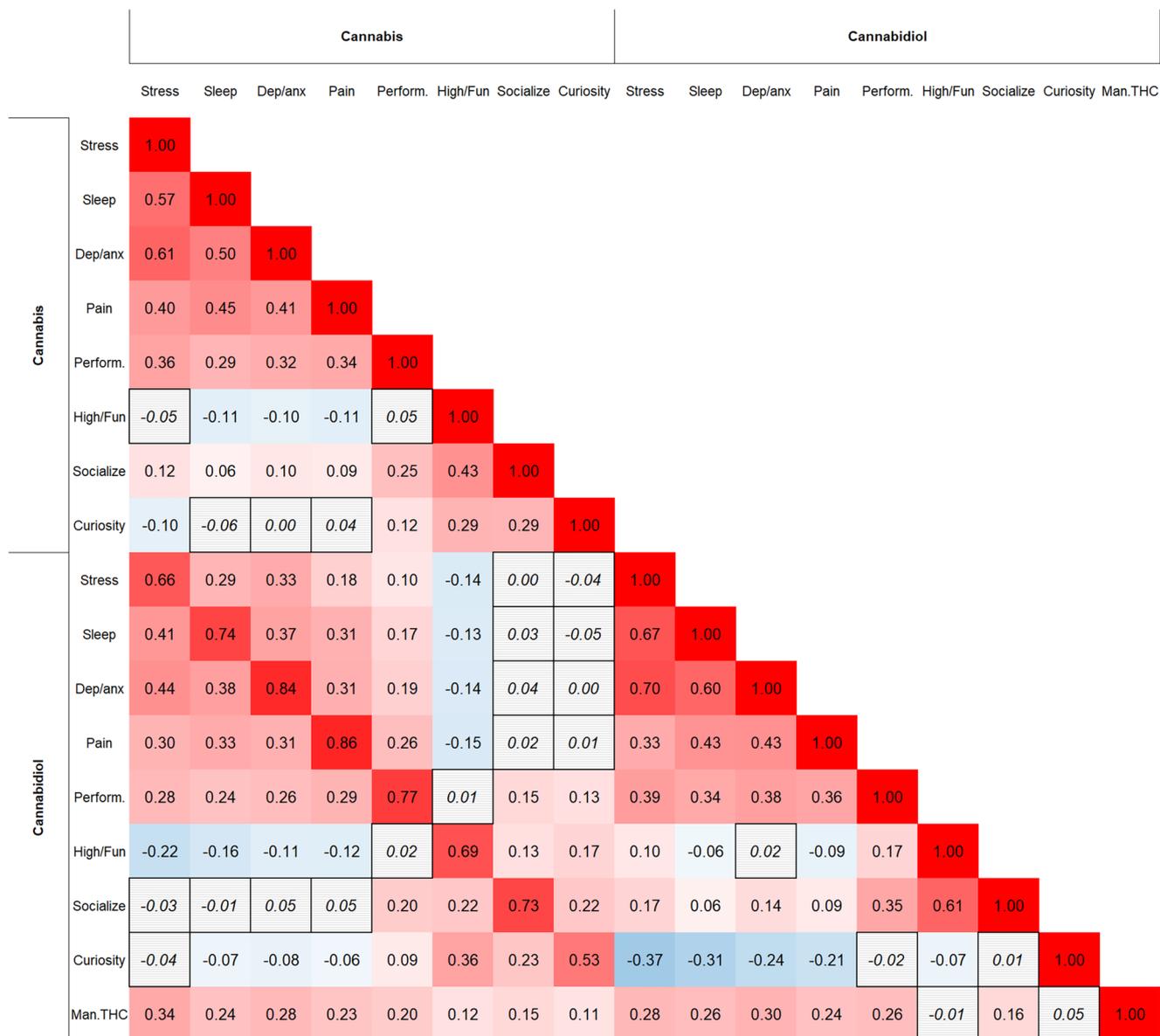
FIGURE 2 | Matrix of tetrachoric correlations of motives for cannabis and cannabidiol use ($n = 15{,}146$). Stress stands for 'to reduce stress/relax'; Sleep stands for 'to improve sleep'; Dep/anx stands for 'to treat depression/anxiety'; Pain stands for 'to reduce pain/inflammation'; Perform. stands for 'to enhance performance (school/work/sport/etc.)'; High/Fun stands for 'to get high/for fun'; Socialise stands for 'to socialise'; Curiosity stands for 'out of curiosity/to experiment'; Man. THC stands for 'to manage THC use'. The colour of the cells reflects the value of their coefficients: from dark blue (−1) to dark red (1), with white as an intermediate colour (0). Correlations of grey-striped cells with black borders are not statistically significant (Bonferroni-adjusted $p \geq 0.05$).

