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# Consumer preferences for Cannabis products with THC content in Germany—The case of flowers

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#### ARTICLE INFO

#### ABSTRACT

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Understanding consumer preferences for cannabis products with THC content in Germany is essential as the country approaches cannabis legalization. This study aims to explore the preferences of German consumers for THC-containing cannabis products, specifically dried flowers, and the safety measures they consider important. Despite increasing cannabis use and evolving public opinion favoring legalization, there is limited research on recreational cannabis preferences in Germany.

To address this gap, a discrete choice experiment was conducted with a sample of 193 German consumers. Participants evaluated cannabis flower products with varying attributes, including THC intensity, price, labeling, and packaging materials. The study also investigated consumer perspectives on safety measures, such as age restrictions, product origin information, and ingredient transparency.

Results revealed three distinct consumer segments: (1) Otto Normal Consumers (63.7 %), representing the average buyer with moderate preferences for calming and stimulating products; (2) Light and Soothing (21.9 %), favoring low-THC, calming products; and (3) Cheap and Hard (14.4 %), characterized by a preference for high-THC, stimulating products at lower prices. The most valued product attributes were the type and strength of effect, followed by packaging and labeling. Consumers emphasized the need for clear product information and safety warnings.

This study provides valuable insights into the German recreational cannabis market, highlighting key attributes that influence purchasing decisions. These findings can support businesses and policymakers in developing targeted marketing strategies and regulatory frameworks to ensure safe and consumer-oriented cannabis products.

# 1. Introduction

In Germany, cannabis offenses account for the largest share of consumption-related illegal drug cases. These offenses involve cannabis containing delta-9-tetrahydrocannabinol (THC), with 188,453 registered cases, representing up to 65.5 % of all drug-related incidents. Surprisingly, despite criminal prosecution efforts, the number of cases continues to rise (Schmengler et al., 2022). Additionally, the costs associated with law enforcement and prosecution related to cannabis reached approximately  $\pounds$ 1.36 billion by 2021 (Haucap & Knoke, 2021). Public opinion has shifted significantly over the years, transitioning from widespread rejection of cannabis legalization in 2014 to a more cautious pro-legalization stance in 2021 (Infratest dimap, 2021). Notably, the current coalition agreement among the SPD, Bündnis 90/Die Grünen, and FDP parties, established in 2019, aimed to combat

the black market and promote safer cannabis consumption by legalizing it. This legalization would have ensure purity, regulate potency, and control the concentration of the active substance (THC) (Presse- und Informationsamt der Bundesregierung, 2021).

On April 1, 2024, Germany enacted the Cannabis Act (Cannabisgesetz, CanG), which introduced significant changes related to cannabis consumption. The act establishes the new Cannabis Consumption Act (Konsumcannabisgesetz, KCanG) and amends existing laws, including the Medicinal Cannabis Act (Medizinal-Cannabisgesetz, MedCanG) and the Narcotics Act (Betäubungsmittelgesetz, BtMG). The primary objectives of the Cannabis Act are to facilitate responsible cannabis use, reduce black market activity, and enhance the protection of children and young individuals. Notably, the act largely aligns with the original proposal put forth by the German Federal Ministry of Health (Bundesministerium für Gesundheit, BMG) in 2023 (Gesley, 2024).

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Key provisions of the Cannabis Act include two major points: 1. Private possession and cultivation. Adults aged 18 and above are allowed to possess up to 25 g of cannabis for personal use. Additionally, they can cultivate up to three cannabis plants at home. However, cannabis use is prohibited near individuals under 18 years old and in specific public areas (e.g., schools, playgrounds). 2. Cultivation associations. Members of cultivation associations have permission to cultivate, distribute, and receive cannabis. Adolescents (ages 18 to 21) can receive up to 25 g per day and a maximum of 30 g per month. Those over 21 years old can receive the same daily amount but up to 50 g per month. The THC level for adolescents is capped at 10 %, while there is no limit for adults. Cultivation associations must obtain a license from the competent authority. The newly added rules related to driving under the influence of THC and the amnesty provision have sparked debate. Although the act took effect on April 1, 2024, cultivation associations cannot begin operating until July 2024 (Art. 15, para. 2) (Gesley, 2024). Cannabis stores like those in the Netherlands and some US states will not be available in Germany. But ff these stores will be introduced in Germany in the future. Start-ups in this sector will have significant market potential, with estimates exceeding €16 billion by 2028 (if shops had been introduced in 2024), albeit with narrower export margins (Prohibition Partners, 2019). To put this in perspective, it represents approximately two-thirds of the current coffee market, valued at around €23 billion (Statista, 2022).

While market research on cannabis is readily available from countries with recreational cannabis markets, such as Canada, German studies have primarily focused on THC as a medical intervention rather than examining recreational consumers. Notably, the legal prohibition of recreational THC sales in Germany has resulted in a lack of research concerning the behavior and preferences of German recreational cannabis users (Bentley, Izadi, Raymakers & McTaggart-Cowan, 2022; Böttge-Wolpers et al., 2023).

However, since THC is not going to be illegal for much longer, we aspire to face this research gap in this study to support future start-ups' success by tackling an obstacle, a lack of orientation towards the wishes and needs of consumers, and an inadequate ability to differentiate (Löffler, 1999). However, previous findings regarding consumer preference in Canada indicate that cannabis is most likely bought in the form of dried flowers, edibles, and vape liquids after legalization (Government of Canada, 2022). Additionally, that their willingness to pay (WTP) may not change and could stay at the level of the current black market price ( $\in 10/g$ ) (DBDD, 2022) and medical cannabis ( $\in 16/g$ ) (KBV, 2023) price (Donnan, Shogan, Bishop, Swab & Najafizada, 2022). Furthermore, because of a lack of education on cannabis, safety warnings regarding the use of THC products may be desired (Rubin-Kahana, Crépault, Matheson & Foll, 2022).

A discrete choice experiment conducted in Canada highlights the importance of product attributes such as THC content, price, and labeling. Donnan et al. (2024a), (2024b) found that approximately 65 % of consumers preferred to purchase cannabis edibles through regulated channels, with price and potency being key determinants in purchasing decisions. Interestingly, the remaining consumers were driven by THC levels and flavor profiles. Xing and Shi (2024) examined consumer preferences for legal and illegal cannabis in the United States. Their findings indicate that while legal products were preferred for safety and consistency, illegal products remained attractive due to lower prices and higher potency. This dual preference suggests that regulatory frameworks must balance pricing strategies with consumer demand for high-potency products. Retaits also shape consumer behavior. Donnan et al. (2024a), (2024b) explored factors influencing where cannabis is purchased. Their study identified that store ambiance, knowledgeable staff, and product diversity significantly affected consumer loyalty and repeat purchases. These insights emphasize the need for dispensaries to invest in customer experience and education. Edibles and vape present growing segments in legalized markets. Donnan et al. (2023) conducted a discrete choice experiment focusing on vaping products, finding that flavor variety and health claims (such as "organic" or "low-toxicity") attracted health-conscious consumers. This suggests that branding and perceived health benefits play a crucial role in product differentiation. Research by Charlebois et al. (2020) highlights the Canadian market's shift towards cannabis-infused food and beverages. Their study indicated that consumers are increasingly open to integrating cannabis into their diets, driven by curiosity and perceived wellness benefits. However, taste, price, and packaging aesthetics were critical factors influencing willingness to try these products. Finally, Shi et al. (2019) examined horice, and warning messages affect consumer choices for cannabis flowers. Their results demonstrated that while high-potency products remain popular, transparent labeling and prominent warning messages increase consumer trust, potentially reducing the likelihood of overconsumption.

Our goal was to determine German consumer segments and their preferences regarding cannabis flowers through a conjoint analysis. Based on an online survey, we examined the preferred product attributes at favored levels and described the consumer segments in terms of their socio-demographics, lifestyle constructs, and favored clarification inscriptions related to product handling and safety. The survey was presented to participants in a hypothetical setting simulating the legalization of THC product sales. Consequently, our work provides an initial impression of consumers' preferences, as the lack of legal approval in Germany at the time did not allow for the verification of our study's results (tagesschau24, 2023).

As Germany approaches cannabis legalization, ensuring product safety and quality will play a crucial role in consumer acceptance and regulatory compliance. Lessons from the food industry, particularly in canned products, highlight the significance of addressing contaminants and utilizing biopreservation agents to extend shelf life and maintain safety standards. Contaminants in food products, such as heavy metals and microbial pathogens, pose substantial health risks if not adequately controlled (Wang et al., 2024; Zheng et al., 2023). Similarly, biopreservation methods using bacteriocins, essential oils, and bioactive compounds have proven effective in mitigating spoilage and preserving product integrity (Jiang et al., 2024; Zhang et al., 2024). In the cannabis market, analogous safety concerns-such as microbial contamination, residual solvents, and heavy metals-necessitate the development of preservation and safety techniques to ensure product purity (Martínez-Páramo et al., 2024). The application of biopreservation strategies, widely used in the food sector, could provide insight into safeguarding cannabis products post-legalization. Moreover, the evolving consumer demand for transparency regarding ingredients, origins, and safety measures parallels trends observed in the food industry (Wu et al., 2021). This underscores the need for comprehensive product safety frameworks that not only comply with regulations but also align with consumer expectations, thereby supporting the legitimacy and acceptance of legal cannabis products.

The remainder of this article is structured as follows: The next section describes the materials and methods used in the study. The results of the choice experiment and latent-class segmentation are presented in the third section. In the discussion, the results are examined critically. Finally, the findings are summarized in the conclusion and further implications for marketing, product development, and future research fields will be noted.

#### 2. Materials and methods

#### 2.1. Consumer preferences for cannabis products

The selected product for this study was THC-containing cannabis. As THC is lipophilic, it enters an organism through lipophilic pathways (Touitou, Fabin, Dany & Almog, 1988). Therefore, they can be consumed in various forms. For example, it can be inhaled through joints as dried flowers or through vapor liquids as oil as well as dabbed, which is a smoking cannabis concentrate. In contrast, it can be

consumed as an edible food containing THC-infused fat, which can be absorbed in small quantities via cremes or ingested, which is unintentional consumption through contamination of cannabis-unrelated products (Schluter & Hodgins, 2022).

This study concerns the dried flowers, but also the THC oils as vapor liquids as well as THC-infused fat as edibles should be studies in further research, including these three forms of cannabis and their respective consumer preferences from the perspective of recreational use is needed to shade light to the most important products on a future cannabis market. Research from Canada and the United States of America indicating that after legalization the purchase of cannabis broadens from only dried cannabis flowers to also vape liquids and edibles (Bentley, Izadi, Raymakers & McTaggart-Cowan, 2022). To the best knowledge of the authors to date, there have been no studies on recreational cannabis available for Germany. German studies are only exploring THC as a medical treatment lacking the legalization for recreational purposes and are therefore not exploring the preferences of recreational cannabis customers, but rather as patients (Böttge-Wolpers et al., 2023). Additionally, previous findings regarding consumers preference in Canada, like minding the current black market ( $\notin 10/g$  (DBDD, 2022)) and medical cannabis (€16/g (KBV, 2023)) prices as a price expectations indicator after legalization (Donnan, Shogan, Bishop, Swab & Najafizada, 2022). Considering the lack of education on cannabis a reference for a demand on safety warnings on the packaging regarding the use of THC products, is expected and therefore also considered in the present study (Rubin-Kahana, Crépault, Matheson & Foll, 2022).

Therefore, our goal is to determine German consumer segments and their preferences for cannabis flowers containing THC. We also examine favoured clarification inscriptions in terms of product handling and safety, data regarding socio-demographics and lifestyle constructs, as well as important product attributes at their preferred levels. The use of cannabis has so far (as of the data collection in July 2022) been illegal in Germany (Liboschik & Huth, 2022), yet cannabis use among young adults is on the rise. In 2021, 25 % of young adults aged 18–25 years had used cannabis at least once in the previous year. Compared with 1993, this is an increase of 10.5 % (Forsa, 2022). Legally controlled sale of cannabis in Germany is also more likely to be supported than rejected (Schwäbische Zeitung, 2021). With the current state of politics in Germany, the legalization of cannabis has never been so close (tagesschau24, 2023).

#### 2.2. Data collection and survey design

The study's data were collected online between May and July 2022 using the survey program Lighthouse Studio from Sawtooth Software. The surveys were distributed per links and quick response codes (QR codes) via social media (Reddit, Instagram, Facebook, WhatsApp), email distribution lists (HAW Hamburg), face-to-face communication in Hamburg, Germany. Participation was voluntary, and respondents were able to cancel at any time and leave without consequences. The data of the participants were not saved when cancelling or leaving the survey.

This study adhered to stringent ethical guidelines to ensure the protection and welfare of all participants. The ethical considerations and procedures employed in this study include the following: Informed Consent: All participants were fully informed about the purpose of the study, the procedures involved, their rights as participants, and any potential risks. Informed consent was obtained from each participant before their involvement in the study. Confidentiality: The privacy and confidentiality of all participants were strictly maintained. Personal data were anonymized to ensure that individuals could not be identified from the information provided. Data were stored securely and accessed only by the research team. Voluntary Participation: Participation in the study was entirely voluntary. Participants had the right to withdraw from the study at any time without any penalty. Ethical Approval: The study protocol was reviewed and approved by the HAW Hamburg Ethics Committee, ensuring that it met all ethical standards and guidelines for

research involving human subjects. Transparency and Honesty: The research team was committed to conducting the study with the highest level of integrity and transparency. Participants were provided with accurate and honest information about the study's objectives and procedures. Beneficence and Non-maleficence: The principle of beneficence was upheld, ensuring that the study aimed to contribute positively to the understanding of consumer preferences in the context of cannabis products.