In a randomised trial, while both CBD- and THC-dominant concentrates led to an immediate decrease in anxiety, THC-dominant concentrates additionally induced paranoia [78]. Similar levels of positive subjective effects, but significantly less paranoia and anxiety, were also noted for balanced CBD/THC cannabis flowers compared to the THC-dominant chemovar in another study [79]. In a recent *ad libitum* self-administration study of edible products, products containing both THC and CBD led to lower THC intake than THC-only products, despite reporting similar levels of positive and psychotomimetic effects [80]. CBD-based products may therefore represent a safer option than cannabis for some consumers primarily motivated by high/fun expectations, such as participants in our cluster 3 (recreational). While adding CBD to THC does not seem to attenuate acute THC effects or impairments [81–83], CBD products may have a harm reduction role to play when it comes to partially replacing THC-rich products, especially in the current context of increasing potency of cannabis in international markets [84]. For instance, since CBD use does not seem to impair driving performance, such products may be considered as an alternative to THC-rich products before operating a vehicle [85]. In jurisdictions where cannabis is legally sold, low-THC products may be systematically recommended to encourage these consumers to minimise their exposure to THC-related risks. Moreover, incentivising the use of low-THC products through lower taxation compared to high-THC products could further favour their use [86].

TABLE 3 | Cannabinoid-related characteristics of participants who co-use cannabis and cannabidiol according to participants' cluster.

	#1: therapeutic and poly-motive (n = 2703)	#2: exclusive therapeutic (n = 3212)	#3: recreational (n = 5871)	#4: stress-oriented (n = 3360)	
	N (%)	N (%)	N (%)	N (%)	p[A]
Motives for cannabis use					
To reduce stress/relax	2677 (99.0)[a]	3172 (98.8)[a]	4298 (73.2)	2652 (78.9)	< 0.001
To improve sleep	2340 (86.6)	2958 (92.1)	2305 (39.3)	1606 (47.8)	< 0.001
To treat depression/anxiety	2118 (78.4)	2638 (82.1)	1375 (23.4)	878 (26.1)	< 0.001
To reduce pain/ inflammations	1631 (60.3)[a]	1908 (59.4)[a]	812 (13.8)	624 (18.6)	< 0.001
To enhance performance (school/work/sport/etc.)	1405 (52.0)	568 (17.7)	872 (14.9)	92 (2.7)	< 0.001
To get high/for fun	2409 (89.1)[a]	1277 (39.8)	5287 (90.1)[a]	1217 (36.2)	< 0.001
To socialise	1955 (72.3)	361 (11.2)	2749 (46.8)	163 (4.9)	< 0.001
Out of curiosity/to experiment	541 (20.0)	44 (1.4)[a]	879 (15.0)	41 (1.2)[a]	< 0.001
Number of motives endorsed, median [IQR]	6 [5–6]	4 [3–5]	3 [2–4]	2 [1–3]	< 0.001
Motives for cannabidiol use					
To reduce stress/relax	2504 (92.6)	3077 (95.8)	2668 (45.4)	2104 (62.6)	< 0.001
To improve sleep	2288 (84.6)	2947 (91.7)	1495 (25.5)	1477 (44.0)	< 0.001
To treat depression/anxiety	1925 (71.2)	2519 (78.4)	568 (9.7)	569 (16.9)	< 0.001
To reduce pain/ inflammations	1487 (55.0)[a]	1876 (58.4)[a]	469 (8.0)	627 (18.7)	< 0.001
To enhance performance (school/work/sport/etc.)	1011 (37.4)	341 (10.6)	301 (5.1)	20 (0.6)	< 0.001
To get high/for fun	922 (34.1)[a]	215 (6.7)	1890 (32.2)[a]	29 (0.9)	< 0.001
To socialise	905 (33.5)	13 (0.4)	885 (15.1)	0 (0.0)	< 0.001
Out of curiosity/to experiment	1042 (38.5)	252 (7.8)[a]	2899 (49.4)	283 (8.4)[a]	< 0.001
To manage THC use	1075 (39.8)	651 (20.3)	678 (11.5)	142 (4.2)	< 0.001
Number of motives endorsed, median [IQR]	5 [4–6]	4 [3–4]	2 [1–3]	2 [1–2]	< 0.001
Pattern of cannabinoid use					
Vaporiser (cannabis)	296 (11.0)[a]	359 (11.5)[a]	420 (7.3)	283 (8.9)	< 0.001
Cannabis grower	160 (6.0)[abc]	228 (7.4)[ad]	290 (5.1)[be]	196 (6.3)[cde]	< 0.001
Cannabis edible/oil	1646 (61.0)	1794 (56.2)	2584 (44.2)	1285 (38.6)	< 0.001
Cannabis herbal	2657 (98.3)	3076 (95.8)[a]	5677 (96.7)[a]	3111 (92.6)	< 0.001
Cannabis resin	1256 (46.5)	1126 (35.1)[b]	2107 (35.9)[b]	893 (26.6)	< 0.001
Days of cannabis use in the last 30 days					< 0.001
< 20	1122 (41.5)	1567 (48.8)	3649 (62.2)	2060 (61.3)	