To ensure representativeness, quotas were set for age and gender, which corresponded to the German population. Only those between the ages of 18–69, who had already consumed cannabis or who could imagine consuming cannabis if it were legalized in Germany, were allowed to participate in the surveys. Participants with no interest in cannabis were excluded.

A total of 759 participants took part in the survey, 566 of survey's respondents were disqualified not meeting the quota requirements or due to incomplete answers as well as speed settings during data collection. Leaving a sample of 193 participants successfully completed the survey and their data were used for the data analysis.

The survey was divided into three parts. In the first part, the choice experiment was conducted, there were three products, composed of five attributes: type of effect, strength of effect, price, label and packaging. Additionally, a non-choice option was provided if the participants did not favour any of the presented products. To see all attributes with their corresponding levels and the non-choice option, see Table 1 in Section *Design of the Discrete Choice Experiment*.

In the second part of the surveys, statements (items) for measuring different constructs were presented to the participants regarding their lifestyle to agree or disagree with on a balanced five-point Likert scale. The origin and application of the scales and constructs are described in Section Statistical Methods: Hierarchical Bayes Model, Latent Class Choice Analysis, and Segment Profiling.

The last part asked sociodemographic questions regarding the participants' marital status, education level, and monthly income. More details on this data collection can be found in Section *Statistical Methods: Hierarchical Bayes Model, Latent Class Choice Analysis, and Segment Profiling.* 

#### 2.3. Design of the discrete choice experiment

In order to investigate the consumers preferences for the cannabis products, a choice experiment was designed using Lighthouse Studio (version 9.13.2). By doing so, different attributes with different attribute levels were assigned to the products, as displayed in Table 1. In general, choice experiments have become increasingly popular in recent decades, serving as a reliable tool to explore consumer preferences and how consumers trade-off between different product characteristics. Choice experiments are based on the choice procedure and random utility theory (Louviere, Flynn & Carson, 2010).

In the choice experiments, respondents were asked to choose between comparable alternatives to cannabis flowers. The alternatives, consisting of certain attributes differ in terms of their attribute level expression. The alternatives were each presented as a level mix, and the respondent was asked to choose from the alternatives presented. This process was repeated 12 times, and the respondents were randomly presented with new choice sets one after another.

Every product was defined with five attributes, each subdivided into five designated levels. The attributes were selected through expert interviews previews with the founders of a German cannabis startup to the design of the study, which estimated which attributes are likely to be important for the future market in Germany. This resulted in the following five attributes: price, packaging, label, effect strength, and type of effect. The attributes vary within their expression levels, and thus offer the respondent a wide range of options to answer. The level values were again agreed upon in consensus with cooperating experts. Table 1 lists the attributes and their assertion levels.

Attributes and attribute levels used in the choice-experiment.

Attribute	Level					None
Flowers						
	Ì	ÌÌ	ÌÌÌ	ŶŶŶŶ	1	
Effect (strength)	5 % THC: Very mild	10 % THC: Mild	15 % THC: Medium	20 % THC: Strong	25 % THC: Very strong	
	2 <sup>2</sup> Z	<del>()</del>		2	<b>E</b>	
Type of effect	Very camling	Calming	Neutral	Stimulating	Strongly stimulating	Laure del cont
Price per gram cannabis	€10	€12	€14	€16	€18	choose any of
Label	Bio		PREMUM	100% CO.	No Label	
				Glass jar with		
Packaging	Opaque plastic foil	Plastic tin	Metal can	packaging	Glass jar	

In the choice experiment, participants were asked to choose one of three different product alternatives they would buy. If the participants did not favor any of the alternatives, they always had the option of explicitly choosing none of them. Images were used to illustrate the individual-level expressions. Table 1 shows the images of the levels.

A randomized combination of attribute levels in each of the choice sets was created using the Lighthouse Studio from Sawtooth Software. Lighthouse Studio provides a reduced design for the choice experiment. In total, the choice experiment contained 12 choice sets, each offering three different possible products to choose from, as well as an option to reject all three presented products. Fig. 1 shows one example choice set in German, as they were presented to the participants.

The following settings were selected for the choice-based conjoint (CBC) design: Twelve random tasks were used, with no fixed tasks and three concepts per task (excluding the none-option). For the noneoption, a traditional design was applied, without dual-response. The random task generation method employed was balanced overlap. In Sawtooth Software choice experiments, balanced overlap manages the repetition of attribute levels across alternatives within a choice task. This method balances minimal overlap—where attribute levels rarely repeat, potentially making tasks feel artificial—and full randomization, which can lead to excessive repetition and redundancy. Balanced overlap introduces limited repetition while preserving variety, fostering a more natural and realistic decision-making environment. This design enhances statistical efficiency, maintains respondent engagement, and improves data quality. A total of 300 questionnaire versions were generated (design seed = 1) without attribute randomization or concept sorting. Discrete choice was used as the response type. The design underwent rigorous testing, including one-way and two-way frequency tests, advanced simulations (simulated data, logit efficiency test, and defficiency) with 300 simulated respondents (15 % none-option), and a legacy OLS efficiency test. A standard benchmark for design quality is achieving standard errors of 0.05 or less for main effect utilities and 0.10 or less for interaction or alternative-specific effects. The highest standard error observed was 0.04668 for the none-option. The overall design strength for this model was calculated at 755.62. This figure reflects the d-efficiency of the design relative to other potential configurations, indicating a high level of reliability and robustness in the chosen approach.

2.4. Statistical methods: hierarchical Bayes model, latent class choice analysis, and segment profiling

First, the sociodemographic data and cannabis-related lifestyle were analyzed using SPSS (version 27). The Hierarchical Bayes model was then used to determine the average part-worth utilities of the attribute levels as well as the relative importance of the attributes. Hierarchical Bayes (HB) analysis in Sawtooth Software is a statistical technique used to estimate individual-level preferences (part-worth utilities) from discrete choice experiment data. It works by combining information from each respondent's choices with overall patterns observed in the data, effectively balancing individual-level detail with population-level insights. HB analysis uses a hierarchical structure with two levels, an individual level which assumes each respondent has their own set of preferences, expressed as part-worth utilities for different attribute levels and a population level which assumes these individual preferences are drawn from a common distribution (e.g., multivariate normal) that characterizes the entire population. The analysis applies Bayes' theorem to estimate part-worth utilities. It starts with a prior distribution, reflecting assumptions about the population's preferences before considering the data, and updates this with likelihoods derived from the respondents' choice data. HB uses a Markov Chain Monte Carlo simulation to iteratively estimate the parameters. The method alternates between estimating the population-level parameters (mean and covariance of the utility distribution) based on the current individual-level estimates, updating the individual-level part-worth utilities by considering each respondent's choices, and the population-level distribution and customization to respondent data. As the model iterates, it refines the estimates by borrowing strength from the population-level data to inform individual-level predictions, particularly for respondents with limited data. HB provides a set of part-worth utilities for each respondent, reflecting their preferences for each attribute level. These utilities can be used to predict individual and group-level choices, simulate market scenarios, and calculate derived measures like willingness-topay or importance scores. To analyze decision data efficiently, the majority of choice-based studies use the model described above (Sawtooth Software, 2017).

A latent class analysis (LCA) was applied to the results of the survey. LCA was used to determine the heterogeneity of the respondents and then divide consumers into relevant segments. It is an instrument that

# Im Folgenden sehen Sie drei verschiedene **Produktoptionen** der **Cannabisblüte (Gras)**.

# Wenn Sie nur diese Möglichkeiten hätten, welche würden Sie wählen?



Fig. 1. Example choice set of the choice experiment regarding flowers (in the original language German).

examines the structures of preferences in more detail. The choices made by the respondents in the choice experiment were the basis for the division into different segments. In individual segments, consumers are grouped and show similar preferences. The division into segments is based on individual part-worth utilities of attribute levels (Sawtooth Software, 2013).

To describe the latent classes, psychographic constructs and suitable items were selected based on a literature review. Adapting items from previous studies to specifically ask about attitudes towards cannabis as a recreational product and the topic of cannabis. Items with the highest factor loadings in the studies were selected for the survey in the presented study. A minimum of three items and a maximum of eight items were selected for each construct. The reference publication is provided for each construct.

Initially, the interview version of the alcohol use disorder identification test was used. It refers to alcohol but has also been applied and adjusted for cannabis consumption and cigarette consumption. The consumption regularity of alcohol, cannabis, and cigarettes were asked through three items each on a related five-point scale (scale to evaluate substance use), based on Babor, Higgins-Biddle, Saunders and Monteiro (2001), which is shown in Table 2.

In the following, the weekly budget available for stimulants (alcohol, cigarettes, or cannabis products) was asked.

In 2013, Haws and Winterich used a Likert scale with an uneven number of points, enabling respondents to express indifference while assessing health awareness. Based on this, we applied a five-point Likert scale ranging from fully disagree to fully agree, which can be viewed in Table 8 (Haws & Winterich, 2013). Furthermore, we utilized an instrument to assess a person's spirituality from 2019, used by Werner, Spiller and Meyerding (2019). The way we determined a person's environmental awareness was derived from Schuhwerk and Lefkoff-Hagius (1995). To determine why respondents consumed cannabis, their leading occasions were queried by eight items. The items are from Woicik, Stewart, Pihl and Conrod from an article from 2009 about substances in general, recreational and medical (Woicik, Stewart, Pihl & Conrod, 2009). Modified from the original from 2017 by Gunarathne, Hemmerling, Krestel, Zühlsdorf and Spiller (2017), the use of cannabis in company was examined in closer detail. The importance of the future is determined by each respondent on a five-point Likert scale measuring agreement via the items by Piyusch's prudence from

Items and levels used for Cannabis-related lifestyle assessment.

Item	Level								
	1	2	3	4	5				
Scale to Evaluate Substance Use (Alcohol/Cannabis/Cigarette Consumption Regularity) (Babor, Higgins-Biddle, Saunders & Monteiro, 2001)									
How often do you consume the mind-altering substance?	Never	Once a month or rarer	2-4 times a month	2–3 times a week	4 times or more a week				
How many units of it on a typical day?	0–2	3–5	6–8	9–11	More than 11				
I am consuming it with others.	Never	Rarer than once a month	Once a month	Once a week	Daily or almost daily				
Mannheim Craving Scale (MaCS) (Cannabis Craving) (Nakovics, Diehl, Geis	elhart & Mann,	2008)							
During the past seven days, how strong was your craving for cannabis (the desire for it while not using) on average?	Very weak	Weak	Neutral	Strong	Very strong				
Please think back to the moment within the last seven days when the craving for cannabis was strongest. How strong was this craving?									
During the past seven days, how often did you have cravings for cannabis (the desire for it while not using)?	Not at all	Rarely	Occasionally	Often	Very often				
Likert Scale Measuring Agreement (All Remaining) (Springer Lehrbuch Psychologie, 2023)									
All Remaining	Fully disagree	Disagree	Neither agree nor disagree	Agree	Fully agree				

Note. To see all constructs and items view table Results of Factor Analysis.

#### Table 3

Summary of sociodemographic analysis.

Variable	Description	Sample frequency (	Sample Share) $N = 193$	Share in % Germany*
Gender	Female	88	(45.6 %)	50.7
	Male	102	(52.8 %)	49.3
	Other	3	(1.6 %)	0
Age in years	18–29	60	(31.1 %)	19.8
	30–39	54	(28.0 %)	19.4
	40–49	35	(18.1 %)	18
	50–59	33	(17.1 %)	23.7
	60–69	11	(5.7 %)	19.1
Marital status	Single	112	(58.3 %)	43.4
	Married	53	(27.6 %)	42.3
	Widowed	5	(2.6 %)	6.7
	Divorced	22	(11.5 %)	7.6
Level of education	No graduation	0	(0.0 %)	4.1
	ESA	10	(5.2 %)	3.5
	MSA	37	(19.3 %)	28.6
	ABI	130	(67.7 %)	23.5
	UNI	15	(7.8 %)	33.5
Gross income in Euros per month	< €1000	61	(31.8 %)	1.1
	€1000 - €2000	46	(24 %)	10.8
	€2000 - €3000	28	(14.6 %)	26.5
	€3000 - €4000	24	(12.5 %)	25.2
	€4000 - €5000	20	(10.4 %)	14.9
	> €5000	13	(6.8 %)	21.6

*Note.* ESA = Erster Schulabschluss Allgemeinbildend (first general school leaving certificate); MSA = Mittlerer Schulabschluss Allgemeinbildend (intermediate general school leaving certificate); Fachabitur/Abitur = Fachgebundenes Abitur/Allgemeine Hochschulreife (subject bound a-levels/a-levels); UNI = University; \*Source: Census data in the version of the 31 May 2022 (Statistisches Bundesamt (Destatis) 2023), except for the gross income (Rudnicka, 2022) and the level of education (Bildungsberichterstattung, 2020).

2010 (Piyusch, 2010). Lastly, craving for cannabis was examined more closely, with the Mannheim Craving Scale (MaCS) shown in Table 2 (Nakovics et al., 2008). Factor analysis was conducted using Principal Component Analysis (PCA) as the extraction method and Varimax rotation with Kaiser Normalization to identify latent factors representing psychographic constructs. PCA reduces dimensionality by transforming the data into components that capture the maximum variance, simplifying complex relationships among observed variables. The Varimax rotation redistributes this variance, enhancing the clarity of the factor structure by encouraging strong loadings on a single factor, which improves interpretability. Kaiser normalization ensures that factors remain on the same scale throughout the rotation process, resulting in a balanced and comprehensible factor solution.

Furthermore, what was agreed upon in an expert interview and suggested in previous research was the importance of investigating preferences concerning educational measures related to cannabis products. For this purpose, 11 statements were drafted, which helped examine the importance of the following topics: trained staff, provision of information in digital and analogue form, information on ingredients, information on the origin, information on warnings, provision of contact details, service hotline, age control, targeted approach to risky cannabis usage, and education on harm-reduced forms of use. These were measured using a five-point Likert scale.

# 3. Results

#### 3.1. Sample description

First, the collected data were analyzed using sociodemographic patterns, as shown in Table 3. A total of 193 respondents aged over 18 years were considered. When comparing the sociodemographic characteristics of the sample to the German population, it is apparent that

respondents having a-levels for their highest level of education are overrepresented as well as the respondents not identifying as men or women, whereas other levels of education are underrepresented. While salaries below  $\notin 1000$  and  $\notin 1000-\notin 2000$  are overrepresented, higher incomes are underrepresented, just as younger singles are overrepresented.

#### 3.2. Results of the hierarchical bayes model

The Hierarchical Bayes model was used to determine the average preference of each survey's respondents in terms of price, packaging, label, effect type, and effect strength. The columns in Fig. 2 illustrate the estimated part-worth utilities for each level in the relevant attribute. A higher part-worth utility represents a greater benefit for consumers. In turn, this indicates a greater likelihood of purchasing a product with this attribute level. The lowest part-worth utility was set to zero in each attribute, except for the attribute label in which the no-label level was set to zero, which was implemented to achieve better comparability of the level effects.

The average respondent preferred a mix of calming flowers with an effect strength of 10 % or 15 % THC packaged in an organic labelled glass jar available for the price per g cannabis flower of  $\in$ 10.

Among the labels with the lowest part-worth utility, the premium label (-6.05) is not only the least favored, but even evaded by the surveyed. The level with the highest part-worth utility is the price per g of cannabis blossoms of  $\in$ 10 with a part-worth utility of 77.37. The attribute price per cannabis flower g has the second lowest importance to the surveyed (19.37 %). The highest relative importance was attributed to the effect (25.94 %), effect strength (23.95 %), and packaging (20.54 %). For the type of effect and packaging, the level with the highest part-worth is by far the highest in the respective attribute compared to the effect strength highest levels, 10 % to 20 % THC, which are all almost equally popular.

Generally, the surveyed respondents saw a benefit in choosing among the offered mix of particular attributes opposing the no-purchase option. This indicates that the attributes appealed to the surveyed overall, except for the premium level from the attribute label. While not all survey respondents avoid the premium it scores drastically lower part-worths than all other labels in all surveys, being comparably desirable to applying no label at all. The highest price was unpopular. The most important attributes overall are the type of effect and the effect strength. Regarding the type of effect, very calming and neutral generally have the lowest part-worths inside their attribute, while the calming and stimulating effects rank as the most well received.

# 3.3. Results of the latent class analysis

In the literature, it is not clear which is the best criterion for determining how many segments should be defined. The consistent Akaike information criterion (CAIC) is the most widely used criterion for deciding the number of reasonable segments. It was proposed by Bozdogan (1987) and is closely related to the log likelihood. Smaller values of the CAIC are preferred (Louviere, Flynn & Carson, 2010). Furthermore, the Bayesian information criterion (BIC) and Akaike information criterion (AIC) are common tools; Nylund et al. (2007) concluded that BIC and CAIC are appropriate instruments to determine the number of segments. However, in every statistical analysis, the researcher should carefully consider the practical aspects of class sizes. Table 4 lists the aforementioned criteria for two to five-class solutions. BIC decreases until the four-class solution. The CAIC also decreases until the four-class solution. Each low point may indicate an inflection mark because all following CAIC and BIC begin to increase.

This suggests that the four-class solution should be applied. Nevertheless, because of the small class sizes resulting from the four-class solution, the three-class solution was used. The results of the LCAs for the three-class solutions are presented in Table 5. The respondents were each into segments with similar utilities based on their choices in the choice experiment (Sawtooth Software, 2004). Again, to achieve better comparability of the level effects, the lowest part-worth was set to zero in each attribute group, except for the attribute group label, in which the no-label option was set to zero. At the end of every table, the relative importance provides an idea of the overall influence of each attribute in a particular segment.

The name of the first segment is Otto Normal Consumers (ONC), as its part-worth utilities are in line with the average preferences of Germans, since it is the largest among all the segments, making up 63.7 % of the respondents. The Otto Normal Consumer is defined as an average German citizen and is often referred to as the Average Joe. Overall, the highest importance has the effect (strength), THC content, and type of effect. A medium to high THC content of 15–20 % is preferred, but a

# Table 4

Number of Latent Classes	Log- Likelihood	AIC	CAIC	BIC	Average Max. Membership Probability in %
2	-2784.14	5654.28	5944.43	5901.43	97.7
3	-2669.36	5468.71	5907.30	5842.30	97.4
4	-2572.68	5319.35	5906.40	5819.40	95.1
5	-2515.10	5248.19	5983.68	5874.68	94.9



Fig. 2. Part-worth utilities for purchase of flowers (N = 193).

Part-worth utilities (zero-based) for different consumer segments.

Attribute	Level	Whole Flowers Sample (100 %, $N = 193$ )	Otto Normal Consumer (63.7 %, $N = 123$ )				Light and (21.9 %,	Soothing $N = 42$ )	Cheap an (14.4 %,	d Hard N = 28)
		Part-Worth Utility								
Effect (strength)	5 % THC	0	0	а	0	b	0	а		
	10 % THC	38.54	52.66	ab	6.48	b	24.65	а		
	15 % THC	38.24	58.21	b	-6.19	b	17.14	а		
	20 % THC	36.85	57.84	b	-25.9	а	38.76	b		
	25 % THC	21.4	48.26	b	-59.23	а	24.38	b		
Type of effect	Very calming	5.92	-12.44	а	69.55	b	-8.86	а		
	Calming	49.82	34.49	b	119.18	с	13.18	а		
	Neutral	0	0	а	0	а	0	а		
	Stimulating	26.45	33.15	b	-5.3	а	44.67	b		
	Very stimulating	15.65	32.92	b	-52.59	а	42.12	b		
Price per gram cannabis flower	€10	77.37	78.78	а	51.51	а	109.97	а		
	€12	70.31	70.76	а	42.96	а	109.39	b		
	€14	44.14	47.69	b	14.14	а	73.54	b		
	€16	23.73	24.1	ab	13	b	38.16	с		
	€18	0	0	b	0	с	0	а		
Label	Organic	14.66	9.54	а	23.17	b	24.4	b		
	Vegan	11.15	16.33	b	-0.1	ab	5.28	а		
	Premium	-6.05	3.16	b	-25.68	а	-17.05	а		
	Carbon footprint	11.83	14.52	ab	1.24	а	15.89	b		
	No label	0	0	а	0	b	0	ab		
Packaging	Opaque plastic foil	0	0	а	0	а	0	а		
	Plastic tin	4.89	3.51	а	11.73	а	0.64	а		
	Metal can	47.04	44.46	b	68.69	b	25.94	а		
	Glass jar with packaging	45.39	39.13	а	65.79	b	42.27	ab		
	Glass jar	71.32	65.1	а	75.43	а	92.47	b		
None	No purchase	-20.3	-63.27	а	-1.02	b	139.05	с		
Relative Importance (%)										
Effect (strength)		23.95	25.43	b	19.67	а	23.91	ab		
Type of effect		25.94	23.99	а	36.15	b	19.17	а		
Price per gram cannabis flower		19.37	20.38	b	13.05	а	24.45	b		
Label		10.19	9.74	а	10.83	а	11.22	а		
Packaging		20.54	20.46	а	20.3	а	21.25	а		

Note. Superscripts stand for significant mean differences at the 0.05 level based on tukey testing.

slightly higher or lower content is still often chosen. Regarding the type of effect, the levels of 'calming' and 'stimulating' are both popular, even though the level of calming is the least popular. The ONC prefers the cheapest price per g of €10 most, and as the price increases, its respective popularity decreases. However, they prefer dried flowers to be packaged in a glass jar. Here, additional outer packaging of the cart board is not favored. The labels with the highest part-worth utilities are vegan, carbon footprint, and organic. Overall, the ONC liked the presented options and choose from among them instead of the no-purchase option.

The second segment is Light and Soothing (21.9% of the sample). For this segment, the attribute effect is clearly the most important. Unlike the other segments, the level stimulating as well as strongly stimulating products are least appealing to them and they prefer a calming effect at an effect strength of 10% THC. Any higher THC content in this segment will choose the no-purchase option. Therefore, they prefer soothing cannabis with a light effect strength packaged in a glass jar or metal can. In terms of price, the highest part-worth utility has the lowest price per g at  $\in$ 10. They preferred the label organic.

In the third-segment effect and price were the most important attributes. The preferred price per g was low, with a level of  $\notin$ 10, scoring the highest part-worth utility in total, whereas the attribute effect had the highest part-worth utility for the 20 % THC level. This leads to the name Cheap and Hard (14.4 % of the sample). The name is further supported by the segment's preference for a stimulating or strongly stimulating type of strain, even disliking the very calming level most. Compared to the other two segments, the part-worth utility of the glass jar level is higher for Cheap and Hard consumers. Finally, the Cheap and Hard segment sees in the attribute label the greatest part-worth utility at the organic level. Altogether, they are prone to not choosing among the choices offered. This indicates that either option did not appeal to them overall, or that they were disagreeable and chose nothing rather than compromise.

#### 3.4. Results of socio-demographic variables for estimated segments

At the beginning of the questionnaire, respondents were asked about sociodemographic variables, such as gender, age, marital status, level of education, and income. Table 6 shows the results of the sociodemographic parameters for the segments resulting from the LCA.

The gender distribution in the sample segments was approximately 2:3. In the Otto Normal Consumers and the Cheap and Hard segments, two parts are female, and three parts are male. These roles are reversed in the Light and Soothing segments. The only segment featuring respondents identifying as another gender than males and females is the Otto Normal Consumers, who additionally stand out in the category age.

Segments differ in their respective share of older members. Whereas the Light and Soothing as well as the Cheap and Hard segments have a share of around 11 % of 60 to 69 years old participants, the Otto Normal Consumers only have a share of 2.4 %. Therefore, the Otto Normal Consumers are younger on average (36.1 years) than the members of the Cheap and Hard segment by one year and by just under four years compared to the oldest segment, Light and Soothing (39.8 years old on average). Across all segments, the share of respondents declines with an increase in the segment members' age.

Regarding marital status, most members, more than half of the respective segments are single, more than one-fifth are married, and the divorced are more than one-tenth of the sample. The share of segment members differs in terms of being widowed. The Light and Soothing consumers have the largest share of widows nearing 5 %, the Otto Normal Consumers the second largest with a share of 2.4 %, Cheap and

Frequency distribution of sociodemographic attributes for latent class segments.

Sociodemographic Attribute	Level	Flowers Sample ( $N = 193, 32.7 \%$ )					
		Otto Normal Consumer (63.7 %, $N = 123$ ) Light and Soothing (21.9 %, $N = 42$ )		= 42) Cheap and Hard (14.4 %, <i>N</i> =			
		Samj	ple Frequency (Sample Share)				
Gender	Female	50	(40.7 %)	27	(64.3 %)	11	(39.3 %)
	Male	70	(56.9 %)	15	(35.7 %)	17	(60.7 %)
	Other	3	(2.4 %)	0	(0.0 %)	0	(0.0 %)
Age in years	18 - 29	39	(31.7 %)	12	(28.6 %)	9	(32.1 %)
	30 - 39	35	(28.5 %)	10	(23.8 %)	9	(32.1 %)
	40 - 49	23	(18.7 %)	7	(16.7 %)	5	(17.9 %)
	50 - 59	23	(18.7 %)	8	(19.0 %)	2	(7.1 %)
	60 - 69	3	(2.4 %)	5	(11.9 %)	3	(10.7 %)
Marital status	Single	73	(59.8 %)	22	(52.4 %)	17	(60.7 %)
	Married	32	(26.0 %)	13	(31.0 %)	8	(28.6 %)
	Widowed	3	(2.4 %)	2	(4.8 %)	0	(0.0 %)
	Divorced	14	(11.4 %)	5	(11.9 %)	3	(10.7 %)
Level of education	No graduation	0	(0.0 %)	0	(0.0 %)	0	(0.0 %)
	ESA	7	(5.7 %)	2	(4.8 %)	1	(3.6 %)
	MSA	24	(19.7 %)	9	(21.4 %)	4	(14.3 %)
	Fachabitur/Abitur	80	(65.0 %)	30	(71.4 %)	20	(71.4 %)
	UNI	11	(8.9 %)	1	(2.4 %)	3	(10.7 %)
Gross income in Euros per month	< 1000	38	(31.1 %)	14	(33.3 %)	9	(32.1 %)
-	1000 - 2000	28	(23.0 %)	11	(26.2 %)	7	(25.0 %)
	2000 - 3000	21	(17.2 %)	5	(11.9 %)	2	(7.1 %)
	3000 - 4000	12	(9.8 %)	6	(14.3 %)	6	(21.4 %)
	4000 - 5000	15	(12.3 %)	4	(9.5 %)	1	(3.6 %)
	> 5000	8	(6.6 %)	2	(4.8 %)	3	(10.7 %)

*Note.* ESA = Erster Schulabschluss Allgemeinbildend (first general school leaving certificate), MSA = Mittlerer Schulabschluss Allgemeinbildend (intermediate general school leaving certificate), Fachabitur/Abitur = Fachgebundenes Abitur/Allgemeine Hochschulreife (subject bound a-levels/a-levels), UNI = University.

Hard consumers do not have widowed members.

The Otto Normal Consumer have a smaller share of a-level graduates than the other segments. The Light and Soothing consumer has the highest share of members with a first general and intermediate schoolleaving certificate, as well as the same number of a-level graduates, whereas their university student share is the lowest with a larger difference of 6 % to the other segments, while the Cheap and Hard segments have the lowest share of graduates with an intermediate general school-leaving certificate.