(Continues)

TABLE 3 | (Continued)

	#1: therapeutic and poly-motive (*n* = 2703)	#2: exclusive therapeutic (*n* = 3212)	#3: recreational (*n* = 5871)	#4: stress-oriented (*n* = 3360)	
	N (%)	*N* (%)	*N* (%)	*N* (%)	*p*[A]
≥ 20	1539 (56.9)	1490 (46.4)	2030 (34.6)	1044 (31.1)	
Missing	42 (1.6)	155 (4.8)	192 (3.3)	256 (7.6)	
Days of cannabis use in the last 30 days, median [IQR]	20 [8–30]	15 [5–30]	10 [2–25][a]	7 [1–25][a]	< 0.001
Cannabis medically prescribed	53.0 (2.0)[ab]	80.0 (2.5)[a]	51.0 (0.9)[c]	48.0 (1.4)[bc]	< 0.001
Criminalisation of cannabis possession	1464 (54.2)[ab]	1620 (50.4)	3242 (55.2)[ac]	1877 (55.9)[bc]	< 0.001
CBD herbal user	1978 (73.2)	2228 (69.4)	3807 (64.8)	2007 (59.7)	< 0.001
CBD resin user	834 (30.9)	767 (23.9)	943 (16.1)[a]	481 (14.3)[a]	< 0.001
CBD joints user	1404 (51.9)	1337 (41.6)	2209 (37.6)	935 (27.8)	< 0.001
CBD liquids user	467 (17.3)	454 (14.1)	590 (10.0)[a]	315 (9.4)[a]	< 0.001
CBD edible user	935 (34.6)	892 (27.8)	1185 (20.2)[a]	608 (18.1)[a]	< 0.001
CBD crystals user	157 (5.8)	111 (3.5)	128 (2.2)[a]	55 (1.6)[a]	< 0.001
CBD cosmetic user	482 (17.8)[a]	531 (16.5)[a]	529 (9.0)	386 (11.5)	< 0.001
Number of forms of CBD products	2 [1–3]	2 [1–3]	1 [1–2]	1 [1–2]	< 0.001

Note: Chi-square and Dunn's tests were used for pairwise comparisons. For a given variable, figures with a similar superscript letter are not statistically significant (*p* > 0.05, Bonferroni corrections for multiple comparisons were applied).
Abbreviations: CBD, cannabidiol; IQR, interquartile range.
[A]Chi-square and Kruskal-Wallis' tests for categorical and continuous variables, respectively.