Across the segments, the lowest income ( $\leq \notin 1000$ ) was the most prevalent, with a share of approximately 32 %. The highest gross income

is in the Otto Normal Consumers segment (> €4000), and Light and Soothing consumers earn the lowest income (> €2000). Cheap and Hard consumers have a midrange income (€2000 to €4000). The distribution of male and female members was most unbalanced in the survey. Therefore, logically, one segment has more female (Light and Soothing), and another more male (Cheap and Hard) members. The sample has a large share for divorced members, over 10 %. Looking at the attribute level of education, all segments deviate strongly from the German average.

#### Table 7

Respondents' preferred clarification measures for cannabis usage.

Option for Clarification Measure		Flowers Sample ( $N = 193$ )									
		Sample , <i>N</i> =	Otto No Consun $N = 12$	Otto Normal Consumer (63.7 %, N = 123)		Light and Soothing (21.9 %, $N = 42$ )			Cheap and Hard (14.4 %, <i>N</i> = 28)		
	Mean	SD	Mean	SD		Mean	SD		Mean	SD	
It is important to me to have <i>staff trained by specialized agencies</i> , with knowledge in the handling, different effects and possible dangers of cannabis.	3.87	0.943	3.78	0.932	а	4.10	0.932	a	3.93	0.979	a
Providing a <i>guide</i> regarding handling, different effects and possible dangers in <i>digital</i> form is important to me.	3.87	1.053	3.81	1.039	а	4.07	1.022	а	3.82	1.156	а
Providing a <i>guide</i> regarding handling, modes of action and possible dangers in <i>analogue</i> form is important to me.	3.44	1.152	3.38	1.145	а	3.48	1.234	а	3.68	1.056	а
The list of ingredients and indication of concentration regarding the active substances on the product packaging are important to me.	4.32	0.920	4.26	1.019	а	4.43	0.703	а	4.39	0.737	а
The indication of the origin of the products as well as origin and quality standards on the product packaging are important to me.	4.24	0.855	4.26	0.873	а	4.14	0.783	а	4.29	0.897	а
The inclusion of warnings on product packaging are important to me.	3.46	1.277	3.25	1.289	а	4.05	1.011	b	3.46	1.347	ab
I consider the provision of contact details of qualified counseling centers and treat-ment facilities for addiction patients to be essential ( <i>referral to adequate help centers</i> ).	3.94	1.052	3.84	1.086	а	4.10	1.122	a	4.14	0.705	а
A 24/7 service hotline is important to me.	3.07	1.254	2.99	1.269	а	3.17	1.305	а	3.25	1.110	а
I consider age and other access restrictions are essential.	4.43	0.829	4.39	0.904	а	4.64	0.533	а	4.32	0.819	а
Targeting risky cannabis use by staff is important to me.	3.71	1.124	3.60	1.088	а	4.10	1.078	а	3.64	1.254	а
To me, education about harm minimized forms of consumption, such as vapes and edibles, is important	4.04	0.920	3.98	0.949	а	4.07	0.921	a	4.29	0.763	а

*Note.* Items were assessed by means of likert scales (1 =totally disagree; 5 =totally agree). Superscripts stand for significant mean differences at the 0.05 level based on tukey testing within each product group inbetween the groups respective segments.

Results of the factor analysis of the flowers survey (N = 193).

Metalon of angle indiability dar Kaiser Mayer Note Note Note Note Note Note Note Note	Factor and the Corresponding Variables	Mean	SD	Factor Loading
spiritore      accord to sumple divelation 2001 ("Combach's Alpha: 0.726)      1.4      1.04      0.08        How ofted do you have six ormer drinks on ene coccision ex dimer or party, etc.?      1.54      0.73      0.63        How made divela containing alcohol?      1.04      1.04      0.08        Row made you have six or more drinks on ene occision ex divela divela (byou are drinking)?      1.04      1.04      0.05        Row made you have six or more drinks on ene occision ex divelation of you are on a typical divela (byou have on a	Measure of sample suitability after Kaiser-Meyer-Olkin 0.684			
Accole Consumption Requirity (Balor, Higgsm Biddle, Saunders & Montein, 2001 (Corobach's Alpha: 0.720)      1.49      0.908        How often dy out have a of mixe of mixing alcohol?      1.54      0.53      0.83        How nay drike scalaniang alcohol?      1.54      0.750      0.750        Consume view in a roadia canabia serve.      0.60      1.547      0.750        How not drike scalaniang alcohol dy on have on a typical dy, Hyou are drinking?      0.61      1.547      0.750        How not drike scalaniang alcohol dy on have on a typical dy, Hyou are drinking?      0.750      1.547      0.750        How not drike scalaniang alcohol dy on have on a typical dy, Hyou are drinking?      0.750      1.770      0.712        Generet Counterphy smole (Gaparettes, cigniflos, File, hookah?      1.770      0.712      0.820        How mary diancettes or esplicitad Myore Mixe and anyone scalaniang alcohol dy on have on a versage per dry?      1.701      1.712      0.820        Begin for Canabia/Stohen Hyore Mixe and Nyore Mix	Significance according to Bartlett 0.000			
How other do you have a site or more drinks on one occasion eq dinner or party, etc.?      2,14      1,040      0.081        How other do you have a drink containing alcohol do you have on a typical day, if you are drinking?      1,64      0.883        How many utic for contable (identic-lice) (itegrine-lice) (identic-lice) (ide	Alcohol Consumption Regularity (Babor, Higgins-Biddle, Saunders & Monteiro, 2001) (Cronbach's Alpha: 0.726)			
How one do use a entrine containing actional by color as a typical day. if you are drinking?3.646.2950.693Cannable Scansurgiton Regularity (Galor, Higgins Biddle, Sanders & Marteiro, 2001) (Cronbach's Alpha: 0.780)5.690.8000.8000.708How namy drinks for cannable (Galor, Squillos, Bay, hookab)?2.691.540.7940.794How oten of you consume cannable, (Easter Higgins Biddle, Sanders & Marteiro, 2001) (Cronbach's Alpha: 0.829)8.770.410.81How oten of you consume cannable, (Easter Higgins Biddle, Sanders & Marteiro, 2001) (Cronbach's Alpha: 0.829)8.770.4120.822How may digretter or explicited on you smale (an average per day?2.691.7571.4120.822Nearow of sample was digretter or explicited on you smale on average per day?3.640.8530.862Reget for Cannable Color Explication (Consults (Son Work)5.771.4120.8530.853To massally avance of sample adaptic (Signetter Scannable products)3.940.8530.8530.853Par avera of the state of my health as 1go through the day.3.940.8510.8530.853Par avera of the state of my health as 1go through the day.1.840.8700.8530.853Par avera of the state of my health as 1go through the day.1.840.8700.8530.853Par avera of the state of my health as 1go through the day.1.840.8700.8530.853Par avera of the state of my health as 1go through the day.1.840.8700.853Par avera of the state of my health as 1go	How often do you have six or more drinks on one occasion eg dinner or party, etc.?	2.14	1.040	0.908
How may dink containing acobid do you have on a typical day, if you are drinking, 2001 (Combach's Alpha: Combas)1,540,693I comands (Goins/Guine) (Goins/Guine) (Goins (Goins) (Goi	How often do you have a drink containing alcohol?	3.04	1.235	0.813
Cannabic Consumption Requiring Calsor, Highen-Biddle, Saunders & Montelro, 2001 (Cronbach's Alpha: 0.780      1.49      1.54      0.880        How many utils of cannabic (cloins/cquirialent) do you have on a typical day when you are consuming?      1.60      0.500      0.708        How many utils of cannabic (cloins/cquirialent) do you have on a typical day when you are consuming?      2.54      1.817      0.941        Is mode to consume cannabic?      2.54      1.817      0.941        Is mode to consume cannabic?      2.54      1.817      0.942        Is mode to many mode (caparette, consumble on average per day?      1.64      0.982        Pages for Cannabic? Other Intorications (clooN bach's Alpha: 0.810)      1.827      0.962        Pages for Cannabic? Other Intorications (clooN bach's Alpha: 0.810)      1.837      0.962        To masually avera of my health at 1go through the day.      3.94      0.833        To masually avera of my health at 1go through the day.      1.830      0.853        To masually avera of my health at 1go through the day.      1.830      0.853        To masually avera of my health at 1go through the day.      1.830      0.853        To masually avera of my health at 1go through the day.      1.830      0.853        To masually	How many drinks containing alcohol do you have on a typical day, if you are drinking?	1.54	0.799	0.693
i consume when i am around cannabis users.      2.69      1.54      0.549        How mary units of cannabis (gints-fliggins-Biddle, Saunders & Monteiro, 2001) (Combach's Alpha: 0.929)      0.900      0.708        I mode when i am around smokes.      2.59      1.817      0.941        I mode when i am around smokes.      2.59      1.817      0.941        I mode when i am around smokes.      2.59      1.817      0.941        I mode when i am around smokes.      1.97      1.412      0.892        How mary units of the show of my of the day on smoke on average per day?      1.97      1.412      0.892        How mary units of the show of my of the day on smoke on average per day?      1.97      1.412      0.892        Masare of simple hand Mayor On the of the show of my of the day.      3.94      0.830      0.831        T m avera of the state of my health.      3.94      0.830      0.832        T m avera of the state of my health al to through the day.      1.97      1.240      0.897        T consider myself a spirituality (Warene, Spiller & Alberto 7.97)      1.940      0.830      0.831        T consider myself a spiritual person.      2.51      1.307      0.532        U consid	Cannabis Consumption Regularity (Babor, Higgins-Biddle, Saunders & Monteiro, 2001) (Cronbach's Alpha: 0.750)			
How name y units of cannabis (joints/equivalent) do you have on a typical day when you are consuming?      1.49      0.59      0.59        Cigarette Consumption Regularity (lishor, liggine, Biddle, Sanders & Monteiro, 2001) (Cronbach's Alpha: 0.592)      0.50      0.50        I mode when I am around smokers, cigaritles, pipe, hoskhi?      2.46      1.70      0.292        How may cigarette or equivalent do you smoke on average per day?      1.412      0.592        Baget for Cannabis/Other Intoxicents (Work)      5.77      1.412      0.592        Coronschr 1 Alpha: Not Application      5.77      0.562      0.562        Test data action of the bala.      0.504      0.583      0.583        In wave of the state of my health.      0.510      0.522      0.562        In wave of the state of my health.      0.510      0.522      0.562        In wave of the state of my health.      0.510      0.522      0.563        In a wave of the state of my health.      0.510      0.522      0.563        In a wave of the state of my health.      0.510      0.532      0.563        In a wave of the state of my health.      0.510      0.532      0.532        In a wave of the state of my health.      <	I consume when I am around cannabis users.	2.69	1.546	0.880
How one do you coassnee cananbis?3.060.9000.708De you currently snoke (igarettes, cigaritles, Biddle, Saunders & Monterio, 2001) (Conbach's Alpha: 0.929)2.591.8170.941Is snoke when I am around snokes.2.591.8170.9410.928How many cigarettes or equivalent do you snoke on average per day?1.971.4120.892How many cigarettes or equivalent do you snoke on average per day?1.971.4120.892Significance according to Barlant 0.000Bardar 6.0043.940.50921.70230.962Health Avareness (lisses & Winterich, 2013) (Conbach's Alpha: 0.810)0.8030.8330.8330.833I'm avare of the state of my health a I go trough the day.4.030.8060.8430.833I'm aver of the state of my health a I go trough the day.1.971.2400.897I consider myself a religious person.1.861.3000.8730.833I consider myself a religious person.1.861.3000.8730.831I consider myself a religious person.1.861.3000.8500.9110.860I and concernado pictor botte the environment.3.900.8610.8600.9110.860I and concernado pictor botte the environment.3.900.8610.8600.9110.860I consider myself a religious person.1.860.9110.8600.9110.860I consider myself a religious person.1.990.8610.8600.9110.860I consider myself a religious inpac	How many units of cannabis (joints/equivalent) do you have on a typical day when you are consuming?	1.49	1.347	0.794
Cignetic Consumption Regularity (Eshor, Higgins Middle, Sander's & Monteiro, 2001) (Cronbach's Alpha: 0.492)      1.57      0.91        I mono vig cargent gamile, signe, hookah?      2.50      1.57      0.921        How may cigner, cignalins, pipe, hookah?      1.97      1.702      0.921        Measure of sample sainability cifer Kaiser-Meyr-Olkin 0.694      500      1.722      0.892        Significant excording to Rartie to 000      East      East      Version 1.000        East for Cannabis/Other Intoxicants (Own Work)      Circonaber's Alpha: Not Applicabl?      Version 1.000        Ensith Avarences (Linsy & Winterfor, 2013) (Cronbach's Alpha: 0.810)      Interformation 1.000      0.853        Ensith avare of the state of my health. 31 p0 through the day.      1.00      0.751      0.822        Ensith avarence of the state of my health. Signer gadance.      1.17      0.843      0.873        Ensith avarence of the state of my health as 10 through the day.      1.100      0.751      0.851        Ensith avarence of the state of my health as 100 through the day.      1.100      0.866      0.751        Ensith avarence of the state of my health as 100 through the day.      0.871      0.873      0.873        Ensithowarence of state of my health as 100 through the d	How often do you consume cannabis?	3.06	0.900	0.708
Do you currently anoke (digarenties, cigarillos, pipe, hookal)?      2.45      1.57      0.491        Isnoke when 1 am around smokers.      2.46      1.77      1.412      0.892        How many cigarenties or equivalent do you smoke on average per day?      1.97      1.412      0.892        Significance according to Borlett 0.000      Borlett 0.000      1.972      1.972      0.962        Combach's Alpha: Not Applicable)	Cigarette Consumption Regularity (Babor, Higgins-Biddle, Saunders & Monteiro, 2001) (Cronbach's Alpha: 0.929)			
i moke when i am around smokers.      2,46      1.704      0.703        How many cigneritors or quivalent do you smoke on average per day?      1.97      1.412      0.892        Measure of sample suitability effer Kader-Meyer Okin 0.694      Significante according to Barlett 0.000      1.412      0.892        Bage for Cannabis/Other Intoxicants (Oron Work)      UCronbech's Alpha: Not Applicable)      0.902        — (Wreck for intoxicants (alcohol/cigarettes/cannabis products)      4.03      0.805      0.833        I'm anaware of the sate of my health. 31 go through the day.      4.03      0.806      0.833        I'm aware of the sate of my health. 31 go through the day.      1.304      0.873      0.863        I'm aware of the sate of my health. 31 go through the day.      1.86      1.307      0.763        Spirituality (Wrener, Suller & Meyerding, 2019) (Orobach's Alpha: 0.791)      1.300      0.873        I'consider myself a spirituality ofter Kaiser-Meyer-Okin O.783      0.861      1.307      0.763        Spirituality (Wrener, Suller & Meyerding, 2019) (Morobach's Alpha: 0.791)      1.86      1.307      0.863        I'a maxing and make satrifices to proter the environment.      3.95      0.911      0.860        Spirituality (Wrener, Suller & Mey	Do you currently smoke (cigarettes, cigarillos, pipe, hookah)?	2.59	1.817	0.941
How many cigareties or quivalent do you snake on average per day?      1.97      1.412      0.892        Measure of sample suitability dip Kaiser-Mayer-Olikin 0.664      Significance according to Borthett 0.000      5        Barget for Cannabis/Other Intoxicants (Goub)/cigaretters/cannabis products)      6.90      217.023      0.962        Fault Mayareness (Have & Winterich, 2013) (Cronbach's Alpha: 0.810)      3.94      0.830      0.853        I'm usually avare of my health as 1 go through the day.      4.03      0.860      0.843        I'm aler to changes in my health as 1 go through the day.      1.77      1.240      0.897        I consider myself a religious person.      1.86      1.300      0.873        I consider myself a religious person.      1.86      1.300      0.763        Segrificance according to Alpha: 0.797)      1.86      1.300      0.860        Enavisiting meass (schulthwerk & Leftorf Hagius, 1995)      1.300      0.861      0.840        My actous impact the environment.      3.95      0.911      0.860        I an willing to nake scriffects to protect the environment.      3.95      0.811      0.860        I and concerned about the environment.      3.95      0.811      0.860	I smoke when I am around smokers.	2.46	1.704	0.928
Measure of sample suitability after Kaiter-Mayer-Okin 0.694      Septificance conding to Bordine 10.000        Septificance conding to Bordine 10.000      Seture 10.0000      Seture 10.0000      Seture 10.0000<	How many cigarettes or equivalent do you smoke on average per day?	1.97	1.412	0.892
Significance according to Bardiet 0.000      Server Constants (Over Morch)      Server Constants (Over Morch)        Correct Introducting (according to Bardiet 2.03) (Consbach's Alpha: 0.810)      Server Constants      Server Constants        In usually avant of the state of my health as 1 go through the day.      A.03      0.860      0.843        I'm aver of the state of my health as 1 go through the day.      A.03      0.860      0.843        Spirituality (Wener, Spiller & Meyerding, 2019) (Consbach's Alpha: 0.791)      I avait of the state of my health as 1 go through the day.      1.7      1.440      0.837        I consider myself a religious person.      1.66      1.300      0.873        I consider myself a religious person.      1.66      1.307      0.763        Suprificance according to Alpha: 0.797      1.840      0.897      0.763        Suprificance according to Alpha: 0.797      I avait of the environment.      0.60      0.811      0.860        I an willing to make sacrifices to protect the environment.      3.95      0.911      0.860        I and willing to make sacrifices to protect the environment.      2.90      0.880      0.870        I and willing to make sacrifices to protect the environment.      2.90      0.860      0.810 </td <td>Measure of sample suitability after Kaiser-Meyer-Olkin 0.694</td> <td></td> <td></td> <td></td>	Measure of sample suitability after Kaiser-Meyer-Olkin 0.694			
Baget for Cannabis/Other Intosicants (lown Work)      5.09      217.023      0.962	Significance according to Bartlett 0.000			
(Crombach's Alpha: Not Applicable)      6.5.09      217.023      0.662        Health Awareness (Haws & Winterich, 2013) (Crombach's Alpha: 0.810)      3.94      0.833      0.833        I'm avard of the state of my health as 1 go through the day.      4.03      0.806      0.843        I'm alert to changes in my health.      4.09      0.751      0.822        Spiriturity (Werner, Syllier & Meyerding, 2019) (Crombach's Alpha: 0.791)      1.86      1.130      0.873        I consider myself a pitting berson.      1.86      1.307      0.763        Mestarre of somges situability diverse, Syllier & Meyerding, 2019) (Crombach's Alpha: 0.791)      0.861      0.867        I consider myself a pitting person.      1.86      1.307      0.763        Mestarre of somges situability diver Raiser MeyerOlkin 0.783      1.86      0.861      0.860        I am villing to nomets.      3.95      0.911      0.866      0.715        I am villing to make sacrifices to protect the environment.      2.99      0.866      0.715        I am villing to nomek sacrifices to protect the environment.      2.32      1.360      0.832        I am villing to cope with any tifte, Conrod, 2009)      0.851      0.863      0.755	Buget for Cannabis/Other Intoxicants (Own Work)			
	(Cronbach's Alpha: Not Applicable)			
Health Awareness (Elives & Winterich, 2013) (Cronbach's Alpha: 0.810)    3.94    0.830    0.853      I'm avare of the state of my health as 1go through the day.    4.03    0.806    0.843      I'm avare of the state of my health as 1go through the day.    4.03    0.806    0.843      I'm alert to changes in my health.    8.09    0.807    0.807      Spirituality (Werner, Spiller & Meyording, 2019) (Cronbach's Alpha: 0.791)    0.897    0.897      I consider myself a religious person.    2.61    1.307    0.897      I consider myself a spiritual person.    2.61    1.307    0.763      Measure of simplice according to 0.000    Environmental Awareness (Schulwerk & Leftoff-Haglus, 1995)    1    0.860      (Cronbach's Alpha: 0.797)    Iam willing to nake sacrifices to protect the environment.    3.95    0.911    0.860      1 am concerned about the environment.    4.00    0.881    0.840      My actions impact the environment.    4.00    0.810    0.840      My actions ingues the environment.    4.00    0.881    0.840      My actions ingues the environment.    4.00    0.881    0.840      Lues canabis to ope with depression.    2.22    1.372 </td <td>€/Week for intoxicants (alcohol/cigarettes/cannabis products)</td> <td>65.09</td> <td>217.023</td> <td>0.962</td>	€/Week for intoxicants (alcohol/cigarettes/cannabis products)	65.09	217.023	0.962
I'm suare of my health.      3.94      0.830      0.853        I'm avare of my health as 1g on through the day.      4.03      0.806      0.843        I'm avare of the state of my health.      4.09      0.751      0.822        Spirituality (Wrener, Spiller & Meyerding, 2019) (Conobach's Alpha: 0.791)      1      1      0.867        I consider myself a religious person.      1.86      1.130      0.873        I consider myself a religious person.      1.86      1.307      0.763        Measure of sample suitability dire Kaiser-Meyer-Olkin 0.783      Significance according to 0.000      5        Environmental Awareness (Schuhwerk & Lefhoff-Hagius, 1995)      0.891      0.840      0.881      0.840        My actions impact the environment.      3.95      0.911      0.886      0.715        I am concerned about the environment.      3.99      0.896      0.715        The condition of the environment affects the quality of my life.      0.232      1.360      0.683        Consumption to copes with diverses      0.890      0.891      0.4665        Lus cannabis to to ope with axitety.      2.23      1.360      0.631        Lus cannabis to to proventh person. <td>Health Awareness (Haws &amp; Winterich, 2013) (Cronbach's Alpha: 0.810)</td> <td></td> <td></td> <td></td>	Health Awareness (Haws & Winterich, 2013) (Cronbach's Alpha: 0.810)			
In avare of the state of my health as 100 through the day.    4.03    0.896    0.843      In alert to changes in my health.    4.09    0.751    0.822      Spirituality (Werner, Spiller & Meyerding, 2019) (Cronbach's Alpha: 0.791)    1    0.843      There is a God or higher power in my life that gives me guidance.    2.17    1.240    0.897      I consider myself a spilitual person.    2.61    1.307    0.763      Measure of sample situability dire Kaiser-Meyer-Olkin 0.783    5    1.307    0.763      Significance according to 0.000    E    5    5    5      I am villing to make sacrifices to potect the environment.    3.95    0.911    0.860      I am concerned about the environment.    3.99    0.886    0.715      The condition of the environment affects the quality of my life.    4.05    0.951    0.683      Consumption Occasions (Woick, Stewart, Pili & Corrod, 2009)    1    1    1    0.665      I use cannabis to cope with dipression.    2.23    1.324    0.665      I use cannabis to improve my performance.    2.03    1.214    0.665      I use cannabis to cope with dipression.    2.23    1.324    0.654	I'm usually aware of my health.	3.94	0.830	0.853
I'm aler to changes in my health.    4.09    0.751    0.822      Spirituality (Wrener, Spiller & Meyerding, 2019) (Cronbach's Alpha: 0.791)    1.240    0.887      There is a God or higher power in my life that gives me guidance.    1.86    1.130    0.873      I consider myself a religious person.    2.61    1.307    0.763      Measure of sample suitability after Kaiser-Meyer-Olkin 0.783    5    0.911    0.860      Significance according to 0.000    Environmental Awareness (Schuhwerk & Lefkoff-Hagius, 1995)    0.881    0.840      Q(cronbach's Alpha: 0.797)    1    1    0.860    0.881    0.840      My actions impact the environment.    3.99    0.886    0.715    0.683      Consumption Occasions (Woick, Stewart, Phil & Conrod, 2009)    0.822    1.372    0.820      I use cannabis to cope with dariety.    2.32    1.372    0.820      I use cannabis to cope with anxiety.    2.33    1.372    0.820      I use cannabis to cope with anxiety.    2.33    1.372    0.820      I use cannabis to cope with anxiety.    2.33    1.372    0.823      I use cannabis to cope with anxiety.    2.33    1.360    0.769	I'm aware of the state of my health as I go through the day.	4.03	0.806	0.843
Spirituality (Wenner, Spiller & Meyerding, 2019) (Cronbach's Alpha: 0.791)      1.86      1.130      0.873        I consider myself a religious person.      1.86      1.130      0.873        I consider myself a religious person.      2.61      1.307      0.763        Measure of sample suitability after Kaiser-Meyer-Olkin 0.783      5	I'm alert to changes in my health.	4.09	0.751	0.822
There is a God or higher power in my life that gives me guidance.    2.17    1.240    0.897      I consider myself a religious person.    2.61    1.307    0.763      Measure of sample suitability offer Kaiser-Meyer-Okin 0.783    2.61    1.307    0.763      Significance according to 0.000    Environmental Avareness (Schuhwerk & Lefkoff-Hagius, 1995)    V    V    V      (Cronbach's Alpha: 0.777)    I am concerned about the environment.    3.95    0.911    0.860      I an concerned about the environment.    4.20    0.881    0.840      My actions inpact the environment.    4.20    0.881    0.840      My actions inpact the environment.    4.20    0.881    0.840      My actions inpact the environment.    2.99    0.896    0.715      (Consumetion Occasions (Woick, Stewart, Pihl & Conrod, 2009)    V    V    0.832      (Donsumetion Occasions (Woick, Stewart, Pihl & Conrod, 2009)    V    V    0.840      (Lue cannabis to cope with depression.    2.23    1.360    0.759      I consume cannabis to improve my performance.    2.03    1.214    0.665      I use cannabis to reprove my performance.    2.05    1.329	Spirituality (Werner, Spiller & Meyerding, 2019) (Cronbach's Alpha: 0.791)			
I consider myself a spiritual person.      1.86      1.130      0.873        I consider myself a spiritual person.      1.307      0.763        Measure of sample suitability ofter Kaise-Meyer-Olkin 0.783      Significance according to 0.000      1.307      0.763        Environmental Awareness (Schuhwerk & Lefkoff-Hagins, 1995)      1.307      0.763      0.873        I am villing to nake sacrifices to protect the environment.      3.95      0.911      0.860        I am concerned about the environment.      4.20      0.881      0.840        My actions impact the environment.      4.05      0.951      0.663        Consumption Occasions (Woickl, Stewart, Pihl & Conrod, 2009)      (Cronbach's Alpha: 0.842)      1.214      0.665        I use cannabis to cope with anxiety.      2.32      1.307      0.763        I use cannabis to cope with anxiety.      2.32      1.320      0.634        I use cannabis to cope with anxiety.      2.32      1.320      0.634        I use cannabis to cope with anxiety.      2.33      1.214      0.665        I use cannabis to copen with anxiety.      2.33      1.231      0.573        I use cannabis to report anxiet, restel, Zühlsdorf & Spiller, 2017) (	There is a God or higher power in my life that gives me guidance.	2.17	1.240	0.897
I consider myseli a spiritual person.    2.61    1.307    0.763      Measure of symple suitability offer Kaiser-Meyer-Okin 0.783    5    5    5      Significance according to 0.000    5    5    5    5    5      Environmental Awareness (Schuhwerk & Lefkoff-Hagius, 1995)    0.660    0.861    0.860      I am concerned about the environment.    3.95    0.911    0.860      I am concerned about the environment.    3.99    0.896    0.715      The condition of the environment.    3.99    0.896    0.715      The condition of the environment.    2.32    1.372    0.820      Consumption Occasions (Voicik, Stewart, Phil & Conrod, 2009)    0.765    0.765      (Cronbach's Alpha: 0.797)    2.32    1.360    0.769      I use cannabis to cope with diverpression.    2.32    1.372    0.820      I use cannabis to cope with anxiety.    2.33    1.214    0.655      I use cannabis to expond myself.    2.71    1.341    0.575      I consume cannabis to expond myself.    2.71    1.341    0.575      I consume cannabis to expond myself.    2.71    1.341    0.575	I consider myself a religious person.	1.86	1.130	0.873
Measure of sample suitability dire Xaise-Meyer-Okin 0.783      Significance according to 0.000      Environmental Awareness (Schuhwerk & Lefkoff-Hagius, 1995)      (Cronbach's Alpha: 0.797)      I am villing to make sacrifices to protect the environment.    3.95    0.911    0.860      I am concerned about the environment.    4.20    0.881    0.840      My actions impact the environment.    4.05    0.951    0.683      Consumption Occasions (Woicik, Stewart, Phil & Conrod, 2009)    0.881    0.840      (Cronbach's Alpha: 0.542)    2.32    1.372    0.820      I use cannabis to cope with degression.    2.32    1.360    0.769      I consume cannabis to cope with anxiety.    2.36    0.631    0.663      I use cannabis to cope with anxiety.    2.65    1.329    0.634      I use cannabis to inprove my performance.    2.03    1.360    0.769      I use cannabis to expand myself.    1.90    1.81    0.552      I use cannabis to expand myself.    2.71    1.341    0.552      I consume cannabis to be social.    0.90    1.081    0.532      Consumtion in Company (Guanarathne, Hemmerling, Krestel, Zühlsdorf & Spiller, 2017) (Cronbach'	I consider myself a spiritual person.	2.61	1.307	0.763
Significance according to 0.000      Environmental Awareness (Schuhverk & Lefkoff-Hagius, 1995)      I am willing to make sacrifices to protect the environment.    3.95    0.911    0.860      I am concerned about the environment.    3.99    0.896    0.715      The condition of the environment affects the quality of my life.    0.991    0.881    0.840      Ocnsumption Occasions (Woich, Stewart, Phil & Conrod, 2009)    0.891    0.892    0.892      (Cronbach's Alpha: 0.842)    2.32    1.372    0.820      I use cannabis to cope with depression.    2.33    1.214    0.665      I use cannabis to cope with anxiety.    0.634    0.769      I consume cannabis to improve my performance.    2.03    1.214    0.665      I use cannabis for enhancement and improvement.    2.65    1.329    0.634      I use cannabis to expand myself.    2.71    1.941    0.575      I consume cannabis to be social.    1.90    1.830    0.779      Consume cannabis to expand myself.    2.91    1.921    0.532      Consume cannabis to expand myself.    2.91    0.532    0.779      Hoen consume cannabis with friends, the most important part of my soci	Measure of sample suitability after Kaiser-Meyer-Olkin 0.783			
<th< td=""><td>Significance according to 0.000</td><td></td><td></td><td></td></th<>	Significance according to 0.000			
(Cronbach's Apin: 0.797)      3.95      0.911      0.860        I am willing to make sacrifices to protect the environment.      4.20      0.881      0.840        My actions inpact the environment.      3.99      0.896      0.715        The condition of the environment affects the quality of my life.      0.05      0.683        Consumption Occasions (Woicik, Stewart, Pihl & Conrod, 2009)      0.051      0.683        (Cronbach's Alpha: 0.842)      1.372      0.820        I use cannabis to cope with depression.      2.23      1.360      0.769        I use cannabis to cope with anxiety.      2.03      1.214      0.665        I use cannabis for enhancement and improvement.      2.65      1.329      0.634        I use cannabis for enhancement and improvement.      2.65      1.329      0.634        I use cannabis for enhancement and improvement.      2.66      1.329      0.634        I use cannabis to expand myself.      2.71      1.341      0.575        Consumtion in Company (Cumarathne, Hemmerling, Krestel, Zühlsdorf & Spiller, 2017) (Cronbach's Alpha: 0.779      33      1.291      0.765        When I consume cannabis with friends, the most important part of my social life.      2.16 <td>Environmental Awareness (Schuhwerk &amp; Lefkoff-Hagius, 1995)</td> <td></td> <td></td> <td></td>	Environmental Awareness (Schuhwerk & Lefkoff-Hagius, 1995)			
I am willing to make sacrifices to protect the environment.    3.95    0.911    0.860      My actions impact the environment.    4.20    0.881    0.840      My actions impact the environment affects the quality of my life.    0.951    0.663      Consumption Occasions (Woicik, Stewart, Phil & Conrod, 2009)    0.896    0.715      (Cronbach's Alpha: 0.842)    2.32    1.372    0.820      I use cannabis to cope with depression.    2.33    1.214    0.665      I use cannabis to cope with anxiety.    2.03    1.214    0.665      I use cannabis to enphancement and improvement.    2.65    1.329    0.634      I use cannabis to enphane to conform.    2.71    1.341    0.575      I consume cannabis to expand myself.    0.991    1.99    1.081    0.532      Consumtion in Company (Gunarathne, Hemmerling, Krestel, Zühlsdorf & Spiller, 2017) (Cronbach's Alpha: 0.772)    1.90    1.081    0.532      We often get together with friends, the most important thing is that we are together.    3.33    1.291    0.765      We often get together with friends is an important part of my social life.    2.09    1.241    0.624      Prudence (Piyusch, 2010) (Cronbach's Alpha: 0.683)    3.	(Cronbach's Alpha: 0.797)			
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During the past seven days, how often did you have cravings for cannabis (the desire for it while not using)? 1.96 1.033 0.871 Please think back to the moment within the last seven days when the craving for cannabis was strongest. How strong was this craving? 2.33 1.216 0.848	During for community (reaction, pricing occurrent to main, 2000) (clubball 3 Appla, 0.510) During the past server days, how strong way your craying for campabic (the decire for it while not using) on average?	216	1 1 2 3	0 884
Please this back to the moment within the last seven days when the craving for cannabis was strongest. How strong was this craving? 2.33 1.216 0.848	During the past server days how storing was your claving to claimants (the desire for it while not using)?	1.96	1.033	0.871
	Please this back to the moment within the last seven days when the craving for cannabis was strongest. How strong was this craving?	2.33	1.216	0.848