However, CBD-based products may fail to substitute for cannabis in the context of symptom management. In a large case series of people who use medical cannabis, for most quality of life domains, products with a balanced ratio of THC and CBD were associated with marginally greater improvements than either CBD-dominant or THC-dominant products [87]. In a large sample of people who use cannabis for medical reasons, THC levels were associated with greater symptom relief (and side effects), while CBD levels were generally not associated with significant symptom changes [88]. Similarly, in a study comparing people who use CBD-oil-only to high-THC cannabis, people who use CBD-oil-only reported fewer symptoms relieved by cannabis, and a slightly lower overall symptom reduction [89].

Our clustering results partly align with those of Amiet et al. In their study of young adults regularly using cannabis, they identified two groups. The first one was characterised by lower endorsement across all motivation (similar to our clusters 3 and 4) and expectation variables, and the second one by endorsing multiple motivations (similar to our clusters 1 and 2), and higher expectations of cannabis use [90]. Like us, they found no marked sociodemographic differences between the two groups. Additionally, the multiple motivation group had more frequent cannabis use and worse scores on the Cannabis Use Problems Identification Test and Depression Anxiety Stress Scale [90]. We also found higher cannabis use frequency in our clusters 1 and 2. Those results, and the correlations we found between the number of motives and daily or near-daily cannabis use, extend previous results found in people who use cannabis to people who co-use cannabis-CBD. For instance, Bonn-Miller and Zvolensky found more severe forms of cannabis use in young adults with greater motivation to use cannabis for multiple reasons [91].

In our clusters of participants endorsing a greater number of motives, therapeutic motives were over-represented, and low-risk routes of cannabis administration were more frequent, suggesting therapeutic-oriented use [54, 55]. The fact that those two clusters were associated with more frequent cannabis use is in line with data from different settings, including therapeutic/medical users and comparing them to recreational users [54, 55, 92–94]. Moreover, within our sample of people who use cannabis, we found that CBD use was associated with therapeutic-oriented cannabis motives. It was also associated with daily or near-daily cannabis use, suggesting that those co-using CBD tend to declare a therapeutic and frequent cannabis use. In a group of people who use CBD, regular cannabis use was also more likely in participants with medical use of CBD [14]. While we did not collect CBD use frequency, previous data suggest that therapeutic CBD use is also associated with more frequent CBD use and non-smoking routes of administration [22].

The first strength of our study lies in the fact that, to our knowledge, it is the first to investigate both cannabis and CBD motives in people who co-use at the international level. The statistical

power of the survey, as well as its international dimension, is a second strength, as our results rely on participants from diverse European sociocultural backgrounds. However, some limitations of this work should be mentioned. First, depending on local legislation and market conditions, 'CBD products' may have referred to different types of products across participating countries (e.g., in terms of authorised THC levels). Secondly, assessment of motives did not rely on a validated scale: a few motives may have been omitted, or we would have benefited from grouping motives into categories such as coping motives. Psychometric properties would also have been guaranteed, which was not the case in the present study. Thirdly, we had no data on CBD use frequency, and were therefore not able to extend findings on cannabis use frequency to CBD. Lastly, our study sample is not representative of the general population, nor of specific groups of people who use drugs, limiting the generalisability of our findings. Web survey respondents generally report higher frequencies of substance use than those from general population surveys [33]. Each participant country devised its own sampling strategy. It resulted, for instance, in varying proportions of participants recruited from social media, while it has been shown within the EWSD that such participants tend to be younger than those recruited through other means [33]. Having said that, previous research based on another international web survey on drugs found that age and sex distributions among people who recently used cannabis were broadly similar to those found in probability sampling [95].

To conclude, people who use both cannabis and CBD tend to use them with the same motives. Considering the safer profile of CBD, further research should explore the potential switching of high-THC products with low-THC, high-CBD products to reduce THC-related harms and the risk of dependence.

Author Contributions

Conceptualisation: T.B., D.F. Methodology: T.B., V.L., D.F. Formal analysis: T.B., V.L. Investigation: J.M. Writing – original draft: T.B. Writing – review and editing: All authors.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.