*Note.* Items were assessed by means of likert scales (1 = totally disagree; 5 = totally agree). Scales for consumption regularity and craving for cannabis vary view Table 2.

# 3.5. Results of the preferred clarification measures for estimated segments

After the choice experiment, the preferred clarification measures for cannabis usage were rated on 5-point Likert-Scales regarding agreement, ranging from level one strongly disagree to five strongly agree. Table 7 presents the average level of agreement across all segments on the 11 measures.

The agreement varies in the sample for the option 'The inclusion of warnings on product packaging is important to me.' On one hand, the segment Otto Normal Consumer rates it of medium importance on a Likert Scale equal to level three. On the other hand, the Light and Soothing segment placed more importance on the inclusion of warnings on product packaging, averaging a four on the Likert Scale. Between them lay the Cheap and Hard segment at approximately three points on the Likert Scale.

Three clarification measures were clearly agreed upon as important: 'The list of ingredients and indication of concentration regarding the active substances on the product packaging are important to me.', 'I consider that age and other access restrictions are essential.' and 'The indication of the origin of the products as well as origin and quality standards on the product packaging are important to me.'. On the counter side least important is the 24/7 service hotline (3.05), which is the only item rated as neither important nor unimportant on average.

#### 3.6. Results of the factor analyses for cannabis-related lifestyle items

A principal component factor analysis with varimax rotation was performed in SPSS using all items measuring respondents' attitudes towards cannabis-related products and psychographic constructs, as specified in section 2.4 and shown in Table 8. The Kaiser-Meyer-Olkin (KMO) criterion and Bartlett test for sphericity (BTS) were used to validate the approach. The KMO values lie between 0 and 1 and are acceptable over 0.5 (Kaiser, 1974). In this study, the KMO values were over 0.684 and therefore classified as at least mediocre. The BTS verifies the null hypothesis that the sample belongs to a basic population with uncorrelated variables. Here, the BTS was significant; therefore, the null hypothesis could be rejected, and a factor analysis was possible. Table 8 show the results of the respective valid factor analysis, including the cannabis-related lifestyle items as well as the other items used to describe different segments together with the associated Cronbach's Alpha, the KMO, and the significance according to Bartlett. In this study, the factor loadings of the items 'I consume to cope with boredom.' and 'I plan everything carefully.', fell below the absolute value of 0.5, and were, therefore, suppressed.

In the table, the extracted factors and their arithmetic means, standard deviations, and factor loadings are presented for each construct, including 'consumption regularity, health awareness', 'spirituality', 'environmental awareness', 'consumption occasions', 'consumption in company', 'prudence, and 'craving for cannabis.' Cronbach's alpha was used to measure internal consistency. In all existing factor analyses, Cronbach's alpha values ranged from 0.683 to 0.929. As recommended by Nunally (1978) values should not fall below 0.6.

Subsequently, the identified consumer segments are described using the extracted factors in Table 9.

Segments judgement did not differ significantly regarding the constructs of alcohol and cigarette consumption regularity, budget for mind-altering substances, health awareness, spirituality, environmental awareness, occasional consumption, and prudence. On average, all consumers consume alcohol and cigarettes two to four times a month and consume approximately three to five drinks/cigarettes/cigarillos/ pipes/hookahs each day. Excessive alcohol consumption in companies occurs rarer than once a month, while excessive smoking occurs once a month. Their Budget regarding said intoxicants, as well as THCcontaining products, on average amounts to  $\epsilon$ 65.10 per month. They lean towards health and environmental awareness as well as prudent factors, being indifferent to spirituality, but reject religion and the idea of a god. Cannabis as a personal enhancement is passable; nevertheless, utilizing it to cope, perform, or conform is rejected.

The segment agreement varied significantly regarding the constructs

#### Table 9

Profiling the latent consumer segments. Values represent mean factor scores and SD respectively of the extracted factors for each segment.

Factor	Flowers S	Sample (32	.7 %, <i>N</i> = 193)						
	Otto Normal Consumer (63.7 %, $N = 123$ )			Light and Soothing (21.9 %, $N = 42$ )			Cheap and Hard (14.4 %, <i>N</i> = 28		
	Mean	SD		Mean	SD		Mean	SD	
Alcohol consumption regularity	0.11	1.03	а	-0.24	0.77	а	-0.15	1.13	а
Cannabis consumption regularity	0.06	0.92	b	-0.49	0.89	а	0.51	1.26	b
Cigarette consumption regularity	0.07	1.03	а	-0.13	0.83	а	-0.15	1.1	а
Budget for mind-altering substances	0.06	1.2	а	-0.21	0.24	а	0.08	0.63	а
Health awareness	-0.03	1.1	а	-0.07	0.78	а	0.27	0.82	а
Spirituality	0.11	1.07	а	-0.19	0.85	а	-0.18	0.86	а
Environmental awareness	-0.03	1.09	а	-0.05	0.86	а	0.22	0.71	а
Consumption occasions	0	1.05	а	0.06	0.88	а	-0.08	0.98	а
Consumption in company	0.13	1.01	b	-0.44	0.99	а	0.03	0.78	ab
Prudence	0.02	0.97	а	-0.11	1.16	а	0.05	0.89	а
Craving for cannabis	0.15	1.02	b	-0.53	0.91	а	0.08	0.79	b

*Note.* Items were assessed by means of likert scales (1 = totally disagree; 5 = totally agree). Superscripts stand for significant mean differences at the 0.05 level based on tukey testing.

cannabis consumption regularity, consumption in company, and craving for cannabis, leading to the following differences in segment characters. The Otto Normal Consumers have the highest mean value for craving for cannabis as well as consumption in company and an exalted mean for consumption regularity. They consume about two to four times a month like the Light and Soothing segment, but unlike them they consume in company around once a month and if they consume, they have three to five joints or equivalents. Thus, Otto Normal Consumers seem more social and closer to cannabis. Otto Normal Consumers object to carving cannabis and consuming in company less expressively than Light and Soothing and about as distinct as the Cheap and Hard segment.

The Light and Soothing market lays in contrast to the Otto Normal Consumers and the Cheap and Hard segment on the low cannabis consumption side of the spectrum and ranks lowest in cannabis consumption regularity, craving for it, and its consumption in company. They consume in company rarer than once a month, and if they consume cannabis alone, they consume less than the other segments, which amounts to under two joints or equivalents. Therefore, it is logical to assume that this segment has only small revenue potential and might prefer to consume alone.

The Cheap and Hard consumers have the highest mean value for cannabis consumption regularity, and the second highest for craving. Instead of consuming cannabis two to four times a month on average, as in the other segments, they consume cannabis approximately two to three times a week. Consequently, they are likely to be a noteworthy potential consumer group, which consumes in company just as often as the Otto Normal Consumers but is rather indifferent to companionship.

The least cravings have received Light and Soothing and the Cheap and Hard consumers. In contrast, Otto Normal Consumers, who crave cannabis the most by experiencing the strongest ones in the midrange, neutral.

# Table 10

Specifications	of nine	optimized	products.
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	1 1				
Product	Effect (Strengh)	Type of Effect	Price	Label	Packaging
Flowers Sample Op Product	otimized				
Otto Normal Consumer's perfect	15 % THC	Calming	€10∕ g	Vegan	Glass jar
Light and Soothing's perfect	10 % THC	Calming	€10∕ g	Organic	Glass jar
Cheap and Hard's perfect	20 % THC	Stimulating	€10/ g	Organic	Glass jar

Potential shares of costumers of each segment, for the customized hypothetical products, evaluated in the market simulation.

Product	Sample	Segment Share %			
Flowers Sample	Whole Sample (100 %, <i>N</i> = 193)	Otto Normal Consumer (63.7 %, <i>N</i> = 123)	Light and Soothing (21.9 %, <i>N</i> = 42)	Cheap and Hard (14.4 %, <i>N</i> = 28)	
Otto Normal Consumer's	30.9	34.9	35.9	5.8	
Light and Soothing's	33.0	29.1	57.2	13.9	
Cheap and Hard's perfect	30.9	33.7	3.8	58.9	
None	5.2	2.2	3.0	21.4	

## 3.7. Results of the market simulation

Applying the Results of the LCA (view 3.3 Results of the LCA) to the market simulator of the Lighthouse Studio software (version 9.14.0) resulted in nine different cannabis products. They are individually tailored to the preferences of the respective segment, in that Lighthouse Studio prioritized the levels with the highest part-worth utilities of the segment's scoring and considered them accordingly for the design of the product. The different products are named after their respective segments. The attributes of the products are listed in Table 10.

Furthermore, the purchasing behavior of the samples and their segments regarding the said products was simulated in Lighthouse Studio, always offering a no-purchase option. The results are presented in the Table 11. The results lay with 95 % certainty <  $\pm 4$  % around the true share of potential cannabis consumers.

The total flower sample is split in 30.90 % preference for the Otto Normal Consumer's perfect, 33.00 % for Light and Soothing's perfect, being the tight favorite, and 30.90 % for the Cheap and Hard perfect products.

Looking at the segments that potentially consume the most cannabis, the Cheap and Hard segment stand out by greatly preferring their intended product ( $\Delta = > 30$  %) as well as choosing the no purchase option by far the most often in their sample (> 13 %), as shown in Table 12.

The Otto Normal Consumer's choices, contrarily, are more evenly

#### Table 12

Potential shares of costumers of each of the segments, for the customized hypothetical products at different levels of pricing, evaluated in the market simulation.

Product	Price						
Flowers	€10/g	€12/g	€14/g	€16/g	€18/g		
Whole Flowers Sample in %							
Otto Normal Consumer's perfect	30.9	28.3	22.8	19.9	16.9		
Light and Soothing's perfect	33.0	30.4	24.5	21.6	18.8		
Cheap and Hard's perfect	30.9	28.5	22.6	16.9	13.5		
Otto Normal Consumer Segment in %							
Otto Normal Consumer's perfect	34.9	32.1	26.5	22.2	18.6		
Light and Soothing's perfect	29.1	26.6	21.6	17.9	14.9		
Cheap and Hard's perfect	33.7	31.0	25.5	21.3	17.8		
Light and Soothing Segment in %							
Otto Normal Consumer's perfect	35.9	32.8	25.2	25.5	23.0		
Light and Soothing's perfect	57.2	53.8	44.6	45.0	41.6		
Cheap and Hard's perfect	3.8	3.3	2.3	2.4	2.1		
Cheap and Hard Segment in %							
Otto Normal Consumer's perfect	5.8	5.0	2.8	1.0	0.6		
Light and Soothing's perfect	13.9	12.2	7.1	2.7	1.5		
Cheap and Hard's perfect	58.9	55.2	40.3	19.4	11.5		

divided among the options, preferring their own product, with 34.9 %, over the Cheap and Hard's perfect by 1.2 % and choosing their least favored, Light and Soothing's perfect, only 4.6 % less with 29.1 %, view Fig. 3; deciding for the no purchase option only with 2.2 %, as shown in Table 12

Regarding the Cheap and Hard segment, 58.9 % are willing to buy their intended product before price changes. At the first increase in the price of  $\pounds 2$  per g of cannabis, the share of Cheap and Hard consumers willing to buy the product falls slightly by 3.7 %. In the following two prices, their willingness to buy said product declined, on average, by 17.9 %. Leaving 19.40 % of the Cheap and Hard segment willing to buy the product customized for them at a price of  $\pounds 16$  per g of cannabis. Before increasing the price by  $\pounds 2$  per g of cannabis again, the willingness to buy of the segment regarding said product decreased by 7.9 %. Emerging a graph with a general gratitude of  $\sim -5.9$  % per euro per g of cannabis price increase, as presented in Fig. 4.

In summary, comparing the overall decreases in the willingness to buy of each of the three segments for the respective products offered to them hypothetically in the simulation, the Cheap and Hard segment shows the greatest price sensitivity by a difference in the willingness to buy for their preferred product of -47.4 % at a change in price of  $\varepsilon+8$ per g of cannabis. This was followed by the Otto Normal Consumer, who showed a 16.3 % decrease in willingness to buy the product intended for them at the same price increase. See Table 12 for the simulated shares of the willingness to buy of each of the segments for the customized hypothetical products at different levels of pricing, which were evaluated in the market simulation.

#### 4. Discussion

Consumer preferences regarding THC products are required to support the purchase of legal products and to curb the black cannabis market with legalization. This study compliments the literature by giving the first impression of German cannabis consumer segments their socio-demographics and lifestyle constructs as well as their preferences regarding cannabis products containing THC in the form of flowers together with their favored clarification inscriptions in terms of product handling and safety, by uniting an experimental study survey to understand the German consumers' preferences regarding cannabis flowers comprehensively and to show ways in which future suppliers can increase the sale of their products.

Based on the results of the discrete choice-based conjoint analysis we compared the German consumer segments and their preferences concerning dried cannabis flowers, regarding five socio-demographic variables (gender, age, marital status, level of education, and gross monthly income), five product attributes (effect strength, type of effect, price, label, and packaging), 11 clarification measures, and 11 lifestyle and psychographic constructs.

#### 4.1. Discussion of data collection and analysis

Conducting online surveys offers the advantage of anonymity. Respondents answering preference-based questions regarding illegal product anonymity supported the collection of reliable data. Further, there are economic advantages of low cost, time-intensive access to participants, and minimal use of paper (Rothstein, Sutton & Borenstein, 2006). Additionally, since, in 2021, 25 % of those between the ages of 18 and 25 already used cannabis at least once per year in Germany, despite being illegal and being digital natives, conducting the surveys mostly online is reasonable (Forsa, 2022). A clear ideal ratio of online to face-to-face distribution could not be determined beforehand because the specific target audience's sociodemographic characteristics are unknown. To accommodate respondents who were less familiar with the online format, the surveys were shared in face-to-face interactions. The resulting exact ratio of online-to-in-person acquisition was not documented; thus, the extent of the anonymity effect on the samples was



**Fig. 3.** Simulated Price Sensitivity of the Otto Normal Consumer Segment for the Constructed Products of the Flower Sample (N = 123). Additionally, the purchasing behavior of each of the segments regarding customized products was simulated at different price levels, as shown in the Table 12. The results show that the Otto Normal Consumer's willingness to buy, in view of the product intended for them, decreases by -1.4 % per Euro per g cannabis to 32.1 % at the second cheapest price option,  $\pounds 12$  per g cannabis. This was followed by a gradual decline of  $\sim -2.3$  % per Euro per g of cannabis to a willingness to buy of 18.6 % at the  $\pounds 18$  per g cannabis level concerning their customized product. Describing a graph progressing down moderately at an overall gradient of approximately -2.0 % per Euro per g of cannabis almost parallel to their willingness to buy the Light and Soothing perfect as well as the Cheap and Hard perfect, as illustrated in 3.



**Fig. 4.** Simulated price sensitivity of the cheap and hard segment for the constructed products of the flower sample (N = 25). The Cheap and Hard segments' willingness to buy the other offered products at different prices declined by 0.7 % per Euro per g cannabis flower, from 5.8 % to 0.6 % willing to buy the Otto Normal Consumer's perfect, and 1.6 % per Euro per g cannabis, from 13.9 % to 1.5 % willing to buy the Light and Soothing perfect product. Preferences for both decline in a similar pattern to their willingness to buy their intended product (see Fig. 4).

compromised.

Face-to-face distribution was carried out in public spaces in central Hamburg, Germany, and since we did not ask for the respondent's place of residence, to not disturb the feeling of anonymity further, it is possible that the participants' place of living was not balanced throughout Germany but was mostly in Hamburg. Moreover, the application of HAW Hamburg's email distribution lists was very effective, which might have led to an overrepresentation of students in the survey. Moreover, since the results were obtained in a hypothetical setting and limited in the number of participants, further research is needed to determine the true share of Germans interested in buying cannabis products to evaluate the representativeness of the studies (Kaderabek & Sinibaldi, 2022).

The chosen method of discrete choice-based conjoint analysis is a widely used tool for estimating and simulating individual product preferences, purchase probabilities, and market share in science and practice. It is necessary to enable more realistic stimulus perceptions, which leads to an improvement in the validity and reliability of the test results compared with non-computer-based procedures. With this method, there is a risk of making the concept description more realistic by taking extensive account of attributes and their levels, but the gain in validity would be at the expense of the reliability of the results; for technical reasons of conjoint analysis, the number of stimuli to be assessed would increase disproportionately, which would ultimately lead to information overload on the part of the respondent. Therefore, we limited the number of attributes and levels to as few as five each, which was as low as possible and as many as needed to avoid compromising relevant concept characteristics. The same was true for the number of lifestyle items and clarification measures. To combat attentional bias, which can arise while choosing attributes, experts and scientists agreed upon in expert interviews (Löffler, 1999). The attributes and levels were supported by pictures for better understanding in terms of effect and effect strength and packaging design with adjectives, as shown in Table 1. Regarding the attribute type of effect, the level of 'very soothing' to 'very stimulating" was oriented towards indica and sativa categorizations. This was decided upon because of its popularity, despite the indica/sativa theory being disproven (Sholler et al., 2021).

To appeal to customers, a targeted LCA was applied. Because our three sample sizes were under 300 participants, problems with low sample sizes including poor functioning fit indices, convergence failures, and failure to uncover classes with low memberships could arise. To combat this, the number of classes was carefully chosen, as described in 3.3 Results of the LCA (Weller, Bowen & Faubert, 2020). The resulting three segments were compared for differences in preferences via SPSS by variance analysis, performed with ANOVA and post hoc test preferring the Tukey test because of stronger statistical power as recommended for unplanned comparisons.

Regarding the factor analysis for cannabis-related lifestyle items, the limited sample sizes, and the application of the varimax method of rotation, a low knowledge barrier appliance could have had adverse impacts on the validity of the solutions generated while being commonly used together with allowing time-efficient data evaluation (Gaskin & Happell, 2014).

## 4.2. Discussion of the results

In relation to the preferences of German citizens concerning THCcontaining products for recreational use, to the best of the authors knowledge, no study has yet been published. Therefore, this study can only be compared to research in other countries; thus, cultural differences may be associated with deviations in study results (Hanel et al., 2018).

The socio-demographic analyses show that younger high school graduates are primarily interested in THC-containing cannabis products. Further, more men showed interest and participated in this study. This is in line with the findings of the Canadian Cannabis Survey 2022, which indicated that 5.0 % more men than women consume cannabis. Additionally, it states that by far the largest consumer group is between the ages of 20 and 24 years, and most have a high school diploma as their highest level of education (Government of Canada, 2022). The discrepancy in the size of shares at different levels of education in the increased number of high school graduates in our survey respondents may be due to the data collection method (see Section 4.1). The same might be true regarding the large share of low-income and single-person marital status. This indicates that the majority of the surveyed participants were probably students (Middendorff et al., 2023).

In Canada, men consume THC in the form of dried cannabis flowers, mainly women have edibles, and vapor liquid is equally popular between the two genders (Government of Canada, 2022). The participation in our survey hints that this might be true for potential German customers, measured by interest in this study, regarding the Flowers. The results are supported by the results for 'cannabis consumption regularity.' The Light and Soothing and the Cheap and Hard segments differ, with the male majority segment, the Otto Normal Consumer, consuming more. Age, education level, marital status, and income cannot explain the large share of gender-diverse participants (Ahmad et al., 2017; Pöge et al., 2022). Furthermore, gender diversity has the potential to strongly influence patterns of cannabis use, but ongoing research is needed to determine the influence direction (Hemsing & Greaves, 2020).

In previous research by Zhu, Guo, Cao, An and Shi (2021) using a best-worst scaling experiment, they found that cannabis users in Canada general perceived 'quality', 'strain type', 'price', 'THC' and 'pesticide' to be important factors in cannabis purchase decisions. Recreational, medical, and dual-purpose users demonstrated heterogeneous allocations of importance to attributes. In our study we investigated the preferences of recreational cannabis consumers in Germany, and our research supports the importance of the attributes 'strain type', as well as 'THC'. However, in the survey results the 'price' was not the least or close to be the least important attribute group. The label 'organic' is liked, which might be due to the young age of the respondents (Gewiese & Rau, 2023), opposed to the label 'premium,' which is unpopular and often even avoided. This could be because of suspicion of the label, as

the premium label displayed in the survey is not officially recognized (Rossi & Rivetti, 2023). In contrast, Ventresca and Elliott (2022) underlined the importance of packaging THC-containing products. The survey results support this by their respondents who value packaging as the third most important product attribute. The favorite packaging, the transparent glass jar, might not be applicable to all cannabis strains because some are photosensitive; in this case, a metal can be used. The preference for tainted glass would require further testing in relation to other packaging materials and the context of THC-containing products. Beyond that, the segments all assess themselves as environmentally aware, which might have been the driver for choosing glass as a favored material, suggesting that recyclable glass is the true favored material (Otto, Strenger, Maier-Nöth & Schmid, 2021).

The results of the survey display that segments in which the larger part are women, such as the Light and Soothing segment, calming cannabis strains are preferred over neutral or stimulating ones, together with placing the most importance on the type of effect or strain of the product. Additionally, the preferred THC content was measured, showing that the Light and Soothing segment prefers low contents of 10.0 % and 5.0 % over a higher THC concentration of > 10.0 %. This is in line with research regarding medical cannabis stating that women prefer lower THC ratios (Boehnke et al., 2019). The segments Cheap and Hard, which have more male respondents, favor 20 % THC content and have higher potencies and stimulating effects than Light and Soothing, which is in line with previous study findings (Donnan, Shogan, Bishop, Swab & Najafizada, 2022).

In the study of Donnan, Shogan, Bishop, Swab and Najafizada (2022) THC content is measured in adjectives and not a clear share. We also offered adjectives, as elaborated in the Discussion of the Data Collection and Analysis. If the participants did not comprehend the shares of THC content on their own, the adjective strong could be used independently of the scale. Further research is required to confirm this hypothesis.

Customers should be appealed to the targeted to heighten their willingness to buy. One product per segment solution can be applied, as shown in Table 10 (Löffler, 1999). In this solution, the segments preferred a price under €16/g cannabis. These price preferences might not be met by vendors comparing them with the price of medical cannabis in Germany, which is €16/g (KBV, 2023). The Light and Soothing segment place more importance on strain and effect, packaging, or label than price; thus, marketing these attributes at their preferred level is likely to compensate for the repulsion of a heightened price. This might not be the case for the Cheap and Hard segment, since they place price as the second most important attribute together with being the most price sensitive, regardless of their relative to the segments of the other surveys' large budget. Lastly, the Otto Normal Consumer place price as third most important attribute and may not be able to compensate for a higher price in the same way as the Light and Soothing. Further research is necessary to determine whether the Cheap and Hard and Otto Normal Consumer segments, can be compensated for a higher price by legality or applying attributes that were not controlled by us like strain type, since low prices remain as the appeal of a black market after cannabis is legalized (Schmengler et al., 2022).

Regarding cannabis-related lifestyle items, the sociodemographic differences of the segments do not differ enough to lead to uniform differences in their cannabis-related lifestyle. This might be due to the applied methods for data evaluation, as elaborated in 4.1 Discussion of Data Collection and Analysis. Overall, the study participants agreed to be environmental- and health-aware, which matches the German average. In Germany, environmental sustainability and health-revolving marketing are efficient trends (Gewiese & Rau, 2023). Thus, the same approaches could benefit the marketing of cannabis products and explain the popularity of the organic, carbon footprint, and vegan labels. As veganism is generally perceived as healthy among younger people due to social media (Jennings, Danforth, Dodds, Pinel & Pope, 2019). The Light and Soothing segment, particularly the low parth-worth utility of the vegan and carbon footprint label, might be because of the low

importance of labels in general; however, this issue would require further testing. However, overall spirituality was softly denied by all segments, and prudence together with consumption occasions were rated rather neutral. Hence, marketing revolving around these constructs may not be as successful as environmental sustainability and health improvement marketing. Additionally, the Light and Soothing segment has the second highest consumption, but the lowest cravings on average might be connected to them being less socially connected through cannabis compared with the Otto Normal Consumer (Meisel, Carpenter, Padovano & Miranda, 2021).

Furthermore, all segments agreed with the importance of clarification measures concerning the use and risks of THC consumption. This matches the previous assessment from Canada. They also underlined the importance of packaging that features a standard THC unit, which is important to all segments of our study as well: The list of ingredients and indication of concentration regarding the active substances on the product packaging are important to me.' (Ventresca & Elliott, 2022). In addition, Ventresca and Elliott's (2022) findings recommend specified descriptive consumption guidance on the product and restrictive packaging to protect children, which we could not implement in our testing due to limitations elaborated in 4.1 Discussion of Data Collection and Analysis (Ventresca & Elliott, 2022). This and a cost-benefit analysis of safety measures require further research. Only for the case of an analogue guide concerning dried flowers and in the case of a 24/7 hotline, two measures were identified as neural important out of 11. Even looking closer at the segments, only the Otto Normal Consumer is indifferent regarding prominent warning labels on the product, diverging from the findings of Ventresca and Elliott (2022).

Our findings align with several international studies that have explored consumer preferences for cannabis products. For instance, Donnan et al. (2022) conducted a systematic review identifying factors influencing cannabis purchasing decisions. They found that price, product quality, and route of administration were significant factors. Similarly, our study revealed that price and product attributes such as THC content and packaging are crucial for German consumers. In Canada, Donnan et al. (2024a), (2024b) conducted a discrete choice experiment focusing on cannabis edibles. They found that approximately 65 % of consumers preferred to purchase edibles through regulated channels, with price and potency being key determinants. This is consistent with our findings, where price and effect strength were significant factors for German consumers. Xing and Shi (2024) examined consumer preferences for legal and illegal cannabis in the United States. They found that while legal products were preferred for safety and consistency, illegal products remained attractive due to lower prices and higher potency. This dual preference suggests that regulatory frameworks must balance pricing strategies with consumer demand for high-potency products, a consideration also relevant for the German market. Charlebois et al. (2020) highlighted the Canadian market's shift towards cannabis-infused food and beverages. Their study indicated that consumers are increasingly open to integrating cannabis into their diets, driven by curiosity and perceived wellness benefits. In our study, the preference for organic and health-conscious labels among German consumers suggests a similar trend towards health and wellness. Shi et al. (2019) examined how potency, price, and warning messages affect consumer choices for cannabis flowers. They found that while high-potency products remain popular, transparent labeling and prominent warning messages increase consumer trust. Our findings also emphasize the importance of clear product information and safety warnings, aligning with the need for transparency in the cannabis market. Staples (2024) explored consumer preferences for CBD- and THC-infused beverages in the United States. They found that younger consumers are willing to pay more for these products, with a higher willingness to pay for THC-infused beverages. This aligns with our finding that younger German consumers show a strong interest in THC-containing products, particularly those with higher potency.

The segmentation of German cannabis consumers into Otto Normal

Consumers, Light and Soothing, and Cheap and Hard highlights the diverse preferences that will shape the marketing and regulatory strategies post-legalization. The Otto Normal segment, representing the majority (63.7 %), seeks balanced THC levels with preferences for calming or stimulating effects, suggesting a market driven by accessible, clearly labeled products that emphasize quality assurance and moderate pricing. In contrast, the Light and Soothing segment's inclination towards low-THC, calming products emphasizes the need for stringent labeling and packaging standards, reinforcing health-conscious branding that aligns with their demand for organic and eco-friendly packaging. This segment may benefit from targeted campaigns around wellness and safety, mirroring trends seen in the Canadian market, where health-focused labeling significantly influenced purchasing behavior (Donnan et al., 2023). Conversely, the Cheap and Hard segment values high-THC products at competitive prices, presenting challenges for regulators to ensure that price-driven demand does not undercut safety and quality standards. Drawing from the experiences in the United States, pricing strategies in legal markets must be balanced to reduce the appeal of illicit cannabis products, which often compete through higher potency and lower prices (Xing & Shi, 2024). This necessitates dynamic pricing models that incorporate taxation frameworks sensitive to consumer price elasticity. Regulatory bodies may also benefit from introducing educational campaigns addressing the risks of high-potency products, as seen in studies emphasizing consumer education as a tool to mitigate harmful consumption patterns (Shi et al., 2019). Ultimately, aligning marketing efforts with segment-specific preferences while enforcing robust safety and labeling regulations will be critical to fostering consumer trust and curbing black market activity in Germany's evolving cannabis landscape.

#### 4.3. Limitations and future research

While this study provides valuable insights into consumer preferences for THC-containing cannabis products in Germany, several limitations should be acknowledged. The use of an online survey for data collection, while efficient, may have introduced selection bias, potentially overrepresenting younger, tech-savvy respondents and underrepresenting older demographics or those less familiar with digital platforms. Additionally, the hypothetical nature of the choice experiments may not fully reflect actual purchasing behavior in a legalized market, as participants' responses were based on simulated scenarios rather than real-world transactions. This limitation could affect the generalizability of the findings to actual market conditions postlegalization. Furthermore, the segmentation analysis, while robust, relied on self-reported data, which may be influenced by social desirability bias, leading to potential inaccuracies in respondents' stated preferences and consumption patterns. One notable additional limitation of this study was the absence of precise location data for respondents, which was intentionally omitted to uphold participant anonymity and adhere to ethical guidelines in social research. While this approach safeguarded privacy, it introduced challenges in assessing regional differences and generalizing the findings across Germany. Given the sensitive nature of cannabis legalization, consumer preferences may vary significantly based on geographic, cultural, or economic factors. Without location-specific data, the study's ability to capture and reflect these potential regional disparities was constrained, which may limit the applicability of the results to the broader population. Future research could address this by incorporating anonymized regional indicators to balance privacy with the need for geographically nuanced insights.

Future research could expand upon this study by incorporating longitudinal data to track evolving consumer preferences as the legal cannabis market in Germany matures. A follow-up study conducted post-legalization, with access to real purchasing data, would provide more accurate insights into market behavior and validate the findings from this hypothetical model. Additionally, further segmentation could explore regional differences within Germany, examining how cultural, economic, and social factors influence cannabis consumption patterns. Research could also investigate preferences for alternative cannabis products, such as edibles or vape products, expanding the scope beyond dried flowers. Finally, future studies may benefit from incorporating qualitative methods, such as focus groups or in-depth interviews, to gain a deeper understanding of consumer motivations and the broader social implications of cannabis legalization.

# 5. Conclusion

Consumer preferences regarding THC products can contribute to the successful launch of legal THC products in a competitive future market. This is a step to stop under-the-counter cannabis sales and relieve law enforcement and persecution. The results of the quantitative analysis showed the importance of its type of effect and effect strength, with the highest part-worths for a calming or stimulating effect of 10/15/20 % THC content in dried flowers. Purchase is strongly affected by the form of cannabis offered; by taking this into account and offering different cannabis products, according to the preferences of the various consumer segments, vendors are able to enlarge their consumer base. Three different consumer segments were examined in the study: Otto Normal Consumer, Light and Soothing, Cheap and Hard. Interestingly, Cheap and Hard are the only segment that place most importance not on the type of effect and effect strength of the product, but on its price, preferring it to be cheap. Additionally, this segment is the second largest with the second highest cannabis consumption; the largest segment is Otto Normal Consumers. By contrast, all segments are prone to environmentally sustainable and healthy products. This shows their preference for labels valuing organic, carbon footprint, and vegan options. The exception is the Light and Soothing segment, which only clearly values the organic label. Regarding the results for packaging the preferences in dried flowers, it might have had an impact on them favoring a transparent glass jar, hinting at the potential of recyclable glass. These attributes are important to compensate for price increases and motivate a shift in purchasing power from the black market to the legal market. Concerning the Otto Normal Consumer and especially Cheap and Hard segment price product lines for price-sensitive customers are likely necessary. Further research regarding the price elasticity of demand and the effect of additional attributes on it is needed to determine the said likelihood. Moreover, since none of the clarification measures were determined as not important, a cost-benefit analysis of safety measures is required along with the following research to be able to put the presented findings into perspective. Further market research could additionally consider different strain types, as well as regional deviations in Germany and the EU member states, to analyze differences in the market potential of THC-containing products.

As Germany moves towards cannabis legalization, it is crucial to address potential health hazards, social implications, and safety limits associated with cannabis consumption. Legalization will likely attract many new and first-time consumers, necessitating comprehensive education on responsible use. Potential health risks include impaired cognitive function, dependency, and adverse mental health effects, particularly among young adults and those with pre-existing conditions. Social implications may involve increased accessibility and normalization of cannabis use, which could impact public health and safety. Therefore, establishing clear safety limits, such as age restrictions, dosage guidelines, and public consumption regulations, is essential to mitigate these risks.

# Ethics statement

This study adhered to stringent ethical guidelines to ensure the protection and welfare of all participants. Informed Consent: All participants were fully informed about the purpose of the study, the procedures involved, their rights as participants, and any potential risks.

Informed consent was obtained from each participant before their involvement in the study. Confidentiality: The privacy and confidentiality of all participants were strictly maintained. Personal data were anonymized to ensure that individuals could not be identified from the information provided. Data were stored securely and accessed only by the research team. Voluntary Participation: Participation in the study was entirely voluntary. Participants had the right to withdraw from the study at any time without any penalty. Ethical Approval: The study protocol was reviewed and approved by the HAW Hamburg Ethics Committee (2021-04), ensuring that it met all ethical standards and guidelines for research involving human subjects. Transparency and Honesty: The research team was committed to conducting the study with the highest level of integrity and transparency. Participants were provided with accurate and honest information about the study's objectives and procedures. Beneficence and Non-maleficence: The principle of beneficence was upheld, ensuring that the study aimed to contribute positively to the understanding of consumer preferences in the context of cannabis products.

#### Ethical statement

Hereby, I Stephan G.H. Meyerding consciously assure that for the manuscript "Consumer Preferences for Cannabis Products with THC Content in Germany – The Case of Flowers" the following is fulfilled:

- 1) This material is the authors' own original work, which has not been previously published elsewhere.
- 2) The paper is not currently being considered for publication elsewhere.
- 3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
- The paper properly credits the meaningful contributions of coauthors and co-researchers.
- 5) The results are appropriately placed in the context of prior and existing research.
- 6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
- 7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

The violation of the Ethical Statement rules may result in severe consequences.

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I agree with the above statements and declare that this submission follows the policies of Solid State Ionics as outlined in the Guide for Authors and in the Ethical Statement.

Date: 23.06.2024

#### CRediT authorship contribution statement

**Stephan G.H. Meyerding:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Zarah L. Groninga:** Writing – original draft, Investigation, Formal analysis, Data curation.

# Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data will be made available on request.

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